





53RD ANNUAL MEETING

George R. Brown Convention Center • Houston, Texas January 21-25, 2017

ABSTRACT BOOK





The Society of Thoracic Surgeons gratefully acknowledges the following companies for providing educational grants for the STS 53rd Annual Meeting.

This list is accurate as of December 7, 2016.

STS Platinum Benefactors

Provided \$50,000 or above

Abbott

Medtronic

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Provided \$10,000-\$24,999

Bard Davol

MISSION STATEMENT

The mission of The Society of Thoracic Surgeons is to enhance the ability of cardiothoracic surgeons to provide the highest quality patient care through education, research, and advocacy.

OVERALL MEETING OBJECTIVE

The overall objective of this meeting is to provide a forum for all cardiothoracic surgeons and their teams to learn the most up-to-date information on research, surgical techniques, patient management, and social, ethical, and political issues in order to maintain the highest level of care for the cardiothoracic patient.

STS CONTINUING MEDICAL EDUCATION (CME) MISSION STATEMENT

The continuing medical education mission of The Society of Thoracic Surgeons is to provide a forum for reporting results of scientific research and for updating information in the disciplines of cardiovascular, general thoracic and congenital heart surgery. The principal continuing education programs conducted by the Society include an annual scientific meeting, self-study programs, and other stand-alone meetings. The Annual Meeting is composed of peer-reviewed scientific abstracts, invited overview presentations, small group presentations, presentations on new technologies and video programs. The broad scope of topics related to cardiothoracic surgery is covered during each Annual Meeting. In addition to and separate from the national meeting, topical meetings are held that focus on relevant information needs of cardiothoracic surgeons. These educational sessions frequently highlight a multidisciplinary approach and include content relevant to cardiothoracic surgeons as well as other physicians and health care providers in related disciplines. STS programs are developed and provided with the intent of confirming existing knowledge base, imparting new knowledge, and promoting competence in the content areas covered for cardiothoracic surgeons, residents, and their allied health care providers.

Amended by the STS Board of Directors: January 25, 2009

FUTURE MEETINGS OF THE SOCIETY OF THORACIC SURGEONS

ECMO Management Symposium

March 10-12, 2017 Tampa, Florida

Symposium on Robotic Mitral Valve Repair

March 31-April 1, 2017 Chicago, Illinois

Advances in Quality & Outcomes

October 18-20, 2017

Chicago, Illinois

Coding Workshop

November 16-18, 2017 Hollywood, California

STS 54th Annual Meeting & STS/AATS Tech-Con

January 27-31, 2018 Fort Lauderdale, Florida

The information in this Abstract Book is accurate as of December 7, 2016.

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TABLE OF CONTENTS

STS Mission Statement	1
Overall Meeting Objective	1
CME Mission Statement	1
Program at a Glance	4
CME Information.	6
Rules Regarding Oral Presentations and Scientific Posters	9
Commercial Relationships of Program Planning Members, STS Staff, and Abstract Reviewer	rs12
STS/AATS Tech-Con 2017.	30
Heater-Cooler-Induced Infections: Practices, Protocols, and Mitigation Strategies	40
Adult Congenital Heart Disease Symposium	44
Practice Management Summit	46
STS/AATS Critical Care Symposium	48
STS/SCA: Integrating Perioperative Echocardiography Into Cardiac Surgical Clinical De Making.	ecision
"How To" Video Session: Technical Tricks and Pitfalls to Simplify Cardiac Surgery Procedure	s52
Residents Symposium: Transitioning From Residency to a Successful Practice	56
Resuscitation of Patients Who Arrest After Cardiac Surgery	58
Surgical Symposium: Congenital Cardiac Surgery Mélange	60
Surgical Symposium: "How To" Video Session: Tips and Tricks in General Thoracic Surger	ry 62
Multidisciplinary Response to Emergencies: Strategies for Team Members	64
J. Maxwell Chamberlain Memorial Papers	68
Richard E. Clark Memorial Papers	74
Presidential Address: Joseph E. Bavaria	79
Adult Cardiac: Arrhythmia	80
Basic Science Research: Adult Cardiac	84
Basic Science Research: General Thoracic	94
Congenital: Adult Congenital.	102
Critical Care	108
Ethics Debate	114
General Thoracic: New Technology	116
Late-Breaking Abstracts I	120
STS Key Contacts: How to Become an Advocate for Cardiothoracic Surgery	120
STS/CATS/CSCS: Quality Improvement in Cardiothoracic Surgery	122
ACC @ STS	124
Redefining Practice Through Quality and Evidence: What's New?	128
Adult Cardiac: Aorta I	144
Adult Cardiac: Ischemic	154
Congenital: Pediatric Congenital I	162

TABLE OF CONTENTS

General Thoracic: Lung Cancer I	1/4
General Thoracic: Lung Transplantation	184
International Symposium	192
SVS @ STS: Sharing Common Ground for Cardiovascular Problems	194
Surgical Motion Picture Matinee: Adult Cardiac	196
Surgical Motion Picture Matinee: Congenital	204
Surgical Motion Picture Matinee: General Thoracic	208
The Annals Academy: Propensity Score Matching	214
STS Social Event: Space Center Houston	215
Early Riser Sessions.	218
Early Riser Health Policy Forum	225
Results of the STS TAVR Survey	226
Thomas B. Ferguson Lecture: Ralph W. Muller	226
Award Presentations	226
C. Walton Lillehei Lecture: Samer Nashef.	226
Residents Luncheon	226
Adult Cardiac: General	228
Adult Cardiac: Mitral and Tricuspid Valves	238
Congenital: Pediatric Congenital II	246
EACTS @ STS: Management of Distal Type B Aortic Dissection	258
Electronic Learning and Innovation in Education	266
General Thoracic: Esophageal	268
General Thoracic: Lung Cancer II	284
Advanced Therapies for End-Stage Heart Disease	298
Patient Safety Symposium: Resilience or Burnout—Do We Have a Choice?	308
Cardiothoracic Surgical Education	310
Late-Breaking Abstracts II	317
Adult Cardiac: Aorta II	318
Adult Cardiac: Aortic Valve	328
Congenital: Pediatric Congenital III.	340
ESTS @ STS: Controversial Issues in General Thoracic Surgery	352
General Thoracic: Mediastinal/Pulmonary	354
STS University.	366
Scientific Poster Abstracts	372
Program Participant Index	518

PROGRAM AT A GLANCE

Friday, January 20

3:00 PM - 6:00 PM

Registration

Saturday, January 21

7:00 AM - 6:00 PM 7:00 AM - 6:30 PM 7:00 AM - 8:00 AM 8:00 AM - 9:30 AM Registration Tech-Con Exhibits Breakfast

Tech-Con Adult Cardiac Track I: Innovations in Mitral Valve Disease and Atrial Fibrillation Management Tech-Con General Thoracic Track I: Precision Thoracic Surgery

9:30 AM - 10:15 AM 10:15 AM - 12:00 PM

BREAK—Visit Tech-Con Exhibits Tech-Con Adult Cardiac Track II: Aortic/Endovascular

Tech-Con General Thoracic Track II: Advanced Thoracic Surgery LUNCH—Visit Tech-Con Exhibits

12:00 PM - 1:00 PM 1:00 PM - 2:45 PM

Tech-Con Adult Cardiac Track III: Ventricular Assist Devices/Heart Failure Tech-Con General Thoracic Track III: Health Care in the 21st Century

2:45 PM - 3:15 PM 3:15 PM - 5:00 PM 5:00 PM - 6:30 PM

BREAK—Visit Tech-Con Exhibits Tech-Con Joint Session: "Shark Tank"—Rapid-Fire Elevator Pitches of Revolutionary Technology

Tech-Con Reception

Sunday, January 22

7:00 AM - 6:30 PM 7:00 AM - 8:00 AM 8:00 AM - 12:00 PM Registration

Heater-Cooler-Induced Infections: Practices, Protocols, and Mitigation Strategies Adult Congenital Heart Disease Symposium: Evaluating Approaches to the Aortic Valve and End-Stage Problems in Young Adults—What Pediatric and Adult

Cardiac Surgeons Can Learn From Each Other

Practice Management Summit: Working In an Employment Model Environment STS/AATS Critical Care Symposium: Challenges in the Management of Mechanical Cardiopulmonary Support in the Cardiothoracic Intensive Care Unit

STS/SCA: Integrating Perioperative Echocardiography Into Cardiac Surgical Clinical Decision Making

10:00 AM - 4:30 PM "How To" Video Session: Technical Tricks and Pitfalls to Simplify Cardiac Surgery Procedures

12:00 PM - 1:00 PM 1:00 PM - 4:00 PM 1:00 PM - 4:30 PM

Residents Symposium: Transitioning From Residency to a Successful Practice Resuscitation of Patients Who Arrest After Cardiac Surgery Surgical Symposium: Congenital Cardiac Surgery Mélange

Surgical Symposium: "How To" Video Session—Tips and Tricks in General Thoracic Surgery

Scientific Posters

Multidisciplinary Response to Emergencies: Strategies for Team Members

Opening Reception in STS Exhibit Hall

Monday, January 23

6:30 AM - 5:00 PM 9:00 AM - 4:30 PM

9:00 AM - 9:40 AM

2:00 PM - 6:30 PM

2:30 PM - 4:30 PM

4:30 PM - 6:30 PM

Registration **Exhibit Hall** Scientific Posters **Opening Remarks**

7:00 AM - 7:15 AM 7:15 AM - 8:15 AM J. Maxwell Chamberlain Memorial Papers 8:15 AM - 9:00 AM Richard E. Clark Memorial Papers

BREAK—Visit Exhibits and Scientific Posters Complimentary coffee available in the Exhibit Hall

9:40 AM - 9:50 AM Introduction of the President: Richard L. Prager 9:50 AM - 10:50 AM Presidential Address: Joseph E. Bavaria 10:50 AM - 11:30 AM **BREAK**—Visit Exhibits and Scientific Posters Complimentary coffee available in the Exhibit Hall

11:30 AM - 12:30 PM Adult Cardiac: Arrhythmia

Basic Science Research: Adult Cardiac Basic Science Research: General Thoracic Congenital: Adult Congenital

Critical Care

Ethics Debate: When a Child's Heart Is Failing General Thoracic: New Technology

PROGRAM AT A GLANCE

11:30 AM - 12:30 PM Late-Breaking Abstracts I STS Key Contacts: How to Become an Advocate for Cardiothoracic Surgery STS/CATS/CSCS: Quality Improvement in Cardiothoracic Surgery—Real-Life Methods to Improve Surgical Performance Within Yourself, Your Division, and Your Specialty 12:30 PM - 1:30 PM BREAK—Visit Exhibits and Scientific Posters 1:15 PM - 5:15 PM ACC @ STS: Cardiologists and Surgeons Tackling Complex Clinical Scenarios as a **Heart Team** Redefining Practice Through Quality and Evidence: What's New 1:30 PM - 3:30 PM Adult Cardiac: Aorta I Adult Cardiac: Ischemic Congenital: Pediatric Congenital I General Thoracic: Lung Cancer I **General Thoracic: Lung Transplantation** International Symposium: The Quality vs Access Dilemma in Cardiothoracic Surgery—Regionalization, Building Sustainable Cardiothoracic Surgery **Programs, and Humanitarian Crises** SVS @ STS: Sharing Common Ground for Cardiovascular Problems BREAK—Visit Exhibits and Scientific Posters 3:30 PM - 4:15 PM Complimentary coffee available in the Exhibit Hall 4:15 PM - 5:15 PM Surgical Motion Picture Matinees: Adult Cardiac, Congenital, and **General Thoracic** The Annals Academy: Propensity Score Matching 5:15 PM - 6:30 PM Scientific Posters and Wine 5:30 PM - 6:30 PM **Business Meeting (STS Members Only)** STS-PAC Reception 6:30 PM - 7:30 PM 7:30 PM - 10:30 PM STS Social Event: Space Center Houston (Shuttle buses start at 6:45 PM) **Tuesday, January 24**

6:30 AM - 4:30 PM Registration **Exhibit Hall** 9:00 AM - 3:30 PM Scientific Posters 9:00 AM - 5:00 PM 7:30 AM - 8:30 AM

10:00 AM - 10:45 AM

12:00 PM - 1:00 PM

Early Riser Sessions

Early Riser Health Policy Forum: Ready or Not: Implementing the New Merit-Based Incentive Payment System in Your Practice Today

8:45 AM - 9:00 AM Results of the STS TAVR Survey 9:00 AM - 10:00 AM Thomas B. Ferguson Lecture: Ralph W. Muller

BREAK—Visit Exhibits and Scientific Posters Complimentary coffee available in the Exhibit Hall

10:45 AM - 11:00 AM **Award Presentations** 11:00 AM - 12:00 PM

C. Walton Lillehei Lecture: Samer Nashef BREAK—Visit Exhibits and Scientific Posters

Residents Luncheon 1:00 PM - 3:00 PM **Adult Cardiac: General**

> **Adult Cardiac: Mitral and Tricuspid Valves** Congenital: Pediatric Congenital II

EACTS @ STS: Management of Distal Type B Aortic Dissection

Electronic Learning and Innovation in Education

General Thoracic: Esophageal General Thoracic: Lung Cancer II

1:00 PM - 5:30 PM Advanced Therapies for End-Stage Heart Disease

Patient Safety Symposium: Resilience or Burnout—Do We Have a Choice?

3:00 PM - 3:30 PM **BREAK**—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall

3:30 PM - 4:30 PM **Cardiothoracic Surgical Education Late-Breaking Abstracts II**

Adult Cardiac: Aorta II 3:30 PM - 5:30 PM

Adult Cardiac: Aortic Valve

Congenital: Pediatric Congenital III

ESTS @ STS: Controversial Issues in General Thoracic Surgery—Perspectives From **Europe and North America**

General Thoracic: Mediastinal/Pulmonary

Wednesday, January 25

6:30 AM - 9:30 AM 7:00 AM - 9:00 AM 9:30 AM - 11:30 AM

Registration & Breakfast STS University

STS University (courses repeated)



CONTINUING MEDICAL EDUCATION CREDIT

STS 53rd Annual Meeting

The Society of Thoracic Surgeons is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The Society of Thoracic Surgeons designates this live activity for a maximum of 27.75 AMA PRA Category 1 CreditsTM. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

The American Board of Cardiovascular Perfusion designates this activity for 31.4 Category I CEUs.

Learning Objectives for the STS 53rd Annual Meeting

Upon completion of this activity, participants should be able to:

- Review the results of clinical and laboratory investigations designed to reveal new knowledge of cardiothoracic disease or to develop new technology applicable to the management of cardiothoracic disease
- Evaluate the impact of new knowledge and the application of new technology on the treatment of cardiothoracic disease
- Discuss the importance of patient safety issues and how current strategies can be introduced into one's practice or institution
- · Discuss surgical techniques in order to improve the standard of care within the specialty
- Examine how public policy can impact the treatment of one's patients
- Share and summarize information provided through small group discussions facilitated by leaders in cardiothoracic surgery

STS EDUCATION DISCLOSURE POLICY

As a sponsor of continuing medical education accredited by the Accreditation Council for Continuing Medical Education (ACCME), The Society of Thoracic Surgeons requires that any individual who is in a position to control the content of an educational activity must disclose all relationships with commercial interests (including known relationships of his or her immediate family, department, and partners). The ACCME defines a commercial interest as "any entity producing, marketing, reselling, or distributing health care goods or services consumed by, or used on, patients. The ACCME does not consider providers of clinical service directly to patients to be commercial interests." The question of whether a disclosed conflict situation could represent undue influence on the educational activity by a commercial interest or whether the disclosed information is sufficient to consider an abstract, presentation, or other educational enduring material to represent potentially biased information must be resolved prior to an individual's involvement in STS educational programming.

Required disclosures include (1) a financial interest of any amount (e.g., through ownership of stock, stock options, or bonds) (2) the receipt of any amount of cash, goods or services within the current 12-month period (e.g., through research grants, employment, consulting fees, royalties, travel, or gifts) or (3) a nonremunerative position of influence (e.g., as officer, director, trustee or public spokesperson). EXCLUDED from this disclosure requirement are blind trusts or other passive investments such as mutual funds. In the case of a financial or other relationship disclosure, the company, product/service, and specific nature of the relationship must be noted. Disclosure is mandatory for any person involved in the planning, management, presentation, and/or evaluation of STS educational activities.

Failure to disclose all relationships with commercial interests disqualifies the individual from being a planning committee member, a teacher, or an author of educational materials, and this individual cannot have any responsibility for the development, management, presentation, or evaluation of STS educational activities. This requirement is intended neither to imply any impropriety of such relationships nor to prejudice any individual planner, presenter or author. It is merely to identify such relationships through full disclosure, and to allow STS to assess and resolve potential influences on the educational activity prior to the planning and implementation of an educational activity. If no relationships with commercial interests exist, the individual must indicate this on the disclosure form.

Additionally, the fact that the presentation, paper, or other educational product describes (a) the use of a device, product, or drug that is not FDA approved or (b) an off-label use of an approved device, product, or drug must also be disclosed. This requirement has been adopted in response to FDA policy and case law involving medical societies, and is not intended to prohibit or inhibit independent presentation or discussion regarding the uses of devices, products, and drugs as described in (a) or (b) above.

For live presentations, all disclosures must be stated orally and on a slide at the beginning of the presentation and will be noted in published material related to the activity. Slides, handouts, and other materials utilized as part of an educational activity cannot contain any advertising, trade names or a product group message. Speakers are required to disclose that they have nothing to disclose if this is the case.

Amended by the STS Executive Committee: April 11, 2012

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

ELECTRONIC CME/CEU EVALUATION

The STS 53rd Annual Meeting utilizes an entirely electronic evaluation and CME/Perfusion CEU credit claim process. Both physicians and perfusionists can use this system to claim credit, complete evaluations, and print CME/Perfusion CEU certificates. Certificates of Attendance also are available for other attendees and international physicians not wishing to claim CME credit. Attendees will not be able to evaluate and claim CME/Perfusion CEU credit for ticketed sessions unless they have registered for those sessions. Please note that CME credit is not available for the Residents Symposium, Residents Luncheon, or STS/AATS Tech-Con 2017.

Attendees can complete the overall meeting evaluations and all individual session evaluations onsite at CME Stations located near Registration, near Room 330, and in Hall B3. Certificate printing is available.

Attendees also can complete evaluations and claim credit at www.sts.org/2017evaluation or by using the STS Annual Meeting Mobile App. In order to make this process more convenient for attendees, the meeting evaluations will be available online through Friday, February 10, 2017.

Attendees can log in to the website with the following information:

- Username: 6-digit member ID number located at the lower left-hand side of the meeting badge
- · Password: First initial and last name

PHYSICIAN COMPETENCIES

As an accredited provider of continuing medical education, STS strives to provide the best, most relevant educational experience for those who take part in the Society's educational activities. The Accreditation Council for Continuing Medical Education (ACCME) has stressed the importance of CME program planning and implementation that is focused on quality with the aim of improving health care. In an effort to help clarify how STS programming focuses on the Accreditation Council for Graduate Medical Education (ACGME) / American Board of Medical Specialties (ABMS) competencies, physician competencies are listed prior to STS 53rd Annual Meeting information. Sessions may touch upon other competencies in addition to those identified below.

Practice-Based Learning and Improvement: Show an ability to investigate and evaluate patient care practices, appraise and assimilate scientific evidence, and improve the practice of medicine.

Patient Care and Procedural Skills: Provide care that is compassionate, appropriate, and effective treatment for health problems and to promote health.

Systems-Based Practice: Demonstrate awareness of and responsibility to the larger context and systems of health care. Be able to call on system resources to provide optimal care (eg, coordinating care across sites or serving as the primary case manager when care involves multiple specialties, professions, or sites).

Medical Knowledge: Demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and their application in patient care.

Interpersonal and Communication Skills: Demonstrate skills that result in effective information exchange and teaming with patients, their families, and professional associates (eg, fostering a therapeutic relationship that is ethically sound, uses effective listening skills with non-verbal and verbal communication; working as both a team member and at times as a leader).

Professionalism: Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to diverse patient populations.

RULES REGARDING ORAL PRESENTATIONS

- 1. For each abstract that is presented orally or as a poster during the STS 53rd Annual Meeting, a corresponding full manuscript must be submitted to *The Annals of Thoracic* Surgery for publication consideration on or before Wednesday, January 25, 2017, unless the STS Board of Directors or Executive Committee has granted an explicit waiver, as discussed below. Manuscripts must be submitted online at www.editorialmanager.com/ annals. Editorial staff will be available in the Exhibit Hall at booth #533 to assist you in submitting your paper if you need help. Manuscripts will not be considered for publication if submitted after Wednesday, January 25, 2017, at 11:59 РМ Central Standard Time. All papers shall become the property of the Society. Publication of manuscripts in *The* Annals of Thoracic Surgery is not assured. If manuscripts are not submitted to The Annals before or at the time of the STS 53rd Annual Meeting, a 2-year period of ineligibility for participation in the STS Annual Meeting will be imposed upon all authors of the paper. The same 2-year sanction applies to all manuscripts returned to authors for revisions that are not resubmitted within 1 calendar year of the request for revision. Notwithstanding the foregoing, the STS Board of Directors or Executive Committee may waive the requirement that authors of an abstract accepted for presentation at the STS Annual Meeting submit a corresponding manuscript to *The Annals of Thoracic Surgery* for publication consideration in unusual circumstances. Requests for such waivers must be submitted in writing to the STS Secretary and may be granted subject to certain terms and conditions. In all such circumstances, manuscripts derived from STS Annual Meeting presentations may not be published before presentation of the material at the Annual Meeting.
- 2. Presenters for scientific sessions are provided with time limits for their presentations and must comply with these limits. Please refer to your confirmation notification for your specific time limit.
- 3. All visuals accompanying scientific oral presentations must be produced in Microsoft Office PowerPoint. Presenters must report to the Speaker Ready Room (Room 340) at least 24 hours prior to their scheduled presentation time to upload their PowerPoint into the presentation system.
- 4. Reserved seating is available for presenters and invited discussants at the front of the room for the General Sessions. In the interest of time, presenters and discussants should sit in this reserved seating.
- 5. Presenters will remain with discussants on the dais during the oral presentations to respond directly to the discussants' queries.
- 6. Commercial and regulatory disclosures as defined in the STS Education Disclosure Policy (see page 6) must be disclosed orally to the audience at the beginning of each presentation. This requirement is for moderators, presenters, and invited discussants. The first slide of a presentation must be used to reveal the nature of the disclosure. Disclosure information also will be provided in the text of this Abstract Book.

NOTE: The Society of Thoracic Surgeons does not necessarily endorse the opinions expressed by any moderator, presenter, or discussant.

RULES REGARDING SCIENTIFIC POSTERS

- 1. For each abstract that is presented orally or as a poster during the STS 53rd Annual Meeting, a corresponding full manuscript must be submitted to The Annals of Thoracic Surgery for publication consideration on or before Wednesday, January 25, 2017, unless the STS Board of Directors or Executive Committee has granted an explicit waiver, as discussed below. Manuscripts must be submitted online at www.editorialmanager.com/ annals. Editorial staff will be available in the Exhibit Hall at booth #533 to assist you in submitting your paper if you need help. Manuscripts will not be considered for publication if submitted after Wednesday, January 25, 2017, at 11:59 рм Central Standard Time. All papers shall become the property of the Society. Publication of manuscripts in *The* Annals of Thoracic Surgery is not assured. If manuscripts are not submitted to The Annals before or at the time of the STS 53rd Annual Meeting, a 2-year period of ineligibility for participation in the STS Annual Meeting will be imposed upon all authors of the paper. The same 2-year sanction applies to all manuscripts returned to authors for revisions that are not resubmitted within 1 calendar year of the request for revision. Notwithstanding the foregoing, the STS Board of Directors or Executive Committee may waive the requirement that authors of an abstract accepted for presentation at the STS Annual Meeting submit a corresponding manuscript to *The Annals of Thoracic Surgery* for publication consideration in unusual circumstances. Requests for such waivers must be submitted in writing to the STS Secretary and may be granted subject to certain terms and conditions. In all such circumstances, manuscripts derived from STS Annual Meeting presentations may not be published before presentation of the material at the Annual Meeting.
- 2. Scientific posters have been assigned designated poster boards. Each scientific poster must correspond with the assigned poster board number. Scientific poster numbers begin with "P" followed by the corresponding poster board, eg, P12.
- **3.** Scientific posters must be designed to fit the poster board, which is 4 feet high by 8 feet wide. The poster title and author block must be displayed across the top of the poster. This will allow meeting participants to find posters easily. Poster material should be readable from a distance of at least 6 feet.
- **4.** Commercial and regulatory disclosures as defined in the STS Education Disclosure Policy (see page 6) must be included on the poster in the lower right-hand corner. Posters not containing commercial and regulatory disclosures may be removed from the scientific poster area. If you do not have anything to disclose, please print "Nothing to Disclose" in the lower right-hand corner. This requirement is not intended to imply any impropriety of such relationships or to prejudice any individual presenter, author, or discussant. It is merely to identify such relationships through full disclosure and to allow audience members to form their own judgments regarding the poster presentation.
- 5. Scientific posters may be set up on Saturday, January 21, from 8:00 AM to 5:00 PM and Sunday, January 22, from 8:00 AM to 2:00 PM in Hall B3. STS will move posters chosen for the Scientific Posters and Wine event (see next page) between 2:00 PM and 4:00 PM on Monday, January 23. You will be notified via e-mail by 7:00 PM on Sunday, January 22, if your poster was selected for the Scientific Posters and Wine event.
- 6. Scientific posters accepted for the STS 53rd Annual Meeting must be displayed at the meeting for the entire time assigned and in the assigned location. Authors who do not display their posters will be subjected to a 2-year period of ineligibility for participation in the STS Annual Meeting. This sanction applies to all poster authors.

- 7. The STS 53rd Annual Meeting will feature a unique Scientific Posters and Wine event on Monday, January 23, from 5:15 pm to 6:30 pm in the Grand Ballroom Foyer. Moderators for each of the three subspecialties will guide participants through a discussion of the selected poster abstracts. If your poster is selected for this event, please arrive at the Grand Ballroom Foyer no later than 5:00 pm on Monday, January 23, to prepare.
- 8. All posters will be graded on the evening of Sunday, January 22. Authors of the top graded posters will present their poster during the Scientific Posters and Wine event and will have their presentations graded by selected reviewers. A winner for each category will be announced shortly thereafter.
- **9.** Scientific posters must remain on display until 5:00 pm on Tuesday, January 24, after which they may be taken down. STS is not responsible for any scientific posters remaining after 10:00 am on Wednesday, January 25. STS will not ship posters back to authors.

Commercial Relationships of Program Planning Members

The Society would like to thank the following STS leaders for planning the educational content of STS/AATS Tech-Con 2017. Unless otherwise noted, the program planning members have no commercial relationships to disclose:

Mark F. Berry, Co-Chair, Workforce on Annual Meeting (Tech-Con Task Force)

Richard Lee, Co-Chair, Workforce on Annual Meeting (Tech-Con Task Force)

Nimesh Desai, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

T. Sloane Guy, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Verb Surgical, Edwards Lifesciences Corporation, Admedus

Ali Khoynezhad, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Research Grant, AtriCure, Medtronic, W. L. Gore & Associates

James D. Luketich, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Ownership Interest, Johnson & Johnson, Intuitive Surgical

Himanshu J. Patel, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, W. L. Gore & Associates, Vascutek Ltd a Terumo Company

Michael F. Reed, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Spiration; Research Grant, Spiration

John M. Stulak, Workforce on Annual Meeting (Tech-Con Task Force)

Rakesh M. Suri, Workforce on Annual Meeting (Tech-Con Task Force)

Mathew R. Williams, Workforce on Annual Meeting (Tech-Con Task Force)

COMMERCIAL RELATIONSHIPS Research Grant, Edwards Lifesciences Corporation, Medtronic

The Society would like to thank the following STS leaders for planning the educational content of the STS 53rd Annual Meeting. Unless otherwise noted, the program planning members have no commercial relationships to disclose:

Kevin D. Accola, Workforce on Health Policy, Reform, and Advocacy

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Edwards Lifesciences Corporation, CorMatrix; Research Grant, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

Michael A. Acker, Workforce on Surgical Treatment of End-Stage Cardiopulmonary Disease

Gorav Ailawadi

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Edwards Lifesciences Corporation, Abbott Vascular; Speakers Bureau/Honoraria, St Jude Medical; Nonremunerative Position of Influence, AtriCure

Gabriel S. Aldea, Workforce on International Relationships

Mark S. Allen, Chair, Workforce on E-Learning and Educational Innovation; Council on Education and Member Services Operating Board; Immediate Past President, Board of Directors

Mara B. Antonoff, Workforce on E-Learning and Educational Innovation

COMMERCIAL RELATIONSHIPS Ownership Interest, Medtronic; Nonremunerative Position of Influence, American Board of Surgery

Jehangir J. Appoo, Workforce on Annual Meeting (Program Task Force)

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, W. L. Gore & Associates

Rakesh C. Arora, Workforce on Critical Care

COMMERCIAL RELATIONSHIPS Research Grant, Pfizer Canada; Speakers Bureau/Honoraria, Mallinckrodt Pharmaceuticals

Giorgio M. Aru, Workforce on Patient Safety

Pavan Atluri, Workforce on Surgical Treatment of End-Stage Cardiopulmonary Disease Ashok N. Babu, Workforce on Surgical Treatment of End-Stage Cardiopulmonary Disease Vinay Badhwar, Council on Clinical Practice and Member Engagement Operating Board

Faisal G. Bakaeen, Workforce on Clinical Education COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, JACE Medical

Craig J. Baker, Workforce on E-Learning and Educational Innovation; Workforce on Thoracic Surgery Resident Issues

Michael K. Banbury, Workforce on Health Policy, Reform, and Advocacy

Joseph E. Bavaria, President, Board of Directors

COMMERCIAL RELATIONSHIPS Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

Edo K. S. Bedzra, Workforce on Thoracic Surgery Resident Issues

Edward M. Bender, Workforce on Clinical Education

Christian Bermudez, Workforce on International Relationships

Shanda H. Blackmon, Director-at-Large, Board of Directors; Workforce on General Thoracic Surgery

Matthew G. Blum, Workforce on Practice Management

Robert S. Boova, Workforce on Health Policy, Reform, and Advocacy

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Bryan A. Whitson, Workforce on Surgical Treatment of End-Stage Cardiopulmonary Disease

COMMERCIAL RELATIONSHIPS Other/Travel, HeartWare, St Jude Medical; Other Research Support, XVIVO

Richard I. Whyte, Workforce on Health Policy, Reform, and Advocacy; Workforce on General Thoracic Surgery

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Gorav Ailawadi

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Joseph B. Clark

Joseph C. Cleveland Jr

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Yolanda L. Colson

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John V. Conte

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Afshin Ehsan

Richard P. Embrev

Robert W. Emery

John W. Entwistle

James I. Fann

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Twelve, Inc, Shockwave Medical; Ownership Interest, Twelve, Inc, Shockwave Medical

Farhood Farjah

Frank L. Fazzalari

Francis D. Ferdinand

Mark K. Ferguson

COMMERCIAL RELATIONSHIPS Nonremunerative Position of Influence, International Society for Diseases of the Esophagus, CTSNet, The Society of Thoracic Surgeons; Other/Royalties, Elsevier BV, Springer

Felix G. Fernandez

Hiran C. Fernando

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, CSA Medical, Galil Medical

Angel Fernández-González

Enrico R. Ferrari

Andrew C. Fiore

Michael S. Firstenberg

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Maquet, Ethicon, Johnson & Johnson; Consultant/Advisory Board, Maquet, Ethicon, Johnson & Johnson; Research Grant, Grifols

Raja M. Flores

Kenneth L. Franco

Richard K. Freeman

Stephanie M. Fuller

Mark E. Galantowicz

James S. Gammie

COMMERCIAL RELATIONSHIPS Ownership Interest, Correx, Harpoon Medical; Consultant/Advisory Board, Edwards Lifesciences Corporation

Sanjiv K. Gandhi

Sidharta P. Gangadharan

James J. Gangemi

J. William Gaynor

Arnar Geirsson

Kristopher M. George

Thomas G. Gleason

COMMERCIAL RELATIONSHIPS Research Grant, Medtronic

Kevin L. Greason

Sean C. Grondin

Robert A. Gustafson

John W. Hammon

John R. Handy

David H. Harpole

Stephen R. Hazelrigg

Jeffrey S. Heinle

William L. Holman

Charles B. Huddleston

Mark D. Iannettoni

John S. Ikonomidis

Jeffrey P. Jacobs

Valluvan Jeevanandam

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Thoratec Corporation, Reliant Heart

Michael E. Jessen

Lauren C. Kane

Mark R. Katlic

Aditya K. Kaza

Michael S. Kent

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Intuitive Surgical

Kemp H. Kernstine

Kenneth A. Kesler

Anthony W. Kim

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Boehringer-Ingelheim

Christopher J. Knott-Craig

Robert L. Kormos

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, HeartWare; Research Grant, HeartWare

S. Ram Kumar

John J. Lamberti

Michael Lanuti

Iennifer S. Lawton

Richard Lee

Bradley Leshnower

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, CryoLife

Jules Lin

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Intuitive Surgical, AtriCure

Shu S. Lin

Kevin W. Lobdell

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Medtronic

Vassyl A. Lonchyna

COMMERCIAL RELATIONSHIPS Ownership Interest, Abbott Laboratories, AbbVie, Motorola Solutions

Donald E. Low

Thomas E. MacGillivray

Joren C. Madsen

Daniel Marelli

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Jarvik Heart

M. Blair Marshall

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Ethicon; Elsevier BV, Thoracic Surgery Clinics

Christopher E. Mascio

Constantine Mavroudis

John E. Mayer

Donna E. Maziak

Patrick M. McCarthy

COMMERCIAL RELATIONSHIPS Ownership Interest, Edwards Lifesciences Corporation; Consultant/Advisory Board, Edwards Lifesciences Corporation, Abbott Laboratories

James B. McClurken

John R. Mehall

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Edwards Lifesciences Corporation

Ari A. Mennander

Walter H. Merrill

Carlos M. Mery

Dan M. Meyer

Shari L. Meyerson

John Miller

John D. Mitchell

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Medtronic, Maquet

Susan D. Moffatt-Bruce

Nahush A. Mokadam

Rainer G. H. Moosdorf

Christopher R. Morse

Ralph S. Mosca

Sudish C. Murthy

Christopher J. Mutrie

Katie S. Nason

Meena Nathan

Jose L. Navia

Jennifer S. Nelson

Dao M. Nguyen

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Intuitive Surgical

William M. Novick

Richard G. Ohye

Francis D. Pagani

Himanshu J. Patel

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Edwards Lifesciences Corporation, Medronic, Vascutek Ltd a Terumo Company, W. L. Gore & Associates; Research Grant, W. L. Gore & Associates, Vascutek Ltd a Terumo Company, Medtronic, Edwards Lifesciences Corporation

G. Alexander Patterson

Arjun Pennathur

COMMERCIAL RELATIONSHIPS Research Grant, Accuray

Lester C. Permut

Jonathan M. Philpott

COMMERCIAL RELATIONSHIPS Research Grant, AtriCure, Consultant/Advisory Board, AtriCure, Speakers Bureau/Honoraria. AtriCure

Allan Pickens

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Ethicon Endo-Surgery

Mark D. Plunkett

Mohammed A. Quader

Joseph Rabin

Daniel Raymond

COMMERCIAL RELATIONSHIPS Ownership Interest, Bristol-Myers Squibb

Dan J. Raz

COMMERCIAL RELATIONSHIPS Research Grant, Circca Theranostics; Ownership Interest, Circca Theranostics

Rishindra M. Reddy

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Intuitive Surgical

T. Brett Reece

COMMERCIAL RELATIONSHIPS Research Grant, Grifols, Bard Medical, Medtronic, St Jude Medical

Michael F. Reed

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Spiration

Harold G. Roberts

COMMERCIAL RELATIONSHIPS Research Grant, Medtronic

Gaetano Rocco

COMMERCIAL RELATIONSHIPS Research Grant, Baxter; Speakers Bureau/Honoraria, Baxter, Medtronic; Ownership Interest/New surgical instrument patented, Scanlan International

Evelio Rodriguez

COMMERCIAL RELATIONSHIPS Research Grant, Edwards Lifesciences Corporation, Direct Flow Medical, Abbott Laboratories; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

Todd K. Rosengart

Matthew A. Romano

COMMERCIAL RELATIONSHIPS Research Grant, Edwards Lifesciences Corporation, AtriCure

Eric E. Roselli

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, W. L. Gore & Associates, Medtronic, Bolton Medical; Speakers Bureau/Honoraria, Vascutek Ltd a Terumo Company; Research Grant, Medtronic, Vascutek Ltd a Terumo Company

Marc Ruel

Valerie W. Rusch

Joseph F. Sabik III

COMMERCIAL RELATIONSHIPS Research Grant, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic

Jorge D. Salazar

Christopher T. Salerno

Juan A. Sanchez

Edward B. Savage

Joseph D. Schmoker

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Medtronic

Matthew J. Schuchert

Frank W. Sellke

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Stryker Performance Solutions

Craig H. Selzman

Jav G. Shake

K. Robert Shen

Brett Sheridan

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, St Jude Medical

Joseph C. Shrager

COMMERCIAL RELATIONSHIPS Research Grant, Becton, Dickinson and Company, Varian Medical Systems; Consultant/ Advisory Board, Becton, Dickinson and Company

Nicholas G. Smedira

Michael Smith

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, Ethicon Endo-Surgery

Edward G. Soltesz

COMMERCIAL RELATIONSHIPS Speakers Bureau/Honoraria, St Jude Medical, Edwards Lifesciences Corporation, AtriCure; Ownership Interest/Royalties, JACE Medical

Howard Song

Alan M. Speir

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, Medtronic

Thomas L. Spray

Sandra L. Starnes

Robert W. Stewart

Wilson Y. Szeto

COMMERCIAL RELATIONSHIPS Research Grant, Edwards Lifesciences Corporation, Medtronic; Consultant/Advisory Board, Micro Interventional Devices

Roy T. Temes

Hassan A. Tetteh

Patricia A. Thistlethwaite

Matthew Thomas

COMMERCIAL RELATIONSHIPS Research Grant, Acelity, The Thoracic Surgery Foundation

Vinod H. Thourani

Betty C. Tong

Curt Tribble

Peter I. Tsai

Elaine E. Tseng

COMMERCIAL RELATIONSHIPS Ownership Interest, ReValve Med

Joseph W. Turek

Mark W. Turrentine

James S. Tweddell

COMMERCIAL RELATIONSHIPS Consultant/Advisory Board, CorMatrix

Akif Undar

Prashanth Vallabhajosyula

Glen S. Van Arsdell

COMMERCIAL RELATIONSHIPS Ownership Interest, CellAegis Devices

Panayotis Vardas

Julio Vasquez

Todd S. Weiser

Benny Weksler

Glenn J. R. Whitman

COMMERCIAL RELATIONSHIPS Research Grant, Abbott Laboratories

Richard I. Whyte

Jason A. Williams

Douglas E. Wood

COMMERCIAL RELATIONSHIPS Research Grant, Spiration; Consultant/Advisory Board, Spiration

Cameron D. Wright

Stephen C. Yang

Leora T. Yarboro

Saikrishna S. Yendamuri

Marco A. Zenati

STS/AATS TECH-CON

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Friday, January 20

3:00 PM - 6:00 PM Room 360 Lobby

Registration

Saturday, January 21

7:00 AM - 6:00 PM Room 360 Lobby

Registration

7:00 AM - 6:30 PM **Grand Ballroom Foyer**

Tech-Con Exhibits

7:00 AM - 8:00 AM **Grand Ballroom Foyer**

Breakfast

8:00 AM - 9:30 AM **Grand Ballroom AB**

Adult Cardiac Track I: Innovations in Mitral Valve Disease and Atrial Fibrillation

Management

Moderators: T. Sloane Guy, New York, NY, and Rakesh M. Suri, Cleveland, OH

COMMERCIAL RELATIONSHIPS T. S. Guy: Consultant/Advisory Board, Admedus, Verb Surgical, Edwards Lifesciences Corporation

8:00 AM

Mitral Valve Replacement Will Dominate the Transcatheter Space: Update on Devices and World Experience

Vinay K. Bapat, London, United Kingdom

COMMERCIAL RELATIONSHIPS V. K. Bapat: Consultant/Advisory Board, Medtronic; Speakers Bureau/Honoraria, Boston Scientific, Edwards Lifesciences Corporation

8:08 AM

Preclinical Experience With the Direct Flow Transcatheter Mitral Valve

W. Douglas Boyd, Sacramento, CA

COMMERCIAL RELATIONSHIPS W. D. Boyd: Consultant/Advisory Board, CorMatrix, Direct Flow Medical, Millipede, Inc; Ownership Interest, Millipede, Inc

REGULATORY DISCLOSURE This presentation describes the pre-clinical experience with a novel transcatheter mitral valve.

8:16 AM

Transcatheter Mitral Valve Replacement With the Medtronic Twelve Valve

Michael J. Reardon, Houston, TX

COMMERCIAL RELATIONSHIPS M. J. Reardon: Consultant/Advisory Board, Medtronic; Research Grant, Medtronic

REGULATORY DISCLOSURE This presentation will discuss the Intrepid TMVR by Medtronic, which has an FDA status of investigational.



8:24 AM

Update on Transcatheter Mitral Valve Repair

Mathew R. Williams, New York, NY

COMMERCIAL RELATIONSHIPS M. R. Williams: Research Grant, Edwards Lifesciences Corporation, Medtronic

8:32 AM

Panel Discussion

8:45 AM

Robotic Mitral Valve Surgery: Where Are We Going?

Robert L. Smith, Plano, TX

COMMERCIAL RELATIONSHIPS R. L. Smith: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation; Research Grant, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Abbott Laboratories, Edwards Lifesciences Corporation, Intuitive Surgical

8:53 AM

Minimally Invasive Non-Robotic Mitral Valve Surgery: A New Standard?

Aubrey C. Galloway, New York, NY

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ A.\ C.\ Galloway: Ownership\ Interest, Edwards\ Lifesciences\ Corporation, Medtronic Communication and C$

9:01 AM

New Developments in Atrial Fibrillation

Niv Ad, Falls Church, VA

COMMERCIAL RELATIONSHIPS N. Ad: Consultant/Advisory Board, AtriCure, LivaNova; Ownership Interest, Left Atrial Appendage Occluder, LCC; Speakers Bureau/Honoraria, Medtronic

9:09 AM

Left Atrial Appendage Closure Devices and Techniques

Richard Lee, St Louis, MO

9:17 AM

Panel Discussion



8:00 AM - 9:30 AM

Room 310ABC

General Thoracic Track I: Precision Thoracic Surgery

Moderators: James D. Luketich, Pittsburgh, PA, and Benjamin Wei, Birmingham, AL COMMERCIAL RELATIONSHIPS J. D. Luketich: Ownership Interest, Ethicon, Intuitive Surgical; Research Grant, Accuray

8:00 AM

Ablative Lung Cancer Therapies

Ieremiah T. Martin, Portsmouth, OH

8:12 AM

Physiologic-Guided Surgery: SPY, Firefly, and Other Localization Techniques

Daniela Molena, New York, NY

COMMERCIAL RELATIONSHIPS D. Molena: Speakers Bureau/Honoraria, Novadaq

REGULATORY DISCLOSURE This presentation describes the off-label use of ICG by Novadag for nodal mapping and lung nodule localization, which is FDA approved.



STS/AATS TECH-CON

8:24 AM

Utilizing Advancements in Cosmetic Surgery to Enhance Lung Resections

Wissam Raad, New York, NY

8:36 AM

Panel Discussion

8:46 AM

Genomic Tools for Lung Cancer Diagnosis and Treatment

Daniel J. Boffa, New Haven, CT

8:58 AM

Lung Cancer Breath Test

Michael Bousamra II, Louisville, KY

COMMERCIAL RELATIONSHIPS M. Bousamra: Ownership Interest, Breath Diagnostics

REGULATORY DISCLOSURE This presentation will describe the use of the OneBreath test by Breath Diagnostics, which has an FDA status of investigational.

9:10 AM

Intelligent Chest Tube Systems for Cardiothoracic Surgery

Randy Preston, Omaha, NE

COMMERCIAL RELATIONSHIPS R. Preston: Employment, Esculon Inc; Ownership Interest, Esculon Inc

REGULATORY DISCLOSURE This presentation describes the use of the Thoraguard by Esculon Inc, which is not FDA approved.

9:22 AM

Panel Discussion

9:30 AM - 10:15 AM

Grand Ballroom Foyer

BREAK—Visit Tech-Con Exhibits

10:15 AM - 12:00 PM

Grand Ballroom AB

Adult Cardiac Track II: Aortic/Endovascular

Moderators: Michael A. Borger, New York, NY, and Ali Khoynezhad, Los Angeles, CA

COMMERCIAL RELATIONSHIPS M. A. Borger: Consultant/Advisory Board, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, St Jude Medical; A. Khoynezhad: Research Grant, AtriCure

10:15 AM

Debate: TAVR Will Be Performed in 95% of Isolated Aortic Stenosis Patients in 5 Years

Pro: Himanshu J. Patel, Ann Arbor, MI

Con: Saibal Kar, Los Angeles, CA

COMMERCIAL RELATIONSHIPS H. J. Patel: Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic; Research Grant, Edwards Lifesciences Corporation, Medtronic; S. Kar: Consultant/Advisory Board, Abbott Vascular, Boston Scientific Corporation, Edwards Lifesciences Corporation; Research Grant, Abbott Vascular, Boston Scientific Corporation, Edwards Lifesciences Corporation, Mitralign, Inc

10:30 AM

Aortic Valve Repair 101

Gebrine El Khoury, Brussels, Belgium





10:38 AM

Edwards INTUITY Elite Rapid Deployment Aortic Valve Replacement Insertions: Technique Video

Kevin D. Accola, Orlando, FL

COMMERCIAL RELATIONSHIPS K. D. Accola: Consultant/Advisory Board, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

10:46 AM

Perceval Sutureless Aortic Prosthesis in the Bicuspid Aortic Valve: Technical Tips and Results From the US Investigational Device Exemption Study

Eric E. Roselli, Cleveland, OH

COMMERCIAL RELATIONSHIPS E. E. Roselli: Consultant/Advisory Board, W. L. Gore & Associates, Medtronic; Research Grant, Medtronic, Vascutek Ltd a Terumo company; Speakers Bureau/Honoraria, LivaNova, Vascutek Ltd a Terumo company

10:54 AM

Prospective European Multicenter Trial Evaluating Decellularized Homografts for Aortic Valve Replacement—The ARISE Study

Samir Sarikouch, Hanover, Germany

REGULATORY DISCLOSURE This presentation will describe the Arise AV by corlife oHG, which is not FDA approved.

11:02 AM

Panel Discussion

11:12 AM

Outcomes of On- and Off-Label Ascending Thoracic Endovascular Aortic Repair (TEVAR)

Rodney White, Torrance, CA

COMMERCIAL RELATIONSHIPS R. White: Other Research Support, Medtronic, Volcano Corporation, W. L. Gore & Associates; Research Grant, Medtronic, W. L. Gore & Associates; Speakers Bureau/Honoraria, Medtronic, Volcano Corporation, W. L. Gore & Associates

REGULATORY DISCLOSURE This presentation will describe the off-label use of the Valient Captiva Ascending Aortic Endograft by Medtronic, which is FDA approved.

11:20 AM

Current Endovascular Technologies in Thoracoabdominal Aortic Aneurysm Repair

Matthew Eagleton, Cleveland, OH

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ \mathrm{M.\ Eagleton:\ Consultant/Advisory\ Board,\ Bolton\ Medical,\ Cook\ Medical}$

11:28 AM

Aortic Wall Strengthening by Endovascular "Net" Prosthesis for Aortic Aneurysm Prevention in Marfan Syndrome and Other Genetic Disorders

Stefano Nazari, Pavia, Italy

11:36 AM

Debate: Branched TEVAR Will Be Performed in 95% of All Arch Pathologies in 5 Years

Pro: Leonard N. Girardi, New York, NY

Con: Nimesh Desai, Philadelphia, PA

COMMERCIAL RELATIONSHIPS N. Desai: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates



STS/AATS TECH-CON

11:50 AM

Panel Discussion

10:15 AM - 12:00 PM Room 310ABC

General Thoracic Track II: Advanced Thoracic Surgery

Moderators: DuyKhanh P. Ceppa, Indianapolis, IN, and Michael F. Reed, Hershey, PA COMMERCIAL RELATIONSHIPS M. F. Reed: Consultant/Advisory Board, Spiration; Research Grant, Spiration

10:15 AM

Training Models and Simulators

Shari L. Meyerson, Chicago, IL

10:27 AM

Advanced Endoscopic Gastrointestinal Techniques: What's New and What's Coming Speaker TBD

10:39 AM

Advanced Bronchoscopic Techniques

Ali I. Musani, Milwaukee, WI

10:51 AM

Cryobiopsy for Diagnosing Interstitial Lung Disease: What Is It and Should Surgeons Be Doing It?

Sadia Benzaquen, Cincinnati, OH

11:03 AM

Panel Discussion

11:13 AM

Robotic Stapling/Advances

Michael Zervos, New York, NY

COMMERCIAL RELATIONSHIPS M. Zervos: Other/Trainer, Intuitive Surgical

11:25 AM

Smart Tissue Autonomous Robot (STAR)

Peter Y. Kim, Washington, DC

COMMERCIAL RELATIONSHIPS P.Y. Kim: Ownership Interest, Omniboros

Subxiphoid and Subcostal Uniportal Lobectomy

Joel Dunning, Middlesbrough, United Kingdom

COMMERCIAL RELATIONSHIPS J. Dunning: Speakers Bureau/Honoraria, Dextera Surgical

11:49 AM

Panel Discussion



12:00 PM - 1:00 PM

Grand Ballroom C/Room 320ABC

LUNCH—Visit Tech-Con Exhibits

1:00 PM - 2:45 PM

Grand Ballroom AB

Adult Cardiac Track III: Ventricular Assist Devices/Heart Failure

Moderators: Duc T. Pham, Chicago, IL, and John M. Stulak, Rochester, MN

COMMERCIAL RELATIONSHIPS D. T. Pham: Consultant/Advisory Board, HeartWare, Thoratec Corporation; Speakers Bureau/Honoraria, HeartWare, Thoratec Corporation

1:00 PM

Options for Biventricular Support: Total Artificial Heart, Bi-HVAD, Bi-HM2

Martin Strueber, Grand Rapids, MI

COMMERCIAL RELATIONSHIPS M. Strueber: Consultant/Advisory Board, HeartWare, Thoratec Corporation

1:15 PM

Current State of Partial Assist Devices: CircuLite, C-Pulse

Daniel Burkhoff, New York, NY

COMMERCIAL RELATIONSHIPS D. Burkhoff: Consultant/Advisory Board, BackBeat Medical, HeartWare, Sensible Medical; Other Research Support, Corvia Medical

REGULATORY DISCLOSURE This presentation will describe the use of a generic, partial support pump by Medtronic, which is not FDA approved.

1:30 PM

Devices in Development: Longhorn, VentriFlo, Pulsatile Extracorporeal Membrane Oxygenation (ECMO)

Nader Moazami, Cleveland, OH

REGULATORY DISCLOSURE This presentation will describe the use of the Ventriflo by DesignMentor Inc, which has an FDA status of investigational, and the LongHorn by Medtronic, which is not FDA approved.

1:45 PM

Percutaneous and Acute Mechanical Circulatory Support Devices: Impella, Right Peripheral, Percutaneous Heart Pump, ECMO (E-CPR)

Jonathan W. Haft, Ann Arbor, MI

2:00 PM

Specialty Products in Development: Percutaneous Distal Embolic Protection for Left Ventricular Assist Device Thrombolysis

David L. Joyce, Rochester, MN

REGULATORY DISCLOSURE This presentation will describe the use of a distal embolic protection device, which is in development.

2:15 PM

Specialty Products in Development: A Universal, Smart, and Portable Driver for All SynCardia Total Artificial Heart Patients

Francisco A. Arabia, Los Angeles, CA

COMMERCIAL RELATIONSHIPS F. A. Arabia: Other/Trainer, Medtronic, SynCardia

2:30 PM

Panel Discussion



STS/AATS TECH-CON

1:00 PM - 2:45 PM Room 310ABC

General Thoracic Track III: Health Care in the 21st Century

Moderators: Lisa M. Brown, Sacramento, CA, and Jeremiah T. Martin, Portsmouth, OH

1:00 PM

Apps to Improve Efficiency/Operating Room Throughput: Core Mobile

Chandra S. Tekwani, San Francisco, CA

1:12 PM

Patient Engagement Apps: HealthLoop

Speaker TBD

1:24 PM

Social Media and Thoracic Surgery

Thomas K. Varghese, Salt Lake City, UT

1:36 PM

Marketing CT Surgeons in the Year 2017: Why and How

Fernando Lamounier, Denver, CO

COMMERCIAL RELATIONSHIPS F. Lamounier: Ownership Interest, SproutPoint™ Consulting

1:48 PM

Panel Discussion

1:58 PM

Automated Lung Cancer Screening/Aspen Lung

Julian Guitron, Loveland, OH

2:10 PM

Lessons Learned in Implementing a Lung Cancer Screening Program

Betty C. Tong, Durham, NC

2:22 PM

Big Data and Thoracic Surgery: Clinical Models

Eric L. Grogan, Nashville, TN

2:34 PM

Panel Discussion

2:45 PM – 3:15 PM Grand Ballroom Foyer

BREAK—Visit Tech-Con Exhibits

3:15 PM – 5:00 PM *Grand Ballroom AB*

Joint Session: "Shark Tank"—Rapid-Fire Elevator Pitches of Revolutionary Technology

Moderators: Mark F. Berry, Stanford, CA, and Richard Lee, St Louis, MO

"Shark Tank" Judge: Rick Anderson, Austin, TX





3:15 PM

Debate: New Technology Is the Birth/Death of Thoracic Surgery

Early Stage Lung Cancer—Thoracic Surgeons Need to Do More Than Just Cut: James D. Luketich, Pittsburgh, PA

Early Stage Lung Cancer Patients Don't Need a Thoracic Surgeon: Robert D. Timmerman, Dallas, TX

COMMERCIAL RELATIONSHIPS J. D. Luketich: Ownership Interest, Johnson & Johnson, Intuitive Surgical; Research Grant, Accuray; R. D. Timmerman: Research Grant, Accuray, Elekta Oncology, Varian Medical System

3:35 PM

Zero Leak Project

Shanda H. Blackmon, Rochester, MN

REGULATORY DISCLOSURE This presentation will describe the use of the Blackmon Mayo Anastomotic Stent Buttressing device by Mayo Clinic (hybrid development with Boston Scientific), which is not FDA approved.

3:50 PM

Flexdex™: A Minimally Invasive Surgical Technology With Enhanced Dexterity and Intuitive Control

James Geiger, Ann Arbor, MI

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ J. \ Geiger: Nonremunerative \ Position \ of \ Influence, \ FlexDex; Ownership \ Interest, \ FlexDex$

4:05 PM

Expandable Devices For Easier, Quicker, and More Efficient Anastomosis in Aortic Prosthetic Substitution

Stefano Nazari, Milan, Italy

4:20 PM

How to Go Through the FDA Process

John C. Laschinger, Silver Spring, MD

4:30 PM

How to Avoid Getting in Trouble With the FDA: The MitraClip Example

Patrick M. McCarthy, Chicago, IL

COMMERCIAL RELATIONSHIPS P. M. McCarthy: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation; Ownership Interest, Edwards Lifesciences Corporation

4:40 PM

Debate: New Technology Is The Birth/Death of Cardiac Surgery

Death: Raj Makkar, Los Angeles, CA **Birth:** Michael J. Mack, Dallas, TX

COMMERCIAL RELATIONSHIPS M. J. Mack: Other: Edwards Lifesciences Corporation, Abbott Vascular; R. Makkar: Consultant/Advisory Board, Medtronic; Research Grant, Edwards Lifesciences Corporation, St Jude Medical

REGULATORY DISCLOSURE This presentation will describe the use of the Transcatheter Mitral Valve by Edwards Lifesciences Corporation, which has an FDA status of investigational.

5:00 PM - 6:30 PM

Grand Ballroom Foyer

Tech-Con Reception

Continuing medical education credit will not be offered for STS/AATS Tech-Con 2017 programming.



SUNDAY, JANUARY 22

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7ам	7:00 AM - 6:30 PM	м 7:00	м — 8:00 ам							
	Registration		er-Cooler- ced Infections							
Вам		8:00 AM -	– 12:00 PM	8:	00 ам – 12:00 рм	8:0	00 AM - 12:0	00 PM	8:00 am – 1	2:00 pr
		Adult Cong Disease Syr	genital Heart mposium: Approaches to Valve and End-Stage	Pra	actice anagement	STS	S/AATS Critica re Symposium		STS/SCA: Inte Perioperative	grating
AM		Evaluating the Aortic V	Approaches to Valve and End-Stage	Su	mmit: Working	Cha	allenges in		Echocardiogr	
AM		Problems in What Pedia	n Young Adults— atric and Adult rgeons Can Learn Other		an Employment odel Environment	of I	Managemen Mechanical		Into Cardiac Surgical Clini	
		From Each	geons Can Learn Other			Car	rdiopulmonar		Decision Mak	
0ам	10:00 AM - 4:3					Car	diothoracic			
	"How To" Video Session: Technic	cal					ensive Care U			
1ам	Tricks and Pitfal	ills to								
	Simplify Cardiac		⊘							
2 РМ										
PM			1:00 PM - 4:00	РМ	1:00 PM - 4:30 PM					
			Residents		Resuscitation of Patients Who	Surgio	cal Symposium:	Surgical Sy	mposium:"How	
PM	2:00 m 6	20.211	Symposium: Transitioning	J	of Patients Who Arrest After Cardiac	Surge	enital Cardiac ry Mélange	and Tricks i	ession—Tips n General	
PIVI	2:00 PM – 6 Scientific		From Residen		Surgery			Thoracic Su		
	Posters		Practice						2:30 PA	
PM									Respon Emerge Strategi Team M	
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							Opening	1		
PM							Reception			
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РМ										
'PM										
ВРМ										

Registration 7:00 AM - 6:30 PM Heater-Cooler-Induced Infections: Practices, Protocols, and 7:00 AM - 8:00 AM **Mitigation Strategies** 8:00 AM - 12:00 PM Adult Congenital Heart Disease Symposium: Evaluating Approaches to the Aortic Valve and End-Stage Problems in Young Adults—What Pediatric and Adult Cardiac Surgeons **Can Learn From Each Other Practice Management Summit: Working In an Employment Model Environment** STS/AATS Critical Care Symposium: Challenges in the Management of Mechanical Cardiopulmonary Support in the Cardiothoracic Intensive Care Unit STS/SCA: Integrating Perioperative Echocardiography Into **Cardiac Surgical Clinical Decision Making** 10:00 AM - 4:30 PM "How To" Video Session: Technical Tricks and Pitfalls to Simplify **Cardiac Surgery Procedures Residents Symposium: Transitioning From Residency to** 1:00 PM - 4:00 PM Successful Practice 1:00 PM - 4:30 PM **Resuscitation of Patients Who Arrest After Cardiac Surgery** Surgical Symposium: Congenital Cardiac Surgery Mélange Surgical Symposium: "How To" Video Session—Tips and Tricks in **General Thoracic Surgery** 2:00 PM - 6:30 PM **Scientific Posters**

2:30 PM - 4:30 PM	Multidisciplinary Response to Emergencies: Strategies for Team Members
4:30 рм – 6:30 рм	Opening Reception in STS Exhibit Hall



7:00 AM - 6:30 PM Room 360 Lobby

Registration

7:00 AM - 8:00 AM Room 310ABC

Heater-Cooler-Induced Infections: Practices, Protocols, and Mitigation Strategies

The worldwide cardiothoracic surgery community is aware of the public health issue with recent heater-cooler infection findings traced to a manufacturing facility and has actively engaged in understanding the cause and developing measures to lower the risk and occurrences of these infections. To date, Mycobacterium chimaera infections related to heater-cooler devices have been reported in Europe and North America (ie, Germany, the Netherlands, Switzerland, the United Kingdom, the United States, and Canada). This symposium will include presentation of data, reflect policy from various constituents, and offer a panel discussion of clinical implications featuring cardiothoracic surgeons and infectious disease experts.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the heater-cooler-induced infection problem facing cardiothoracic surgery practices
- Identify potential preventative solutions
- Explain optimal options for assessing and treating patients who are potentially impacted

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The physician competencies addressed in this session are practice-based learning and improvement, patient care and procedural skills, systems-based practice, and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-andanswer session after each topic.

Moderators: Joseph E. Bavaria, Philadelphia, PA, and Richard L. Prager, Ann Arbor, MI COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

7:00 AM Description of the Heater-Cooler Issue Facing Cardiothoracic Surgery **Practices**

Richard L. Prager, Ann Arbor, MI



7:10 AM

Nontuberculous Mycobacterium (NTM) Infections Associated with Heater-Cooler Devices (HCD) Used During Cardiothoracic Surgery: An Emerging Public Health Concern

K. B. Allen¹, S. B. Schwartz², D. D. Yuh³, R. A. Hopkins⁴, R. Lange⁵, K. Bauer⁶, J. A. Marders², J. Delgado Donayre², N. Milligan², C. P. Wentz²

¹St Luke's Mid America Heart Institute, Kansas City, MO, ²Center for Devices and Radiological Health, US Food and Drug Administration, Silver Spring, MD, ³Yale University School of Medicine, New Haven, CT, ⁴Children's Mercy Hospital, Kansas City, MO, ⁵Texas Tech University Health Sciences Center, El Paso, ⁶US Food and Drug Administration, Silver Spring, MD COMMERCIAL RELATIONSHIPS K. B. Allen: Research Grant, Edwards Lifesciences Corporation, St Jude Medical, Medtronic; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

Purpose: Serious, disseminated nontuberculous mycobacterium (NTM) infections have occurred following surgical procedures involving extracorporeal circulation; NTM-contaminated water from heater-cooler devices (HCD) has been implicated as the source. The purpose of this study was to quantify the public health concern and to educate physicians who care for this patient population.

Methods: Between January 2010 and February 2016, the Food & Drug Administration (FDA) Medical Device Report (MDR) database was queried for reports of patient infections and/or device contamination associated with the use of HCDs. The MDR database contains mandatory reports of suspected device-related adverse events from manufacturers, importers, and device user facilities, as well as voluntary reports from health care professionals and patients. Reports were reviewed for event type (patient infection and/or HCD contamination, type of infection, patient demographics and outcome, reporting country, HCD manufacturer, and the time to event occurrence).

Results: A total of 180 MDRs were identified involving four HCD manufacturers and 55 facilities. MDRs originated both within (n=62) and outside the US (n=118) and included 61 reports of infections involving at least 66 patients and 119 reports of HCD contaminations; mortality among infected patients was 21% (14/66). Among the 61 reports of patient infections, the MDR identified the surgical procedure in 46 and infection location in 48 (Table). The time from NTM exposure during the index surgical procedure to diagnosis was able to be calculated in 33 reports; latency from exposure to a contaminated HCD to diagnosis varied depending on infection location but was reported up to 60 months. The MDRs noted significant diagnostic delays related to lack of awareness of this problem and the insidious onset of symptoms. NTM was the most frequent organism identified in the MDRs, with *M chimaera* being the predominate isolate (Table).

Conclusions: NTM infections associated with HCDs used during cardiothoracic surgery have a long latency period and are frequently fatal. The FDA convened a Circulatory System Devices Panel in June 2016 to seek recommendations on mitigating this emerging public health concern. Cardiothoracic surgeon awareness/involvement in this issue is critical to addressing this problem.

SUNDAY, JANUARY 22

Heater-Cooler-Induced Infections: Practices, Protocols, and Mitigation Strategies-Continued Continued from previous page

TABLE 1	
	NUMBER
	OF MDR's
TYPE OF ORGANISM	
Nontuberculous Mycobacterium Total	136
M. chimaera	34
M. abscessus	16
M. avium	5
M. avium/irtracellulare	5
M. fortuitum	1
Mycobacterium (unspecified)	54
NTM/Atypical Mycobacterium	21
Pseudomonas aeruginosa	3
Unidentified organism	11
Bacteria (unidentified)	28
Coliform	3
Cupriavidus pauculus	2
Legionella sp.	1
SURGICAL PROCEDURES	
Unidentified	15
Heart/Lung Transplant	14
Valves	11
Unspecified Cardiac Procedure	10
LVAD	5
CABG	3
ECMO	2 2
Congenital	
Lung Resection	1
INFECTION LOCATION	
Surgical Wound	21
Unspecified	13
Blood	11
LVAD Driveline	2
SBE/prosthetic valve/ring	13
Mycotic Graft	2
Acrtic Root Abscess	3
Disseminated	2
Other	6

7:25 AM The Infectious Disease Perspective

Neil O. Fishman, Philadelphia, PA

7:30 AM The European Response

A. Pieter Kappetein, Rotterdam, The Netherlands

The North American Response 7:35 AM

Larry Shears, Chattanooga, TN

7:40 AM **Panel Discussion**

Kenneth Shann, Boston, MA, Miguel Sousa Uva, Lisbon, Portugal, Thoralf M. Sundt, Boston, MA, and all session participants
COMMERCIAL RELATIONSHIPS T. M. Sundt: Consultant/Advisory Board, Thrasos Therapeutics







NOTES



8:00 AM - 12:00 PM Room 350DEF

Adult Congenital Heart Disease Symposium: Evaluating Approaches to the Aortic Valve and End-Stage Problems in Young Adults—What Pediatric and Adult Cardiac Surgeons Can Learn From Each Other

The surgical treatment of young adults with aortic valve disease is controversial, and there is substantial practice-pattern variation among centers. In this session, experts in pediatric and adult cardiac surgery will discuss strategies for management of the aortic valve and aortic root. Considerations regarding mechanical circulatory support and transplantation for single ventricle patients also will be reviewed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Explain different approaches to the aortic valve in young adults and the risks and benefits of each approach
- Describe advanced techniques for repair of the aortic valve in teens and young adults
- Demonstrate an increased awareness of different surgical and mechanical support options for congenital heart patients
- Describe the criteria that contribute to a decision about timing of transplantation for the failing Fontan

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The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, professionalism, interpersonal and communication skills, practice-based learning improvement, and systems-based practice. These physician competencies will be addressed through a series of lectures, videos, and a question-and-answer session that will focus on strategies for management of the aortic valve and aortic root in young people.

Moderators: Joshua L. Hermsen, Seattle, WA, Robert B. Jaquiss, Durham, NC, Jennifer S. Nelson, Chapel Hill, NC, and Frank G. Scholl, Hollywood, FL

COMMERCIAL RELATIONSHIPS J. L. Hermsen: Significant other, Consultant, Medtronic

1 m 4 m m m l 1 m m 4 l m m

8:00 AM	Introduction Jennifer S. Nelson, Chapel Hill, NC
8:10 AM	Three Young Adult Aortic Valve Cases I Handled Differently and Why Joseph A. Dearani, Rochester, MN
8:30 AM	Aortic Valve Repair for Bicuspid Aortic Valve: Techniques and Results Joseph E. Bavaria, Philadelphia, PA

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates



8:45 AM Valve-Sparing Root: Leaflet Plication Techniques and Valves NOT to

Save

Duke E. Cameron, Baltimore, MD

9:05 AM Why I Choose a Ross for Aortic Valve Replacement in a Teen or Young

Adult

Richard G. Ohye, Ann Arbor, MI

9:25 AM Staging for Transcatheter Aortic Valve Replacement: An Emerging

Perspective on AVR in the Young Adult

Vinod H. Thourani, Atlanta, GA

9:40 AM Q&A

10:00 AM Break

10:20 AM Timing of Transplant and Candidate Considerations for the Failing

Fontan

Steven I. Kindel, Milwaukee, WI

10:35 AM Transplantation in the Adult Congenital Patient: Pulmonary Artery

Reconstruction and Other Advanced Techniques

Kristine J. Guleserian, Dallas, TX

10:50 AM The Failing Fontan: Two Cases I Wish I Handled Differently

Carl L. Backer, Chicago, IL

11:10 AM Experience With the Total Artificial Heart in Congenital Heart Disease

J. William Gaynor, Philadelphia, PA

11:25 AM Experience With the Total Artificial Heart: Implantation Tips and

Pitfalls to Avoid

Francisco A. Arabia, Los Angeles, CA

COMMERCIAL RELATIONSHIPS F. A. Arabia: Other, Syncardia Systems, Medtronic, Trainer

11:45 AM Q&A

8:00 AM – 12:00 PM Room 360A

Practice Management Summit: Working In an Employment Model Environment

Following the massive changes in health care financing from the Centers for Medicare & Medicaid Services (CMS) and other payers, there has been a major shift from individual physician-owned practices to an employment model, which influences the value of cardiothoracic surgery services delivered to patients. The Summit will address how cardiothoracic surgeons can best function in this new health care delivery environment. Speakers also will explain how to utilize patient outcomes data and effectively align with hospital administrators in a service line co-management situation.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe how to effectively use survey data in negotiations
- · Explain the relationship between outcomes data and practice patterns
- Articulate how to approach compensation mythology negotiations with a health care organization
- Discuss how to administrate a co-management relationship with a health care organization
- Explain the current reimbursement changes being proposed by CMS
- Demonstrate a greater understanding of the management of a cardiac service line at a large nationwide hospital system and the various ethical theories relating to the doctor and patient relationship

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The physician competencies addressed in this session are professionalism, interpersonal skills and communication, practice-based learning improvement, and systems-based practice. These physician competencies will be addressed through a series of individual lectures and panel discussions that are meant to cover concerns over the changes in health care that have impacted providers and hospitals. The program will have an open discussion forum at the end to encourage questions and participant discussion.

Moderators: Frank L. Fazzalari, Ann Arbor, MI, and Paul S. Levy, Jonesboro, AR

8:00 AM	Introduction
8:10 AM	Health First Strategies for Economic Alignment of the CT Surgery Service Line Aaron Robinson, Rockledge, FL
8:30 AM	Recent Trends in Economic Surveys and Their Use in Contract Negotiations Michael N. Heaton, Indianapolis, IN
8:50 AM	Work Relative Value Unit Employment Models: A Bad Choice for Cardiothoracic Surgeons Michael G. Moront, Toledo, OH



9:10 AM Partnering for Excellence in Today's Health Care Environment: Health

Corporation of America's Cardiovascular Service Line

Steven V. Manoukian, Nashville, TN

9:30 AM Panel Discussion

10:00 AM Break

10:20 AM Experience in Dealing With Employed Physicians

Mark Kopson, Bloomfield Hills, MI

10:40 AM Ethical Issues in an Employment Model

Richard I. Whyte, Boston, MA

COMMERCIAL RELATIONSHIPS R. I. Whyte: Consultant/Advisory Board, Baxter International

11:00 AM Update From the STS/AATS Workforce on Health Policy, Reform, and

Advocacy

Alan M. Speir, Falls Church, VA

COMMERCIAL RELATIONSHIPS A. M. Speir: Consultant/Advisory Board, Medtronic

11:20 AM How to Take Your Idea From a Napkin to a Company

Steven F. Bolling, Ann Arbor, MI

11:40 AM Panel Discussion

8:00 AM - 12:00 PM Room 351DEF

STS/AATS Critical Care Symposium: Challenges in the Management of Mechanical Cardiopulmonary Support in the Cardiothoracic Intensive Care Unit

With the rapidly increasing utilization of mechanical circulatory support (MCS) in cardiothoracic surgery patients, health care teams must be well-versed in patient selection and periprocedural management of these complex patients. This session will provide attendees with a comprehensive review of the roles and responsibilities of interdisciplinary team members and potential pitfalls in challenging clinical scenarios.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the revolution and evolution in therapy represented by mechanical assist devices for heart failure
- Identify methods to optimize hemodynamics during MCS support
- Describe the interaction and pharmacologic strategies of pulmonary hypertension and new right heart failure in the CT ICU
- Discuss the use of invasive and noninvasive monitoring strategies to identify and manage the failing right ventricle (RV) in the CT ICU
- Propose a management strategy to deal with RV failure after left ventricular assist device (LVAD) implantation
- Demonstrate recognition of important risks in advanced heart failure/MCS patients through the phases of care (preoperative, critical care, post-ICU, and post-acute care)
- Describe the components of an ICU Liberation Campaign (daily Awakening, spontaneous <u>B</u>reathing trials, <u>C</u>oordination of sedation, <u>D</u>elirium screening, <u>E</u>arly mobilization and exercise, and Family engagement and empowerment)

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The physician competencies addressed in this session are patient care and medical knowledge. These physician competencies will be addressed through a series of collaborative lectures by members of The Society of Thoracic Surgeons and the American Association for Thoracic Surgery. These lectures are meant to advance knowledge and expertise in the complex field of cardiothoracic critical care. Panel discussions, case studies, and questions from the audience will augment these competencies.

Moderators: Rakesh C. Arora, Winnipeg, Canada, Aaron M. Cheng, Seattle, WA, Kevin W. Lobdell, Charlotte, NC, Vassyl A. Lonchyna, Hinsdale, IL, and Glenn J. R. Whitman, Baltimore, MD

COMMERCIAL RELATIONSHIPS V. A. Lonchyna: Ownership Interest, Abbott Laboratories, AbbVie; G. J. R. Whitman: Research Grant, Abbott Nutrition; R. C. Arora: Research Grant, Pfizer Canada; Speakers Bureau/Honoraria, Mallinckrodt Pharmaceuticals; K. W. Lobdell: Consultant/Advisory Board, Medtronic

8:00 AM Introduction

Vassyl A. Lonchyna, Hinsdale, IL

COMMERCIAL RELATIONSHIPS V. A. Lonchyna: Ownership Interest, Abbott Laboratories, AbbVie

MCS Management for the Cardiac Intensivist

8:05 AM State of the Art of LVAD Therapy

Mark S. Slaughter, Louisville, KY

COMMERCIAL RELATIONSHIPS M. S. Slaughter: Consultant/Advisory Board, Oregon Heart, CARMAT; Other Research Support, HeartWare





8:25 AM Hemodynamics of MCS: Bedside Interpretation and

Overinterpretation

Nir Uriel, Chicago, IL

COMMERCIAL RELATIONSHIPS N. Uriel: Consultant/Advisory Board, Medtronic, Novartis; Research

Grant, HeartWare, Medtronic, St Jude Medical

8:40 AM Veno-Arterial, Veno-Arterial-Venous, and Veno-Venous Extracorporeal

Membrane Oxygenation: How to Choose, How to Start, and How to

Stop

Valluvan Jeevanandam, Chicago, IL

8:55 AM Panel Discussion and Difficult Cases

Joseph Rabin, Baltimore, MD

9:15 AM Break and Networking

RV Dysfunction in the Postoperative Period

9:30 AM Pulmonary Hypertension and the RV in the CT ICU

David A. Fullerton, Aurora, CO

9:50 AM Use of Invasive and Noninvasive Monitoring Strategies to Identify the

Failing RV in the CT ICU

Andre Denault, Montreal, Canada

COMMERCIAL RELATIONSHIPS A. Denault: Speakers Bureau/Honoraria, CAE Healthcare,

Medtronic

10:05 AM RV Failure After MCS: Preoperative Recognition, Perioperative

Physiology, and Therapeutic Approaches

Ryan J. Tedford, Baltimore, MD

REGULATORY DISCLOSURE This presentation describes the off-label use of Slidenafil by Pfizer, which is

FDA approved.

10:20 AM Panel Discussion and Difficult Cases

Michael S. Firstenberg, Akron, OH

REGULATORY DISCLOSURE This presentation describes the off-label use of ECMO for respiratory and

cardiac circulatory support beyond short-term support.

10:35 AM Break and Networking

Multisystem Issues in the MCS Patient

10:50 AM High-Risk and Complex Problems in MCS

Jonathan W. Haft, Ann Arbor, MI

11:10 AM ICU Liberation Bundle: What Does It Look Like for the CT ICU?

Rakesh C. Arora, Winnipeg, Canada

COMMERCIAL RELATIONSHIPS R. C. Arora: Research Grant, Pfizer Canada; Speakers Bureau/

Honoraria, Mallinckrodt Pharmaceuticals

11:30 AM Panel Discussion

Jay G. Shake, Jackson, MS



8:00 AM - 12:00 PM Room 330AB

STS/SCA: Integrating Perioperative Echocardiography Into Cardiac Surgical Clinical Decision Making

New technology is being used in the operating room to improve clinical decision making. This joint session by STS and the Society of Cardiovascular Anesthesiologists will provide physicians with information on the appropriate use of intraoperative echocardiography in surgical clinical decision making. New clinical evidence, along with data obtained through echocardiographic analysis, will be presented in case-based scenarios, which mimic real-life situations and decision making. The process will be followed by expert interpretation and critical analysis by a multidisciplinary team (cardiothoracic surgeons and anesthesiologists).

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the utility of echo anatomy and intraoperative echocardiographic analysis in surgical decision making in the pre-bypass period
- Summarize the utility of intraoperative echocardiography in diagnosing complications in the immediate post-cardiopulmonary bypass period
- Discuss the integration of echocardiographic measurements with new clinical evidence in certain patient populations

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The physician competencies addressed in this session are patient care and procedural skills. These physician competencies will be addressed through a series of collaborative lectures and case-based presentations by members of The Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists.

Moderator: Alina Nicoara, Durham, NC

Introduction

Panelists: Vinay Badhwar, Morgantown, WV, John V. Conte, Baltimore, MD, Daniel H. Drake, Traverse City, MI, and Vinod H. Thourani, Atlanta, GA

COMMERCIAL RELATIONSHIPS J. V. Conte: Consultant/Advisory Board, Medtronic; Research Grant, Boston Scientific, Medtronic, St Jude Medical

3.00 AM	Alina Nicoara, Durham, NC
8:10 AM	When Is Mitral Valve Surgery Required in Patients Undergoing Revascularization? Applying New Evidence Feroze Mahmood, Boston, MA
8:45 AM	When Is Mitral Valve Surgery Required in Patients Undergoing Myectomy for Hypertrophic Cardiomyopathy? $Alina\ Nicoara, Durham, NC$
9:20 ам	When Is a Tricuspid Valve Procedure Recommended in Patients Undergoing Mitral Valve Surgery? Charles B. Nyman, Boston, MA COMMERCIAL RELATIONSHIPS C. B. Nyman: Ownership Interest, Edwards Lifesciences Corporation;

Speakers Bureau/Honoraria, Edwards Lifesciences Corporation



8.00 444

Break 10:00 AM **Failed Mitral Valve Repair** 10:30 AM Alina Nicoara, Durham, NC Cannot Separate from Cardiopulmonary Bypass: Now What? 11:00 AM Feroze Mahmood, Boston, MA 11:30 AM **High Gradients After Aortic Valve Replacement**

Charles B. Nyman, Boston, MA

COMMERCIAL RELATIONSHIPS C. B. Nyman: Ownership Interest, Edwards Lifesciences Corporation;

Speakers Bureau/Honoraria, Edwards Lifesciences Corporation



10:00 AM - 4:30 PM Room 320ABC

"How To" Video Session: Technical Tricks and Pitfalls to Simplify Cardiac Surgery **Procedures**

Cardiothoracic surgery is a highly technical specialty. Every successful surgeon has useful tips and tricks that can help colleagues improve techniques, become more efficient, and optimize outcomes. Many educational sessions focus on short- and long-term outcomes, debating optimal approaches, postoperative care, and evaluation of new technologies; however, until now, there has been little focus on how to refine and improve technique.

In this "how to" session, world-renowned faculty will share high-quality videos that focus on the technical aspects of adult cardiac operations. The 2017 session will focus on more complex operations than at the 2016 meeting and will benefit both private practice and academic surgeons.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Detail the technical aspects of complex operations commonly performed in adult cardiac surgery
- Discuss the pitfalls of critical steps in complex cardiac surgery
- · Identify novel tricks to make cardiac operations easier, safer, and more reproducible

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The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, professionalism, and interpersonal and communication skills. These physician competencies will be addressed through a series of surgical videos followed by discussion and questions from the audience.

Moderators: Gorav Ailawadi, Charlottesville, VA, and Wilson Y. Szeto, Philadelphia, PA COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices

Coronary Artery Bypass Grafting (CABG)

10:00 AM	Introduction
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10:10 AM Sequencing Grafts: Getting the Angles/Lengths Perfect

Joseph F. Sabik, Cleveland, OH

COMMERCIAL RELATIONSHIPS J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/ Honoraria, Medtronic

No-Touch Aorta CABG 10:20 AM

Marc Ruel, Ottawa, Canada

COMMERCIAL RELATIONSHIPS M. Ruel: Other Research Support, Medtronic; Research Grant, Abbott Laboratories, CryoLife, Edwards Lifesciences Corporation, Medtronic; Speakers Bureau/Honoraria, Medtronic, Abbott Laboratories

C-Port Anastomosis 10:30 AM

Husam H. Balkhy, Chicago, IL





10:50 AM Discussion

Mitral Valve Surgery

11:00 AM Transseptal Exposure of Mitral Valve (Surgical and Transcatheter)

Steven F. Bolling, Ann Arbor, MI

11:10 AM Measuring Neochords: Getting the Length Perfect

Evelio Rodriguez, Nashville, TN

COMMERCIAL RELATIONSHIPS E. Rodriguez: Research Grant, Abbott Laboratories, Edwards

Lifesciences Corporation

11:20 AM Minimally Invasive Mitral Valve Surgery

Gorav Ailawadi, Charlottesville, VA

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards

Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure

11:30 AM Decalcifying Mitral Annular Calcification (MAC): How Much and When

to Stop

Michael A. Acker, Philadelphia, PA

11:40 AM Balloon-Expandable Valve to Treat MAC

Robert L. Smith, Plano, TX

COMMERCIAL RELATIONSHIPS R. L. Smith: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation; Research Grant, Edwards Lifesciences Corporation; Speakers Bureau/

 $Honoraria, Abbott\ Laboratories, Edwards\ Lifesciences\ Corporation, Intuitive\ Surgical$

11:50 AM MitraClip Procedure

Gilbert H. Tang, New York, NY

COMMERCIAL RELATIONSHIPS G. H. Tang: Consultant/Advisory Board, Bolton Medical; Research

Grant, Bolton Medical; Speakers Bureau/Honoraria, Abbott Vascular, Bolton Medical

12:00 PM - 1:00 PM

Break

Atrial Fibrillation Surgery

1:00 PM Biatrial Maze: Efficient Lesions

Hersh S. Maniar, St Louis, MO

1:10 PM Thoracoscopic Epicardial Maze/Left Atrial Appendage Ligation

Gansevoort H. Dunnington, St Helena, CA

1:20 PM Subxiphoid Epicardial Maze

Thomas G. Caranasos, Chapel Hill, NC

COMMERCIAL RELATIONSHIPS T. G. Caranasos: Consultant/Advisory Board, AtriCure, Synecor

Aortic Valve Surgery

1:30 PM Aortic Valve Replacement: Running Suture

Thomas G. Gleason, Pittsburgh, PA

COMMERCIAL RELATIONSHIPS T. G. Gleason: Research Grant, Medtronic

1:40 PM Percutaneous Femoral Access/Closure Devices/Iliac Complications

T. Brett Reece, Aurora, CO



SUNDAY, JANUARY 22

1:50 PM Rapid Deployment Valve

Michael A. Borger, New York, NY

COMMERCIAL RELATIONSHIPS M. A. Borger: Consultant/Advisory Board, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude

Medical

Root Enlargement Simplified 2:00 PM

Kevin D. Accola, Orlando, FL

COMMERCIAL RELATIONSHIPS K. D. Accola: Consultant/Advisory Board, Edwards Lifesciences

Corporation; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

Transcatheter Aortic Valve Replacement (TAVR) Complications: 2:10 PM

Paravalvular Leak/Valve Malposition

Vinod H. Thourani, Atlanta, GA

TAVR Complication: Annular Rupture 2:20 PM

Thomas Walther, Leipzig, Germany

Aortic Surgery

2:30 PM Homograft Insertion/Root Abscess

Iose Luis Navia, Cleveland, OH

David Procedure: Simplified 2:40 PM

Wilson Y. Szeto, Philadelphia, PA

COMMERCIAL RELATIONSHIPS W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices

TEVAR for Chronic Type B Dissection With Aneurysm 2:50 PM

G. Chad Hughes, Durham, NC

COMMERCIAL RELATIONSHIPS G. C. Hughes: Consultant/Advisory Board, Medtronic; Research Grant, Bolton Medical, Cook Medical, Medtronic, W. L. Gore & Associates; Speakers Bureau/Honoraria,

Cook Medical, Medtronic

Hybrid/Arch 3:00 PM

Eric E. Roselli, Cleveland, OH

COMMERCIAL RELATIONSHIPS E. E. Roselli: Consultant/Advisory Board, W. L. Gore & Associates, Medtronic; Research Grant, Medtronic, Vascutek Ltd a Terumo Company; Speakers Bureau/Honoraria,

LivaNova, Vascutek Ltd a Terumo Company

Heart Failure/Weaning Catastrophe

3:10 PM Trouble Weaning: Subclavian Intra-Aortic Balloon Pump

Valluvan Jeevanandam, Chicago, IL

Trouble Weaning: Impella 5.0 3:20 PM

Vinay Badhwar, Morgantown, WV

3:30 PM Trouble Weaning: Temporary Left Ventricular Assist Device (LVAD)

Simon Maltais, Nashville, TN

3:40 PM Trouble Weaning: Right Ventricular Assist Device

Igor Gregoric, Houston, TX

Elective LVAD Insertion 3:50 PM

Leora T. Yarboro, Charlottesville, VA





4:00 PM Minimally Invasive HVAD

Speaker TBD

4:10 PM Pulmonary Thromboendarterectomy: Acute Pulmonary Embolism

W. Brent Keeling, Atlanta, GA

1:00 PM - 4:00 PM Room 370BC

Residents Symposium: Transitioning From Residency to a Successful Practice

This symposium will help cardiothoracic surgery residents navigate the challenges of completing training and beginning practice. The first session explains the process of finding a position: reasons for choosing private or academic practice, the logistics and schedule of searching for a position, interviewing successfully, and understanding health care financing with regard to one's practice. The second session covers essential aspects of growing a new practice: building a clinical practice, milestones and benchmarks to set during the beginning of one's career, and achieving work-life balance. Each session will be followed by small group table discussions led by experienced surgeons and a larger group discussion with the speakers.

Learning Objectives

4.00 ---

Upon completion of this activity, participants should be able to:

- Summarize the steps of a successful job search
- Identify the important elements of a contract
- Explain the keys to building a successful clinical practice
- Identify the important aspects of early career development

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The physician competencies addressed in this session are professionalism, practice-based learning and improvement, and interpersonal skills and communication. These physician competencies will be addressed through a series of individual lectures that will address practical early career information.

Moderator: Ara A. Vaporciyan, Houston, TX 1-4---

1:00 РМ	Introduction Edward P. Chen, Atlanta, GA, and Sidharta P. Gangadharan, Boston, MA
	Session I: Finding a Job
1:05 PM	Why I Chose Private Practice Asad A. Shah, Durham, NC
1:15 PM	Why I Chose Academics Shanda H. Blackmon, Rochester, MN
1:25 PM	The Mechanics of Finding a Job Ravi K. Ghanta, Charlottesville, VA
1:40 рм	What You Need to Know About Finances Frederick Y. Chen, Boston, MA
1:55 рм	Breakout Sessions
	Session II: Transition to Practice
2:30 рм	Building a Successful Clinical Practice Edward P. Chen, Atlanta, GA



Early Career Development Elizabeth A. David, Sacramento, CA

2:45 PM

3:00 PM Achieving a Successful Work-Life Balance

Sidharta P. Gangadharan, Boston, MA

3:15 PM Breakout Sessions

1:00 PM - 4:30 PM Room 360BC

Resuscitation of Patients Who Arrest After Cardiac Surgery

Cardiac arrest is a dreaded postoperative complication with a wide range of occurrence and outcomes, confirming large variations in current practice. This session will provide participants with the essential information to improve clinical outcomes after postoperative cardiac arrest. Using a format similar to Advanced Cardiac Life Support, this session will include brief lectures combined with hands-on practice with emergency pacing, internal and external defibrillation, and open chest resuscitation techniques. This course will allow all participants to become Cardiac Surgical Unit Advanced Life Support (CSU-ALS)-approved providers and able to provide arrest care for post-cardiac surgery patients.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify unique features of the cardiac surgery patient that warrant modifications to standard resuscitation techniques
- Describe the protocol for management of a cardiac surgical arrest

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this hands-on session are patient care and procedural skills, interpersonal skills and communication, practice-based learning and improvement, and systemsbased practice. These physician competencies will be addressed through lectures and hands-on sessions to gain knowledge and practical application experience on resuscitation protocols.

Moderator: Joel Dunning, Middlesbrough, United Kingdom

Faculty: Richard S. Bell, Baltimore, MD, Sondra J. Ley, San Francisco, CA, Aaron Morton, Louisville, KY, and John P. Whitlock, Boston, MA

COMMERCIAL RELATIONSHIPS J. Dunning: Speakers Bureau/Honoraria, Dextera Surgical; A. Morton: Nonremunerative Position of Influence, APACVS Board Member, Vice President of CSU-ALS North America

1:00 рм	Introduction Joel Dunning, Middlesbrough, United Kingdom COMMERCIAL RELATIONSHIPS J. Dunning: Speakers Bureau/Honoraria, Dextera Surgical
1:05 рм	Arrest Practical 1: Group Simulation of Cardiac Arrest After Cardiac Surgery
1:30 рм	The Protocol for the Resuscitation of Patients Who Arrest After Cardiac Surgery Joel Dunning, Middlesbrough, United Kingdom COMMERCIAL RELATIONSHIPS J. Dunning: Speakers Bureau/Honoraria, Dextera Surgical
2:15 рм	Arrest Practical 2: Manikin Simulation of the Arrest Protocol
3:00 рм	Cardiac Arrest Skills Stations
3:45 рм	How to Implement Resuscitation Protocols for Arrest After Cardiac Surgery in Your Own Hospital and How to Become a Trainer Aaron Morton, Louisville, KY COMMERCIAL RELATIONSHIPS A. Morton: Nonremunerative Position of Influence, APACVS Board

Member, Vice President of CSU-ALS North America



NOTES





1:00 PM - 4:30 PM Room 350DEF

Surgical Symposium: Congenital Cardiac Surgery Mélange

This symposium will focus on three modes of presentation (video, clinical scenario, and lecture) to address challenges in the surgical management of children with congenital heart disease. Topics will include contemporary approaches to old problems (eg, pulmonary vein stenosis), new techniques (eg, pulmonary artery banding for dilated cardiomyopathy, novel operative use of percutaneous valves, and aortic leaflet reconstruction with autologous pericardium), and challenges in perioperative decision making (eg, the child with trisomy 13/18). Back by popular demand will be case presentations of patients with complex management issues, with commentary from leading experts.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify current indications for surgical intervention in patients with trisomy 13/18
- Describe current outcomes and patient selection for application of pulmonary artery banding for children with isolated dilated cardiomyopathy
- · Identify the best initial surgical management and later reoperative strategies for pulmonary vein stenosis and recurrent pulmonary vein stenosis
- Explain the inclusion/exclusion criteria for utilizing transcatheter valves for left-sided atrioventricular valve replacement in children
- Describe several operative techniques for repair of atrioventricular valves in single ventricle patients
- Identify indications and limitations for aortopexy in the management of childhood airway obstruction
- Assess potential candidacy for aortic valve reconstruction with autologous pericardium

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The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, video demonstrations, and case scenarios that will address issues in congenital heart surgery. Questions from the audience will augment these competencies.

Moderators: Jonathan M. Chen, Seattle, WA, Christopher E. Mascio, Philadelphia, PA, and Glen S. Van Arsdell, Toronto, Canada

COMMERCIAL RELATIONSHIPS J. M. Chen: Speakers Bureau/Honoraria, Medtronic

Introduction 1:00 PM

Jonathan M. Chen, Seattle, WA

COMMERCIAL RELATIONSHIPS J. M. Chen: Speakers Bureau/Honoraria, Medtronic

Clinical Scenario #1 1:05 PM

1:20 PM Video: Novel Use of Expandable Valves

Sitaram M. Emani, Boston, MA

COMMERCIAL RELATIONSHIPS S. M. Emani: Consultant/Advisory Board, Paidon Research **REGULATORY DISCLOSURE** This presentation describes the off-label use of the Melody valve by Medtronic for pediatric patients with mitral valve disease, which is FDA approved.



Should We Offer Operations to Patients With Trisomy 13 or 18? 1:28 PM Aarti Bhat, Seattle, WA Clinical Scenario #2 1:48 PM Video: Repair of Atrioventricular Valves in Single Ventricle Patients 2:03 PM Scott M. Bradley, Charleston, SC 2:11 PM Pulmonary Artery Banding for Dilated Cardiomyopathy: North American Experience Iki Adachi, Houston, TX **Break** 2:31 PM Clinical Scenario #3 2:46 PM Video: Advanced HeartWare Techniques 3:01 PM Christopher E. Mascio, Philadelphia, PA Aortic Reconstruction With Autologous Pericardial "Neo-Cusps" 3:09 PM

3:29 PM Clinical Scenario #4

Speaker TBD

3:44 PM Video: Aortopexy in Complex Airway Disease

Michael E. Mitchell, Milwaukee, WI

COMMERCIAL RELATIONSHIPS M. E. Mitchell: Consultant/Advisory Board, TAI Diagnostics; Ownership Interest, Ariosa Diagnostics, TAI Diagnostics; Research Grant, Ariosa Diagnostics, TAI Diagnostics

3:52 PM What's New in the Management of Pulmonary Vein Stenosis

Christopher A. Caldarone, Toronto, Canada

REGULATORY DISCLOSURE This presentation describes the off-label use of losartan by Merck in animal

models, which is not FDA approved.

4:12 PM Discussion

1:00 PM - 4:30 PM Room 351DEF

Surgical Symposium: "How To" Video Session: Tips and Tricks in General Thoracic

This session will focus on the technical tips and tricks that make more difficult operations achievable in a safe and effective manner. Topics include difficult aspects of minimally invasive procedures (eg, esophagogastric anastomosis during minimally invasive esophagectomy, video-assisted anatomic dissections after induction therapy, video-assisted or robotic thymectomy for larger thymomas) and less commonly performed procedures (eg, resection of invasive germ cell tumors, video-assisted diaphragm plication); videos will be used to clearly demonstrate these technical approaches. Tips on how surgeons can safely transition to minimally invasive approaches will be offered from an expert on managing the learning curve and early adopters of robotic and video-assisted lung resection.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the available methods of minimally invasive esophagectomy, including their technical performance and pros and cons of each
- Explain the goals and application method of both ischemic preconditioning and SPY technology to patients undergoing esophagectomy
- · Describe and demonstrate techniques that allow difficult minimally invasive anatomic lung dissections to be completed safely and effectively, as well as safe management of bleeding that may occur during these dissections
- Discuss the approach to difficult mediastinal germ cell tumors, including when and how far to carry resection of major adherent structures
- Explain the potential difficulties in resecting larger thymomas minimally invasively, how to overcome those difficulties, and the potential benefits of using open techniques for these larger tumors
- Describe the benefits and techniques of video-assisted diaphragm plication using a running, to-and-fro suture
- Discuss the learning curve for adoption of minimally invasive approaches and make a plan for the safe, stepwise adoption of one minimally invasive technique

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The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, professionalism, practice-based learning improvement, and systems-based practice. These physician competencies will be addressed through video demonstrations, individual lectures, and case-based presentations that will address issues in thoracic surgery that are commonly encountered in daily practice. Questions from the audience will augment these competencies.

Moderators: Melanie A. Edwards, St Louis, MO, and Shari L. Meyerson, Chicago, IL

1:00 PM Introduction

Joseph B. Shrager, Stanford, CA

1:05 PM Stapled Functional End-to-End

Mark F. Berry, Stanford, CA





1:15 PM End-to-End Anastomosis via Chest/OrVil via Mouth

Robert E. Merritt, Columbus, OH

1:25 PM Ischemic Preconditioning/SPY Technology

John A. Howington, Nashville, TN

1:35 PM Panel Discussion

1:50 PM Difficult Post-Induction Dissections (Thoracotomy)

Valerie W. Rusch, New York, NY

COMMERCIAL RELATIONSHIPS V. W. Rusch: Research Grant, Genelux

2:00 PM Difficult Post-Induction Dissections (Minimally Invasive)

Thomas A. D'Amico, Durham, NC

COMMERCIAL RELATIONSHIPS T. A. D'Amico: Consultant/Advisory Board, Scanlan International

2:10 PM Managing Unexpected Intraoperative Bleeding

Scott I. Swanson, Boston, MA

COMMERCIAL RELATIONSHIPS S. J. Swanson: Consultant/Advisory Board, Ethicon, Medtronic;

Research Grant, Ethicon

2:20 PM Panel Discussion

2:40 PM Break

2:55 PM Intraoperative Decision Making for Difficult Germ Cell Tumors

Kenneth A. Kesler, Indianapolis, IN

3:05 PM Tricks for Removing Larger Thymomas Minimally Invasively

Jens Rueckert, Berlin, Germany

3:15 PM A Simple Approach to Video-Assisted Thoracoscopic Diaphragm

Plication

Joseph B. Shrager, Stanford, CA

3:25 PM Panel Discussion

3:45 PM Transitioning to Robotics

Bernard J. Park, New York, NY

COMMERCIAL RELATIONSHIPS B. J. Park: Speakers Bureau/Honoraria, Bard Medical, Baxter

International

3:55 PM What Is the Learning Curve?

Bryan F. Meyers, St Louis, MO

4:05 PM How Did an Old Dog Learn New Tricks? The Innovator

Robert J. McKenna, Los Angeles, CA

COMMERCIAL RELATIONSHIPS R. J. McKenna: Speakers Bureau/Honoraria, Medtronic, Ethicon

4:15 PM Panel Discussion



2:00 PM - 6:30 PM Hall B3

Scientific Posters

2:30 PM - 4:30 PM Room 360A

Multidisciplinary Response to Emergencies: Strategies for Team Members

This session will focus on the team-based approach to cardiac surgical emergencies, including acute aortic dissection, initiation of extracorporeal membrane oxygenation (ECMO), and decompensation related to transcatheter aortic valve replacement (TAVR). Experts will discuss evidence-based approaches to recognizing these conditions and ensuring optimal patient outcomes. Panelists will include STS Associate Members and others who will review emergency management from a multidisciplinary perspective, focusing on clinical care and the common "human factors" that impact teamwork, communication, and collaboration.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify hallmark features of acute aortic dissection, cardiopulmonary compromise warranting ECMO support, and catastrophic complications of TAVR, which signal the need for emergent intervention
- Explain evidence-based approaches to these conditions that contribute to optimal patient outcomes
- Discuss effective strategies for communication and collaboration during management of acute surgical emergencies

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The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, professionalism, and interpersonal and communication skills. These physician competencies will be addressed through a series of lectures that are meant to enhance the understanding of the evolving roles within the interprofessional team. Questions from the audience, bibliographies, and handout materials will augment these competencies.

Moderators: Sondra J. Ley, Greenbrae, CA, and Edward A. Ranzenbach, Sacramento, CA

2:30 рм	Introduction $Edward A$. Ranzenbach, Sacramento, CA
2:35 рм	Aortic Dissection Kathryn Gray DeAngelis, Philadelphia, PA
3:05 рм	ECMO for Respiratory and Circulatory Problems $Michael \ Colligan, \ Houston, \ TX$
3:35 рм	TAVR Emergencies Prakash Patel, Philadelphia, PA
4:05 рм	Human Factors and Teamwork in Emergency Management Sondra J. Ley, Greenbrae, CA
4:25 PM	Panel Discussion



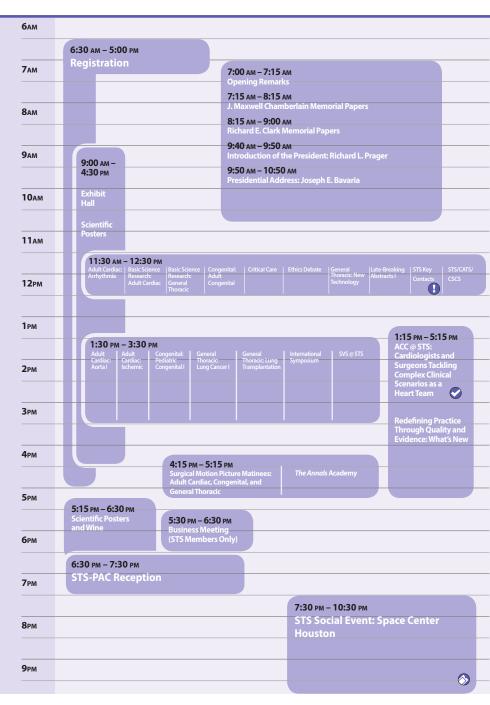
4:30 PM - 6:30 PM Exhibit Hall A3

Opening Reception in STS Exhibit Hall





MONDAY, JANUARY 23



Registration 6:30 AM - 5:00 PM 9:00 AM - 4:30 PM **Exhibit Hall** Scientific Posters 7:00 AM - 7:15 AM **Opening Remarks** 7:15 AM - 8:15 AM J. Maxwell Chamberlain Memorial Papers 8:15 AM - 9:00 AM Richard E. Clark Memorial Papers 9:40 AM - 9:50 AM Introduction of the President: Richard L. Prager 9:50 AM - 10:50 AM Presidential Address: Joseph E. Bavaria 11:30 AM - 12:30 PM **Adult Cardiac: Arrhythmia** Basic Science Research: Adult Cardiac **Basic Science Research: General Thoracic** Congenital: Adult Congenital **Critical Care** Ethics Debate: When a Child's Heart Is Failing General Thoracic: New Technology **Late-Breaking Abstracts I** STS Key Contacts: How to Become an Advocate for Cardiothoracic Surgery STS/CATS/CSCS: Quality Improvement in Cardiothoracic Surgery— Real-Life Methods to Improve Surgical Performance Within Yourself, Your Division, and Your Specialty 1:15 PM - 5:15 PM ACC @ STS: Cardiologists and Surgeons Tackling Complex Clinical Scenarios as a Heart Team Redefining Practice Through Quality and Evidence: What's New 1:30 PM - 3:30 PM Adult Cardiac: Aorta I Adult Cardiac: Ischemic Congenital: Pediatric Congenital I General Thoracic: Lung Cancer I **General Thoracic: Lung Transplantation** International Symposium: The Quality vs Access Dilemma in Cardiothoracic Surgery—Regionalization, Building Sustainable Cardiothoracic Surgery Programs, and Humanitarian Crises SVS @ STS: Sharing Common Ground for Cardiovascular Problems 4:15 PM - 5:15 PM Surgical Motion Picture Matinees: Adult Cardiac, Congenital, and **General Thoracic** The Annals Academy: Propensity Score Matching Scientific Posters and Wine 5:15 PM - 6:30 PM 5:30 PM - 6:30 PM **Business Meeting (STS Members Only) STS-PAC Reception** 6:30 PM - 7:30 PM STS Social Event: Space Center Houston 7:30 PM - 10:30 PM

(Shuttle buses depart beginning at 6:45 PM)

MONDAY, JANUARY 23

6:30 AM – 5:00 PM Room 360 Lobby

Registration

9:00 AM – 4:30 PM Exhibit Hall A3

Exhibit Hall

9:00 AM – 4:30 PM Hall B3

Scientific Posters

7:00 AM – 10:50 AM Grand Ballroom

General Session I

Moderators: Joseph E. Bavaria, Philadelphia, PA, and Keith S. Naunheim, St Louis, MO
COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, and professionalism. These physician competencies will be addressed through a series of individual lectures and focused discussion on key points of presentations.

7:00 AM

Opening Remarks

7:15 AM

J. Maxwell Chamberlain Memorial Paper for Adult Cardiac Surgery

Natural History of Moderate Coronary Artery Stenosis After Surgical Revascularization

S. Raza, E. Blackstone, P. L. Houghtaling, G. Olivares, K. Ravichandren, M. Koprivanac, F. Bakaeen, J. F. Sabik

Cleveland Clinic, OH

COMMERCIAL RELATIONSHIPS F. Bakaeen: Consultant/Advisory Board, JACE Medical; E. Blackstone: Other, Edwards Lifesciences Corporation, Head of the Cleveland Clinic PARTNER Publications Office, which carries out independent analyses of data stemming from the PARTNER trial. The funding organization plays no role in analysis or interpretation of data and has no right to approve or disapprove publications; J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic

Discussant: T. Bruce Ferguson, Greenville, NC

COMMERCIAL RELATIONSHIPS T. B. Ferguson: Ownership Interest, RFPI, LLC

Purpose: Progression of moderate coronary artery stenosis after coronary artery bypass grafting (CABG) surgery is not well known. We sought to determine how grafting moderately stenosed coronary arteries influenced native-vessel disease progression and whether grafting may be protective from late ischemia.

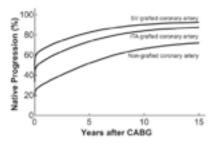
Methods: From 1972 to 2011, 55,567 patients underwent primary isolated CABG; 1,901 had a single coronary artery with angiographically moderate (50%-69%) stenosis and results

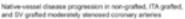


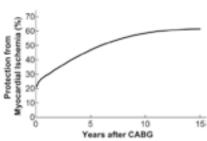
of at least one postoperative angiogram available. Of these moderately stenosed coronary arteries (MSCAs), 488 were not grafted, 385 were internal thoracic artery (ITA)-grafted, and 1,028 were saphenous vein (SV)-grafted. At follow-up angiograms, disease progression information was available for 488 non-grafted, 371 ITA-grafted, and 957 SV-grafted MSCAs, and patency information was available for 376 ITA and 1,016 SV grafts to these MSCAs. Grafts were considered patent if not occluded.

Results: At 1, 5, 10, and 15 years, native-vessel disease progressed from moderate to severe stenosis/occlusion (>70%) in 32%, 52%, 66%, and 72% of non-grafted MSCAs, in 55%, 73%, 84%, and 87% of ITA-grafted MSCAs, and in 67%, 82%, 90%, and 92% of SV-grafted MSCAs. After adjusting for patient characteristics, disease progression in MSCAs was 3.6 times higher (OR: 3.6; CL: 2.1, 6.0) with ITA and 10 times higher (OR: 9.9; CL: 6.3, 15) with SV grafting compared with non-grafting. At 1, 5, 10, and 15 years, occlusion in grafts to MSCAs was 8%, 9%, 11%, and 15% for ITA grafts and 13%, 32%, 46%, and 56% for SV grafts. At these same time points, protection from myocardial ischemia in ITA-grafted vs non-grafted MSCAs was 29%, 47%, 59%, and 61%.

Conclusions: Most non-grafted MSCAs progress to severe stenosis or occlusion in the long term. Progression is greater in grafted than non-grafted MSCAs, more so with SV than ITA grafts. However, ITA grafts to such arteries have excellent patency, providing long-term protection from myocardial ischemia. Therefore, ITA grafting of MSCAs should be considered.







Protection from myocardial ischemia in ITA grafted vs. non-grafted moderately stemosed coronary arteries

General Session I - Continued

7:35 AM Grand Ballroom

J. Maxwell Chamberlain Memorial Paper for Congenital Heart Surgery

The Optimal Timing of Stage-2 Palliation After the Norwood Operation: A Multi-Institutional Analysis From the Congenital Heart Surgeons' Society

J. Meza¹, E. Hickey¹, B. W. McCrindle¹, E. Blackstone², B. R. Anderson³, D. M. Overman⁴, J. K. Kirklin⁵, C. A. Caldarone¹, K. J. Guleserian⁶, R. W. Kim⁷, W. M. Decampli⁸, M. L. Jacobs⁹, M. E. Mitchell¹⁰, P. Chai¹¹, W. G. Williams¹², R. B. Jaquiss¹³

¹The Hospital for Sick Children, Toronto, Canada, ²Cleveland Clinic, OH, ³Columbia University Medical Center, New York-Presbyterian/Morgan Stanley Children's Hospital, New York, NY, ⁴Children's Heart Clinic at Children's Hospitals and Clinics of Minnesota, Minneapolis, ⁵University of Alabama at Birmingham, ⁶Children's Medical Center Dallas/University of Texas Southwestern Medical Center, ⁷Children's Hospital Los Angeles, CA, ⁸The Heart Center at Arnold Palmer Hospital For Children, Orlando, FL, ⁹The Johns Hopkins University School of Medicine, Newtown Square, PA, ¹⁰Children's Hospital of Wisconsin, Milwaukee, ¹¹Columbia University Medical Center, New York, NY, ¹²Hospital for Sick Children, Toronto, Canada, ¹³Duke University Medical Center, Durham, NC

COMMERCIAL RELATIONSHIPS E. Blackstone: Other, Edwards Lifesciences Corporation, Head of the Cleveland Clinic PARTNER Publications Office, which carries out independent analyses of data stemming from the PARTNER trial. The funding organization plays no role in analysis or interpretation of data and has no right to approve or disapprove publications; M. E. Mitchell: Consultant/Advisory Board, TAI Diagnostics; Ownership Interest, Ariosa Diagnostics, TAI Diagnostics Research Grant, Ariosa Diagnostics, TAI Diagnostics

Discussant: James M. Hammel, Omaha, NE

Purpose: While previous studies have investigated whether early Stage-2 palliation (S2P) can be performed without increased post-S2P mortality, the effect of the timing of S2P on post-Norwood mortality remains unknown. This study sought to determine the optimal timing of S2P that both minimizes pre-S2P attrition and maximizes long-term post-S2P survival.

Methods: Neonates diagnosed with left ventricular outflow tract obstruction that precluded adequate systemic cardiac output through the aortic valve who initially underwent a Norwood operation from 2005 to 2016 were included. Overall survival after Norwood and after S2P was modeled using multiphase parametric hazard analysis. Risk factors for death after Norwood and after S2P were identified. Both risk-adjusted models were used together to determine cumulative survival at 4 years post-Norwood for all patients, through Norwood and S2P (parametric conditional survival analysis). The optimal timing of S2P was determined by plotting nomograms of 4-year, risk-adjusted, post-Norwood survival vs age at S2P.

Results: In total, 534 neonates from 20 institutions were included. S2P was performed in 71% (377/534) at a mean age of 5.4 months ± 2.1 months, while 22% (115/534) died after Norwood, and the remainder underwent biventricular repair or heart transplantation. After S2P, 10% (38/377) died, 66% (248/377) underwent Fontan, and the remainder were alive awaiting Fontan or underwent heart transplantation. Risk factors for death after Norwood and after S2P are displayed in the Table. Risk-adjusted, 4-year, post-Norwood survival was 72% (69% confidence limits [one standard deviation] = 67%-75%). When plotted vs the age at S2P, risk-adjusted, 4-year, post-Norwood survival for the 534 patients was maximized by undergoing S2P at 3-6 months old (Figure, "Cohort Average"). Risk-adjusted, 4-year survival in low-risk infants was compromised only by undergoing S2P earlier than 3 months old (Figure, "Low-Risk Patient"). In high-risk infants, survival was severely compromised,

especially when undergoing S2P earlier than 6 months of age (Figure, "High-Risk Patient").

Conclusions: The optimal timing of S2P depends on patient-specific risk factors. In infants with low or average risk profiles, this analysis supports a strategy of elective S2P at 3-6 months. In high-risk infants, overall survival is decreased substantially, especially in those who require early S2P.

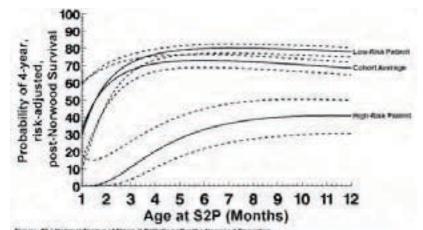


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Solot extrage. Suns represents an everage of every individual come general actions the actual patient risk factor values for all 834 patients into ovidence is Norvold scenation.

High-risk betient. Required 8 GMC pre-Nonecol not of low fath weight, WVPs-conduit, RFA dismeters 4.5 mon, mittel selve dismeters 9.5 m, tro-larged velocities of terms, Cercepter race, pre-SSP Cyclinic estimators (SPs., pre-SSP RV dysfunction post-formsport LOS-RS days).

Table. Incremental risk factors for death after None ocd and Stage-2-Pathation

	Parameter Estimate	P-value
Risk factors for death after Norwood		Visc Con
Required pre-Norwood E CMO	0.97	£ 0.0001
Low birth weight (< 2.5kg)	1.34	< 0.0001
MBTS vs. RVFA conduit	0.67	0.0003
Larger baseine RPA diameter (cm)	0.02	0.0003
Structer baseline midral valve diameter (cm)	0.25	0.0000
Strailer baseline tricuspid valve diameter (cm)	0.20	0.0001
Non-white race	0.34	0.01
Risk factors for death after 52P		
Lower Q ₂ saturation at pre-S2P covic will (%)	0.07	0.00
Pre-S2P RV dysfunction, moderate or severe	1,00	0.0007
Younger age at SZP (days)	1.40	0.005
Longer post-Norwood length of stay (days)	0.006	0.03

Abbreviations S2P=Stage-2-Pall-wide, ECMO-Extraoryporeal Memorane Citygeniatris, MBTS=Modified Biolock-Taussig Shunt, RVPA=Right Ventrice to Pullionary Artery, RPA=Right Pullionary Artery, RV=Right Ventricular



General Session I - Continued

7:55 AM Grand Ballroom

J. Maxwell Chamberlain Memorial Paper for General Thoracic Surgery

Prediction of Long-Term Survival Following Lung Cancer Surgery for Elderly Patients in The Society of Thoracic Surgeons General Thoracic Surgery Database

M. Onaitis¹, A. P. Furnary², A. S. Kosinski³, S. Kim³, D. J. Boffa⁴, P. Cowper⁵, J. P. Jacobs⁶, C. D. Wright⁷, J. B. Putnam⁸, F. G. Fernandez⁶

¹Duke University Medical Center, Durham, NC, ²Starr-Wood Cardiac Group of Portland, OR, ³Duke Clinical Research Institute, Durham, NC, ⁴Yale University School of Medicine, New Haven, CT, ⁵Duke University, Durham, NC, ⁶Johns Hopkins All Children's Heart Institute, St Petersburg, FL, ⁷Massachusetts General Hospital, Boston, ⁸Baptist MD Anderson Cancer Center, Jacksonville, FL, ⁹Emory University, Atlanta, GA

COMMERCIAL RELATIONSHIPS P. Cowper: Research Grant, AstraZeneca, Bristol-Myers Squibb, Eli Lilly, GE, Gilead Sciences, Tenax Therapeutics

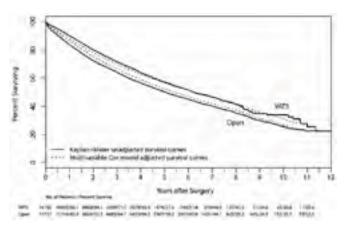
Discussant: Mark F. Berry, Stanford, CA

Purpose: Prior risk models using the STS General Thoracic Surgery Database (GTSD) have been limited to 30-day outcomes. We have now linked STS data to Medicare data and sought to create a risk prediction model for long-term mortality following lung cancer resection in patients older than 65.

Methods: The GTSD was linked to Medicare data for lung cancer resections from 2002 to 2013, as previously reported. Successful linkage was performed in 29,899 lung cancer resection patients. Cox proportional hazards modeling was used to create a long-term survival model. Variable selection was performed using statistically significant univariate factors and known clinical predictors of outcome. Calibration was assessed by dividing the cohort into deciles of predicted survival and discrimination assessed with a C-statistic corrected for optimism via 1,000 bootstrap replications.

Results: Median age was 73 years (69,78), and 48% of the patients were male. Of the 29,094 patients with non-missing pathologic stage, 69% were stage I, 18% stage II, 11% stage III, and 2% stage IV. Procedure performed was lobectomy in 69%, wedge resection in 17%, segmentectomy in 7%, bilobectomy in 3%, pneumonectomy in 3%, and sleeve lobectomy in 1%. Thoracoscopic approach was performed in 47% of resections. The final Cox model (Table) reveals that stage and age are strong predictors of long-term survival. Even after controlling for stage, wedge resection, segmentectomy, bilobectomy, and pneumonectomy are all associated with increased hazard of death in comparison to lobectomy. Thoracoscopic approach is associated with improved long-term survival in comparison to thoracotomy (Table and Figure). Other modifiable predictive factors include smoking and low body mass index. Calibration of the model demonstrates excellent performance across all survival deciles. Discrimination is good with a C-statistic of 0.694.

Conclusions: The GTSD-Medicare long-term risk model includes several novel factors associated with mortality. Although medical factors predict long-term survival, age and stage are strong predictors. Despite this, procedure choice and thoracoscopic/open approach are potentially modifiable predictors of long-term survival after lung cancer resection.



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General Session I - Continued

8:15 AM Grand Ballroom

Richard E. Clark Memorial Paper for Adult Cardiac Surgery

Mortality Is Reduced When Surgical Ablation for Atrial Fibrillation Is Performed Concomitantly With Mitral Operations

J. S. Rankin¹, M. V. Grau-Sepulveda², N. Ad³, R. J. Damiano⁴, P. M. McCarthy⁵, A. M. Gillinov⁶, V. H. Thourani⁷, J. P. Jacobs⁸, D. M. Shahian⁹, V. Badhwar¹

¹West Virginia University, Morgantown, WV, ²Duke Clinical Research Institute, Durham, NC, ³Inova Heart and Vascular Institute, Falls Church, VA, ⁴Barnes-Jewish Hospital, Washington University in St Louis, MO, ⁵Northwestern University, Chicago, IL, ⁶Cleveland Clinic, OH, ⁷Emory University, Atlanta, GA, ⁸Johns Hopkins All Children's Heart Institute, St Petersburg, FL, ⁹Massachusetts General Hospital, Boston

COMMERCIAL RELATIONSHIPS N. Ad: Consultant/Advisory Board, AtriCure, LivaNova; Ownership Interest, Left Atrial Appendage Occluder, LCC; Speakers Bureau/Honoraria, Medtronic; R. J. Damiano: Research Grant, AtriCure, Speakers Bureau/Honoraria, AtriCure, CryoLife, LivaNova; A. M. Gillinov: Consultant/Advisory Board, Abbott Vascular, AtriCure, CryoLife, Medtronic, St Jude Medical; Ownership Interest, ClearFlow; Research Grant, Abbott Vascular, St Jude Medical; Speakers Bureau/Honoraria, AtriCure, CryoLife, Edwards Lifesciences Corporation, Medtronic; P. M. McCarthy: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation; Ownership Interest, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Abbott Laboratories; J. S. Rankin: Consultant/Advisory Board, Admedus, AtriCure, BioStable Science and Engineering; Employment, BioStable Science and Engineering; Ownership Interest, BioStable Science and Engineering

Discussant: Richard Lee, St Louis, MO

Purpose: Surgical ablation (SA) for atrial fibrillation (AF) concomitant to mitral valve repair or replacement (MVRR) improves longitudinal sinus rhythm. However, the potential risk of adding SA to MVRR remains a clinical concern. This study examined the impact of performing or not performing SA on mortality of contemporary MVRR operations.

Methods: The study cohort included 88,765 MVRR patients in the STS Adult Cardiac Surgery Database between July 2011 and June 2014. Tricuspid repair and coronary artery bypass grafting were included. All STS comorbid risk variables and mitral etiology were assessed for univariate predictors and unadjusted mortality. Following multivariable logistic regression, risk-adjusted odds ratios (OR) for mortality were compared by AF type at operation and SA performance: Group 1, No AF + No SA; Group 2, No AF + SA; Group 3, AF + No SA; Group 4, AF + SA; Group 5, Persistent AF + No SA; and Group 6, Persistent AF + SA.

Results: Baseline characteristics and unadjusted outcomes differed among groups (Table). Groups 3 and 5 (AF without SA) were older with worse symptoms, had more reoperations, and higher unadjusted mortalities. Following multivariable risk adjustment, Groups 2-6 with AF history \pm SA were referenced to Group 1 patients without AF or SA. Groups 2-4 represented the overall population, and Groups 5 and 6 were patients with persistent AF. Patients with AF at the time of operation not receiving SA (Groups 3 and 5) had odds ratios of 1.16 and 1.17, respectively, or an increase of 16%-17% in relative risk of mortality (P \leq .01). In Groups 4 and 6, concomitant SA reduced the AF-related mortality to a level that was statistically comparable to reference baseline Group 1 without a history of AF.

Conclusions: At the time of MVRR operations, the addition of SA to treat AF can be performed without increased risk of mortality. These data further suggest that there may be an early mortality benefit when SA is added, particularly in higher-risk patients.

Group1: No AF+No SA (g=10,780) Group 4: AF+SA Group 3: AF+No SA Group 6: Persistent Group 5: Persistent Group2: No AF+SA AF/No-SA (n=5,663) AF/SA (n=9,514) (Total n=88,765) Sub-Group Table 1 (g=16,352) (g-53,519) (a=8,114) (median) (xsars) 5 71 8 70 72 8 Presenta Elective 74% 63% 72% 58% 76% 67% tion (%) VIIIIV 41% 28% 32% 50% 39% 50% (median) 55% 55% 55% 57% 55% 55% EF Reope ration 14% 32% 30% 95 7% 9% Unadjusted Operative Mortality 3.6% 6.7% 3.0% 3.7% 3.7% 6.6% 30 Adjusted Odds Risk-Ratio for Mortality 1.00 0.97 1.09 1.00 (sompared to Group 1) p-value 0.004 0.13 0.65 0.2 8

Audience Poll

General Session I – Continued

8:30 AM Grand Ballroom

Richard E. Clark Memorial Paper for Congenital Heart Surgery

Early Shunt Failure, Prevalence, Risk Factors, and Outcomes: An Analysis of The Society of Thoracic Surgeons Congenital Heart Surgery Database

N. Do¹, K. Hill², A. Wallace², L. A. Vricella³, D. E. Cameron¹, J. A. Quintessenza⁴, N. Goldenberg⁵, C. Mavroudis⁶, T. R. Karl⁶, S. K. Pasqualiˀ, J. P. Jacobs⁶, M. L. Jacobs⁶

¹The Johns Hopkins Hospital, Baltimore, MD, ²Duke Clinical Research Institute, Durham, NC, ³The Johns Hopkins University, Baltimore, MD, ⁴All Children's Hospital, St Petersburg, FL, ⁵Johns Hopkins All Children's Hospital, St Petersburg, FL, ⁶Florida Hospital for Children, Orlando, ⁷University of Michigan, Ann Arbor, ⁸Johns Hopkins All Children's Heart Institute, St Petersburg, FL, ⁹The Johns Hopkins University School of Medicine, Newtown Square, PA

COMMERCIAL RELATIONSHIPS K. Hill: Consultant/Advisory Board, Kowa Pharmaceuticals; Research Grant, Gilead Sciences

Discussant: Emmett D. McKenzie, Houston, TX

Purpose: Systemic-to-pulmonary shunt failure is a potentially catastrophic complication. Previous studies have explored the potential benefits of pharmacologic agents to prevent shunt failure but have been inadequately powered to quantify anatomic and procedural risk factors. We sought to evaluate risk factors for in-hospital shunt failure using a large, multicenter clinical registry.

Methods: Infants (≤365 days) undergoing shunt construction as a source of pulmonary blood flow (including systemic-to-pulmonary artery or right ventricle-to-pulmonary artery shunts) from 2010 to 2015 in the STS Congenital Heart Surgery Database (CHSD) were included. Criteria for shunt failure were: documented diagnosis of in-hospital shunt failure, shunt revision, or catheter-based shunt intervention. Multivariable logistic regression was used to evaluate risk factors for in-hospital shunt failure. Model covariates were chosen a priori and included important patient characteristics (weight, age, prematurity, previous cardiothoracic operations, fundamental diagnosis), presence of preoperative risk factors, type of systemic-to-pulmonary artery shunt, and center effects. Centers with excess missing data for key covariates were excluded.

Results: Included were 9,172 infants who underwent shunt operations at 118 centers. In-hospital shunt failure occurred in 674 (7.4%) overall. In multivariable analysis (Table), risk factors for in-hospital shunt failure included lower weight at the time of shunt creation, presence of a preoperative hypercoaguable state, and the collective presence of any other CHSD preoperative risk factors. Neither use nor non-use of cardiopulmonary bypass was associated with increased risk of shunt failure. Risk of shunt failure was not increased in single ventricle patients, including those with hypoplastic left heart syndrome. Having a Norwood with right ventricle-to-pulmonary artery shunt was associated with decreased odds of shunt failure. Patients with in-hospital shunt failure had significantly higher operative mortality (31.9% vs 11.1%, P < .0001), a higher prevalence of major morbidity (33.5% vs 29.4%, P < .0001), and longer median postoperative length of stay among survivors (45 vs 22 days, P < .0001).

Conclusions: In-hospital shunt failure is common and associated with high mortality. These data highlight at-risk patients and procedural cohorts that warrant expectant surveillance, enhanced anti-thrombotic prophylaxis, or other management strategies to reduce the risk of shunt failure. These findings also may be useful for risk stratification in future clinical trials.



Table: Adjusted Odds of In-hospital Shunt Failure in Neonates and Infants

	Adjusted OR (95% CI)	Adjusted P
Patient Factors		
Neonate (vs. infant)	1.04 (0.46,2.34)	0.9288
Prematurity	0.80 (0.62,1.04)	0.0909
Previous CT operations	1.37 (0.90,2.08)	0.1398
Any non-cardiac anatomic abnormalities	1.29 (0.91,1.82)	0.1569
Any genetic abnormalities	1.09 (0.89,1.33)	0.3945
Weight, neonates (per kg decrease)	1.35 (1.13,1.61)	0.0007
Weight, infants (perkg decrease)	1.34 (1.15,1.56)	0.0002
Preoperative risk factors		
Circulatory support	1.45 (0.62,3.36)	0.3878
Shock, persistent at time of surgery	0.85 (0.46,1.57)	0.6067
Renal failure	1.03 (0.58,1.82)	0.9207
Ventilatory support	1.12 (0.93,1.35)	0.2451
Neurological Deficit	1.11 (0.51,2.39)	0.7986
Hypocoagulable state	0.78 (0.29,2.07)	0.6187
Hypercoagulable state	2.47 (1.09,5.60)	0.0306
Any other preoperative risk factor	1.24 (1.01,1.53)	0.0378
CPB during shunt placement (vs. no CPB)	1.05 (0.83,1.33)	0.6857
Shunt type		
mBIS (non-Norwood)	Ref	45
Central	1.30 (0.99,1.69)	0.0569
Norwood with mBTS	1.27 (0.91,1.76)	0.1578
Norwood with RVPAS	0.65 (0.45,0.93)	0.0200
TAPVC repair with shunt	1.20 (0.63,2.30)	0.5754
Other	1.07 (0.68,1.69)	0.7654
Fundamental diagnosis		
Two ventricle	Ref	20
HLHS	0.97 (0.72,1.33)	0.8709
Non-HLHS single ventricle	1.02 (0.82,1.27)	0.8490

General Session I - Continued

8:45 AM **Grand Ballroom**

Richard E. Clark Memorial Paper for General Thoracic Surgery

The Society of Thoracic Surgeons Composite Score for Evaluating Program Performance in Esophagectomy for Esophageal Cancer

A. C. Chang¹, A. S. Kosinski², D. P. Raymond³, M. J. Magee⁴, M. M. DeCamp⁵, F. Farjah⁶, E. L. Grogan⁷, C. W. Seder⁸, M. S. Allen⁹, S. H. Blackmon⁹, J. Blasberg¹⁰, W. R. Burfeind¹¹, S. D. Cassivi⁹, B. J. Park¹², D. M. Shahian¹³, D. W. Wormuth¹⁴, F. G. Fernandez¹⁵, B. D. Kozower¹⁶

¹University of Michigan, Ann Arbor, ²Duke Clinical Research Institute, Durham, NC, ³Cleveland Clinic, OH, ⁴HCA North Texas Division, Dallas, ⁵Northwestern Memorial Hospital, Chicago, IL, ⁶University of Washington Medical Center, Seattle, ⁷Vanderbilt University Medical Center, Nashville, TN, 8Rush University Medical Center, Chicago, IL, 9Mayo Clinic, Rochester, MN, ¹⁰Yale University School of Medicine, New Haven, CT, ¹¹St Luke's University Health Network, Bethlehem, PA, ¹²Memorial Sloan Kettering Cancer Center, New York, NY, ¹³Massachusetts General Hospital, Boston, ¹⁴CNY Thoracic Surgery, PC, Jamesville, NY, ¹⁵Emory University, Atlanta, GA, 16 University of Virginia Health System, Charlottesville

COMMERCIAL RELATIONSHIPS M. M. DeCamp: Consultant/Advisory Board, Holaira, PulmonX, Soffio Medical; M. J. Magee: Consultant/Advisory Board, Biodesix; Speakers Bureau/Honoraria, Biodesix; B. J. Park: Speakers Bureau/ Honoraria, Bard Medical, Baxter International

Discussant: Katie S. Nason, Pittsburgh, PA

Purpose: The Society of Thoracic Surgeons (STS) has developed multidimensional composite quality measures for common cardiac surgery procedures and lobectomy for lung cancer. A similar metric for esophagectomy does not exist. We sought to develop a composite measure for STS National Database participant performance for esophagectomy in esophageal cancer.

Methods: The STS esophagectomy composite score is derived from two outcomes: riskadjusted mortality (discharge and 30-day) and risk-adjusted major complications. General Thoracic Surgery Database (GTSD) data from 2012 to 2014 were included. Participantspecific composite score 95% Bayesian credible intervals (CrI) were established and compared with the average to determine "star" ratings. Database participants with composite scores that included the 95% CrI of the average score were considered "two star," whereas participants with the 95% CrI below or above the average scores were considered "one" or "three" stars, respectively. For benchmarking of GTSD participants, discharge mortality and length of stay were compared with the National Inpatient Sample (NIS) 2012 cohort.

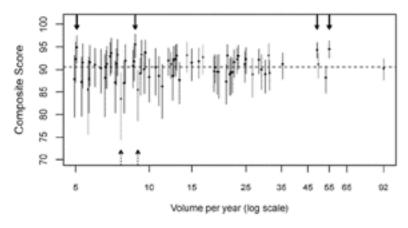
Results: The study population included 4,321 esophagectomy patients from 167 participating centers. Operative mortality (discharge and 30-day) was 3.1% (n=135) and the major complication rate was 33.1% (n=1,429). Of the 167 participants, only 70 reported an average yearly operative volume of five or more during the study period. With this operative volume threshold, the model reliability for the composite outcome score was 58% (95% CrI, 41% to 72%). Of these 70 participants (Figure), four (5.7%) were three-star (solid arrow), 64 (91.4%) were two-star, and two (2.9%) were one-star (dashed arrow). A majority of Database participants, 58.1% (n=97), was considered not to have sufficient operative volume to receive a reliable composite score. Using the 2012 NIS cohort as a benchmark for national performance, GTSD subjects have comparable discharge mortality, albeit with less variability and shorter postoperative length of stay than those identified in the NIS 2012 cohort (Table).

Conclusions: STS has developed a two-domain quality measure for esophageal cancer surgery based on a composite score of risk-adjusted operative mortality and major





complications. Further efforts should be directed at identifying additional indicators of quality that might allow statistically valid comparisons of programs with a broader range of operative volumes.



Comparison of unadjusted outcomes following escohagediumy

	STS (2017-2014)	NIS (2012)
	Dischurge	Mortality
Percent (N) 95% Ct	6%4321 2.7% (118) (2.3%, 3.3%)	1=2725 3.5% (95) (1.0%, 5.1%)
	Phatoperative	Length of Stay
Mean days (95% CI) Median days (IQR)	6-4311 t3 8 (13.8, 14.2) (0.0 (8.0, 14.0)	15.5 (14.3, 16.7) 10.0 (7.5, 18.0)

9:00 AM

BREAK—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall

9:40 AM

Introduction of the President

Richard L. Prager, Ann Arbor, MI

9:50 AM

Presidential Address: Quality and Innovation in Cardiothoracic Surgery: Imperatives Colliding?

Joseph E. Bavaria, Philadelphia, PA

 $\textbf{COMMERCIAL RELATIONSHIPS} \ J.\ E.\ Bavaria:\ Research\ Grant,\ Edwards\ Lifesciences\ Corporation,\ Medtronic,\ St\ Jude\ Medical,\ W.\ L.\ Gore\ \&\ Associates$

10:50 AM - 11:30 AM

BREAK—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall



11:30 AM – 12:30 PM Room 310ABC

Adult Cardiac: Arrhythmia

Moderators: Vinay Badhwar, Morgantown, WV, and Edward G. Soltesz, Cleveland, OH

COMMERCIAL RELATIONSHIPS E. G. Soltesz: Ownership Interest, JACE Medical; Speakers Bureau/Honoraria, AtriCure, Edwards Lifesciences Corporation, St Jude Medical

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, as well as a pro-con debate.

11:30 AM

Sex Differences in the Epidemiology of New-Onset Post-Coronary Artery Bypass Grafting Atrial Fibrillation: A Large, Multicenter Study

G. Filardo¹, G. Ailawadi², B. D. Pollock¹, B. da Graca¹, D. Sass¹, T. Phan¹, D. E. Montenegro¹, V. H. Thourani³, R. J. Damiano⁴

¹Baylor Scott & White Health, Dallas, TX, ²University of Virginia, Charlottesville, ³Emory University, Atlanta, GA, ⁴Barnes-Jewish Hospital, Washington University in St Louis, MO

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; R. J. Damiano: Research Grant, AtriCure, Speakers Bureau/Honoraria, AtriCure, CryoLife, LivaNova; G. Filardo: Research Grant, Gilead Sciences

Purpose: New-onset atrial fibrillation (AF) following coronary artery bypass grafting (CABG) surgery is associated with poorer outcomes. While several studies show differences in outcomes in women vs men following CABG, little is known about the sex-specific incidence and characteristics of post-CABG AF. This large, multicenter study sought to fill that gap.

Methods: 11,239 consecutive patients without preoperative AF underwent isolated CABG from 2002 to 2010 at four US academic medical centers and one high-volume specialty cardiac hospital. Data routinely collected for the STS National Database were augmented with details on new-onset post-CABG AF events detected via continuous in-hospital electrocardiography/telemetry monitoring, regardless of duration or need for treatment.

Results: Unadjusted incidence of post-CABG AF was 29.5% overall, 30.2% in men, and 27.4% in women. Following adjustment for STS-recognized risk factors, women had significantly lower risk for post-CABG AF (OR [95% CI] = 0.72 [0.62, 0.85]), shorter durations of first and longest AF episodes, and total time in AF (mean difference [95% CI] = -3.1 [-5.1, -1.2] hours; -4.6 [-7.3, -2.0] hours; and -4.8 [-8.8, -0.8] hours, respectively). Risk-adjusted timing of first AF episode (P = .37), number of episodes (P = .08), operative mortality (P = .058), stroke (P = .165), and discharge in AF (P = .225) did not differ significantly by sex.

Conclusions: These novel data regarding sex-specific characteristics of new-onset AF following isolated CABG show that women had lower adjusted risk for post-CABG AF and experienced shorter episodes. Investigation of sex-specific impacts on outcomes is needed to identify optimal strategies for prevention/management to ensure all patients achieve the best possible outcomes.

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Adult Cardiac: Arrhythmia - Continued

11:45 AM Room 310ABC

Effectiveness of the Posterior Pericardiotomy in Preventing Pericardial Effusion and Atrial Fibrillation After Coronary Artery Bypass Grafting Surgery

R. Kumar Baral, B. Koirala

Manmohan Cardiothoracic Vascular and Transplant Center, Institute of Medicine, Kathmandu,

Purpose: The aim of this prospective, randomized study was to assess the efficacy of posterior pericardiotomy in decreasing the prevalence of pericardial effusion and postoperative atrial fibrillation (AF).

Methods: The study was performed in 70 patients who underwent elective coronary artery bypass grafting (CABG) surgery performed by a single team between March 2014 and March 2015. Patients were randomized to receive posterior pericardiotomy (PP) with a 4-cm longitudinal incision made parallel and posterior to the left phrenic nerve, extending from the left inferior pulmonary vein to the diaphragm, or no posterior pericardiotomy (control). All other methods of treatment were similar in both the groups.

Results: There was no difference between the two groups regarding demographic data and risk factors. Only eight out of 64 patients (12.5%) were older than 70 years of age, and patients' ages ranged from 36 to 76 years. Both pericardial effusion and AF were common in the control group. Occurrence of AF was also significantly high in patients with pericardial effusion. All patients with large or very large pericardial effusion in the control group were found to have AF. This association was statistically significant with a P value < .05. Early pericardial effusion developed in one patient (3.22%) in the pericardiotomy group and 22 patients (66.66%) in the control group (P < .0001). The number of patients who developed postoperative AF was significantly lower in the pericardiotomy group compared with the control group (four [12.9%] vs 13 [39.39%], P < .001). In patients with AF, most developed AF in the second to fifth postoperative days. No patients developed AF after the seventh postoperative day when followed up with 12-lead electrocardiogram on the 15th and 30th postoperative days.

Conclusions: These findings suggest that posterior pericardiotomy reduces the prevalence of early pericardial effusion and related AF by improving pericardial drainage in patients undergoing CABG surgery.



Table 1: Pericardial effusion and occurrence of AF in two groups

	XIII	AF		Total
Group	Size of PE	Not present	Present	
Posterior	None	27	3	30
person diotomy	Small	0	1	1
	None	8	1	9
Control	Small	7	2	0
C.OMPOI	Moderate	5	5	10
	Large	4	4	4
	Very large	0	1	1

12:00 PM

Debate: A Complete Cox-Maze Only in Surgical Treatment of Atrial Fibrillation

Con: Patrick M. McCarthy, Chicago, IL Pro: Ralph J. Damiano, St Louis, MO

COMMERCIAL RELATIONSHIPS P. M. McCarthy: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation; Ownership Interest, Edwards Lifesciences Corporation; R. J. Damiano: Research Grant, AtriCure, Speakers Bureau/Honoraria, AtriCure, CryoLife, LivaNova

11:30 AM - 12:30 PM Room 350DEF

Basic Science Research: Adult Cardiac

Moderators: Pavan Atluri, Philadelphia, PA, and Jennifer S. Lawton, St Louis, MO

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

11:30 AM

Prevention of Aortic Aneurysm Formation and Rupture by Using Clarithromycin

W. Uchida, A. Yamawaki-Ogata, H. Oshima, A. Usui, Y. Narita

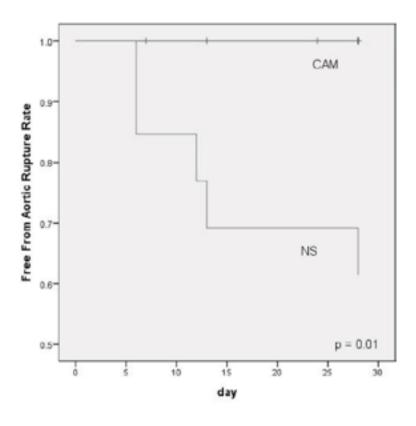
Nagoya University Graduate School of Medicine, Japan

Purpose: The pathogenesis of aortic aneurysm is mainly characterized by chronic inflammation in the aortic wall with accumulation of macrophages and degradation of extracellular matrix with increased matrix metalloproteinases (MMP), particularly MMP-2 and MMP-9, resulting in the degradation of collagen, elastin fragmentation, and smooth muscle cell apoptosis.

Methods: Male ApoE-/- mice were infused with 1,000 ng/kg/min Angiotensin II by implanted osmotic pump for 28 days. In the clarithromycin-treated group (CAM: n=13), the mice were dosed with clarithromycin (100 mg/kg/day) by a gastric tube every day. In the control group (NS; n=13), saline was administrated. Echo was performed every week and aortic diameters were evaluated by following weekly. Twenty-eight days after pump implantation, the aorta was dissected free from the connective tissue, and elastin values and accumulations of inflammatory macrophages were measured. Furthermore, gelatin zymography was performed to evaluate MMP-2 and MMP-9 enzymatic activities.

Results: Echo showed attenuated significant expansion of aortic diameters in CAM. The incidence of developing aortic aneurysm in NS was 100%, which was significantly decreased to 23% in CAM. No ruptured death was observed in the CAM group in contrast to five ruptured deaths in NS (log-rank test, P = .01). Clarithromycin significantly suppressed aortic elastin degradation (56.3% and 16.5%, P < .001) and decreased infiltrated inflammatory macrophages (5.3% and 16.0%, P = .005). Clarithromycin significantly attenuated MMP-2 activities (0.15 and 0.56, P < .001) and MMP-9 activities (0.12 and 0.60, P < .001).

Conclusions: Clarithromycin prevented the development of aortic aneurysm formation and rupture through suppression of infiltrated inflammatory macrophages, increased MMP-2 and MMP-9, and degradation of elastin layer.



Basic Science Research: Adult Cardiac - Continued

11:42 AM Room 350DEF

Risk of Spinal Ischemia in Thoracic Aortic Procedures: The Influence of Number and Distribution of Anterior Radiculomedullary Arteries on Cord Perfusion

F. Kari¹, K. Wittmann¹, S. Krause¹, B. E. Saravi¹, L. Puttfarcken¹, K. Foerster¹, B. Rylski¹, S. Maier¹, U. Goebel², M. Siepe¹, M. Czerny¹, F. Beyersdorf²

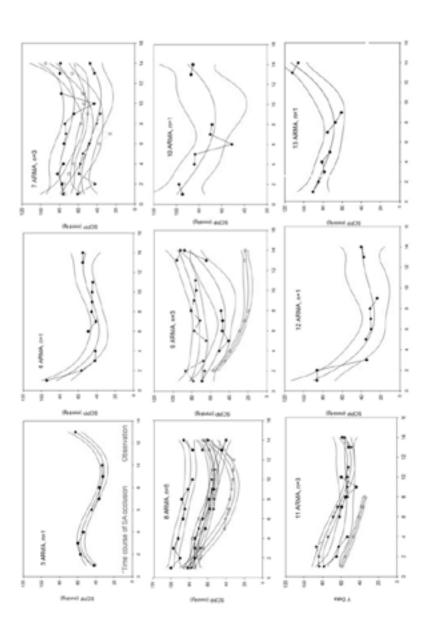
¹Heart Center Freiburg University, Germany, ²University Medical Center Freiburg, Germany COMMERCIAL RELATIONSHIPS F. Beyersdorf: Ownership Interest, ResuSciTec

Purpose: To investigate the influence of number and distribution of thoracic anterior radiculomedullary arteries (ARMA) on spinal cord perfusion in an experimental frozen elephant trunk (FET) porcine animal model.

Methods: Twenty pigs (German country race, weight 34 kg ± 3 kg) underwent ligation of the left subclavian artery and thoracic segmental arteries via left lateral thoracotomy in normothermia. Primary functional endpoints were spinal cord perfusion pressure (SCPP, directly measured) and regional spinal cord blood flow (SCBF, fluorescent microspheres). Cerebrospinal fluid pressure (CSF) was monitored. Observation time was 3 hours postligation. After sacrifice, complete body perfusion with colored cast resin was performed, and number and distribution of ARMA were documented upon autopsy. Distribution of ARMA was analyzed as maximum distance between any two thoracic ARMA.

Results: The numbers of thoracic ARMA ranged between n=3 and n=13 (mean 8 ARMA). When stratified according to the absolute number of ARMA, SCPP levels showed comparable courses of decline during clamping and recovery during the observation period (Figure). The absolute number of ARMA was not linked to specific courses of SCPP or SCBF during clamping and post-ligation. Distribution patterns of ARMA were linked to inhomogeneous SCBF and SCPP distribution along the spinal cord: if ARMA distance was two or three segments, greater SCBF differences were seen as compared to ARMA distances of zero or one segments (0.4 mL/g/min vs 0.05 mL/g/min, P < .05).

Conclusions: The absolute number of thoracic ARMA is not linked to SCPP during simulated FET procedure. Strategies of predicting risk of spinal ischemia should focus on distribution patterns rather than the absolute number of ARMA.





Basic Science Research: Adult Cardiac - Continued

11:54 AM Room 350DEF

A TNF-α and Hypoxia-Induced Secretome Therapy for Myocardial Repair

K. Selvasandran¹, G. Makhoul¹, R. Jurakhan¹, P. Jaiswal², L. Li¹, K. Ridwan¹, R. Cecere³ ¹McGill University, Montreal, Canada, ²Montreal General Hospital, Canada, ³McGill University Health Centre, Montreal, Canada

Purpose: Poor viability and retention of transplanted bone-marrow mesenchymal stem cells (BM-MSC) in harsh microenvironments remains an obstacle in promoting healing in ischemic hearts post-myocardial infarction (MI). This study aims to understand the cardioprotective effects of tumor necrosis factor-α (TNF-α) and hypoxia on rat BM-MSC (rBM-MSC) paracrine secretions, which may initiate and sustain the process of cardiac repair post-MI.

Methods: Secretome from rBM-MSC cultures treated and untreated with either rat cardiomyocyte-conditioned medium (rCCM), TNF-α, and/or normoxia/hypoxia in various combinations were collected. Immunocytochemistry, Western blot analyses, trans-well cell migration, and live-dead assays in conjunction with fluorescence-activated cell sorting were conducted. In rats with induced MI, in vivo, echocardiography was performed at 3 weeks following their treatment with a control (rCCM, hypoxia, and BM-MSCs) or TNF-α hypoxia-induced secretome. Histological analyses including Masson's trichrome staining and immunohistochemistry (IHC) using Ki67, a marker of proliferation, and CD31, a marker of angiogenesis, were further conducted. Image I and Prism were used for statistical analysis.

Results: Immunocytochemistry and Western blots confirmed the presence of both TNF-Receptors 1 and 2 (TNFR1&2) on rBM-MSCs, indicating that TNF-α is able to bind to rBM-MSCs and initiate cell survival pathways. Western blot analyses on rBM-MSC lysates treated with TNF- α and hypoxia showed an increased expression of TGF- α , FGF-2, FGF-7, Ang-2, VEGF-1, and Myogenin. These proteins either contribute to neovascularization, MSC proliferation, decreasing inflammatory responses, and/or inducing MSC differentiation. The TNF-α hypoxia-induced secretome exhibited chemotactic properties, which may aid in the migration of BM-MSCs to the infarct site. In vivo, the TNF- α hypoxia-induced secretome treated rats had a higher left ventricle fractional shortening (LVFS) than the control, while trichrome staining revealed a decrease in the size of infarct, indicating that myocardial preservation may be occurring. IHC revealed increased expression of CD31 and Ki67 near the area of infarct in TNF-α hypoxia-induced secretome treated rats, suggesting the occurrence of angiogenesis and proliferation.

Conclusions: Our data suggest that post-MI, rBM-MSCs secrete paracrine factors in response to TNF-α that work together to manipulate the microenvironment to trigger neovascularization and cardioprotective properties at the infarct site. These results may shed light on moving toward a potential cell-free, cytokine-dependent secretome therapy as a strategy for salvaging myocardium in patients with myocardial infarction.



12:06 PM

Pulsatile Characteristics of the Mechanically Actuated Fibrillating Heart Are Similar to the Native Beating Heart

B. Schmitt, N. V. Wright, Y. Zhou, D. B. Reynolds, M. P. Anstadt

Wright State University, Dayton, OH

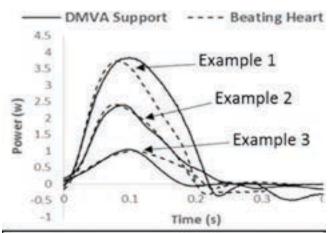
Purpose: Direct mechanical ventricular actuation (DMVA) is a non-blood-contacting device shown effective for resuscitating both humans and animals following cardiac arrest. The purpose of this study was to determine if DMVA support during ventricular fibrillation (VF) generates vascular pulsatility similar to the native heart.

Methods: Large canine (n=10) and swine (n=10) were anesthetized, underwent sternotomy, and instrumented for hemodynamic monitoring and intracardiac echocardiography. VF was induced for 5 mins of circulatory arrest and DMVA applied for 15 mins. Hearts were then defibrillated and allowed to recover. Repeated periods of arrest were used to increase cardiac dysfunction post-resuscitation. Paired t-tests were used to compare the baseline, supported VF, and unsupported post-resuscitation states. Mean pressures and flows were similar between DMVA-supported hearts and unsupported resuscitated hearts. Previously described metrics of pulsatility were calculated using 10-sec flow and pressure intervals.

Results: Baseline and DMVA generated equivalent levels of pulsatility by all metrics (PP, PI, SHE, EEP/MAP). Differences in overall energy (EEP, Power) between the possibly hyperdynamic baseline and support can be explained by discrepancies between mean flows and pressures (continuous flow component) given matching pulsatility. External forces alone during arrest were able to replicate the level of pulsatile energy generated by the physiologic heart. Given the limitations of many cardiac assist devices to replicate physiologic hemodynamic waveforms, DMVA has a clear advantage since the actual heart structure is being manipulated rather than using a blood pump. Unsupported resuscitated hearts had significantly less pulsatility than supported hearts even with equal mean hemodynamics. These results suggest a significant drop in pulsatility can accompany even mild reductions in mean hemodynamics in the resuscitated heart.

Conclusions: DMVA was able to generate physiologic levels of pulsatility during support of the fibrillating heart across a range of heart sizes. Furthermore, DMVA was shown to provide superior pulsatility compared to the resuscitated heart. These characteristics may be valuable for resuscitation of other vital organs.

Basic Science Research: Adult Cardiac – Continued Continued from previous page



Average instantaneous aortic power curves showing equivalency between supported and unsupported beating hearts in three different animals.

	Exp	perlmental Cond	Iltion
	Baseline	Supported Arrest	Beating Heart
CO (L/min)	3.08 ± 0.06	2.71±0.05*	2.70 ± 305*
MAP (mmHg)	94.2 + 4.0	77.3 + 4.2*	83.6±3.6*
PP (mmHg)	68.9±4,79	70.6 ± 4.2	39.7 ± 3.4*+
PI	0.72 ± 0.05	0.82 ± 0.04	0.68 ± 0.04
EEP (mmHg)	112.3 ± 4.2	95.2 ± 4.3*	96.7 ± 3.8*
EEP/MAP	1.22 ± 0.02	1.26 ± 0.02	1.16 ± 0.02*+
SHE (mmHg)	18.1 : 1.1	18.9 ± 1.1	12.6 ± 1.0**
Mean Power (W)	0.74 ± 0.03	0.53 ± 0.03*	0.53 ± 0.03*

Expressed as Mean ± SEM; * p<0.05 vs Baseline, 1 p<0.05 vs DMVA

CO - cardiac output; MAP - me an arterial pressure; PP - pulse pressure; PI - pulsatility index; EEP - energy equivalent pressure; SeE - surplus hemodynamic energy



12:18 PM Room 350DEF

Ex-Vivo Assessment of Material Characteristics in Ascending Aortic Aneurysm Tissue for Bicuspid and Trileaflet Valve Groups

R. Beddoes¹, E. S. Di Martino¹, J. J. Appoo²

¹University of Calgary, Canada, ²Libin Cardiovascular Institute, University of Calgary, Canada

Purpose: Risk of rupture or dissection of dilated ascending aortas is poorly understood. Debate exists as to whether aneurysms associated with bicuspid aortic valves behave differently than aneurysms with trileaflet valves. To help understand rupture risk, biomechanical analysis was performed to assess tissue strength and stiffness of human ascending aortic aneurysms.

Methods: Ascending aortic aneurysm samples obtained from 32 patients were cut into 54 circumferential specimens. Uniaxial tensile strength testing was performed by first preconditioning and then stretching to failure at rate of 5 mm/min. Material strength was defined as the first local maximum on stress-strain curve. Stiffness was assessed from the linear region of stress-strain curve. Neo-Hookean parameter, a surrogate for stiffness for materials exhibiting non-linear behavior, was fit to the data. Corresponding goodness of fit, R2, was computed via regression analysis. Results of material strength and stiffness were compared in patients with bicuspid aortic valves vs trileaflet aortic valves.

Results: Uniaxial tensile tests were performed on 21 trileaflet valve and 33 bicuspid valve specimens. Median ascending aortic diameters were 5.6 cm vs 5.2 cm for trileaflet and bicuspid valves, respectively (P < .05). Median material strength was 0.73 MPa in trileaflet vs 1.16 MPa in bicuspid (P < .05). Median material stiffness in the linear region was 3.24 MPa in trileaflet and 4.17 MPa in bicuspid (P > .05). The median neo-Hookean parameter for non-linear region for trileaflet and bicuspid was found to be 0.03 MPa (R2 = 0.90) vs 0.05 MPa (R2 = 0.99) (P < .05).

Conclusions: Ex vivo biomechanical assessments of ascending aortic aneurysms suggest that bicuspid aortas may be stronger and stiffer than aortic tissue associated with trileaflet valves. This is contrary to popular clinical belief that aneurysms associated with bicuspid valves are at higher rupture or dissection risk. Further studies will control for maximum diameter.

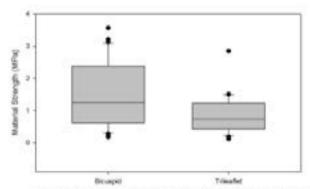


Figure: Material Strength in Ascending Aorta Aneurysm Tissue For Bicuspid and Trileaflet Valve Groups



Basic Science Research: Adult Cardiac - Continued Continued from previous page

Table: Comparison of Trileaflet and Biouspid Valve Group Parameters

Trileaflet (N=21)	Bissepid (NEX)3)	
(Range)	Median (Range)	P Value
(0.12-1.51)	1.16 (0.163-X37)	+0,05
(0.18-0.92)	0.64 (0.25-1.97)	0.325
5.6 (1.0.1.0)	\$.2 (4.3-6.5)	<0.05
(1/05-4.77)	1.96 (1.15-7.32)	0.312
(0.027-11-14)	(0.15-7.287)	9.544
3.24 (0.67-10.77)	4.17 (0.96-10.28)	0.105
(0.03	(0.05-0.4)	40.05
	(N=21) Median (Range) 0.73 (0.11-1.31) 0.47 (0.18-0.92) 5.6 (1.6-6.0) 2.22 (1.05-4.77) 0.36 (0.07-11.14) 3.24 (0.62-10.77) 0.03	(Next) (Next)) Median Median [Range) (Range) 0.73 116 (0.13-0.51) (0.163-5.27) 0.47 0.64 (0.13-0.92) (0.25-1.07) 5.6 5.2 (1.64.6) (4.3.65) 2.22 1.96 (1.05-4.77) (1.15-7.32) 0.36 0.32 (0.077.11.14) (0.16-7.28) 1.24 0.17 (0.16-7.28) (0.16-7.28) 0.03 0.05

NOTES





11:30 AM - 12:30 PM Room 361A

Basic Science Research: General Thoracic

Moderator: Joseph B. Shrager, Stanford, CA

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

11:30 AM

A Phase I Clinical Trial of Targeted Intraoperative Molecular Imaging for Pulmonary Adenocarcinomas

J. Predina¹, J. J. Keating², C. B. Gaughan³, D. Jarrar⁴, T. T. Pechet², J. C. Kucharczuk², P. Low⁵, S. Singhal⁶

¹University of Pennsylvania School of Medicine, Philadelphia, ²University of Pennsylvania, Philadelphia, ³University of Pennsylvania Health System, Lancaster, ⁴Perelman School of Medicine at the University of Pennsylvania, Philadelphia, 5Purdue University, West Lafayette, IN, 6Hospital of the University of Pennsylvania, Philadelphia

COMMERCIAL RELATIONSHIPS P. Low: Nonremunerative Position of Influence, On Target Laboratories; Ownership Interest, On Target Laboratories; Research Grant, On Target Laboratories

REGULATORY DISCLOSURE This presentation will describe the use of OTL38 by On Target Laboratories, which has an FDA status of investigational.

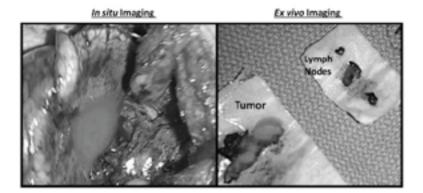
Purpose: Annually, 80,000 patients undergo pulmonary resection, and identification of pulmonary nodules can frequently be challenging. We hypothesize that targeted intraoperative molecular imagining can improve identification of pulmonary nodules during resection. To test the safety of our novel targeted optical contrast agent, we performed a phase I trial involving 20 patients.

Methods: OTL38 is a near-infrared imaging agent that targets FRα, a receptor upregulated by 10,000-fold in 85%-90% of patients with pulmonary adenocarcinoma. In vitro affinity of OTL38 for murine (TC1, LLC) and human cancers (A549, KB) was tested by immunohistochemistry and flow cytometry. After determining selective binding of OTL38, 20 patients with a biopsy-proven lung adenocarcinoma were enrolled in a phase I clinical trial. Prior to surgery, patients were systemically administered OTL38 (0.025 mg/kg) by intravenous infusion. During surgery, tumors were imaged in situ and ex vivo. Tumor fluorescence was quantified using tumor-to-background ratio (TBR).

Results: In vitro, murine and human cell lines demonstrated high levels of fluorescence (1,000-fold increases) after co-incubation with OTL38; P = .001. After 4 hours, additional exposure did not improve the fluorescence signal, and fluorescence was FRα dependent. In 20 human subjects receiving OTL38 prior to resection, we observed only three Grade I toxicities: three subjects with transient nausea/abdominal pain. We identified nodules in 18 of 20 enrolled patients (90%), and the mean tumor size was 2.5 cm (range 0.5-10.5 cm). 22% of the fluorescent nodules measured less than 1 cm. Mean TBR of fluorescent tumors

was 3.2 (range 1.7-4.6). Tumor size did not correlate with TBR (P > .05). In two patients, intraoperative imaging identified synchronous subcentimeter (5 mm, 9 mm) nodules, which were not detected by preoperative CT or PET scanning.

Conclusions: Our phase I trial demonstrated that targeted imaging with OTL38 is safe, with only Grade I toxicity. Additionally, we demonstrated that OTL38 is capable of detecting subcentimeter pulmonary nodules in humans. Our group is initiating a multicenter, phase II study to better understand implications of intraoperative molecular imaging using OTL38.



Basic Science Research: General Thoracic - Continued

11:42 AM Room 361A

HER2 Amplification Confers Resistance to Targeted Therapy in Esophageal Adenocarcinoma Cells With Concomitant Amplification of MET

A. Goltsov¹, B. Fang¹, T. K. Pandita², D. Maru¹, S. G. Swisher¹, W. L. Hofstetter¹

¹The University of Texas MD Anderson Cancer Center, Houston, TX, ²Houston Methodist Research Institute, Houston, TX

Purpose: Recent genomic studies indicated that esophageal adenocarcinoma (EAC) is driven by amplification of c-MET and/or HER2 in a subset of patients. We studied the feasibility of MET targeting by small-molecule inhibitor foretinib in EAC cells and interplay between MET and HER2 signaling.

Methods: We evaluated the levels of expression and phosphorylation status of MET and HER2 proteins using Western blot in EAC cell lines. The expression levels of MET and HER2 were manipulated by transfecting cells with specific siRNA or plasmid expressing HER2. Small molecule inhibitors of c-MET and ERBB1/2, foretinib and lapatinib, as single agents or in combination were tested for effect on growth, apoptosis, and downstream signaling pathways of EAC cells. The response to inhibitors was correlated to the levels of MET, HER2 expression, and amplification status.

Results: Foretinib inhibits phosphorylation of MET, which correlated with reduced EAC cell growth and inhibition of AKT and ERK phosphorylation. The cell growth inhibition by foretinib is most profound in the ESO51 cell line, which has MET gene amplification and overexpression. Inhibition of MET signaling by foretinib or siRNA-specific knock down of MET expression induces apoptosis in ESO51 cells. Ectopic expression of HER2 reduces foretinib-mediated growth inhibition and downstream ERK phosphorylation in ESO51-HER2 cells. The EAC OE33 cell line, with amplification and overexpression of both MET and HER2, demonstrated reduced sensitivity to foretinib or lapatinib and a transient effect on downstream inhibition of p-AKT and p-ERK. The co-administration of foretinib and lapatinib effectively blocked both MET and HER2 signaling through p-APK and p-ERK, dramatically inhibited growth, and induced apoptosis to overcome single-agent resistance in OE33 cells.

Conclusions: The mechanism for foretinib inhibiting growth in MET-amplified EAC tumor cells is demonstrated. The interplay of dual MET/HER2 overexpression in the AKT and ERK pathways for esophageal cancer is described. Therefore, combination therapy could be a novel strategy for EAC with amplification of both MET and HER2.



11:54 AM

18F-FDG PET Intensity Correlates with a Hypoxic Gene Signature and Other Oncogenic Abnormalities in Early Stage Non-Small-Cell Lung Cancer

B. Heiden, M. Hermann, G. Chen, A. C. Chang, J. Lin, W. R. Lynch, P. W. Carrott, M. Orringer, D. Beer, R. K. Brown, R. M. Reddy

University of Michigan, Ann Arbor

COMMERCIAL RELATIONSHIPS J. Lin: Speakers Bureau/Honoraria, Intuitive Surgical; Other/Travel, AtriCure; R. M. Reddy: Speakers Bureau/Honoraria, Intuitive Surgical

Purpose: 18F-fluorodeoxyglucose positron emission tomography (FDG-PET/CT) is a critical imaging modality in the diagnosis and staging of non–small-cell lung cancer (NSCLC). While FDG uptake intensity (SUVmax) has been shown to have prognostic value, the genetic abnormalities associated with increased intensity remain unspecified. This study aims to identify these genetic aberrations.

Methods: Patients undergoing lung resection for NSCLC from 1999 to 2011, for whom frozen tissue and FDG-PET data were available, were identified. Tumor FDG uptake was classified as mild, moderate, unreported, or intense based on SUVmax measurement or radiology report. Associations between tumor genome-wide expression (RNAseq) and FDG uptake and survival were determined. Genes associated with both higher FDG uptake and survival were then validated in two external NSCLC tumor cohorts.

Results: Thirty-four patients with stored PET data and tissue were reviewed. Overall survival was significantly worse in patients with PET-intense (n=11) vs mild (n=10) tumors (P = .039). PET-intense tumors demonstrated enrichment of multiple genes, many of which were also associated with poor survival (CA9, MMP1, and CDCA2). Although FDGintense tumors exhibited modest enrichment of most glycolytic genes, overall metabolic gene expression patterns and pathway involvement were remarkably similar between the FDG-intense and mild tumor subsets. Gene ontology analysis of the most differentially expressed genes showed significant enhancement of cell-cycle and proliferative processes in FDG-intense tumors (P < .001). Gene set enrichment analysis further demonstrated associations between PET intensity and canonical oncogenic signaling pathways, including MYC, AKT, EGFR, and HIF-1. Using an external cohort of 25 tumors with radiologic and genomic profiling data, a common group of 42 genes and 30 gene sets were validated for additional study. On analysis, 20% of these common gene sets were associated with hypoxia or HIF-1 signaling. While HIF-1 expression did not correlate with poor survival in the NSCLC validation cohort (n=442), established targets of hypoxia signaling were significantly associated with poor overall survival in these early stage surgical patients (GLUT3, ADM, CA9, and PLAUR).

Conclusions: PET intensity is associated with a variety of oncogenic alterations in early stage NSCLC. Given the prognostic significance of preoperative PET intensity, these pathways present potential therapeutic targets for adjuvant or neoadjuvant treatment to improve survival within this subset of high-risk patients.



Basic Science Research: General Thoracic – Continued

12:06 PM Room 361A

Ozone Therapy Protects Against Chronic Rejection in an Orthotopic Lung Transplantation Model: A New Potential Treatment?

N. Santana-Rodríguez¹, B. Clavo², P. Llontop³, W. Raad⁴, K. Alshehri⁵, A. Ayub⁴, M. D. Fiuza³, F. Bhora⁶

¹Mount Sinai Health System, New York, NY, ²Instituto Universitario de Investigaciones Biomédicas y Sanitarias and Dr. Negrin University Hospital, Las Palmas de Gran Canaria, Spain, ³Instituto Universitario de Investigaciones Biomédicas y Sanitarias, Las Palmas de Gran Canaria, Spain, ⁴Icahn School of Medicine at Mount Sinai, New York, NY, ⁵Mount Sinai St Luke's West Hospital, New York, NY, ⁶Mount Sinai Roosevelt and Mount Sinai St Luke's Hospitals, New York, NY

COMMERCIAL RELATIONSHIPS F. Bhora: Other Research Support, TEI Biosciences

REGULATORY DISCLOSURE This presentation describes the use of ozone, which has an FDA status of investigational.

Purpose: Chronic rejection (CR) is the leading cause of the low long-term survival after lung transplantation (LT). Oxidative stress (OS) is genetically regulated in CR, and ozone (O³) is able to modulate the inflammation induced by OS. For the first time, we evaluated the effect of O³ against CR.

Methods: Thirty-six male Sprague-Dawley inbred rats were randomly assigned into four groups: (1) Control (n=6): healthy left lung; (2) Sham (n=6): left thoracotomy without LT; (3) LT (n=12, 6 donors and 6 receptors): unilateral left LT; (4) O_3 -LT (n=12, 6 donors and 6 receptors): unilateral left LT and O_3 rectal administration daily for 2 weeks before LT (from 20-50 ug) and three times/week (50 ug/dose) from LT up to the sacrifice of the animals at 3 months. No immunosuppressant drugs were applied. CR and acute rejection (AR) were histologically determined blindly. Expression of genes involved in CR and OS was determined using qRT-PCR.

Results: All operated animals had a good postoperative outcome. Macroscopically, control and sham group showed normal appearance, the LT group showed a dark atrophic tissue containing mucous cysts lacking lung morphology, and the lungs of the O_3 -LT group were smaller than the sham group but with normal appearance, consistency, and expansion, as well as few pleural adhesions and atelectasis. Histologically, normal appearance was observed in controls, some signs of vascular congestion and hyperinflation were observed in Sham, severe CR was observed in all animals of the LT group, and none of the animals of the O_3 -LT group showed signs of CR—just a mild AR (R1) was observed in one animal. Sham vs LT group: a significant increase of Hspb27 (P < .001), Epas1 (P < .001), Sepp1 (P = .0042), Sftpb (P = .001), Plvap (P = .0024), Cldn5 (P < .0001) and Fmo-2 (P = .0168) mRNA expression was observed in the LT group. LT group vs O_3 -LT: a significant decrease of Hspb27 (P < .0001), Prdx (P = .0392), Epas1 (P < .001), Gpx3 (P = .0024), Vegfa (P = .088), Sftpa1 (P = .0191), Sftpb (P = .0001), Plvap (P = .0001), Plvap (P = .0001), Rhad (P = .0015), Dsip (P = .0271) and Fmo2 (P = .0024) mRNA expression was observed in O_3 -LT group.

Conclusions: O_3 significantly ameliorated CR, regulating the expression of genes involved in its pathogenesis, which could serve as new biomarkers. No known immunosuppressive therapy has been capable of achieving similar results. From a translational point of view, O_3 therapy could become a new adjuvant treatment for CR in patients undergoing LT.

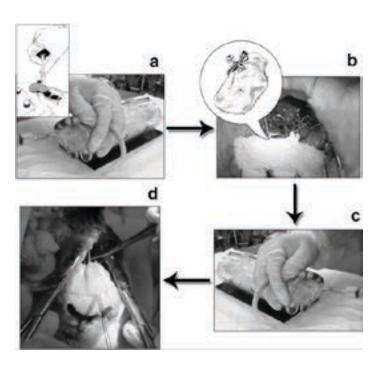


Table 1. Histological findings in the study groups stained with hematoxylin-eosin

Animal		Groups		
	Control	Sham	LT	O ₂ -LT
1	No injuries	Vascular congestion, hiperinsuffation	Severa CR	No injuries
2	No injuries	Asiated Hystiocites	Severe CR	No injuries
3	No injuries	Vascular congestion,	Severe CR	No injuries
3		hiperinsuflation		
4	No injuries	Vascular congestion,	Severe CR	101
•		hiperinsuffation		AR1 (mild AR)
5	No injuries	Vascular congestion,	Severe CR	Focal
5		hiperinsuffation		Bronchopneumoni
	No injuries	Vascular congestion,	Severe CR	No valuable
		hiperinsuffation		NO VALUEDRE

Basic Science Research: General Thoracic - Continued

12:18 PM Room 361A

The Effect of Chemotherapy and Autophagy Modulation on PD-L1 Expression in Esophageal Adenocarcinoma

L. Van Der Kraak¹, J. D. Luketich², M. J. Schuchert², K. S. Nason¹, A. Pennathur², H. J. Zeh², M. T. Lotze², **R. Dhupar**²

¹University of Pittsburgh, PA, ²University of Pittsburgh Medical Center, PA

COMMERCIAL RELATIONSHIPS M. T. Lotze: Consultant/Advisory Board, Celgene Cellular Therapeutics, Checkmate Pharmaceuticals, Pieris Pharmaceuticals; Employment, Lion Biotechnologies; J. D. Luketich: Ownership Interest, Johnson & Johnson, Intuitive Surgical; A. Pennathur: Research Grant, Accuray

Purpose: PD-L1 expression is important for selecting optimal immunotherapy for cancer treatment. We hypothesized that select chemotherapies alter PD-L1 expression in esophageal adenocarcinoma (EAC) cells, and that autophagy modulators may alter this expression because of shared pathways. This could have a profound impact on treatment protocols for esophageal cancer.

Methods: OE33 cells (human EAC cell line) were treated with 5-Fluorouracil (5-FU; 0.5-500 μ M) or cisplatin (0.05-50 μ M). Interferon gamma (IFN- γ ; 10 ng/mL) was used as a positive control for PD-L1 induction. After 24 hours, PD-L1 expression was quantified using flow cytometry and Western blot analysis. To evaluate the effects of an autophagy inhibitor on PD-L1 expression, cells were treated with hydroxychloroquine (HCQ; 50 μ M) in addition to 5-FU/cisplatin. Autophagy was quantified using Western blot analysis.

Results: Treatment of EAC cells with 5-FU increases PD-L1 protein expression, as seen on Western blot and flow cytometry, in a dose-dependent manner (Figure 1A). However, the same effect is not seen with cisplatin (Figure 1A). Both 5-FU and cisplatin also had modest effects of upregulating autophagy, as expected, and was demonstrated by mildly increased levels of LC3-II on Western blot. The commercially available and clinically safe drug HCQ is an inhibitor of late stage autophagy. When HCQ is added to EAC cells that are also treated with 5-FU or cisplatin, autophagy is inhibited, as demonstrated by high accumulation of LC3-II. Interestingly, the increase in in PD-L1 protein expression seen with 5-FU is mitigated when HCQ is added (Figure 1B). As expected, no change in PD-L1 expression was seen when HCQ was added to cisplatin-treated EAC cells.

Conclusions: PD-L1 expression in EAC cells is affected by a chemotherapy regimen and can be modulated by autophagy inhibitors. These findings may guide the choice of chemotherapy to combine with checkpoint inhibitors. In addition, autophagy modulators may be used to enhance or reduce PD-L1 expression, further improving the efficacy of treatments.



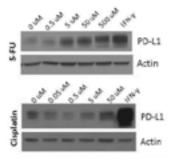


Figure 1A: Western blots of exophageal adenell line OEM treated with 5-RJ or displatio, PO-LS expression is upregulated predictably, and in a graded fachlon after treatment with 5.811, but not when treated with cisplatis.

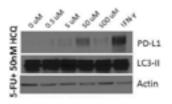


Figure 18: Western blot of employees adenocation cell line OESS treated with 5-FU and hydroxychloroquine (MOS). S-FU induced PO-L1 upregulation is mitigated by the autophagy inhibitor HCQ. As expected, LC3-I levels are greatly increased with HCQ administration, demonstrating inhibition of autophagy.

Room 360BC 11:30 AM - 12:30 PM

Congenital: Adult Congenital

Moderators: Joseph A. Dearani, Rochester, MN, and Christopher E. Mascio, Philadelphia, PA

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

11:30 AM

High Prevalence of Late Hypertension After Coarctation Repair: The Impact of Arch Reobstruction and Early Postoperative Hypertension

M. Lee¹, J. Brink², I. E. Konstantinov², C. P. Brizard², Y. d'Udekem²

¹Murdoch Childrens Research Institute, Melbourne, Australia, ²The Royal Children's Hospital, Melbourne, Australia

COMMERCIAL RELATIONSHIPS C. P. Brizard: Consultant/Advisory Board, Admedus Australia; Ownership Interest, Admedus Australia; Y. d'Udekem: Consultant/Advisory Board, MSD, Actelion Pharmaceuticals US

Purpose: Late hypertension after coarctation repair is associated with high mortality, but its risk factors remain contentious. This study aims to determine if early postoperative hypertension and early and late arch reobstruction are risk factors for the development of late hypertension after coarctation repair.

Methods: A cross-sectional study including transthoracic echocardiogram, 24-hour blood pressure (BP) monitoring, and retrospective record review was performed in 144 patients aged ≥ 10 years with previous coarctation repair. Median age at repair was 39 days (interquartile range 0-3 years); 69% (99/144) were performed within the first year of life. Early postoperative hypertension was evaluated by calculating the mean of BP measurements taken on the same day before hospital discharge or the need for antihypertensive medication prior to discharge. Multivariate analyses were performed to adjust for gender, surgical age, surgical period, and follow-up length.

Results: After a mean follow-up of 22 years ± 7 years, 59% (84/142) were hypertensive in total (58% [82/142] on 24-hour BP monitoring, 1% [2/142] on antihypertensives). Early postoperative hypertension was present in 58% (73/126) in total (39% [49/126] on BP measurements, 19% [24/126] on antihypertensives). Early and late arch reobstruction (echocardiogram gradient ≥ 25 mm Hg) was present in 37% (23/62) and 23% (33/144), respectively. On multivariate analysis, 24-hour systolic BP was correlated with maximum descending arch velocity on echo (coefficient = 6.3, P = .009, 95% CI: 1.6-11.0). Early postoperative hypertension was associated with late hypertension (OR 3.4, P = .02, 95% CI: 1.3-8.9).

Conclusions: There is a high prevalence of late hypertension after coarctation repair. Residual obstruction is a major determinant of the development of late hypertension. Early postoperative hypertension may predict very early in life those at risk of developing late hypertension. Stringent follow-up for late hypertension and arch reobstruction is warranted.



11:45 AM

Long-Term Outcome of Mustard/Senning Procedure for Patients With Complete Transposition of the Great Arteries: 50 Years' Experience

T. Sakamoto, M. Nagashima, G. Matsumura, K. Yamazaki Tokyo Women's Medical University, Shinjuku-ku, Japan

Purpose: The atrial switch operation, Mustard or Senning procedure, for the complete transposition of the great arteries (d-TGA) was introduced in the late 1950s and was widely applied until the late 1980s, when the arterial switch operation (ASO) became the first choice. The long-term outcome over 50 years was evaluated.

Methods: A total of 157 patients undergoing the Mustard (75)/Senning (82) procedure between 1966 and 2003 were evaluated. There were 117 males and 40 females. Age at operation ranged from 7 days to 22 years (median: 1.2 years). Diagnoses were d-TGA (I) in 83, (II) in 44, (III) in 20, and (IV) in 10 [d-TGA (IV) = intact ventricular septum + mild left ventricular outflow tract obstruction].

Results: There were 41 early deaths (ED) and 29 late deaths (LD); early mortality was 26.1%. Reasons for late death were heart failure in seven, pulmonary venous obstruction in six, sudden death in three, pulmonary hypertensive crisis in two, infection in two, and other in nine. The follow-up period for early survivors was 19.5 years ± 13.2 years. The Kaplan-Meier survival rate was 55.2% and 54.3% at 20 years and 30 years, respectively. In 54 patients who underwent surgery after 1982 when ASO was introduced in our institute, the Kaplan-Meier survival rate was 79.4% at both 20 and 30 years. Multivariate logistic regression revealed that ED was significantly increased by the Mustard procedure, longer cardiopulmonary bypass, and larger preoperative cardiothoracic ratio (P = .0001, .0008, .0165, respectively). LD was significantly increased only by the Mustard procedure (P < .0001). Reoperations were performed 26 times in 23 patients (pacemaker implantation [PMI]: six, tricuspid valve surgery: five, PVO repair: five, superior vena cava obstruction repair: three, other: seven). Freedom from reoperation was 83.1% and 76.7% at 20 years and 30 years, respectively. Multivariate analysis revealed that the risk of reoperation was correlated to the diagnosis of d-TGA (II) or (III) (HR: 2.82; 95% CI: 1.20-6.63, P = .01). PQ interval in ECG has increased significantly over time (129 msec ± 35 msec, 154 msec ± 28 msec, 192 msec ± 44 msec at 1 month, 12 years, and 30 years later, P < 0.01), and six patients underwent PMI more than 20 years later. Four patients have delivered children so far.

Conclusions: The long-term outcomes of Mustard/Senning procedures performed after 1982 might be better than expected. Mustard procedure and TGA morphology are the risk factors of mortality and morbidity. Careful observation for arrhythmia and the following PMI is mandatory.

Congenital: Adult Congenital – Continued

12:00 PM Room 360BC

Neuropsychological Functioning and Psychosocial Outcomes in Adults With D-Transposition of the Great Arteries Corrected With the Arterial Switch Operation

L. Kasmi¹, M. Montreuil¹, J. Calderon², N. Geronikola¹, V. Lambert³, E. Belli⁴, D. Bonnet⁵, D. Kalfa⁶

¹Laboratoire de Psychopathologie et Neuropsychologie, Université Paris 8, Saint Denis, France, ²Harvard Medical School and Boston Children's Hospital, MA, ³Hôpital Universitaire Bicêtre, Le Kremlin-Bicêtre, France, ⁴Institut Hospitalier Jacques Cartier, Massy, France, ⁵Centre de Référence Malformations Cardiaques Congénitales Complexes, Hôpital Necker Enfants Malades, Paris, France, 6Columbia University Medical Center, New York-Presbyterian/Morgan Stanley Children's Hospital, New York, NY

Purpose: We have previously shown that adults with dextro-transposition of the great arteries (d-TGA) are at increased overall cognitive risk. The objective of this study was to assess more precisely neuropsychological functioning and psychosocial outcomes of adults who underwent an arterial switch operation for d-TGA.

Methods: Sixty-seven adults with operated d-TGA (59.7% males, mean age 22.9 years ± 3.4 years) and forty-three healthy subjects (53.5% males, 23.8 years ± 2.8 years) matched in age, gender, and educational level participated. Neuropsychological outcomes were evaluated with the Wechsler Adult Intelligence Scale - Third Edition, the Wisconsin Card Sorting Test, and the California Verbal Learning Test. The psychological outcomes and healthrelated quality of life (QOL) were assessed using the Mini International Neuropsychiatric Interview and the 36-item Short Form Health Survey, respectively. Finally, we analyzed patient-related and procedure-related risk factors associated with neuropsychological and psychological outcomes.

Results: Patients with d-TGA displayed poorer cognitive performances than healthy subjects in tasks involving attention, visuospatial skills, executive functions, and episodic memory (Table). Moreover, the proportion of patients who presented cognitive impairments (scores ≤ 5th percentile) was higher than the frequency of 5% expected in the general population in tasks assessing visuospatial skills (10%, P = .039), working memory (10%, P = .039), and episodic memory (24% and 31%, all P < .001). Patients had a higher lifetime prevalence of depression and anxiety disorders than healthy subjects (respectively, 43% vs 19%, P = .008; 54% vs 33%, P = .030). In the d-TGA group, the presence of cognitive impairments was associated with a lower educational level (P = .004) and a higher number of grade retention at school (P = .040), while the presence of depression or anxiety disorders during life was associated with a poorer health-related quality of life (QOL), all P < .05. Predictors of worse outcomes included female gender (P = .011), late age at surgery (P = .003), and longer hospitalization stay (P = .029).

Conclusions: Adults with operated d-TGA seem to present an increased risk of specific cognitive and psychological impairments which may reduce their QOL and academic success. Evaluation of long-term neuropsychological and psychosocial outcomes in this population is an essential step to anticipate for adapted treatment strategies (eg, cognitive remediation and psychological support).



Table 1: Cognitive performances of TGA group compared to control group

Cognitive functions	TGA group (n=67)	Control group (n=43)	pvalue
Parameters (tests)	Mean s star	dard deviation	
Language Vertial Comprehension Index (WAIS-III)	98.4 ± 15.5	102.4 ± 11.2	9,118
Attention	577,855750	593.573	2235
Processing Speed Index (VIAIS-III)	95.4 ± 13.9	102.5 ± 10.9	0.006*
Vauo-spatial skills			
Perceptual Organization Index (WAIS-III)	93.1 ± 15.8	104 ± 17	<0.001
Executive functions (working memory, flexibility and abstraction)			
Working Memory Index (AVA/S-III)	91.6 ± 14.4	96.9 ± 12.5	0.054
Perseverative errors (WCST)	49.4 ± 10.1	55.5 1 8	<0.001
Conceptual answers (WCST)	485+93	54.2 ± 7.5	+0.001
Episodic memory	2002000	20011015	7.50-17.63
Long delay free recall (CVLT)	11.9 ± 3	12.9 ± 2.3	0.051
Long delay used recall (CVLT)	11.9 ± 2.9	13.1 ± 2.2	0.017*
Correct recognition (CVLT)	14.6 ± 1.5	15.4 ± 0.7	<0.001

[&]quot;Significant difference between groups (Student I test for independent samples), WAG-III, Wechsler Adult Intelligence Scale, third edition; WCST, Wisconsin Card Sorting Test, CVLT: California Verbal Learning Test.

Congenital: Adult Congenital - Continued

12:15 PM Room 360BC

Long-Term Outcomes After Total Repair for Tetralogy of Fallot and the Predictive Factor of Pulmonary Valve Replacement: 25-Year Follow-Up

J. Bang¹, W. Kim², J. Kwak², Y. Kim², E. Kim¹

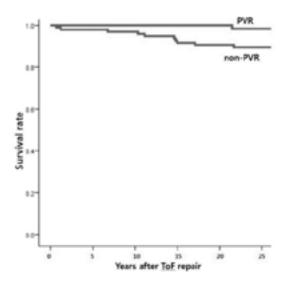
¹Seoul National University Hospital, South Korea, ²Seoul National University Children's Hospital, South Korea

Purpose: This study sought to explore the long-term outcomes after surgical repair of tetralogy of Fallot (TOF) with respect to the predictive factors of pulmonary valve replacement (PVR). It also compared surgical outcomes (sudden cardiac death, arrhythmia, functional capacity) between PVR and non-PVR groups.

Methods: From January 1991 to December 1997, 193 patients with TOF (age at repair, 1.5 years ± 1.4 years) underwent definitive repair with transannular incision. The PV was bicuspid in 41 patients (35.0%); the Z value of PV was -3.6 ± 2.6. We excluded patients who underwent TOF repair with pulmonary valve preservation (n=7) and those who underwent percutaneous pulmonary valve implantation (n=7). Finally, 180 patients (median follow-up, 23.2 years ± 4.1 years) were enrolled; of these, 84 patients (47%) underwent PVR, whereas 96 patients (53%) did not.

Results: At 25-year follow-up from date of TOF repair, freedom from death was 93.6%, arrhythmia 79.3%, and surgical reintervention 49.0%. All detected ventricular arrhythmias were isolated monofocal premature ventricular contractions. During follow-up, 164 patients (91.1%) were NYHA class 1-2. Mean QRS duration was 142 ms ± 28 ms. Magnetic resonance imaging with mean right ventricular end-diastolic volume index (RV EDVi) was 143 mL/m² ± 39 mL/m², right ventricular end-systolic volume index (RV ESVi) was 76 mL/m² ± 29 mL/m², and RV ejection fraction 45% ± 7%. Ninety-three patients (51.6%) had a cardiopulmonary exercise test. Peak VO₃max was 34.3 mL/kg/m² ± 6.7 mL/kg/m². This correlated with RV ejection fraction (P = .03), but not RV EDVi (P = .28) or QRS duration (P = .59). Eighty-eight PVRs were performed in 84 patients at the age of 17.4 years ± 6.2 years. A bicuspid PV (HR 1.67; 95% CI, 1.08-2.58; P = .02), previous shunt history before TOF repair (HR 2.68; 95% CI, 1.55-4.62; P < .001) were the independent factors for requiring PVR. For subgroup analysis, sudden cardiac death occurred in 10 of the non-PVR group compared with one in the PVR group (P = .006). Freedom from arrhythmia at 25 years was $76.6\% \pm 0.1\%$ in the PVR group and $78.9\% \pm 0.1\%$ in the non-PVR group (P = .46). Oxygen consumption at peak exercise did not significantly change in either group

Conclusions: The long-term outcomes after repair of tetralogy of Fallot were acceptable. However, morbidity and arrhythmias were frequently observed. PV morphology and the history of shunt implantation before repair of TOF were predictive factors for requiring PVR. In patients after TOF repair, early PVR strategy conferred a long-term survival advantage compared with non-PVR.



11:30 AM - 12:30 PM Room 330AB

Critical Care

Moderators: Aaron M. Cheng, Seattle, WA, and Jay G. Shake, Jackson, MS

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

11:30 AM

What Is the Optimal Blood Pressure on Extracorporeal Membrane Oxygenation? Impact of Mean Arterial Pressure on Survival

D. Tanaka, S. Shimada, N. Cavarocchi, H. Hirose

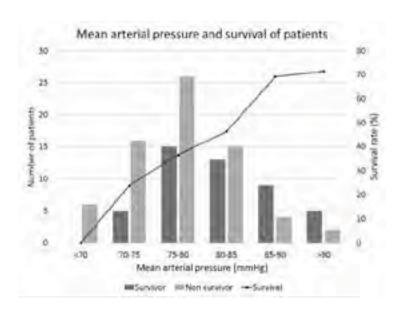
Thomas Jefferson University Hospital, Philadelphia, PA

Purpose: Blood pressure management is crucial for patients on veno-arterial extracorporeal membrane oxygenation (VA ECMO). Lower pressure can cause end organ malperfusion, and higher pressure may compete with ECMO flow and cardiac output. We evaluated the impact of mean arterial pressure (MAP) on outcomes of patients on VA ECMO.

Methods: Patients who were supported on VA ECMO from September 2010 to March 2016 were retrospectively analyzed for average MAP on ECMO. Patients supported less than 24 hours were excluded. MAP q 2 hours were averaged over the course on ECMO, excluding the first and last days. Survival and complications observed during ECMO were investigated by classifying patients into groups based on their average MAP. Risk factors to predict lower MAP or mortality were evaluated.

Results: A total of 116 patients were identified. Average MAP was significantly higher in patients who survived to discharge (81.7 mm Hg ± 5.6 mm Hg vs 77.7 mm Hg ± 5.5 mm Hg, P = .0003). There was positive correlation between MAP and survival. Survival was best with MAP of higher than 90 mm Hg (71%) and worst with MAP of less than 70 mm Hg, where no patient survived (Figure). MAP of higher than 80 mm Hg was an independent predictor of survival to discharge by multivariate analysis (OR 6.61, P = .0096). Lower cardiac function and liver dysfunction were statistically significant predisposing factors for lower MAP during ECMO, although they did not influence survival of patients. Vasopressors were used after 24 hours on ECMO significantly more frequently in patients with lower pressure (P = .049), but their use did not impact survival by multivariate analysis (P = .56). MAP did not affect probability of strokes or bleeding complications; higher MAP tended to have lower chance of kidney injury (P = .06).

Conclusions: Survival of patients on VA ECMO was significantly better with higher MAP. Considering that the use of vasopressors did not affect the survival of patients, more generous use would be warranted. Based on our findings, MAP of patients on VA ECMO should be kept higher than 70 to 80 mm Hg.



Critical Care - Continued

11:45 AM Room 330AB

Infections Occurring During Extracorporeal Membrane Oxygenation Use in Adult Patients for Postcardiotomy Heart Failure

H.A. Welp, M. Scherer, S. Martens, J. Sindermann

University Hospital Münster, Germany

Purpose: The application of extracorporeal membrane oxygenation in adults has been increasing, but infections occurring during extracorporeal membrane oxygenation use are rarely described. The aim of the present study was to evaluate incidence, time course, and causative microorganisms in patients under extracorporeal membrane oxygenation (ECMO) support and to identify possible risk factors.

Methods: We retrospectively analyzed the prospectively collected data on nosocomial infection surveillance of 184 patients aged 18 years or more undergoing their first ECMO for more than 48 hours of cardiac support after major cardiac surgery.

Results: During a total of 1,775 ECMO days, 110 episodes of infections occurred in 95 patients, including 42 respiratory tract, 40 bloodstream, 10 surgical site, 10 urinary tract, and eight other infections. E. coli (20.7%) and Candida species (22.6%) were the predominant blood isolates. In stepwise logistic regression analysis, longer duration of ECMO use (OR 2.315; P = .004), open chest treatment (OR 4.849; P = .006), and dialysis (OR 1.234; P = .003) were independently associated with a higher risk for infections during ECMO use. Overall in-hospital mortality was 66.3%, and its independent risk factors included older age (OR 1.538; P = .003), neurologic complications (OR 5.153; P < .001), and vascular complications (OR 1.922; P < .001), but not infections during ECMO use.

Conclusions: Respiratory tract infections and bloodstream infection were the most common infections during ECMO use. Duration of ECMO, open chest treatment, and dialysis seemed to be independently associated with infections.



12:00 PM

Cumulative Fluid Balance Is an Independent Predictor of In-Hospital Mortality in Patients Supported With Veno-Arterial Extracorporeal Membrane Oxygenation

A. Proudfoot¹, **T. Boeve**¹, A. Borgman², G. Marco³, S. Fitch¹, M. G. Dickinson¹, T. Timek¹, A. Khaghani⁴, P. Wilton¹, M. Strueber¹, S. Jovinge¹

¹Spectrum Health, Grand Rapids, MI, ²Frederick Meijer Heart & Vascular Institute, Grand Rapids, MI, ³Spectrum Health, Ada, MI, ⁴Spectrum Health - Richard DeVos Heart & Lung Transplant Program, Grand Rapids, MI

COMMERCIAL RELATIONSHIPS A. Khaghani: Consultant/Advisory Board, HeartWare, St Jude Medical; M. Strueber: Consultant/Advisory Board, HeartWare, St Jude Medical

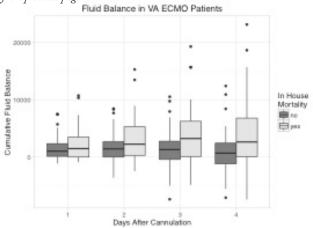
Purpose: Although positive fluid balance (FB) negatively correlates with outcome in critical illness, there are limited data to support this assertion in patients supported with veno-arterial extracorporeal membrane oxygenation (VA-ECMO). We sought to identify the impact of FB on outcomes in VA-ECMO and its association with clinical variables that may prompt fluid administration.

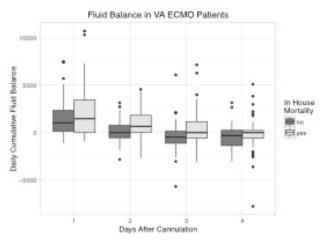
Methods: Data were retrospectively collected from the records of consecutive patients supported with VA-ECMO between January 2010 and October 2015. Only those who were alive at 48 hours and had complete data were included for study. The association between daily and cumulative FB over the first 96 hours following cannulation and in-hospital mortality was analyzed using multivariable logistic regression.

Results: Out of a total of 186 patients, 95 had complete data and were included for study. In-hospital mortality was 51%, and patients had a median SAVE score of -9 (SD \pm 4.8). 51% (48/95) of patients were post surgical (post-cardiotomy n=38, post-transplant n=10). Median cumulative FB increased incrementally over the first 72 hours in those who died, whereas it remained static in those who survived to discharge (Figure). Cumulative FB at day 4 predicted in-hospital mortality independently of other clinically relevant variables, including severity of illness score, blood product admission on day 1, and presence of early (day 1) acute kidney injury with or without renal replacement therapy (P = .02, Table). Failure to achieve a neutral FB by day 2 (as a surrogate for persistence of shock) predicted a worse outcome (P = .02, Figure).

Conclusions: Failure to achieve neutral FB by day 2 and an ongoing fluid requirement at day 4 may predict in-hospital mortality in VA-ECMO patients. Research investigating methods to mitigate early shock and analyzing the potential effects of tight FB control strategies in these patients may be warranted.

Critical Care – Continued Continued from previous page





San many assessment of the	β coefficient	Std error	2-score	p value
Cumulative fluid balance day 4	0.0001	0.0001	2.2799	0.022
Renal replacement therapy day 1	-0.8121	0.7398	-1.0977	0.272
Median CVP day 1	0.0322	0.0529	0.6096	0.542
AKI pre-ECMO	0.7644	0.6232	1,2267	0.220
AKI post-ECMO	0.7865	0.6346	1.2393	0.215
Furosemide use day 1	0.0594	0.5561	0.1067	0.915
Cumulative urine output day 1	0.0000	0.0001	-0.2991	0.765
Cumulative blood products day 1	0.0001	0.0001	0.7990	0.424
SOFA score day 1	0.0392	0.1155	0.3388	0.735

12:15 PM Room 330AB

Single Caregiver Nurse Model for Extracorporeal Membrane Oxygenation Can Lead to Significant Cost Savings

F. Najam, R. Melody, S. Newman, B. V. Sambuco, E. S. Pocock, J. Honig

The George Washington University Hospital, Washington, DC

Purpose: With increased utilization of adult extracorporeal membrane oxygenation (ECMO), hospitals have seen an increase in demand for resources that can be expensive. Since the inception of our hospital's ECMO program in 2008, we have used an ECMO nurse-based single caregiver model that has proven to be simple and cost-effective.

Methods: In 2015, our institution performed 23 ECMO cases utilizing this model. ECMO-trained bedside nurses provided care for these patients for a total of 171 days with a total of 4,104 hours. Perfusionists were on call for troubleshooting the circuit and transportation. Financial models were analyzed to compare the single caregiver vs multiple caregiver models.

Results: The cost of a single caregiver ECMO nurse model was \$353,532.24. In comparison, the projected cost of a single caregiver perfusionist model would have been \$1,231,200. The estimated cost of a multi-caregiver model with round-the-clock bedside perfusionist and bedside ECMO nurse coverage would have been \$1,584,732. Hence, the single caregiver nurse model saved the hospital \$877,667.76 when compared to the single caregiver perfusionist model. When the single caregiver nurse model was compared to the multi-caregiver model, the total cost savings to the hospital increased to \$1,231,199.76. The cost savings with the single caregiver nurse model vs the single caregiver perfusionist and multi-caregiver models were 71.3% and 77.7%, respectively.

Conclusions: The single caregiver nurse model for the care of critically ill patients on ECMO simplifies the delivery of health care in a very complex environment. This model also makes a very resource-intensive care delivery model cost effective for the hospital.





11:30 AM – 12:30 PM Room 362A

Ethics Debate: When a Child's Heart Is Failing

Surgeons face a difficult choice in deciding what to do for a child with a heart malformation and a very bleak outlook—move forward with complex, expensive treatment or offer palliative care only. This debate between two passionate advocates with opposing positions will focus on a young girl with trisomy 21 who has severe heart disease (atrioventricular canal, mitral insufficiency, and a failing left ventricle). A pediatric intensivist will argue for withdrawing extracorporeal membrane oxygenation (ECMO) life support, while a pediatric cardiac surgeon will argue for replacing ECMO with a ventricular assist device while listing the patient for a heart transplant. All physicians, nurses, technologists, and others who are involved with patient care will benefit from this session; its utility is not limited to those who care for children, as the issues are present in all age groups.

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Describe the decision-making process in complex cases of futile care
- Discuss the arguments in favor of withdrawing life support and in favor of proceeding with further surgery
- · State how to correctly use a ventricular assist device as a bridge to heart transplant

Facilitator: Robert M. Sade, Charleston, SC

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The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, interpersonal skills and communication, practice-based learning and improvement, and professionalism. These physician competencies will be addressed through lectures, a debate, and questions from the audience.

Pro: Minoo N. Kavarana, Charleston, SC **Con:** Jessica M. Turnbull, Nashville, TN



NOTES



11:30 AM - 12:30 PM Room 361BC

General Thoracic: New Technology

Moderators: Mark F. Berry, Stanford, CA, and Anthony W. Kim, New Haven, CT

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11:30 AM

First Report of Circumferential 3D-Printed Trachea Transplanted in a Large Animal Model

A. M. Al-Ayoubi¹, S. Rehmani², A. Ayub¹, K. Alshehri³, W. Raad¹, R. Lebovics⁴, R. M. Flores⁵, F. Bhora⁶

¹Icahn School of Medicine at Mount Sinai, New York, NY, ²Mount Sinai St Luke's Hospital, New York, NY, 3Mount Sinai St Luke's West Hospital, New York, NY, 4Mount Sinai West Hospital, New York, NY, 5Mount Sinai Health System, New York, NY, 6Mount Sinai Roosevelt and Mount Sinai St Luke's Hospitals, New York, NY

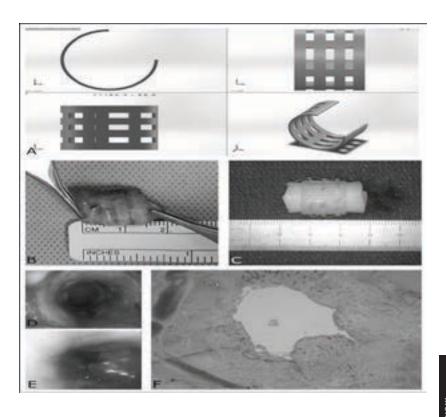
COMMERCIAL RELATIONSHIPS F. Bhora: Other Research Support, TEI Biosciences

Purpose: The purpose of this study is to create a 3D-printed trachea that would replace a complete tracheal segment in a large animal model.

Methods: 3D images of tracheas were obtained using neck CT scans of juvenile mini pigs; the dimensions (2 cm axial length, 1.1 cm diameter) were used to design grafts in CAD software (Figure A). The tracheas were made in a fused-deposition modeling 3D printer with a polycaprolactone polymer filament and an extracellular membrane collagen lining. The 3D-printed tracheas were used to replace 4-cartilage ring segment (Figure B) in the native cervical trachea. Weekly bronchoscopy (with balloon dilation when necessary) was performed. Histology of the explanted tracheas was examined. Three (n=3) Yucatan mini pigs were used.

Results: 3D-printed tracheas were produced with high fidelity to the native organ (Figure C). All animals survived the preset minimum of 7 days. Bronchoscopy showed patent airway in the first week (Figure D). Granulation tissue appeared by the end of the second week (Figure E). Animal 1 died on POD#30 from pneumonia. Animal 2 died on POD#17 from granulation tissue at the distal anastomosis. Animal 3 was euthanized on POD#18 due to failure to thrive. Post-mortem histological examination showed significant granulation tissue formation in the distal aspect of the grafts (Figure 1F); epithelialization was also noted.

Conclusions: We report the first successful short-term transplantation of 3D-printed trachea in a large animal model. Early granulation tissue was encountered and appeared to compromise airway patency. Refinements in graft material and design are necessary to allow for improved long-term outcomes.



General Thoracic: New Technology – Continued

11:45 AM Room 361BC

Robotic First Rib Resection for Paget-Schroetter Disease

F. Gharagozloo

Celebration Health/Florida Hospital System, University of Central Florida

Purpose: First rib resection is a key component of the treatment of Paget-Schroetter disease. The transaxillary and supraclavicular approaches are associated with a number of complications. We report our experience with minimally invasive robotic transthoracic approach for resection of the first rib and scalenectomy.

Methods: Patients diagnosed with Paget-Schroetter disease underwent thrombolysis followed by robotic first rib resection. Diagnosis of the disease was made by preoperative venous angiography. On a thoracoscopic platform using three 2-cm incisions, the robot was used to dissect the first rib and divide the scalene muscles. Success of the first rib resection was assessed by physical exam and postoperative venous angiography.

Results: Over a 25-month period, 83 robotic first rib resections were performed. Preoperative assessment included physical exam and bilateral venous angiography. There were 49 men and 34 women. Mean age was 24 years ± 8.5 years. Operative time was 127.6 minutes ± 20.8 minutes. Median hospitalization was 4 days. There were no surgical complications, neurovascular injuries, or mortality. Those patients with a patent subclavian vein on the postoperative venogram (69%) were anticoagulated with warfarin for 3 months. Patients with a persistent postoperative occlusion of the subclavian vein (31%) underwent angioplasty (21 patients, 77%) and stent placement (six patients, 23%). These patients underwent antiplatelet therapy coupled with warfarin anticoagulation for 3 months. At a median follow-up of 23 months, all patients had an open subclavian vein for a patency rate of 100%.

Conclusions: Robotic transthoracic first rib resection is feasible and allows for a minimally invasive en bloc resection of the first rib and scalenectomy, while minimizing neurovascular complications. This procedure should be considered as an alternative to the transaxillary and supraclavicular approach.



12:00 PM

Phase 1 Clinical Trial Evaluating the Safety of Pulmonary Artery Branch Sealing Using an Ultrasonic Energy Vessel-Sealing Device in Video-Assisted Thoracoscopic Lobectomy

E. Goudie¹, R. L. Oliveira¹, V. Thiffault², A. Jouquan¹, E. Lafontaine¹, P. Ferraro¹, M. Liberman¹ ¹CHUM Endoscopic Tracheobronchial and Oesophageal Center, University of Montreal, Canada, ²CHUM Notre Dame Hospital, Montreal, Canada

COMMERCIAL RELATIONSHIPS M. Liberman: Research Grant, Boston Scientific, Ethicon; Other Research Support, Medtronic, Olympus

Purpose: Pulmonary artery (PA) ligation and division with endostaplers during video-assisted thoracoscopic (VATS) lobectomy may cause iatrogenic PA injury, especially in short and small vessels. We evaluated the safety, defined as success or failure (measured by intra-and postoperative bleeding), of PA branch sealing with an ultrasonic energy vessel-sealing device during VATS lobectomy.

Methods: The study consisted of a phase 1 clinical trial. Patients planned to undergo VATS pulmonary lobectomy were prospectively enrolled. Target sample size was 20 patients. PA branch diameter was measured intraoperatively using a sterile ruler. Branches of 7 mm or less were sealed and cut with an ultrasonic energy vessel-sealing device. The remainder of the lobectomy was performed in a standard fashion. No clips, sutures, staples, or hemostatic glues were used to protect the sealed PA branches. Intraoperative, in-hospital, and 30-day postoperative bleeding were prospectively recorded.

Results: Thirty-three patients were prospectively enrolled. Fourteen patients were not amenable to PA sealing with the ultrasonic energy vessel-sealing device due to all PA branch diameter exceeding 7 mm (13) or lobectomy not performed (one). A minimum of one PA branch was sealed with the device in 20 patients. A total of 58 PA branches were divided in these 20 patients: 31 with the ultrasonic energy vessel-sealing device, 24 with endostaplers, two with clips, and one with sutures. The mean vessel diameter sealed with the ultrasonic energy vessel-sealing device was 4 mm ± 1 mm (± standard deviation). Two patients were converted to thoracotomy (one - PA injury during dissection, one - PA tumor invasion). Two patients were reoperated on for bleeding (one - bronchial artery bleeding, one - chest wall bleeding). There was no intra- or postoperative bleeding related to ultrasonic PA branch sealing. There was no postoperative mortality.

Conclusions: This phase 1 safety trial was positive; no sealing failures were observed. PA branch sealing for vessels 7 mm or less was safely achieved using an ultrasonic energy vessel-sealing device in VATS lobectomy. Large scale, prospective, multi-institutional studies are necessary before widespread clinical application of energy for PA branch sealing in VATS lobectomy.

12:15 PM Discussion



11:30 AM - 12:30 PM

Late-Breaking Abstracts I

The physician competencies addressed in this session are patient care and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief questionand-answer session after each topic.

To view the late-breaking abstracts presented at the STS 53rd Annual Meeting, please see the handout provided with this *Abstract Book* or visit www.sts.org/annualmeeting.

11:30 AM - 12:30 PM Room 360A

STS Key Contacts: How to Become an Advocate for Cardiothoracic Surgery

One way that cardiothoracic surgeons can have a direct impact on federal policy affecting the specialty is by participating in the STS Key Contact program, which offers grassroots advocacy opportunities. However, many surgeons may not know how to get involved. This session will benefit anyone who would like to become more active in government advocacy. Surgeon leaders will share their experiences participating in advocacy activities, and STS staff will review the Society's advocacy priorities. Experienced and novice Key Contacts will role-play a meeting with a member of Congress and have time to network.

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Explain how to meet or speak with their members of Congress
- · Discuss the Society's legislative priorities
- Describe how to use peer Key Contacts as a resource

Moderators: Joshua Krantz, Washington, DC, and Madeleine Stirling, Washington, DC

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are interpersonal skills and communication and professionalism. These physician competencies will be addressed through individual lectures, panel discussions, and role playing.

11:30 AM Panel Discussion / Q&A

Mark S. Allen, Rochester, MN, Leslie J. Kohman, Syracuse, NY, and Douglas J. Mathisen, Boston. MA

COMMERCIAL RELATIONSHIPS L. J. Kohman: Research Grant, CareFusion; D. J. Mathisen: Consultant/Advisory Board, Baxter International

11:50 AM Legislative Presentation

Joshua Krantz, Washington, DC, and Madeleine Stirling, Washington, DC

12:00 PM Mock Congressional Meeting

Richard Lee, St Louis, MO, Keith S. Naunheim, St Louis, MO, and Jess L.

Thompson, Oklahoma City, OK

12:15 PM Awards & Networking



Room 320ABC

NOTES



11:30 AM - 12:30 PM Room 351DEF

STS/CATS/CSCS: Quality Improvement in Cardiothoracic Surgery—Real-Life Methods to Improve Surgical Performance Within Yourself, Your Division, and Your Specialty

Cardiothoracic surgeons perform complex, high-risk procedures as part of normal practice. Professional societies, patients, and providers increasingly are scrutinizing not only surgeons, but also programs of care and institutional practices. This session from STS, the Canadian Association of Thoracic Surgeons, and the Canadian Society of Cardiac Surgeons will focus on implementing quality improvement by starting with describing how surgeons and institutions perceive their practice vs true data-based performance.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe key concepts in local morbidity and mortality performance rounds
- Define strategies for personal performance improvement
- Identify the components to and benefits of participation in societal databases
- Describe broader efforts aimed at specialty-wide quality improvement and public reporting of outcomes

Moderators: Sean C. Grondin, Calgary, Canada, and Colin Schieman, Hamilton, Canada Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are medical knowledge, practice-based learning and improvement, and systems-based practice. These physician competencies will be addressed through a series of lectures and a panel discussion that is meant to enhance the understanding of implementing quality improvement in cardiothoracic surgery.

11:30 AM Understanding Your Performance as an Individual and Learning From Surgeons With Low Complication Rates – The Concept of Positive Deviance

Andrew J. Seely, Ottawa, Canada

11:45 AM Improving the Quality of Cardiothoracic Surgery on a National Scale – Moving From Data to Changes in Care

Susan D. Moffatt-Bruce, Columbus, OH

Public Reporting of Quality Metrics – How Will This Affect and Improve 12:00 PM

Your Practice?

David A. Fullerton, Aurora, CO

12:15 PM Panel Discussion

12:30 PM - 1:30 PM

BREAK—Visit Exhibits and Scientific Posters



NOTES





1:15 PM - 5:15 PM Room 330AB

ACC @ STS: Cardiologists and Surgeons Tackling Complex Clinical Scenarios as a Heart Team

This session by STS and the American College of Cardiology will focus on the truly collaborative "heart team" approach to treating complex issues facing the practicing physician or affiliate provider. Using a unique and innovative format highlighting the spectrum of adult cardiac diseases, speakers will discuss the multidisciplinary approach to coronary artery disease (CAD), mitral regurgitation, aortic stenosis (AS), and atrial fibrillation. Session components include invited technical videos featuring procedural expertise in these disease processes, a critical review of the literature, lectures regarding the STS/ACC TVT RegistryTM, presentations describing difficult clinical scenarios, and an interactive panel discussion.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Discuss the controversies surrounding CAD management
- Describe the indications and contraindications for the treatment of mitral regurgitation
- Describe the construction and makeup of the multidisciplinary "heart team" and its influence in improving patient outcomes and fostering communication among specialties
- Identify and explain the optimal management of patients who are evaluated for aortic stenosis, coronary artery bypass grafting (CABG), mitral regurgitation, and atrial fibrillation

Moderators: Niv Ad, Falls Church, VA, Jodie Hurwitz, Dallas, TX, Roxana Mehran, New York, NY, Patrick T. O'Gara, Boston, MA, Joseph F. Sabik, Cleveland, OH, and Vinod H. Thourani, Atlanta, GA

COMMERCIAL RELATIONSHIPS N. Ad: Consultant/Advisory Board, AtriCure, LivaNova; Ownership Interest, Left Atrial Appendage Occluder, LCC; Speakers Bureau/Honoraria, Medtronic; J. Hurwitz: Speakers Bureau/Honoraria, Medtronic; J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are medical knowledge, patient care, and systems-based practice. These physician competencies will be addressed through a series of collaborative lectures by members of The Society of Thoracic Surgeons and the American College of Cardiology.

Heart Team Approach (Aortic Valve)

1:15 PM Case Presentation 1

Mathew R. Williams, New York, NY

COMMERCIAL RELATIONSHIPS M. R. Williams: Research Grant, Edwards Lifesciences Corporation, Medtronic

1:20 PM Lessons Learned From the STS/ACC TVT Registry™

Vinod H. Thourani, Atlanta, GA





1:30 PM In the Era of Transcatheter Aortic Valve Replacement (TAVR), Who Is Low-Risk for Surgical AVR and Predictions for Management of AS in 2020

2020

Michael J. Mack, Dallas, TX

COMMERCIAL RELATIONSHIPS M. J. Mack: Other: Edwards Lifesciences Corporation, Abbott Vascular

1:40 PM Are We Ready for Asymptomatic Patients or Those With Moderate AS and Heart Failure to Have SAVR or TAVR?

Patrick T. O'Gara, Boston, MA

1:50 PM What I Have Learned About TAVR in Failed Surgical Bioprosthetic

Valves

Richard W. Smalling, Houston, TX

2:00 PM Panel Discussion and Case Presentation Wrap-Up

Tom C. Nguyen, Houston, TX

COMMERCIAL RELATIONSHIPS T. C. Nguyen: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, St Jude Medical

Heart Team Approach (Atrial Fibrillation)

2:16 PM Case Presentation 2

Niv Ad, Falls Church, VA

COMMERCIAL RELATIONSHIPS N. Ad: Consultant/Advisory Board, AtriCure, LivaNova; Ownership Interest, Left Atrial Appendage Occluder, LCC; Speakers Bureau/Honoraria, Medtronic

2:21 PM Which Patients Are Optimal for Transcatheter Atrial Fibrillation

Management?

Jodie Hurwitz, Dallas, TX

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ J. \ \ Hurwitz: Speakers \ Bureau/Honoraria, Medtronic$

2:31 PM How I Decide Between Biatrial or Left Atrial-Only Surgical Ablation

Surgery

Vinay Badhwar, Morgantown, WV

2:41 PM How to Do It: Biatrial Ablation

Marc R. Moon, St Louis, MO

2:51 PM Panel Discussion and Case Presentation Wrap-Up

3:05 PM Break

Heart Team Approach (Coronary Artery Disease)

3:25 PM Case Presentation 3

Speaker TBD

3:30 PM Which Patients With Multivessel Disease Are Best Treated

Percutaneously?

Roxana Mehran, New York, NY

3:40 PM How to Do It: Options for Non-Sternotomy Multivessel CABG

Marc Ruel, Ottawa, Canada

COMMERCIAL RELATIONSHIPS M. Ruel: Other Research Support, Medtronic; Research Grant, Abbott Laboratories, CryoLife, Edwards Lifesciences Corporation, Medtronic; Speakers Bureau/Honoraria, Medtronic, Abbott Laboratories



ACC @ STS - Continued

My Worst CABG Case and How I Got Out of It 3:50 PM

David A. Fullerton, Aurora, CO

4:00 PM Panel Discussion and Case Presentation Wrap-Up

Heart Team Approach (Mitral Regurgitation)

4:15 PM What Surgeons Should Know About the ACC/AHA Valve Guidelines

Patrick T. O'Gara, Boston, MA

How I Decide Management of the Patient With Functional Mitral 4:25 PM

Regurgitation

Tirone E. David, Toronto, Canada

Update on Transcatheter Mitral Valve Devices 4:35 PM

Gorav Ailawadi, Charlottesville, VA

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure

4:45 PM My Worst Transcatheter MV Case and How I Got Out of It

Vinod H. Thourani, Atlanta, GA

5:00 PM Panel Discussion and Case Presentation Wrap-Up



NOTES



1:15 PM - 5:15 PM Room 351DEF

Redefining Practice Through Quality and Evidence: What's New

The STS National Database is the most valuable tool in cardiothoracic surgery for outcomes assessment, evidence-based practice, and clinical practice guideline development. Founded in 1989, the Database has evolved to meet the changing needs of physicians in a complex health care delivery system. This session will address Database initiatives, including the latest updates in clinical practice guideline development, risk modeling, public reporting, and quality measurement.

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Describe the methodology for risk adjustment
- · Outline the rationale for use of composite measures and mitral measures
- · Discuss implications of and strategies for physician-level reporting
- · Identify strategies for long-term follow-up of patient outcomes
- Discuss the importance of cost and resource utilization in care delivery
- Define data transparency and describe its importance in improving quality
 Illustrate how to apply strategies for using the feedback report for quality improvement
- Explain the rationale for a multidisciplinary approach in quality improvement

Moderators: Vinay Badhwar, Morgantown, WV, and Jeffrey P. Jacobs, St Petersburg, FL

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competency addressed in this session is medical knowledge. This physician competency will be addressed through a series of individual lectures regarding STS National Database initiatives, including the latest updates in clinical practice guideline development, risk modeling, public reporting, and quality measurement.

1:15 PM

Introduction

1:20 PM

STS Clinical Practice Guidelines: What's New

Faisal G. Bakaeen, Cleveland, OH

COMMERCIAL RELATIONSHIPS F. G. Bakaeen: Consultant/Advisory Board, JACE Medical

1:50 PM

Q&A

2:10 PM

Impact of Medicaid Expansion on Cardiac Surgery Volume and Outcomes

E. J. Charles¹, L. E. Johnston², M. Herbert³, J. H. Mehaffey¹, K. W. Yount², D. S. Likosky⁴, P. F. Theurer⁴, C. E. Fonner⁵, J. B. Rich⁶, A. M. Speir⁷, G. Ailawadt², R. L. Prager⁴, I. L. Kron⁸

¹University of Virginia Health System, Charlottesville, ²University of Virginia, Charlottesville,



³Southwest Data Consultants, Dallas, TX, ⁴University of Michigan Health System, Ann Arbor, ⁵Virginia Cardiac Services Quality Initiative, Charlottesville, ⁶Virginia Cardiac Services Quality Initiative, Virginia Beach, ⁷Cardiac, Vascular & Thoracic Surgery Associates, Falls Church, VA, ⁸University of Virginia Medical Center, Charlottesville

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; D. S. Likosky: Research Grant, Agency for Healthcare Research and Quality; A. M. Speir: Consultant/Advisory Board, Medtronic

Purpose: Thirty-one states have approved Medicaid expansion since the signing of the Affordable Care Act, in light of contentious financial debates. The objective of this study was to determine the relationship between Medicaid expansion and cardiac surgery volume and outcomes by comparing data from Virginia (non-expansion state) and Michigan (expanded Medicaid in April 2014).

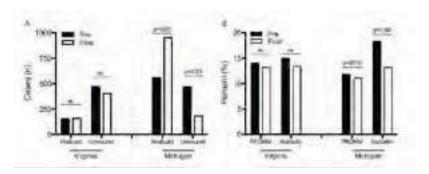
Methods: Data from the Virginia Cardiac Surgery Quality Initiative and the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative were analyzed simultaneously to compare volume and outcomes for Medicaid and uninsured patients undergoing coronary artery bypass grafting (CABG) and/or cardiac valve operations. Pre-expansion data were obtained from the 18 months prior to April 2014 (Pre) and post-expansion data from the 18 months thereafter (Post) for both Virginia and Michigan. Differences in patient characteristics and outcomes were analyzed by state and era (pre- or post-expansion).

Results: Between October 2012 and September 2015, 14,293 patients with government insurance (Medicaid/Medicare/Dual-Eligible) or who were uninsured underwent CABG and/or valve surgery in Virginia (Pre: 7,303, Post: 6,990) compared with 17,806 in Michigan (Pre: 8,518, Post: 9,288). While there was no change in Medicaid volume (Pre: 3.2%) [153/7,303] vs Post: 3.4% [157/6,990]) or uninsured volume (Pre: 9.8% [471/7,303] vs Post: 8.7% [402/6,990], P = .31) in Virginia, Michigan experienced a significant increase in Medicaid volume (Pre: 6.6% [558/8,518] vs Post: 10.3% [954/9,288]) with a commensurate decrease in uninsured volume (Pre: 5.5% [468/8,518] vs Post: 1.9% [181/9,288], P < .001) (Figure 1A). There were no differences in predicted risk of morbidity or mortality (PROMM) or rate of postoperative morbidity between Pre and Post in the Virginia Medicaid population. However, in the Michigan Medicaid population, a significant decrease in both PROMM (Pre: 11.9% [8.1, 20.0] vs Post: 11.1% [7.7, 18.0], P = .019) and the postoperative morbidity rate (Pre: 18.3% [102/558] vs Post: 13.2% 126/954], P = .008) was observed (Figure 1B).

Conclusions: Medicaid expansion is associated with a significant shift of cardiac surgery patients from being uninsured to having government coverage, which likely allows patients to seek necessary preoperative medical care. Expansion states may see decreases in preoperative predicted risk and postoperative morbidity rates for Medicaid patients undergoing cardiac surgery.



Redefining Practice Through Quality and Evidence: What's New – Continued Continued from previous page



2:20 PM Room 351DEF

Good at One, or Good at All? Correlation of Outcomes Between Coronary Artery Bypass Grafting and Valve Surgery Among Centers

L. E. Johnston¹, E. A. Downs¹, R. B. Hawkins¹, M. A. Quader², A. M. Speir³, J. B. Rich⁴, L. Yarboro¹, R. K. Ghanta¹, G. Ailawadi¹

¹University of Virginia, Charlottesville, ²Virginia Commonwealth University, Richmond, ³Cardiac, Vascular & Thoracic Surgery Associates, Falls Church, VA, ⁴Virginia Cardiac Services Quality Initiative, Virginia Beach

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; A. M. Speir: Consultant/Advisory Board, Medtronic

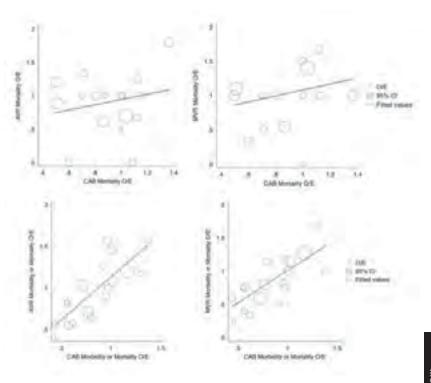
Purpose: The technical expertise required for treatment of coronary and structural heart valve disease differs. Correlation between center-specific mortality after coronary artery bypass grafting (CABG) and valve operations has not been well studied. This study tested the hypothesis that risk-adjusted outcomes between coronary and valve procedures do not correlate within centers.

Methods: Records of patients undergoing isolated CABG, isolated aortic valve (AVR), or isolated mitral valve (MVR) procedures from 2008 to 2015 in a multi-institutional STS database were used to generate observed-to-expected (OE) ratios for morbidity and mortality. Ratios were based on the STS predicted risks of morbidity and mortality and were calculated by procedure for each institution. Hierarchical models evaluated the linear relationship between institutional performance in CABG and valve operations.

Results: A total of 22,258 records from 18 institutions were analyzed: 17,026 CABG, 3,238 isolated AVR, and 1,994 MVR procedures. With respect to mortality, the correlations were weak: for AVR and CABG, the correlation coefficient was 0.24, and was 0.31 for MVR and CABG (Figure). With respect to morbidity, however, a strong relationship was seen between the morbidity OEs, with coefficients of 0.81 for AVR (beta 1.04, 95% CI: 1.03-1.05, P < .001) and 0.78 for MVR (beta 0.99, 95% CI: 0.98-1.00, P < .001), suggesting a nearly 1:1 relationship between morbidity observed in an institution's CABG and valve operations.

Conclusions: Sites that perform CABG with low mortality may not have similarly low mortality with valve operations, suggesting different expertise required for these unique operations. Most striking, however, is the high degree of correlation between morbidity for CABG and valve operations at each center.





Redefining Practice Through Quality and Evidence: What's New – Continued

2:30 PM Room 351DEF

Economic Impact of an Enhanced Recovery Pathway for Lung Resection

A. Madani¹, P. Paci¹, L. Lee¹, J. Mata¹, D. S. Mulder², J. Spicer¹, L. E. Ferri³, L. Feldman¹ ¹McGill University, Montreal, Canada, ²Montreal General Hospital, Canada, ³McGill University Health Centre, Montreal, Canada

COMMERCIAL RELATIONSHIPS L. Feldman: Research Grant, Medtronic

Purpose: Multimodal Enhanced Recovery Pathways (ERP) improve clinical outcomes and hospital length of stay for patients undergoing lung resection; however, data supporting their cost-effectiveness are lacking. This study evaluated the impact of an ERP on costs of lung resection.

Methods: Adult patients undergoing elective anatomic or non-anatomic lung resection between 2011 and 2013 at a single university-affiliated institution were prospectively recruited. Pneumonectomies and extended resections were excluded. Beginning September 2012, all patients were enrolled in an ERP with written patient education, multimodal analgesia, early structured mobilization, diet and drain management, and target discharge on postoperative day 4. Pre-pathway (conventional care) and post-pathway (ERP) clinical outcomes were recorded until 90 days. Total costs from institutional, health care system, and societal perspectives were recorded and reported in 2016 Canadian dollars (CAD\$) with uncertainty expressed as 95% confidence intervals (CI) derived using bootstrapped estimates (10,000 repetitions).

Results: Out of 396 patients undergoing lung resection during the study period, 133 were enrolled (conventional care: n=58; ERP: n=75). There were no differences in patient, pathological, and operative characteristics between groups. The ERP group had shorter median length of stay (4 days [interquartile range, IQR, 3-6 days] vs 6 days [IQR 4-9 days], P < .01), decreased complications (28 [48%] vs 51 [68%], P = .03), and decreased pulmonary complications (12 [16%] vs 20 [34%], P = .02). There were no differences in readmissions. Patients in the ERP group had a trend towards less total caregiver burden (53 hours \pm 90 hours vs 101 hours \pm 252 hours, P = .13), with decreased overall societal costs (mean cost saving per patient: -4,396 CAD\$, 95% CI: -8,674 to -618). There were no differences in total days lost from work (27 days ± 26 days vs 28 days ± 28 days, P = .91). Breakdown of institutional, health care system, and societal costs are shown in the Table.

Conclusions: A multidisciplinary ERP is associated with improved clinical and postdischarge outcomes, as well as cost savings, compared with conventional perioperative management for elective lung resection. Implementation of structured evidence-based perioperative pathways can be a potential strategy for health care providers, administrators, and institutions to diminish costs and improve care for these patients.



Table 1: Comparison of institutional, health care system and societal costs per patient between conventional care and ERP groups. Data is expressed as 2016 Canadian dollars (CAD\$) with uncertainty expressed as 95% confidence intervals (CI) derived from the 2.5° and 97.5° percentile of 10,000 bootstrap replications.

(4.5 DK	Conventional Care (n=58), 5 (95% CI)	ERP (n=75), 5 (95% CI)	Mean Difference, 5 (95% CI)
Operating room costs	2414 (2157, 2736)	2640 (2407, 2887)	226 (-161, 606).
Surgical ward hotel costs	5780 (3337, 8872)	3415 (2393, 4873)	-2365 (-5560, 283)
Intensive Care Unit costs	222 (39, 503)	33 (0, 89)	-189 (-460, -4)
Kadiology costs	122 (96, 150)	76 (65, 88)	-46 (-79, -19)
Laboratory costs	28 (23, 33)	18 (15, 20)	-10 (-17, -5)
Pharmacy costs	903 (249, 1976)	568 (489, 650)	-335 (-543, -145)
Allied braith professionals costs	71 (63, 61)	64 (55, 74)	-7 (-30, 7)
Ambulatory clinic costs	131 (105, 162)	143 (116, 174)	12 (-28, 54)
Energency department costs	139 (69, 24)	120 (74, 174)	-19 (-112, 67)
ERP costs (design, implementation)	4,200	1531	1531
Institutional Costs*	9811 (7107, 13076)	7231 (6105, 8836)	-2580 (-6245, 576)
Community health service costs	6 (0, 17)	42 (22, 72)	36 (13, 67)
Assisted care facility costs	360 (14, 800)	0 (0, 0)	-360 (-800, -14)
Physician billing costs	2126 (1993, 2318)	2180 (2014, 2352)	54 (-200, 353)
Healthcare System Costs;	12504 (9642, 15499)	9453 (8176, 11048)	-2850 (-6380, 244)
Productivity losses	1193 (668, 1799)	770 (411, 1244)	-423 (-1126, 294)
Caregiver costs	2301 (1041, 3924)	1178 (754, 1701)	-1123 (-2827, 216)
Societal Costs?	15799 (12464, 19624)	11402 (10056, 13063)	:4396 (-8674, -618)

Institutional costs include costs of operating room, surgical ward betef, Intensive Care Unit, radiology, laboratory, phaemacy, allied beath professionals, ambulatory clinic, emergency department and design and implementation of an Enhanced Recovery Program.

[§] Healthcare system costs include institutional costs, in addition to costs of community health services, assisted care facility and physician billing.

^{*} Societal costs include healthcare system costs, in addition to costs related to productivity loss and caregiver costs.

² No confidence interval

Redefining Practice Through Quality and Evidence: What's New – Continued

2:40 PM Room 351DEF

Patient Race Influences Risk Assessment and Recommendations for Lung Resection

M. K. Ferguson¹, C. Demchuk², K. Wroblewski¹, J. M. Farnan¹, M. Huisingh-Scheetz³, K. Thompson¹, J. Acevedo¹

¹The University of Chicago, IL, ²University of Illinois College of Medicine, Peoria, ³The University of Chicago Medicine, IL

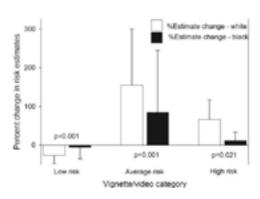
COMMERCIAL RELATIONSHIPS M. K. Ferguson: Employment, The Society of Thoracic Surgeons, Deputy Editor of The Annals of Thoracic Surgery

Purpose: Racial disparities in utilization of surgical therapy for lung cancer exist in the United States. Videos of standardized patients (SPs) can help identify factors that influence surgical risk estimation and recommendations. We hypothesized that viewing videos of black SPs influences surgeon decision making differently than viewing videos of white SPs.

Methods: Three race-neutral clinical vignettes representing male lung resection candidates were paired with risk-level concordant short silent videos of SPs. Trainees and practicing thoracic surgeons read a vignette, provided an initial estimate of the percent risk of major surgical complications, viewed a video randomized to black or white SP (matched for age, body mass index, gait speed, and strength), and provided a final estimate of risk, the importance of the video, and the likelihood that they would recommend surgery. To compare changes in risk estimates in relation to surgeon and SP characteristics, generalized estimating equation (GEE) linear regression models were fit.

Results: A total of 117 surgeons (51 practicing surgeons, 66 trainees) participated; 86 were white, 31 were in other self- identified racial categories; 96 were men, 21 were women. Final risk estimates were used to classify vignettes/video combinations as low, average, and high risk, and were significantly different: 10.7% ± 6.9%, 15.8% ± 13.2%, and 32.9% ± 19.9% (P < .001 by ANOVA). Changes between initial and final risk estimates were not related to training vs practicing status (P = .09) or surgeon race (white vs other; P = .60). Videos of white SPs were associated with a significantly greater change in risk estimates than for black SPs (P < .05 for each vignette/video combination; Figure). Videos of black SPs were associated with a higher likelihood of recommending surgical therapy than for videos of white SPs (88% vs 75%; P < .001).

Conclusions: Patient race significantly influenced risk estimation and surgical recommendations. How these findings influence shared decision making and their association with treatment disparities require further investigation.



2:50 PM

Quality Measurement: What's New

David M. Shahian, Boston, MA

3:05 PM

STS National Database and National Quality Forum: What's New

Jeffrey P. Jacobs, St Petersburg, FL

3:20 PM

Break

Redefining Practice Through Quality and Evidence: What's New – Continued

Room 351DEF 3:35 PM

Staphylococcus aureus Prevention Strategies in Cardiac Surgery: A Cost Effectiveness

J. Hong¹, M. K. Saraswat², T. Ellison³, J. T. Magruder², J. M. Gardner², W. V. Padula¹, G. J. Whitman²

¹The Johns Hopkins University School of Public Health, Baltimore, MD, ²The Johns Hopkins Hospital, Baltimore, MD, ³The Johns Hopkins Hospital, Nottingham, MD COMMERCIAL RELATIONSHIPS W. V. Padula: Consultant/Advisory Board, Molnlycke; G. J. Whitman: Research Grant, Abbott Nutrition

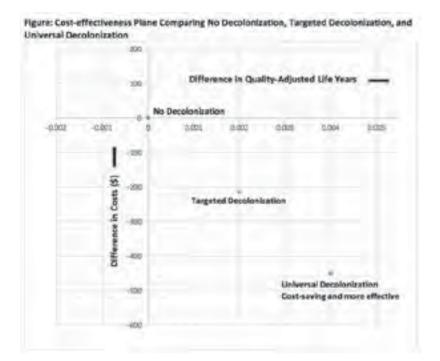
Purpose: Cardiac surgery patients colonized with Staphylococcus aureus have a greater risk of surgical site infections (SSI). Preoperative decolonization among methicillin-resistant S aureus carriers decreases SSI. The purpose of this study was to evaluate the costeffectiveness of three decolonization strategies to prevent SSI in cardiac surgery patients.

Methods: We compared three decolonization strategies: 1) "Universal Decolonization" (UD), all patients treated; 2) "Targeted Decolonization" (TD), only S aureus carriers treated; and 3) "No Decolonization" (ND), no patients treated. Decolonization included mupirocin, chlorhexidine, and vancomycin. We implemented a decision tree comparing the effect of these strategies on SSI over a 1-year period for patients undergoing coronary artery bypass grafting (CABG) surgery. We calculated differences in costs, SSIs prevented, qualityadjusted life years (QALYs) gained, and incremental cost effectiveness ratio. The costs of the intervention were compared to the costs of SSI. Deterministic and probabilistic sensitivity analyses were conducted to address the uncertainty.

Results: UD was the dominant strategy, since it resulted in reduced costs and SSI rates at near-equal QALYs compared to TD and ND. Compared to ND, UD decreased costs by \$453 and increased QALYs by 0.004 per patient, while TD decreased costs by \$215 and increased QALYs by 0.002 per patient. For 1,000 patients, UD prevented 23 SSI while TD prevented only 12 SSI compared to ND. Results were robust in the univariate sensitivity analysis for a wide range of parameters. UD was the dominant strategy even when the reference SSI rate was 0.5%. In probabilistic sensitivity analysis, UD dominated the other two strategies in over 90% of simulations for willingness-to-pay thresholds between \$0 and \$50,000 per QALY (<\$100,000/QALY is considered by health economists as cost-effective). For the 250,000 CABG procedures performed yearly in US, UD will save \$113 million, while TD will save \$54 million compared to ND.

Conclusions: Universal decolonization outperforms other strategies, probably due to its more complete implementation with improved decolonization rates in all preoperative patients. However, the cost savings of \$59.4 million per 250,000 CABG procedures comparing UD vs TD must be weighed against the potential risk of developing mupirocin resistance associated with universal decolonization.







Redefining Practice Through Quality and Evidence: What's New – Continued

3:45 PM Room 351DEF

Multicenter Quality Improvement Project to Prevent Sternal Wound Infections in **Pediatric Cardiac Surgery Patients**

C. Woodward¹, R. Taylor¹, M. Son¹, R. Taeed¹, M. L. Jacobs², S. K. Pasquali³, L. C. Kane⁴, I. P. Iacobs⁵, S. A. Husain¹

¹The University of Texas Health Science Center, San Antonio, ²The Johns Hopkins University School of Medicine, Newtown Square, PA, 3University of Michigan, Ann Arbor, 4Texas Children's Hospital / Baylor College of Medicine, Houston, 5 Johns Hopkins All Children's Heart Institute, St Petersburg, FL

Purpose: Children undergoing cardiac surgery are at risk for sternal wound infections (SWI), leading to increased morbidity and mortality. Single center quality improvement (QI) initiatives have demonstrated decreased infection rates utilizing a bundled approach. This multicenter initiative was undertaken to determine the efficacy of a protocolized approach to decrease SWIs.

Methods: Pediatric cardiac surgery programs joined a 2-year collaborative effort to prevent sternal wound infections utilizing a protocol that decreased infection rates in a single center. The protocol included elements of pre- and post-operative care and intraoperative antibiotic timing. Institutional project teams implemented the protocol, collected compliance data, and provided additional data points for the 2 years preceding and following the study period. Data were collected in local clinical registries using STS Congenital Heart Surgery Database harvest-compliant software.

Results: Nine programs prospectively collected compliance data on 4,189 children. Utilization of the protocol extended the mean days between infections from 68.2 days (range 25-82 days) to 130 days (range 43-412 days). Compliance was 76.7% the first quarter of year one and 91.3% the final quarter. Ninety children (1.9%) developed a SWI pre-protocol and 64 (1.5%) post-protocol, P = .18 (Figure). During the study period, 637 delayed sternal closure (DSC) patients (15%) had a 5% infection rate with 18 (5.7%) year one and 14 (4.3%) year two. There was a trend toward increased risk for SWI by 1.046 for each day the sternum remained open, P = .067. Single dose bolus preoperative antibiotics administered 0-60 minutes prior to incision resulted in fewer infections than when administered outside 0-60 minutes, 3.7% vs 1.9%, P = .025 (Table).

Conclusions: A multicenter QI project to reduce pediatric SWIs demonstrated an extension of days between infections and a decrease in SWIs. Administration of preoperative antibiotics within the recommended time was associated with decreased infection rates.



Infection Rate & Compliance by Quarter

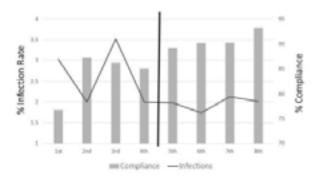


Table 1: Timing of Prophylactic Antibiotic and Incidence of SWI

	Within prescribed time Outside prescribed time interval N(%) N(%)		
Single Bolus Pre			
Operative Antibiotic* N = 4055	3703 (91)	352 (8.7)	
SWI	71 (1.9)	13 (3.7)	
No SWI	3632 (98.1)	339 (96.3)	p=0.025
Vancomycin ^b N=135	19 (14)	116 (86)	
SWI	0 (0)	2(1.7)	
No SWI	19 (100)	114 (9.8)	p=0.564
Any Antibiotics N=4190	3804	3864	
5747	73 (1.9)	13 (3.4)	p=0.056
No SWI	3731 (98)	373 (96.6)	

 $^{^{}a}$ cephalosporins and/or gentamycin single bolus injection 0-60 minutes prior to incision



byancomycin infused over 1 hr, started 60 - 120 minutes prior to incision

cat least one antibiotic given within prescribed time

dincludes 32 records where no pre-operative antibiotic administration was listed

Redefining Practice Through Quality and Evidence: What's New – Continued

Room 351DEF 3:55 PM

A Prospective Multi-Institutional Cohort Study of Mediastinal Infection After Cardiac Surgery

L. P. Perrault¹, K. A. Kirkwood², H. Chang², J. C. Mullen³, M. A. Miller⁴, B. Gulack⁵, K. Doud⁵, M. Argenziano⁷, R. K. Ghanta⁸, B. A. Whitson⁹, D. Williams², N. M. Sledz–Joyce², B. Lima¹⁰, G. Greco², N. Fumakia¹¹, E. Rose¹², J. Puskas¹³, R. D. Weisel¹¹, M. E. Bowdish¹⁴

¹Montreal Heart Institute, Canada, ²Icahn School of Medicine at Mount Sinai, New York, NY, ³University of Alberta, Edmonton, Canada, ⁴National Heart, Lung, and Blood Institute, Bethesda, MD, ⁵Duke University, Durham, NC, ⁶Cleveland Clinic, OH, ⁷Columbia University College of Physicians and Surgeons, New York, NY, 8University of Virginia, Charlottesville, 9The Ohio State University Wexner Medical Center, Columbus, 10 Baylor University Medical Center, Dallas, TX, ¹¹Toronto General Hospital, Canada, ¹²Mount Sinai Health System, New York, NY, ¹³Mount Sinai Beth Israel, New York, NY, 14 University of Southern California Keck School of Medicine, Los Angeles

COMMERCIAL RELATIONSHIPS M. E. Bowdish: Research Grant, HeartWare, Sunshine Heart; B. A. Whitson: Other/ Travel Grant, HeartWare, St Jude Medical; Other Research Support, XVIVO

Purpose: Mediastinal infections after cardiac surgery remain a significant source of morbidity and mortality postoperatively, and strategies to effectively prevent them are highly important. We examined the timing and risk factors, including modifiable management practices, for mediastinal infection after cardiac surgery and estimated its impact on clinical outcomes.

Methods: In a prospective cohort study, 5,158 adult cardiac surgery patients were enrolled across 10 centers. All mediastinal infections (deep sternal wound infection, myocarditis, pericarditis, or mediastinitis) were adjudicated by an independent committee. Competing risk models were used to assess the association of patient characteristics and management practices with mediastinal infection within 65 days of surgery. Mortality was assessed by a Cox proportional hazards model (adjusting for age, sex, creatinine at baseline, and history of congestive heart failure and diabetes), and the increase in index length of stay due to infection was assessed using a multi-state Markov model.

Results: In this cohort, there were 43 mediastinal infections in 41 patients (0.79%). Median time to infection was 20 days (interquartile range 14-28 days), with 65.9% occurring after index hospitalization discharge. Higher body mass index (BMI), higher creatinine, preoperative corticosteroid use, ventricular assist device (VAD) or transplant surgery, postoperative hyperglycemic episodes, and longer time on ventilation were associated with higher risk for mediastinal infection (see Table). Additional length of stay (LOS) during the index hospitalization attributable to mediastinal infection was 11.5 days (bootstrap 95% CI [1.88, 21.11]). The readmission rate within 30 days of surgery was 0.65 vs 0.13 per patient month for patients with mediastinal infection compared to those without (P = .0003). The hazard of associated mortality was 5.4 (95% CI [1.67, 17.53]).

Conclusions: In experienced cardiac surgery centers, mediastinitis incidence is low. However, these infections have a high impact on LOS, readmissions, and mortality. This study identifies BMI, preoperative creatinine, corticosteroids, VADs, or transplantation as determinants of increased risk. Improving hyperglycemic management and minimizing ventilator time are important targets for reducing infection risk.

Table: Predictors of Chest Infection*

	Hazard Ratio	95% Confidence Interval	p-value
BMI	1,064	(1.02, 1.11)	0.0013
Creatinine, mg/cll.	1.272	(1.16, 1.39)	<.0001
Baseline conficonteroids	3.550	(1.4, 9.01)	0.0077
Postoperative hyperglycemic episode	2.289	(1.21, 4.35)	0.0113
VAD or transplant surgery	5,043	(2.01, 12.62)	0.0005
Time on ventilation (days)	1.057	(1.01, 1.11)	0.0263

Determined using a multivariate proportional luxurals regression model with death as a competing risk

Redefining Practice Through Quality and Evidence: What's New - Continued

4:05 PM Room 351DEF

The Use of Bacitracin for Preventing Sternal Wound Infections Following Cardiac Surgery

J. L. Chan, A. C. Diaconescu, K. A. Horvath

National Heart, Lung, and Blood Institute, Bethesda, MD

Purpose: The development of sternal wound infections remains a serious complication following cardiac surgery. Multiple studies have assessed the use of antibiotics placed directly along the sternal borders. We evaluated the use of bacitracin ointment applied over the sternotomy skin incision and its impact on the incidence of sternal wound infections.

Methods: A retrospective review of all cardiac surgery cases performed at a single institution between May 2006 and December 2015 was performed (n=2,049). Appropriate preoperative intravenous antibiotics were administered for all patients. Bacitracin topical antibiotic ointment was routinely applied to the sternal surgical incision following skin closure for all patients during this time period. The incidence of sternal wound infection of any type (superficial, deep, mediastinitis) was assessed. This cohort was compared to a historic control group of patients (n=5,158) enrolled in the CTSN Management Practices and Risk of Infection Following Cardiac Surgery Trial who were not treated with bacitracin.

Results: Despite the increased presence of multiple known risk factors for sternal wound infections (age: 66.2 years ± 12.6 years vs 64.4 years ± 13.2 years; diabetes mellitus: 27.3% vs 22.7%; prior cardiac surgery: 21.9% vs 18.6%), bacitracin-treated patients were free from any occurrences of superficial or deep sternal surgical site infections during the 9-year study period. This is in comparison to 26 episodes (0.57%) of deep wound sternal infections in the non–bacitracin-treated group. Additionally, no incidences of mediastinitis occurred in patients treated with topical bacitracin, while 12 episodes (0.24%) of mediastinitis were noted in the control group. Bacitracin ointment was well tolerated by patients with no serious adverse effects reported.

Conclusions: This study suggests that the routine application of topical bacitracin over the surgical skin incision is associated with a decreased incidence of sternal site infections following cardiac surgery. As a readily available and inexpensive therapy, this simple intervention may be a useful adjunct in minimizing sternal wound infections.

4:15 PM

Public Reporting: What's New

Vinay Badhwar, Morgantown, WV

4:30 PM

Physician Reimbursement – Current Procedural Terminology and Relative Value Scale Update Committee: What's New

Stephen J. Lahey, Farmington, CT, and Francis C. Nichols, Rochester, MN

4:45 PM

Q&A



NOTES



1:30 PM - 3:30 PM Room 310ABC

Adult Cardiac: Aorta I

Moderators: Edward P. Chen, Atlanta, GA, and Thomas G. Gleason, Pittsburgh, PA COMMERCIAL RELATIONSHIPS T. G. Gleason: Research Grant, Medtronic

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, including a pro-con debate and a brief question-and-answer session after each topic.

1:30 PM

Concomitant Antegrade Stent Grafting of the Descending Thoracic Aorta During Transverse Hemiarch Reconstruction for Acute DeBakey I Aortic Dissection Repair Improves Aortic Remodeling

I. Sultan¹, T. Wallen², M. A. Siki², A. Habertheuer², G. J. Arnaoutakis³, R. S. Menon⁴, W. Y. Szeto², J. E. Bavaria⁵, P. Vallabhajosyula²

¹University of Pittsburgh, PA, ²University of Pennsylvania, Philadelphia, ³University of Pennsylvania Health System, Philadelphia, 4Howard University College of Medicine, Washington, DC, ⁵University of Pennsylvania, Philadelphia

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices

Purpose: Several institutions are empirically treating acute DeBakey I dissection patients with variable aortic arch reconstructions with stent grafting (TEVAR) of the descending thoracic aorta (DTA) for the purpose of improving distal aortic remodeling. We assessed postoperative and 1-year aortic remodeling outcomes with this strategy compared to standard open repair.

Methods: From 2006 to 2013, acute DeBakey I dissection patients (n=257) undergoing standard open distal hemiarch reconstruction (n=198) (Standard group) vs those undergoing hemiarch with DTA TEVAR (n=59) (Stent group) were retrospectively reviewed. To reduce time bias and inter-patient variability, we only included patients with three-dimensional scans available at 1-month and 12-month time points post-surgery (Standard group n=28; Stent group n=20). Aortic total, true, and false lumen diameters were measured at 12 locations along the aorta (innominate artery to common iliac artery bifurcation). Aortic remodeling in the two groups was compared.

Results: Intragroup analysis: In both groups, total and true lumen diameters remained stable. Centerline measurements remained stable in Standard group (mean change +4 mm ± 15 mm) and suggested reduction in Stent group (mean change -22 mm ± 12 mm; P = .09). Intergroup analysis: At 1 month, true lumen and true lumen to total diameter ratios in arch and DTA were significantly improved in Stent group (P < .05). But in-abdomen, aortic bifurcation, and common iliac artery total diameters were larger in Stent group (P < .05), although true lumen diameters were similar. Mean fenestrations were similar $(1.8 \pm 1.5 \text{ vs } 2.4 \pm 1.9, P = .32)$. At 12 months, DTA true lumen and true lumen to total

diameter ratios remained significantly improved in the Stent group at all locations (P < .01) (Table). This translated to increased complete false lumen thrombosis rates in the chest (83% vs 32%, P = .01). In the abdomen, diameters were smaller at a ortic bifurcation (P < .05), but true lumen to total diameters were similar.

Conclusions: TEVAR during hemiarch repair for DeBakey I dissection improves immediate and 1-year DTA remodeling by improving true lumen diameter and false lumen thrombosis. Abdominal aortic remodeling will need to be carefully followed as TEVAR may cause early enlargement that persists at 1-year time point.

Table 1 Comparison of aortic diameters at the 12-month point post-surgery

Anatomic	Steet group		Standard group		Pvalue	Fysise
location	Total	TL	Total	TL	(total)	(TL)
Incentive LC	3050	_	313654	_	p-6,711	
LUTISCA	26254.6		313633		p-8381	
Edge LNCA	203-63		318/34		p438	
DA.	363/87	28.865.6	31943	17,548.3	5.390	1300
DV	313683	27.543.7	30.564	17.5-8.3	E-869	4000
Th	STREET.	28.545.1	30.147.4	173687	8.407	+8.861
Arriv histor	36317.3	18,347.0	29.1+6.6	16.047.5	6.537	6,325
CA	265.63	15.968	27.6+4.3	15.847.7	8215	1111
Left rend	20.043	70663	22,314.4	19,346.7	6.847	1.796
Artic Measure	202662	1033	197643	142643	ENIX	1.970
RCTA	1470.1	TETATA	313439	182522	-0.001	8,353
LCIA	18.632	113/33	122/23	18.6(2.3	KRIT	1388
LSCA to Mileonion		L'Étalia.	34	AMUS		in (3.F)
TREAM BETA	40.3(29.3			221618		sen difference: 3x13.9)
TREA P. TETA	- 6	LE303	-	85-C1		nes difference: (c13.5)

Adult Cardiac: Aorta I - Continued

1:45 PM Room 310ABC

Aortic Valve-Sparing David I Procedure Has Excellent Long-Term Results in Elective Patients: A Single-Center Experience Over 20 Years

M. L. Shrestha¹, F. Abd Albadi¹, E. Beckmann¹, H. Krueger¹, J. Umminger¹, T. Kaufeld¹, J. Schmitto¹, S. Cebotari¹, A. Haverich¹, A. Martens²

¹Hanover Medical School, Germany, ²Clinic for Cardiothoracic, Transplantation and Vascular Surgery, Hanover, Germany

COMMERCIAL RELATIONSHIPS M. L. Shrestha: Consultant/Advisory Board, Vascutek Ltd a Terumo Company; Speakers Bureau/Honoraria, Vascutek Ltd a Terumo Company

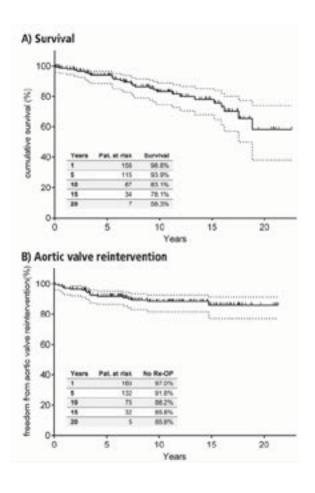
Purpose: The valve-sparing reimplantation (David) procedure is an alternative to the Bentall procedure when the aortic valve is not calcified. However, few long-term results of aortic valve-sparing David procedures have been published. We present our results in patients receiving isolated David procedures in an elective setting over the past 20 years.

Methods: Between July 1993 and October 2015, over 600 patients underwent the David procedure at our center. Out of these, 170 patients underwent isolated David procedures without any other concomitant procedures. All patients (mean age 47 years ± 17 years, 69% male) were operated according to the original technique proposed by Tirone David (David I). Fifty-six (33%) had Marfan syndrome, and 13 (8%) had a bicuspid aortic valve. Ten patients (6%) were operated through upper mini-sternotomy.

Results: There was no perioperative mortality. Stroke rate was 1.8% (3/170). Discharge echocardiography showed no aortic insufficiency (AI 0°) in 42% (71/170) or trivial AI in 19% (33/170). Follow-up (mean follow-up: 8.4 years \pm 6.3 years, maximum 22.6 years) was 91% complete. Twenty-eight patients (16.5%) died during follow-up (8 years \pm 5.5 years post-surgery). No deaths were valve related. Eighteen patients (10.6%) underwent aortic valve reoperations during follow-up (4 years \pm 3.7 years post-surgery). Follow-up echocardiography showed aortic valve insufficiency (AI) ≤ I° in 115 (67%), AI II° in 13 (7.6%), and AI ≥ III° in four patients (2.3%) after 12.12 years \pm 5.34 years. Freedom from valve reoperation at 1, 5, 10, 15, and 20 years was 97%, 92%, 88%, 86%, and 86%, respectively. Survival at 1, 5, 10, 15, and 20 years was 99%, 94%, 83%, 78%, and 58%, respectively.

Conclusions: The valve-sparing David I procedure in an elective setting has excellent short- and long-term results. Freedom from valve-related complications, such as stroke or major bleeding, are exceedingly low. Erosion due to supposed leaflet contact with the straight Dacron graft in the David I procedure was not observed in any patient, proving that using a straight graft has no negative impact on the leaflets. The "spared valve" – being native living tissue – seems to be more resistant to infection than prosthetic valves.





Adult Cardiac: Aorta I - Continued

2:00 PM Room 310ABC

Valve-Sparing Root Replacement to Facilitate Aortic Valve Repair in Moderately Dilated Aortic Roots – Is It Justifiable?

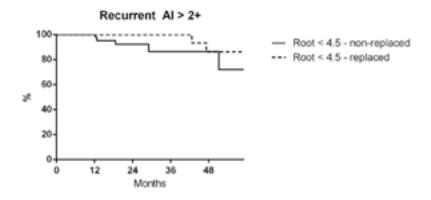
F. Hage, S. Mohajeri, B. Sohmer, T. Coutinho, L. Beauchesne, R. Masters, M. Boodhwani University of Ottawa Heart Institute, Canada

Purpose: Patients eligible for aortic valve repair for aortic insufficiency (AI) can present with varying degrees of aortic root and annular dilatation. Valve sparing root replacement has been proposed as a method to perform robust annuloplasty of the aortic valve even in patients with only moderate aortic root dilatation (<4.5 cm). The safety and efficacy of this practice remains to be demonstrated.

Methods: From 2009 to 2015, 195 patients undergoing aortic valve preservation and repair were prospectively enrolled in a database that captured clinical, echocardiographic, and follow-up data. Patients with unicuspid and quadricuspid valves, endocarditis, and acute aortic dissection were excluded. Of the remaining 175 patients, those with moderate aortic root dilation (n=120) who did not undergo aortic root replacement (n=64) were compared to those who underwent aortic root replacement (n=56). Valve-sparing root replacement was preferentially performed using the reimplantation technique (97.3%). Cusp repair was performed in 130 patients (74%).

Results: Root replacement patients were more likely to have bicuspid aortic valves (69% vs 21%, P < .001) and larger root diameters (4.0 cm \pm 0.4 cm vs 3.6 cm \pm 0.4 cm, P < .01), but had similar incidence of severe AI (38% vs 45%, P = .43). Cardiopulmonary bypass time was longer in the root replacement group (183 min \pm 32 min vs 116 min \pm 44 min, P < .001). There was no in-hospital mortality. The incidence of reoperation for bleeding (3.2% vs 3.6%, P = .80), permanent pacemaker (0% vs 3.6%, P = .32), stroke (1.6% vs 0%, P = .41) was similar between groups. There was a trend toward lower freedom from recurrent AI (>2+) at 5 years in the non-root replacement group (72% vs 87%, P = .08).

Conclusions: Aortic root replacement in patients with moderate aortic root dilatation prolongs cardiopulmonary bypass time, is not associated with increased risk of peri-operative complications, but showed a trend towards improved freedom from recurrent AI.



2:15 PM

The Florida Sleeve Procedure Is Durable and Improves Aortic Valve Function

S. Aalaei-Andabili', T. Martin², P. Hess³, G. Janelle¹, Y. Peng¹, K. Berg¹, C. Klodell¹, T. M. Beaver¹

¹University of Florida, Gainesville, ²Florida Hospital Orlando, ³Indiana University, Indianapolis

Purpose: The Florida sleeve (FS) procedure was introduced as a simplified approach
for valve-sparing correction of functional type I aortic insufficiency (AI) associated with
aortic root aneurysms. In this study, short-term and long-term survival rate, freedom from
reoperation, and aortic valve function after FS procedure were investigated.

Methods: From May 2002 to March 2014, 177 patients underwent the FS procedure. As a referral center, some patients had outside follow-up echocardiograms. Left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), ejection fraction (EF), and degree of AI (none=0, minimal=1, mild=2, moderate=3, severe=4) were evaluated in echocardiographic measurement. Long-term follow-up was obtained by the Social Security Death Index and contact with patients' primary care physicians.

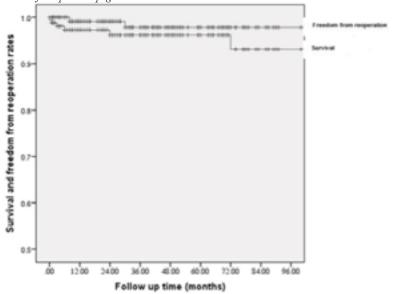
Results: Mean \pm SD age was 49.41 years \pm 15.37 years. Survival rate was 98% at 1 year, 97% at 5 years, and 93% at 8 years (Figure). Freedom from reoperation was 99% at 1 year and 98% at 2–8 years (Figure). There was one (0.56%) in-hospital and one (0.56%) 30-day death. Three patients (1.69%) had periprocedural stroke (Table). Postoperative follow-up echo was available in 53 patients at 1 week, 41 patients at 30 days, and 13 patients at 5 years. AI grade significantly improved at 1 week (2.27 \pm 1.24 vs 1.02 \pm 0.96, P < .001) and 30 days (1.97 \pm 1.17 vs 1.21 \pm 0.81, P < .001); and at 5 years (2.25 \pm 1.21 vs 1.33 \pm 0.88, P = .067). Preoperative mean LVEDD significantly decreased from 53.5 \pm 6.21 to 47.21 \pm 8.28 (P < .001) at 1 week, from 51.53 \pm 7.51 to 48.09 \pm 8.30 (P = .019) at 30 days, and from 53 \pm 7.44 to 46.45 \pm 9.84 (P = .029) at 5 years. Although EF did not change through the study, change in LVESD decreased at 1 week (37.48 \pm 7.07 vs 34.83 \pm 8.67, P = .023) and at 5 years (35.9 \pm 9.4 vs 30.9 \pm 9.9, P = .068).

Conclusions: The Florida sleeve procedure is a safe, effective, and durable procedure for treatment of aortic root aneurysm and type I aortic insufficiency. Long-term survival and freedom from reoperation rates are encouraging.





Adult Cardiac: Aorta I - Continued Continued from previous page



Pre-Operative CI	haracteristics (n=177)	
Age (year), tunned SD	49/4/6/15.81	
Male, N (%)	128 (72.31)	
Dypertension, N (54)	933250	-
Dishdio, N (%)	(2(6.71))	
Price stoke, N (%)	9 (5.00)	- 10
Price TIA, N (%)	+ (2.25)	
Program, NOW	1 (0.56)	100
Price CABG	3 (\$ 89);	
little operation and	Post-Operator ontrone	
Cardiogulatonary Dypan-Tima (mm), excitateD	180,79+54,75	
ICU Lours, manual 573	162 Sur 186 Av.	-
Vertilation boxes, rocas a SD	20 17425 75	
Transportative blood youkus transmiss. 9 (84)	41/34-40)	139
In-bospitel MI, N (%)	0.003	1
In-homital Streke TLA, N (%)	2.0.80	
Re-useryention due to bleeding	3(1,69%)	
Lingth of say (slay), memi SD	8.761.5.6	_
In-Bospital dorth, N (%)	1 (0.56)	
Readminson within Friday, N = 17	15(6.47)	
30-day mortality (after declarge), N (%)	1 (0.56)	

2:30 PM Room 310ABC

Outcomes of Reoperation With Conventional and Frozen Elephant Trunk Procedures After Acute Type A Dissection Repair

J.J. Idrees¹, E. E. Roselli¹, D. R. Johnston¹, E. G. Soltesz¹, C. C. Rosu², M. Tong¹, G. B. Pettersson¹, J. F. Sabik¹, L. G. Svensson¹

¹Cleveland Clinic, OH, ²Hôpital du Sacré-Coeur de Montréal, Canada

COMMERCIAL RELATIONSHIPS D. R. Johnston: Consultant/Advisory Board, Edwards Lifesciences Corporation, JACE Medical, St Jude Medical; E. E. Roselli: Consultant/Advisory Board, W. L. Gore & Associates, Medtronic; Research Grant, Medtronic, Vascutek Ltd a Terumo Company; J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic; E. G. Soltesz: Ownership Interest, JACE Medical; Speakers Bureau/Honoraria, AtriCure, Edwards Lifesciences Corporation, St Jude Medical; L. G. Svensson: Nonremunerative Position of Influence, Serve as an unpaid Member of the PARTNER Trial Executive Committee

Purpose: Patients with residual dissection after emergency acute type A repair often undergo multiple reoperations over their lifetimes for disease progression and complications. Our objectives were to characterize these patients and assess outcomes of complex aortic reconstruction with conventional elephant trunk (ET) and frozen elephant trunk procedures (FET).

Methods: From 2000 to 2016, 790 patients underwent ET or FET procedures. Of these, 214 (27%): 168 ET and 46 FET, were performed as reoperations for degenerative chronic dissection after acute type A repair (interval 6.8 years ± 6 years). Mean maximum diameter was 6 cm ± 0.9 cm. The initial type A repair was performed at our institution in 11%. Forty-three (20%) had connective tissue disorders. Twenty (9.3%) presented with pseudoaneurysm, 18 (8.4%) with de novo acute on chronic dissection, and four (2%) with contained rupture. Forty-two patients (19.6%) had moderate descending aneurysm (mean: 4.1 cm ± 0.6 cm) and underwent prophylactic ET/FET. Root was replaced during initial type A repair in 55 (26%) and during ET/FET in 41 (19%).

Results: Operative mortality was 1.8% (n=4/214, ET: 4, FET: 0). All died due to coagulopathy complications and heart failure, including two who also had stroke. Morbidity included: stroke (n=8, 3.7%, ET: 8, FET: 0), tracheostomy (n=8, 3.7%, ET: 6, FET: 2), renal dialysis (n=6, 2.8%, ET: 6, FET: 0) and reoperation for bleeding (n=19, 8.8%, ET: 16, FET: 3). Two patients (0.9%) had paralysis (ET: 1, FET: 1). In the ET group, two patients developed pseudocoarctation and underwent emergency endovascular completion. Mean follow-up was 3 years ± 2 years. Second-stage completion was performed in 134 patients (63%; Open: 75, 56%; Endovascular: 59, 44%) at a median interval of 3.7 (0-19) months. Of the remaining 80 patients (37%) who did not complete second stage, 19 died, six were scheduled for completion, and 55 were under surveillance for disease progression distal to repair. Estimated survival at 6 months and 1, 3, and 5 years was 91%, 82%, 77%, and 72%, respectively.

Conclusions: Patients with chronic residual type A dissection require lifelong surveillance for late complications at centers specializing in the care of aortic disease. Both ET and FET are good options for arch reconstruction during re operations in these patients and facilitate later distal aortic repair.



Adult Cardiac: Aorta I – Continued

2:45 PM Room 310ABC

Safety of Moderate Hypothermia in Total Aortic Arch Replacement With Antegrade Cerebral Perfusion: A Report of More than 3,000 Patients From the ARCH Database

W. B. Keeling¹, D. Tian², B. G. Leshnower³, E. P. Chen³

¹Emory University, Atlanta, GA, ²International Aortic Arch Surgery Study Group, Macquarie Park, Australia, ³Emory University School of Medicine, Atlanta, GA

COMMERCIAL RELATIONSHIPS B. G. Leshnower: Consultant/Advisory Board, CryoLife

Purpose: Total arch replacement (TOTAL) is a complicated operation and has required deep hypothermic circulatory arrest. Controversy remains over the optimal temperature and perfusion strategy to optimize outcomes. In this study, the clinical outcomes and impact of using moderate hypothermic circulatory arrest (MHCA) and antegrade cerebral perfusion for TOTAL were examined.

Methods: The ARCH International aortic database was queried, and 3,265 patients undergoing TOTAL using antegrade cerebral perfusion (ACP) were identified. Patients were then divided based on lowest cooling temperature: MHCA [20-28°C] or deep hypothermia (DHCA) [12-20°C]. Propensity score matching using 15 variables was used to level the groups and resulted in 600 matched pairs. Multivariate analyses were performed identify risk factors for mortality and stroke.

Results: In the unmatched cohort, more patients underwent MHCA (2,586, 79.2%) who were also younger (P < .001) and more frequently underwent emergent operations (P < .001) than DHCA patients. For the propensity score-matched patients, there were significant differences in cardiopulmonary bypass (CPB) time (MHCA 215 minutes vs DHCA 260 minutes, P < .001), aortic cross clamp time (MHCA 127 minutes vs DHCA 151 minutes, P < .001), and cerebral perfusion time (MHCA 68 minutes vs DHCA 77 minutes, P < .001). Postoperative outcomes are detailed in the Table for the propensity score-matched group. Of note, there was no difference in neurologic outcomes nor in-hospital mortality for the two temperature groups. Multivariate analysis of risk factors for mortality included CPB time (P < .001), preoperative shock (P = .006), concomitant coronary artery bypass grafting (CABG) surgery (P = .004), and emergent status (P < .0001). Independent risk factors for stroke included CABG (P = .004), cerebral vascular disease (P = .001), and emergent status (P = .002).

Conclusions: In this multicenter international series, TOTAL with MHCA and ACP can be safely performed with acceptable operative risk. Compared to DHCA, MHCA was not associated with adverse neurologic outcomes or worse operative outcome in TOTAL, despite prolonged periods of circulatory arrest, but did result in significantly shorter CPB times.

Postoperative outcome	OHCA (N=600)	MHCA (N=600)	P VALUE
Mortality	76 (13)	79 (12.4)	0.760
PND	47 (8)	52 (9)	0.544
TND	43 (7.7)	36 (6.8)	0.579
50	12 (2.4)	29 (3.7)	0.421
AKI	67 (15)	69 (13.4)	0.664
Bleeding	83 (14.3)	80 (14.2)	0.741
ICU LOS	8.1±11.5	6.4±10	0.074
Mospital LOS	21.9123.5	23±25.9	0.473

3:00 PM

Debate: Should a Moderately Dilated Ascending Aorta (4.6-5.4 cm) Be Replaced in a Patient With a Normally Functioning Bicuspid Aortic Valve?

Pro: Lars G. Svensson, Cleveland, OH

Con: Thomas G. Gleason, Pittsburgh, PA

COMMERCIAL RELATIONSHIPS L. G. Svensson: Nonremunerative Position of Influence, Serve as an unpaid Member of the PARTNER Trial Executive Committee; T. G. Gleason: Research Grant, Medtronic

1:30 PM - 3:30 PM Room 320ABC

Adult Cardiac: Ischemic

Moderators: Richard L. Prager, Ann Arbor, MI, and Elaine E. Tseng, San Francisco, CA
COMMERCIAL RELATIONSHIPS E. E. Tseng: Research Grant, American Heart Association

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, videos, and a brief question-and-answer session after each topic.

1:30 PM

Utilization of Multiarterial Grafting During Coronary Artery Bypass Grafting Across the Predicted Risk of Mortality Spectrum: Impact on Short- and Long-Term Survival

W.B. Keeling¹, X. DeGrauw¹, J. Hunting¹, M. E. Halkos¹, B. G. Leshnower², E. P. Chen², J. Miller¹, O. M. Lattouf¹, R. Guyton¹, V. H. Thourani¹

¹Emory University, Atlanta, GA, ²Emory University School of Medicine, Atlanta, GA

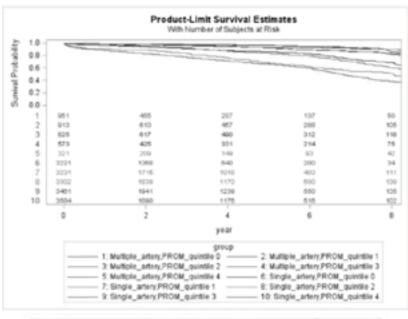
COMMERCIAL RELATIONSHIPS M. E. Halkos: Consultant/Advisory Board, Medtronic; B. G. Leshnower: Consultant/Advisory Board, CryoLife

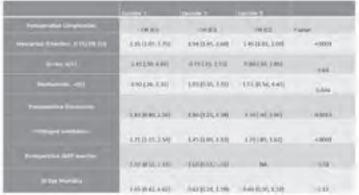
Purpose: Multiarterial coronary artery bypass grafting (MA-CABG) surgery improves long-term survival over single-arterial CABG, but effects of MA-CABG on survival stratified by The Society of Thoracic Surgeons (STS) predicted risk of mortality (PROM) are unknown. The purpose of this study was to determine if MA-CABG had differential benefits for higher risk patients.

Methods: A retrospective review of 20,385 patients who underwent CABG from January 2, 2002, through December 31, 2015, at Emory Healthcare Hospitals was performed. Emergent salvage patients were excluded. Patients were then divided into quintiles based on preoperative STS PROM scores (I: 0.2-0.5; II: 0.5-0.8; III: 0.8-1.4; IV: 1.4-2.6; V: 2.6-4.9). Multiple logistic regression analysis was used to assess the difference in postoperative and long-term outcomes between multi- and single-arterial grafting across PROM groups. Kaplan-Meier curves were constructed for comparisons of long-term survival.

Results: Over the study period, 3,584 patients (17.8%) underwent MA-CABG. Patients in the lowest PROM quintile were more than twice as likely to undergo MA-CABG compared to patients in the highest PROM stratum (22.8% vs 8.2%). Myocardial infarction, prolonged ventilation, and major adverse cardiac events were more likely for multi- than single-arterial across PROM strata (Table). While the entire cohort derived a survival benefit from MA-CABG, patients in the highest PROM quintile derived the greatest benefit compared to the other PROM strata from MA-CABG (HR 0.81; P = .04). Long-term survival was affected greatly by the number of arterial grafts per procedure and differed greatly by PROM (Figure).

Conclusions: In this large dataset, patients in the highest PROM quintile underwent the fewest number of multi-arterial CABG procedures but derived the greatest benefit in long-term survival. Further efforts should be made to use multi-arterial grafting strategies for all patients, concentrating on those with the highest short-term risk.





Adult Cardiac: Ischemic – Continued

1:45 PM Room 320ABC

Should Coronary Revascularization With Bilateral Internal Mammary Arteries Be the **Default Approach?**

J. DeSimone¹, D. J. Malenka¹, P. W. Weldner², A. Iribarne¹, B. J. Leavitt³, J. N. McCullough¹, R. D. Quinn⁴, J. D. Schmoker³, R. S. Kramer⁵, Y. R. Baribeau⁶, J. D. Klemperer⁷, G. L. Sardella⁸, E. Olmstead¹, C. S. Ross⁹, A. W. Discipio¹

¹Dartmouth-Hitchcock Medical Center, Lebanon, NH, ²Central Maine Heart and Vascular Institute, Portland, ³University of Vermont Medical Center, Burlington, ⁴Maine Medical Partners Cardiothoracic Surgery, Portland, 5Maine Medical Center, Portland, 6Catholic Medical Center, Manchester, NH, ⁷Eastern Maine Medical Center, Bangor, ⁸Concord Hospital, NH, ⁹Dartmouth College, Lebanon, NH

COMMERCIAL RELATIONSHIPS J. D. Schmoker: Consultant/Advisory Board, Medtronic

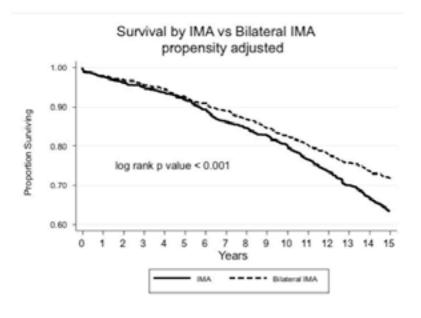
Purpose: In coronary artery bypass grafting (CABG) surgery, arterial conduits are preferred to venous conduits because of longer patency. A single internal mammary artery (IMA) is used routinely. Bilateral internal mammary arteries (BIMA) are used less frequently. We sought to determine if BIMAs had improved survival compared to IMA.

Methods: From our regional registry of consecutive open heart surgeries, we identified 48,175 patients who underwent isolated CABG from 1992 to 2014. Of the 1,482 patients with BIMA, 1,297 were propensity score-matched to a cohort of IMA patients. Short-term outcomes were compared using standard statistical techniques. Long-term survival was compared using Kaplan-Meier estimators and compared using a log-rank test.

Results: BIMA patients were younger and had fewer comorbid conditions than IMA patients. After propensity weighting, BIMA and IMA patients were well matched. There was no difference in in-hospital outcomes for BIMA vs IMA patients: mortality (1.2% [n=15] vs 0.8% [n=10], P = .315); stroke (0.7% [n=9] vs 0.7% [n=9], P = 1.000); bleeding (2.2% [n=28] vs 2.8% [n=36], P = .311); mediastinitis (0.8% [n=10] vs 0.9% [n=12], P = .667). The median follow-up was 12 years. Survival (Figure) was better for BIMA than IMA (P < .001). Survival curves began to separate at 5 years. At 15 years, the absolute difference in survival was 8.4%.

Conclusions: In a large regional experience, BIMA is associated with no upfront risk of adverse events and improved long-term survival compared to IMA. Our results indicate that BIMA conduits should be considered more frequently during CABG due to their demonstrated survival advantage.





Adult Cardiac: Ischemic – Continued

2:00 PM Room 320ABC

Should Diabetes Be a Contraindication to Bilateral Internal Mammary Artery **Grafting? A Multicenter Analysis**

A. Iribarne¹, B. M. Westbrook², D. J. Malenka¹, J. D. Schmoker³, J. N. McCullough¹, B. J. Leavitt³, P. W. Weldner⁴, J. DeSimone¹, R. S. Kramer⁵, R. D. Quinn⁶, E. Olmstead¹, J. D. Klemperer⁷, G. L. Sardella⁸, C. S. Ross⁹, A. W. Discipio¹

¹Dartmouth-Hitchcock Medical Center, Lebanon, NH, ²Catholic Medical Center, Manchester, NH, ³University of Vermont Medical Center, Burlington, ⁴Central Maine Heart and Vascular Institute, Portland, 5Maine Medical Center, Portland, 6Maine Medical Partners Cardiothoracic Surgery, Portland, ⁷Eastern Maine Medical Center, Bangor, ⁸Concord Hospital, NH, ⁹Dartmouth College, Lebanon, NH

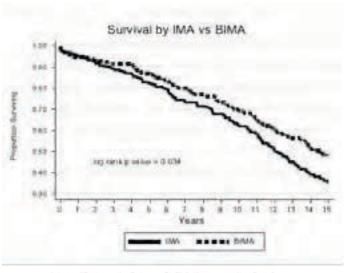
COMMERCIAL RELATIONSHIPS J. D. Schmoker: Consultant/Advisory Board, Medtronic

Purpose: To evaluate the influence of diabetes on in-hospital morbidity and long-term survival among patients undergoing coronary artery bypass grafting (CABG) surgery with bilateral internal mammary artery (BIMA) vs single internal mammary artery (IMA) conduits.

Methods: A multicenter, retrospective analysis of 48,175 consecutive CABGs performed from 1992 to 2014 among seven medical centers reporting to a prospectively maintained clinical registry was conducted. Among the study population, 1,482 CABGs with BIMA were identified, and 1,297 BIMA patients were propensity score-matched to 1,297 IMA patients. The rate of diabetes was 16.7% (n=217) among IMA and 16.4% (n=213) among BIMA. The primary endpoint was all-cause mortality. Additionally, data on postoperative morbidity (including stroke and frequency of mediastinitis), length of stay, and in-hospital mortality were analyzed.

Results: The median duration of follow-up for the series was 9.3 years (interquartile range 4.3-13.9 years). Among diabetics in the propensity score-matched cohort, there was no significant difference in age, body mass index, or major baseline comorbidities. The groups were matched in the number of diseased coronary arteries: BIMA three-vessel disease 51.2% (n=109) vs IMA three-vessel disease 54.4% (n=118), P = .413; and the completeness of revascularization (P = .074). Groups did not differ in the urgency of surgery (BIMA elective 32.4% (n=69) vs IMA elective 40.1% (n=87), P = .058) or the rate of a recent myocardial infarct (P = .725). There was no overall difference in the frequency of in-hospital morbidity or mortality (Table). Specifically, the frequency of mediastinitis was 2.8% (n=6) among BIMA and 1.8% (n=4) among IMA (P = .503). Both groups had a similar median length of stay of 5 [4-7] days. Diabetics who received a BIMA had significantly improved long-term survival when compared to IMA patients (P = .034, Figure).

Conclusions: Among diabetics, use of BIMA during CABG does not result in an increase in in-hospital morbidity or mortality and confers a long-term survival advantage when compared to IMA. Thus, diabetes should not be considered a contraindication to BIMA grafting.



Intra- and Postoperative Outcomes for Diabetics - propensity adjusted

Variable	IMA	BIMA	p value*
Number of procedures	217	213	
In-hospital mortality, %	2.3	1.9	0.758
Operative mortality**, %	2.3	2.4	0.970
Return to O.R. for bleeding, %	1.8	2.8	0.503
Mediastinitis/sternal dehiscence, %	1.8	2.8	0.503
Stroke, %	1.8	1.9	0.979
Median length of stay surgery to	5	s	0.498
discharge, days			

^{*} p value for chi square to Wilcoxon rank sum

THE RESIDENCE OF STREET, STREE

2:15 PM

Video: How I Do Internal Mammaries

Faisal G. Bakaeen, Cleveland, OH



test **In-hospital or 30-day mortality

Adult Cardiac: Ischemic – Continued

2:35 PM Room 320ABC

Hybrid Coronary Revascularization vs On-Pump Coronary Artery Bypass Grafting: Comparative Effectiveness Analysis With Long-Term Follow-Up

V. Giambruno¹, P. Jones¹, F. Khaliel¹, S. A. Fox², M. Chu¹, P. Teefy¹, K. Sridhar¹, S. Lavi¹, R. Bagur¹, P. Diamantouros¹, I. Iglesias¹, D. Bainbridge¹, B. Kiaii¹

¹Western University, London Health Sciences Centre, Canada, ²University of Western Ontario, London, Canada

COMMERCIAL RELATIONSHIPS M. Chu: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, LivaNova, Medtronic, Canada, Symetis; B. Kiaii: Speakers Bureau/Honoraria, Johnson & Johnson, LivaNova, Medtronic, Symetis; Consultant/Advisory Board, Johnson & Johnson, LivaNova, Medtronic, Symetis; P. Teefy: Speakers Bureau/Honoraria,

Purpose: Hybrid coronary revascularization (HCR) most commonly combines a minimally invasive coronary artery bypass grafting (CABG) procedure involving the left internal thoracic artery (LITA) to the left anterior descending coronary artery (LAD) anastomosis with percutaneous coronary intervention (PCI) to non-LAD vessels. We provide a comparative analysis to conventional on-pump CABG with long-term follow-up.

Methods: We enrolled all double on-pump CABG (n=682) and HCR (147 robotic-assisted minimally invasive direct CABG of the LITA to the LAD and PCI to one of non-LAD vessels) at our institution between March 2004 and November 2015. We performed an adjusted analysis using inverse-probability weighting (IPW) based on the propensity score of receiving either off-pump CABG or HCR (139 observations were excluded). To compare covariates of the two groups, we computed standardized differences. We performed inverse probability weight-adjusted analysis of the outcomes using the teffects ipw package and using the average treatment effect (P < .05 was considered significant).

Results: In the two groups, there were not statistically significant differences in rate of re-exploration for bleeding (CABG 1.7%, HCR 2.8%, P = .44), perioperative myocardial infarction (CABG 1.1%, HCR 1.4%, P = .79), stroke (CABG 2.4%, HCR 2.1%, P = .83), need of hemodialysis (CABG 0.4%, HCR 0%, P = .16), prolonged mechanical ventilation (CABG 2%, HCR 0.7%, P = .15), ICU length of stay (CABG 1.7 days ± 2.3 days, HCR 1.0 day \pm 0.8 day, P = .23). HCR was associated with a lower blood transfusion rate (CABG 25%, HCR 14%, P = .002), lower in-hospital mortality (CABG 1.3%, HCR 0%, P = .008), shorter hospital length of stay (CABG 6.7 days \pm 4.7 days, HCR 4.5 days \pm 2.1 days, P < .001). After the median follow-up period of 70 (37-106) months (CABG group) and 96 (53-114) months (HCR group), there was no significant difference in survival (CABG 92%, HCR 97%, P = .13) and freedom from any form of revascularization (CABG 93%, HCR 91%, P = .27). HCR was superior in freedom from angina (CABG 70%, HCR 91%, P < .001).

Conclusions: HCR seems to be a feasible, safe, and effective coronary artery revascularization strategy in selected patients with multivessel coronary artery disease. It seems to provide faster postoperative recovery with similar and excellent short- and longterm outcomes when compared with standard on-pump CABG.

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Abbreviations C) - postkined interval, PC1 - partitionance communications and CMHC - commany artery hypers grafting, SD - standard deviation; RCU - intensitie consent, IQR - inter-quartile range.

2:50 PM

How I Do Hybrid Coronary Revascularization

Michael E. Halkos, Atlanta, GA

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ M.\ E.\ Halkos:\ Consultant/Advisory\ Board,\ Medtronic$

3:10 PM

How to Build a Coronary Artery Bypass Grafting Bundle

Alan M. Speir, Falls Church, VA

COMMERCIAL RELATIONSHIPS A. M. Speir: Consultant/Advisory Board, Medtronic



1:30 PM - 3:30 PM Room 360BC

Congenital: Pediatric Congenital I

Moderators: Jonathan M. Chen, Seattle, WA, and Ralph S. Mosca, New York, NY COMMERCIAL RELATIONSHIPS J. M. Chen: Speakers Bureau/Honoraria, Medtronic

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

1:30 PM

Left-Sided Operations After Arterial Switch Operation for D-TGA and DORV-TGA Type: A **Multicenter European Congenital Heart Surgeons Association Study**

V. Vida¹, L. Bagozzi¹, L. Zanotto¹, M. Padalino¹, G. E. Sarris², E. Protopapas³, C. Pizarro⁴, C. Prospero⁵, E. Woodford⁶, H. Berggren⁶, M. Kostolny⁷, I. Omeje⁷, V. Hraska⁸, A. Kadner⁹, T. P. Carrel¹⁰, P. H. Schoof¹¹, M. Nosal¹², J. I. Fragata¹³, L. A. Vricella¹⁴, D. E. Cameron¹⁵, V. Sojak¹⁶, J. Salminen¹⁷, I. Mattila¹⁸, C. Schreiber¹⁹, J. Cleuziou¹⁹, T. Tlaskal²⁰, D. Gergori²¹, G. Stellin²², B. Maruszewski²³, P. Myers²⁴, M. Hazekamp¹⁶, M. Kozlowski²³

¹University of Padua, Italy, ²Athens Heart Surgery Institute, Greece, ³Athens Heart Institute, Greece, ⁴Nemours/Alfred I. duPont Hospital for Children, Wilmington, DE, ⁵Nemours Cardiac Center, Alfred I. duPont Hospital for Children, Wilmington, DE, ⁶The Queen Silvia Children's Hospital, Gothenburg, Sweden, ⁷Great Ormond Street Hospital for Children, London, United Kingdom, & German Pediatric Heart Center, Sankt Augustin, Germany, Genter for Congenital Heart Disease, Bern, Switzerland, ¹⁰Clinic for Thoracic and Cardiovascular Surgery, Bern, Switzerland, ¹¹University Medical Center Utrecht, Netherlands, ¹²Children's Heart Center, Bratislava, Slovakia, 13 Hospital de Santa Marta, Alges, Lisbon, Portugal, 14 The Johns Hopkins University, Baltimore, MD, 15 The Johns Hopkins Hospital, Baltimore, MD, 16 Leiden University Medical Center, Netherlands, 17 Hospital for Children and Adolescents, Helsinki University Central Hospital, Finland, ¹⁸Childrens Hospital, Helsinki University Hospital, Finland, ¹⁹German Heart Center Munich, ²⁰Children's Heart Center at Motol University Hospital and Second Faculty of Medicine at Charles University, Prague, Czech Republic, ²¹Unit of Biostatistics, Epidemiology and Public Health Unit, Department of Thoracic, Cardiac and Vascular Sciences, Padua, Italy, ²²University of Padua Medical School, Italy, ²³Children's Memorial Health Institute, Warsaw, Poland, ²⁴Geneva University Hospitals, Switzerland

Purpose: To report types and outcomes of left-sided surgical reoperations after the arterial switch operation (ASO) for dextro-transposition of the great arteries (D-TGA) and double outlet right ventricle (DORV-TGA type).

Methods: Sixteen of the 42 European Congenital Heart Surgeons Association centers contributed to data collection. We included 111 patients who underwent left-sided reoperation following ASO between 1975 and 2010. Median age at ASO was 10 days (interquartile range [IQR] 6.5-76 days). Original diagnoses included: D-TGA, n=104 (including D-TGA intact ventricular septum, n=27, and more complex forms of D-TGA,



n=77) and DORV-TGA type, n=7. Main indications for reoperation were aortic valve regurgitation (n=68), neo-aortic root dilation/stenosis (n=25), and coronary artery problems (n=18).

Results: Median age at reoperation was 8.9 years (IQR 3-14 years). Left-side surgical procedures included: aortic valve replacement (n=32), neo-aortic valve plasty (n=19), patch enlargement of ascending aorta (n=14), relocation of coronary ostium (n=12), coronary artery bypass (n=10), Bentall procedure (n=10), switch-back operation (n=5), and other less common procedures (n=30). Median follow-up time after reoperation was 5.8 years (IQR 3-11 years). There were six hospital (5.4%) and four late (3.8%) deaths after reoperation. Hospital mortality was higher in patients with DORV- TGA type (P = .006). Seventeen patients (16%) underwent a second reoperation, including: aortic valve replacement (n=6), re-aortic valve replacement (n=2), Bentall procedure (n=4), heart transplant (n=2), and other less common other procedures (n=6). The majority of survivors were asymptomatic (91/101, 90%) and doing well.

Conclusions: Reoperations for residual left-sided lesions may become necessary late after ASO, with aortic valve regurgitation and neo-aortic root dilation/stenosis being the most frequent indications. Risk at reoperation is low; nonetheless, DORV-TGA type was significantly associated with a higher hospital mortality at reintervention. Recurrent reoperations are not infrequent.

Congenital: Pediatric Congenital I – Continued

Room 360BC 1:45 PM

Improving Results of Surgery for Ebstein's Anomaly: Where Are We After 235 Cone Repairs?

K. Holst, S. Said, R. Pike, P. O'Leary, H. Connolly, J. Dearani

Mayo Clinic, Rochester, MN

Purpose: Ebstein's anomaly (EA) has heterogeneous anatomy, and numerous operative techniques are described. Cone repair (CR) includes circumferential leaflet delamination and annular reattachment at the true atrioventricular junction, providing a near anatomic repair. The purpose of this study was to examine a single institution's experience with CR in a large series.

Methods: There were 235 consecutive patients with EA, 134 children (57%) and 101 adults (43%), who underwent CR from June 2007 to December 2015. Mean age was 21.2 years (6 months to 73.4 years). It was the first operation in 192 (82%), second in 41 (17%), and third in two (1%). Previous tricuspid valve (TV) repair had been performed in 27 (12%), atrial septal defect (ASD) or patent foramen ovale (PFO) closure in 20 (9%), and bidirectional Glenn in seven (3%). History of arrhythmia was present in 90 (38%) and accessory pathway was most common (41/90=46%); 49 (49/90=54%) had history of preoperative ablation.

Results: All underwent CR. TV repair modifications included leaflet augmentation in 67 (28%), Sebening stitch in 57 (24.2%), neochordae in 40 (17%), and annuloplasty band in 156 (66%). Associated procedures included right reduction atrioplasty in 204 (87%), ASD/ PFO closure in 150 (64%), subtotal ASD closure in 26 (11%), ventricular plication in 136 (58%), Maze in 56 (24%), and bidirectional Glenn in 46 (20%). There was one early death (0.4%). Early morbidity included in-hospital reoperation for recurrent TV regurgitation in 14 (5.9%); re-TV repair was possible in seven (50%). The majority of early reoperations (11/14=79%) occurred in the first third of the series. Extracorporeal membrane oxygenation was required in six patients (2.5%). Pericardial effusion requiring pericardial window occurred in two (0.8%) and stroke in one (0.4%). Mean follow-up was 2.6 years ± 2.3 years. There were six late reoperations on the TV; re-repair was possible in all. Mean time to reoperation was 4.7 years ± 3.2 years; freedom from late reoperation was 97.3% at 6 years. Survival at 6 years was 98%.

Conclusions: CR and selective TV repair modifications were safe and effective in addressing the anatomic diversity of EA. TV replacement was rare and the rate of reoperation at intermediate follow-up was low. The learning curve for this operation is steep. Additional follow-up is required to assess the late durability of CR.



2:00 PM

Promising Mid-Term Functional Outcomes of Anatomic Correction of Corrected Transposition of the Great Arteries

V. Hraska, M. Vergnat, P. Zartner, C. Hart, P. Suchowerskyj, B. Bierbach, E. Schindler, B. Asfour, M. Schneider

German Pediatric Heart Center, Sankt Augustin, Germany

COMMERCIAL RELATIONSHIPS M. Schneider: Consultant/Advisory Board, St Jude Medical, W. L. Gore & Associates

Purpose: Anatomic correction of congenitally corrected transposition of the great arteries (ccTGA), utilizing the morphologic left ventricle as a systemic pumping chamber, is the preferred method. The purpose of the study was to analyze functional outcome after anatomical correction.

Methods: Between 1997 and May 2016, 62 patients with ccTGA and associated lesions underwent anatomical correction. Forty-two patients (67%) underwent palliation before correction, including 12 patients (19%) who required training of the left ventricle. The mean interval between palliation and correction was 2.2 years. The double switch procedure was performed in 33 patients; 24 patients underwent the Senning/Rastelli operation, and in one patient, a combination of Senning and aortic translocation was used. The median age at final operation was 1.5 years (range 0.2-15.7 years).

Results: The survival benefit and freedom from reoperation was 94% and 72% at 15 years of follow-up, respectively. Three patients needed reoperation of the right ventricular outflow track, three had an obstruction in the Senning pathway, and two others underwent enlargement of the intraventricular tunnel. Function of the systemic ventricle was normal in all patients but one, who had a moderately depressed function and aortic regurgitation. Mild to moderate neo-aortic regurgitation was noticed in four patients. Preoperatively, tricuspid regurgitation was detected in 21 patients (36%), but in all 21 patients, it had become irrelevant following the operation. All patients were in sinus rhythm, but 13 patients (20%)—seven before and six after the operation—required implantation of a pacemaker. Neurological development was normal in all patients and 52% of the patients were without any medication.

Conclusions: Anatomical correction of ccTGA is a safe procedure that provides an excellent function of the systemic left ventricle, even in patients who needed preoperative training of the left ventricle. Tricuspid regurgitation, which frequently is seen preoperatively, does not require intervention. Heart block is imminent for the whole group of patients.

Congenital: Pediatric Congenital I – Continued

Room 360BC 2:15 PM

Excision of Systemic Atrioventricular Valve Facilitates Placement of Continuous Flow Ventricular Assist Devices in Pediatric Patients With Congenital Heart Disease

D. Nandi, K. D. Miller, C. M. Bober, T. Rosenthal, L. M. Montenegro, J. W. Rossano, J. W. Gaynor, C. E. Mascio

The Children's Hospital of Philadelphia, PA

Purpose: Continuous flow ventricular assist devices (CF VADs) increasingly are being used in pediatric patients. However, due to size and anatomy, there is a greater risk of device inflow obstruction. We report here our experience managing this complication by excising the atrioventricular valve (AVV) at or near the time of VAD implantation.

Methods: This retrospective study reviews all cases of systemic AVV excision with HeartWare VAD (HVAD) implantation in the systemic ventricle performed at our institution from November 2015 through May 2016. Demographics, intraoperative data, and postoperative outcomes were collected from the medical record.

Results: AVV excision with HVAD implantation was undertaken in three patients (Table). Patient 1 was palliated in infancy, resulting in biventricular physiology with a systemic right ventricle (RV). This patient presented at age 15 years with worsening systemic ventricular dysfunction and tricuspid regurgitation (TR). After HVAD implantation in the systemic RV, the patient developed tricuspid valve (TV) obstruction to VAD inflow and underwent TV excision on postoperative day 52. Patients 2 and 3 were under age 4 years, single RV variants, status-post Fontan palliation, with subsequent systemic ventricular dysfunction and TV regurgitation. In both Fontan patients, the HVAD was implanted in the right atrium with simultaneous excision of TV (Figure). All three patients were extubated within 72 hours, and none has had evidence of elevated atrial pressures or recalcitrant pulmonary edema. There have been no concerns for inflow obstruction or low flows in follow-up thus far.

Conclusions: HVAD implantation with AVV excision can successfully support complex congenital heart disease patients in a wide range of size (smallest body surface here of 0.58 m²) and anatomy (small chambers, with thinner walled RV). This technique may allow for CF VAD implantation in patients previously deemed too small for such support.



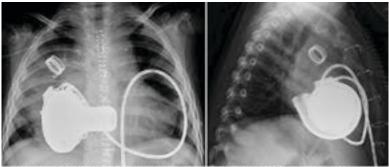


Figure: 2-view chest radiograph of a 3.7-year-old child with Fontan physiology after HeartWare ventricular assist device implantation in right atrium with simultaneous atrioventricular valve excision

Table: Characteristics of pediatric patients undergoing HVAD implantation with AVV excision

Patient: Diagnosis	Age & BSA	HVAD implantation site	HVAD speed / Cardiac output	Follow-up time / status
Situs inversus, DORV/pulmonary atresia, LV-PA conduit, RV-aorta baffle, failing systemic ventricle	16 years; 1.43m ²	Right ventricle	2800 RPM / 4-5.2 L/min	143 days; ongoing support
 DORV/mitral atresia, Fontan, mechanical AVV dehiscence 	3.7 years; 0.62m ²	Right atrium	2560 RPM / 2.6 - 3.0 L/min	84 days; ongoing support
3: HLHS, Fontan, worsening failure on milrinone	3.8 years; 0.58m ²	Right atrium	2700 RPM / 3.5 – 4.5 L/min	22 days; ongoing support

Abbreviations: BSA, Body Surface Area; HVAD, HeartWare Ventricular Assist Device; DORV, Double Outlet Right Ventricle; LV, Left Ventricle; PA, Pulmonary Artery; RV, Right ventricle; AVV, Atrioventricular valve; HLHS, Hypoplastic Left Heart Syndrome; RPM, Revolutions per minute.

2:30 PM

Liver Disease After the Fontan: Report From the ACC Consortium

Speaker TBD



Hospital Medical Center, OH

Congenital: Pediatric Congenital I – Continued

Room 360BC 2:45 PM

An Optimal Organ Acceptance Rate for Pediatric Heart Transplantation: Is There a "Sweet Spot?"

C. Park¹, C. Villa¹, A. Lorts¹, C. Chin¹, J. S. Tweddell², F. Zafar¹, D. L. Morales¹ ¹Cincinnati Children's Hospital Medical Center, OH, ²Heart Institute, Cincinnati Children's

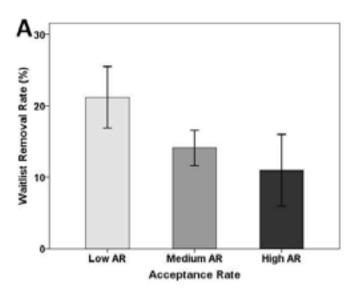
COMMERCIAL RELATIONSHIPS D. L. Morales: Consultant/Advisory Board, Berlin Heart, CorMatrix, HeartWare, SynCardia; Research Grant, CorMatrix; J. S. Tweddell: Consultant/Advisory Board, CorMatrix

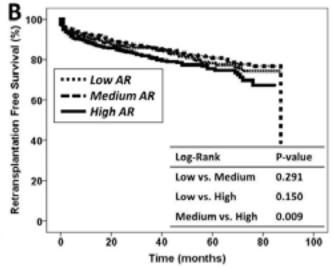
Purpose: Despite a limited supply of pediatric donors, potential donor hearts are often declined for subjective concerns regarding organ quality. We sought to define the relationship between donor heart acceptance rate (AR) and patient outcome at pediatric transplant centers.

Methods: The United Network of Organ Sharing database was used to identify all match runs from January 2008 through March 2015 in which a heart offer was ultimately placed in a patient less than 18 years of age. Centers that received 10 or more offers per year were included (10,634 offers), and an acceptance rate (AR) was calculated for each center. Centers were stratified based on their AR: low (<20%, n=13), medium (20%-40%, n=16), or high (>40%, n=9). Waitlist (WL) (n=3,730) and post-transplant (n=2,579) outcomes were compared among the AR groups.

Results: The mean AR was 29% ± 14% (8%-60%). There was no intergroup difference in transplantation volume (low: 6/year vs medium: 10/year vs high: 9/year; P = .115) and offer volume (low: 43/year vs medium: 33/year vs high: 21/year; P = .228). Low AR centers experienced higher rates of adverse WL outcome (WL removal due to death or decompensation) at 24%, compared to medium (17%; P = .022) and high (13%; P = .004) AR centers (Figure). There was no significant difference in posttransplant survival between low AR centers vs medium (P = .311) and high (P = .393) AR centers; however, medium AR centers had higher posttransplant survival compared to high AR centers (P = .037) (Figure). Overall survival from time of listing regardless of transplant (death, delisted for decline in condition, and retransplant as events) at 1 and 5 years was significantly worse for low AR centers (74% and 62%, respectively) compared to medium (80% and 70%, respectively; P < .001) and high (81% and 69%, respectively; P = .001) AR centers.

Conclusions: Transplant centers with a low AR experience higher WL mortality, and centers with high AR experience higher post-transplant mortality. An AR of 20%-40% appears to have optimal WL and post-transplant outcomes. Shared learning is necessary in order to help define best practices for donor acceptance and maximize overall patient survival.





Congenital: Pediatric Congenital I – Continued

3:00 PM Room 360BC

Long-Term Outcomes After Extracardiac Fontan Takedown to an Intermediate **Palliative Circulation**

M. Trezzi, E. Cetrano, S. Giannico, F. Iorio, S. B. Albanese, A. Carotti Bambino Gesù Children's Hospital, Rome, Italy

Purpose: Early failure of the Fontan circulation is rare in the current era but remains associated with a high morbidity rate. Little is known about the long-term outcomes of patients who underwent Fontan takedown to an intermediate palliative circulation and their potential candidacy for a second attempt at Fontan completion.

Methods: Patients followed up at a single institution who underwent acute takedown of a Fontan circulation to an intermediate palliative circulation within 2 months of extracardiac Fontan completion were reviewed. Patients who underwent a Fontan operation elsewhere and takedown at our institution or patients who underwent conversion of one form of modified Fontan connection to the extracardiac connection type were excluded.

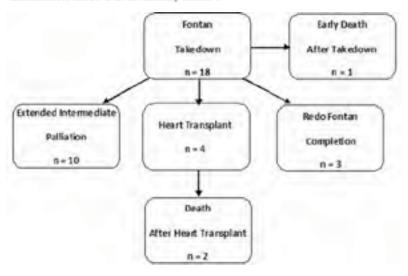
Results: Between 1990 and 2015, 18 patients underwent Fontan takedown at a median age and weight of 3.3 years (range 1.8-8.0 years) and 14.5 kg (range 8.0-27.0 kg), respectively. Fontan fenestration was performed in 10 patients. Takedown was required during the Fontan procedure itself in two patients and within the first 2 postoperative months in 16 (median time to takedown was 3 days, Table). Anatomic obstruction was ruled out as a cause of Fontan failure in 10 patients with postoperative cardiac catheterization. Overall, 17 patients survived the early period after takedown, and three ultimately underwent successful extracardiac Fontan completion at a median of 2.1 years after takedown. Four patients underwent heart transplantation with two late mortalities (Figure). In those with extended intermediate palliation (superior cavopulmonary anastomosis with or without shunt), median arterial oxygen saturation was 83% (range 76%-89%) at a median follow-up of 7.0 years (range 0.9-26.2 years).

Conclusions: Fontan takedown to an intermediate palliative circulation is associated with satisfactory long-term survival and adequate arterial oxygen saturation level. A thorough evaluation for treatable pulmonary arterial abnormalities should be performed in all patients in order to address residual hemodynamically significant lesions and to assess future candidacy for redo surgery.

Table 1. Baseline Patients Characteristics, Timing and Indications for Fontan Takedown

3.3 (1.8-8.0)
14.5 (8.0-27.0)
5
2
9
26.6 (9.9-79.9)
11.5(9.0-15.0)
8 (3.0-12.0)
78 (67-91)
10
3 (0-41)
3
8
11
2
1
15
3
85 (76-98)

Indications for takedown are not mutually exclusive



Congenital: Pediatric Congenital I – Continued

3:15 PM Room 360BC

Determinants of Adverse Outcomes After Systemic-to-Pulmonary Shunts in Biventricular Circulation: The Melbourne Experience 2004-2014

B. Hobbes¹, Y. d'Udekem¹, D. Zannino², C. P. Brizard³, I. E. Konstantinov³, **J. Brink**¹ ¹The Royal Children's Hospital, Melbourne, Australia, ²Murdoch Childrens Research Institute, Parkville, Australia, ³Royal Children's Hospital Melbourne, Parkville, Australia COMMERCIAL RELATIONSHIPS C. P. Brizard: Consultant/Advisory Board, Admedus Australia; Ownership Interest, Admedus Australia; Y. d'Udekem: Consultant/Advisory Board, MSD, Actelion Pharmaceuticals US

Purpose: The systemic-to-pulmonary shunt is a useful palliative procedure; however, many teams have been deterred from its use due to associated high mortality and morbidity. We aimed to identify predictors of adverse outcomes after systemic-to-pulmonary shunts in biventricular hearts in order to determine whether these events could be prevented.

Methods: From January 2004 to December 2014, 173 consecutive children underwent a left (nine) or right (86) modified Blalock-Taussig shunt or central shunt (78). Morphologies included: tetralogy of Fallot (69), pulmonary atresia with ventricular septal defect (VSD) with major aortopulmonary collaterals (MAPCAs) (29) and without MAPCAs (44), transposition of great arteries with pulmonary stenosis (16), double outlet right ventricle (10), and others (five). Median age was 22 days (3-3,438 days) and median weight 3.2 kg (1.720 kg). Shunt sizes were 3 mm (71), 3.5 mm (73), 4 mm (21), and > 4 mm (seven), with a median shunt size/weight ratio of 1.03 mm/kg (0.32.5 mm/kg).

Results: In-hospital mortality was 5.2% (9/173) for the initial shunt procedure. Inter-stage mortality was 3.6% (6/173). Overall, 148 patients (86%) progressed to corrective surgery. Acute events were observed in 41 patients (24%), leading to six deaths. Events included 30 emergency chest openings, 16 shunt thromboses, and 17 pulmonary overcirculations. Independent predictors of acute events or in-hospital mortality were genetic or extracardiac anomalies (HR = 1.9, P = .04), and preoperative shock/acidosis (HR = 2.73, P = .003). Diagnosis of pulmonary atresia with VSD and MAPCAs was protective (HR = 0.23, P = .042). Weight, shunt size, and size/weight ratios were not significant risk factors for hospital mortality or acute events. Shunt thrombosis occurred at a median of 3 hours postoperatively (046 hours) and led to 33% (3/9) of in-hospital deaths. High preoperative platelet count, platelet transfusion, and low immediate postoperative PaO, were predictors of shunt thrombosis by univariate analysis.

Conclusions: Mortality and morbidity remain significant after systemic-to-pulmonary shunts mainly due to early adverse events. These events are not influenced by patient or shunt size. Patients with lower oxygen saturation and platelet transfusion in the immediate postoperative period are at higher risk of shunt thrombosis and should receive more intensive surveillance.

NOTES



1:30 PM - 3:30 PM Room 361BC

General Thoracic: Lung Cancer I

Moderators: David T. Cooke, Sacramento, CA, and Thomas K. Varghese Jr, Salt Lake City, UT COMMERCIAL RELATIONSHIPS D. T. Cooke: Consultant/Advisory Board, Emmi Solutions, Core Mobile

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, a debate, and a brief question-and-answer session after each topic.

1:30 PM

Neoadjuvant Chemotherapy and Radiation Show No Survival Advantage Over Chemotherapy Alone in Stage IIIA Patients: A Propensity Score-Matched Analysis of the **National Cancer Database**

S. B. Krantz¹, B. A. Mitzman², W. Lutfi¹, C. Wang¹, J. A. Howington³, K. Kim¹ ¹NorthShore University Health System, Evanston, IL, ²The University of Chicago, IL, ³Saint Thomas Healthcare, Nashville, TN

Purpose: For operable patients with clinical stage IIIA non-small-cell lung cancer (NSCLC), there still is significant debate as to whether they should receive neoadjuvant chemotherapy combined with radiation or chemotherapy alone. Our aim was to compare perioperative and long-term outcomes in patients receiving neoadjuvant chemoradiation vs those receiving chemotherapy alone.

Methods: We queried the National Cancer Database to identify all patients with N2 and either T1-T2 NSCLC who received either neoadjuvant chemotherapy (NCT) or combined chemotherapy and radiation (NCRT) followed by lobectomy between 2006 and 2012. Patients with T3 tumors were excluded. A propensity score-matched analysis was performed incorporating preoperative variables, and the incidence of postoperative complications, pathologic downstaging, and long-term survival were compared. Chi-square, ANOVA, and Kaplan-Meier methods were used for analysis.

Results: There were 1,936 patients who met criteria—745 who received NCT and 1,191 who received NCRT. Patients who received NCRT were older, less likely to be treated at an academic medical center, and more likely to have adenocarcinoma vs squamous cell carcinoma. After propensity score matching, there were 682 patients in each group. Patients in the NCT group showed lower 30-day (1.3% vs 2.9%) and 90-day mortality (2.9% vs 6.0%) compared with NCRT patients (Table). NCT patients were more likely to undergo a minimally invasive resection. With respect to long- term and oncologic outcomes, NCRT patients were more likely to have a pathologic complete response (14.2% vs 4.0%) and to have N0 status at the time of resection (45.2% vs 38.7%). Patients who had NCT had a median survival of 55 months, compared with 45.2 months in the NCRT group, though this fell short of statistical significance (Figure, P = .078).



Conclusions: In our cohort, combined neoadjuvant chemotherapy and radiation were associated with improved mediastinal and overall pathologic complete response, but showed increased perioperative mortality with no improvement in long-term overall survival. In stage IIIA patients with smaller tumors without local invasion, chemotherapy alone may be the preferred neoadjuvant treatment.

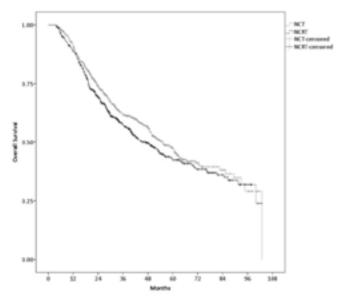


Table 1. Outcome: of propensity exatched analysis of patients receiving neoully wart therapy with either chemotherapy alone or combined chemotherapy and radiation.

	Chemotherapy Alone	Chenotherapy + Xadiation	
Pathologic T Stage			P=0.01
T0	5.9%	16 1%	
T1	46.9%	45.5%	
T2	44.3%	33.7%	
T3	2.8%	2.9%	
T4	0.9%	2.3%	
Pathologic NStage			Pw0.012
\$40	38.7%	45.2%	
341	12.9%	5.4%	
352	47.8%	44.0%	
10	0.3%	014	
Any Downstaging	57%	52.6%	Pw0.036
Complete Barponer	14.0%	14.2%	2 < 0.000
Median LOS (days)	6.67	6.95	p=0.523
30 Day Readminson	3.4%	4.4%	P=0.475
Minimally invaire	25.7%	14.1%	P<0.001
Convention rate	25%	24.1%	PHC 9
Preioperative Mortality			
30-day	1.2%	2.9%	P=0.039
90-day	2.9%	6.0%	P=0.006
Median Durvival (months)	55	45.3	P=0.078



General Thoracic: Lung Cancer I – Continued

1:45 PM Room 361BC

Concomitant Mediastinoscopy Increases the Risk of Postoperative Pneumonia After Thoracoscopic Lobectomy

S. Yendamuri¹, A. Battoo¹, K. Attwood¹, S. Dhillon¹, M. W. Hennon¹, A. L. Picone¹, M. Huang¹, C. E. Nwogu¹, T. L. Demmy², E. U. Dexter¹

¹Roswell Park Cancer Institute, Buffalo, NY, ²Rutgers Cancer Institute of New Jersey, New Brunswick

COMMERCIAL RELATIONSHIPS E. U. Dexter: Other, Author of Chapter, Up To Date

Purpose: Mediastinoscopy is considered the gold standard for pre-resectional staging of lung cancer. However, mediastinoscopy can induce temporary swallowing dysfunction even without obvious recurrent laryngeal nerve injury, predisposing patients to postoperative pneumonia (POP). We sought to examine the effect of concomitant mediastinoscopy on POP in patients undergoing lobectomy.

Methods: All patients in our institutional database (2008-2015) undergoing lobectomy who did not receive neoadjuvant therapy were included. The relationship between mediastinoscopy and POP was examined using univariate analyses (chi-square) and multivariate analysis (binary logistic regression). In addition, in order to validate our institutional findings, all patients having lobectomy with data in the National Surgical Quality Improvement Program (NSQIP) from 2005 to 2014 were analyzed to examine for these potential associations.

Results: Of 832 patients having a lobectomy at our institution, 754 (90.6%) had the lobectomy by video-assisted thoracoscopic surgery (VATS) and 498 (59.8%) underwent mediastinoscopy at the same time as a lobectomy. In patients undergoing a VATS lobectomy, mediastinoscopy was associated with higher POP (8.8% vs 5.3%; P = .049) with a trend toward an increase in POP for the entire cohort (9.4% vs 6.5%; P = .09). Binary logistic regression modeling retained only FEV, % predicted (forced expiratory volume in the first second predicted) and mediastinoscopy as predictors of POP in the VATS population. In the NSQIP cohort (n=12,785), mediastinoscopy was performed in only 8.9% of patients at the same time as the lobectomy, with 44.5% of the resections performed by VATS. Mediastinoscopy was associated with POP in patients having both open (OR 1.69; P < .001), as well as VATS lobectomies (OR 1.72; P = .002). This effect persisted after adjusting for covariates in both groups (OR 1.59 and 1.56 respectively; P < .01).

Conclusions: Mediastinoscopy is associated with an increased risk of POP after pulmonary lobectomy. This effect is accentuated in patients undergoing a VATS resection. This previously unrecognized side effect of mediastinoscopy should be considered while defining a preresectional staging algorithm for patients with lung cancer.



2:00 PM

Sleeve Pulmonary Resection in the United States: Analysis of National Trends, Practice Patterns, and Outcomes from the National Cancer Database

Z. Abdelsattar, M. S. Allen, S. H. Blackmon

Mayo Clinic, Rochester, MN

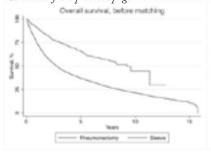
Purpose: To study the current national trends, practice patterns, and outcomes following pulmonary sleeve resection compared to pneumonectomy, and to assess if hospital sleeve-topneumonectomy (S:P) ratios are a marker of hospital quality.

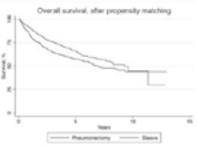
Methods: We identified all patients (n=13,369) undergoing sleeve resection (n=697 [5.2%]) or pneumonectomy (n=12,672 [94.8%]) in the National Cancer Database (NCDB) between 1998 and 2012 at 293 Commission on Cancer-accredited hospitals in the United States. To minimize confounding by indication, we used propensity score matching and Weibull survival analyses to estimate the average treatment effect on survival at the patient level. We then grouped hospitals into quintiles based on their S:P ratios and used multilevel modeling to analyze yearly trends, practice patterns, and outcomes at the hospital level.

Results: There has been a ~1%/year increase in sleeve resection rates, with wide variation in hospitals' S:P ratios (mean 1:8, range 1:143 to 2:1). Before propensity score matching, patients undergoing sleeve resections were younger (55.5 years ± 15.5 years vs 62.1 years ± 10.7 years; P < .001), had earlier clinical T (cT1= 20.8% vs 8.1%; P < .001) and N stages (cN0 = 36.7% vs 26.5%; P < .001), and were more likely to have upper lobe (54% vs 46.8%; P < .001) or main bronchus tumors (22.4% vs 8.5%; P < .001) compared to pneumonectomy. After matching, all measured differences were negligible with overall reduction in standardized bias to 2.5% (Table). Sleeve resections were associated with lower 30-day (1.3% vs 4.2%; P = .007) and 90-day mortality (1.3% vs 4.2%; P = .026) and improved overall survival (Figure). At the hospital level, hospitals with higher S:P ratios were not associated with better risk-adjusted 30-day (6.8% vs 6.5%; P = .059) or 90-day mortality (11.5% vs 11%; P = .064), nor same-hospital readmission (4.6% vs 4.4%; P = .434) rates.

Conclusions: Pulmonary sleeve resections are increasingly utilized across the United States. At the patient level, sleeve resections are associated with improved short-term outcomes and overall survival even after propensity score matching. However, hospital S:P ratios were not associated with better hospital-level risk-adjusted outcomes and thus cannot be used as a hospital quality measure.

General Thoracic: Lung Cancer I – Continued Continued from previous page





	Propensity Matched Cohort			
Characteristic	Type of Res			
	Preumonectomy (n=697)	Means (n=457)	p Value	
Age, y, mean +SC	55.4 + 14.9	55.5+15.5	0.84	
Gender; Male	341 (51.8)	381 (54.7)	0.20	
Race White	645 (92.5)	625 (89.7)	0.0	
Charlson-Deyo Score			0.45	
	388 (55.7)	417 (92)		
1	221 (31.7)	198 (29.4)		
3+	64 (9.2)	58 (8.4)		
Insurance			0.52	
Uninsumed	19 (2.7)	75 (10.8)		
Private:	383 (54.9)	237 (34)		
Government	282 (40.5)	290 (K2)		
Unknown	13 [1.9]	92 (33.2)		
Median income Quartiles			0.79	
< 538,000	132 (18.9)	26 (3.7)		
\$36,000 - \$47,999	167 (24)	365 (55.2)		
548.000 - 562,999	184 (26.4)	268 (38.5)		
568,000+	193 (27.7)	18 (2.6)		
% No High School Degree			0.17	
P=21%	104 (14.9)	133 (19.6)		
13% - 20.9%	162 (23.2)	150 (22.1)		
7% - 12.5%	272 (39)	185 (27.1)		
<7%	138 (19.8)	250 (31)		
Histology		500000	0.93	
Adenocarcinoma	70 (30)	106 (15.4)		
Igumous cell carcinoma	240 (34.4)	171 (25.1)		
Carcinold	295 (42.3)	219 (34.4)		
Other	92 (13.2)	168 (24.8)		
AJCC Clinical Tutage			0.96	
13	150 (21.5)	145 (20.8)		
12	146 (21.2)	152 (21.9)		
73	61 (8.8)	35 (7.9)		
74	22 (3.2)	24 (3.4)		
Unknown	336 (45.3)	321 (46.1)		
AJCC Clinical N stager			0.66	
NO	349 (35.7)	256 (36.7)		
NS .	65 (9.3)	60 (90		
N2	69 (9.9)	58 (8.3)		
N3	9 (3.30	3 (0.7)		
Unknown	305 (43.8)	375 (45.2)		
Turner location			0.90	
Main brenchus	157 (22.5)	156 (22.4)		
Upper lobe	100 (52.50	376 (540		
Middle lobe	27 (3.9)	32 (4.4)		
Lower lobe	138 (16.9)	130 (15.8)		
Overlapping lesion	7(1)	6 (D.9)		
W05	22 (3:2)	17 (2.4)		

2:15 PM Room 361BC

Timeliness of Care and Lung Cancer T-stage Progression: How Long Can We Wait?

A. Maiga¹, S. A. Deppen¹, R. Pinkerman², C. Callaway-Lane², P. P. Massion¹, T. Speroff³, R. S. Dittus¹, E. S. Lambright³, J. C. Nesbitt¹, D. Baker², E. L. Grogan¹

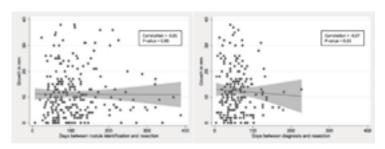
¹Vanderbilt University Medical Center, Nashville, TN, ²Tennessee Valley Healthcare System, Nashville, ³Vanderbilt University, Nashville, TN

Purpose: Timely care of lung nodules suspicious for cancer is presumed critical, yet there is a lack of experimental evidence of stage progression with delays in care. Our purpose was to investigate the reasons for delays in treatment and the impact these delays may have on stage progression.

Methods: We queried our retrospective single-institution database of 265 veterans who underwent lung resections for malignancy from 2005 to 2015. Exclusions were undocumented nodule size and neoadjuvant therapy. We extracted time intervals between nodule identification, diagnosis, and surgical resection, changes in nodule radiographic size over time, final pathological staging, and reasons for delays in care. Nodule growth was scaled to above zero. For nodules identified at <1 cm, the date of radiological growth was substituted as the "start" point. Pearson's correlation and Fisher's exact test were used to compare cancer growth and stage by time to treatment. Complete case analyses were used for missing data.

Results: Median time from referral to surgical evaluation was 11 days (interquartile range [IQR] 8-17 days). Median time from nodule identification to therapeutic resection was 98 days (IQR 66-139 days) and from diagnosis to resection was 53 days (IQR 35-77 days). Sixty-eight patients (26%) were diagnosed at resection; the remainder had preoperative tissue diagnoses. No correlation existed between tumor growth and time between nodule identification and resection or between tumor growth and time between diagnosis and resection (Figure). Among 197 patients with preoperative diagnoses, 42% (83) had intervals >60 days between diagnosis and resection. The most common reasons for delay were cardiac clearance (54% [45/83]), staging including mediastinoscopy (43% [36/83]), and smoking cessation (29% [24/83]). There was a negative correlation between nodule size at the time of identification and the number of days between nodule identification and surgical resection (-0.137, *P* = .03).

Conclusions: Medical evaluation, staging, and smoking cessation drive resection delays. Larger tumors had timelier resection. The lack of association between tumor growth and time to treatment suggests other clinical or biological factors, not time alone, underlie the growth risk. Until these factors are identified, delays to diagnosis and treatment should be minimized.





General Thoracic: Lung Cancer I – Continued

2:30 PM Room 361BC

Radiological Classifications of Multiple Lung Cancers and the Prognostic Impacts Based on the Presence of Ground-Glass Opacity Component on Thin-Section Computed Tomography

A. Hattori¹, K. Suzuki², T. Matsunaga¹, K. Takamochi¹, S. Oh¹

¹Juntendo University, Tokyo, Japan, ²Juntendo University School of Medicine, Tokyo, Japan

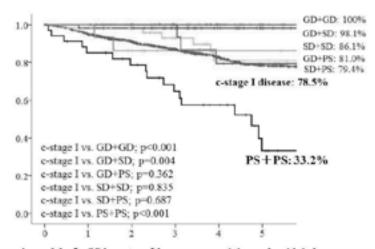
Purpose: The prognoses of ground-glass opacity (GGO) lesions are excellent despite their multifocal expression. The eighth edition of the TNM classification proposed that separate tumor nodules presenting as solid appearances are related to the upgrading of clinical stage; however, definition of the tumor findings and their prognostic impacts are still controversial.

Methods: We evaluated 1381 surgically resected c-stage I lung cancer between 2008 and 2013 in our institute. The findings of thin-section computed tomography (CT) were reviewed for all, and they were classified into three groups based on consolidation tumor ratio (CTR), ie, GGO-dominant (GD; $0 \le CTR < 0.5$), solid-dominant (SD; $0.5 \le CTR < 1.0$), and pure-solid (PS; CTR = 1.0). Among them, multiple lung cancers were radiologically divided into six types based on the CTR, and their prognoses were compared with that of c-stage I lung cancer using a Cox proportional hazards model. The survivals were calculated by Kaplan-Meier estimation methods using log-rank test.

Results: Multiple lung cancers presented in 246 (17.4%). The number of GD+GD was 73 (30%), GD+SD was 54 (22%), GD+PS was 52 (21%), SD+SD was 14 (6%), SD+PS was 18 (7%), and PS+PS was 34 (14%), respectively. A multivariate analysis revealed that dominant lesion showing PS and PS+PS type were independently significant prognostic factors (P = .025, .025). The overall survival (OS) of multiple lung cancers was 82.5% in the entire population, 100% in GD+GD, 98.1% in GD+SD, 81.0% in GD+PS, 86.2% in SD+SD, 79.4% in SD+PS, and 33.2% in PS+PS, which showed significant differences between PS+PS and the others (PS+PS vs GD+GD, *P* < .001; PS+PS vs GD+SD, *P* < .001; PS+PS vs GD+PS, P < .001; PS+PS vs SD+SD, P = .047; PS+PS vs SD+PS, P = .010). Furthermore, the OS of 1,135 c-stage I lung cancer was 78.5%, and the prognoses of multiple lung cancers were significantly poor only in patients with PS+PS type compared with that of c-stage I lung cancer (PS+PS vs c-stage I, P < .001), while the OS of the other types of multiple lung cancers were almost equivalent or much better than c-stage I disease.

Conclusions: Among the patients with multiple lung cancers, PS+PS type is associated with dismal survival, which would contribute to the upstaging of T descriptor. The presence of GGO based on thin-section CT is extremely important when considering the correlation between radiological classification of multiple lung cancers and its prognosis.





Comparison of the 5y-OS in e-stage I lung cancer and those of multiple lung cancers

General Thoracic: Lung Cancer I - Continued

2:45 PM Room 361BC

Caprini Risk Assessment Model Implementation Decreases Venous Thromboembolism Rates in High-Risk Thoracic Surgery Patients at a Safety Net Hospital

H. Sterbling¹, A. K. Rosen¹, K. Hachey², N. S. Vellanki¹, H. C. Fernando³, V. R. Litle³

¹Boston University School of Medicine, MA, ²Brigham and Women's Hospital, Boston, MA, ³Boston Medical Center, MA

COMMERCIAL RELATIONSHIPS H. C. Fernando: Consultant/Advisory Board, CSA Medical; Other, Medical Monitor, Galil Medical

 $\label{eq:Purpose:extended} \begin{tabular}{ll} Purpose: Extended postoperative chemoprophylaxis is effective in reducing venous thromboembolism (VTE) among general surgical patients. However, its safety and efficacy have not been established in thoracic surgery. We hypothesized that implementation of the Caprini risk assessment model (RAM) would reduce VTE rates among patients undergoing lung and esophageal resection for cancer. \\ \end{tabular}$

Methods: All patients undergoing major thoracic surgery at a safety-net hospital beginning in July 2014 were prospectively enrolled in the intervention group (Group 1), which included risk stratification and extended postoperative chemoprophylaxis with low molecular weight heparin (LMWH). Provider and patient adherence to treatment protocol was audited. VTE and adverse bleeding events were monitored for 60 postoperative days. A pre-intervention control group (Group 2) including esophagectomy and lung resection cancer patients (June 2003 – June 2013) was used for VTE rate comparison. Exclusion criteria included chronic anticoagulation and presence of filters.

Results: There were 15 esophagectomies and 45 lung cancer resections in Group 1 and 70 esophagectomies and 232 lung resections in Group 2 (Table). VTE rates before implementation of prolonged chemoprophylaxis were 14.3% (10/70) for esophagectomy patients and 5.2% (12/232) for lung resections. After implementation of the Caprini RAM and prescription of LMWH, VTE rates decreased to 5.6% for esophagectomy (P = .68) and 2.2% for lung resections (P = .7) (Figure). The overall VTE rates for Group 1 and Group 2 were 3.3% (2/60) and 7.3% (22/302), respectively (P = .39). Within the intervention group (all thoracic patients, n=216), providers assigned Caprini scores to 99.5% of patients (215/216), prescribed the appropriate prophylaxis regimen to 96.7% (208/216) of patients, and discharged 53.7% (116/216) of patients on LMWH prophylaxis. Outpatient adherence to treatment was 97.4%, and patient understanding of treatment was 73.7%. There have been no adverse bleeding events.

Conclusions: This study demonstrates a trend toward decreased VTE following Caprini RAM implementation, as demonstrated in high-risk cancer patients at a safety-net hospital. The absence of bleeding complications and high provider and patient adherence to VTE RAM support the safety and feasibility of a VTE prevention protocol in thoracic surgery patients.



16% 14% 14.3% 12% 10% 8% 604 6.7% 5.2% 4% 256 2.2% 096 Control Group Intervention Group Control Group Intervention Group Esophageal Cancer Lung Cancer

Figure 1. Control and Intervention groups VTE rates for esophageal and lung cancer patients

Table 1. High-risk thoracic surgery patient distribution and VTE event rate by group.

	High-risk Patients Distribution, n (%)	VTE (%)
Intervention Group (Group 1)	60	2 (3.3)
Enophageal Cancer	15 (25.0%)	1 (5.6)
Lung Cancer	45 (75.0%)	1 (2.2)
Control Group (Group 2)	302	22 (7.3)
Esophageal Cancer	70 (23.2%)	10 (14.3)
Lung Cancer	232 (76.8%)	12 (5.2)

3:00 PM

Debate: A Lung Cancer Bundle Is Possible

Pro: Wayne L. Hofstetter, Houston, TX **Con:** Daniel L. Miller, Marietta, GA

COMMERCIAL RELATIONSHIPS D. L. Miller: Consultant/Advisory Board, Ethicon, Medtronic; Research Grant, Medela

Room 361A 1:30 PM - 3:30 PM

General Thoracic: Lung Transplantation

Moderators: Errol L. Bush, San Francisco, CA, and Daniel Kreisel, St Louis, MO

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, a pro-con debate, and a brief question-and-answer session after each topic.

1:30 PM

Low Mortality and Morbidity After Lung Volume Reduction Surgery in Emphysema **Patients With Severely Impaired Diffusion Capacity**

C. Caviezel, I. Opitz, I. Inci, S. Hillinger, D. Franzen, W. Jungraithmayr, D. Schneiter, W. Weder University Hospital Zurich, Switzerland

Purpose: Lung volume reduction surgery (LVRS) has proven to be successful with low mortality when defined selection criteria are met. Diffusion capacity <20% and homogeneous emphysema is associated with high mortality. We hypothesized good outcome after LVRS for selected patients with severely impaired diffusion capacity with different morphologies and severe hyperinflation.

Methods: All patients for LVRS between March 2005 and May 2014 with preoperative diffusion capacity <20% were included in the study. Postoperative 90-day mortality was the primary endpoint. Emphysema morphology, postoperative complications, and preoperative and 3-month postoperative lung function served as secondary endpoints.

Results: Thirty-three patients with a median FEV₁ of 23% (range 16%-44%), a median diffusion capacity of 15% (10%-19%), and a median hyperinflation of 75.6% (RV/TLC, 57%-83%) were included. Twenty-six had heterogeneous emphysema, and seven patients showed homogeneous morphology. Eighteen procedures were performed bilaterally and 15 unilaterally, 31 were performed by VATS, and two were converted to open procedures due to adhesions. The 90-day mortality was zero. Median FEV, % at 3 months increased from 23% to 30.4% (P < .001). Median diffusion capacity increased from 15% to 26% (P < .001), and median hyperinflation decreased from 75.6% to 56% (P = .002). Thirteen patients (39.4%) had a prolonged air leak >7 days, and four of them needed reoperation for fistula closure. The seven patients with homogeneous emphysema showed an increase in FEV₁ of 43% from median 21% preoperatively to median 30% postoperatively (P = .042). There were two prolonged air leaks without reoperation.

Conclusions: Selected patients with severely impaired diffusion capacity should still be considered as potential candidates if hyperinflation is very severe and the lungs are not "vanished." Even in this subgroup, homogeneous emphysema morphology is not an absolute contraindication for LVRS.

1:45 PM

Long-Term Survival in Bilateral Lung Transplantation for Scleroderma-Related Lung Disease

E. Y. Chan, A. Goodarzi, N. Sinha, G. Youssef, E. Graviss, D. Nguyen, E. E. Suarez, T. A. Kaleekal, B. A. Bruckner, S. Scheinin

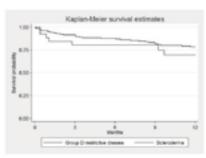
Houston Methodist Hospital, TX

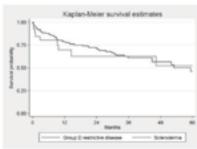
Purpose: Lung disease is the leading cause of morbidity and mortality in scleroderma patients. Scleroderma is often a contraindication to lung transplantation due to concerns that extrapulmonary involvement will yield worse outcomes, with medical therapies frequently ineffective and 3-year mortality exceeding 50%. Few studies have addressed long-term survival or rejection.

Methods: This was a single-center, retrospective cohort study of all patients undergoing bilateral lung transplantation (BLT) for scleroderma-related end-stage pulmonary disease between January 1, 2006, and December 31, 2014. This cohort was compared with a cohort of patients undergoing BLT for non-scleroderma group D restrictive disease over the same time period. Retransplant patients were excluded. Primary outcomes reported were 1-year and 5-year survival, with freedom from bronchiolitis obliterans syndrome and rates of acute rejection as secondary outcomes. Diagnoses were identified by United Network of Organ Sharing listing and were confirmed by explanted lung pathology.

Results: We compared 26 patients who underwent BLT for scleroderma to 155 patients who underwent BLT for non-scleroderma group D restrictive disease. Overall, the non-scleroderma cohort was younger with lower lung allocation scores but no difference in functional status. Donor characteristics were not significantly different between the two cohorts. Survival at 1 year was not significantly different between groups (73.1% vs 80.0%, P = .323). Long-term survival at 5 years also was not significantly different (65.4% vs 66.5%, P = .608). Multivariate Cox proportional hazards analysis found no significant differences in survival between scleroderma and non-scleroderma group D restrictive disease (HR 2.19, P = .122).

Conclusions: Despite being at high risk for extrapulmonary complications, patients undergoing BLT for scleroderma have similar 1-year and 5-year survival to those with restrictive lung disease. Transplantation is a reasonable treatment option for a carefully selected population of candidates.







General Thoracic: Lung Transplantation – Continued

2:00 PM Room 361A

Extracorporeal Membrane Oxygenation for Acute Lung Injury

Jonathan W. Haft, Ann Arbor, MI

2:15 PM

Young Recipients, Old Lungs: Does Double vs Single Lung Transplant Affect Overall Survival?

P. Henley, E. Schumer, J. Trivedi, V. H. van Berkel, M. Fox

University of Louisville, KY

Purpose: In an effort to expand the donor pool for lung transplant (LTx), multiple studies have examined the use of advanced age donors with mixed results, including decreased survival in younger recipients. We evaluated the impact of single vs double LTx on posttransplant survival with a recipient and donor age mismatch.

Methods: The United Network of Organ Sharing database was retrospectively queried between January 2005 and June 2014 to identify LTx patients between 18 and 50 years of age. This cohort was divided into two groups: patients with donor age <60 (age matched) and ≥60 (age mismatched). These groups were further stratified by the use of a single or double lung transplant, and overall survival was compared using Kaplan-Meier analysis. Multivariable survival analysis was performed using a Cox proportional hazards model.

Results: A total of 3,690 patients received lungs from a young donor (age matched) and 72 from an advanced age donor (age mismatched). The age matched group had 3,333 double LTx and 352 single LTx performed, while the age mismatched group had 62 double LTx and 10 single LTx. There was no significant difference in overall survival between the age matched and age mismatched groups (P = .161, Figure 1A). After stratifying for transplant type, there was no significant difference in survival between the matched and mismatched groups who underwent double lung transplants (P = .491); however, survival was significantly decreased in the mismatched group who underwent single LTx compared to double LTx (P = .017, Figure 1B). With multivariate analysis, recipient age (P < .0001), diagnosis (P < .0001), and single vs double LTx (P = .009) significantly affected long-term survival, while donor age did not (P = .281). An interaction between advanced age donors and single LTx was tested and approached significance (HR = 2.19, P = .077).

Conclusions: Use of young and advanced age donors produced comparable survival in young transplant recipients who underwent double LTx. Survival of young recipients who underwent single LTx was worse with advanced age donors. This suggests advanced age donors are viable options for young recipients but double LTx should strongly be considered.

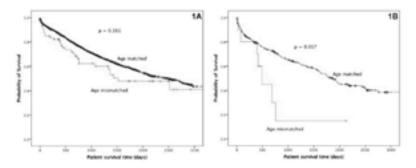


Figure 1. Comparison of survival for the age matched and age mismatched groups for the total population (1A, p=0.161) and comparison of survival for the age matched and age mismatched groups for patients who underwent single lung transplant (18, p=0.017).

General Thoracic: Lung Transplantation – Continued

2:30 PM Room 361A

Lung Retransplantation for Chronic Rejection: A Single-Center Experience

S. Biswas Roy¹, R. Panchanathan², R. Walia¹, K. Varsch¹, P. Kang³, J. L. Huang⁴, S. Hashimi¹, T. Mohanakumar¹, R. M. Bremner¹, M. Smith¹

¹Norton Thoracic Institute, St Joseph's Hospital and Medical Center, Phoenix, AZ, ²Norton Thoracic Institute, St Joseph's Hospital and Medical Center & University of Arizona College of Medicine, Phoenix, ³University of Arizona, Phoenix, ⁴St Joseph's Hospital and Medical Center, Phoenix, AZ COMMERCIAL RELATIONSHIPS R. M. Bremner: Consultant/Advisory Board, EndoStim; Other Research Support, Ethicon; J. L. Huang: Other/Education: Ethicon; M. Smith: Speakers Bureau/Honoraria, Ethicon; Research Grant, Transmedics

Purpose: Chronic rejection remains the biggest obstacle to long-term survival after lung transplantation (LTx). No cure exists for this progressive decline in lung function, and retransplantation remains the sole definitive therapeutic option for extended survival. We analyzed our experience with retransplantation as treatment for chronic rejection in the modern era.

Methods: We retrospectively reviewed the charts of 418 consecutive patients who underwent primary LTx and retransplantation at our center between March 1, 2010, and May 31, 2016. Patient demographics, clinical characteristics, and outcomes of patients undergoing retransplantation were compared with those of patients undergoing primary LTx. Demographics, lung allocation score (LAS), type of surgery, length of stay (LOS), and survival outcomes were analyzed. Survival probability at 30 days, 1 year, and 5 years was estimated using Kaplan-Meier survival curves.

Results: In total, 28 of 418 patients (6.7%) underwent lung retransplantation for chronic rejection. Median time to retransplantation from primary LTx was 1,157 days ± 993.5 days. Patients undergoing retransplantation were younger and had higher LAS than primary LTx patients (Table). Most LTx were bilateral (93% of retransplantation group; 95% of primary LTx group). Cardiopulmonary bypass was required in 13/28 retransplantation patients (46%) and 83/390 primary LTx patients (21%; P = .004). Postoperative extracorporeal membrane oxygenation (ECMO) support for severe primary graft dysfunction was required for 4/28 retransplantation patients (14%) and 12/390 primary LTx patients (3.1%; P = .016). Median postoperative LOS was 11.5 days for retransplantation and 13 days for primary LTx. Thirtyday mortality was 3.6% in retransplantation patients and 0.8% in primary LTx patients (P = .25). One- and 5-year survival rates in the retransplantation group were 85.7% and 50%, respectively, and 88.6% and 48.8%, respectively, in the primary LTx group (P = .72 for 1-year survival).

Conclusions: Lung retransplantation may prolong survival in appropriately selected LTx patients with chronic rejection. In this study, retransplantation patients were younger, had higher LAS scores, and were more likely to require cardiopulmonary bypass and ECMO; however, postoperative LOS and short- and medium-term survival were comparable to those of primary LTx patients.



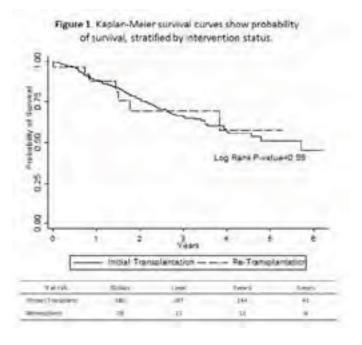


Table 1. Demographic and clinical characteristics of 418 patients undergoing primary LTx or retransplantation

Variable	feest Netti	Transplantation nv.160	Herromphetonics 10078	Failer
Median agr., years (KQR)	P3 (3.5)	65 (11)	MILE (20)	<0.000
Median lang allocation score (IC/II)	97.1 (15.9)	86.5 (12.9)	50.8 (22.7)	<0.0001
Cardiopolimonery (rypon), n(%)	96 (22%)	83 (21.3)	(3 (46.4)	0.004
ECMO for peutop PGO, n(N)	16 (1.8)	32 (3.1)	(4.014.3)	0.010
Median LOS, days (ICR)	24(24)	34 (35)	13 (18)	0.60

To usine calculated using the Wikiner's Earth from Text for continuous secretion and Fatier's Earth for stagestard vertical Advantages, EFMC, estimate process therefore the expension of the EFMC, estimate of the EFMC, and translated the EFMC, primary graft depletation.



General Thoracic: Lung Transplantation - Continued

2:45 PM Room 361A

Debate: Lung Retransplantation Is an Appropriate Option

Pro: Robert Duane Davis, Durham, NC

Con: Thomas K. Waddell, Toronto, Canada

COMMERCIAL RELATIONSHIPS Employment, Ownership Interest, Consultant/Advisory Board, XOR Labs, Perfusix Canada, and United Therapeutics

REGULATORY DISCLOSURE This presentation will describe the use of immunosuppressants that are FDA approved for kidney transplants, but are used off label for lung transplants.

3:15 PM

Discussion



NOTES





1:30 PM - 3:30 PM Room 360A

International Symposium: The Quality vs Access Dilemma in Cardiothoracic Surgery— Regionalization, Building Sustainable Cardiothoracic Surgery Programs, and **Humanitarian Crises**

The symposium will focus on the fascinating quality vs access debate in cardiothoracic surgery care. It will explore the costs and benefits of regionalized/specialized cardiothoracic surgery care (including attendant advantages in terms of outcomes quality) vs localized care in lower volume centers (where outcomes quality can be a concern). The session also will examine the challenges involved in establishing a sustainable cardiothoracic surgery program in an underserved country and consider the quality, access, financial, and ethical considerations in providing cardiothoracic surgery care in the midst of a humanitarian crisis.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Define the key aspects of the quality vs access debate with respect to providing cardiothoracic surgery care
- State the key advantages and disadvantages of regionalized cardiothoracic surgery care as opposed to local cardiothoracic surgery care in lower volume centers
- Describe the critical steps involved in establishing a sustainable cardiothoracic surgery program in an underserved country
- Identify key challenges in providing cardiothoracic surgery care in a humanitarian crisis

Moderator: A. Pieter Kappetein, Rotterdam, The Netherlands

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The physician competencies addressed in this session are professionalism, medical knowledge, and patient care. These physician competencies will be addressed through a debate of contrasting views, followed by panel discussions and audience participation.

1:30 РМ	The Qu	ality vs Acc	ess Issue

Juan P. Umana, Bogota, Colombia

Debate: Regionalization/Specialization 1:40 PM

> **Pro:** Speaker TBD Con: Speaker TBD

Establishing Sustainable Cardiothoracic Surgery Programs in 2:00 PM **Underserved Countries**

Kathleen N. Fenton, Memphis, TN

Creating a Cardiothoracic Surgery Program Where None Has Existed 2:15 PM

Peter Zilla, Cape Town, South Africa

2:30 PM Quality, Access, Financial, and Ethical Challenges Involved in the

Syrian Refugee Crisis: The Experience in Turkey

Adnan Cobanoglu, Portland, OR





Quality, Access, Financial, and Ethical Challenges Involved in the 2:45 PM

Syrian Refugee Crisis: The Experience in Germany

Speaker TBD

The Global Challenge of Treating Noncommunicable Diseases, 3:00 PM

Including Cardiothoracic Diseases

David A. Fullerton, Aurora, CO

Q&A 3:15 PM

1:30 PM – 3:30 PM Room 350DEF

SVS @ STS: Sharing Common Ground for Cardiovascular Problems

Many cardiothoracic surgeons continue to incorporate the care of patients with vascular disease into their practices, while many vascular surgeons are now treating pathology that previously was purely in the domain of cardiothoracic surgeons. This session from STS and the Society for Vascular Surgery will offer topics relevant to both fields and provide each perspective.

Learning Objectives

Upon completion of this activity, participants should be able to:

• Express a plan for the management of arch pathology

· Describe the current state of cell therapy in cardiac and vascular applications

Moderators: Keith B. Allen, Kansas City, MO, and Jason T. Lee, Stanford, CA

COMMERCIAL RELATIONSHIPS K. B. Allen: Research Grant, Edwards Lifesciences Corporation, St Jude Medical, Medtronic; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation

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The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of collaborative lectures by members of The Society of Thoracic Surgeons and the Society for Vascular Surgery.

1:30 рм	Introduction
1:35 PM	Current Management Options for Arch Pathology Wilson Y. Szeto, Philadelphia, PA COMMERCIAL RELATIONSHIPS W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices
1:50 РМ	$\begin{tabular}{ll} Management of the Left Subclavian Artery During Endovascular Repair of the Aorta \\ Carlos F. Bechara, Houston, TX \\ {\it COMMERCIAL RELATIONSHIPS} & C. F. Bechara: Consultant/Advisory Board, Cook Medical \\ \end{tabular}$
2:05 РМ	Discussion
2:25 PM	Cell Therapy for "No Option" Patients With Critical Limb Ischemia: Current Status Michael P. Murphy, Indianapolis, IN
2:40 PM	Cell Therapy for "No Option" Patients With Medically Refractory Angina: Current Status $Todd\ K.\ Rosengart,\ Houston,\ TX$
2:55 PM	Cell Therapy for End-Stage Congestive Heart Failure: Current Status $Amit\ N.\ Patel,\ Salt\ Lake\ City,\ UT$ REGULATORY DISCLOSURE This presentation will describe the following biological therapies for the heart: Vericel, Mesoblast, Capricor, and Ventrix, which all have FDA statuses of investigational.
3:10 рм	Discussion



3:30 PM - 4:15 PM

BREAK—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall

4:15 PM — 5:15 PM Room 320ABC

Surgical Motion Picture Matinee: Adult Cardiac

Moderators: Derek R. Brinster, New York, NY, and Bradley G. Leshnower, Atlanta, GA COMMERCIAL RELATIONSHIPS B. G. Leshnower: Consultant/Advisory Board, CryoLife

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of surgical videos, followed by discussion and questions from the audience.

4:15 PM

Endoscopic Robotic Septal Myectomy With Very Large Patch Augmentation of the Anterior Mitral Valve Leaflet for Hypertrophic Cardiomyopathy: A Radical Paradigm Change

T. S. Guy¹, M. M. Fitzgerald¹, N. Skubas¹, L. N. Girardi²

¹New York-Presbyterian Hospital, Weill Cornell Medical College, New York, NY, ²Weill Cornell Medical Center, New York, NY

COMMERCIAL RELATIONSHIPS T. S. Guy: Consultant/Advisory Board, Admedus, Edwards Lifesciences Corporation, Verb Surgical

Purpose: The current standard surgical approach to hypertrophic obstructive cardiomyopathy (HOCM) is an extended transaortic septal myectomy. Alternatively, we employ an endoscopic robotic septal myectomy through the mitral valve with a very large patch augmentation of the anterior leaflet contrary to traditional thinking about the role of anterior mitral valve leaflet size.

Methods: The illustrative patient presented in this case is a 39-year-old man with a positive family history of HOCM, including sudden death. He had several episodes of syncope, and his septum was 26 mm with a 60 mm Hg provoked gradient. A totally endoscopic robotic approach was used with a 15-mm working port and peripheral cardiopulmonary bypass and cardiac arrest with an endoballoon. Antegrade and retrograde del Nido cardioplegia was given. The anterior leaflet of the mitral valve was detached and a septal myectomy performed, followed by a large patch augmentation of the anterior leaflet.

Results: The operation was smooth and uneventful. Exposure of the left ventricular outflow tract (LVOT) after detachment of the anterior leaflet of the mitral valve from its base was excellent from the aortic valve to the apex of the heart. The septal myectomy was performed with a 10-mm deep knife making several vertical incisions to form several rows of muscle and scissors to remove them from just below the aortic valve to the apex of the ventricle. The segment of muscle removed anatomically corresponds to that removed during an extended transaortic myectomy. The exposure provided by the robotic system is excellent. The use of the large patch to close the anterior leaflet ensured posterior coaptation of the mitral valve and, along with the myectomy, formed a large unobstructed left ventricular outflow tract. A 4 mm Hg gradient was observed at the conclusion of the operation with a wide open LVOT. The patient was discharged on postoperative day 3.

Conclusions: This video demonstrates a novel concept of dramatically enlarging the anterior leaflet of the mitral valve as part of a septal myectomy for HOCM. Traditional thought is that a large anterior leaflet leads to obstruction. We have found the opposite due to the posterior coaptation and early closure of the mitral valve facilitated by a large anterior leaflet sweeping out of the outflow tract during systole.

Surgical Motion Picture Matinee: Adult Cardiac - Continued

4:27 PM Room 320ABC

Minimally Invasive Bicuspid Aortic Valve Repair and Valve-Sparing Root Replacement With Hemiarch Replacement

I. Sultan¹, M. A. Siki², G. J. Arnaoutakis³, A. Kilic², P. Vallabhajosyula², N. Desai², J. E. Bavaria², W. Y. Szeto²

¹University of Pittsburgh, PA, ²University of Pennsylvania, Philadelphia, ³University of Pennsylvania Health System, Philadelphia

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; N. Desai: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices

Purpose: This video demonstrates our standard technique of valve-sparing root replacement and hemiarch replacement performed via a partial sternotomy. With the increasing focus on minimally invasive techniques, we submit this video as an alternative for patients who would have the same operation performed with a full sternotomy.

Methods: The raw footage of the video was created using overhead cameras in the operating room.

Results: The patient presented did very well and was discharged home on postoperative day 5 with no aortic insufficiency.

Conclusions: This video demonstrates our standard technique of valve-sparing root replacement and hemiarch replacement performed via a partial sternotomy. This has become our standard technique for most proximal aortic and arch surgery.



4:39 PM

Prosthetic Surgical Tissue Valve Enlargement Using a High-Pressure Balloon (Fracturing the Ring) to Facilitate Transcatheter Valve-in-Valve Implantation

K. B. Allen¹, A. Chhatriwalla¹, S. Aggarwal¹, D. Cohen¹, A. Hart¹, S. Baron¹, J. R. Davis², A. F. Pak3, D. Dvir4, A. M. Borkon1

¹St Luke's Mid America Heart Institute, Kansas City, MO, ²St Luke's Hospital, Kansas City, MO, ³MidAmerica Heart and Lung Surgeons, Kansas City, MO, ⁴St Paul's Hospital, Vancouver, British Columbia

COMMERCIAL RELATIONSHIPS K. B. Allen: Research Grant, Edwards Lifesciences Corporation, St Jude Medical, Medtronic; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation; S. Baron: Consultant/Advisory Board, Edwards Lifesciences Corporation, St Jude Medical; A. Chhatriwalla: Other/Travel Reimbursement, Edwards Lifesciences Corporation, Medtronic, Abbott Vascular, St Jude Medical; D. Cohen: Research Grant, Edwards Lifesciences Corporation, Medtronic, Boston Scientific; Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic, St Jude Medical; D. Dvir: Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic, St Jude Medical; A. Hart: Speakers Bureau/Honoraria, St Jude Medical

Purpose: Transcatheter valve-in-valve (VIV) may be less effective in small surgical bioprostheses because of further reduction in the effective orifice area. We performed bench top testing on commercial US aortic tissue valves for feasibility of prosthetic surgical tissue valve enlargement using a high-pressure balloon ("fracturing the ring") to facilitate transcatheter VIV implantation.

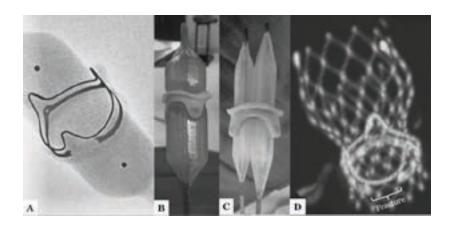
Methods: Aortic tissue valves currently available in the US, sizes 19 mm and 21 mm, were obtained for bench top testing. Valves studied were Mitroflow, Magna and Magna Ease, Trifecta and Biocor Epic, and Hancock II and Mosaic. Valves were tested to determine whether a high-pressure balloon was able to fracture the internal stent of the sewing ring and at what pressure fracture occurred. High-pressure balloons utilized were TRU DILATATION, ATLAS GOLD, and DORADO. Fluoroscopy/video documented testing.

Results: The Table summarizes the "fracturability" of each valve. Mitroflow, Magna, Magna Ease (Figure A), Mosaic, and Biocor Epic valves fractured using balloons 1 mm larger than the valve size (ie, 19-mm valves were fractured with 20-mm balloons). In each case, only the internal valve frame was fractured and the Dacron sewing cuff was never disrupted. Manufacturers' rated burst pressures for balloons were exceeded with fracture pressures ranging from 8-24 ATM. Trifecta and Hancock II surgical valves could not be fractured with single balloons (Figure B) or two smaller high-pressure DORADO balloons using a double balloon technique (Figure C). The clinical utility of knowing which valves can be fractured is illustrated in Figure D—a VIV procedure involving placement of a 23-mm transcatheter valve within a 19-mm surgical valve required fracturing of the surgical valve to facilitate full expansion of the transcatheter valve to achieve a minimal gradient.

Conclusions: Transcatheter VIV procedures in small surgical valves (19 mm and 21 mm) can be facilitated if needed to avoid high residual gradients by fracturing the sewing ring with a high-pressure balloon to optimize transcatheter valve expansion. Bench testing demonstrates, however, that not all surgical valves can be fractured.



Surgical Motion Picture Matinee: Adult Cardiac - Continued Continued from previous page



Manufacturer/ Brand	Valve Size	Sard TRU Balloon Fracture Pressure	Bard Atlas Gold Balloon Fracture/Fressure	Appearance After Fracture
Sr. Juste Trifecta	10 mar.	NO.	NO	
		NG		
St. Jude Boose Epit	21 mm	YES / A ATM	YES / B ATM	0
Medicini Mosek	19 mm	985/10.00M	YES / 10 ATM	0 0
	21 mm	VES/10 ASM	VES/10 ATM	204
Medieneic Hancock II	Zine	NO.	NO	
Solin Mitroflow	19 mm	YES/12 ATM	YES / 13 ATM	PAR
	21 mm	YES/12/ARM	YES / 12 ATM	10000
filmardi Magnafase	19 mm	YES/18/KIM	YES / 18 ATM	1
	21 mm	YES/18JEM	YES / 18 ATM	
Edurards Magna	19 mm	YES/24.83M	YES / 24 ATM	LA
	21 mm	YES/24 ATM	YES / 24 ATM	

^{2.} Meditionic Mosaic and Sorin filmoflow have no metal in ring therefore appearance after fracture unchanged.

4:51 PM Room 320ABC

Implantation of HeartMate 3 Left Ventricular Assist Device Through Left Lateral **Thoracotomy**

T. Krabatsch¹, V. Falk², E. V. Potapov²

¹German Heart Institute Berlin, ²Deutsches Herzzentrum Berlin, Germany COMMERCIAL RELATIONSHIPS V. Falk: Research Grant, Aesculap, Edwards Lifesciences Corporation, HeartWare, Phillips

Purpose: In patients with previous cardiac surgery implantation of a left ventricular assist device (LVAD), redo surgery may be difficult due to massive adhesions. Implantation through a left lateral thoracotomy with connection to the descending aorta is an established procedure for many LVADs.

Methods: We demonstrate the feasibility of this technique for the new LVAD HeartMate 3.

Results: The HeartMate 3 was implanted in a 64-year-old woman through a left lateral thoracotomy on cardiopulmonary bypass. The operation was successful and the patient was discharged home 2 weeks later.

Conclusions: Implantation of the new LVAD HeartMate 3 through a left lateral thoracotomy is an easy and safe procedure, reduces operative trauma, and may lead to faster recovery.



Surgical Motion Picture Matinee: Adult Cardiac - Continued

5:03 PM Room 320ABC

A Simple Technique of Arch Debranching to Facilitate Total Endovascular Arch Replacement in Chronic Residual Arch Dissection

N. Desai¹, W. Y. Szeto¹, A. C. Hoedt², M. M. Reinke², K. A. Dufendach², M. A. Siki¹, J. E. Bavaria¹

¹University of Pennsylvania, Philadelphia, ²Hospital of the University of Pennsylvania, Philadelphia, ³Perelman School of Medicine at the University of Pennsylvania, Philadelphia COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; N. Desai: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board: Microinterventional Devices

Purpose: Residual dissection after type A arch repair is a difficult problem as residual arch and descending thoracic dissection are usually present. Traditional approaches often require redo total arch replacement/elephant trunk or debranching procedures via redo sternotomy followed by descending thoracic repair. We present a novel approach to this problem.

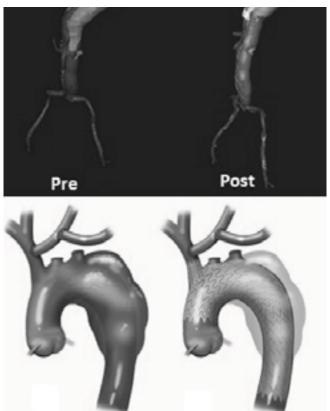
Methods: The patient presented here is a 50-year-old man with previous type A repair (ascending graft) and previous redo aortic valve replacement. He had a residual arch dissection with large tear in the proximal descending thoracic aorta causing false lumen pressurization and a large descending thoracic aorta of greater than 7 cm diameter. A novel debranching and branched thoracic endovascular aortic repair (TEVAR) technique was used. Supraaortic debranching and a single branched zone 0 TEVAR were performed with a 12-mm side branch placed into the innominate.

Results: The patient had an uncomplicated course and is doing well at 6 months. Ankle brachial indexes are normal bilaterally, and there has been complete cessation of antegrade flow into the false lumen.

Conclusions: This simple technique of supraaortic debranching facilitates zone 0 TEVAR with a single side branch. It can be employed without cardiopulmonary bypass, circulatory arrest, or extra anatomic bypasses, there is limited risk of nerve injury, and it can be safely applied to redo situations like residual chronic dissection.







4:15 PM - 5:15 PM Room 360BC

Surgical Motion Picture Matinee: Congenital

Moderators: James J. Gangemi, Charlottesville, VA, and Mark W. Turrentine, Indianapolis, IN Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of surgical videos, followed by discussion and questions from the audience.

4:15 PM

Side-to-Side Bronchus Suis Tracheoplasty for Reconstruction of Complex Tracheobronchial Stenosis

W. Ragalie¹, D. Beste², N. S. Ghanayem¹, M. E. Mitchell²

¹Medical College of Wisconsin, Milwaukee, ²Children's Hospital of Wisconsin, Milwaukee

COMMERCIAL RELATIONSHIPS M. E. Mitchell: Consultant/Advisory Board, TAI Diagnostics; Ownership Interest, Ariosa Diagnostics, TAI Diagnostics; Research Grant, Ariosa Diagnostics, TAI Diagnostics

Purpose: Bronchus suis trachea is a rare congenital anomaly associated with congenital tracheal stenosis (CTS). We present our experience with side-to-side bronchus suis tracheoplasty (BSTP) in four neonatal, ventilator-dependent patients. This technique allows a tension-free anastomosis that enlarges tracheal lumen without reducing length

Methods: Four patients presented with long segment tracheal stenosis in the context of a bronchus suis, complete tracheal rings. All patients were unable to ventilate consistently despite intubation and required urgent tracheal reconstruction. Patient 1 was initially managed with traditional slide tracheoplasty and tracheostomy. Patients 2, 3, and 4 were managed with single stage procedures. All patients underwent definitive long segment tracheoplasty consisting of a side-to-side anastomosis between the bronchus suis and the hypoplastic trachea and right lower lobe bronchus.

Results: Age at presentation was 80, 69, 24, and 142 days, respectively. Weight at surgery was 2.8 kg, 4.3 kg, 2.7 kg, and 5.9 kg, respectively. The first patient remained tracheostomy-dependent after slide tracheoplasty and was liberated from mechanical ventilation 84 days after returning for BSTP. The remaining three patients were weaned from mechanical ventilation at 13, 47, and 8 days after BSTP. All patients were alive and free from tracheostomy at follow-up of 6.33 years, 3.09 years, 1.75 years, and 0.25 years, respectively.

Conclusions: Bronchus suis tracheoplasty is a feasible, reproducible reconstruction technique for long segment CTS. It can be successfully performed in the neonatal period and provides excellent long-term results.

4:27 PM

Resection, Rerouting, and Reconstruction of the Aorta to Correct Tracheal Compression Secondary to a Vascular Ring

L. Donahoe¹, G. S. Van Arsdell², S. Keshavjee³

¹University of Toronto, Canada, ²The Hospital for Sick Children, Toronto, Canada, ³Toronto General Hospital, Canada

Purpose: Vascular rings with a diverticulum of Kommerell are an uncommon cause of shortness of breath and dysphagia in adults. Although division of the ductus arteriosus may alleviate symptoms, some patients may require resection of the diverticulum in order to provide a cure.

Methods: A 58-year-old woman with a history of vascular ring and prior thoracoscopic division of ductus arteriosus presented with symptomatic tracheal and esophageal compression. Work-up included computed tomography of the chest with intravenous contrast and 3D tracheal reconstructions, bronchoscopy, and upper endoscopy. These investigations showed that she had a diverticulum of Kommerell with aberrant posterior takeoff of the left subclavian artery from a right-sided aortic arch. Surgery was planned to resect the diverticulum and alleviate her symptoms.

Results: Through a fourth intercostal space clamshell, the diverticulum of Kommerell was dissected. The double lumen tube was pulled proximally, and the area of stenosis was examined and greatly improved when the aorta was lifted superiorly and laterally. The patient was placed on cardiopulmonary bypass. The diverticulum of Kommerell was transected and excised. An 8-mm HEMASHIELD interposition graft with T side arm was implanted between the left subclavian artery and left anterolateral aspect of the ascending aorta. After the distal anastomosis was performed, the graft was connected to a Y-arterial cannula to reestablish perfusion to the upper limb. The dilated portion of the right aortic arch was resected, and the aortic ends were oversewn. The proximal end of the HEMASHIELD graft was then anastomosed to the right anterolateral side of the ascending aorta, in a manner to ensure that the aorta was not compressed between the sternum and vertebral body.

Conclusions: The surgery and postoperative course were uncomplicated. The patient recovered well and remained asymptomatic at follow-up.

Surgical Motion Picture Matinee: Congenital - Continued

4:39 PM Room 360BC

Pulmonary Annuloplasty for Severe Pulmonary Regurgitation in a Patient Undergoing the Norwood Operation

Y. Kotani¹, S. Kasahara¹, S. Arai¹, K. Hiroaki¹, S. Sano²

¹Okayama University, Japan, ²Okayama University Graduate School of Medicine and Dentistry, Japan

Purpose: Norwood operation may not be the first choice of surgery when the patient presents with significant pulmonary regurgitation (PR). Herein, we report a case of Norwood operation incorporating pulmonary annuloplasty to address significant PR.

Methods: The patient was diagnosed with critical aortic stenosis (AS), left ventricular outflow tract (LVOT) stenosis, multiple muscular ventricular septal defects (VSDs), pulmonary stenosis (PS) and regurgitation, and coarctation of the aorta (CoA). Bilateral pulmonary artery banding was performed at 3 days of age. Because of AS and multiple VSDs, the decision was made to perform Norwood operation for possible biventricular repair in future.

Results: Preoperative echocardiogram showed that the pulmonary valve was severely dysplastic and showed stenosis and regurgitation. The pulmonary valve annulus size was enlarged with a diameter of 15.8 mm or z-score of 3.47. The aortic valve was a bicuspid valve with a diameter of 6.0 mm or z-score of -2.59. At Norwood operation, a 14-mm Goretex tube graft was cut in a small piece and was used to plicate the pulmonary annulus at subcommissure level. Pulmonary valve was tricuspid, although the leaflet was thickened. Commissuroplasty also was performed to have a better competence. Postoperative course was uneventful and postoperative echocardiogram showed mild PR and no significant PS.

Conclusions: Pulmonary annuloplasty was a useful technique to address pulmonary regurgitation in patients undergoing the Norwood operation.



4:51 PM

Resection of Left Ventricular Tumor, Berlin Heart Implantation, and Neonatal Cardiac Transplantation

M. Schweiger, M. Huebler, O. Kretschmar

University Children's Hospital Zurich, Switzerland

Purpose: We report on a female newborn baby (3.3 kg, body surface area 0.21 m²) who after an uncomplicated pregnancy and routine abdominal Cesarean delivery suddenly deteriorated 90 minutes after birth. Echocardiographic examination revealed a huge tumor within the free wall of the left ventricle (LV) (24 mm x 52 mm).

Methods: Intubation was necessary due to a 90% obstruction of the main left bronchus by the tumor mass. Surgical tumor resection was performed on the 6th day of life.

Results: During surgery, partial enucleation of the tumor, including the mitral valve, was done. After resection, the free wall of the LV was thin and collapsed; therefore, a Berlin Heart Excor (BH) left ventricular assist device had to be implanted (left apex, aorta ascendens). Histology of the tumor revealed a fibroma. The neonate was listed for cardiac transplantation 12 days after surgery (3.3 kg) since myocardial recovery was unlikely. Six days after listing, a donor organ was accepted from outside of Switzerland. The 11-month-old donor weighed 11.3 kg and died from severe brain injury. Uncomplicated bicaval cardiac transplantation with an ischemic time of 3.45 hours was performed. For right ventricular support, iNO and intropics were given and slowly weaned. Control bronchoscopy showed a 70% stenosis of the main left bronchus; however, the patient was successfully extubated 12 days after transplantation. Immunosuppressive therapy included rATG for 3 days and steroids for 7 days following surgery.

Conclusions: In this case, a newborn was bridged with a BH for 16 days and then successfully transplanted despite aggravating circumstances, including a cardiac tumor mimicking a single ventricle physiology, prior VAD implantation, organ donor/recipient size mismatch of >200%, and significant bronchus stenosis with successful extubation.

5:03 PM

How to Address the Dilated Aortic Root in Fontan Patients

Christian Pizarro, Wilmington, DE

4:15 PM - 5:15 PM Room 361BC

Surgical Motion Picture Matinee: General Thoracic

Moderators: Melanie A. Edwards, St Louis, MO, and Shari L. Meyerson, Chicago, IL

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The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of surgical videos, followed by discussion and questions from the audience.

4:15 PM

Staple-Free, Totally Energized Video-Assisted Thoracoscopic Lobectomy

R. L. Oliveira¹, E. Goudie², V. Thiffault³, A. Jouquan², P. Ferraro², M. Liberman²

¹CHUM, Montreal, Canada, ²CHUM Endoscopic Tracheobronchial and Oesophageal Center,
University of Montreal, Canada, ³CHUM Notre Dame Hospital, Montreal, Canada

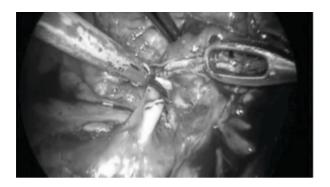
COMMERCIAL RELATIONSHIPS M. Liberman: Research Grant, Boston Scientific, Ethicon; Other Research Support, Medtronic, Olympus

Purpose: Pulmonary artery (PA) ligation and division during video-assisted thoracoscopic (VATS) lobectomy is typically achieved with endostaplers. Ultrasonic energy vessel-sealing devices can be an alternative to conventional PA branch stapling. We demonstrate a video showing a technique for VATS lobectomy without staple utilization for pulmonary arterial ligature.

Methods: A 72-year-old woman presented with a 3.3 cm x 2.8 cm left upper lobe (LUL) mass. Transthoracic biopsy showed adenocarcinoma, and clinical staging was T2aN0M0. The patient was scheduled for a LUL VATS lobectomy. We used an ultrasonic energy vessel-sealing device to seal and divide all PA branches of 7 mm diameter or less. Vessel diameter was measured with a sterile ruler. PA branches were dissected and surrounded with a vessel loop. The device was then applied and activated until vessel division. No clips, sutures, staples, or hemostatic glues were used to protect the sealed PA branches.

Results: The superior pulmonary vein was divided using an endostapler with vascular load (not shown in the video). Thereafter, the truncus anterior was dissected into two branches. These two branches were sealed with the device. The left upper lobe bronchus was divided. A posterior PA branch and three lingular branches were dissected and sealed with the device. A total of six PA branches were sealed with diameters of 6 mm, 5 mm, 5 mm, 4 mm, 5 mm, and 4 mm, respectively. Operative time was 70 minutes. There was no intra- or postoperative complications or bleeding. Final pathology reported pT2N1 adenocarcinoma. At 30-day follow-up, the patient was doing well and was referred to oncology for adjuvant chemotherapy.

Conclusions: VATS lobectomy with PA branch sealing with an ultrasonic energy vessel-sealing device is technically feasible.



4:27 PM

Robot-Assisted Right Lower Lobe Sleeve Lobectomy

D. C. Rice, S. Atay

The University of Texas MD Anderson Cancer Center, Houston

COMMERCIAL RELATIONSHIPS D. C. Rice: Speakers Bureau/Honoraria, Pacira Pharmaceuticals; Speakers Bureau/ Honoraria, Intuitive Surgical

Purpose: One of the perceived benefits of surgical robotics is enhanced dexterity compared to conventional video-assisted thoracoscopic (VATS) techniques. Accordingly, robotics may allow complex oncologic resections to be performed minimally invasively that would otherwise be difficult or even impossible with VATS.

Methods: The patient is a 36-year-old woman who had been treated for intermittent pneumonias over a 4-year period. Ultimately, bronchoscopy revealed an obstructing welldifferentiated neuroendocrine carcinoma at the origin of the RB6 bronchus. Because of the location, a right lower lobe sleeve lobectomy was required with reimplantation of the divided right middle lobe bronchus into the bronchus intermedius. The procedure was performed using the da Vinci Xi Surgical robot with a completely port-based technique.

Results: All ports were placed along the 8th interspace, including three 7-mm ports and one 12-mm port anteriorly (for the robotic stapler). An additional 5-mm port was placed anteriorly over the 10th rib to allow insufflation of humidified CO₂ (10 mm Hg) and robotic controlled suctioning. A right lower lobe lobectomy was performed, dividing the pulmonary vessels and lung parenchyma with a 30-mm robotic-controlled stapler. Intraoperative bronchoscopy guided precise bronchial transection. The bronchus intermedius and right middle lobe bronchus were anastomosed in an end-to-end fashion using running 4-O PDS suture. Margins of resection were negative for tumor. The anastomosis was airtight and buttressed with pericardial fat. Estimated blood loss was 100 cc. The patient was extubated in the operating room, transferred to a telemetry floor, and discharged on the 4th postoperative day without complications.

Conclusions: The surgical robot facilitated performing a complex pulmonary resection in a safe and minimally invasive fashion. Though the role of robotic-assisted thoracic surgery vs VATS for routine pulmonary resection is debated, for technically advanced procedures, such as sleeve lobectomy and bronchoplasty, it may offer an advantage.



Surgical Motion Picture Matinee: General Thoracic - Continued

4:39 PM Room 361BC

A Novel Subxiphoid "Three-Hole" Approach for Cut of Thymoma Invasive Left **Innominate Veins and Pericardium**

J. Wang, Y. Zhou, Q. Lu, W. Wang

Tangdu Hospital of The Fourth Military Medical University, Xi'an, China

Purpose: To evaluate the feasibility and safety of a novel subxiphoid "three-hole" approach for minimally invasive thymectomy (MIT) in invasive thymoma.

Methods: A 2-cm incision was cut below the xiphoid and two 5-mm incisions were created at the bilateral costal arch. A pneumomediastinum was created by insufflating the 8-cm H2O positive pressure carbon dioxide. Then, the mediastinal pleurae were cut. The thymus and all the fat pads near the phrenic nerves were dissected. The harmonic scalpel was used to secure the vessels throughout this procedure. The pericardium was opened, and the ascending aorta was exposed. The left innominate vein (LIV) was skeletonized and disconnected with stapler. The whole thymus, with the thymoma, LIV, and pericardium involved, were dissected in an en bloc fashion.

Results: Movement-related swelling appeared in the left upper limb and disappeared 2 days after operation. The novel approach brought less postoperative pain, quicker recovery, and no other postoperative complications. According to the new World Health Organization histological classification system, the thymoma was confirmed to be type B2-B3. The histopathology also showed that the LIV and pericardium were invaded, and there was no lymph node metastasis. Chest plain film was normal at 1 day after surgery. The patient was discharged at 3 days postoperatively, and no occurrence of complications was found. No thymoma recurred as yet.

Conclusions: The subxiphoid "three-hole" approach has the advantages of good exposure of the anterior mediastinum, small incision, small trauma, less postoperative pain, quick recovery, and shorter hospitalization. In summary, this approach might be a good choice for MIT in the future.



4:51 PM

Fluorescent Thoracoscopic Right Upper Apicoposterior Segmentectomy for Early Lung Cancer: Real-Time Visualization of Lymphatic Flow and Segmental Anatomy Using Indocyanine Green

K. Han¹, H. Kim¹, Y. Choi²

¹Korea University Guro Hospital, Seoul, South Korea, ²Korea University Medical Center, Seoul, South Korea

Purpose: A near infrared fluorescence thoracoscopic system could enable us to perform image-guided minimally invasive segmentectomy and mediastinal lymph node dissection using preoperative and intraoperative indocyanine green (ICG) installation.

Methods: A 73-year-old woman with a 1.9-cm lung lesion on the right upper lobe (cT1aN0M0) received uniportal thoracoscopic segmentectomy and mediastinal lymph node dissection using a near infrared fluorescence thoracoscopic system. We performed preoperative computed tomography-guided localization with Lipiodol and ICG 1 hour before the operation. We also used intravenous ICG (1 mg/kg) to identify the intersegmental plane after division of segmental pulmonary arteries and veins.

Results: During mediastinal lymph node dissection, we could detect ICG fluorescence along the peribronchial and mediastinal lymphatic flow from the lung lesion. Segmentectomy and lymph node dissection guided by sentinel lymph node concept was performed to determine the extent of lung resection and node dissection. Identification of intersegmental plane was performed by visualization of both airway and flow-based lung segmental anatomy with this technique.

Conclusions: Thoracoscopic segmentectomy for early lung cancer using a near infrared fluorescence thoracoscope with ICG localization and intraoperative injection might be a feasible option for real-time visualization of lymphatic flow and intersegmental plane.



Surgical Motion Picture Matinee: General Thoracic - Continued

5:03 PM Room 361BC

Intercostal to Intercostal Nerve Reconstruction Surgery for Severe Compensatory Hyperhidrosis: The "Gebitekin Technique"

C. Gebitekin, H. Melek, G. Çetinkaya, M. M. Erol, A. S. Bayram

Uludag University, Bursa, Turkey

Purpose: We present results of a novel videothoracoscopic technique, bilateral intercostal nerve reconstruction in patients with severe compensatory sweating (CS) after endoscopic thoracic sympathectomy (ETS) performed for primary hyperhidrosis.

Methods: Patients undergoing intercostal nerve reconstruction surgery (the Gebitekin technique) for severe CS between January 2014 and December 2015 were retrospectively reviewed. A videothoracoscopic two-port technique was performed in all cases using general anesthesia. Intercostal nerves were connected using 5/0 Polyglactine (PDS) suture and covered with fibrin glue. The same procedure was performed for the opposite side. The patients were evaluated with 3 months interval in the outpatient clinic.

Results: In total, 36 procedures were performed in 18 patients, 14 male and four female, with mean age of 31 years. The primary surgery was cutting the nerve in nine and clipping in nine patients. Severe compensatory sweating, along with depression and fatigue, were observed in all patients. The reconstruction was between the T4 intercostal and sympathetic nerve in three cases, and the Gebitekin technique was performed in 15 cases, with reconstruction between intercostal nerves. The median surgery time was 90 minutes (75-120 minutes). Minor venous hemorrhage was the only morbidity without mortality. Improvement of CS was excellent/good in eight patients (44%), mild but satisfactory in seven (39%) and same in three (17%). In addition, improvement of dryness was observed in six patients (33%). The symptoms of depression and fatigue disappeared in all but one patient. Furthermore, all but one patient agreed to advise such surgery to the other patients suffering from CS along with other symptoms.

Conclusions: Our novel technique and results suggest that intercostal to intercostal nerve reconstruction, or the Gebitekin technique, is a safe and effective procedure for the treatment of compensatory sweating.



NOTES



4:15 PM - 5:15 PM Room 350DEF

The Annals Academy: Propensity Score Matching

Manuscripts submitted to *The Annals of Thoracic Surgery* sometimes present statistical models that are not a good match for the data being analyzed. This session will provide potential authors with the necessary tools and information to improve statistical reporting—specifically, propensity score matching—in their submissions. Attendees will learn when propensity score matching is appropriate for their dataset and how to present these findings in their manuscripts.

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Explain how to perform a propensity score-matched analysis
- · Identify when to select this type of statistical analysis
- · Demonstrate the ability to use this information in a manuscript

Moderators: Graham A. Colditz, St Louis, MO, and G. Alexander Patterson, St Louis, MO

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The physician competencies addressed in this session are interpersonal skills and communication. These physician competencies will be addressed through individual lectures and panel discussions as they pertain to presenting data in a manuscript.

4:15 рм	Introduction
4:20 рм	Rationale for Propensity Scores in Observational Data Margaret Olsen, St Louis, MO COMMERCIAL RELATIONSHIPS M. Olsen: Consultant/Advisory Board, Pfizer, Sanofi Pasteur; Research Grant, Pfizer, Sanofi Pasteur
4:30 рм	Theory of Propensity Scores Margaret Olsen, St Louis, MO COMMERCIAL RELATIONSHIPS M. Olsen: Consultant/Advisory Board, Pfizer, Sanofi Pasteur; Research Grant, Pfizer, Sanofi Pasteur
4:40 PM	Generating Propensity Scores Varun Puri, St Louis, MO
4:50 рм	Methods to Use Propensity Scores and Respective Analysis <i>Varun Puri, St Louis, MO</i>
4:55 PM	How to Report Findings for Publication Graham A. Colditz, St Louis, MO
5:00 рм	Alternative Methods When Propensity Scores Are Not Indicated Graham A. Colditz, St Louis, MO
5:05 рм	Q&A



5:15 PM – 6:30 PM Grand Ballroom Foyer

Scientific Posters and Wine

5:30 PM – 6:30 PM Room 310ABC

Business Meeting (STS Members Only)

6:30 PM - 7:30 PM Meeting Room 340, Hilton Americas-Houston

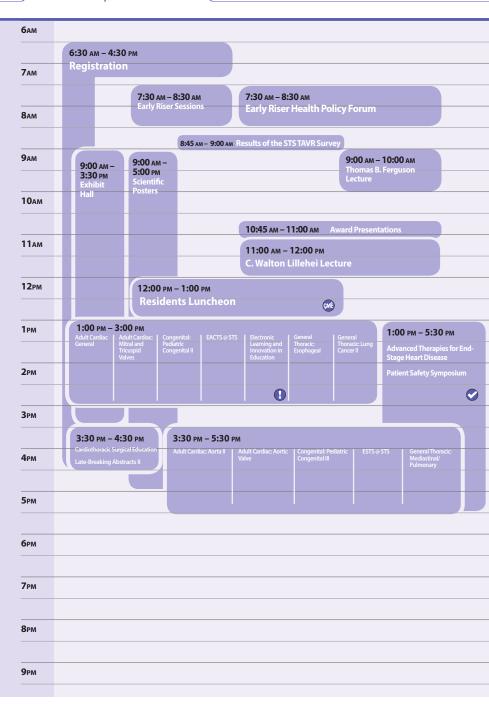
STS-PAC Reception

7:30 PM - 10:30 PM

STS Social Event: Space Center Houston

Join your colleagues at the 2017 STS Social Event at the Space Center Houston, the official visitor's center of NASA's Johnson Space Center. In addition to enjoying an extensive buffet and open bar, you'll be able to check out artifacts documenting the history of space travel, including a collection of spacesuits worn by NASA astronauts, the Apollo 17 Command Module, the giant Skylab Trainer, and more. Don't miss this opportunity! Purchase a ticket at Registration. Shuttle buses depart from all official STS hotels beginning at 6:45 PM.





6:30 AM - 4:30 PM Registration

7:30 AM - 8:30 AM

Early Riser Sessions Early Riser Health Policy Forum: Ready or Not: Implementing

the New Merit-Based Incentive Payment System in Your Practice

Today

Results of the STS TAVR Survey 8:45 AM - 9:00 AM

9:00 AM - 3:30 PM **Exhibit Hall**

Scientific Posters 9:00 AM - 5:00 PM

9:00 AM - 10:00 AM Thomas B. Ferguson Lecture: Ralph W. Muller

10:45 AM - 11:00 AM **Award Presentations**

C. Walton Lillehei Lecture: Samer Nashef 11:00 AM - 12:00 PM

12:00 PM - 1:00 PM Residents Luncheon

1:00 PM - 3:00 PM **Adult Cardiac: General**

Adult Cardiac: Mitral and Tricuspid Valves

Congenital: Pediatric Congenital II

EACTS @ STS: Management of Distal Type B Aortic Dissection

Electronic Learning and Innovation in Education

General Thoracic: Esophageal General Thoracic: Lung Cancer II

1:00 PM - 5:30 PM **Advanced Therapies for End-Stage Heart Disease**

Patient Safety Symposium: Resilience or Burnout—Do We Have

a Choice?

3:30 PM - 4:30 PM **Cardiothoracic Surgical Education**

Late-Breaking Abstracts II

Adult Cardiac: Aorta II 3:30 PM - 5:30 PM

Adult Cardiac: Aortic Valve

Congenital: Pediatric Congenital III

ESTS @ STS: Controversial Issues in General Thoracic Surgery

Perspectives From Europe and North America

General Thoracic: Mediastinal/Pulmonary



6:30 AM - 4:30 PM

Registration

7:30 AM - 8:30 AM

Various locations: see below



Early Riser Sessions

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in these sessions are patient care and procedural skills, medical knowledge, practice-based learning and improvement, professionalism, and systems-based practice. These physician competencies will be addressed through conversational lectures on the specific course topic.

Early Riser Session 1

Room 351DEF

Career Transitions: How to Prepare for Life After the OR

Several surgeons have moved on to new and exciting nonsurgical activities and careers, but life outside the operating room or after a surgical career doesn't just happen. It takes planning, and many surgeons do not take this into consideration. This session, organized by Women in Thoracic Surgery, will address managing career decisions and transitions for life outside the operating room. In addition, issues related to the aging physician, such as knowing when to stop operating, will be discussed.

Learning Objectives

7.20 ...

Upon completion of this activity, participants should be able to:

- Identify ways to start preparing now for what they want to do later in life
- Discuss why a mandatory retirement age is not an answer to the problem of knowing when to stop operating
- Propose existing options for evaluating an aging surgeon

Introduction

7:30 AM	Valerie A. Williams, Cincinnati, OH
7:35 AM	Managing Career Decisions and Preparing for Your Life/Career After Surgery $Mary\ Brandt,\ Houston,\ TX$
7:50 AM	When to Stop Operating Mark R. Katlic, Baltimore, MD
8:05 AM	Life After Surgery Leslie J. Kohman, Syracuse, NY COMMERCIAL RELATIONSHIPS L. J. Kohman: Research Grant, CareFusion
8:20 AM	Panel Discussion



Early Riser Session 2

Room 360A

Research Using the STS National Database™

The STS National Database is a valuable tool for quality improvement and research. Speakers, including STS members who have directed multiple successful research projects using the Database, will share strategies and tips with attendees on how to perform research within the Database. The new Participant User File Program also will be discussed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the process for creating a data request to access the STS National Database for research
- · Discuss the differences between major data requests and minor data requests
- Explain the process of developing a hypothesis, specific aims, and a research plan
- Discuss research options for longitudinal follow-up or linking to other registries
- State the available options, rules, and policies for obtaining investigator access to deidentified patient-level data for analysis at their own institutions

7:30 AM	Introduction to A&P, LFLR, and PUF Jeffrey P. Jacobs, St Petersburg, FL
7:39 AM	Access and Publications Research Marshall L. Jacobs, Newtown Square, PA
7:48 AM	Longitudinal Follow-Up and Linked Registries Research $\it SpeakerTBD$
7:57 AM	Participant User File Research Felix G. Fernandez, Atlanta, GA, and Robert Habib, Chicago, IL
8:06 AM	Additional STS Research Center Information Robert Habib, Chicago, IL
8:15 AM	Q&A



Room 362A

Clinical Trials in Cardiothoracic Surgery

This session will review the latest cardiothoracic surgery research trials. Inclusion and exclusion criteria, brief summaries, protocol details, overcoming barriers to enrollment, building a research team, funding trials, and strategically developing trials for the future will be discussed.

Learning Objectives

- · List current cardiothoracic surgery clinical trials
- · Outline inclusion and exclusion criteria for each trial
- · Analyze brief summaries of each trial





Early Riser Sessions - Continued

7:30 AM Introduction
Shanda H. Blackmon, Rochester, MN

7:35 AM Review of Cooperative Group Trials
Linda W. Martin, Baltimore, MD

8:00 AM Review of Industry Trials

Shanda H. Blackmon, Rochester, MN

8:10 AM Q&A

Early Riser Session 4

Room 362BC

SBRT vs Surgery: A Debate With a Twist

In this session, a surgeon and a radiation therapist will debate the role of surgery and stereotactic body radiation therapy (SBRT) in early stage lung cancer. Strategies to better understand reoccurrence, complications, and survival between the two modes of treatment will be discussed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the contemporary data on local reoccurrence and complications related to surgery and SBRT for early stage lung cancer
- · Discuss the best treatment strategies for early stage lung cancer

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ו	of Care for Those With Stage I Lung Cancer

Clifford Robinson, St Louis, MO

COMMERCIAL RELATIONSHIPS C. Robinson: Consultant/Advisory Board, Varian Medical Systems; Ownership Interest, Radialogica; Research Grant, Varian Medical Systems; Speakers Bureau/Honoraria, DFine, Varian Medical Systems, ViewRay

7:50 AM SBRT Is the Standard of Care for Those With Stage I Lung Cancer

Traves Crabtree, Springfield, IL

8:05 AM "Somewhere in the Middle"

Traves Crabtree, Springfield, IL

8:15 AM Q&A

Early Riser Session 5

Room 310ABC

Management of Functional Mitral Regurgitation in the Modern Era

The appropriate management of patients with severe functional mitral regurgitation (MR) has been a point of major controversy. There are debates over whether mitral repair or replacement is the appropriate strategy and how to approach patient selection. These debates have been fueled by recent data from the Cardiothoracic Surgical Trials Network, which is evaluating repair vs replacement of the mitral valve for functional MR.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify patients with severe functional MR for mitral valve surgery by utilizing current outcomes data
- Evaluate which patients are best for mitral repair vs replacement
- Describe the role of percutaneous therapies

7:30 AM The Mitral Valve Should Be Replaced in Functional MR

Speaker TBD

7:40 AM Characteristics for Successful and Durable Mitral Valve for

Functional MR

Gorav Ailawadi, Charlottesville, VA

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure

7:50 AM Minimally Invasive Approaches to Functional MR

Pavan Atluri, Philadelphia, PA

8:00 AM Percutaneous Approaches to Functional MR

Robert S. Farviar, Minneapolis, MN

8:10 AM Panel Discussion

Early Riser Session 6

Room 360BC

Robotic Lung Resection vs VATS for Lung Cancer

M. Blair Marshall, Washington, DC, and Inderpal Sarkaria, Pittsburgh, PA

COMMERCIAL RELATIONSHIPS M. B. Marshall: Consultant/Advisory Board, Clinical Key, Ethicon, Thoracic Clinics

Currently, the majority of lung cancer operations in the US are performed with an open technique. This session will highlight minimally invasive techniques, video-assisted thoracoscopic surgery (VATS), and robotic-assisted thoracopic surgery (RATS) as the ideal approaches to the management of patients with non-small-cell lung cancer (NSCLC). Rather than focusing on standard VATS lobectomy for early stage lesions, this session will focus on the use of VATS and RATS for a lobectomy with chest wall resection, segmentectomy, and sleeve resections, all performed with minimally invasive approaches. The advantages and disadvantages of these minimally invasive approaches for the management of patients with NSCLC also will be covered.

Learning Objectives

- Identify a stepwise plan to incorporate VATS and RATS into anatomic lung resection
- Discuss the advantages and limitations of VATS and RATS in the management of NSCLC, including chest wall involvement, segmentectomy, and sleeve resection



Early Riser Sessions – Continued



Early Riser Session 7

Room 361BC

All-Arterial CABG vs Hybrid CABG vs Multivessel PCI: What Is the New Standard for Revascularization?

Every cardiac surgeon and cardiologist has patients with coronary artery disease. All possible methods of coronary revascularization—surgical, hybrid, and percutaneous—will be covered in this session, fostering interdisciplinary discussion. This session also will introduce the concept of hybrid coronary artery bypass grafting, emphasizing the need for adequate training and skills in minimally invasive approaches for harvesting the arterial conduit.

Learning Objectives

7:30 AM

Upon completion of this activity, participants should be able to:

Introduction

- Discuss the different methods of coronary revascularization and explain how to tailor each to an individual patient
- Describe how arterial grafts compare to vein grafts for short-term complications, as well as mid- and long-term follow-up

7:35 AM	Full Arterial Revascularization Juan Grau, Ridgewood, NJ
7:50 AM	Multivessel PCI John T. Schindler, Pittsburgh, PA
8:05 AM	Hybrid Coronary Revascularization Michael E. Halkos, Atlanta, GA COMMERCIAL RELATIONSHIPS M. E. Halkos: Consultant/Advisory Board, Medtronic
8:20 AM	Panel Discussion

Early Riser Session 8

Room 330AB

Learning From My Mistakes: A Case I Wish I Could Do Over

J. William Gaynor, Philadelphia, PA, and Christopher E. Mascio, Philadelphia, PA

Making a technical error or incorrect decision in patient management is never something a surgeon wants to experience, but it's important to learn from these mistakes and share that knowledge with others. This session will look at actual—as opposed to ideal—outcomes with a critical look at errors committed throughout each case.

Learning Objectives

- Explain the importance of self-critique as a method of reflective thinking after each case
- Discuss the challenges in complex case decision making
- Identify leaders in the field who may be future sources of reference when encountering a difficult case



Early Riser Session 9

Room 361A

Improving Combat Casualty Care: The Use of Golden Hour Offset Trauma (GHOST) Surgical Teams and Group O Low-Titer Whole Blood Transfusion in the Field

Carl W. Adams, Durango, CO, and Matthew Bacchetta, New York, NY

The knowledge and practice of modern trauma care is a neglected skillset for most cardiothoracic surgeons. The experiences of US military medical units in Iraq and Afghanistan have led to a number of advances in how the military approaches traumatic injuries, including point-of-injury treatment, resuscitation, and damage control surgical techniques. This session will address the knowledge gap many cardiothoracic surgeons have regarding trauma care.

Learning Objectives

- Describe the importance of early treatment for traumatic hemorrhage
- · Identify the risk factors for massive transfusion after trauma
- · Outline the important tools and methods of combat casualty care
- Explain the principles of damage control resuscitation and surgery
- · Explain how whole blood is utilized in combat casualty care

7:30 AM	Introduction
7:35 AM	The GHOST Team Concept in Principle and Practice Theodore C. Koutlas, Coeur d'Alene, ID
7:55 AM	The Use of Whole Blood Transfusion in Combat Jeffrey C. Johnson, Portsmouth, VA
8:15 AM	Panel Discussion

Early Riser Session 10

Room 350DEF

Developing an Extracorporeal Life Support Program

Extracorporeal life support (ECLS) is recognized as effective therapy for many patients with life-threatening cardiopulmonary failure. The number of centers that offer ECLS has increased by more than 300% during the past decade. Although ECLS is a highly effective form of supportive therapy, infrequent utilization and the need for multidisciplinary team involvement underscore the importance of appropriate ECLS program management. Developing and implementing an ECLS program requires careful planning and significant investment in institutional resources, personnel, equipment, and education. This session will discuss best practices in ECLS management for centers that wish to establish or improve ECLS care.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Explain how clinical data can be used to improve ECLS program quality and outcomes
- Choose ECLS equipment that is appropriate for the unique needs of a program
- Manage an ECLS oversight program that improves multidisciplinary communication and engagement
- Describe the beneficial impact of medical simulation for staff training
- · Identify opportunities for ECLS program growth based on local and regional health administrative data

Developing an ECMO Program 7:30 AM

David M. McMullan, Seattle, WA

ECLS Case Presentation 7:55 AM

Edwin C. McGee, Maywood, IL

8:05 AM Discussion 7:30 AM – 8:30 AM Room 320ABC

Early Riser Health Policy Forum

Ready or Not: Implementing the New Merit-Based Incentive Payment System in Your Practice Today

In passing the Medicare Access and CHIP Reauthorization Act (MACRA), Congress changed how all physicians will be paid under the Medicare program. As the Centers for Medicare & Medicaid Services begins to implement the new law, a number of policies regarding cardiothoracic surgeons' payments have come to light. This session will focus on the Merit-Based Incentive Payment System (MIPS)—the revised fee-for-service payment model that will affect most physicians, including STS members. It also will cover Alternative Payment Models (APMs), bundled payments for coronary artery bypass grafting (CABG) procedures, and data collection efforts that could impact surgical payments in the future.

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Outline the changes their practices must make to comply with MACRA requirements
- · Describe the mandatory bundled payment model for CABG
- State the new data reporting requirements to document services provided under global surgical payments
- Explain how STS is working to ensure that MACRA policies are improving care delivery without posing undue burden
- · Discuss the Society's plans for an APM that STS members can opt into

Moderator: Alan M. Speir, Falls Church, VA

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The physician competencies addressed in this session are patient care and professionalism. These competencies will be addressed through a lecture focusing on the Merit-Based Incentive Payment System.

7:30 AM Ready or Not: Implementing the New Medicare Payment Systems in

Your Practice - TODAY

Robert Jasak, Washington, DC

8:00 AM The Role of STS Advocacy

Courtney Yohe, Washington, DC

9:00 AM – 3:30 PM Exhibit Hall A3

Exhibit Hall

9:00 AM - 5:00 PM Hall B3

Scientific Posters





8:45 AM – 12:00 PM Grand Ballroom

General Session II

Moderators: Joseph E. Bavaria, Philadelphia, PA, and Keith S. Naunheim, St Louis, MO

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

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The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and focused discussion on key points of presentations.

8:45 AM

Results of the STS TAVR Survey

Joseph E. Bavaria, Philadelphia, PA

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

9:00 AM

Thomas B. Ferguson Lecture: Specialty Care in an Age of Population Health

Ralph W. Muller, Philadelphia, PA

COMMERCIAL RELATIONSHIPS R. W. Muller: Employment, University of Pennsylvania Health System

Recent efforts in health care policy and innovations in new care delivery models to lower health care costs have focused on improving population health. These efforts (eg, accountable care organizations, clinically integrated networks, risk-based primary care) have been largely targeted at broad populations of relatively healthy patients. However, data show that health care costs are very concentrated in complex and chronic patients, with 5% of the population responsible for 50% of health care spending. To bend the cost curve, we must focus on how to best manage and efficiently deliver care to these patients, much of which is specialty care. There is currently significant variation in both the value of care that specialists provide and the payment they receive for this care. Specialists must take a broader role in patient care through service lines and disease team approaches to promote care standardization by developing disease protocols and pathways. They must also be more accountable for patient outcomes and more engaged in managing patients across the inpatient, outpatient, and home settings. Access to real-time data to measure and reduce the variations in processes and outcomes, to assist with patient management, and to identify areas to reduce costs is critical. Specialists need to be seen as an integral part of managing patient care over the care episode and play a leadership role in driving the efficient use of care that will lead to lower health care costs.

10:00 AM

BREAK—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall

10:45 AM

Award Presentations





11:00 AM

C. Walton Lillehei Lecture

Samer Nashef, Cambridge, United Kingdom

12:00 PM - 1:00 PM

BREAK—Visit Exhibits and Scientific Posters

12:00 PM – 1:00 PM
Residents Luncheon

Room 370BC



1:00 PM - 3:00 PM Room 320ABC

Adult Cardiac: General

Moderators: Francis D. Ferdinand, Albany, NY, and Thomas E. MacGillivray, Houston, TX

COMMERCIAL RELATIONSHIPS F. D. Ferdinand: Research Grant, Edwards Lifesciences Corporation, St Jude Medical

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

1:00 PM

In Elective Arch Surgery, Does the Site of Arterial Cannulation for Circulatory Arrest Really Matter?

O.A. Preventza¹, M. Price², K. Spiliotopoulos², L. Cornwell³, S. Omer⁴, K. I. de la Cruz¹, T. K. Rosengart², Q. Zhang², S. Y. Green¹, S. A. LeMaire², J. S. Coselli²

¹Baylor College of Medicine/Texas Heart Institute, Houston, ²Baylor College of Medicine, Houston, TX, ³Michael E. Debakey VA Medical Center, Houston, TX, ⁴Baylor College of Medicine and Michael E. DeBakey VA Medical Center, Houston, TX

COMMERCIAL RELATIONSHIPS J. S. Coselli: Research Grant, Vascutek Ltd a Terumo Company, Medtronic, W. L. Gore & Associates, Baxter, Bolton Medical, GlaxoSmithKline; Ownership Interest, Vascutek Ltd a Terumo Company; Consultant/Advisory Board, Vascutek Ltd a Terumo Company, Medtronic, W. L. Gore & Associates; S. A. LeMaire: Research Grant, GlaxoSmithKline, Medtronic, W. L. Gore & Associates, Baxter, Vascutek Ltd a Terumo Company; O. A. Preventza: Consultant/Advisory Board, Medtronic, W. L. Gore & Associates

Purpose: Traditionally, the preferred arterial cannulation site for circulatory arrest has been the femoral artery. More recently, a variety of alternative sites have been used. Our purpose was to evaluate these sites with regard to adverse outcomes, including an increased risk of stroke, in patients undergoing elective arch surgery.

Methods: We reviewed the records of 938 patients who underwent elective hemiarch and total arch surgery with circulatory arrest from 2006 to 2016. Five cannulation sites were used: the right axillary artery (n=515; 54.9%), innominate artery (n=376; 40.1%), and common carotid artery (n=15; 1.6%), each with a side graft; ascending aorta (n=19; 2.0%); and femoral artery (n=13; 1.4%). Multivariate logistic regression analysis was used to model the effects of the cannulation site on operative mortality, stroke, a composite adverse outcome, and respiratory failure. Propensity score analysis yielded 180 pairs (360 patients), which were used to compare the right axillary and innominate artery groups.

Results: The overall rates of mortality, stroke, and a composite adverse outcome (operative death, and/or persistent stroke and/or persistent renal failure at hospital discharge) were 6.8%, 4.1%, and 9.6%, respectively. On multivariate analysis, the cannulation site was not a predictor of operative mortality, persistent stroke, or a composite outcome.

Femoral cannulation appeared to be associated with respiratory failure (P = .015, CI 1.4-23.6) and stroke (P = .023, CI 1.2-22.6), but the small sample size made it difficult to prove such an association. In the propensity score-matched analysis, right axillary artery cannulation and innominate artery cannulation, both with the use of a side graft, provided similar neuroprotection and the same operative mortality and composite adverse outcome rate (Table).

Conclusions: During elective arch surgery, a number of arterial cannulation sites are available to cardiac surgeons. Right axillary cannulation and innominate artery cannulation with the use of a side graft provide the same amount of neuroprotection with excellent results. Femoral artery cannulation is possibly associated with increased respiratory failure and stroke.

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Chambo desh	11 (40)	11 (14)	Property.
Operative desaft Overall stroke	8 (4.4) 15 (5.6)	T (3.8)	0.5
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Acute renal dystunction	34 (7.8)	(3 (8.3)	4
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Respiratory failure	A0 (24.4)	40 (25.0)	0.8
Composite adverse overs	15 (8.3)	23 (12.8)	0.2

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1:15 PM Room 320ABC

Risk Evaluation System Based on Genetic Background (GenoSCORE) for Predicting Long-Term Prognosis After Coronary Artery Bypass Grafting

H. Liu, Z. Zheng

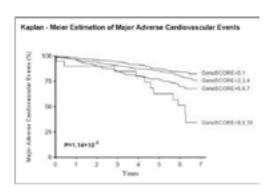
National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences, and Peking Union Medical College, Beijing

Purpose: Clinical risk scores predicting the adverse events after coronary artery bypass grafting (CABG) surgery exist, but the efficacy and quality of these models still needs to be improved. Several genetic variants have been associated with poor prognosis after CABG. This study aims to put forward a gene-based risk score system to predict long-term prognosis after CABG.

Methods: A cohorts of 1,544 patients undergoing CABG surgery were examined, and the adverse events after the index CABG were followed up. For every patient, 95 single-nucleotide polymorphisms (SNPs) were tested. These SNPs were reported to be associated with coronary artery diseases in genome-wide association studies and/or studies of candidate genes. For every SNP, a variable recording the allele count (0, 1, 2) was used to perform statistical analysis. Cox proportional hazards models were used to identify genomic predictors of major adverse cardiac and cerebrovascular events (MACCE). The sums of the allele count of all the remaining risk SNPs were calculated as a risk score.

Results: In the 6-year follow-up period, 328 out of 1,544 patients (21.27%) suffered adverse events. Five SNPs were selected as risk SNPs. The GenoSCORE of all patients ranged from 0 to 10. When the GenoSCORE increased for one unit, the risk of MACCE would increase 1.172 times (P = 1.57*10-7). The patients were divided into four groups according to GenoSCORE, namely the low-risk group (GenoSCORE: 0 and 1), intermediate-risk group (GenoSCORE: 2, 3, and 4), high-risk group (GenoSCORE: 5, 6, and 7) and extremely high-risk group (GenoSCORE: 8, 9, and 10). The hazard ratios of the intermediate-risk group, high-risk group, and extremely high-risk group were 1.361 (P = .074), 2.109 (P = 7.75*10-5) and 4.212 (P = 2.30*10-5) compared to the low-risk group. The Cox regression C statistics of GenoSCORE was 0.798, which means it can predict the adverse events accurately.

Conclusions: We established a genetic risk score based on the association between SNPs and poor prognosis after CABG, and the GenoSCORE can predict the adverse events after CABG accurately.



1:30 PM

Impact of Regional Collaboration on Quality Improvement and Associated Cost Savings in Coronary Artery Bypass Grafting Surgery

J. B. Rich¹, C. E. Fonner², M. A. Quader³, G. Ailawadi⁴, A. M. Speir⁵

¹Virginia Cardiac Services Quality Initiative, Virginia Beach, ²Virginia Cardiac Services Quality Initiative, Charlottesville, ³Virginia Commonwealth University, Richmond, ⁴University of Virginia, Charlottesville, ⁵Cardiac, Vascular & Thoracic Surgery Associates, Falls Church, VA COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; A. M. Speir: Consultant/Advisory Board, Medtronic

Purpose: Prolonged ventilation and acute renal failure were identified as the biggest cost drivers following isolated coronary artery bypass grafting (CABG) surgery in a statewide database. Efforts to reduce these complications should improve outcomes and lower health care costs. We hypothesized that a regional collaboration through focused quality improvement initiatives would accomplish these goals.

Methods: 27,978 patients who underwent isolated CABG were divided into pre- and post-quality improvement initiative (QII) groups (early era, 2008-2011, n=15,176; late era, 2012-2015, n=12,802). Focused learning sessions on prolonged ventilation (PV) and postoperative renal failure (RF) were undertaken in the earlier era. PV QII included onsite visits to high-performing centers, lectures, and sharing of best practices. RF QII included expert lectures, pre- and postoperative optimization including hemodynamics, preoperative creatinine clearance, and ACE inhibitor use. Incidence of mortality, PV, and RF in the two groups were analyzed using two-sided analysis of variance and Fisher exact tests.

Results: STS predicted risk of mortality (PROM) and predicted risk of morbidity or mortality (PROMM) were both significantly higher in the late era (P < .01), as were STS predicted PV (10.1% vs 11.3%) and RF (3.4% vs 3.8%). Despite these increased risks, STS OE for mortality (1.00 vs 0.82) and mortality or morbidity (1.05 vs 0.79) fell. Observed rates for PV (10.51% vs 8.78%, P < .01) and RF (3.6% vs 2.3%, P < .01) were associated with STS OEs of PV (1.04 vs 0.78) and RF (1.03 vs 0.60). Adjusting for case volume in the two eras, 271 cases of PV and 170 of RF were avoided. Linear regression analysis in the later era showed costs of PV and RF to be \$48,046 and \$50,037, respectively. Estimated cost savings were \$13,020,398 for PV and \$8,519,630 for RF. Total savings were \$21,540.028.

Conclusions: A regional collaboration using a statewide STS and all-payer database with focused QII is a powerful tool for change. Despite rising risks for mortality and morbidity, outcomes for PV and RF improved and produced significant cost savings. Applying these efforts nationally can enormously impact patient care and health care costs.

Adult Cardiac: General - Continued

1:45 PM Room 320ABC

The Association Between Timing of Preoperative Clopidogrel Discontinuation, Platelet Reactivity, and Bleeding Complications in Patients Undergoing Coronary Artery Bypass Grafting Surgery

M. Petricevic¹, B. Biocina¹, M. Mikus¹, L. Konosic¹, M. Rasic¹, M. Milosevic², T. Madzar², M. Mihalf³, H. Gasparovic¹, K. Goerlinger⁴

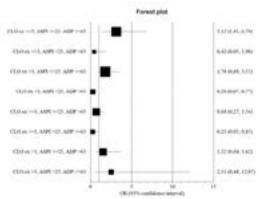
¹University Hospital Centre Zagreb, Croatia, ²University of Zagreb School of Medicine, Croatia, ³University Hospital Split, Croatia, ⁴Klinik fur Anasthesiologie und Intensivmedizin, Universitat Duisburg-Essen, Universitatsklinikum Essen, and TEM International GmbH, Munich, Germany COMMERCIAL RELATIONSHIPS K. Goerlinger: Employment, TEM International GmbH

Purpose: The purpose of this study was to determine how the timing of preoperative clopidogrel discontinuation influences bleeding complications and transfusion requirements in patients undergoing coronary artery bypass grafting (CABG) surgery and whether preoperative platelet function testing may provide clinically relevant information regarding the risk of bleeding complications.

Methods: The retrospective analysis of prospectively collected data included patients exposed to dual antiplatelet therapy within 7 days of isolated CABG. With regard to the period between preoperative clopidogrel cessation and surgery, patients undergoing CABG were divided into three groups: Group 1 (n=94, clopidogrel discontinued ≤3 days before surgery), Group 2 (n=100, clopidogrel discontinued 4-5 days before surgery), and Group 3 (n=83, clopidogrel discontinued 6-7 days before surgery). Multiple electrode aggregometry with drug-specific platelet function assays (ASPItest sensitive to aspirin effect and ADPtest sensitive to clopidogrel effect) was performed in all cases before the surgery. Twenty-four hour chest tube output (CTO) was considered the primary outcome, whereas transfusion requirements were considered the secondary outcome.

Results: A total of 1,202 consecutive patients undergoing isolated CABG between September 2009 and March 2016 were assessed for eligibility. Out of those 1,202 patients, 277 were exposed preoperatively to clopidogrel within 7 days of CABG and were subject to the final analysis. Group 1 patients were found to have a significantly higher amount of 24-hour CTO (median 11.04 mL/kg (7.80-17.64) vs 9.51 mL/kg (6.87-13.00) in Group 2 and 8.11 mL/kg (6.74-12.00) in Group 3, respectively (P = .003). Group 1 patients more frequently experienced excessive bleeding (P = .013) and reexplorations for excessive bleeding (P = .045) relative to patients in Groups 2 and 3, respectively. In addition, Group 1 patients frequently were more transfused, and if transfused, a significantly higher amount of transfusion requirements also was noticed relative to patients in Groups 2 and 3. Multiple electrode aggregometry ASPItests and ADPtests significantly correlated to 24-hour CTO (ASPItest – r = -0.258, P < .001; ADPtest – r = -0.164, P = .007). A significant correlation was observed between clopidogrel-free interval and 24-hour CTO (r = -0.200, P < .001). Receiver operating curve (ROC) analysis was performed for all three parameters found to correlate significantly with CTO and revealed cut-off values to delineate bleeding tendency (ASPItest ≤25 AUC, ADPtest ≤63 AUC and clopidogrel-free interval ≤3 days). The number of parameters found to be below the cut-off value reflected bleeding amount and transfusion requirements. Different combinations of the parameters being below or above the cut-off value yielded different odds ratios for excessive bleeding as shown in the Figure and Table.

Conclusions: Bleeding complications and transfusion requirements occur less frequently after a 3-day waiting period following clopidogrel cessation. Shortening the waiting period after clopidogrel discontinuation (even shorter than 3 days) sounds reasonable if coupled with adequate platelet reactivity. Platelet function testing may shift hemostatic management towards a personalized approach.



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		Excessive				
		(2)	4h)	PPV	NPV	OR
		No N	Yes	(95% CI)	(95% CI)	(95% CI)
	No	187	51	45.95%	78.57%	3.12
CLO ex <=3, ASPI <=25, AOP <=63	Yes	20	17		N)(72,81% to 83,61%)	
CLO es < x3. ASPI >25. ACP >63	No	193	66	12.5%	74.52%	0.42
CLO #1 -43, ASP1 -25, ACP -163	Yes	14	2	(1,56% to 38,351	6) (68,75% to 79,71%)	(0.05 to 1.90)
CLOex >3. ASPI <=25. ADP <=63	No	170	49	33.93%	77,65%	1.78
CLU 61 x 3, A3P1 <023, AUP <003	Yes	37	19	(21,81% to 47,81)	N)(71,52% to 82,97%)	(0.88 to 3.51)
CLO ex >3, ASP(>25, ADP>63	No	167	64	9.09%	72.29%	0.26
CUU 41 - 0, AGP1 - 20, AUF - 100	Yes	40	4	(2.53% to 21.671	4) (66,04% to 77,96%)	(0.07 to 0.77)
CLOex <x3. <x25.="" aop="" aspi="">63</x3.>	No	109	59	19,15%	74,12%	0.68
C(O#1 4K), A3F1 4K(3, ACF 7K)	Yes	38	9	(9,16% to 33,261	(c) (67,93% to 79,68%)	(0.27 to 1.54)
CLO ex <=3. ASPI >25. ADP <=63	No	175	65	8,57%	72.92% 0.25	
CCC 48, 443, AGP1 725, ALP 4463	(443, ASP1 >25, ASP1 >26, ASP1 >463 Yes 32 3 (1,6% to 23,06%) (66,62% to 7)	(66.82% to 78.45%)	(0.05 to 0.85)			
CLO ex >3, ASPI <=25, ADP>63	No	186	58	32.26%	76.23%	1.62
UUU 81 - 2, MOFT 4-20, MUP-163	AGP1 4420, AUP 700 Yes 21 10 (16,68% to 51,37%)(70,38% to 8	N)(70,38% to 81,43%	(0.60 to 3.62)			
010-1-1 100-15 ADD-163	No	202	64	44,44%	75.94%	2.51
GLO ex >3, ASPI >25, ADP <=63	Yes	5	4	(13,7% to 78,8%) (70,34% to 80,95%)	(0.48 to 12.0T)



Calculation of CE's, 200's and NSV's for excessive blending the different classed scenarios in regard to number of depiloped free days prior to surgery, any function test (ASPI test) and depideged sessitive plateler function test (ASPI test). Cut of values for each parameter were calculated using no

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Adult Cardiac: General - Continued

2:00 PM Room 320ABC

A Randomized Study Comparing the Relative Cost Effectiveness of Two Types of Endoscopic vs Traditional Open Vein Harvesting for Coronary Artery Bypass Grafting Surgery

B. Krishnamoorthy¹, A. Thompson², W. R. Critchley³, J. Barnard¹, J. Carey⁴, R. Venkateswaran⁴, A. Caress⁵, J. Fildes⁶, K. Payne⁷, N. Yonan⁴

¹University Hospital of South Manchester NHS Foundation Trust, United Kingdom, ²Manchester Centre for Health Economics, United Kingdom, ³Institute of Inflammation and Repair, University of Manchester, United Kingdom, ⁴University Hospital of South Manchester, Wythenshawe Hospital, United Kingdom, ⁵University of Manchester School of Nursing, Midwifery, and Social Work, United Kingdom, ⁶The Transplant Centre, Manchester, United Kingdom, ⁷University of Manchester School of Health Economics, United Kingdom

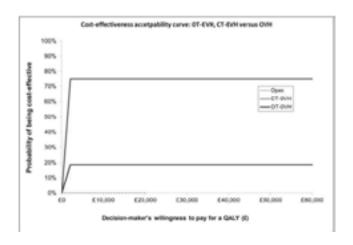
COMMERCIAL RELATIONSHIPS R. Venkateswaran: Consultant/Advisory Board, St Jude Medical

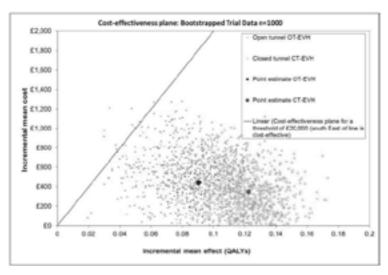
Purpose: Endoscopic vein harvesting (EVH) is associated with reduced wound complications and improved patient satisfaction when compared with open vein harvesting (OVH). The economic implications are not well understood. Our aim was to assess the cost effectiveness of two types of EVH and OVH for patients undergoing coronary artery bypass grafting (CABG) surgery.

Methods: Between 2011 and 2015, 301 patients were randomized to OVH (n=101), open tunnel (OT-EVH, n=100), and closed tunnel (CT-EVH, n=100). Patients were followed beginning on the day of surgery and at 3, 6, 9, 12, 24, and 36 months. All health care resource use associated with treatment and follow-up care was recorded and micro-costed. Health-related quality of life was assessed using the validated questionnaire SF-36 and EQ-5D-3L at 3 and 12 months. EQ-5D scores were used to generate quality-adjusted life years (QALYs) for each patient. Incremental costs, incremental QALYs, and incremental net benefit were calculated with 95% confidence intervals using percentile bootstrap methods.

Results: CT-EVH and OT-EVH led to an increase in vein harvesting costs vs OVH of £1,180 (95% CI, £1,085-£1,276) per patient and £981 (95% CI, £896-£1,066) per patient, respectively. CT-EVH led to a £814 (95% CI, -£1,317 to -£310) reduction in costs vs OVH for follow-up care, while OT-EVH led to a reduction of £598 (95% CI, -£1,128 to -£67). Overall, CT-EVH and OT-EVH led to net increases in costs over OVH of £274 (95% CI, -£292 to £840) per patient and £436 (95% CI, -£168 to £1,041) per patient, respectively. Those undergoing CT-EVH had an increase in QALYs of 0.12 per patient (95% CI, 0.08-0.16) vs OVH while OT-EVH led to an increase in QALYs of 0.08 per patient (95% CI, 0.04-0.13). CT-EVH had an incremental net benefit per patient of £1,251 (95% CI, £32-£2,471) for decision makers willing to pay £20,000 per QALY.

Conclusions: Both EVH techniques led to net increases in cost vs OVH. However, both EVH techniques substantially reduced post-surgery costs and improved patients' quality of life. CT-EVH was associated with lower costs and better outcomes compared to OT-EVH. Therefore, CT-EVH may represent the optimal cost-effectiveness technique for vein harvesting.





Adult Cardiac: General - Continued

2:15 PM Room 320ABC

Rapid Deployment Aortic Valve Replacement Facilitates the Implantation of Larger Prostheses With Increased Indexed Effective Orifice Areas While Significantly Reducing Procedure Times Compared to Standard Tissue AVR in a Propensity-Matched Cohort

P.B. Rahmanian¹, S. Kaya¹, K. Eghbalzadeh¹, M. Scherner¹, N. Madershahian¹, T. C. Wahlers²
¹University Hospital Cologne, Germany, ²University of Cologne, Germany

Purpose: Rapid-deployment aortic valve replacement (RD-AVR) simplifies aortic valve surgery and reduces aortic cross clamp (ACC) and cardiopulmonary bypass (CPB) times. Furthermore, the utilization of larger valve sizes may be possible due to implantation technique. The aim of this study was to evaluate the effects of RD-AVR on surgical outcome and hemodynamics compared to standard AVR.

Methods: We retrospectively analyzed 2,114 patients undergoing tissue AVR from January 2011 to May 2016 at our institution. RD-AVR was performed in 142 patients (mean age 76 years ± 6 years, 57% male). Propensity score matching (age, gender, height, body mass index, isolated AVR vs combined procedures) was performed to create a control group (n=142, mean age 76 years ± 7 years, 54% male) out of the remaining patients undergoing standard tissue AVR. Primary endpoints were the association between valve type and CPB and ACC times, size of prosthesis, transvalvular gradient at discharge, calculated indexed effective orifice area (EOAI), and postoperative mortality and morbidity.

Results: ACC and CPB times in the RD-AVR group were 53 minutes \pm 23 minutes and 86 minutes \pm 47 minutes compared to 73 minutes \pm 25 minutes and 103 minutes \pm 33 minutes in the standard AVR group (P < .001). In the subgroup of patients undergoing isolated RD-AVR (n=67/142), the ACC and CPB times were 38 minutes \pm 12 minutes and 70 minutes \pm 43 minutes compared to 59 minutes \pm 15 minutes and 84 minutes \pm 20 minutes in the control group (n=68/142; P < .001). In patients undergoing combined procedures, the ACC and CPB times of the RD-AVR group (n=75/142) were 66 minutes \pm 23 minutes and 99 minutes \pm 46 minutes compared to 86 minutes \pm 26 minutes and 120 minutes \pm 34 minutes among standard AVR patients (n=74/101; P < .001). RD-AVR patients received larger prostheses (23.3 mm \pm 1.8 mm) compared to standard AVR (22.5 mm \pm 1.5 mm; P < .001). Mean transvalvular gradients and EOAI were 9 mm Hg \pm 3 mm Hg and 1.1 mm Hg \pm 0.1 mm Hg compared to 11 mm Hg \pm 3 mm Hg and 1 mm Hg \pm 0.1 mm Hg in the RD-AVR and control group, respectively (P = .049 and P < .001). Hospital mortality was 2.8% (n=4/142) in the RD-AVR group compared to 2.1% (n=3/142) in the standard AVR group (P = .723).

Conclusions: RD-AVR facilitates reduced ACC and CPB times compared to standard AVR, particularly in patients undergoing concomitant procedures allowing the usage of larger prostheses resulting in lower transvalvular gradients and higher EOAI compared to standard AVR. Therefore, RD-AVR may help to overcome patient prosthesis mismatch in selected patients.

2:30 PM

Transmitral Septal Myomectomy for Hypertrophic Obstructive Cardiomyopathy

B. P. Wehman, N. Foster, S. Maghami, M. Ghoreishi, M. Y. Dawood, J. S. Gammie

University of Maryland School of Medicine, Baltimore

COMMERCIAL RELATIONSHIPS J. S. Gammie: Ownership Interest/Founder, Harpoon Medical, Correx, Inc; Consultant/ Advisory Board, Edwards Lifesciences Corporation

Purpose: Left ventricular outflow obstruction in patients with hypertrophic obstructive cardiomyopathy results from interaction between the anterior leaflet of the mitral valve and the septum. Frequently, mitral valve pathology contributes to the obstruction and needs to be addressed surgically. We describe our experience with a transmitral approach to septal myomectomy.

Methods: Patients undergoing transmitral septal myomectomy at a single institution from 2006 to 2016 were retrospectively reviewed. The ventricular septum was visualized via left atriotomy and detachment of the anterior leaflet of the mitral valve from commissure to commissure. An extended myomectomy was performed to the level of the base of the papillary muscles. Following myomectomy, the anterior leaflet was reattached and concomitant mitral valve repair was performed, if necessary. In some cases, we performed a modified anterolateral commissural closure suture, which served to reposition the lateral aspect of the anterior leaflet out of the left ventricular outflow tract ("curtain stitch").

Results: Twenty-three patients were identified (70% female, mean age 63 years). Preoperatively, the mean grade of mitral valve regurgitation was 2.3 \pm 1.4 and mean ejection fraction was 64.3% \pm 6.9%. Average preoperative peak left ventricular outflow tract gradient was 85.7 mm Hg \pm 35.3 mm Hg. Concomitant procedures included mitral valve replacement (n=8), mitral valve repair (n=12), aortic valve replacement (n=2), coronary artery bypass grafting (n=3), CryoMaze (n=7), atrial septal defect repair (n=2), and tricuspid valve annuloplasty (n=1). Pre-discharge transthoracic echocardiography demonstrated a peak left ventricular outflow tract gradient of 15.0 mm Hg \pm 4.1 mm Hg. There was 100% follow-up with a mean follow-up time of 35.2 months \pm 31.6 months. At last follow-up, peak left ventricular outflow tract gradient continued to decline, with an average peak value of 7.0 mm Hg \pm 5.4 mm Hg. No patient required reoperation, and there was no recurrence of significant outflow tract obstruction or mitral regurgitation greater than mild.

Conclusions: The transmitral approach to septal myomectomy provides a safe and effective means of addressing septal hypertrophy. This approach affords a panoramic view of the septum and mitral subvalvular apparatus as opposed to the constricted view through the aortic valve and allows all pathology to be addressed.

2:45 PM

Discussion



1:00 PM - 3:00 PM Room 310ABC

Adult Cardiac: Mitral and Tricuspid Valves

Moderators: Richard Lee, St Louis, MO, and Brett C. Sheridan, San Francisco, CA COMMERCIAL RELATIONSHIPS B. C. Sheridan: Consultant/Advisory Board, St Jude Medical

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question–and–answer session after each topic.

1:00 PM

Should ≤2+ Functional Tricuspid Regurgitation Be Repaired During Surgery for Degenerative Mitral Valve Disease?

K. Ravichandren, E. Blackstone, J. Rajeswaran, S. Raza, A. M. Gillinov, G. B. Pettersson, S. L. Mick, J. L. Navia, J. F. Sabik

Cleveland Clinic, OH

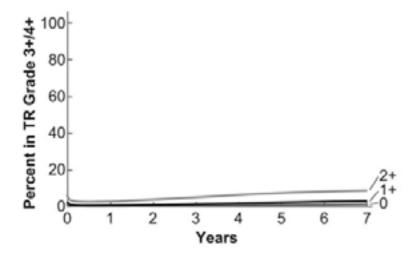
COMMERCIAL RELATIONSHIPS E. Blackstone: Research Grant, Edwards Lifesciences Corporation; A. M. Gillinov: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, CryoLife, On-X Life Technologies, AtriCure, ClearFlow; Consultant/Advisory Board, Medtronic, CryoLife, On-X Life Technologies, Abbott Vascular, St Jude Medical; Ownership Interest, ClearFlow; J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic

Purpose: To determine whether ≤2+ functional tricuspid regurgitation (TR) can be repaired during surgery for degenerative mitral valve disease and identify the patients who may benefit from concomitant tricuspid valve repair, we studied the natural course of unaddressed TR and identified risk factors for its progression after mitral valve surgery.

Methods: From 2001 to 2011, 2,982 patients with isolated degenerative mitral valve disease underwent mitral valve repair or replacement. By random selection, an enriched cohort of 200 patients in TR grade 0, 197 with 1+ TR, and 177 with 2+ TR were studied. Mean age was 58.6 years ± 12 years, 65% were male, and 94% underwent mitral valve repair. A total of 1,150 postoperative echocardiograms were available for 550 patients. A longitudinal nonlinear mixed model analysis was used to assess TR progression for each preoperative TR grade and identify demographic, clinical, right, and left heart morphology and function associated with the progression.

Results: Prevalence of severe TR (3+/4+) was 1.1%, 2.2%, 3.6%, and 4.4% by 1, 3, 5, and 7 years, respectively. Patients in preoperative TR grade 2+ had a higher likelihood of progressing to 3+/4+ TR during follow-up at 7 years (8.6%) than those in grades 0 (1.3%) and 1+ (3.2%) (P < .001). Other risk factors for progression to severe TR included larger tricuspid valve diameter in diastole (P = .03), shorter right ventricular base-to-apex length (P = .0004), and smaller tethering area (P = .01), as well as older age and heart failure. Thus, elderly patients >70 years old with 2+ TR, symptoms and signs of heart failure, abnormally low creatinine clearance, and vasculopathies were prone to progress to 3+/4+ TR more than 10% by 7 years.

Conclusions: Routine repair of ≤2+ functional TR during surgery for degenerative mitral valve disease does not appear to be warranted because progression to severe TR is uncommon, and repair carries risk. Instead, we suggest a tailored approach, reserving it for patients with risk factors in whom benefit of repair outweighs risk.



Percentage of patients in tricuspid regurgitation (TR) grade 3+/4+ over time after isolated mitral valve surgery, according to preoperative TR grade.

Adult Cardiac: Mitral and Tricuspid Valves - Continued

1:15 PM Room 310ABC

Long-Term Results of Annuloplasty in Trivial-to-Mild Functional Tricuspid Regurgitation During Mitral Valve Replacement: Should We Perform Annuloplasty on the Tricuspid Valve or Leave It Alone?

J. Choi, S. Kim, S. Yeom, H. Hwang, K. Kim

Seoul National University Hospital, South Korea

Purpose: There are controversies as to whether tricuspid annuloplasty during mitral valve surgery for less than mild to moderate functional tricuspid regurgitation (TR) is beneficial. We evaluated long-term results of tricuspid valve function with or without ring annuloplasty.

Methods: From 2004 to 2014, 256 patients (56.4 years ± 12.1 years) who underwent mitral valve replacement with less than mild to moderate TR were enrolled. Eighty-two patients underwent concomitant tricuspid ring annuloplasty (TAP group) using MC3 (81 patients) or classic CE ring (one patient), and 174 patients did not undergo tricuspid valve procedure (no TAP group). The main etiology of mitral valve was rheumatic (82.8%). A propensity score-matched analysis was performed to minimize differences in preoperative variables (n=78 in each group). Follow-up duration was 77.4 months ± 42.4 months.

Results: Early postoperative mortality and morbidity were similar between groups before and after propensity score matching, with an early mortality rate of 3.5% (9/256). There were no ring-related complications during follow-up. Eleven patients (6.5%) developed moderate or higher grade TR in no TAP group, while no patients had significant TR in TAP group. Among 11 patients, two died within 6 months after operations, two underwent tricuspid valve surgery, and the others continued outpatient follow-up. Freedom from development of moderate or higher TR was significantly higher in TAP group (P = .01). There were no significant differences in overall survival and freedom from major adverse valve-related events (MAVE) between two groups, respectively (P = .84, P = .34). In the propensity scorematched analysis, freedom from development of moderate or higher TR was higher in the TAP group, and freedom from MAVE was also higher in the TAP group with significance, respectively (P = .01, P = .05).

Conclusions: Tricuspid valve annuloplasty could be performed without additional complications and TAP group showed no development of moderate or higher grade TR and higher MAVE occurrence significantly. Therefore, we recommend tricuspid ring annuloplasty as a favorable treatment for patients with less than mild to moderate functional TR during mitral valve replacement.

1:30 PM

Debate: Should Concomitant Repair of Moderate Tricuspid Regurgitation Be Performed During Mitral Valve Surgery?

No: Michael A. Acker, Philadelphia, PA Yes: Steven F. Bolling, Ann Arbor, MI





NOTES



Adult Cardiac: Mitral and Tricuspid Valves - Continued

2:00 PM Room 310ABC

Early European Experience With Echo-Guided Transapical Off-Pump Mitral Valve **Repair With NeoChord Implantation**

A. Colli¹, L. Besola¹, E. Bizzotto¹, E. Manzan¹, F. Zucchetta¹, D. Pittarello¹, A. Aidietis², K. Rucinskas², V. Janusauskas², D. Zakarkait², A. Drasutiene², A. Lipnevicius², B. C. Danner³, H. Sievert⁴, S. Salizzoni⁵, M. Rinaldi⁵, D. Pacini⁶, C. Savini⁶, K. Wróbel⁷, K. Kurnicka⁸, G. Gerosa1

¹University of Padua, Italy, ²Vilnius University, Lithuania, ³University Medical Center, Gottingen, Germany, ⁴CardioVasculäres Centrum Frankfurt, Germany, ⁵Molinette Hospital, Turin, Italy, ⁶S. Orsola–Malpighi Hospital, Bologna, Italy, ⁷Medicover Hospital, Warsaw, Poland, ⁸Medical University of Warsaw, Poland

COMMERCIAL RELATIONSHIPS B. C. Danner: Other/Travel, NeoChord; H. Sievert: Consultant/Advisory Board, Abbott Laboratories, Ablative Solutions, Acoredis, Atrium, Biosense Webster, Bioventrix, Boston Scientific, Carag, Cardiac Dimensions, CardioKinetix, Celonova, CGuard, Coherex, Comed B.V., Contego, CSI, CVRx, ev3, FlowCardia, Gardia, W. L. Gore & Associates, Lumen Biomedical, Lifetech, Medtronic, Occlutech, pfm Medical, Recor, SentreHeart, St Jude Medical, Svelte Medical Systems, Terumo, Trivascular, Valtech, Vascular Dynamics, Venus Medical, Veryan; Speakers Bureau/Honoraria, Abbott Laboratories, Ablative Solutions, Acoredis, Atrium, Biosense Webster, Bioventrix, Boston Scientific, Carag, Cardiac Dimensions, CardioKinetix, Celonova, CGuard, Coherex, Comed B.V., Contego, CSI, CVRx, ev3, FlowCardia, Gardia, W. L. Gore & Associates, Lumen Biomedical, Lifetech, Medtronic, Occlutech, pfm Medical, Recor, SentreHeart, St Jude Medical, Svelte Medical Systems, Terumo, Trivascular, Valtech, Vascular Dynamics, Venus Medical, Veryan; Ownership Interest, Cardiokinetix, Access Closure, Coherex; K. Wróbel: Other/Proctor, NeoChord; D. Zakarkait: Consultant/Advisory Board, NeoChord

REGULATORY DISCLOSURE This presentation will describe the use of the NeoChord DS 1000 Artificial Chordae Delivery System, which is not FDA approved.

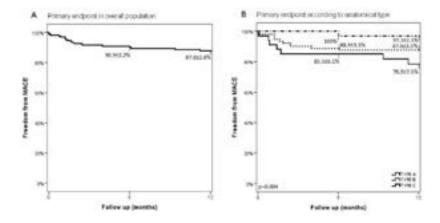
Purpose: Transapical off-pump mitral valve repair with neochordae implantation (TOP-MINI) is a novel transcatheter procedure to treat degenerative mitral valve regurgitation (MR). The aim of this retrospective, multicenter study was to evaluate 1-year clinical results of the TOP-MINI procedure in a consecutive cohort of patients.

Methods: Between February 2013 and May 2016, 176 patients were enrolled in the NeoChord Independent International Registry. All patients presented with severe MR due to flail/prolapse of one or both leaflets. According to Mitral Valve Academic Research Consortium definitions, we identified the primary endpoint as composite of procedural success, freedom from mortality, stroke, reintervention, recurrence of severe MR, rehospitalization, and a decrease of at least one NYHA functional class. We also compared outcomes according to anatomical type classification (Type A: isolated central posterior leaflet disease; Type B: posterior multisegment disease; Type C: anterior, bileaflet, paracommissural disease with or without leaflet and annular calcifications).

Results: Median age was 67 years (interquartile range [IQR] 56-76), and median Euroscore-II was 1.16% (IQR 0.67%-1.89%). Type A, B, and C patients were 45 (26%), 97 (55%), and 34 (19%), respectively. A median of four chordae (IQR 3-4) were implanted. Procedure success was achieved in 170 patients (97%). A total of 109 patients (62%) completed the 1-year follow-up. Overall 1-year survival was 98.1% ± 1.1%. Freedom from MR >2+ was $88.4\% \pm 2.6\%$ for overall population and $97.1\% \pm 2.9\%$, $88.6\% \pm 3.4\%$, and $78.5\% \pm 7.3\%$ for Type A, Type B, and Type C, respectively (P = .003). Freedom from redo was 95.4% ± 1.7% for overall population and 100%, 96.6% ± 2.0%, and 87.4% ± 6.0% for Type A, Type B, and Type C, respectively (P = .034). Primary endpoint was achieved in 87.8% \pm 2.9% for the overall population, and 97.1% ± 2.3%, 87.6% ± 3.5%, and 78.5% ± 7.3% for Type A, Type B, and Type C, respectively (P = .004).



Conclusions: The present results demonstrated that TOP-MINI is a safe, effective, and reproducible procedure. Clinical and echocardiographic efficacy is maintained up to 1 year with significant differences between anatomical type groups. Patient selection is necessary to achieve stable results.



Adult Cardiac: Mitral and Tricuspid Valves - Continued

2:15 PM Room 310ABC

Mitral Valve Repair vs Replacement in Patients With Functional Mitral Regurgitation Undergoing Complex Cardiac Surgery

N. B. Langer¹, B. S. Van Boxtel^p, R. A. Sorabella³, Y. Wu², J. Park², H. Takayama⁴, M. A. Borger², Y. Naka³, C. Smith³, I. George³, M. Argenziano³

¹New York-Presbyterian Hospital/Columbia University Medical Center, New York, NY, ²Columbia University Medical Center, New York, NY, ³Columbia University College of Physicians and Surgeons, New York, NY, ⁴Columbia University, New York, NY

COMMERCIAL RELATIONSHIPS M. A. Borger: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical; Consultant/Advisory Board, Edwards Lifesciences Corporation

Purpose: Outcomes following mitral valve repair (MVP) vs mitral valve replacement (MVR) in patients undergoing complex cardiac operations are not well characterized. This study was designed to examine outcomes of MVP vs MVR in patients with functional mitral regurgitation (FMR) undergoing complex cardiac surgery (ie, mitral valve plus additional concomitant procedures).

Methods: All patients who underwent mitral valve surgery at our institution between 2005 and 2012 were retrospectively reviewed, and 562 patients with an operative indication of FMR were identified and included in the study. Patients were stratified by operation: MV repair (group MVP, n=457) and MV replacement (group MVR, n=105), and 1:1 propensity score matching was used to identify 105 matched pairs. The two groups were then subdivided according to concomitant procedures performed in order to examine the impact of operative complexity. Primary outcomes of interest were 30-day/in-hospital mortality, perioperative morbidity, and 5-year freedom from all-cause mortality.

Results: There were no differences in the baseline demographics, medical comorbidities, severity of mitral regurgitation, or number of concomitant procedures between the two propensity score-matched groups. The mean cardiopulmonary bypass time and aortic cross clamp time were significantly higher in the MVR group compared to the MVP group (160.8 minutes ± 57.9 minutes vs 133.6 minutes ± 51.1 minutes, P < .001, and 109.2 minutes \pm 44.3 minutes vs 87.9 minutes \pm 33.6 minutes, P < .001). There were no differences in 30day/in-hospital mortality or overall hospital length of stay between the groups (7.6% MVP vs 8.6% MVR, P = .800, and 12 days (8-18) MVP vs 11 days (8-22) MVR,P = .890). Additionally, there were no differences in the rates of postoperative respiratory failure, stroke, new dialysis requirement, new-onset atrial fibrillation, new pacemaker requirement, reoperation for bleeding, need for mechanical circulatory support, or deep sternal wound infection. Kaplan-Meier survival analysis showed no difference in survival at up to 5 years. When the two groups were subdivided according to additional concomitant procedures performed, there were no differences in 30-day/in-hospital mortality in patients who underwent MVP vs MVR during an isolated mitral valve (MV) operation (0% MVP vs 0% MVR), MV operation plus coronary artery bypass grafting (CABG) (13.6% MVP vs 9.7% MVR, P = .683), MV operation plus CABG plus other operation (15.8% MVP vs 13.6% MVR, *P* = 1.000), or multiple valve operation (6.8% MVP vs 9.8% MVR, *P* = .707).

Conclusions: There was no difference in early mortality, perioperative morbidity, or 5-year survival in patients who underwent MVP vs MVR for FMR regardless of overall complexity of the operation. MVP can be performed with no early mortality penalty in patients with functional mitral regurgitation undergoing cardiac operations while minimizing operative time.



2:30 PM

Debate: Bioprosthetic Mitral Valve Replacement Is the Optimal Choice for the Young Patient Less than 60 Years Old

Yes: Gorav Ailawadi, Charlottesville, VA No: Joseph A. Dearani, Rochester, MN



1:00 PM - 3:00 PM Room 360BC

Congenital: Pediatric Congenital II

Moderators: Carlos M. Mery, Houston, TX, and Christian Pizarro, Wilmington, DE

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

1:00 PM

Incidence and Impact of Recurrent Laryngeal Nerve and Swallowing Dysfunction in Neonatal Aortic Arch Repair

K. K. Pourmoghadam¹, W. M. Decampli¹, J. Kosko¹, K. D. Piggott¹, M. Ruzmetov¹, A. Cowden¹, M. C. O'Brien², S. Kishawi¹, H. Fakioglu¹

¹The Heart Center at Arnold Palmer Hospital For Children, Orlando, FL, ²Arnold Palmer Hospital for Children, Orlando, FL

Purpose: The aim of this study was to evaluate the incidence and clinical impact of recurrent laryngeal nerve injury and swallowing dysfunction in neonates undergoing aortic arch repair and to assess the rate of recovery of the vocal fold (cord) function in the post-discharge period.

Methods: We retrospectively evaluated 101 neonates who underwent aortic arch reconstruction from 2008 to 2015. Direct flexible laryngoscopy (DFL) was performed in 89 patients prior to initiation of postoperative oral feeds after Norwood (n=63) and non-Norwood aortic arch reconstructive surgery (n=26). Patients without the initial DFL (n=12) were excluded from analysis. We defined immobility of vocal folds or their lack of coaptation and poor mobility as vocal cord dysfunction (VCD). The Mann-Whitney-U and t-test were used for univariate analysis.

Results: The overall incidence of VCD after aortic arch repair was 48% (n=43). There was no significant difference between the VCD and non-VCD group in postoperative length of stay (LOS), extubation failure, cardiopulmonary bypass, cross clamp, selective cerebral perfusion time, hospital mortality, and STAT score (Table). Placement of gastrostomy (P=.03) and aspiration documented by oropharyngeal motility study (OPMS) (P=.01) were significantly more common in patients with VCD. The incidence of VCD after Norwood was 41% (n=26), while in non-Norwood repair, it was 65% (n=17) (P=.06). Fortyfour Norwoods (70%) required gastrostomy vs nine non-Norwood patients (35%) (P=.004). The median LOS was not significantly different in the Norwood population with or without VCD: 53 (interquartile range [IQR] 42-69) vs 44 (IQR 34-73), P=.28. However, LOS was significantly longer in non-Norwood patients with VCD (37 [IQR 30-54]) vs those without (17 [IQR 14-23]), P=.002. At follow-up DFL, VCD rate of recovery was 72% (13 of 18) in Norwood and 75% (6 of 8) in non-Norwood group.



Conclusions: Neonates undergoing aortic arch reconstruction who develop VCD have significantly higher incidence of gastrostomy placement and aspiration by OPMS evaluation. In the Norwood population, LOS is not associated with presence or absence of VCD. More than 70% of patients in each group recover vocal cord function in post-discharge DFL follow-up.

Variables	VCD (n=43)	non-VCD (n=46)	p-value
Norwood	26 (60%)	37 (80%)	0.06
ron-Norwood	17 (40%)	9 (20%)	0.06
Extubation failure	18 (42%)	13 (28%)	0.19
Gastrostomy tube placement	31 (72%)	22 (48%)	0.03

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Norwood	26 (50%)	37 (80%)	0.06
ron-Norwood	17 (40%)	9 (20%)	0.06
Extubation failure	18 (42%)	13 (28%)	0.19
Gastrostomy tube placement	31 (72%)	22 (48%)	0.03
Nissen fundoplication and gastrostomy	20 (47%)	8 (17%)	0.006
Aspiration by OPMS/OPMS performed	21/96 (62%)	9/35 (27%)	0.01
Hospital mortality	1 (2.5%)	1 (2.8%)	1.00
Postoperative length-of-stay, [median (IQR)]	45 (35-64)	39 (29-64)	0.19
Readmission within 30 days	14 (33%)	15(33%)	1.00

Congenital: Pediatric Congenital II - Continued

1:15 PM Room 360BC

Aortic Stenosis of the Neonate: A 26-Year, Single-Center Experience

M. Vergnat, B. Asfour, B. Bierbach, P. Suchowerskyj, C. Arenz, E. Schindler, M. Schneider, V. Hraska

German Pediatric Heart Center, Sankt Augustin

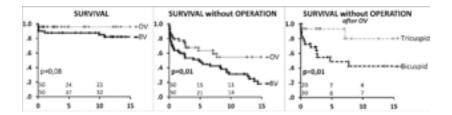
COMMERCIAL RELATIONSHIPS M. Schneider: Consultant/Advisory Board, St Jude Medical, W. L. Gore & Associates

Purpose: As data for neonates are limited, optimal management of critical aortic stenosis remains controversial. We assessed the long-term outcome of this specific group of patients over a 26-year time frame, using concurrent strategies of balloon valvotomy (BV) and open valvotomy (OV).

Methods: Retrospective review of data and late follow-up (survival and freedom from surgery) of all neonates suitable for biventricular repair undergoing intervention for aortic valve stenosis from 1989 to 2015 was performed.

Results: A total of 100 patients were treated consecutively with BV (n=50) or OV (n=50). Median age at intervention was 8 days; median aortic annulus Z-score was -0.59 for BV and -0.33 OV patients (P = .9). Operative mortality after BV or OV was 8% (n=4) and 4% (n=2), respectively. With a median follow-up of 11 years (range 1 month to 26 years), 10-year event-free survival was 31.4% and 54.7% after BV or OV, respectively (P = .01). Thirty-two patients ultimately required a valve replacement (n=20 [40%] in BV group and n=12 [24%] in OV group) within a median time of 5.9 years. After OV, tricuspid valve morphology ended up with an event-free survival of 80% and a freedom from aortic valve replacement of 95% at 10 years of follow-up.

Conclusions: In neonates with critical aortic stenosis, both methods (BV and OV) offer excellent survival benefit. OV significantly minimized the need for reoperation. Clearly, superior results can be achieved with OV when a postrepair tricuspid arrangement is obtained.



1:30 PM

Hybrid Balloon Valvuloplasty Through the Ascending Aorta via Median Sternotomy in Infants With Severe Congenital Valvular Aortic Stenosis: Immediate Results and Mid-Term Follow-Up

X. Pan, W. Ouyang, S. Wang, K. Pang, S. Li

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences, and Peking Union Medical College, Beijing

Purpose: To describe immediate results and mid-term follow-up of a novel hybrid balloon valvuloplasty procedure for severe congenital valvular aortic stenosis in low-weight infants, performed through the ascending aorta via median sternotomy.

Methods: Forty-five infants (<90 days of age) with severe congenital aortic stenosis were included in this study from October 2010 to March 2016. Hybrid balloon valvuloplasty procedures were performed in a hybrid or an ordinary operating room. Patients were followed up at 1 month, 3 months, 6 months, and every year following the procedure.

Results: The hybrid balloon valvuloplasty procedure was successful in all patients. The latest eight patients were conducted in an ordinary operating room only guided by echocardiography. Thirty-two patients were successfully rescued from left ventricular systolic dysfunction by cardiac compression under direct vision. The degree of aortic regurgitation was mild in seven patients and moderate in one patient. The aortic valve pressure gradient decreased from 70.6 mm Hg \pm 17.5 mm Hg preoperatively to 15.2 mm Hg \pm 4.2 mm Hg immediately postoperatively (P < .001). The fluoroscopy time was 4.8 minutes \pm 2.3 minutes. The patients were all alive and healthy at the end of the follow-up period (mean 32.1 months; range 1-68 months), and the aortic valve pressure gradient remained low (19.1 mm Hg \pm 5.2 mm Hg). The ejection fraction of left ventricular increased from 51.5% \pm 13.4% (range 21%-70%) preoperatively to 63.3% \pm 3.5% (range 58%-75%). No developed aortic insufficiency was observed. Reintervention was not required in any of the patients.

Conclusions: Hybrid balloon valvuloplasty through the ascending aorta via median sternotomy is an effective and safe procedure for infants with severe congenital aortic stenosis. It has encouraging short- and mid-term outcomes.



Congenital: Pediatric Congenital II – Continued

1:45 PM Room 360BC

Primary Pulmonary Vein Stenosis: Outcomes, Prognostic Factors, and Severity Score in a Multicenter Study

D. Kalfa¹, E. Belli², E. A. Bacha¹, V. Lambert², D. di Carlo⁴, M. Kostolny⁵, J. Salminen⁶, M. Nosal^r, J. Hörer⁸, H. Berggren⁹, I. Yemets¹⁰, M. Hazekamp¹¹, B. Maruszewski¹², G. E. Sarris¹³, T. Ebels¹⁴, L. Francois¹⁵

¹Columbia University Medical Center, New York-Presbyterian/Morgan Stanley Children's Hospital, New York, NY, ²Institut Hospitalier Jacques Cartier, Massy, France, ³Hôpital Universitaire Bicêtre, Le Kremlin-Bicêtre, France, ⁴Bambino Gesù Children's Hospital, Rome, Italy, ⁵Great Ormond Street Hospital for Children, London, United Kingdom, ⁶Hospital for Children and Adolescents, Helsinki University Central Hospital, Finland, ⁷Children's Heart Center, Bratislava, Slovakia, 8 Hospital Marie Lannelongue, Les Plessis-Robinson, France, 9 The Queen Silvia Children's Hospital, Gothenburg, Sweden, 10 Ukrainian Children's Cardiac Center, Kiev, 11 Leiden University Medical Center, Netherlands, 12 Children's Memorial Health Institute, Warsaw, Poland, 13 Athens Heart Surgery Institute, Greece, 14 University Hospital Groningen, Netherlands, 15 Royal Hospital Heart Center, Muscat, Oman

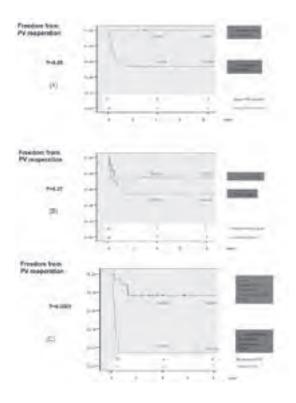
Purpose: Primary pulmonary vein stenosis (PPVS) still carries a poor prognosis in recent series, even despite the adoption of a sutureless technique by many groups. The optimal management and prognostic factors remain controversial. We sought to determine current PVS outcomes and prognostic factors in a multicenter study in the current era.

Methods: Thirty patients with PPVS operated in 10 European/North American centers (2000-2012) were included retrospectively. A specific PVS severity score was developed, based on the echocardiographic pressure gradient and the focal/diffuse aspect of the stenosis for each PV. A univariate and multivariate risk analysis was performed. Median followup was 37 months (range 3-171 months). Mean preoperative score was 8.8 ± 4.1. Mean number of affected PV/patient was 2.8 ± 1.1. Sutureless repair was used in 21 patients (70%), endarterectomy in five, and patch venoplasty in four. Median age and weight at surgery were 9 months (range 1-100) and 6.8 kg (range 2.7-20.3 kg), respectively.

Results: Overall PV restenosis, reoperation, and mortality occurred in 50% (n=15/30), 40% (n=12/30), and 30% (n=9/30), respectively. Kaplan-Meier cumulative restenosis-free survival was 67% ± 9% at 1 year and 48% ± 9% at 5 and 8 years. Cumulative patient survival was 73% ± 8% at 1 year and 70% ± 8% at 5 and 8 years. Restenosis and mortality rates after sutureless repair vs non-sutureless repair were 57% (n=12/21) vs 33% (n=3/9) (P = .42) for restenosis and 38% (n=8/21) vs 11% (n=1/9) (P = .21) for mortality. Patients selected for a sutureless technique had a higher preoperative severity score (>4) in 90% (n=19/21) vs 67% (n=6/9) for other patients (P = .14). Kaplan-Meier reoperation-free survival curves according to the preoperative PVS score, surgical technique, and postoperative pulmonary hypertension are shown in the Figure. Results of the univariate analysis are shown in the Table. High postoperative PVS score and postoperative pulmonary hypertension were independent risk factors for PV restenosis (HR 1.34; 95% CI, 1.11-1.61; P = .002 and HR 6.81; 95% CI, 1.30-35.5; P = .02, respectively), PV reoperation (HR 1.24; 95% CI, 1.05-1.46; P = .01 and HR 7.60; 95% CI, 1.41-40.97; P = .02), and PVS-related mortality (HR 1.39; 95% CI, 1.07-1.80; P = .01 and HR 39.5; 95% CI, 2.6-607.8; P = .008).

Conclusions: Primary PVS still has a guarded prognosis in the current era despite the adoption of the sutureless technique. Postoperative pulmonary hypertension and severity of the disease evaluated by a new severity score are independent risk factors for poor outcomes, regardless of surgical technique.





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Congenital: Pediatric Congenital II - Continued

2:00 PM Room 360BC

New Approaches to Bleeding in Congenital Heart Patients

Erin A. Gottlieb, Houston, TX

2:15 PM

Higher Programmatic Volume in Neonatal Heart Surgery Is Associated With Lower Early Mortality

A. Kansy¹, G. E. Sarris², T. Ebels³, J. P. Jacobs⁴, J. I. Fragata⁵, Z. Tobota¹, B. Maruszewski¹

¹Children's Memorial Health Institute, Warsaw, Poland, ²Athens Heart Surgery Institute, Greece,

³University Hospital Groningen, Netherlands, ⁴Johns Hopkins All Children's Heart Institute,

St Petersburg, FL, ⁵Hospital de Santa Marta, Alges, Portugal

Purpose: The early results of congenital heart surgery (CHS) in neonates remain a challenge. Further improvements require identification of risk factors associated with outcomes. We sought to determine the nature of the association between volume of neonatal cardiac surgery and in-hospital mortality using a multicenter cohort.

Methods: Neonates undergoing CHS at centers participating in the European Congenital Heart Surgeons Association Database were included. Only primary procedures stratified using STAT mortality scores were analyzed. Patients below 2.5 kg at patent ductus arteriosus ligation were excluded. Centers with mean annual volume loads of five or more neonatal procedures who submitted data for at least 2 years were included. Initially, programs were grouped as <20, 20-39, 40-59, 60-79, and ≥80 and finally as <60 and ≥60. Multivariable logistic regression was used to identify the differences between groups with the adjusted inhospital mortality. The outcomes were adjusted for patients and surgical risk factors.

Results: The dataset consists of 28,674 procedures performed between 1999 and 2015 in 108 centers. There were no differences in hospital mortality between groups <20, 20-39, and 40-59 (P = .91) and also between groups 60-79 and ≥80 (P = .99). In group <60, there were 17,491 procedures performed in 91 centers, and in group ≥60, there were 11,183 procedures performed in 17 centers. Total hospital mortality was 12.07% (0%-55.56%); it was 13.68% (0%-55.56%) and 9.54% (2.84%-21.22%) (P < .001) in the first and second groups, respectively. Mean STAT mortality score was 1.41, 1.34, and 1.51, respectively (P < .001). Performances in two groups were: 80.9 and 88.3 (P < .01). Multivariable logistic regression model showed that the risk of in-hospital death decreased with the increase of volume load, OR 0.961 (0.955-0.968) (P < .001). The risk of in-hospital death was significantly higher in group <60 as compared to group ≥60, OR 1.68 (1.55-1.82) (P < .001).

Conclusions: In neonatal CHS, the risk of in-hospital death decreased with the increase of volume load and is significantly lower when the volume load per year is 60 or higher.

2:30 PM

Parent Preferences Regarding Public Reporting of Outcomes in Congenital Heart Surgery: A Cross-Sectional Survey of Parents of Children With Congenital Heart Disease

M. L. Irons¹, J. W. Gaynor², T. L. Spray², C. Feudtner²

¹Hospital of the University of Pennsylvania, Philadelphia, ²The Children's Hospital of Philadelphia, PA

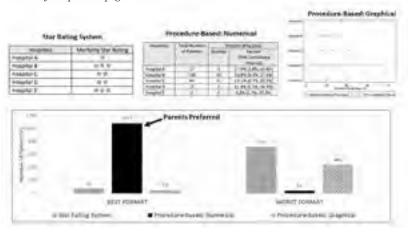
Purpose: Calls for public reporting of outcomes in pediatric congenital heart surgery have led to several different proposed reporting schemes, including a hospital star rating system and benchmark procedure-specific mortality data tables. Important unanswered questions remain, however, about the optimal format and content of public reporting of congenital heart surgery outcomes.

Methods: We first developed, in conjunction with leadership of three parent advocacy groups (Mended Little Hearts, the Pediatric Congenital Heart Association, and Sisters by Heart), a 43-item questionnaire to gauge parent attitudes regarding the format and content of an "optimal" public reporting scheme. We then performed a cross-sectional anonymous survey of parents of children with congenital heart disease. Parents were solicited for participation via e-mail lists of members of the three parent advocacy groups and from a cohort of parents whose children had undergone surgical correction for an STS benchmark procedure at the Children's Hospital of Philadelphia after January 1, 2007.

Results: Of the 1,862 survey responses collected, 1,281 provided complete data for analysis. Nearly all (92%) of the participants were mothers of children with congenital heart disease (CHD), and most (92%) were white. About half (57%) of the children were diagnosed with CHD prenatally, and 63% underwent an initial repair in the neonatal period. Many families were referred to a cardiac surgical center by a physician (60%) or as a transfer from their birth hospital (23%). When asked to rank categories of outcome measures or other types of information to include in an optimal public reporting scheme, parents identified survival statistics, surgeon-specific experience, and complication rates as most important (Table). Presented with three display formats for hospital-specific mortality rates, most parents (89%) identified a numerical procedure-based approach as the best format, and more than half (60%) identified the hospital star rating system as the worst potential format to display mortality data (Figure).

Conclusions: Parents of children with CHD identify survival statistics, surgeon-specific experience, and complication rates as the most important congenital heart surgery outcome measures to report publicly. Additionally, parents preferred mortality data to be presented in a procedure-specific format using the numerical procedure-based approach, as opposed to the star rating system.

Congenital: Pediatric Congenital II – Continued Continued from previous page



TYPE OF INFORMATION	MEAN RATING*	95% CONFIDENCE INTERVAL
Survival Statistics	1.87	1.78, 1.94
My buby's changes of sursiving the surgery, or surviving after the surgery		
Surgeons' Experience with Congenital Heart Surgery	2.41	2.13, 2.50
This surgeon's track record with congenital heart surgeries		
Problems and Complications	2.83	2.75, 2.91
Medical problems my hoby may have after the operation		
Quality of Life Outcomes	3.00	2.91, 3.10
How this heart condition and other medical problems will affect my child in the long term		
Center's Experience with Congenital Heart Surgery	3.30	3.19, 3.40
This hospital's track record with congenital heart surgeries		
Care After the Procedure	4.36	4.25, 4.47
How my baby will be cared for in the hospital		
Center's Other Aspects of Care	5.92	5.79, 6.04
Other services this hospital may offer me and my lamily		
Cost to My Family	6.50	6.18, 6.62
How this specution will affect my lamily financially		

[&]quot;I = most important, 8 = least important

NOTES



Congenital: Pediatric Congenital II – Continued

2:45 PM Room 360BC

Effect of Antifibrinolytic Drugs on Pulmonary Function in Neonates Undergoing the **Norwood Procedure**

G. Hoffman¹, J. P. Scott¹, R. A. Niebler¹, E. E. Stuth¹, M. E. Mitchell², J. S. Tweddell³, N. S. Ghanayem⁴, K. A. Mussatto²

¹Children's Hospital and Medical College of Wisconsin, Milwaukee, ²Children's Hospital of Wisconsin, Milwaukee, ³Heart Institute, Cincinnati Children's Hospital Medical Center, OH, ⁴Medical College of Wisconsin, Milwaukee

COMMERCIAL RELATIONSHIPS M. E. Mitchell: Research Grant, TAI Diagnostics, Ariosa Diagnostics; Ownership Interest, TAI Diagnostics, Ariosa Diagnostics; Consultant/Advisory Board, TAI Diagnostics; J. S. Tweddell: Consultant/Advisory Board, CorMatrix

REGULATORY DISCLOSURE This presentation will describe the use of Aprotinin by Bayer, which has an FDA status of investigational.

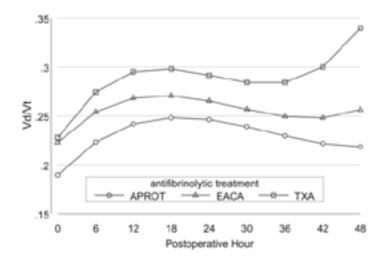
Purpose: The use of aprotinin (APROT) in neonatal cardiac surgery has been associated with reduced inflammatory markers and favorable modification of the host response to cardiopulmonary bypass (CPB). We compared effects of APROT, epsilon aminocaproic acid (EACA), and tranexamic acid (TXA) on postoperative lung function and hemodynamics in neonates undergoing a Norwood stage one palliation (S1P) for hypoplastic left heart syndrome.

Methods: All neonates undergoing S1P since 1996 were enrolled in an Institutional Review Board-approved registry containing demographic, treatment, and physiologic variables (SpO₂, SvO₂, MABP, HR, CVP, rSO₂C, rSO₂R, end-tidal pCO₂, fiO₂) and interpolated blood gases (PaCO, PaO, pH, SaO, BE, Hb) prospectively recorded over 48 postoperative hours. The effects of antifibrinolytic drugs on alveolar dead space (VdVt) and pulmonary (PVRI) and systemic (SVRI) vascular resistance were assessed by multilevel panel regression controlling for shunt type and size, CPB and deep hypothermic circulatory arrest (DHCA) times, vasodilator strategy, age, weight, time, and physiologic measures. Regression parameter coefficients were significant if P < .05. Differences between coefficients for parameter levels were tested by F-statistics. Analyses were performed with Stata V14.

Results: Data from 10,408 hours in 329 patients from 1996 to 2013 were included in this analysis. No antifibrinolytics were given to 16 patients (5%), APROT to 210 (63%), EACA to 52 (16%), and TXA to 51 (16%). Survival to hospital discharge was 92% (88%-94%), without difference between groups. Over 48 hours, VdVt was affected by weight, DHCA time, pH, pCO2, and antifibrinolytic treatment. VdVt increased over the first 6-12 hours in all groups, but VdVt was significantly smaller in the APROT group compared both to EACA (effect size -0.031 ± 0.016 , P = .045) and to TXA (effect size -0.060 ± 0.019 , P < .001); see Figure. Over 48 hours, PVRI was affected by weight, postnatal age, time, pH, fiO₂, SaO₂, Hb, vasodilator strategy, shunt size, and antifibrinolytic treatment; PVRI was lower in the APROT group compared to any other antifibrinolytic treatment (effect size -0.26 ± 0.10 , P = .013). Over 48 hours, SVRI was affected by SaO₂, SvO₂, pH, and Hb; SVRI was significantly lower in the TXA group compared both to EACA (effect size -1.32 ± 0.49, P = .007) and to APROT (effect size $-1.21 \pm 0.50, P = .015$).

Conclusions: Antifibrinolytics have distinct pulmonary and hemodynamic effects, which are clinically important in vulnerable patients. APROT showed salutary effects on lung function (VdVt and PVRI) compared to both EACA and TXA. TXA was associated with larger alterations in SVRI. These findings are consistent with a significant anti-inflammatory effect unique to APROT.





1:00 PM - 3:00 PM Room 330AB

EACTS @ STS: Management of Distal Type B Aortic Dissection

In this session, presented by STS and the European Association for Cardio-Thoracic Surgery (EACTS Vascular Domain), international experts will discuss the various treatment strategies and techniques for distal thoracic aortic dissection. Complex open reconstructive techniques, as well as endovascular approaches to both acute and chronic dissection, will be discussed. Additionally, hybrid approaches and the impact of distal endovascular adjunctive stent graft therapies on distal aortic remodeling and survival will be discussed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Explain various treatment strategies for distal aortic dissection, including open, endovascular, and hybrid approaches
- Discuss the results of open repair, endovascular stent grafting, and hybrid repairs and the long-term impact on aortic remodeling and survival
- Describe the nuanced anatomy and patient characteristics used to select the various treatment strategies available for distal aortic dissection

Moderators: Joseph E. Bavaria, Philadelphia, PA, and Ruggero De Paulis, Rome, Italy

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, and interpersonal and communication skills. These physician competencies will be addressed through a series of collaborative lectures by members of The Society of Thoracic Surgeons and the European Association for Cardio-Thoracic Surgery.



1:00 PM

Introduction to the Type B Dissection Treatment Conundrum

Joseph E. Bavaria, Philadelphia, PA, and Ruggero De Paulis, Rome, Italy

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates

1:10 PM

Presentation of a Newly Designed Thoracic Aortic Surgery Module: An Initial Report From the STS Adult Cardiac Surgery Database

Nimesh D. Desai, Philadelphia, PA

COMMERCIAL RELATIONSHIPS N. D. Desai: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates





EACTS @ STS: Management of Distal Type B Aortic Dissection - Continued

1:15 PM Room 330AB

The Impact of Thoracic Endovascular Aortic Repair on Long-Term Survival in Type B Aortic Dissection

X. Lou¹, E. P. Chen², R. Veeraswamy², Y. Duwayri², **B.G. Leshnower²**

¹Emory University, Atlanta, GA, ²Emory University School of Medicine, Atlanta, GA

COMMERCIAL RELATIONSHIPS Y. Duwayri: Research Grant, Cook Medical, Trivascular Institution; Consultant/Advisory

COMMERCIAL RELATIONSHIPS Y. Duwayri: Research Grant, Cook Medical, Trivascular Institution; Consultant/Advisory Board, Cook Medical; B. G. Leshnower: Consultant/Advisory Board, CryoLife; R. Veeraswamy: Research Grant, Medtronic; Consultant/Advisory Board, Cook Medical

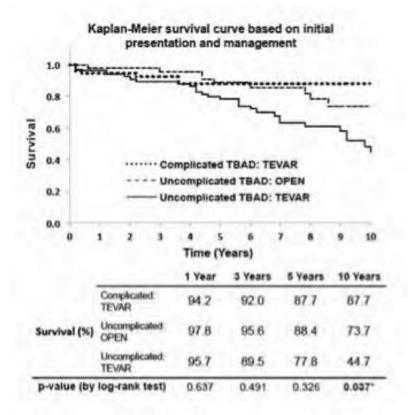
Purpose: Thoracic endovascular aortic repair (TEVAR) has revolutionized the treatment of type B aortic dissection (TBAD). This study examines the impact of TEVAR in the acute phase compared to TEVAR and open surgery in the chronic phase on long-term survival.

Methods: A retrospective review of a US academic center aortic database from 2000 to 2016 identified 194 patients who were diagnosed with acute TBAD and failed medical management. Residual type A dissections were excluded. Acute complicated TBAD patients (aTEVAR, n=72) were treated with TEVAR on the index hospitalization. The remaining 122 patients underwent open aortic replacement (OPEN, n=49) or TEVAR (cTEVAR, n=73) in the chronic phase for aneurysmal degeneration. Follow-up was complete in 88% (43/49) of OPEN and 90% (130/145) of TEVAR cases. Kaplan-Meier curves were constructed to assess long-term mortality, and odds ratios were calculated to identify independent predictors of mortality.

Results: Mean age of all patients was 56 years ± 11 years, and 69% were male. In the aTEVAR group, operative and 10-year mortality were 5.6% and 8.3%. Sixteen patients (22.2%) required 20 reinterventions (open, n=10; endovascular, n=10). In the chronic groups, median time to intervention was 1.7 years (interquartile range [IQR] 0.28-3.95), and the maximum diameter of the descending aorta was 4.8 cm (IQR 4-5.5) at index hospitalization and 6.1 cm (IQR 5.6-6.7) at intervention. Operative and 10-year mortality were 12.2% and 20.4%, respectively, for OPEN patients and 2.7% and 38.4%, respectively, for cTEVAR patients. Twenty-two patients (18.0%) required 24 reinterventions (open, n=11; endovascular, n=13). Incidence of stroke, paraparesis, and paraplegia were equivalent in all three groups (Table). Age >60 (OR 2.75; 95% CI, 1.21-6.25) and history of stroke upon presentation (OR 3.81; 95% CI, 1.18-12.31) were independent predictors of long-term mortality. At 10 years, the aTEVAR group had a significantly improved survival compared to the other two cohorts (Figure).

Conclusions: Despite equivalent operative mortality and adverse neurologic outcomes, acute TBADs undergoing TEVAR have an improved long-term survival compared to TBADs undergoing open or endovascular therapy in the chronic phase. TEVAR at the index hospitalization may confer a survival advantage and serve as optimal therapy for complicated and uncomplicated acute TBADs.





	Complicated: TEVAR n=72	Uncomplicated: OPEN n=49	Uncomplicated: TEVAR n=73	p-value
Mean age (yrs) at presentation ± 50	54.1 x 12.3	54.0 ± 10.9	59.6 ± 11.4	0.367
Operative mortality	5.60%	12.20%	2.70%	0.066
Stroke	4.20%	2.00%	1.40%	0.548
New onset paraplegia	0%	4.10%	2.70%	0.265
New onnet paraparesis	5.00%	2.00%	0%	0.102
Re-intervention rate	22.20%	8.20%	24.70%	0.062

1:30 PM

Frozen Elephant Trunk Procedure for Type A and B Dissection

Heinz G. Jakob, Essen, Germany



EACTS @ STS: Management of Distal Type B Aortic Dissection - Continued

1:45 PM Room 330AB

Twelve-Month Outcomes of Patients Treated for Chronic Symptomatic Aortic Dissection Using the Streamliner Multilayer Flow Modulator

S. Sherif, N. Hynes², E. P. Kavanagh³, V. S. Costache⁴, F. Stefanov³, A. Elhelali⁵

¹Galway University Hospitals, Ireland, ²Western Vascular Institute, Galway, Ireland, ³Galway Clinic, Ireland, ⁴University, Sibiu, Romania, ⁵GMedTech, Galway, Ireland

REGULATORY DISCLOSURE This presentation will describe the use of the Multilayer Flow Modulator by Carditatis, which has an FDA status of investigational.

Purpose: This study reports the initial 12-month outcomes of patients treated for chronic symptomatic aortic dissection (CSAD) by the Streamliner Multilayer flow modulator (SMFM). Primary endpoints were freedom from rupture and aortic related death, as well as reduction in false lumen index. Secondary endpoints were patency of great vessels and visceral branches, and freedom from stroke, paraplegia, and renal failure.

Methods: Out of 876 SMFM implanted globally, we have knowledge of 542. To date, 312 patients are maintained in the global registry, of which 38 patients were identified as having an aortic dissection (12.2%). Indications included 35 Stanford type B dissections, two Stanford type A and B dissections, and one mycotic Stanford type B dissection.

Results: Morphological analysis exhibited dissection remodelling by a reduction in longitudinal length of the dissected aorta and false lumen volume. A statistically significant reduction in false lumen index (P = .016) at 12 months and increase in true lumen volume (P = .053) confirmed dissection remodelling. All-cause survival was 85.3%. Twelve-month freedom from neurological events was 100%, and there were no incidences of end-organ ischemia, paraplegia, or renal insult.

Conclusions: The SMFM offers immense promise in the treatment of complex pan-aortic dissection. Results highlight that placement of the SMFM leads to dissection stabilization with no further aneurysm progression and no retrograde type A dissection. Treatment using the SMFM resulted in freedom from aortic rupture, neurological stroke, paraplegia, and renal failure.

2:00 PM

Open Thoracoabdominal Aortic Aneurysm Surgery vs TEVAR for Chronic Type B Dissection

G. Chad Hughes, Durham, NC

COMMERCIAL RELATIONSHIPS G. C. Hughes: Consultant/Advisory Board, Medtronic; Research Grant, Bolton Medical, Cook Medical, Medtronic, W. L. Gore & Associates; Speakers Bureau/Honoraria, Cook Medical



2:15 PM

The Impact of Initial Aortic Diameter and the Larger Area Ratio of False Lumen on Stanford Type B Aortic Dissection Prognosis

A. Matsushita, Y. Tsunoda, T. Hattori, W. Mihara

Seikeikai Chiba Medical Center, Japan

Purpose: Endovascular treatment for uncomplicated acute type B aortic dissection (UATBAD) may be used to avoid severe late complications. However, it remains controversial as to which patients would benefit. The aim of this study was to evaluate the outcomes of patients with UATBAD. Furthermore, we tried to identify the predictors of adverse events.

Methods: We conducted a retrospective cohort study reviewing 134 consecutive patients underwent initial treatment for UATBAD between 2004 and 2015. We excluded 25 complicated patients (rupture, impending rupture, malperfusion). Mean follow-up duration was 44.0 months ± 33.5 months. Adverse events (all-cause mortality, late operation, or indication of operation for dissected aorta) were assessed with the Kaplan-Meier method. We explored predictors of adverse events using a Cox proportional hazards model. Predictors of adverse events that were included in the initial model were age, male sex, initial aortic diameter ≥ 40 mm, patent false lumen, and false lumen diameter > true lumen diameter.

Results: In-hospital mortality was one (0.7%) because of respiratory failure. Long-term mortality was 14 (10.4%). There were 25 patients (18.7%) who underwent late operation for dissected aorta, and 11 patients (8.2%) refused late operation despite of the dissected aneurysm ≥55 mm. The freedom from adverse events rate was 76.7%, 73.3%, and 68.2% at 1, 3, and 5 years, respectively. Multivariate analysis detected risk factors of adverse events were age (HR 1.05; 95% CI, 1.01-1.08; P < .01), initial aortic diameter ≥40 mm (HR 2.98; 95% CI, 1.39-6.37; P < .01), and false lumen diameter > true lumen diameter (HR 3.15; 95% CI, 1.43-6.92; P < .01).

Conclusions: We identify that the predictors of adverse events were age, initial aortic diameter ≥40 mm, and false lumen diameter > true lumen diameter. We will introduce the endovascular treatment to these high-risk patients.

2:30 PM

TEVAR vs Medical Management for Acute Uncomplicated Type B Dissection: Are There High-Risk Features Worthy of Consideration?

Davide Pacini, Bologna, Italy



EACTS @ STS: Management of Distal Type B Aortic Dissection - Continued

2:45 PM Room 330AB

Predictors of Remodeling of the Distal Aorta in Patients Who Underwent TEVAR for Chronic Type B Aortic Dissection

I. Sultan¹, M. A. Siki², J. E. Bavaria², T. Dibble², A. Kilic², W. Y. Szeto², N. Desai²

¹University of Pittsburgh, PA, ²University of Pennsylvania, Philadelphia

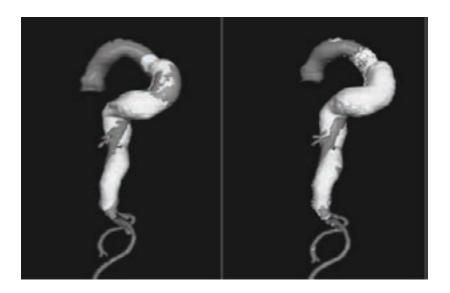
COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; N. Desai: Speakers Bureau/Honoraria, St Jude Medical, Edwards Lifesciences Corporation; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/ Advisory Board, Microinterventional Devices

Purpose: Chronic type B aortic dissection (TBAD) typically is managed with open aortic reconstruction. Thoracic endovascular aortic repair (TEVAR) therapy has been attempted in chronic TBAD with mixed outcomes and frequent failures. This study investigates factors associated with positive aortic remodeling from a large aortic center.

Methods: We analyzed 3D reconstructions of computed tomography angiography scans of 48 patients who underwent TEVAR from 2005 to 2015. Four timepoints were included in the analysis: preoperative, early postoperative (<3 months), mid-term follow-up (6-18 months), and long-term follow-up (>2 years). In addition to characterizing the dissection and residual flap, we measured aortic and stent diameter and obtained true lumen and false lumen indices. Standard univariate Wilcoxon rank-sum and Fisher's exact tests were used to analyze continuous and ordinal/nominal data, respectively. Longitudinal data were analyzed using a linear mixed model with an unstructured covariance matrix to account for within-subject correlation. Multivariable logistic regression was performed.

Results: All 48 patients were included in the analysis. Maximum diameter of the true lumen $(24.4 \text{ cm} \pm 13.4 \text{ cm} \text{ preoperatively to } 31.2 \text{ cm} \pm 7.9 \text{ cm} \text{ after 2 years; } P = .02)$ and maximum diameter of the true lumen 2 cm above the celiac axis (18 cm ± 7.1 cm preoperatively to 21.3 cm \pm 6.6 cm after 2 years; P < .01) both increased significantly over the study period, whereas maximum diameter of the false lumen decreased significantly (31.6 cm ± 14.1 cm preoperatively to 26.8 cm \pm 16.8 cm after 2 years; P = .01). 58% (25/42) of patients had total thrombosis in zones 3 and 4 after 2 years and 76% (32/42) had total thrombosis in at least one segment of the descending aorta after 2 years. In a multivariate logistic model, having fewer than two visceral vessels off the true lumen preoperatively was a negative predictor of false lumen thrombosis (OR 0.01; 95% CI, <0.01-0.84; P = .04). In a logistic model predicting thrombosis in the stented aortic portion (zones 3 and 4), maximum diameter 2 cm above the celiac axis was a significant negative predictor (OR 0.75; 95% CI, 0.57-0.99; P = .05). Finally, in a model predicting failure of the maximum overall diameter of the descending aorta to regress within 1 year post-TEVAR, maximum overall diameter preoperatively (OR 1.19; 95% CI, 1.02-1.29; P = .03) and tear location on the greater curve (OR 18.1; 95% CI, 1.3-243; P = .03) were significant predictors.

Conclusions: TEVAR is feasible in chronic dissection but is limited by complex dissectionrelated anatomy. Increasing number of visceral vessels off the false lumen, maximum preoperative aortic size, and location of the primary tear on the greater curve were associated with poorer remodelling.



1:00 PM - 3:00 PM Room 361A

Electronic Learning and Innovation in Education

In this session, attendees will be introduced to the new STS learning management system. Participants will learn how to create a curriculum, assign tasks and quizzes to residents, generate reports, and successfully adapt the new system into their programs. Participants also will learn new teaching techniques involving the latest technology.

Learning Objectives

1:00 PM

Upon completion of this activity, participants should be able to:

- Demonstrate how to use the STS learning management system to develop a resident education curriculum within their program
- · Describe several techniques to improve resident education

Moderators: Mark S. Allen, Rochester, MN, and Edward D. Verrier, Seattle, WA

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are medical knowledge, patient care, interpersonal skills and communication, and practice-based learning improvement. These physician competencies will be addressed through didactic presentations, demonstrations, and hands-on opportunities.

Adapting the New STS Learning Management System into Your

	Program Ara A. Vaporciyan, Houston, TX
1:20 PM	Discussion
1:20 рм	Assessment Review Stephen C. Yang, Baltimore, MD
1:40 рм	eMTRCS Milestone Application Nahush A. Mokadam, Seattle, WA COMMERCIAL RELATIONSHIPS N. A. Mokadam: Consultant/Advisory Board, HeartWare; Research Grant, HeartWare, SynCardia
2:00 PM	Resident-Faculty Feedback Application Shari L. Meyerson, Chicago, IL
2:20 PM	Discussion

NOTES

1:00 PM - 3:00 PM Room 351DEF

General Thoracic: Esophageal

Moderators: Daniela Molena, New York, NY, and Christopher R. Morse, Boston, MA COMMERCIAL RELATIONSHIPS D. Molena: Speakers Bureau/Honoraria, Novadaq

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

1:00 PM

Revisional Surgery Following Esophagectomy: Straight Talk About the Conduit

E. G. Chan¹, J. D. Luketich¹, B. W. Schaheen², M. A. Villa Sanchez¹, L. W. Schaheen¹
¹University of Pittsburgh Medical Center, PA, ²University of Virginia Health System,
Charlottesville

COMMERCIAL RELATIONSHIPS J. D. Luketich: Ownership Interest, Johnson & Johnson, Intuitive Surgical; Research Grant, Accuray

Purpose: Gastrointestinal complaints, such as dysphagia and reflux, are often considered an expected consequence of esophagectomy. In some patients, these symptoms may be secondary to a correctable anatomic problem that warrants consideration for surgical intervention. We sought to review our outcomes with revisional surgery following esophagectomy.

Methods: Two of the conditions in which patients with recalcitrant symptoms may benefit from surgical intervention include a redundant gastric conduit and a paraconduit hernia. A retrospective review from 1995 to 2015 identified patients who were radiographically diagnosed with a redundant gastric conduit, paraconduit hernia, or combination of both following esophagectomy. The clinical presentation, time to diagnosis, operative approach, and postoperative outcomes were reviewed.

Results: A total of 130 patients were identified. A redundant conduit was diagnosed in 61% of patients (n=79), paraconduit hernia in 22% (n=29), or a combination of both in 17% (n=23). Mean time from esophagectomy to diagnosis was 43 months for redundant conduit and 40 months for paraconduit hernia. The majority of hernias occurred to the left of the gastric conduit. The transverse colon was most commonly involved (81%), followed by small bowel (33%) and omentum (42%). In both of these diagnoses, patients presented with dysphagia (55%), reflux (19%), regurgitation (5%), and aspiration (6%), with delays in gastric conduit emptying noted in 49% of patients. Revisional surgery was performed successfully in 125 patients; minimally invasively in 73.6%, planned open in 13.6%, and a decision to convert to open in 12.8%. Greater than 90% of patients experienced resolution or improvement in their preoperative symptoms.

Conclusions: The development of a redundant conduit or paraconduit hernia may occur years after esophagectomy. These conditions are associated with a functional outflow obstruction leading to profound morbidity and even death. With careful selection, surgical interventions that restore normal anatomy improve symptoms and quality of life in the majority of patients.

General Thoracic: Esophageal – Continued

1:15 PM Room 351DEF

Induction Therapy Before Esophagectomy Improves Overall Survival in Patients With Clinical T3NO Esophageal Cancer: A Nationwide Study in Taiwan

Y. Chao¹, C. Chen², T. Liu³

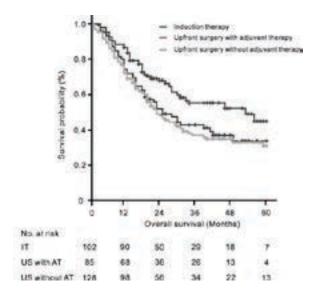
¹Chang Gung Memorial Hospital, Kweisan, Taiwan, ²Institute of Medicine, Chung Shan Medical University, and Chung Shan Medical University Hospital, Taichung, Taiwan, ³National Institute of Cancer Research, National Health Research Institute, Miaoli, Taiwan

Purpose: Controversy still surrounds the use of induction therapy (IT) in patients with esophageal cancer and resectable primary tumors in the absence of clinically evident nodal metastases. We retrospectively compared the overall survival (OS) of patients with clinical T3N0 esophageal cancer who received IT before surgery vs upfront surgery (US).

Methods: In this nationwide study, we searched the Taiwan Cancer Registry (TCR) for patients with esophageal cancer who were clinically staged as T3N0 and underwent esophagectomy as part of their treatment schedule between 2008 and 2013. Patients were divided into two groups according to whether IT was used (IT group) or not (US group). We compared the general characteristics of the study participants, as well as their perioperative outcomes. The potential survival benefit of IT was investigated with multivariate Cox regression analysis after allowance for potential confounders.

Results: Of the 11,752 patients with esophageal cancer included in the TCR database, 339 (2.9%) had cT3N0 disease and were treated with surgery. 92% of this patient group had squamous cell carcinomas. Of them, 102 received IT (IT group) and 273 did not (US group). Pretreatment clinical staging was found to be accurate in 47.9% of patients in the US group. In contrast, 21 patients (8.97%) were clinically overstaged and 101 (43.17%) understaged. The use of IT before surgery was associated with higher R0 resection rates (96.1% vs 84.4%, P < .01) and fewer pathological nodal metastases (18.6% vs 40.5%, P < .01), despite unexpected M1 disease being more common (4.9% vs 1.3%, P = .043). The 5-year overall survival (OS) rate was significantly lower (31%) in the US group than in the IT group (44%, P = .007), regardless of adjuvant therapy. Multivariate analysis identified US (hazard ratio: 1.58, P = .03) as the only independent adverse prognostic factor for OS.

Conclusions: The use of IT before esophagectomy improves 5-year OS of patients with clinical T3N0 esophageal cancer. More investigation and communication between surgeons and oncologists will be needed to reach a consensus in implementing the use of IT for all cT3N0 patients who are not inoperable and do not have contraindications for chemoradiotherapy.



Yorishic	US group (n = 257)	IT group (n = 102)	Prolee
Sca	(8-22)	(8 - 100)	0.69
Mele	215 (96.7%)	96 (93.2%)	
Female	22 (9.7%)	8 (7.8%)	
Age, mean + SD (years)	56.7 ± 10.8	54.1 + 8.8	0.60
Ago, mean + SO (years) Tumor lecation	36.7 = 10.8	34.1 = 8.8	0.64
Conscillapper third	32 (13.5%)	12 (11.8%)	0.04
Middle third	74 (31.2%)	38 (37.3%)	
Lower third	51 (38.4%)	39 (38.2%)	
Undefined	40 (16.9%)	13 (12.7%)	
Histology			0.38
SCC	222 (91.7%)	98 (96.176)	
Non-SCC	15 (6.3%)	4 (3.9%)	
R0 resection			-0.01
R0	200 (84.4%)	98 (96.1%)	
R1/R2	31 (13.1%)	3 (2.9%)	
Unspecified	6 (2.5%)	1 (9.8%)	
Number of dissected modes			
Mean x SD	23.0×13.2	20.3 ± 13.5	0.06
Median	20	17	
Range	3-62	1-61	
Pathological model status			-1.01
Negative	141 (29.3%)	83 (81.4%)	
Positive	96 (40.5%)	19 (18.4%)	
Pathological M1 status	3 (1.3%)	5 (4.9%)	0.043
Postop 30-day metality	0.69%	2 (2.0%)	0.09
Postop 90-day mortality	5 (2.1%)	7 (6.9%)	0.049
Facility type			0.18
Regional hospital	142 (68.4%)	42 (91.8%)	
Medical cerner	25 (31.0%)	40 (39.2%)	

Data are given as counts and percentages, unless otherwise indicated. Abbreviations: SDs standard deviation, SCC, squamous cell carcinoma, Postop, postoperative



General Thoracic: Esophageal – Continued

1:30 PM Room 351DEF

Is Open Esophagectomy Still the Gold Standard in the Treatment of Esophageal **Cancer? A National Cancer Database Study**

B. Weksler, J. L. Sullivan

University of Tennessee Health Science Center, Memphis

Purpose: Although open esophagectomy (OE) is considered the "gold standard" treatment for esophageal cancer, minimally invasive robotic esophagectomy (RMIE) and laparoscopic/ thoracoscopic esophagectomy (MIE) are becoming more common. This study compared RMIE, MIE, and OE—assessing the three approaches in the same study for the first time and examined long-term outcomes.

Methods: The National Cancer Database was queried for all patients who had surgical resection of esophageal cancer from 2010 to 2013. Patients lacking information on the type of surgical procedure performed were excluded. We used the chi-square test and one-way ANOVA with the Bonferroni correction for multiple comparisons to identify differences among the groups. Kaplan-Meier analysis was used to examine survival. The Cox proportional hazards model was used to identify variables affecting survival. Significance was set at $P \le .05$.

Results: We identified 9,217 patients who underwent RMIE (581, 6.3%), MIE (2,379, 25.8%), or OE (6,257, 67.9%) (Table). Patients who underwent RMIE were treated at academic institutions more frequently and had pathologic stage III esophageal cancer less frequently than patients who underwent MIE or OE. More patients with RMIE received preoperative neoadjuvant therapy as compared with patients with MIE or OE. Patients who underwent RMIE had a higher frequency of R0 resection, more lymph nodes resected, and shorter hospital stays than patients who underwent MIE or OE (Table). Nonetheless, 30-day mortality was higher among patients who underwent RMIE, and overall survival was shorter. Median survival was 28 months after RMIE, 31 months after MIE, and 34 months after OE (P < .001) (Figure). In both univariate and multivariate analysis, the type of surgery performed significantly affected survival (RMIE vs OE, HR 1.58, P < .001; MIE vs OE, HR 1.19, P < .001).

Conclusions: RMIE shows promising early oncologic outcomes with more R0 resections, a higher number of lymph nodes harvested, and shorter hospital stays than OE. However, the longer overall survival after OE suggests that open surgery is still the gold standard for the treatment of esophageal cancer. Prospective trials are urgently needed.

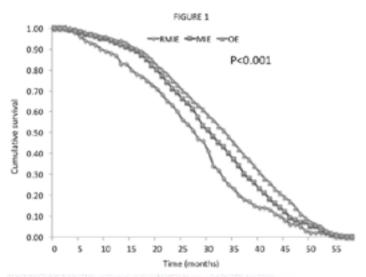


Table 5	Patient Characteristics and	Charten agatism Chatenman

Characteristic	RMIE N=S81	MIE N=2379	0E N=6257	p
Age, median years (range)	63.5 (30-87)	64.0 (18-90)	64.0 (21-90)	0.212
Male sex	480/581 (82.6%)	1987/2379 (83.5%)	5129/6257 (82.0%)	0.237
White race	534/574 (93.0%)	2211/2357 (93.8%)	5707/6165 (92.6%)	0.138
Surgery performed at an ocademic institution	445/575 (77.4%)	1661/2356 (70.5%)	3716/6152 (60.4%)	< 0.001
Preoperative chemotherapy and radiotherapy	383/581 (65.9%)	1379/2379 (S8.0%)	3572/6257 (58.6%)	<0.001
Esophageal adenocarcinoma	455/581 (78.8%)	1793/2379 (75.4%)	4583/6257 (73.2%)	0,008
Pathologic Stage III tumor	105/456 (23.0%)	477/1859 (25.7%)	1297/4799 (27.0%)	0.020
R0 resection	\$\$3/\$77 (95.8%)	2203/2361 (93.3%)	5640/6090 (92.6%)	0.012
Number of resected nodes, median [range]	15 (0-71)	14 (0-83)	12 (0-90)	<0.001
Hospital stay, median days (range)	9 (0-107)	10 (0-132)	10 (0-150)	<0.001
Readmission within 30 days	40/580 (6.9%)	156/Z369 (6.6%)	435/6207 (7.0%)	0.787
30-day mortality	5.4%	2.9%	4.2%	0.023

General Thoracic: Esophageal – Continued

1:45 PM Room 351DEF

Patient Response to Neoadjuvant Chemoradiotherapy Predicts Overall and Disease-Free Survival in Locally Advanced Esophageal Cancer

A. Knight¹, J. Reinersman², M. S. Allen¹, D. A. Wigle¹, S. D. Cassivi¹, F. C. Nichols¹, K. R. Shen¹, S. H. Blackmon¹

 $^1Mayo\ Clinic,\ Rochester,\ MN, ^2University\ of\ Oklahoma\ Health\ Sciences\ Center,\ Oklahoma\ City$

Purpose: Prior studies report a 5%-7% incidence of ypT0N+ esophageal cancer, which has been associated with poorer survival outcomes. Our study compared survival between various categories of residual disease after neoadjuvant chemoradiotherapy (ypT0N0, ypT+N0, ypT0N+, ypT+N+).

Methods: Patients undergoing surgical resection for esophageal cancer following neoadjuvant chemoradiotherapy from August 1, 2008, to December 31, 2014, were selected from a prospectively maintained surgical database at a single institution. Patient factors, neoadjuvant chemoradiotherapy dosing and timing data, final pathologic response, and intraoperative, postoperative, and survival data were recorded. Kaplan-Meier analysis was performed for overall (OS) and disease-free survival (DFS) for the entire study group, as well as subgroups separated by final pathologic response.

Results: There were 883 esophagectomies performed, 635 of which were for malignancy. 448 patients received neoadjuvant chemoradiotherapy. 399 patients were available for hospital discharge analysis. Following chemoradiotherapy, 98 patients (24.6%) had a complete pathologic response (ypT0N0), 142 (35.6%) had only primary tumor site residual disease (ypT+N0), 20 (5.0%) had only residual lymph node disease (ypT0N+), and 139 (34.8%) had residual disease in the primary tumor site and lymph nodes (ypT+N+). Both clinical stage (P = .39) and number of lymph nodes harvested (P = .26) were similar between the pathologic responses. Patients received similar neoadjuvant chemotherapy regimens (P = .47) and radiotherapy doses (P = .84). Median DFS was 27.2 months (13.2-48.9 months) for ypT0N0, 21.0 months (9.3-41.3 months) for ypT+N0, 20.1 months (13.5-34.4 months) for ypT0N+, and 11.9 months (6.4-23.3 months) for ypT+N+ (P < .0001). Observations were similar in the adenocarcinoma subgroup, as shown in the Figure.

Conclusions: In a high-volume, single-institution experience, patient response to chemoradiotherapy predicts both disease-free and overall survival in locally advanced esophageal cancer. Large, multi-institutional experiences will likely elucidate discrete differences between partial and complete responders.

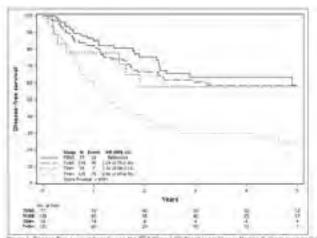


Figure 1. Disease-free surviver based upon the 1" biddon AUX Exophages Sencer thaying 5 cities has used free perhapsing of passed unto strain incompleted expenses assessmentation in undergoing management the mendature. For the exceptage term, sometimes that is against on the particle group in a post of the perhapsing of post of the perhapsing of the pe

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General Thoracic: Esophageal – Continued

2:00 PM Room 351DEF

Local and Population-Level Analyses of Extent and Risk Factors of Readmission Within 1 Year of Esophagectomy

B. Kidane¹, B. J. Jacob², J. Peel³, Y. Shen³, R. Saskin⁴, T. K. Waddell⁵, G. Darling⁵

¹University of Toronto, Canada, ²Centre for Addiction and Mental Health, Toronto, Canada, ³Toronto General Hospital, Canada, ⁴Institute for Clinical Evaluative Sciences, Toronto, Canada, ⁵University Health Network, Toronto, Canada

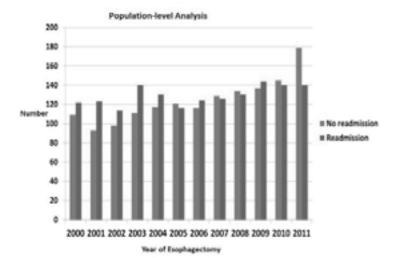
COMMERCIAL RELATIONSHIPS T. K. Waddell: Employment, Ownership Interest, Consultant/Advisory Board: XOR Labs, Perfusix Canada, and United Therapeutics

Purpose: Hospital readmission after esophagectomy can occur beyond the 90-day horizon and has implications on quality of life and resource utilization. Single-center and populationbased databases have limitations. Our objective was to determine the extent of readmissions within 1 year of esophagectomy, as well as to identify local and population-level factors associated with readmission.

Methods: We conducted simultaneous cohort studies of consecutive esophagectomies for cancer in 1) a high-volume tertiary hospital in Ontario, Canada, using local single-center data from 1999 to 2014 and 2) all hospitals in the province of Ontario using linked health administrative data (2000-2012) with the ability to identify readmissions at other, non-index hospitals. Ontario has a single-payer health care system with a population of 13.8 million people. Multivariable logistic regression was used to identify factors associated with higher readmission. Demographic, socioeconomic (income, rurality, social supports, language), and medical/surgical (comorbidity, resection type, use of minimally invasive surgery) factors were assessed.

Results: In the population-level analysis, there were 3,344 esophagectomies with in-hospital mortality of 5.8% (n=193). Of those discharged, 51.3% (n=1,617) were readmitted within 1 year of esophagectomy. On multivariable analysis, higher comorbidity (P = .001) and use of chemotherapy and/or radiation therapy (P < .001) independently predicted readmission. There was a significant annual reduction in readmission (52.8% in 2000 vs 43.8% in 2012, P < .0001). The point at which readmission rates dropped below 50% occurred between 2006 and 2008 and coincides with regionalization of esophagectomy in Ontario. In addition to these risk factors, rural status independently predicted frequent (≥3) readmissions (P = .02). In local-level analysis, there were 520 esophagectomies with in-hospital mortality of 6% (n=31). Of those discharged, 32.3% of patients (n=168) were readmitted within 1 year. On multivariable analysis, higher comorbidity (P = .03) and occurrence of respiratory complications (P = .02) or anastomotic leak (P = .05) independently predicted readmission. Resection type, minimally invasive surgery, and demographic/socioeconomic factors did not predict readmission.

Conclusions: There is a high readmission rate within 1 year of esophagectomy. Local and population-level analyses revealed local and system-level risk factors not otherwise accessible from either alone. Further study is needed to assess whether closer follow-up of patients with respiratory/anastomotic complications or better supports for rural patients may reduce readmissions.



	Local Anal	ysis	Population-level An	alysis
	Adjusted Odds Ratio (95% confidence interval)	P	Adjusted Odds Ratio (95% confidence interval)	ρ
Higher Comorbidity	1.64 (1.05-2.56)	0.03	1.04 (1.02-1.06)	0.001
Chemotherapy	0.80 (0.50-1.27)	0.34	1.58 (1.23-2.02)	<0.001
Radiation Therapy	1.68 (0.52-5.44)	0.39	1.39 (1.17-1.65)	<0.001
Respiratory Complications	187 (1.12-3.01)	0.02	Could not be assessed	
Anastomotic Leuk	1.73 (1.00-3.01)	0.05	Could not be exserted	
Year of Esophagectomy	0.97 (0.92-1.02)	0.17	0.95 (0.93-0.97)	< 0.001
Age	1.00 (0.98-1.02)	0.98	1.13 (0.38-3.30)	0.83
Male Sex	1.34 (0.84-2.14)	0.22	1.00 (0.84-1.20)	0.96
Cardiac Complications	0.74 (0.39-1.38)	0.34	Could not be assessed	
Recurrent Laryngeal Nerve Palsy	0.65 (0.27-1.57)	0.34	Could not be assessed	
Chylothorax	1.28 (0.55-2.98)	0.57	Could not be assessed	
Median Family Income	1.00 (1.00-1.00)	0.35	0.92 (0.73-1.16)	0.49
Minimally invasive Surgery	1.24 (0.66-2.33)	0.50	1.05 (0.77 1.44)	0.76
English Fluency	0.82 (0.39-1.72)	0.60	Could not be assessed	
Social Supports	0.89 (0.51-1.54)	0.67	Could not be assessed	
Rural Status	Could not be assessed		1.09 (0.83-1.27)	0.29

General Thoracic: Esophageal – Continued

2:15 PM Room 351DEF

A Nationwide Rise in the Use of Stents to Manage Benign Esophageal Perforation

L. Thornblade¹, A. Cheng², D. E. Wood¹, M. S. Mulligan², M. Saunders¹, H. He¹, B. K. Oelschlager², D. Flum¹, F. Farjah²

¹University of Washington, Seattle, ²University of Washington Medical Center, Seattle

COMMERCIAL RELATIONSHIPS M. S. Mulligan: Consultant/Advisory Board, Covidien /Medtronic; M. Saunders:
Consultant/Advisory Board, Medtronic

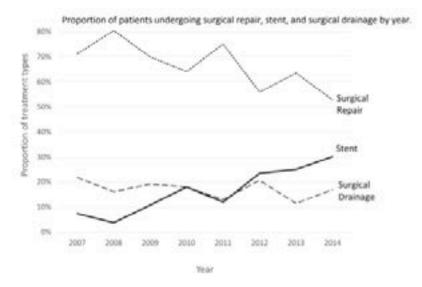
REGULATORY DISCLOSURE This study describes national trends in the use of esophageal stents for esophageal perforation, which is an off-label use of a device that is FDA approved for malignant strictures and esophageal fistula.

Purpose: Surgical repair or drainage is the standard treatment for benign esophageal perforation. We hypothesize that increasing enthusiasm and experience with esophageal stents—approved by the Food and Drug Administration for management of malignant strictures and/or fistulas—has led to greater use of stents for the management of benign esophageal perforation.

Methods: We conducted a retrospective cohort study (2007-2014) of patients with benign esophageal perforation using MarketScan—a national database of health care claims for individuals (and their dependents) with employer-provided commercial insurance. Inclusion criteria were an International Classification of Diseases diagnostic code for perforation and a Common Procedure Code for either repair, a drainage procedure (mediastinum and/or pleural spaces), or esophageal stent. All subjects had 6 months of continuous enrollment (ie, follow-up) unless disenrollment was due to death. Regression models were used to evaluate unadjusted and adjusted trends in treatment, outcomes, utilization, and costs over time.

Results: A total of 659 patients (mean age 49 years, 41% female) were treated for benign esophageal perforation (surgical repair: n=449, 69%; surgical drainage: n=110, 17%; stent: n=100, 15%). Stent use increased from 7% in 2007 to 30% in 2014 (Figure). Over the same period, the frequency of surgical repair decreased from 71% to 53%, whereas the frequency of surgical drainage did not change over time. Stent use increased by 28% per year (incidence rate ratio=1.28; 95% CI, 1.17-1.39; P < .001) after adjustment for changes over time in age, sex, comorbidity index, health insurance type, and the frequency of recent esophageal instrumentation in the 2 weeks prior to diagnosis. There were no significant changes in risk-adjusted deaths, discharges home, length of stay, readmissions, or costs over the same period for the overall cohort (all P > .05).

Conclusions: The use of stents for the management of benign esophageal perforation has increased by over four-fold in just 8 years. A multisite clinical registry of off-label use of esophageal stents would likely clarify the potential advantages and disadvantages of stenting in the management of benign esophageal perforation.



General Thoracic: Esophageal – Continued

2:30 PM Room 351DEF

Predictors of Failure to Rescue After Esophagectomy

D. Z. Liou, D. Serna-Gallegos, J. Mirocha, R. Alban, H. J. Soukiasian

Cedars-Sinai Medical Center, Los Angeles, CA

Purpose: Failure to rescue (FTR), defined as mortality following a major complication, is a metric increasingly being used to assess quality of care. Risk factors associated with failure to rescue after esophagectomy have not been previously studied.

Methods: The American College of Surgeons National Surgical Quality Improvement Program database was queried for patients who underwent esophagectomy with gastric conduit between 2010 and 2014. Patients who suffered at least one major postoperative complication were considered. Patients with incomplete discharge data were excluded. The cohort was divided into two groups according to in-hospital mortality following the complication (FTR) vs those who survived to discharge (SUR). Demographic and clinical characteristics were compared between the two groups. A stepwise logistic regression model was used to identify predictors of FTR following esophagectomy.

Results: During the study period, 4,527 patients underwent esophagectomy with gastric conduit, of which 1,986 (43.8%) suffered at least one major postoperative complication. After exclusions, a total of 1,730 patients were included in the study group, with 102 (5.9%) in FTR and 1,628 (94.1%) in SUR. FTR patients were older compared to SUR (69.0 years vs 64.0 years, P < .001). There were no significant differences in gender, ethnicity, body mass index, or comorbidities between the two groups, except for a higher incidence of chronic obstructive pulmonary disease (COPD) in FTR (19.6% vs 10.6%, P = .009). FTR had fewer patients with independent functional status preoperatively (94.1% vs 97.7%, P = .037). Factors that were predicative of FTR based on multivariable logistic regression included age >70 years (adjusted odds ratio [AOR] 2.05, P < .001) and COPD (AOR 2.01, P = .008). Independent functional status was associated with decreased risk (AOR 0.37, P = .0031).

Conclusions: Approximately 6% of patients who suffer a major complication after esophagectomy do not survive to discharge. Age over 70 years and COPD predict FTR, while preoperative independent functional status is protective. Further research is necessary to investigate how these factors impact survival after complications in order to improve rescue efforts.

	AOR (95% CI)	p-value
Age <50 (vs. age 50-70)	0.82 (0.32-2.11)	0.687
Age >70 (vs. age 50-70)	2.05 (1.35-3.10)	< 0.001
COPD	2.01 (1.20-3.38)	0.008
Independent functional status	0.37 (0.15-0.91)	0.031

General Thoracic: Esophageal – Continued

2:45 PM Room 351DEF

Postoperative Complications Drive Unplanned Readmissions After Esophagectomy

R. Bhagat¹, E. Juarez-Colunga¹, M. J. Weyant¹, J. D. Mitchell², N. O. Glebova¹, W. G. Henderson¹, D. A. Fullerton¹, R. A. Meguid¹

¹University of Colorado School of Medicine, Aurora, ²University of Colorado, Aurora

COMMERCIAL RELATIONSHIPS J. D. Mitchell: Speakers Bureau/Honoraria, Medtronic; Consultant/Advisory Board, Medtronic, Maquet; M. J. Weyant: Consultant/Advisory Board, Covidien/Medtronic

Purpose: Hospital readmissions increasingly are viewed as markers of inferior health care quality and penalized with decreased reimbursement. The timing of and reasons for unplanned readmissions after esophagectomies are not well understood. We examined the association of complications to 30-day postoperative unplanned readmission to identify opportunities for improvement.

Methods: We analyzed the American College of Surgeons National Surgical Quality Improvement Program database (2012-2014) to characterize 30-day postoperative unplanned readmissions after esophagectomies using descriptive statistics as identified by CPT codes. Timing of readmission after discharge was examined for patients who did and did not experience one or more (≥1) postoperative complications. Thirty-day follow-up was performed 90 days after surgery by surgical clinical reviewers who contacted patients/families directly to ensure accuracy.

Results: Of 3,500 patients who underwent esophagectomy, 2,765 (79%) were male, mean age was 63.0 years, and mean length of stay (LOS) was 12.8 days; 1,517(43%) experienced ≥1 complication within 30 days; and there were 18 deaths (0.5%). 355 (10.1%) experienced related, unplanned readmissions within 30 days of surgery. Readmitted patients had shorter mean LOS (10.3 days vs 13.1 days, P < .001) and higher 30-day mortality (1.69% (6/355) vs 0.38% (12/3,145), P = .001). Among patients who experienced postoperative complications, 83% (1,263/1,517) had inpatient complications and 7% (91/1,263) were readmitted; 11% (166/1,517) had post-discharge complications and 67% (111/166) were readmitted; and 5% (82/1,517) had both pre- and post-discharge complications and 66% (54/82) were readmitted. Of patients who experienced a related, unplanned readmission, 72% (256/355) suffered documented postoperative complications. Leading causes of readmission were gastrointestinal, infectious, and pulmonary complications (Table). Of patients who experienced complications, 58% (134/230) had 7-day and 90% (208/230) had 14-day readmission rates, while among patients who did not experience complications, 48% (58/122) had 7-day and 80% (97/122) had 14-day readmission rates (P < .005; Figure).

Conclusions: Related, unplanned readmission within 30 days of surgery occurred in 10% of patients undergoing esophagectomy. More than two-thirds of patients who developed complications after discharge were readmitted. Follow-up within the first few days after discharge may identify patients suffering post-discharge complications and facilitate complication-targeted outpatient intervention to prevent unplanned readmission.

Figure 1. Days to unplanned, related readmission after discharge by post-operative complications

(3 cases were missing days to readmission).

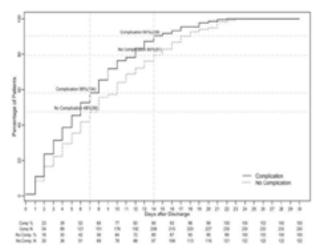


Table 1. Reasons for unplanned related readmissions (Total number of unplanned related readmissions is 355). There were 9 cases with missing reason.

Reason	n (%)
Total	346 (100%)
Gastrointestinal	91 (26.30)
Infectious	83 (23.99)
Pulmonary	80 (23.12)
Venous Thromboembolic	21 (6.07)
Other	20 (5.78)
Metabolic Derangement	14 (4.05)
Dehydration	13 (3.76)
Pain	11 (3.18)
Cardiac/Transfusion	10 (2.89)
Renal	3 (0.87)

1:00 PM - 3:00 PM Room 361BC

General Thoracic: Lung Cancer II

Moderators: Mara B. Antonoff, Houston, TX, and Farhood Farjah, Seattle, WA

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

Defining Selection Bias: Development of a Surgical Selection Score for Advanced Stage Non-Small-Cell Lung Cancer Patients

E. A. David¹, S. W. Andersen², L. A. Beckett¹, J. A. Melnikow¹, K. Kelly¹, D. T. Cooke¹, L. M. Brown¹, R. J. Canter¹

¹University of California, Davis Medical Center, Sacramento, ²University of California, Davis, Sacramento

COMMERCIAL RELATIONSHIPS S. W. Anderson: Employment, Novo Nordisk; D. T. Cooke: Consultant/Advisory Board, Core Mobile, Emmi Solutions

Purpose: For advanced stage non-small-cell lung cancer (NSCLC), chemotherapy and chemoradiation are the principal treatments. Although surgery in these patients is associated with improved survival, the effect of selection bias is poorly defined. Our objective was to construct a surgical selection score (SSS) that defines selection bias.

Methods: Patients with clinical stage IIIA, IIIB, or IV NSCLC were identified in the National Cancer Database from 2003 to 2012 and stratified by treatment group. A classification tree was created using characteristics from the time of treatment decision using 10-fold cross-validation. Logistic regression, applied to randomly assigned training and validation datasets, was used to develop the SSS based on characteristics in the classification tree. Estimated Area Under the Receiver Operating Characteristic Curve (AUROC) was used to assess discrimination performance of the SSS. Kaplan-Meier survival analysis was used to compare patients with similar SSS by treatment group.

Results: 300,572 patients with stage IIIA, IIIB, or IV NSCLC without missing data were identified; 6% (18,701) had surgery. The groups differed on all clinical and demographic variables (P < .001). The surgical cohort was 57% (10,650) stage IIIA, 19% (3,483) stage IIIB, and 24% (4,568) stage IV. Both logistic regression and the classification tree indicated that clinical metastasis category was the most important factor in the decision to operate, then clinical nodal stage. The AUROCs from the best-fit logistic regression model in the training and validation sets were not significantly different: 0.82 (95% CI, 0.82-0.83) and 0.82 (95% CI, 0.82-0.83). The SSS was created from the logistic regression model and is shown in the Table with an example SSS calculation. The range of SSS is 43-1,141. As expected, SSS is a good predictor of survival. Within each quartile of SSS, patients in the surgical group had significantly longer survival (P < .001) (Figure).

Conclusions: A prediction model for selection of patients for surgery was created and demonstrates that surgery is associated with improved survival after stratifying for SSS. This decision model can be applied to additional cohorts of advanced stage NSCLC patients to help further define patients who may benefit from surgical intervention.

Figure 1. Kaplan-Meier analysis of patients stratified by treatment group. A. Lowest quartile of SSS B. 2rd quartile of SSS C. 8rd quartile of SSS D. 4rd quartile qua

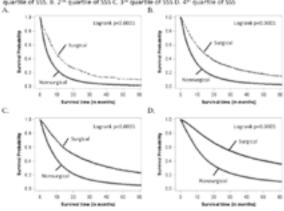


Table 1. Association between Surgical Treatment and Patient Variables for the model creating the Surgical Selection Score (SSS). The SSS was created by multiplying the logarithm of the odds ratios by 100 and adding the texts.

Variable	Olds ratio (95% CI)	Sample patient SSSP	Variable	(96% CI)
Clinical T Status			Charlest Dept Score	
1	28-24-349		0	Reference
2	31(3.933)		1	13 (13-13)
3	24(23-28)		1	TAULD-LIS
4	Reference		Race	
X	1.2 el. 1-1.36		White	1403-15
Tumor Sur			Other	1.4 (1.2-1.5)
Tie	224.1436		Net	Reference
TIP	1.7(1.6-1.8)		Investory Status	
715 12s	1.7 (1.6-1.8)		Trinate	24-0.9-225
7.25	T.F-(L0-1.1)		Modeure	1.6 (1.4-1.7)
73	Reference	- 0	Medicaid	12 (0.1-0.4)
Clinical Nedal Status			Other Government	12(1.0-1.4)
	1434133-1556	7466	Not invoted	Reference
	11.4 (10.4-12.4)		locome	
2	4.794.4-5.00		High Models	12 (0.1-1.2)
3	Reference		Modele	14-(1.0-1.1)
X	378344		Low	Reference
Clinical M Status			Facility Type	
	15.6(14.3-17.1)	EH.	Academic Research Program	1.7 (1.6-1.8)
	1.9 (1.7-2.1)		Composh, Com. Cancer Program	12 (12-13)
IA.	21(182.6)		Community Concer Program	Reference
IA IB	Reference			
Hamiliago				
Squamous Cell Carcinoma	1.8 (1.7-1.9)			
Admocsociment	22(21)236			
NSCLC, NOS	Reference			
Agr. group				
	6105625	191		
42 82.59	4.9(43-3.4)			
59-67	410345			
67.75	3.4 (3.1-3.7)			
79.40	23-01-259			
-41	Reference			
Surgical Selection Score		733		

^{*}The sample SSS is provided for a 48 year old, black man with Stage IIIA (THMSMO) NSCLC NOS, with Charlson Dayo Score of and belonging to the reference group for all nemaining factors. No estimated probability of surgical resortment is 4.5%, he is in the nonswipcial cohort.



General Thoracic: Lung Cancer II – Continued

1:15 PM Room 361BC

Early and Long-Term Results of Tracheal Sleeve Pneumonectomy for Lung Cancer After Induction Chemotherapy

D. Galetta, L. Spaggiari

European Institute of Oncology, Milan, Italy

Purpose: Tracheal sleeve pneumonectomy (TSP) is an extended pulmonary resection performed in case of tumors involving carina or tracheobronchial angle. The role of induction therapy (IT) and its effects on morbidity and mortality of these patients are unclear. We evaluated early and long-term outcomes of patients who underwent TSP after IT.

Methods: From September 1998 to December 2015, 32 patients (26 male; median age, 63 years) underwent TSP for carcinoma involving carina or tracheobronchial angle. All patients underwent mediastinoscopy or endobronchial ultrasound for mediastinal staging. Twenty-two patients (69%) received IT (cisplatin-based chemotherapy): 18 chemotherapy and four chemoradiation. Histology included 18 squamous cell carcinomas and 14 adenocarcinomas. TSP were all right-sided and included three completion pneumonectomies. Superior vena cava resection was combined with TSP in 15 cases (seven tangential resection; eight patients with graft interposition). Diaphragmatic and vertebral resection were also associated in one case each.

Results: Operative mortality was nil. Thirty-day mortality was 9% (n=3). Major complications occurred in seven patients (21.8%): three bronchopleural fistulas, two acute respiratory distress syndrome, one cardiac hernia, and one empyema. IT did not influence morbidity and mortality. Resection was complete in 31 patients (97%). Pathological N status was N0 in two cases, N1 in 17, and N2 in 13. Nodal downstaging was diagnosed in 12/22 patients (54.5%) who received IT (11 passed from N2 to N1, and two to N0). Follow-up was completed for all patients. Mean survival was 36 months (range 1-181 months). Nine patients (28%) are still alive, two with disease. Overall 5-year survival and disease-free survival were 30.3% and 58.0%, respectively. Patients receiving IT had a poor survival (P = .03). Nodal downstaging, adjuvant treatment, and postoperative complications significantly influenced survival (P = .007, and P = .009, respectively).

Conclusions: TSP is a feasible but technically challenging surgical procedure and provides acceptable results in terms of operative mortality and long-term outcomes. IT did not influence morbidity and mortality, but in our experience, it negatively influenced survival. Pathological nodal downstaging and adjuvant treatment positively impacted long-term survival.

1:30 PM

Lung Cancer Screening in the Community Setting: Challenges for Adoption

S. Randhawa¹, G. Drizin², T. Obeid¹, T. Kane¹, G. Y. Song³, T. J. Reilly¹, D. Jarrar⁴

¹Einstein Healthcare Network, Philadelphia, PA, ²Einstein Healthcare Network, East Norriton, PA, ³University of Pennsylvania, Philadelphia, ⁴Perelman School of Medicine at the University of Pennsylvania, Philadelphia

COMMERCIAL RELATIONSHIPS T. Kane: Speakers Bureau/Honoraria, AstraZeneca

Purpose: Secondary prevention of lung cancer by screening a high-risk population with low-dose computed tomography (LDCT) of the chest has been shown to save lives. To increase accessibility, a free lung cancer screening program was offered following National Lung Screening Trial criteria (NLST).

Methods: Data for eligible lung cancer screening patients were collected prospectively over a 12-month period using Lung-RADS (Reporting and Data System) and compared to the corresponding data from the Tumor Registry. A preceding 12-month period was used to streamline the process. A lung navigator confirmed eligibility of patients according to NLST criteria and provided feedback to patients and referring physicians. The screening program was promoted through flyers, radio programs, face-to-face information sessions, and a multidisciplinary lung symposium. After the 12-month period, an online survey was sent out to all primary care and referring physicians in the network.

Results: Of 278 eligible patients across the network, 242 were Lung-RADS 1 or 2 (87%), 21 were Lung-RADS 3 (7%), and 15 were Lung-RADS 4 (5%). Out of the 15 Lung-RADS category 4 patients, four ultimately underwent anatomic resection for stage I non-small-cell lung cancer (1.4% incidence, first round of screening). In the same time period, a total of 145 patients were reported to the Tumor Registry with carcinoma of the lung/bronchus, the majority with stage IV disease. Compared to the preceding year, there was no change in stage distribution. A survey at the end of the study period showed that 100% of network primary providers (87) were aware of the screening program, but 15% never referred a patient. 26% of providers were unaware that LDCT was recommended by the US Preventive Task Force, on par with colonoscopy and mammography.

Conclusions: The NLST showed that screening with LDCT could reduce lung cancer mortality by 20%. Significant concerns exist about the generalizability of these results and the applicability of screening programs in the community. Health care providers in our study voiced significant concerns about time constraints in shared decision making and documentation.

General Thoracic: Lung Cancer II - Continued

1:45 PM Room 361BC

Lymph Node Assessment Is Necessary for Surgical Treatment of Patients With Clinical Stage T1aN0M0 Typical Carcinoid Tumors

L. M. Brown, D. T. Cooke, E. A. David

University of California, Davis Medical Center, Sacramento

COMMERCIAL RELATIONSHIPS D. T. Cooke: Consultant/Advisory Board, Core Mobile, Emmi Solutions

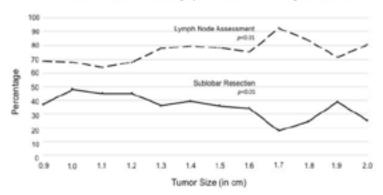
Purpose: The extent of lung resection and necessity of lymph node (LN) assessment for surgical treatment of clinical stage T1aN0M0 typical carcinoid tumors is unclear. Using a large cohort including only these patients, we aimed to determine the impact of extent of lung resection and LN assessment on long-term overall survival.

Methods: Patients undergoing lobectomy or sublobar resection (wedge resection or segmentectomy) for clinical stage T1aN0M0 typical carcinoid tumor were identified in the National Cancer Database from 1998 to 2012. Only tumors within the parenchyma were included; endobronchial tumors were excluded. Tumors were considered upstaged if the final pathologic stage was greater than T1aN0M0. A multivariable Cox proportional hazards model was used to determine independent predictors of overall mortality. Kaplan-Meier analysis was used to determine long-term overall survival and log-rank test to determine differences in survival.

Results: Of 1,492 patients, 522 (35%) underwent sublobar resection (wedge resection n=418, segmentectomy n=89) and 352 (24%) had no LN assessment: 54% of sublobar resections vs 7% of lobectomies. Sublobar resection and LN assessment varied with tumor size (Figure). The overall rate of upstaging was 4.2% (62 tumors), 2.2% for sublobar resection vs 6.3% for lobectomy (P = .005). Of those that were upstaged, 53/62 were due to LN upstaging to pN1 (n=40), pN2 (n=12), and pN3 (n=1). Only five of these 53 patients (9.4%) received adjuvant chemotherapy. Overall 5-year survival for those without LN upstaging was 88% and for those with LN upstaging was 65% (P = .002). In a multivariable analysis including sublobar resection and tumor size, independent predictors of mortality were: LN upstaging (HR 3.37; 95% CI, 1.41-8.03), male gender (HR 2.18; 95% CI, 1.32-3.59), Charlson/Deyo Comorbidity Score (HR 1.81; 95% CI, 1.31-2.49), and age (HR 1.08; 95% CI, 1.05-1.11).

Conclusions: For patients with clinical stage T1aN0M0 typical carcinoid, sublobar resection results in similar long-term overall survival compared with lobectomy. However, regardless of resection type, LN assessment is paramount to identify LN upstaging, the most important independent predictor of overall mortality in these patients with early stage carcinoid.

Sublobar Resection and Lymph Node Assessment by Tumor Size



General Thoracic: Lung Cancer II - Continued

2:00 PM Room 361BC

Video-Assisted Thoracoscopic Surgery vs Thoracotomy—Differences in Outcomes Are Not Just Technique-Dependent: A Study of 9,787 Patients

A. S. Wolf[†], B. Liu², E. Leoncini³, D. G. Nicastri⁴, D. D. Lee[†], E. Taioli², R. M. Flores⁴

⁴Mount Sinai Medical Center, New York, NY, ²Icahn School of Medicine at Mount Sinai, New York, NY, ³Institute of Public Health, Catholic University of the Sacred Heart, Rome, Italy, ⁴Mount Sinai Health System, New York, NY

Purpose: Studies have reported better outcomes with video-assisted thoracoscopic surgery (VATS) compared to open pulmonary resection, but have been subject to selection bias because differential factors determine whether patients undergo VATS or thoracotomy. We evaluated the patient and hospital characteristics associated with type of surgery and compared outcomes of these techniques.

Methods: The Statewide Planning and Research Cooperative System of New York State database was queried to identify all lung cancer patients undergoing lobectomy (L) or sublobar resection (SR) by VATS or open technique between 2007 and 2012. Multivariable logistic regression models were created to identify which patient (age, sex, race, comorbidities, year, and insurance) and hospital (urban, teaching, and total lung surgery volume) cofactors were associated with surgical technique. Additional logistic regression models were performed to evaluate whether VATS or open technique was independently associated with complications or in-hospital mortality.

Results: There were 5,505 L and 4,282 SR patients, with 2,322 (42%) and 2,470 (58%) undergoing VATS, respectively. For L, patients with female gender, private insurance, older age, and surgery in later years were more likely to undergo VATS, while black patients and those with comorbidities were more likely to undergo thoracotomy (Table). For SR, patients with comorbidities, Medicaid, and surgery in earlier years were more likely to undergo thoracotomy. The likelihood of VATS decreased with increasing hospital lung surgery volume for L, but the reverse for SR. VATS was performed more often in urban hospitals for L, but the reverse for SR. For SR, the likelihood of VATS was higher at teaching hospitals and those with higher volume. No significant differences in complication rates were found between VATS and thoracotomy, but the risk of in-hospital mortality was significantly less for VATS for both procedures (Figure).

Conclusions: VATS is associated with lower in-hospital mortality than thoracotomy. Numerous patient and hospital-related variables that affect morbidity and mortality also affect whether a patient undergoes VATS or open lung resection. Studies evaluating VATS must account for selection bias and adjust for these confounders.

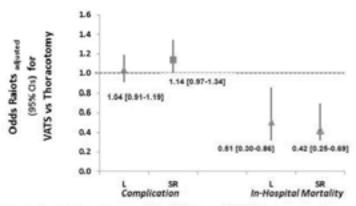


Fig. 1. Postoperative outcomes between VATS and thoracotomy approach for lobectomy (L) and sublobar resection (SR).

Table: Patient- and hospital-level factors associated with VATS vs. open approaches

	Lobertomy (L)		Sublober resection (SR)		
	Office	(95% CK)	OResi	(99% CI)	
Gender Immale su blain	1.36	(1.21 - 1.81)	130-	(0.08-1.28)	
Blicks vs Whites	0.73	(0.61 - 0.61)	3,04	(0.03-1.25)	
Comorbidities' Yes is No.	0.84	[0.79 - 0.86]	0.82	(0.68 - 0.98)	
Insurance eletus:					
Medicare	1.D (deterency)		141(Reference)		
Medicard	0.92	(0.69-1.21)	0.62	0.45-0.06	
Private Incorney	1.1	[1.2 - 1.68]	1.07	[D-89 - 1.28]	
No insurance	0.86	\$1-41 - 1-811	1.09	(0.45 - 2.35)	
Other	0.75	(0.46 - 1.21)	0.51	(0.28 - 0.95)	
Age (years)	1.62	(1.01 - 1.03)	1.01	(1.00 - 1.02)	
Admission year	1.20	(1.23 - 2.33)	1.59	(1.52 - 1.66)	
Mespital setting Althorays Rocal	1.66	(1.55 - 2.2)	0.33	(0.44 - 0.65)	
Yes in No.	0.99	IR 78 (.76)	1.32	(1.04 - 1.67)	
turning surpery columns*	0.83	(0.76 - 0.91)	1.62	(1.43 - 1.43)	

Note: odiested suids ratios (CR ...)



At least one among sungestive forms failure, salidate decisie, peripheral variation discrete, farming almost y disease, distincts with and without introne complications, renal failure, and hyportonion.
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General Thoracic: Lung Cancer II – Continued

2:15 PM Room 361BC

Bacterial Colonization of Non-Operated Lung Increases Mortality in Patients Undergoing Lung Cancer Surgery

J. Iquille, F. De Dominicis, A. Fourdrain, S. Lafitte, G. Merlusca, P. Berna University Hospital of Amiens Picardy, France

Purpose: Postoperative pneumonia (POP) is the main source of mortality after major lung resection. Some authors suggest that bacterial colonization of the airway has a detrimental effect on POP incidence. This study's aim was to evaluate the prognostic impact of preoperative and intraoperative respiratory tract samples on postoperative course.

Methods: Over 4 years, all patients referred to our unit for major lung resection got three systematic bacteriological samples: screening of a pharyngeal carriage with an oropharyngeal swab the day before surgery, bronchial aspiration on the non-operated lung during the surgery, and a swab on the resected specimen's bronchial stump in order to identify intraoperative colonization of the sloped lung. Specified pathogen identification defined colonization. Primary endpoint was overall 30-day mortality. Secondary endpoints were 90-day mortality and incidence of postoperative pneumonia, which was defined by standardized criteria.

Results: Of 623 referred patients, 518 got at least one sample and were included in the study; 107 had positive oropharyngeal swab (26.2%), 54 had positive bronchial aspiration (12.5%), and 42 had positive bronchial stump swab (9.3%). Positive intraoperative bronchial aspiration culture was associated with increased 30-day mortality (9.2% vs 2.6%, P = .029) and 90-day mortality (20.3% vs 23.1%, P < .001) because of a highly increased incidence of postoperative pneumonia (55.5% vs 24.1%, P < .001). Positive bronchial stump swab culture and positive oropharyngeal swab culture had no influence on mortality or incidence of postoperative pneumonia.

Conclusions: Bacterial colonization of the non-operated lung, detected intraoperatively by protected sampling, appears to be an unfavorable prognostic factor. On the other hand, screening pharyngeal carriage by oropharyngeal samples seems not to be a useful tool.

	Occuping support and the control of		Benedad separates		Bronchiel streng weath	
	Negative	Positive	Negative.	Positiva	Negative	Persons
or de-Mente	12%	7,5%	3.0%	28.3%	4.7%	2.3%
90 days Mortality		p=0.09		p < 0.001		NS
30 days Monaday	3.0%	7,9%	2.6%	124	32%	2.3%
		202		p = 0.029		1/5
Restubation	1,9%	5.3%	3.9%	11.3%	6.9%	2.9%
		p = 0.492		P<0.001		y = 0.32
Ранциона	26,0%	9.7%	34,87%	55.3%	36.7%	38%
		P = 0.150		h < 0.004		p = 0.076
Deonchial	21.5%	20,1%	23.5%	45.1%	29.3%	25.4%
Endoscopy		p-0.03		p < 0.001		p= 026

Postoperative Morbidity and Mortality following results of respiratory tract bacteriological samples General Thoracic: Lung Cancer II - Continued

2:30 PM Room 361BC

Geographic Variations Observed in Lung Cancer Lobectomy Procedural Outcomes: The Society of Thoracic Surgeons General Thoracic Surgery Database

A. W. Shroyer¹, J. A. Quin², J. Groff¹, M. V. Grau-Sepulveda⁴, A. S. Kosinski⁴, B. Yerokun⁵, J. D. Mitchell⁵, T. V. Bilfinger⁷

¹Stony Brook University, NY, ²VA Boston Healthcare System, West Roxbury, MA, ³Southampton Hospital, NY, ⁴Duke Clinical Research Institute, Durham, NC, ⁵Duke University Medical Center, Durham, NC, ⁶University of Colorado, Aurora, ⁷Stony Brook University Medical Center, NY COMMERCIAL RELATIONSHIPS J. D. Mitchell: Speakers Bureau/Honoraria, Medtronic; Consultant/Advisory Board, Medtronic, Maquet

Purpose: Lung cancer (LC) ranks the highest for cancer-related deaths within the United States. Using the STS General Thoracic Surgery Database (GTSD), the geographic variability of LC lobectomy procedural patient risk characteristics, perioperative processes of care, resource utilization, and operative mortality and major morbidity (both unadjusted and risk-adjusted) were examined.

Methods: From January 2009 to June 2015, the GTSD LC lobectomy records (excluding robotic procedures) were assigned to a US Census region based upon hospital location. Surgeons completing < 20 total cases during the study period were categorized as "low volume." The American College of Surgeons Oncology Group (ACOSOG) criteria was used to classify patients as "high risk." Across geographic regions, patient characteristics, procedural details, outcomes, and resource utilization were compared using Kruskal-Wallis and chi-square tests. Applying the published GTSD risk algorithms, unadjusted and adjusted odds ratios (OR) for regions were computed using univariable and multivariable generalized estimating equation logistic regression.

Results: From 2009 to 2015, there were 39,078 LC lobectomies that met study inclusion criteria (31.5% Northeast, 23.5% Midwest, 31.1% South, and 14.0% West). Fewer "high-risk" cases were seen in the West region (18.9% Northeast, 19.6% Midwest, 19.9% South, and 15.9% West; P < .001). Across geographic regions, there was no difference in the proportion of "low-volume" surgeons (43.6% Northeast, 49.0% Midwest, 47.3% South, and 52.6% West; P = .385). Adjusted OR for operative mortality and major perioperative morbidity did not show statistically significant differences across regions (P = .761 and .600, respectively), Table. Resource use metrics showed geographic variations for ICU admissions (36.7% Northeast, 39.4% Midwest, 50.3% South, and 47.0% West; P < .001), median length of stay (LOS) (Midwest median = 4 days; all other regions median = 5 days; P < .001), and 30-day readmission rates (7.3% Northeast, 8.5% Midwest, 7.7% South, and 7.2% West; P < .001).

Conclusions: Despite geographic variations in the proportion of high-risk LC lobectomies, the risk-adjusted mortality and morbidity ORs did not vary by region. The proportion of "low-volume" surgeons was not different across regions. Resource utilization varied across geographic regions based upon ICU stay, postoperative LOS, and 30-day readmissions.

Table 1. Usual justed and Addissred Olds Pation across Employs for Operative Mortality and Motor Morbidity.

BEGIONE	Odds Batter (95% Ch.	P. Sales	Oats Ratio (Sts (4))	P-Value	
Operative N	fortality	-		- A T.	
Northwest	1.00 (Reterence)	0.602	1.00 (Reference)	0.761	
South	1:17 (0:99-1:51)		1 02 (0.60-1.71)		
Midwest	1,13 (0.83-1.39)	1 E	0.96 (0.73-1.26)	1	
Wast	L16(0.87-1.53)	1	1.13 (0.86-1.48)		
Majoir Mork	dditv				
Northcast	1.00 (Reference)	0.007	1.00 (Reference)	.0.500	
South	1.21(1.03-1.43)	1000	1.03 (0.67-1.22)	1	
Midwest	1.30(1.06-1.57)	1 /	1.09 (0.91-1.31)		
West	1.00(0.83-1.21)		0.96(0.78-1.18)		

^{*}Wald of it-square test

[&]quot;Northeast region used in reference

General Thoracic: Lung Cancer II - Continued

2:45 PM Room 361BC

Pulmonary Resection for Second Lung Cancer After Pneumonectomy: Is It Worth the Risk?

A. Ayub¹, S. Rehmani², A. M. Al-Ayoubi¹, N. Santana-Rodríguez³, W. Raad¹, R. M. Flores³, F. Bhora⁴

¹Icahn School of Medicine at Mount Sinai, New York, NY, ²Mount Sinai St Luke's Hospital, New York, NY, ³Mount Sinai Health System, New York, NY, ⁴Mount Sinai Roosevelt and Mount Sinai St Luke's Hospitals, New York, NY

COMMERCIAL RELATIONSHIPS F. Bhora: Other Research Support, TEI Biosciences

Purpose: Pulmonary resection for lung cancer after pneumonectomy is generally considered prohibitive risk. Using a population-based database, we examined treatment patterns and survival in patients who underwent pulmonary resection after pneumonectomy for lung cancer.

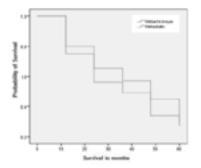
Methods: We queried the Surveillance, Epidemiology, and End Results (SEER) database (1973-2012) to identify patients who underwent pneumonectomy and subsequently developed contralateral non–small-cell lung cancer (NSCLC). Patients who received ablative therapy or adjuvant radiation therapy (RT) were excluded. Patient demographics, tumor characteristics, and treatment modalities were examined. Multivariate logistic regression was performed to identify factors associated with receiving surgical resection. Survival was estimated using Kaplan-Meier method.

Results: Of 15,919 pneumonectomy cases, 407 patients (2.5%) developed subsequent contralateral NSCLC and 379 patients (93%) met the selection criteria. Surgical resection was performed in 81 cases (21.4%) (sublobar, n=71; lobectomy, n=10). Patients with stage I/ II disease, tumor size \leq 2 cm, and metachronous cancers were more likely to receive surgery (Table). Overall 1-, 3-, and 5-year survival after surgical resection was 75%, 51%, and 28%, respectively. There was no survival difference between patients with metachronous or metastatic cancer (P = .824). Five-year survival after sublobar resection was 29% compared to 19% for lobectomy (P = .21).

Conclusions: Pulmonary resection for second cancer after pneumonectomy is a reasonable treatment modality in selected patients. Sublobar resection provides better long-term results and can be considered in appropriate cases.



Figure: Kaplan-Meier Curves for 5-year Survival rates in Patients who underwent Surgical Resection, Stratified by Nature of Second Tumor and Type of Resection



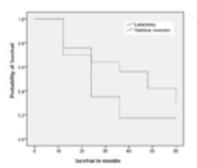


Table: Multivariate Analysis of Factors Associated with Surgery for Second Cancer after Pneumonectomy

	OR*	95% Confidence Interval	P
Age at diagnosis	0.980	0.941 - 1.021	0.337
Fernale (vs Male)	1.590	0.733 - 3.451	0.241
White (vs Non-White)	1.951	0.521 - 7.304	0.321
Latency (in years)	0.769	0.667 - 0.886	<0.001
Metachronous (vs Metastatic) ^b	2.858	1.152 - 7.092	0.024
Turnor Size s 2cm	3.725	1.731 - 8.018	0.001
Stage I/II (vs Stage III/IV)	3.175	1.391 - 7.249	0.006
Previous RT (vs No Previous RT)	0.775	0.342 - 1.770	0.549

^{*} Odds Ratio (CR)

3:00 PM - 3:30 PM

BREAK—Visit Exhibits and Scientific Posters

Complimentary coffee available in the Exhibit Hall



Defined according to American Association of Chest Physicians (ACCP) guidelines (Korower BO, et al., Chest 2013)

1:00 PM - 5:30 PM Room 350DEF

Advanced Therapies for End-Stage Heart Disease

The treatment of end-stage heart disease requires a multidisciplinary approach that selects the most appropriate therapy to optimize clinical outcomes. This session will cover the appropriate indications and optimal patient selection for use of mechanical circulatory support and heart transplantation, appropriate clinical indications for selecting alternative treatment strategies—other than mechanical circulatory support or heart transplantation—for treatment of advanced heart failure, and identifying the causes of and understanding treatment options for major adverse events in patients receiving mechanical circulatory support.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify current and appropriate indications for end-stage heart disease treatment options, including mechanical circulatory support, heart transplantation, and newer alternative treatment options
- Identify alternative non-mechanical or non-transplant treatment strategies that can lead to improved patient outcomes
- Explain the results from recent major studies in the field that have had a significant impact on patient selection and patient care practices
- Discuss new trials and technology that will be or recently have been introduced into the field

Moderators: Pavan Atluri, Philadelphia, PA, Robert L. Kormos, Pittsburgh, PA, Francis D. Pagani, Ann Arbor, MI, and Jay D. Pal, Seattle, WA

COMMERCIAL RELATIONSHIPS R. L. Kormos: Other/Travel, HeartWare

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care, medical knowledge, and practice-based learning and improvement. These physician competencies will be addressed through a series of lectures meant to enhance the understanding of patient selection, new technologies and devices, and how to tailor devices to patients.

1:00 PM Hemodynamic Support for Shock: Are All Devices Created Equal?

Nir Uriel, Chicago, IL

COMMERCIAL RELATIONSHIPS N. Uriel: Consultant/Advisory Board, Medtronic; Research Grant, HeartWare, Novartis, St Jude Medical

1:15 PM Extracorporeal Cardiopulmonary Resuscitation: Is Broader
Dissemination of Its Use Appropriate and Who Should Provide It?

Ashish Shah, Nashville, TN





1:30 PM Extracorporeal Membrane Oxygenation (ECMO) Complications:

Prevention and New Approaches for Management

Jonathan W. Haft, Ann Arbor, MI

1:45 PM Short-Term Circulatory Support as a Bridge to Transplant or Recovery:

Changing Techniques and Approaches

Pavan Atluri, Philadelphia, PA

2:00 PM Increasing the Donor Pool in Thoracic Transplantation: Experience

With Ex Vivo Perfusion

Iason W. Smith, Seattle, WA

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ J.\ W.\ Smith: Consultant/Advisory\ Board, HeartWare; Other$

Research Support, Transmedics; Research Grant, Transmedics

2:15 PM Case Presentation on ECMO and Panel Discussion

Michael S. Firstenberg, Akron, OH

COMMERCIAL RELATIONSHIPS M. S. Firstenberg: Consultant/Advisory Board, Ethicon, Maquet,

Medtronic; Speakers Bureau/Honoraria, Maquet





Advanced Therapies for End-Stage Heart Disease - Continued

2:30 PM Room 350DEF

Does Duration of Continuous-Flow Left Ventricular Assist Devices Have an Impact on Postoperative Outcomes After Cardiac Transplantation? An Analysis of UNOS/OPTN Data

D. Chauhan¹, N. Haik², D. Baran³, M. Zucker³, M. T. Camacho³, M. J. Russo⁴

¹Rutgers New Jersey Medical School, Newark, NJ, ²Barnahas Heart Hospitals, Newark, NJ, ³Newark Beth Israel Medical Center, NJ, ⁴Rutgers/Barnahas Health, Newark, NJ

COMMERCIAL RELATIONSHIPS D. Baran: Speakers Bureau/Honoraria, Otsuka Pharmaceuticals; Consultant/Advisory Board, Maquet, Astellas Pharma; M. T. Camacho: Consultant/Advisory Board, Sunshine Heart

Purpose: Although a common practice in candidates for cardiac transplantation, impact of continuous-flow left ventricular assist devices (LVAD) on postoperative mortality and acute rejection is not well documented. This study analyzes the UNOS/OPTN database to evaluate impact of duration of continuous-flow LVADs on postoperative outcomes in patients undergoing cardiac transplantation.

Methods: UNOS/OPTN post-heart transplant follow-up data from 2005 to 2015 was obtained. Out of 21,336 recipients, we analyzed 4,382 patients who underwent pre-transplant continuous-flow LVAD placement and subsequently underwent cardiac transplantation. Pre-transplant LVAD time was divided into three time periods: <1 year, 1-2 years, and >2 years. Multivariate Cox-regression analysis was used to evaluate association between these time periods and postoperative graft survival. Multivariate logistic regression was used to evaluate the association between pre-transplant LVAD duration and postoperative acute rejection episodes before and after hospital discharge after transplant.

Results: There was no difference in survival among patients with increasing time durations (HR 1.01; 95% CI, 0.89-1.15; P = .824). Independent predictors of poor post-transplant graft survival were recipient and donor age, high body mass index, dialysis dependence at transplant, poor functional status, patient on ventilator at transplant, total bilirubin >2 mg/dl, recipient on extracorporeal membrane oxygenation (ECMO) at transplant, and acute rejection episodes requiring treatment during follow-up period. One-, 2-, and 5-year graft survival among <1, 1-2, and >2 years LVAD duration were not significantly different (Table). Interestingly, LVADs were associated with increased incidence of acute rejection before hospital discharge (OR 1.14; 95% CI, 1.02-1.28; P = .019). Increasing age, male gender, and preoperative use of steroids were independent factors protective against and four or more human leukocyte antigen mismatches, poor functional status, and ECMO at time of transplant were independent risk factors for acute rejection before hospital discharge. Duration of VADs was not associated with acute rejection episodes after discharge.

Conclusions: Preoperative duration of continuous-flow LVAD does not have impact on post-transplant graft survival. However, increasing duration of LVAD support increases acute rejection episodes before hospital discharge after transplant.

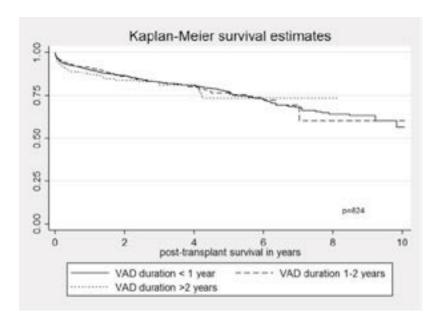


Figure 1: Actuarial graft survival after cardiac transplantation by duration of continuous LVAD

VAD duration	1-year survival	2-year survival	5-year survival
<1 year	89.7%	86.4%	77.0%
1-2 years	91.1%	86.2%	76.4%
>2 years	87.3%	83.9%	73.4%

Advanced Therapies for End-Stage Heart Disease - Continued

2:45 PM Room 350DEF

Clinical and In Vitro Evidence That Left Ventricular Assist Device (LVAD)-Associated Hemolysis Contributes to LVAD Thrombosis

C. Bartoli¹, D. Zhang¹, J. Kang¹, D. Restle¹, G. Redline¹, J. Howard¹, C. A. Bermudez², M. A. Acker³, P. Atluri²

¹Hospital of the University of Pennsylvania, Philadelphia, ²University of Pennsylvania, Philadelphia, ³University of Pennsylvania Medical Center, Philadelphia

Purpose: Left ventricular assist device (LVAD) thrombosis is a life-threatening complication. We investigated whether LVAD-associated hemolysis contributes to LVAD thrombosis. In LVAD patients, we measured markers of hemolysis and the incidence of LVAD thrombosis. In an in vitro LVAD model, we examined mechanistic relationships between hemolysis, von Willebrand factor (vWF) metabolism, and increased thrombogenicity.

Methods: We performed two studies: 1) Clinical Study: Serial whole blood samples were obtained from continuous-flow LVAD patients (n=28 pre-LVAD, n=28 at 1 week post-LVAD, n=19 at 3 months post-LVAD). Plasma-free hemoglobin (pfHgb), hemin, Fe2+, and Fe3+ were measured with colorimetric assays. 2) In Vitro Study: To investigate mechanisms, fresh whole blood was collected from volunteer human donors (n=10). Plasma was exposed to LVAD-like supraphysiologic shear stress (4 hours, 175 dyne/cm2) with and without pfHgb (100 mg/dL). Plasma ADamTS-13 (the vWF protease) activity was quantified with Forester resonance energy transfer. Large vWF multimers and vWF degradation fragments were characterized with electrophoresis and immunoblotting.

Results: LVAD Patient Study: LVAD support significantly increased pfHgb (baseline: 23 mg/dL \pm 3 mg/dL; 1 week: 48 mg/dL \pm 5 mg/dL, P < .001; 3 months: 56 mg/dL \pm 10 mg/dL, P < .01), hemin (baseline: 0.2 µg/dL \pm 0.1 µg/dL; 1 week: 4.3 µg/dL \pm 1.9 µg/dL; P = .04; 3 months: 1.4 µg/dL \pm 0.4 µg/dL, P < .01), Fe2+ (baseline: 161 µg/dL \pm 17 µg/dL; 1 week: 208 µg/dL \pm 24 µg/dL, P < .01; 3 months: 231 µg/dL \pm 28 µg/dL, P = .01), and Fe3+ (baseline: 21 µg/dL \pm 6 µg/dL; 1 week: 47 µg/dL \pm 7 µg/dL, P = .02; 3 months: 46 µg/dL \pm 13 µg/dL, P = .20). Eight of 28 patients developed LVAD thrombosis. In these eight patients, preoperative pfHgb (65 mg/dL \pm 12 mg/dL vs 36 mg/dL \pm 5 mg/dL, P = .01) and hemin (0.42 µg/dL \pm 0.15 µg/dL vs 0.18 µg/dL \pm 0.04 µg/dL, P = .05) were significantly elevated vs preoperative values in non-thrombosis LVAD patients. In Vitro Study: Supraphysiologic shear stress degraded vWF with the same profile as an LVAD patient. PfHgb inhibited ADamTS-13 activity during shear stress (633 ng/mL \pm 27 ng/mL vs 565 ng/mL \pm 24 ng/mL, P < .001). As a result, large vWF multimers were protected from degradation, and four of the six smallest vWF degradation fragments decreased significantly (P \leq .05 for each fragment).

Conclusions: We showed that prolonged LVAD support increased plasma-free iron species, elevated preoperative pfHgb and hemin predisposed LVAD patients to thrombosis, and pfHgb inhibited ADamTS-13 and decreased vWF degradation. Mechanistically, ADamTS-13 inhibition by pfHgb from hemolysis may protect vWF from degradation, cause a relative hypercoagulability, and thereby promote LVAD thrombosis.

3:00 PM Break

3:30 PM What Defines a Bad Right Ventricle? Perioperative Imaging and

Hemodynamic Assessment of the Right Ventricle

J. Eduardo Rame, Philadelphia, PA

3:45 PM The Right Ventricle Is Not Working and I'm in Trouble: What's Next?

Robert L. Kormos, Pittsburgh, PA

COMMERCIAL RELATIONSHIPS R. L. Kormos: Other/Travel, HeartWare

4:00 PM Durable BiVAD Support and Total Artificial Heart Options:

Perspectives From INTERMACS

Francisco A. Arabia, Los Angeles, CA
COMMERCIAL RELATIONSHIPS F. A. Arabia: Other/Trainer, Medtronic, SynCardia

4:15 PM Challenges in Durable VAD Therapy

Mark S. Slaughter, Louisville, KY

 $\textbf{COMMERCIAL RELATIONSHIPS} \ \ \text{M. S. Slaughter: Consultant/Advisory Board, CARMAT, Oregon}$

Heart; Other Research Support, HeartWare

4:30 PM Advanced Structural Heart Disease: Ischemic Cardiomyopathy—When

to Bypass, Stent, Transplant, or VAD

Carmelo A. Milano, Durham, NC

COMMERCIAL RELATIONSHIPS C. A. Milano: Consultant/Advisory Board, HeartWare

4:45 PM Case Presentation on Right Heart Failure and Panel Discussion

Bryan A. Whitson, Columbus, OH

COMMERCIAL RELATIONSHIPS B. A. Whitson: Other/Travel, HeartWare, St Jude Medical; Other

Research Support, XVIVO





Advanced Therapies for End-Stage Heart Disease – Continued

5:00 PM Room 350DEF

Do Left Ventricular Assist Device-Related Complications Impact Graft Survival After Cardiac Transplantation? Insight from UNOS/OPTN Data

D. Chauhan¹, A. Merlo², D. Baran³, M. Zucker³, M. T. Camacho³, M. J. Russo⁴ ¹Rutgers New Jersey Medical School, Newark, NJ, ²Case Western Reserve University, Cleveland, OH, ³Newark Beth Israel Medical Center, NJ, ⁴Rutgers/Barnabas Health, Newark, NJ

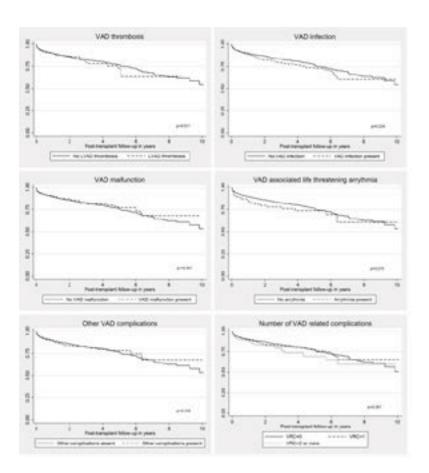
COMMERCIAL RELATIONSHIPS D. Baran: Speakers Bureau/Honoraria, Otsuka Pharmaceuticals; Consultant/Advisory Board, Maquet, Astellas Pharma; M. T. Camacho: Consultant/Advisory Board, Sunshine Heart

Purpose: Left ventricular assist device (LVAD)-related complications (VRC) are a leading cause of emergent cardiac transplantation. Impact of VRCs on postoperative outcomes is unknown. This study describes the impact of continuous-flow LVAD complications on postoperative outcomes following cardiac transplantation.

Methods: UNOS/OPTN post-heart transplant follow-up data from 2005 to 2015 was obtained. After combining waiting list data with postoperative follow-up data, we analyzed 3,877 patients who underwent pre-transplant continuous-flow LVAD placement and subsequently underwent cardiac transplantation (bridge to transplant). VRCs at patient's last follow-up before transplant were reported in five categories: thrombosis (B1), device infection (B2), device malfunction (B3), life-threatening arrhythmias (B4), and others (B5). Multivariate Cox regression models were used to evaluate association of each category of complications and number of complications with postoperative graft survival.

Results: Incidence of VRCs was as following: 374 (9.65%) for thrombosis (B1), 869 (22.41%) for device infection (B2), 400 (10.32%) for device malfunction (B3), 135 (3.48%) for life-threatening arrhythmias (B4), and 510 (13.15%) for others (B5). 2,018 patients (52.05%) did not have any VRC at last follow-up. 1,482 patients (38.23%) had one VRC and 377 patients (9.72%) had two or more VRCs. Mean waiting time from VAD insertion to transplant was significantly higher in patients with VRCs (491 days in patients with any VRC vs 311 days without VRC). Mean time from last preop follow-up to transplant in patients with zero, one, and two or more VRCs was 93, 18, and 11 days, respectively. Multivariate analysis showed that none of the complications (from B1 to B5) were independent risk factors for poor graft survival after cardiac transplantation. Independent predictors of postoperative graft failure were increasing donor age, inpatient status, increasing body mass index, poor functional status, ventilator dependence, and extracorporeal membrane oxygenation at the time of transplant.

Conclusions: VRCs are associated with increased waiting time from VAD placement to cardiac transplantation. However, if the patient had VRC, they were likely to have a transplant earlier than patients without VRC. Contrary to popular belief, VRCs are not independently associated with poor postoperative graft survival in patients undergoing cardiac transplantation.



Advanced Therapies for End-Stage Heart Disease – Continued

Room 350DEF 5:15 PM

Predicting Right Ventricular Failure in the Current Continuous-Flow Left Ventricular **Assist Device Era**

A. Loforte¹, A. Montalto², F. Musumeci³, V. Polizzi³, F. Grigioni¹, R. Di Bartolomeo¹, G. Marinelli¹

¹S. Orsola-Malpighi Hospital, Bologna, Italy, ²Ospedale San Camillo, Heart Surgery Unit, Rome, Italy, 3S. Camillo Hospital, Rome, Italy

Purpose: In the current era of continuous-flow (CF) left ventricular assist devices (LVADs), the decision of whether a patient will tolerate isolated LVAD support or will need biventricular support (BVAD) can be challenging. We undertook this study to determine predictors that identify patients who are candidates for isolated LVAD.

Methods: We reviewed demographic, echocardiographic, hemodynamic, and laboratory variables for 186 patients who underwent long-term mechanical circulatory support (MCS) implantation between 2004 and 2015 (LVAD=125, BVAD=61).

Results: Sixty preoperative risk factors were compared between patients who were successfully managed with a CF LVAD and those who required a BVAD. Sixteen variables demonstrated statistical significance by univariate analysis. Multivariable logistic regression analysis identified destination therapy (OR 2.0, P = .086), pulmonary artery pulsatility index <2 (OR 3.3, P = .001), right ventricle/left ventricle end-diastolic diameter ratio >0.75 (OR 2.7, P = .011), right ventricle (RV) stroke work index <400 mm Hg x mL/m² (OR 4.3, P < .001), the United Network for Organ Sharing modified Model for End-Stage Liver Disease score >17 (OR 3.5, P < .001) as the major criteria predictive of the need for biventricular support. Utilizing these data, a highly sensitive and easy-to-use risk score for determining RV failure was generated, and an institutionally defined "ALMA score" was created, which resulted to outperform other established risk stratification tools.

Conclusions: We present a preoperative risk calculator to determine suitability of a patient for isolated LVAD support in the modern destination CF MCS era.

NOTES

1:00 PM - 5:30 PM Room 360A

Patient Safety Symposium: Resilience or Burnout—Do We Have a Choice?

Recent reports have highlighted the problem of work-related stress and burnout among health care providers. The interventional strategies for managing burnout are not welldefined, particularly in cardiothoracic surgery, and much has been proposed in terms of methods to combat such a condition. Didactic lectures and case presentations will provide an understanding of the causes, prevalence, and consequences of work-related stress and professional burnout, along with interventional and implementable strategies to recognize burnout and mitigate its impact.

Learning Objectives

Upon completion of this activity, participants should be able to:

- State the definition of and contributors to professional burnout
- Identify work-related and personal stressors
- Discuss the personal and patient-related consequences of professional burnout
- Identify factors associated with physician resilience and mindfulness
- Describe different methods and tactics (personal and institutional) to mitigate professional burnout and enhance resilience

Moderator: Susan D. Moffatt-Bruce, Columbus, OH

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are medical knowledge, patient care, interpersonal skills and communication, professionalism, and practice-based learning improvement. These physician competencies will be addressed through a series of lectures, panel discussions, and demonstrations.

1:00 РМ	Introduction Susan D. Moffatt-Bruce, Columbus, OH
1:15 PM	Work-Related Stress and Burnout in Surgery Charles Balch, Houston, TX COMMERCIAL RELATIONSHIPS C. Balch: Speakers Bureau/Honoraria, Merck & Co
2:00 рм	Developing Physician Resilience Wayne Sotile, Winston–Salem, NC COMMERCIAL RELATIONSHIPS W. Sotile: Speakers Bureau/Honoraria, Abbvie Pharmaceuticals; Other, American Medical Association Press, Book Royalties
2:45 PM	Q&A
3:00 рм	Break
3:30 PM	How Can the Institution Address Physician Burnout? Steven Gabbe, Rochester, MN
4:15 PM	Mindfulness to Combat Work-Related Stress Maryanna Klatt, Columbus, OH



5:00 PM Panel Discussion

J. Michael DiMaio, Dallas, TX, and Theolyn Price, Colorado Springs, CO

3:30 PM – 4:30 PM Room 362A

Cardiothoracic Surgical Education

Moderator: Ara A. Vaporciyan, Houston, TX

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are professionalism and interpersonal and communication skills. These physician competencies will be addressed through a series of lectures and a brief question-and-answer session after each topic.

3.30 pm

Current Status of Endovascular Training for Cardiothoracic Surgery Residents in the United States

P. N. Vardas¹, A. C. Stefanescu Schmidt², A. B. Goldstone³, A. A. Shah⁴, D. LaPar⁵, W. F. DeNino⁶, E. A. Gillaspie⁷, A. G. Fiedler², M. S. Halbreiner⁸, A. L. Eilers⁶, D. M. Walters¹⁰, E. H. Stephens¹¹, V. Tchantchaleishvili⁷

¹Indiana University School of Medicine, Indianapolis, ²Massachusetts General Hospital and Harvard Medical School, Boston, ³University of Pennsylvania, Philadelphia, ⁴Duke University Medical Center, Durham, NC, ⁵University of Virginia, Charlottesville, ⁶Medical University of South Carolina, Charleston, ⁷Mayo Clinic, Rochester, MN, ⁸Cleveland Clinic, OH, ⁹The University of Texas Health Science Center, San Antonio, ¹⁰University of Washington, Seattle, ¹¹Columbia University Medical Center, New York, NY

Purpose: Cardiothoracic surgery residency programs demonstrate an increasing interest to incorporate endovascular skills and accommodate the growth of new percutaneous technologies within the specialty. This study aimed to assess the prevalence and perceived efficacy of current training in endovascular skills and identify differences or areas for improvement among different training paradigms.

Methods: Trainee responses (n=379) regarding endovascular training from the mandatory 2016 Thoracic Surgery Directors Association/Thoracic Surgery Residents Association Survey that accompanies the yearly In-Service Training Examination were analyzed based on the four different cardiothoracic surgery (CT) training pathways: traditional 2-year (2Y, n=127) and 3-year CT (3Y, n=86), integrated 6-year (I-6, n=130), and combined (4+3, n=36) residency programs. Continuous variables were compared with the Kruskal-Wallis test, and a multivariable linear regression model was employed to adjust for potential confounders of training time.

Results: Duration of endovascular training was substantially different among programs (median of 17 weeks for I-6 vs 8.5 weeks for 3Y vs 6 weeks for 4+3 vs 4 weeks for 2Y; P < .0001). Many respondents reported no endovascular training (7% vs 16% vs 39% vs 33%, respectively). The number of weeks spent on endovascular rotations significantly predicted self-assessed comfort with skills, after adjusting for year of training and program type (P < .0001). 82% of residents rotated with trainees from other specialties on endovascular rotations, and 58% experienced competition for cases. Residents reported greater exposure to transcatheter aortic valve replacement (TAVR) (60%), compared to thoracic endovascular

aortic repair (TEVAR) (15%), cardiac catheterization (14%), percutaneous closure of atrial septal defect (8%), and transcatheter mitral valve surgery (2%) (*P* < .0001). A majority of respondents reported feeling uncomfortable performing key steps of TAVR (52%) or TEVAR (49%).

Conclusions: Heterogeneity exists for endovascular training among different cardiothoracic surgery training pathways, with a significant number of residents having minimal to no exposure to these emerging techniques. This study highlights the need to create a standardized curriculum for endovascular training and expand endovascular training experience.

Cardiothoracic Surgical Education - Continued

3:45 PM Room 362A

Implementation of a Novel Debate-Style Cardiothoracic Surgery Journal Club for Trainee Acquisition and Application of Seminal Literature: Results of a Pilot Curriculum

M. B. Antonoff, J. Luc², T. C. Nguyen³, C. Fowler¹, S. B. Eisenberg⁴, R. K. Wolf⁴, A. L. Estrera⁴, A. A. Vaporciyan¹

¹The University of Texas MD Anderson Cancer Center, Houston, ²University of Alberta, Edmonton, Canada, ³Memorial Hermann-Texas Medical Center, Houston, ⁴The University of Texas Health Science Center, Houston

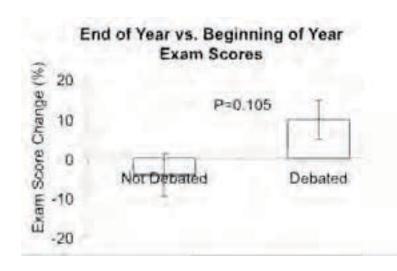
COMMERCIAL RELATIONSHIPS A. L. Estrera: Research Grant, W. L. Gore & Associates; Consultant/Advisory Board, W. L. Gore & Associates; Speakers Bureau/Honoraria, Maquet; T. C. Nguyen: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, St Jude Medical; R. K. Wolf: Research Grant, AtriCure; Ownership Interest, AtriCure; Speakers Bureau/Honoraria, AtriCure

Purpose: Journal clubs serve to impart specialty-specific seminal literature to trainees, though studies demonstrate that they lack structure and efficacy to achieve these ends. We developed a novel debate-style journal club for trainees to utilize best available evidence to address controversial topics in cardiothoracic surgery through discussion of realistic patient scenarios.

Methods: We designed and implemented a novel debate-style journal club for cardiothoracic surgical trainees. Assessment of trainee knowledge acquisition and retention consisted of debate scoring by faculty and a written exam administered before, immediately after the debate, and at the end of the year. Efficacy of the debate-style journal club was demonstrated by evaluating the change in trainee exam performance from beginning to the end of the year on topics that were debated compared to those that were not. Trainee and faculty participants completed a survey to compare the debate-style vs prior traditional journal club in achieving educational objectives.

Results: Cardiothoracic surgery trainees participated in five debates each over 10 monthly sessions. Written exam results revealed a trend toward enhanced knowledge acquisition and retention as shown via improved scores on topics that were debated as compared to those that were not (+9.8% vs -4.2%, P = .105) (Figure). Surveys completed by trainees (n=6) and faculty (n=11) with a response rate of 94.4% demonstrated that the debate-style journal club was deemed superior to the previous single-paper traditional journal club by encouraging greater participant engagement, enabling better application of literature to clinical scenarios, holding participants more accountable for the breadth of literature related to given topics, encouraging participants to explore the literature in greater depth, and requiring more critical evaluation of the cardiothoracic surgical literature (Table). Additional objective feedback was gathered and consisted of laudatory remarks, uniformly supportive of the innovative educational strategy.

Conclusions: Our novel debate-style cardiothoracic surgery journal club is an effective educational intervention for cardiothoracic surgical trainees to acquire, retain, and gain practice in applying specialty-specific literature-based evidence to controversial case-based issues. Evaluation via multi-institutional expansion is needed to validate our preliminary findings in this initial trainee cohort.



Post-Curricular Survey Responses	Likert Scale Results 1 = Strongly Disagree, 5 = Strongly Agree (n = 17)		
To what extent do you agree with the following statements, companing the debate style journal club to the previous traditional, single-paper journal club?			
The new debate style format:			
Encourages greater participant engagement	4.6 ± 0.6		
Better facilitates application of the literature to clinical scenarios	4.6 ± 0.6		
loids the participants more accountable for the breadth of literature related to a given topic	4.5 ± 0.9		
Stimulates participants to explore the depth of literature related to a given topic	4.6 ± 0.6		
Encourages more critical evaluation of the literature	4.4 ± 0.9		

Cardiothoracic Surgical Education – Continued

4:00 PM Room 362A

Resident Autonomy in the Operating Room: Expectations vs Reality

J. M. Sternbach¹, E. M. Bender², J. B. Zwischenberger³, S. L. Meyerson¹

¹Northwestern University, Chicago, IL, ²St Francis Medical Center, Cape Girardeau, MO, ³University of Kentucky, Lexington

COMMERCIAL RELATIONSHIPS J. B. Zwischenberger: Ownership Interest, Maquet; Consultant/Advisory Board, CytoSorbents; Research Grant: Xenios; Nonremunerative Position of Influence, Procedural Learning and Safety Collaborative, SIMPL App

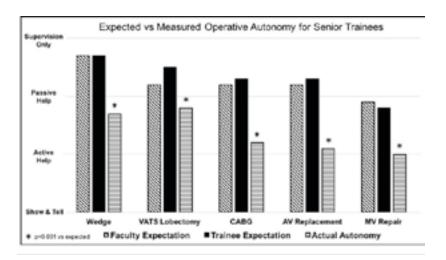
Purpose: Concerns about whether graduating cardiothoracic trainees are able to operate independently are due to many factors limiting autonomy during training. This study compares faculty and trainee expected autonomy at each level of training with objective, intraoperative measurements of autonomy for common cardiothoracic operations.

Methods: Participants underwent frame-of-reference training by the principal investigator on the four-point Zwisch scale to measure operative autonomy (show-and-tell -> active help -> passive help -> supervision only). After training, participants were surveyed regarding the Zwisch level a resident should achieve for six common operations (decortication, wedge resection, thoracoscopic lobectomy, coronary artery bypass grafting, aortic valve replacement, and mitral valve repair) at each level of training (integrated resident PGY-1 to PGY-6, traditional fellow year 1-3). These expectations were then compared to actual operative autonomy, measured using the "Zwisch Me!!" mobile application.

Results: Expected autonomy surveys were completed by 21 attendings and 19 trainees from five institutions. Trainee and attending expectations did not differ significantly for senior trainees (last 2 years of training). Twenty-one trainees then submitted evaluations of 490 cases over 15 months (March 2015 to May 2016). Twenty attendings subsequently provided their evaluation of 388 of those cases, a 79% response rate. The six operations included in the survey constituted 47% (231/490) of the total cases submitted by trainees. Five of the six operations were evaluated more than five times for senior trainees (excluding decortication, which is commonly a junior case). Both attendings and trainees expected higher levels of autonomy than observed in the operating room for all five types of cases (Figure). For each operation, observed autonomy was nearly a full step on the Zwisch scale lower than expected.

Conclusions: Although both faculty and trainees expect similar levels of autonomy in the operating room, real-time measurements of autonomy reveal a significant gap between expectations and reality. Closing this gap will require faculty to promote graduated autonomy and residents to focus on independent operative skills.





Cardiothoracic Surgical Education – Continued

4:15 PM Room 362A

Integration of Simulation Components Enhances Team Training in Cardiac Surgery

D. Joyce, J. Riley, B. D. Lahr, S. Maltais, S. Said, J. M. Stulak, L. D. Joyce Mayo Clinic, Rochester, MN

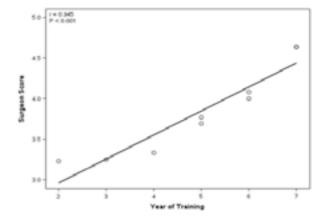
Purpose: Simulation in resident education has traditionally focused on isolated components of a surgical procedure. We hypothesized that incorporating an interdisciplinary team into a high-fidelity simulation laboratory would enhance the modeling of real-world challenges during cardiac surgery.

Methods: Twelve cardiothoracic surgical residents participated in three simulation exercises conducted on the Orpheus Perfusion Simulator: coronary artery bypass grafting (CABG), aortic valve replacement (AVR), and mitral valve repair. In order to enhance the assessment of team-based skills, the stations were staffed with surgeons, anesthesiologists, perfusionists, surgical assistants, and operating room technicians. Evaluations were performed on each resident according to their role in the exercise (primary surgeon, first assistant, perfusionist, or anesthesiologist). The relationship between scores and years of experience was assessed with a Pearson correlation, and the comparison of scores across the three stations was evaluated using an analysis of variance.

Results: Post-simulation review of video monitor recordings revealed significant gaps in communication during each of the scenarios. Performance varied considerably based on a resident's role in the simulation exercise (Table). Mean surgical scores were significantly higher for mitral repair (4.4) compared to AVR (3.6) and CABG (3.6) stations (P = .049) and were highly correlated with years of experience (Figure). Assistant scores did not correlate by resident experience (P = .674). Two-thirds of the residents completed the anesthesia portion of the exercise without prompting and demonstrated competence in the perfusion skillsets.

Conclusions: This work supports the notion that integrating components from each of the disciplines involved in cardiac surgical procedures enhances the overall value of the exercise. Our findings highlight the importance of team training as an essential component of the residency curriculum.





Score	Mean	Std Dev	Median	Minimum	Maximum
Anesthesia	2.94	0.10	3.00	2.72	3.00
Surgeon	3.85	0.54	3.77	3.23	4.64
First					
Assistant	3.60	0.78	3.40	2.71	4.78

3:30 PM - 4:30 PM Room 320ABC

Late-Breaking Abstracts II

The physician competencies addressed in this session are patient care and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief questionand-answer session after each topic.

To view the late-breaking abstracts presented at the STS 53rd Annual Meeting, please see the handout provided with this *Abstract Book* or visit www.sts.org/annualmeeting.

3:30 PM - 5:30 PM Room 310ABC

Adult Cardiac: Aorta II

Moderators: Jehangir J. Appoo, Calgary, Canada, and T. Brett Reece, Aurora, CO

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Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, a pro-con debate, and a brief question-and-answer session after each topic.

3:30 PM

Open Distal Anastomosis in Acute Type A Aortic Dissection Is Associated With Equivalent Short-Term Mortality But Improved Long-Term Survival Compared to Clamp-On Anastomosis: A Multicenter Study With Propensity Score Matching Analysis

A. Geirsson¹, C. Olsson², A. Ahlsson³, S. Fuglsang⁴, A. Franco-Cereceda², J. Gunn⁵, E. Hansson⁶, V. E. Hjortdal⁷, K. Jarvela⁸, A. Mennander⁸, S. Nozohoor⁹, E. Pan⁵, A. Wickbom³, I. Zindovic⁹, A. Jeppsson⁶, T. Gudbjartsson¹

¹Landspitali University Hospital, Reykjavik, Iceland, ²Karolinska University Hospital, Stockholm, Sweden, ³Örebro University Hospital, Sweden, ⁴Skejby University Hospital, Aarhus, Denmark, ⁵Turku University Hospital, Finland, ⁶Sablgrenska University Hospital, Gothenburg, Sweden, ⁷Aarhus University Hospital, Denmark, ⁸Tampere University Hospital, Finland, ⁹Skåne University Hospital, Lund, Sweden

COMMERCIAL RELATIONSHIPS E. Hansson: Speakers Bureau/Honoraria, AstraZeneca; J. Gunn: Other/Travel, Ethicon, St Jude Medical

Purpose: The use of open distal anastomosis for repair of acute type A aortic dissection (ATAAD) is the preferred operative method despite sparse evidence for its advantage. The aim was to define whether short- and long-term outcomes of ATAAD were affected by the use of open vs clamp-on distal anastomosis techniques using propensity score matching analysis.

Methods: The Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) is an inter-Nordic study of patients treated for type A aortic dissection at eight centers in Denmark, Finland, Iceland, and Sweden between 2005 and 2014. In a cohort of 1,159 patients, 987 underwent repair with open distal anastomosis and 166 with clamp-on distal anastomosis, while six cases had to be excluded due to missing information on distal anastomosis. Propensity score matching resulted in 120 matched pairs (1:1) open distal vs clamp-on distal anastomosis techniques that were compared for short-term mortality, long-term survival, and postoperative complications. Mean follow-up was 37.2 months ± 34.8 months.

Results: In the unmatched cohort, patients operated with clamp-on distal anastomosis more frequently had history of coronary artery disease, bicuspid aortic valve, hypotension/shock or syncope, and higher PennClass. Postoperative complications, including stroke, acute kidney injury, pneumonia, and atrial fibrillation, were more common in the unmatched open distal

group, while 30-day mortality was lower (OR 0.578; 95% CI, 0.393-0.863; P = .006) and long-term survival better (HR 0.616; 95% CI, 0.468-0.813; P < .001) than the clamp-on group. Following propensity score matching, groups were evenly matched for surgical center, year of operation, and all clinical preoperative variables except cerebral malperfusion, which was more common in the clamp-on group. Postoperative complications, stroke, acute kidney injury, respiratory failure, and atrial fibrillation remained more frequent in the open distal group. However, 30-day mortality was similar in the matched groups (OR 1.195; 95% CI, 0.666-2.154; P = .551), while long-term survival was significantly better in the open distal group (HR 0.616; 95% CI, 0.468-0.813; P < .001).

Conclusions: Open distal anastomosis for ATAAD repair is associated with improved long-term survival, while 30-day mortality is equivalent to the clamp-on technique. Open distal anastomosis is, however, associated with higher rates of neurological and other postoperative complications, indicating that further research is warranted to optimize the outcomes of distal repair for ATAAD.

Adult Cardiac: Aorta II - Continued

3:45 PM Room 310ABC

Risk Modeling to Optimize Patient Selection for Management of Descending Thoracic Aortic Aneurysm

H. K. Sandhu¹, A. Tanaka¹, W. Pratt¹, R. O. Afift¹, C. C. Miller², K. M. Charlton-Ouw², N. U. Saqib¹, M. E. Codreanu¹, A. Azizzadeh¹, H. J. Saft², A. L. Estrera²

¹McGovern Medical School, Houston, TX, ²The University of Texas Health Science Center, Houston, TX

COMMERCIAL RELATIONSHIPS A. Azizzadeh: Consultant/Advisory Board, Medtronic; K. M. Charlton-Ouw: Consultant/Advisory Board, W. L. Gore & Associates; A. L. Estrera: Research Grant, W. L. Gore & Associates; Consultant/Advisory Board, W. L. Gore & Associates; Speakers Bureau/Honoraria, Maquet

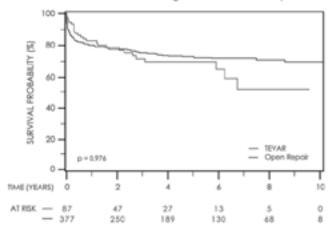
Purpose: A single-institution study comparing early and mid-term outcomes of thoracic endovascular aortic repair (TEVAR) and open surgical repair (OSR) was performed to determine the appropriate treatment option for descending thoracic aortic aneurysm (DTAA).

Methods: Between 2005 and 2014, 464 DTAA patients were treated at our institution (TEVAR=87, OSR= 377). Acute aortic dissection, traumatic injury, and false aneurysm were excluded from the study. Perioperative and follow-up data were reviewed. Stratified analyses were conducted to identify patients most likely to benefit from TEVAR. A propensity score for repair by TEVAR was developed (Table) by logistic regression, and prediction models for mortality were adjusted for propensity score by logistic and Cox regression.

Results: TEVAR was performed more frequently in females (54% vs 36%, P < .002), older age (median age 75 vs 62 years, P < .001), emergent status (22% vs 11%, P < .001), chronic obstructive pulmonary disease (COPD) (56% vs 33%, P < .001), coronary artery disease (45% vs 18%, P < .001), and less frequently in chronic dissections (13% vs 50%, P < .001) and DTAA-extent-C (20% vs 57%, P < .001). TEVAR, compared to OSR, had similar rates of immediate (0% vs 1.6%, P = .26) and delayed (5% vs 7%, P = .35) paraplegia, but lower rates of dialysis (3.5% vs 17.8%, P < .001), respiratory failure (10% vs 33%, P < .001), ICU stay $(3.6 \text{ days} \pm 4.8 \text{ days} \text{ vs } 7.9 \text{ days} \pm 0.9 \text{ days}, P < .001)$, and early mortality (5% vs 11%, P < .05). In stratified analysis, early mortality after TEVAR was lower in septuagenarians (3% vs 16%, P < .02), glomerular filtration rate (GFR) <60 (8% vs 32%, P < .049), COPD (6% vs 21%, P < .02), defined as target population as there was a four-fold mortality reduction (P < .006) attributable to TEVAR in this group. Propensity-adjusted early mortality predictors included OSR (OR 4.3, P < .024), target population (OR 7.7, P < .001), diabetes (OR 3, P < .009), peripheral vascular disease (PVD) (OR 4.7, P < .001), and emergent status (OR 4.6, P < .001). Although survival was not different (Figure) over a median follow-up of 3.8 years, TEVAR was associated with marginal reduction in mortality (HR 0.58, P = .058). Propensity-adjusted determinants of mid-term survival were age, GFR <60, PVD, COPD, and emergent status.

Conclusions: Open repair can be performed with acceptable results in younger patients with more extensive aneurysmal disease. In older patients (>70 years) with significant comorbidities (renal and pulmonary insufficiency), however, TEVAR demonstrated superior results as compared to open repair and may be preferable in this target population.

Impact of Surgical Approach on Survival after Descending Thoracic Aortic Repair



Adult Cardiac: Aorta II - Continued

4:00 PM Room 310ABC

Operative Outcomes for Valve-Sparing Aortic Root Repair and Bentall Procedure in Marfan Patients: An International Collaboration From Johns Hopkins and UK Data (NICOR)

M. Bashir¹, M. Fok², J. Dunning³, J. T. Magruder⁴, M. Shaw², D. E. Cameron⁴, A. Oo²

¹Barts Heart Centre, London, United Kingdom, ²Liverpool Heart and Chest Hospital, United Kingdom, ³The Old Rectory, Kirkby Stephen, United Kingdom, ⁴The Johns Hopkins Hospital, Baltimore, MD

COMMERCIAL RELATIONSHIPS J. Dunning: Speakers Bureau/Honoraria, Dextera Surgical

Purpose: The optimal treatment for a ortic root disease in Marfan patients has not been determined. We sought to identify a large international cohort of Marfan patients to compare the operative outcomes following Bentall and valve-sparing a ortic root repair (VSRR).

Methods: All VSRR and Bentall operations performed on Marfan patients in the United Kingdom and at Johns Hopkins Medical Center were identified through the National Institute for Cardiovascular Outcomes Research (NICOR), which holds data on every cardiac operation performed in the UK, and chart review at Johns Hopkins from 2007 to 2014. Total number of patients was 286, of which 134 and 152 underwent Bentall and VSRR, respectively.

Results: Patients who underwent Bentall were significantly older (P = .002), had more aortic dissections (P < .001), and underwent urgent or emergency surgery (P < .001), compared to VSRR. Postoperative complications revealed no difference in cerebrovascular accidents and reoperation for bleeding. There was no observed difference for in-hospital mortality between the two procedures (1 vs 0, respectively, P = .47). Five-year survival stratified by procedure was significantly lower in the Bentall compared to VSRR.

Conclusions: Our preliminary results reveal no superiority in outcomes for Marfan patients undergoing Bentall or VSRR. However, 5-year survival is significantly higher for patients undergoing VSRR.

4:15 PM

Analysis of More Than 700 Type A Dissections Using the Penn Classification

N. Desai¹, F. H. McCarthy², T. Dibble¹, D. Spragan¹, D. Savino¹, K. A. Dufendach², K. M. McDermott², M. L. Williams¹, P. Vallabhajosyula¹, W. Y. Szeto¹, J. E. Bavaria¹, J. Augoustides¹

¹University of Pennsylvania, Philadelphia, ²Hospital of the University of Pennsylvania, Philadelphia, ³Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA

COMMERCIAL RELATIONSHIPS J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; N. Desai: Speakers Bureau/Honoraria, St Jude Medical, Edwards Lifesciences Corporation; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/ Advisory Board, Microinterventional Devices

Purpose: Preoperative malperfusion is present in up to one-third of patients presenting with acute type A aortic dissection and is a predictor of early mortality following surgery. This study aims to evaluate the Penn classification for type A aortic dissections with a larger patient cohort and greater follow-up time.

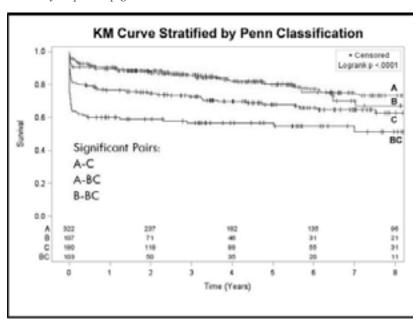
Methods: All patients classified with acute type A aortic dissection treated at a single tertiary-care center from 2002 to 2015 were evaluated preoperatively according to the Penn classification, with types A, B, C, and BC corresponding to: absence of ischemia, branch vessel malperfusion, circulatory collapse, combined branch vessel malperfusion, and circulatory collapse. Statistical analysis was performed using both univariate analysis, one-way ANOVA (continuous), and chi-square (categorical) with post-hoc pairwise comparisons and Bonferroni correction, and multivariable analysis, logistic regression, and Cox proportional hazards modeling.

Results: 712 patients with acute type A dissection were included in the study. Perioperative outcomes demonstrated a significantly increased 30-day mortality in class BC compared to all other classes: 38% (38/103) vs 6% (16/322), 11% (11/107), and 19% (35/180) in classes A, B, and C, respectively (P < .001). In a Cox survival model, classes C and BC had a hazard ratio (HR) of 1.8 and 3.0, respectively (P = .003 and P < .001). Among all patients with branch vessel malperfusion (n= 233), 30-day mortality was increased with iliofemoral (OR 2.3, P = .02), cerebral (OR 2.5, P = .01), and mesenteric malperfusion (OR 3.9, P < .001). A Cox survival model indicates that iliofemoral malperfusion (HR 1.8, P = .01) and mesenteric malperfusion (HR 2.1, P = .001) are predictors of increased mortality.

Conclusions: The Penn classification system accurately stratifies patients according to short- and long-term outcomes. Circulatory collapse (class C) results in increased mortality compared with branch vessel malperfusion (class B), and both these risk factors combined confer poorer outcomes in the highest-risk subset of type A dissection patients (class BC).



Adult Cardiac: Aorta II – Continued Continued from previous page



Logistic Model Predicting 30 Day Mortality

Parameter	Odds Ratio	95% CI	P
Age	1.03	(1.01, 1.05)	0.006
Male	0.7	(0.4, 1.2)	0.19
White	0.8	(0.4, 1.4)	0.36
Diabetes	1.0	(0.4, 2.2)	0.91
Hypertension	0.5	(0.3, 1.0)	0.06
COPD	1.1	(0.5, 2.3)	0.81
Renal failure	1.1	(0.5, 2.5)	0.88
BAV	1.3	(0.5, 3.6)	0.61
CVA	1.1	(0.6, 2.2)	0.74
Previous cardiac intervention	3.2	(1.8, 5.6)	< 0.001
Penn class B	3.2	(1.3, 8.3)	0.02
Penn class C	5.0	(2.4, 10.0)	< 0.001
Penn class BC	15.4	(7.2, 33.1)	<0.001

4:30 PM Room 310ABC

A Challenging Treatment for Aortic Arch Aneurysm With Fenestrated Stent Graft

K. Yuri, N. Kimura, A. Yamaguchi, H. Adachi

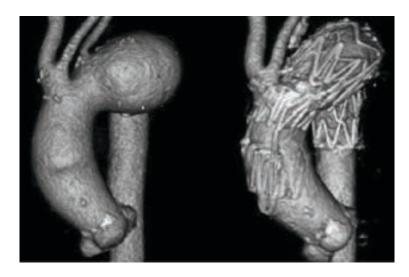
Saitama Medical Center of Jichi Medical University, Japan

Purpose: We have been performing treatment for aortic arch aneurysms using fenestrated stent graft (FSG) in patients without an extra-anatomical bypass. This study aimed to evaluate the early outcomes of FSG treatment for arch aneurysms and safety of operative procedures.

Methods: We retrospectively analyzed the early outcomes of 54 aortic arch aneurysm cases among 70 FSG treatments (except dissecting aneurysms) that have been performed in our department between January 2008 through May 2016. A retrograde approach was applied for all patients. The FSG was delivered with a 21-23 Fr J-shaped sheath by "tug-of-wire" technique. Thereafter, the FSG was deployed at the planned position under fluoroscopic guidance without additional circulatory support. Post-deployment touch-up ballooning proceeded as required, and the left subclavian artery was revascularized in selected patients.

Results: The primary technical success rate was 100%. There were two operative deaths due to shower embolism and respiratory failure (2/54, 3.7%). Two patients have central nerve system injury (2/54, 3.7%) without remaining sequelae. One patient developed a type 1 endoleak at 1 week after operation. However, this endoleak vanished at 2 weeks after operation. At a mean follow-up of 1,068 days, the survival rate was 70.5%, but there was no aortic-related death. On follow-up, secondary interventions were needed in three cases. The rate of freedom from secondary reintervention was 94.1%.

Conclusions: Although further observation and a larger number of prospective studies are required to validate this process, the FSG treatment and our procedures were acceptable. This procedure does not require surgical transposition of the arch branches and has a potential to expand the indication of aortic arch aneurysm treatment.





Adult Cardiac: Aorta II - Continued

4:45 PM Room 310ABC

Characteristics and Predictors of Unplanned Readmissions After Open Thoracoabdominal Aortic Aneurysm Repair

S.A. LeMaire¹, M. Price¹, S. Y. Green², Q. Zhang¹, S. J. Woodside¹, A. Tullos¹, H. Amarasekara¹, D. Wu¹, J. S. Coselli¹

¹Baylor College of Medicine, Houston, TX, ²Baylor College of Medicine/Texas Heart Institute, Houston

COMMERCIAL RELATIONSHIPS J. S. Coselli: Research Grant, Vascutek Ltd a Terumo Company, Medtronic, W. L. Gore & Associates, Baxter, Bolton Medical, GlaxoSmithKline; Ownership Interest, Vascutek Ltd a Terumo Company; Consultant/Advisory Board, Vascutek Ltd a Terumo Company, Medtronic, W. L. Gore & Associates; S. A. LeMaire: Research Grant, GlaxoSmithKline, Medtronic, W. L. Gore & Associates, Baxter, Vascutek Ltd a Terumo Company

Purpose: Although reducing the incidence of unplanned hospital readmission after thoracoabdominal aortic aneurysm (TAAA) repair represents an important opportunity to improve outcomes, predictors of readmission are not well known. We sought to characterize and identify factors associated with unplanned readmission in survivors of open TAAA repair.

Methods: Through prospective phone contact and retrospective record review, we determined the frequency and characteristics of unplanned readmissions within 30 days after surgery in 341 patients who survived open TAAA repair from January 1, 2011, to December 31, 2015. Ninety-two patients (27.0%) had undergone Crawford extent I TAAA repairs, 101 (29.6%) had undergone extent II repairs, 72 (21.1%) had undergone extent III repairs, and 76 (22.3%) had undergone extent IV repairs. Urgent or emergent repairs were performed in 80 patients (23.5%). Chronic dissection was present in 160 patients (46.9%). We used univariate and multivariable analyses to identify factors associated with readmission.

Results: There were 42 unplanned readmissions involving 39 patients (11.4%). The median interval between initial discharge and readmission was 12 days (interquartile range [IQR] 7-17); the median readmission length of stay (LOS) was 6 days (IQR 3-13). After readmission, 12 patients underwent operations, two of which involved aortic repair, and 14 patients underwent nonsurgical procedures, thoracentesis being the most common (n=9). Readmitted patients had significantly lower preoperative estimated glomerular filtration rates (eGFR) (P=.04), higher frequencies of preoperative sleep apnea (P=.008) and postoperative pulmonary complications (P=.04), and longer hospital LOS (P=.015) than patients without readmissions. Patient age, aortic dissection, urgency of operation, and extent of TAAA repair were similar in those with and without readmissions. Multivariable analysis identified sleep apnea (OR 3.06; 95% CI, 1.44-6.53; P=.004), increasing eGFR (OR 0.98/mL/min/1.73m²; 95% CI, 0.97-1.00; P=.03), postoperative infection (OR 4.46; 95% CI, 1.08-18.49; P=.04), and increasing local LOS (OR 1.05/day; 95% CI, 1.01-1.09; P=.03) as significant predictors of readmission.

Conclusions: The risk of readmission after TAAA repair was associated with a combination of perioperative factors, but not with dissection, urgency, or extent of repair. Patients with preoperative renal dysfunction, sleep apnea, or postoperative infection were particularly likely to be readmitted; optimizing the management of these factors may reduce unplanned readmissions.

5:00 PM

Debate: Management of the Aortic Arch in DeBakey Type I Dissection

Hemiarch Only: Marc R. Moon, St Louis, MO

Extended Arch Reconstruction: Jehangir J. Appoo, Calgary, Canada COMMERCIAL RELATIONSHIPS M. R. Moon: Speakers Bureau/Honoraria, Medtronic



3:30 PM - 5:30 PM Room 330AB

Adult Cardiac: Aortic Valve

Moderators: Joseph F. Sabik, Cleveland, OH, and Wilson Y. Szeto, Philadelphia, PA

COMMERCIAL RELATIONSHIPS J. F. Sabik: Research Grant, Medtronic, Abbott Vascular, Edwards Lifesciences Corporation; Consultant/Advisory Board, Medtronic, LivaNova; Speakers Bureau/Honoraria, Medtronic; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures, a pro-con debate, and a brief question-and-answer session after each topic.

3:30 PM

The Impact of Tricuspid Valve Regurgitation on Transcatheter Aortic Valve Replacement Outcomes: A Report From the STS/ACC TVT Registry™

F.H. McCarthy¹, S. Vemulapalli², Z. Li², V. H. Thourani³, R. A. Matsouaka², N. Desai⁴, A. Kirtane⁵, S. Anwaruddin⁴, M. L. Williams⁴, J. Giri⁴, P. Vallabhajosyula⁴, R. Li⁴, J. E. Bavaria⁴, H. C. Herrmann¹, W. Y. Szeto⁴

¹Hospital of the University of Pennsylvania, Philadelphia, ²Duke University, Durham, NC, ³Emory University, Atlanta, GA, ⁴University of Pennsylvania, Philadelphia, ⁵Columbia University, New York, NY

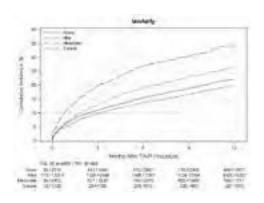
COMMERCIAL RELATIONSHIPS S. Anwaruddin: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic; Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic; J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; N. Desai: Speakers Bureau/ Honoraria, St Jude Medical, Edwards Lifesciences Corporation; J. Giri: Research Grant, St Jude Medical; H. C. Herrmann: Research Grant, Abbott Vascular, Boston Scientific, St Jude Medical, Medtronic, W. L. Gore & Associates; A. Kirtane: Research Grant, Abbott Vascular, Boston Scientific, St Jude Medical, Medtronic, W. L. Gore & Associates, Siemens, CardioKinetix, MitraSpan, Bayer; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices; S. Vemulapalli: Research Grant, Abbott Vascular, America College of Cardiology; Consultant/Advisory Board, Novella Clinical

Purpose: Transcatheter aortic valve replacement (TAVR) has demonstrated at least equivalent outcomes compared to surgical aortic valve replacement (SAVR) in treating aortic stenosis in moderate, high-risk, and inoperable patients, but less is known regarding patients with concomitant valve disease. This study evaluates the impact of tricuspid regurgitation (TR) severity on outcomes following TAVR.

Methods: From November 2011 through March 2015, 34,576 patients underwent TAVR in the United States and were entered into the STS/ACC TVT Registry. To perform 1-year mortality and readmission analyses, the STS/ACC TVT Registry data were linked to Medicare claims data. We examined 1-year mortality, heart failure readmission, in-hospital major adverse cardiac events (MACE), and length of ICU and hospital stays. Multivariable Cox proportional hazards models were used to assess adjusted 1-year mortality as a function of TR severity. Interaction terms were used to investigate whether other covariates, such as left ventricular ejection fraction (LVEF), modified the relationship between TR and mortality.

Results: Tricuspid regurgitation was present in 80% of TAVR patients (n=27,804), with mild TR in 56% (n=19,393), moderate TR in 19% (n=6,687), and severe TR in 5% (n=1,724). Increasing TR severity was associated with a number of comorbidities, including STS PROM for no TR (7.3 \pm 5.4), mild TR (8.0 \pm 5.7), moderate TR (9.6 \pm 6.7), and severe TR (10.7 \pm 7.4, P < .001). Each increase in grade of TR severity was associated with unadjusted increased use of cardiopulmonary bypass, longer ICU and hospital stay, new dialysis, inhospital MACE, and increased in-hospital mortality (P < .001, Table). Unadjusted long-term mortality and readmission rates were significantly higher with increasing degree of TR (Figure). Severe TR demonstrated worse in-hospital mortality with an O:E of 1.14 (95% CI, 0.97-1.31). Compared to patients with no TR, adjusted mortality at 1 year was also significantly worse for patients with severe TR when LVEF >30% (HR 1.3; 95% CI, 1.1-1.5), but not when LVEF ≤30 (HR 1.2; 95% CI, 0.8-1.7).

Conclusions: Tricuspid regurgitation was a common finding in patients undergoing TAVR. Increasing TR severity was associated with higher-risk patients, increased mortality, and readmission. Severe TR is not fully captured by current STS PROM and may warrant further consideration and possible intervention to address TR in lower-risk patients.



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Adult Cardiac: Aortic Valve - Continued

3:45 PM Room 330AB

Cost and Outcomes of Surgical vs Transcatheter Aortic Valve Replacement: Analysis of the Post-Approval TAVR Experience in the United States

J. M. Burg, N. F. Fino, F. A. Tibayan, J. S. Raman, H. Song

Oregon Health & Science University, Portland

COMMERCIAL RELATIONSHIPS J. S. Raman: Research Grant, Zimmer Biomet; Ownership Interest/Founder, Phoenix Cardiac, iSpectrom LLC; H. Song: Research Grant, HeartWare; Consultant/Advisory Board, Oregon Heart

Purpose: Transcatheter aortic valve replacement (TAVR) has substantially impacted treatment of patients with aortic stenosis. A concern with widespread adoption of TAVR is higher cost compared to surgical AVR (SAVR). We sought to define cost and outcomes of TAVR vs SAVR in the real-world setting since commercial TAVR approval in 2012.

Methods: The National Inpatient Sample (NIS) dataset post-TAVR approval was analyzed by quarter (June 2012 to December 2013). Patients over age 65 undergoing isolated TAVR or SAVR were identified by procedure code. Patient characteristics were compared using ANOVA and chi-square tests. Linear regression was used to determine correlates of the log distribution of total charges, while testing for interactions with procedure type. Patients were risk stratified based on All Patient Refined Diagnosis Related Group (APR-DRG) Mortality risk score: 1-minor, 2-moderate, 3-major, 4-extreme likelihood of dying. All statistics take into account the National Inpatient Sample sampling strategy. Outcomes were in-hospital mortality, length of stay (LOS), discharge location, and hospitalization cost.

Results: An estimated 17,095 and 73,555 patients underwent TAVR and SAVR, respectively. Utilization of TAVR increased from 1,900 cases in the third quarter of 2012 to 3,580 cases in the fourth quarter of 2013 (P < .01). TAVR patients were older, had more comorbidities, and higher APR-DRG mortality score (P < .01). TAVR patients had shorter length of stay than SAVR patients (8.5 days vs 10.5 days, P < .01). TAVR and SAVR patients had similar rates of discharge to home vs care facility (SAVR: 62%, TAVR: 64% discharged to home; P = .06). Overall mortality was higher for TAVR (4.7% vs 3.9%, P = .04); however, when grouped by APR-DRG score, only the moderate-risk TAVR patients had higher mortality (Table). Total hospital costs were higher in the TAVR group (\$225,917 vs \$208,515, P < .01), but when adjusted for age, sex, chronic conditions, race, and procedure year, high-risk SAVR and TAVR (APR-DRG score = 4) hospital costs did not differ (Figure).

Conclusions: TAVR utilization increased dramatically over the first year and a half following commercial approval in the United States. In high-risk groups, SAVR and TAVR costs and mortality were similar; however, in moderate-risk groups, SAVR had significantly better mortality and lower cost.

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Figure 1: Total Hospital Cost for SAVR vs TAVR. Error bars represent SEM.

APR-DRG Mortality Risk Score	SAVR	TAVR	p-value
1: Low	0.52	0.93	0.58
2: Moderate	0.36	1.02	< 0.01
3: Major	1.94	1.93	0.99
4: Extreme	16.71	20.07	0.06

Table 1: In hospital mortality rates (%) for SAVR versus TAVR by APR-DRG Mortality Risk Score.

Adult Cardiac: Aortic Valve - Continued

4:00 PM Room 330AB

The Ross Procedure: 21-Year Follow-Up

R. R. Favaloro¹, M. Gilbert², G. Giunta², M. Candioti², G. Ganum²

¹Favaloro Foundation University Hospital, Buenos Aires, Argentina, ²Fundación Favaloro, Buenos Aires, Argentina

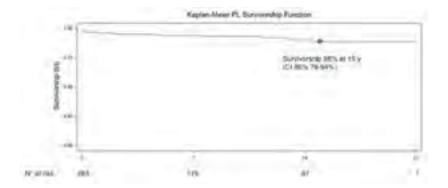
Purpose: The aim of this study was to assess the long-term results of the Ross procedure (RP) with the root replacement technique in adults and to evaluate patient survival, pulmonary autograft and pulmonary homograft durability, and valve-related morbidity.

Methods: From May 1995 to December 2015, 283 consecutive patients (200 males, mean age 42 years ± 14 years) underwent aortic valve replacement using the RP. Yearly clinical and echocardiographic follow-up was 90% complete; the mean follow-up was 9.3 years ± 5.5 years. Survival, freedom from reoperation of the autograft, homograft, and Ross-related reoperation were analyzed using Kaplan-Meier curves. Cox hazards regression analysis was performed to recognize independent predictors of death.

Results: The Table shows the characteristics of the population analyzed. Early mortality was 2.5% (n=7) and late mortality was 4.9% (n=14). 203 operations were performed by the same surgeon. Survival at 10 and 15 years was 93% (95% CI, 89%-96%) and 88% (95% CI, 79%-94%), respectively. Freedom from autograft reoperation at 10 years was 96% (95% CI, 91%-98%) and at 15 years was 88% (95% CI, 78%-93%). Freedom from homograft reoperation at 10 and 15 years was 98% (95% CI, 94%-99.5%) and 97% (95% CI, 91%-99%), respectively. Overall, freedom from Ross-related reoperation at 10 years was 96% (95% CI, 90%-98%) and at 15 years was 87% (95% CI, 78%-93%). Death in follow-up was associated with age (*P* < .02) and previous sternotomy (*P* < .01).

Conclusions: Despite being a technically demanding procedure, the Ross operation constitutes a valid surgical option for the treatment of aortic valve disease in selected patients. The technique was associated with a very good survival, low reoperation rate, and valve-associated events.





	No. of patients (n,%)
Age (years)	42 ± 14 (15-67)
Male	200 (71)
Diabetes mellitus	7 (2)
NYHA functional class	
HI	149 (52)
III-IV	56 (20)
LVEF (%)	58 ± 8 (34-75)
>50%	218 (77)
50-30%	52 (18)
<30%	
Previous cardiac surgery	21 (7)
Preoperative aortic valve disease	
Aortic stenosis	143 (51)
Aortic regurgitation	99 (35)
Aortic stenosis + regurgitation	41 (14)
Etiology	
Bicuspid aortic valve	218 (77)
Infective endocarditis	25 (9)
Active infective endocarditis	8 (3)
Aortic root dilatation	23 (8)
Rheumatic	17 (6)
Prosthetic dysfunction	11 (4)
Congenital aortic stenosis	9 (3)
Unicuspid aortic valve	5 (2)
Additive EuroScore	5.4 ± 1.0
Emergencies/Urgencies	1 (0) / 16 (6)
Isolated procedure	247 (87)
Combined procedure	36 (13)
Ross + CABG	16 (6)
Ross + mitral valve repair	7 (2)
Ross-Konno procedure	5 (2)
Ross + interventricular septal defect	4 (1)
closure	
Ross + mitral valve replacement	2(1)
Ross + mitral and tricuspid valve	1 (0)
repair	
Ross + mitral valve commissurotomy NYHA: New York Heart Association, LVEF; left ventricular of	1 (0)

Adult Cardiac: Aortic Valve – Continued

4:15 PM Room 330AB

Aortic Valve Replacement With Sutureless Perceval Bioprosthesis: Single-Center **Experience With 617 Implants**

G. Concistrè, F. Chiaramonti, G. Bianchi, M. Murzi, A. G. Cerillo, T. Gasbarri, D. S. Gilmanov, R. Margaryan, P. Farneti, M. Solinas

G. Pasquinucci Heart Hospital, G. Monasterio Tuscany Foundation, Massa, Italy COMMERCIAL RELATIONSHIPS A. G. Cerillo: Speakers Bureau/Honoraria, LivaNova

Purpose: Patients referred for a ortic valve replacement (AVR) may benefit from sutureless technology in order to reduce mortality and morbidity and facilitate a minimally invasive approach. We describe our experience with the sutureless Perceval aortic bioprosthesis.

Methods: Between March 2011 and December 2015, 617 patients underwent AVR with the Perceval bioprosthesis. Mean age was 76 years ± 7 years, 388 patients were female (63%), and mean logistic EuroSCORE was 12.3% ± 10.1%. Concomitant procedures were mitral valve surgery (n=74), tricuspid valve repair (n=22), coronary artery bypass grafting (n=42), myectomy (n=3), and ascending a replacement (n=2).

Results: In-hospital mortality was 1.9% (12/617). 475 patients (77%) underwent minimally invasive AVR with an upper ministernotomy (n=81) or right anterior minithoracotomy (n=394) approach. Cardiopulmonary bypass and aortic cross clamp times were 81.7 minutes ± 29.1 minutes and 50.5 minutes ± 19.8 minutes for isolated AVR and 138.7 minutes ± 51.5 minutes and 91.5 minutes ± 29.5 minutes for combined procedures. At mean follow-up of 16.3 months ± 12.8 months, survival was 91.3%, freedom from reoperation was 99%, and mean transvalvular pressure gradient was 11.9 mm Hg ± 5.4 mm Hg.

Conclusions: AVR with the Perceval bioprosthesis is a safe and feasible procedure associated with low mortality and excellent hemodynamic performance. This technology facilitates a minimally invasive approach.



NOTES



Adult Cardiac: Aortic Valve - Continued

4:30 PM Room 330AB

Two-Year Echocardiographic and Clinical Outcomes in 937 Intermediate Patients Undergoing Surgical Aortic Valve Replacement From the PARTNER 2A Study

V. H. Thourani¹, W. Y. Szete², S. Kodali³, E. Blackstone⁴, A. Lowry⁴, R. Makkar⁵, M. Williams⁶, J. E. Bavaria², H. C. Herrmann⁷, H. S. Maniar⁸, V. Babaliaros¹, C. Smith³, A. Trento⁵, P. J. Corso⁹, A. Pichard¹⁰, D. Miller¹¹, L. G. Svensson⁴, S. R. Kapadia⁴, G. Ailawadi¹², R. M. Suri⁴, K. L. Greason¹³, R. Hahn³, W. Jaber⁴, J. Forcillo¹, M. Alul⁴, M. B. Leon¹⁵, M. J. Mack¹⁶

¹Emory University, Atlanta, GA, ²University of Pennsylvania, Philadelphia, ³Columbia University College of Physicians and Surgeons, New York, NY, ⁴Cleveland Clinic, OH, ⁵Cedars-Sinai Medical Center, Los Angeles, CA, ⁶New York University Langone Medical Center, NY, ⁷Hospital of the University of Pennsylvania, Philadelphia, ⁸Washington University School of Medicine, St Louis, MO, ⁹Cardiovascular & Thoracic Surgery Associates, Washington, DC, ¹⁰Medstar Washington Hospital Center, Washington, DC, ¹¹Stanford University School of Medicine, CA, ¹²University of Virginia, Charlottesville, ¹³Mayo Clinic, Rochester, MN, ¹⁴Columbia University Medical Center, New York, NY, ¹⁵Columbia University, New York, NY, ¹⁶Baylor Scott & White Health, Plano, TX

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; V. Babaliaros: Consultant/Advisory Board, Edwards Lifesciences Corporation, Abbott Vascular; J. E. Bavaria: Research Grant, Edwards Lifesciences Corporation, Medtronic, St Jude Medical, W. L. Gore & Associates; E. Blackstone: Research Grant, Edwards Lifesciences Corporation; R. Hahn: Speakers Bureau/Honoraria, Abbott Vascular, St Jude Medical; Consultant/Advisory Board, Abbott Vascular, St Jude Medical; Other/Trials, Edwards Lifesciences Corporation; H. C. Hermann: Research Grant, Abbott Vascular, Boston Scientific, St Jude Medical, Medtronic, W. L. Gore & Associates, Siemens, Cardiokinetix, MitraSpan, Bayer AG, Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Edwards Lifesciences Corporation; Consultant/Advisory Board, Edwards Lifesciences Corporation; Ownership Interest, Microinterventional Devices; W. Jaber: Research Grant, Edwards Lifesciences Corporation; S. Kodali: Research Grant, Edwards Lifesciences Corporation, Medtronic, Claret Medical; Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic, Claret Medical, Thubrikar Aortic Valve, Inc; Ownership Interest, Thubrikar Aortic Valve, Inc; M. J. Mack: Other: Edwards Lifesciences Corporation, Abbott Vascular; R. Makkar: Research Grant: Edwards Lifesciences Corporation, St Jude Medical; D. C. Miller: Research Grant, Edwards Lifesciences Corporation, Medtronic, Vascutek Ltd a Terumo Company, Abbott Vascular; Nonremunerative Position of Influence, Edwards Lifesciences Corporation; A. Pichard: Consultant/Advisory Board, Edwards Lifesciences Corporation; W. Y. Szeto: Research Grant, Edwards Lifesciences Corporation, Medtronic, Bolton Medical; Consultant/Advisory Board, Microinterventional Devices; M. Williams: Research Grant, Edwards Lifesciences Corporation, Medtronic

Purpose: Recent trials demonstrate mortality and morbidity superiority of transfemoral transcatheter aortic valve replacement (TF-TAVR) to surgical AVR (SAVR) in intermediaterisk patients with severe aortic stenosis. To understand these findings, we performed in-depth analyses of outcomes of SAVR patients in the Placement of Aortic Transcatheter Valves (PARTNER 2A) trial.

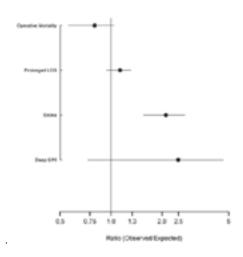
Methods: From December 2011 to November 2013, 1,011 severe aortic stenosis patients (STS PROM 4%-8%) were randomized in 57 North American centers to SAVR. Of these, 937 (92%) had surgical valve implantation and compose our study group. Mean age was 82 years ± 6.7 years, 513 (55%) were male. Most operations were performed via full sternotomy, but 140 (15%) were via less-invasive incisions (MI-SAVR). SAVR was isolated in most, but included concomitant procedures in 211 (23%). Mean aortic clamp time for all patients was 75 minutes ± 30 minutes; bypass time was 104 minutes ± 46 minutes. Major outcomes and echocardiograms were adjudicated by an independent clinical events committee. Follow-up was 94% complete to 2 years.

Results: Operative mortality was 4.1% (n=38), somewhat lower than STS expected; inhospital stroke 5.4% (n=51), twice expected; and sternal wound infection 0.75% (n=7), twice expected (Figure). Time-related events mostly occurred early after SAVR (Table). Patients



having severe (\leq 0.65 cm·m²) prosthesis-patient mismatch (n=260, 33%) had similar survival to those without (P > .9), as did those undergoing MI-SAVR (P = .3). Risk factors for death early after SAVR included longer procedure time (P < .0001), and for later deaths, cachexia (P = .02), lower ejection fraction (P = .01), higher creatinine (P = .03), coronary artery disease (P = .03), and smaller prostheses (P = .01). Transprosthesis mean gradient at hospital discharge was 15.9 mm Hg \pm 5.9 mm Hg, 13.8 mm Hg \pm 5.2 mm Hg, 11.6 mm Hg \pm 4.2 mm Hg, 10.3 mm Hg \pm 3.4 mm Hg, and 7.3 mm Hg \pm 2.7 mm Hg for label sizes 19 (n=112), 21 (n=301), 23 (n=335), 25 (n=150), and 27 (n=32), respectively. To date, there have been no valve thromboses or severe hemolysis, but four valves were explanted: three for endocarditis and one for early structural valve problems.

Conclusions: From this adjudicated, prospectively collected data in the contemporary era, SAVR can be performed in intermediate-risk elderly patients with mortality commensurate with national benchmarks, although with a greater than expected number of strokes. In addition, postoperative gradients are high and prosthesis-patient mismatch common. Continued surveillance of these patients remains important.



Time-related event	30 d, % (68% CI)	1 yr, % (68% CI)	2 yr, % (68% CI)
Death	3.7 (3.2 - 4.3)	12.4 (11.4 - 13.5)	17.4 (16.2 - 18.7)
Stroke	6.6 (5.8 - 7.4)	9.7 (8.8 - 10.7)	11.0 (10.0 - 12.1)
Pacemaker	7.2 (6.4 - 8.1)	9.3 (8.3 - 10.3)	10.7 (9.7 - 11.8)
Endocarditis	0	0.69 (0.46 - 1.04)	0.69 (0.46 - 1.04)
Explant	0	0.35 (0.20 - 0.62)	0.48 (0.29 - 0.79)
SVD	0.11 (0.040 - 0.30)	0.35 (0.20 - 0.62)	0.76 (0.50 - 1.14)

Adult Cardiac: Aortic Valve – Continued

4:45 PM Room 330AB

Annular Stabilization During Bicuspid Aortic Valve Repair: A Prospective Study

M. Jasinski

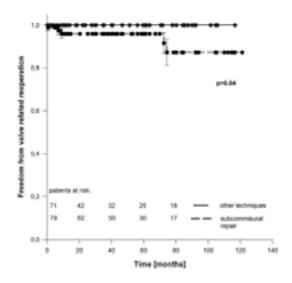
Medical University Wroclaw, Poland

Purpose: This prospective study deemed to supplement existing information with echocardiographic and clinical outcome data regarding different techniques of ventriculoaortic junction (VAJ) stabilization during bicuspid aortic valve (BAV) repair.

Methods: Among 335 consecutive patients who underwent aortic valve and aortic root repair, there were 150 BAV repair. 50 consecutive BAV patients were prospectively randomized according to aortic annulus stabilization. Group 1 underwent external annuloplasty with cutting of appropriate diameter tube graft anchored with pledgeted stiches from inside and reimplantation procedure if indicated. Group 2 received subcommissural annuloplasty with pledgeted mattress stiches and root remodeling if indicated. Echocardiographic follow-up was performed at 1 week and 2 years. Univariable log-rank testing was used to identify association between risk factors and major events

Results: Aortic root and left ventricle reverse remodeling and aortic regurgitation showed significant reduction. The VAJ maintained significantly reduced diameter only in group 1: (27.4 [SD 3.2] to 24.1 [SD 5.17]: P = .002, ANOVA- P = .05). In group 1 at 2-year followup, there was lower flow velocity (-1.8 m/s $[SD \ 0.57]$ vs 2.28 m/s $[SD \ 0.32]$, P = .012) and lower mean gradient (-7 mm Hg [SD -4.0] vs 12.6 [SD -4.6], P = .018). Reoperations were associated with subcommissural annuloplasty, P = .04.

Conclusions: In both techniques, proper aortic competence can be achieved, as well as a comparable reverse ventricle and aortic remodeling. Only external stabilization guarantees durable stabilization of VAJ. Subcommissural annuloplasty was associated with higher transaortic flow velocity and gradient, which may have influenced durability.



	BAV- reimplantation- external annulopl.(gr1)			BAV remodelling subcomissural(gr2)				Gr1vs. gr2	
	pre	ор	post o	p (2y.)	pre	ор	post op	(2y.)	
	mean	SD	mean	SD	mean	SD	mean	SD	
VAJ[mm]	27,4	3,1	24,1	2,5*	26,5	4,7	25,8	3,8	0,05
Root [mm]	47,3	7,7	38	4,1*	40,5	6,9	36,4	3,3*	
STJ [mm]	42,2	8,9	30,7	4.3*	32,7	4,6	28,4	3.6*	
Aorta [mm]	49,5	6,8	32,2	2,7*	45,8	8,8	31,8	3,8*	
EDV [ml]	198,1	53,9	164,6	44,8*	232	96,7	165	32,1	
ESV [ml]	73,8	35,4	50,5	14,3	134,5	50,2	70,1	27*	
gradient mmHg	11	4,9	7	4,4	17,5	4,9	12,6	4,6	0,018
IA [mm]	11,1	1,9	3,0	1.8*	9.9	5,1	3,6	3,6*	
			*p<	0.05					

5:00 PM

Debate: TAVR for Aortic Stenosis in Low-Risk Patients: Is It Natural Evolution or Madness?

Natural Evolution: Michael J. Mack, Plano, TX Madness: Thomas E. MacGillivray, Houston, TX

COMMERCIAL RELATIONSHIPS M. J. Mack: Other: Edwards Lifesciences Corporation, Abbott Vascular

3:30 PM - 5:30 PM Room 360BC

Congenital: Pediatric Congenital III

Moderators: Joseph W. Turek, Iowa City, IA, and James S. Tweddell, Cincinnati, OH COMMERCIAL RELATIONSHIPS J. S. Tweddell: Consultant/Advisory Board, CorMatrix

Unless otherwise noted in this *Abstract Book* or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

3:30 PM

Postoperative and Long-Term Outcomes in Children With Trisomy 21 Following Surgery for Congenital Heart Disease: A Study From the Pediatric Cardiac Care Consortium

J. K. Peterson¹, K. Catton², L. Kochilas³, S. P. Setty¹

¹Long Beach Memorial/Miller Children's & Women's Hospital, CA, ²Memorial Care Medical Group, Long Beach, CA, ³Emory University, Sibley Heart Center Cardiology, Atlanta, GA COMMERCIAL RELATIONSHIPS L. Kochilas: Consultant/Advisory Board, Novartis

Purpose: Trisomy 21 is commonly associated with congenital heart disease (CHD), and when operated for CHD may be at risk for increased postoperative morbidity and mortality. We examined in-hospital mortality and long-term outcomes in patients with trisomy 21 following corrective, single ventricle, or palliative procedures of their CHD.

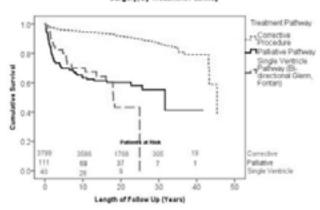
Methods: Retrospective review from the Pediatric Cardiac Care Consortium (PCCC) for patients with trisomy 21 who underwent surgical intervention for CHD from 1982 to 2007. Short-term outcomes included in-hospital mortality, need for extracorporeal life support (ECLS), and need for permanent pacemaker. Thirty-day mortality, long-term survival, and transplant status were obtained for a subgroup of patients with available direct identifiers enrolled to PCCC up to April 15, 2003 (date of stricter HIPAA rules implementation) by linkage to the National Death Index (NDI) and the United Network for Organ Sharing. Kaplan-Meier survival analysis was used to examine long-term survival for this subgroup.

Results: A total of 7,057 trisomy 21 patients (3,691 female) were identified. The most common procedures are outlined in the Table. Corrective procedures were performed in 6,694 patients with 5% (334/6,694) in-hospital mortality, palliative procedures in 251 patients with 28.7% (72/251) mortality, and single ventricle procedures in 112 patients with 34% (38/112) mortality. Forty of 7,057 patients required ECLS and 140 (2%) initial pacemaker implantation. Common causes of in-hospital mortality were cardiac (250/458, 54.6%) and multiorgan failure (99/458, 21.6%). Five patients underwent cardiac transplant; one patient underwent lung transplant. Late deaths were documented in 429 patients out of 3,950 discharged alive and submitted to the NDI (including 15 with 30-day mortality) (median follow-up 19.3 years; interquartile range [IQR] 15.3-24.3). Survival by treatment pathway is shown in the Figure. The most common causes of late mortality were cardiac

(117/414, 28.3%), infection (66/414, 15.9%), CHD (63/414, 15.2%), and pulmonary hypertension (42/414, 10.1%).

Conclusions: Long-term survival conditioned after surgery for CHD in patients with trisomy 21 approaches 92% (95% CI, 91.1%-92.9%) after corrective surgery, 61.4% (95% CI, 52.7%-71%) after palliative procedures, and 64.3% (95% CI, 48.2%-80.4%) after single ventricle procedures. Causes of long-term deaths are predominately cardiac.

Figure. Kaplan-Meier Survival Curve for Trisomy 21 Patients Following Congenital Heart Surgery, by Treatment Pathway



Table, Most Common Surgical Procedures, N = 8511

Surgical Procedures	Number (%)
Endocardial Cushion Defect Repair	3197 (37.6%)
Ventricular Septal Defect Closure	1728 (20.3%)
Tetralogy of Fallot Repair/Right Ventricular Outflow Tract Obstruction Procedure	589 (6.9%)
Mitral Valve Repair/Replacement	417 (4.9%)
Patent Ductus Arteriosus Ligation/Vascular Ring Repair	415 (4.9%)
Pacemaker Procedure	383 (4.5%)
Atrial Septal Defect Closure	369 (4.3%)
Pulmonary Artery Banding	250 (2.9%)
Tetralogy of Fallot + Atrioventricular Septal Defect Repair	220 (2.6%)
Coarctation/Interrupted Aortic Arch repair	177 (2.1%)
Bi-Directional Glenn/Fontan/Other Single Ventricle Repair	122 (1.4%)
Subaortic Stenosis Procedure	121 (1.4%)

¹ Median age at surgery 6.8 months (IQR 4-18.7 months)





Congenital: Pediatric Congenital III - Continued

3:45 pm Room 360BC

Surgical Outcomes of Heterotaxy Syndrome With Functional Single Ventricle

T. Nakano, S. Oda, K. Hinokiyama, H. Kado

Fukuoka Children's Hospital, Japan

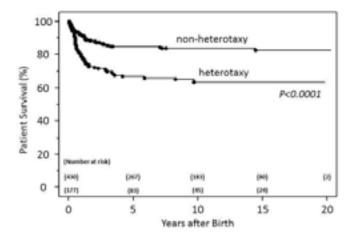
Purpose: Heterotaxy syndrome with a single ventricle is frequently associated with variety of cardiac malformations, including anomalous pulmonary/systemic venous connections, atrioventricular (AV) valve incompetency, and rhythm disturbances, which are obstacles for Fontan completion. We retrospectively reviewed our surgical outcomes in cases with this anatomy in order to recognize the intrinsic issues.

Methods: Among 607 patients with a functional single ventricle (excluding hypoplastic left heart syndrome) who underwent surgical treatment in our institution from 1995 to 2015, heterotaxy was diagnosed in 177 patients (right isomerism in 142, left isomerism in 35). Sixty-four patients (36.2%) had extracardiac total anomalous pulmonary venous connection, 66 patients (37.3%) demonstrated pulmonary atresia, and 149 patients (84.2%) had a common AV valve. The course of surgical treatment and the results, predictors of mortality, and hemodynamics after Fontan completion, were assessed. Follow-up time was 6.5 years ± 6.0 years.

Results: During the entire course of surgical treatment, 86 AV valve surgeries, 69 pulmonary arterioplasties, 74 surgeries for pulmonary vein, and five pacemaker implantations were performed as additional procedures. There were 50 mortalities before and five mortalities after the Fontan operation, and 98 patients completed and 13 post-Glenn patients await Fontan operation. Actuarial survival at 5 and 10 years was 66.8% and 63.5%, respectively, which is significantly lower than that in non-heterotaxy patients (84.7% and 83.6%, P < .0001). Multivariate analysis revealed that a predictor for mortality was AV valve surgery at the first palliative operation (HR 3.4; 95% CI, 1.39-8.68; P = .007). Post-Fontan catheterization (n=93) showed a central venous pressure of 10.4 mm Hg ± 2.5 mm Hg, ventricular end-diastolic pressure of 6.1 mm Hg ± 3.0 mm Hg, and arterial oxygen saturation of 94.6% ± 1.7%. Seventy-three patients (74.5%) demonstrated mild or less AV valve regurgitation at the last follow-up.

Conclusions: Heterotaxy syndrome with a functional single ventricle requires frequent additional procedures for associated cardiac malformations and demonstrates a higher mortality than non-heterotaxy patients. However, if patients undergo Fontan operation, satisfactory Fontan circulation can be achieved.





Actuarial survival curve by Kaplan-Meier analysis comparing heterotaxy group (n=177) and non-heterotaxy group (n=430).

Congenital: Pediatric Congenital III – Continued

4:00 PM Room 360BC

Effect of Congenital Gastrointestinal Malformations on the Outcomes of Patients With **Congenital Heart Disease**

C. M. Mery¹, L. E. De Leon², J. R. Rodriguez², R. M. Nieto¹, W. Zhang², I. Adachi², J. Heinle², L. C. Kane¹, E. D. McKenzie¹, C. D. Fraser Jr²

¹Texas Children's Hospital/Baylor College of Medicine, Houston, ²Texas Children's Hospital, Houston

Purpose: The effect of congenital gastrointestinal (GI) malformations on outcomes of patients undergoing congenital heart surgery (CHS) is unclear, but the risk has been considered prohibitive for some patients. The goal of this study was to assess the effect of associated GI malformations on the outcomes of patients undergoing CHS.

Methods: A retrospective matched cohort study was conducted. Neonates and infants with upper (esophageal atresia, tracheoesophageal fistula) and lower (duodenal stenosis/atresia, imperforate anus, Hirschprung's disease) GI malformations undergoing CHS between 1995 and 2015 were included. Two control groups were created, one for each group. Patients were matched (variable 1:2 or 1:1) based on diagnosis, procedure, history of prematurity, presence of a genetic syndrome, and a propensity score including weight and year of surgery. Data were analyzed using parametric and non-parametric tests, as appropriate, accounting for variable matching. Survival was analyzed using Kaplan-Meier methods and log-rank tests.

Results: The cohort included 383 patients: 52 (14%) with upper GI malformations, 98 (25%) upper GI controls, 80 (21%) with lower GI malformations, and 153 (40%) lower GI controls. Median follow-up was 6 years (7 days-20 years). Patients with upper GI malformations had longer length of stay (P < .001), longer intubation times (P = .006), and higher perioperative mortality (P = .015) than controls (Table). There was a tendency for worse overall survival than controls, mainly explained by the higher risk of early mortality (P = .06, Figure). There was no difference in short- or long-term outcomes between patients with lower GI malformations and controls. Forty-six patients (12%) had single ventricle (SV) physiology (nine with upper and seven with lower GI malformations). There was no appreciable difference in long-term outcomes between SV patients with GI malformations and controls (Figure). During the study period, only one patient was not offered CHS based on the presence of GI malformations (SV with tracheoesophageal fistula).

Conclusions: Patients with upper GI malformations have worse perioperative outcomes than controls, but their conditional long-term survival is not different and their perioperative mortality is likely not prohibitive. There is no significant effect of lower GI malformations on outcomes. The presence of GI malformations should not preclude patients from undergoing CHS.

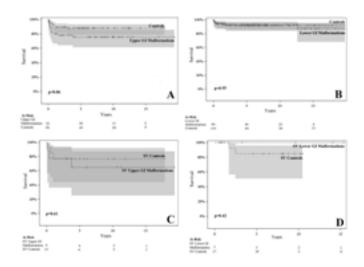


Table 1. Demographics and outcomes of patients with upper GI malformations and their controls.

	Cases	Controls	p-value
opper GI malformations	n=52	n=98	
Gender (f), n (%)	28 (54)	53(54)	1.0
Age at surgery (d), median (range)	36 (1-323)	41(1-334)	0.7
Weight (kg), mean ± SD	3.8 ± 1.7	3.8 ± 1.4	0.3
Hospital LOS* (d), median (range)	41 (4-188)	13 (3 – 131)	<0.001
ICU LOS* (d), median (range)	9 (1 - 41)	6 (1-117)	0.006
Intubation* (d), median (range)	5 (0 - 179)	3 (0-15)	~9,001
Perioperative mortality, n(%)	7 (13)	3 (7)	0.015
ower GI malformations	n=80	n=153	
Gender (f), n(%)	38 (48)	81 (53)	0.5
Age at surgery (d), median (range)	125 (2 - 345)	100 (0 - 333)	0.34
Weight (kg), mean # SD	4.5 ± 1.7	4.5 ± 1.6	0.88
Hospital LOS* (d), median (range)	13 (3 – 88)	10 (3 - 149)	0.35
ICU LOS* (d), median (range)	6 (1 - 88)	4 (1 - 142)	9.24
Intubation* (d), median (range)	2 (0 - 36)	2 (0 - 52)	9.56
Perioperative mortality, n (%)	2(3)	8 (5)	0.33

^{*} Postoperative. d: days, f: female, ICU: intensive care unit, LOS: length of stay.



Congenital: Pediatric Congenital III - Continued

4:15 PM Room 360BC

Impact of Chromosomal Abnormalities on Outcomes After Congenital Heart Surgery Speaker TBD

4:30 PM

Current Surgical Outcomes of Congenital Heart Surgery for Patients With Down Syndrome: An Analysis of the Japan Congenital Cardiovascular Surgery Database

T. Hoashi¹, N. Hirahara², Y. Hirata³, A. Murakami⁴, H. Ichikawa¹, S. Takamoto⁵

¹National Cerebral and Cardiovascular Center, Suita, Japan, ²Keio University, Tokyo, Japan, ³The University of Tokyo, Japan, ⁴Gunma Children's Medical Center, Shibukawa, Japan, ⁵Mitsui Memorial Hospital, Tokyo, Japan

Purpose: A clinical trial of noninvasive prenatal testing for chromosome abnormalities, including Down syndrome, is now ongoing in Japan. Therefore, the purpose of this study is to review the current surgical outcomes of congenital heart surgery for patients with Down syndrome using the Japan Congenital Cardiovascular Surgery Database (JCCVSD).

Methods: Between 2008 and 2012, 2,651 of 29,087 registered operations were carried out for patients with Down syndrome (9%). Of those, five major biventricular repair procedures (ventricular septal defect [VSD] repair, atrioventricular septal defect [AVSD] repair, patent ductus arteriosus [PDA] closure, atrial septal defect [ASD] repair, and tetralogy of Fallot [TOF] repair), as well as two major single ventricular palliations (bidirectional Glenn [BDG] and Fontan operation) were picked up, and the outcomes were compared between patients with and without Down syndrome. Ninety-day and in-hospital mortality was the endpoint of this study.

Results: For 2,651 patients with Down syndrome, 90-day and in-hospital mortality rate was 2.8%. Ninety-day and in-hospital mortality rates after all five major biventricular repair procedures were similarly low in patients with Down syndrome as compared to patients without Down syndrome; nevertheless, preoperative pulmonary vascular resistance (PVR) in patients with Down syndrome was significantly higher than that in patients without Down syndrome, except for patients who underwent TOF repair (Table). On the other hand, 90-day and in-hospital mortality rate after Fontan operation in patients with Down syndrome was significantly higher than that in patients without Down syndrome (12.0% vs 2.7%, P = .005); nevertheless, all patients with Down syndrome showed preoperative PVR of less than 4 WU/m² (Table). Therapeutic or prophylactic home oxygen therapy was more frequently required in patients with Down syndrome than without Down syndrome at discharge after all picked up procedures, except for BDG.

Conclusions: Favorable prognostic outcomes after five major biventricular repair procedures in patients with Down syndrome were observed from analysis of the JCCVSD. Indication of Fontan operation for patients with Down syndrome should be carefully decided, even if preoperative PVR was calculated to be low enough to move forward.

Procedure	Patient number (n)	Preop. catheter [n(%)]	PVKH WU112 [8(%)]	90 day and in-hospital mortality [n(%)]
PDA closure	1646	208(12.6)		
No Down Syndron	or 1462	150(10.3)	17(11.3)	42(2.9)
Down Syndrome	184	58(31.5) *	21(36.2) *	5(2.7)
ASD repair	2712	1842(67.9)		
No Down Syndron		1699(66.8)	30(1.8)	1(0.04)
Down Syndrome	167	149(35.6)*	33(23.1) *	1(0.6)*
VSD repair	5446	3925(72.1)		
No Down Syndron	e 4694	3343(71.2)	3289.0	10(0.2)
Down Syndrome	752	582(77.4) *	181(31.1) *	4(3.5)
AVXD-repair	786	693(88.2)		
No Down Syndron	se 334	299(97.7)	24(8.2)	10(3.0)
Down Syndrome	452	400(88.5)	113(28.3) *	10(2.2)
TOF repair	1181	1104(93.5)		
No Down Syndron	e 1073	1003(99.5)	32(3.2)	12(1.1)
Down Syndrome	106	101(93.5)	7(7.0)	4(3.5)
EDG	1351	1285(95.1)		
No Down Syndron	ne 1330	1267(95.3)	30(2.4)	40(3.0)
Down Syndrome	21	18(85.7)	1(5.6)	1(4.8)
Fostan	1583	1550(97.9)		
No Down Syndron	M 1558	1528(98.1)	23(1.5)	(2(2.7)
Down Syndrome	25	22(98.0) *	0(8.0)	3(12.0) *

PVR= pulmonary vascular resistance, *. No Down Syndrome vs Down Syndrome, p<0.05.

Congenital: Pediatric Congenital III - Continued

4:45 PM Room 360BC

Can Pulsatility Be Eliminated Without a Careful Consideration During Bidirectional Glenn?

C. Park¹, J. Park², T. Yun², J. Baek², J. Yu², Y. Kim², J. Ko²

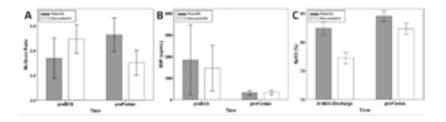
¹Cincinnati Children's Hospital Medical Center, OH, ²Asan Medical Center, Seoul, South Korea

Purpose: Maintaining pulsatility at the time of bidirectional Glenn (BDG) has theoretical advantages and disadvantages. The practice is diverse throughout centers and individual surgeons without clear rationale behind its application. We sought to investigate the impact of pulsatility in pulmonary blood flow on the outcomes before Fontan operation (FO).

Methods: From 2003 through June 2014, among 237 patients who underwent BDG as an interim palliation for functional single ventricle (FSV), patients with preexisting pulmonary blood flow from the ventricle before BDG were included, and patients undergoing Kawashima operation or having history of Norwood operation or bilateral pulmonary arterial band were excluded (n=152). Patients were grouped by presence or absence of pulsatility in pulmonary blood flow following BDG: Group 1 (pulsatile) (n=74) or Group 2 (non-pulsatile) (n=78). The outcomes were compared until FO between the two groups.

Results: Age and weight at BDG were 7 months (P = .218) and 7.8 kg (P = .517). Five early deaths (P = .675) and seven interstage deaths (P = .107) occurred. McGoon ratio before BDG was lower in Group 1 (2.3 ± 0.7) compared to Group 2 (2.5 ± 0.5) (P = .014); however, it was reversed before FO (Group 1: 2.5 ± 0.5 vs Group 2: 2.3 ± 0.4 ; P = .015), Figure. Oxygen saturation was higher in Group 1 ($82\% \pm 4\%$) compared to Group 2 ($77\% \pm 4\%$) (P < .001) at discharge of BDG and remained higher in Group 1 ($85\% \pm 4\%$) compared to Group 2 ($82\% \pm 4\%$) before FO (P = .001), Figure. The level of brain natriuretic peptide (BNP) before FO was similar between groups (P = .750), Figure. Mean pulmonary arterial pressure on catheterization prior to FO was 11 mm Hg ± 4 mm Hg in Group 1 and 10 mm Hg ± 3 mm Hg in Group 2 (P = .163). Five pulmonary arteriovenous malformations (AVM) were documented, all in Group 2 (P = .059). Supplemental oxygen or pulmonary vasodilator seemed to be required more frequently in Group 2 (P = .063).

Conclusions: At the time of BDG in FSV, maintaining pulsatility is beneficial for pulmonary arterial growth and oxygen saturation without increasing BNP. It also appears to prevent the development of AVM or reduce the need for supplemental oxygen and pulmonary vasodilator. The above findings should be fully considered before eliminating pulsatility.



5:00 PM

Hypoplastic Left Heart Syndrome Is Not a Predictor of Outcomes Following the Fontan Operation: A Cohort Study

B. Martin¹, M. M. Alaklabi², I. M. Rebeyka³, D. B. Ross³

¹University of Alberta, Edmonton, Canada, ²Stollery Children's Hospital, University of Alberta Hospital, Edmonton, Canada, ³University of Alberta Hospital, Edmonton, Canada

Purpose: The anatomy of children with single ventricle physiology has changed since the advent of the Fontan operation, with a greater proportion of those living with single ventricle having hypoplastic left heart syndrome (HLHS). Our objective was to determine if there is an association between HLHS and outcomes post-Fontan operation.

Methods: All pediatric patients from across Western Canada who underwent a Fontan procedure at the University of Alberta Stollery Children's Hospital between 1996 and 2014 were included. Follow-up clinical data were obtained from the Western Canadian Children's Heart Network Database. Outcomes of interest included postoperative length of stay (LOS), early mortality, and long-term transplant-free survival. Baseline characteristics were compared between those with and without HLHS, and the association between postoperative outcomes and HLHS was assessed using Kaplan-Meier survival analysis and Cox proportional hazards models.

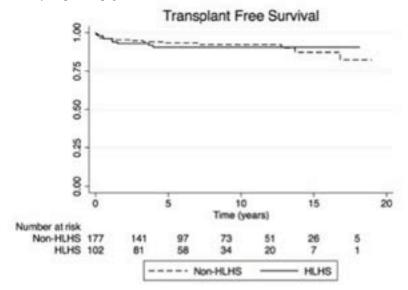
Results: A total of 279 children (median age 3.3 years [interquartile range, IQR, 2.8-3.9]; 121 [43.4%] female) underwent a Fontan procedure over the course of the study. Original cardiac anatomy was hypoplastic left heart syndrome (HLHS) in 102 (36.6%) subjects, double inlet left ventricle in 43 (15.4%), tricuspid atresia in 32 (11.5%), and other in 102. Median follow-up was 6.6 years (IQR 3.6-12.1). There was a total of 16 deaths (two early) and 11 transplants over the course of follow-up. Five-year transplant-free survival was 92.3% overall, 90.6% in those with HLHS vs 93.3% in those without (P > .05). There was no difference in survival by HLHS (Figure; log-rank P = .73). In multivariable analysis, HLHS was not predictive of either LOS (median LOS in HLHS 11 days [IQR 8-17], in non-HLHS 10 days [IQR 7-16]) or transplant-free survival (HR 1.15, 95% CI, 0.50-2.65).

Conclusions: Despite their challenging anatomy, subjects with HLHS who survive to the Fontan do no worse with the operation than those with other anatomy. It is possible than any attendant risk associated with HLHS is no longer an issue by the time these subjects are ready for their third-stage palliation.





Congenital: Pediatric Congenital III - Continued Continued from previous page



5:15 PM Room 360BC

Improving Clinical Outcomes of Right Atrial Isomerism Associated With Extracardiac Total Anomalous Pulmonary Venous Connection

T. Kakuta, T. Hoashi, K. Kagisaki, M. Shimada, H. Ichikawa

National Cerebral and Cardiovascular Center, Suita, Japan

Purpose: Treatment for patients with right atrial isomerism (RAI) associated with extracardiac total anomalous pulmonary venous connection (TAPVC) is still challenging. The aim of this study was to confirm whether our current treatment strategy initiated from 2007 improved clinical outcomes or not.

Methods: Our current treatment strategy consists of 1) catheter-based stent implantation for obstructed pulmonary venous drainage pathway at birth, 2) palliative right ventricle to pulmonary artery conduit for pulmonary atresia, instead of systemic to pulmonary shunt, 3) sutureless repair for post-surgical pulmonary venous stenosis, 4) aggressive surgical intervention for mild to moderate systemic atrioventricular valve regurgitation (SAVVR), 5) prophylactic perioperative gamma-globulin administration, and 6) routine Palivizumab and Prevenar vaccination. Fifty-nine consecutive patients with RAI and extracardiac TAPVC were divided into two groups by surgical era (Early group [1989-2006]: n=43, late group [2007-2016]: n=16), and the outcomes were retrospectively compared.

Results: The mean follow-up period was 4.2 years \pm 6.0 years (range 0.02-20.2 years). More than mild SAVVR coexisted at birth in 27.9% of patients in the early group and 18.7% in the late group (P = .73). Obstruction on pulmonary venous drainage pathway coexisted at birth in 62.7% of patients in the early group and 75.0% in the late group (P = .53). Seven out of 16 patients among the late group underwent catheter-based stent implantation at birth, then surgical TAPVC repair was performed mainly concomitantly with bidirectional Glenn. The actuarial survival rates at 1, 5, and 10 years were 55.8%, 25.6%, and 23.3% in the early group and 81.2%, 54.2%, and 36.1% in the late group (P = .13). In the early group, only 27.9% of patients completed the Fontan operation, whereas 37.5% of patients underwent Fontan with 18.8% waiting in a good hemodynamic condition in the late group (P = .04).

Conclusions: Although the outcomes require further improvement, the current treatment strategy tends to improve life prognoses of patients with RAI associated with extracardiac TAPVC. Changes of surgical strategy for SAVVR and obstructed pulmonary venous drainage pathway helped to increase the probability of Fontan completion.

3:30 PM - 5:30 PM Room 351DEF

ESTS @ STS: Controversial Issues in General Thoracic Surgery—Perspectives From Europe and North America

This collaborative session by STS and the European Society of Thoracic Surgeons will provide European and North American perspectives on a variety of controversial issues in general thoracic surgery. Experts will discuss the adjuvant treatment for thymic malignancies, donors for lung transplantation, the role of lung volume reduction surgery for emphysema, and the surgical management of spontaneous esophageal perforations.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the adjuvant treatment for resected thymic malignancies
- Identify potential donors after cardiac death for lung transplantation
- · Discuss the role of lung volume reduction surgery for emphysema in the modern era
- · Describe the management of spontaneous esophageal perforations

Moderators: Janet P. Edwards, Calgary, Canada, and Jaroslaw Kuzdzal, Krakow, Poland Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in this session are patient care and procedural skills, medical knowledge, and practice-based learning and improvement. These physician competencies will be addressed through a series of collaborative lectures by members of The Society of Thoracic Surgeons and the European Society of Thoracic Surgeons.

3:30 PM	Introduction
3:35 рм	Adjuvant Treatment After Completely Resected Thymic Malignancies: European Perspective Enrico Ruffini, Turin, Italy
3:45 рм	Adjuvant Treatment After Completely Resected Thymic Malignancies: North American Perspective Frank C. Detterbeck, New Haven, CT COMMERCIAL RELATIONSHIPS F. C. Detterbeck: Research Grant, Medela; Other/Data Safety Monitoring Board, Olympus
3:55 РМ	Panel Discussion
4:05 PM	Donors After Circulatory Death for Lung Transplantation: European
	Perspective Dirk E. Van Raemdonck, Leuven, Belgium
4:15 рм	•



Lung Volume Reduction for Emphysema in 2017: European 4:35 PM

Perspective

David Waller, Leicester, United Kingdom

COMMERCIAL RELATIONSHIPS D. Waller: Speakers Bureau/Honoraria, PulmonX

Lung Volume Reduction for Emphysema in 2017: North American 4:45 PM

Perspective

Malcolm M. DeCamp, Chicago, IL

COMMERCIAL RELATIONSHIPS M. M. DeCamp: Consultant/Advisory Board, Holaira, PulmonX,

Soffio Medical

Panel Discussion 4:55 PM

5:05 PM Surgical Management of Spontaneous Esophageal Perforations:

European Perspective

Hasan F. Batirel, Istanbul, Turkey

COMMERCIAL RELATIONSHIPS H. F. Batirel: Other Research Support, Ethicon; Speakers Bureau/

Honoraria, Ethicon; Consultant/Advisory Board, Ethicon

Surgical Management of Spontaneous Esophageal Perforations: North 5:15 PM

American Perspective

M. Blair Marshall, Washington, DC

COMMERCIAL RELATIONSHIPS M. B. Marshall: Consultant/Advisory Board, Clinical Key, Ethicon,

Thoracic Clinics

5:25 PM Panel Discussion

3:30 PM - 5:30 PM Room 361A

General Thoracic: Mediastinal/Pulmonary

Moderators: Elizabeth A. David, Sacramento, CA, and Joseph B. Shrager, Stanford, CA

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

Presenting authors are listed in **bold**.

The physician competencies addressed in this session are patient care and procedural skills and medical knowledge. These physician competencies will be addressed through a series of individual lectures and a brief question-and-answer session after each topic.

3:30 PM

Predictive Factors of Postoperative Disease Control in Thymomatous Myasthenia Gravis

K. Hyun¹, S. Park¹, Y. Hwang¹, H. Lee¹, I. Park¹, Y. Kim¹, S. Park², D. Kim², Y. Kim², H. Kim², S. Choi², Y. Shim³, J. Zo³, J. Kim³, Y. Choi³, H. Kim³, J. Cho³, K. Chung⁴, H. Paik⁴, D. Kim⁴, J. Lee⁴, C. Lee⁴, C. Kang¹

¹Seoul National University Hospital, South Korea, ²Asan Medical Center, Seoul, South Korea, ³Samsung Medical Center, Seoul, South Korea, ⁴Yonsei University College of Medicine, Seoul, South Korea

Purpose: The optimal surgical treatment for myasthenia gravis (MG) with thymoma remains controversial, and the expected postoperative course as part of postoperative disease control (PODC) needs to be elucidated. This study aimed to clarify surgical outcome and the risk factors of PODC and remission.

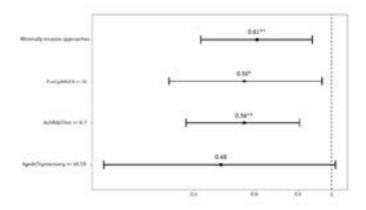
Methods: Multicenter clinical data of 263 thymoma patients with MG who underwent total thymectomy from 2003 to 2013 were retrospectively reviewed. Therefore, 207 patients (97/110, male/female; median age, 47 years) were followed up for a minimum of 12 months to apply the Myasthenia Gravis Foundation of America (MGFA) Clinical Classification. Total thymectomy by open sternotomy or minimally invasive operation were performed according to the preference of surgeon or institute. PODC was defined as a sum of stable complete remissions, pharmacologic remissions, and minimal manifestations. Patients who were asymptomatic with low-dose single immunotherapy or without medication for more than 12 months were classified as being in general complete remission (GCR).

Results: The preoperative MGFA stage was I/II/III/IV/V in 67/123/27/3/6 patients, respectively. Kaplan-Meier analysis revealed PODC rate of 54% at 24 months and 64% at 48 months and GCR rate of 26% at 24 months and 41.5% at 48 months. Median follow-up period was 60.8 months. Univariate Cox proportional hazards analysis for PODC revealed a negative correlation with preoperative MGFA III or more (P = .018), anti-acetylcholine receptor antibody (AchR-Ab) titer 6.7 or more (P = .003), age at thymectomy 64.6 years or more (P = .049), age at onset 57.4 years or more (P = .048), duration of MG 2.27 months or less (P = .045), and minimally invasive operation (P = .004). Masaoka-Koga stage or completeness of resection were not associated with PODC. Multivariate Cox regression showed AchR-Ab titer 6.7 or more (HR 0.56; 95% CI, 0.38-0.82; P = .002) and minimally invasive operation (HR 0.63; 95% CI, 0.43-092; P = .018) independently predicted PODC. No prognostic factors for GCR were identified.



Conclusions: The result of the review indicates that open total thymectomy for patients with MG thymoma achieved superior postoperative MG control rate compared to minimally invasive techniques. Lesser preoperative MGFA stage and low AchR-Ab titer were also important prognostic factors for postoperative control of MG in patients with thymoma.

Hazard Ratios Plot for Final Cox Model



Cox model for significant variables (Backward Elimination) 1134 Lawer 41 Diger Ch Postphilit A --ADDITION TO A T n Air 0.00 LANGE 0.190 MATE. Applification of \$1.77 8.476 1,630 -1.876 8.231 4.000

General Thoracic: Mediastinal/Pulmonary – Continued

3:45 PM Room 361A

Utility of Soluble Mesothelin-Related Peptides for Prediction of Recurrence Following **Resection of Malignant Pleural Mesothelioma**

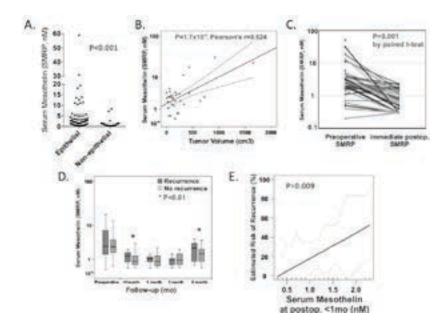
B. Burt, H. Lee, V. Lenge De Rosen, O. Wald, E. Biaghoshi, S. Groth, D. Sugarbaker Baylor College of Medicine, Houston, TX

Purpose: Surgical resection in the context of multimodal therapy can extend survival in malignant pleural mesothelioma (MPM); however, the majority of these patients will suffer local recurrence. We hypothesized that the serum biomarker soluble mesothelin-related peptides (SMRP) could predict recurrence in patients with surgically resected MPM.

Methods: Single-institution retrospective review of 86 patients undergoing curative intent surgical resection for MPM (49 pleurectomy with decortication, 16 extrapleural pneumonectomy, 21 exploratory thoracotomy) for whom SMRP data were available. SMRP was detected by the ELISA assay. Preoperative 3D tumor volume was calculated from chest computed tomography or magnetic resonance imaging by a thoracic radiologist. Gene microarray analyses were performed on tumors of 10 patients. Analyses of SMRP and recurrence were conducted in 55 patients with epithelial histology undergoing complete macroscopic resection. Descriptive statistics, Mann-Whitney U tests, linear correlations, and multivariable Cox regressions were performed.

Results: Preoperative values of SMRP were highest in patients with epithelial histology (5.0 nM ± 8.5 nM [SD]) and minimal in patients with non-epithelial histology (1.7 nM ± 2.3 nM, Figure A). Among patients with epithelial histology, SMRP levels correlated significantly with preoperative 3D tumor volume (Figure B) and decreased dramatically immediately following surgical resection (Figure C). Tissue mRNA expression of mesothelin correlated significantly with preoperative levels of SMRP (P = .03, Pearson's r=0.7). Seventeen patients (31%) had a local recurrence during the follow-up period (median followup 11 months). Following complete macroscopic resection of epithelial MPM, the risk of recurrence increased with increasing SMRP at the first postoperative visit (<1 month postop) (Figures D-E). Cox regression analyses adjusted for variables associated with recurrence in univariable analyses (perioperative chemotherapy, intraoperative heated chemotherapy, pathologic nodal status) demonstrated that SMRP at <1 month following surgery was independently associated with recurrence (HR 3.46; 95% CI, 1.01-11.8; P = .009).

Conclusions: SMRP is a serum biomarker of tumor burden in epithelial MPM, which can be used as a clinical test in the postoperative setting to identify patients who are at highest risk for recurrence. Prospective studies will be performed to validate these findings.



General Thoracic: Mediastinal/Pulmonary - Continued

4:00 PM Room 361A

Robotic Thymectomy Is Feasible for Large Thymomas: A Propensity-Matched Comparison

P. Kneuertz¹, M. K. Kamel¹, B. M. Stiles², G. R. Ghaly³, A. Nasar¹, N. K. Altorki¹, J. Port³

¹New York-Presbyterian Hospital, Weill Cornell Medical College, New York, NY, ²Weill Cornell Medicine, New York, NY, ³Weill Cornell Medical College, New York, NY

Purpose: While robotic-assisted thymectomy (RAT) has been utilized for non-thymomatous myasthenia gravis and small thymomas, its application for large thymomas remains controversial. Recently, we have performed extended RAT for larger tumors. In this study, we evaluate the safety and feasibility of RAT for large thymomas in comparison to transsternal thymectomy (ST).

Methods: A prospectively collected single institution database was reviewed for patients who underwent RAT for thymoma >4 cm between 2011 and 2016. Propensity score matching was used to match RAT patients with a balanced group of ST patients, based on age, gender, tumor size, and Masaoka stage. Clinical, perioperative, and pathological outcomes were compared. Significance level was set at *P* < .1.

Results: Eighteen patients (13 females and five males, median age 59 years) underwent RAT for large thymoma (median size 6.2 cm). Right-sided approach was used in 12 patients (67%). A control group of 34 ST patients (median size 6.7 cm) had similar Masaoka staging (Table). Extended resection of adjacent structures, including pericardium, lung, and phrenic nerve, were frequently performed in both groups (56% RAT vs 47% ST, P = .56, Table). Compared with ST, RAT patients had lower intraoperative blood loss, longer operative time, and were more frequently extubated in the OR (Table). There were no perioperative mortalities and no major vascular injuries. One RAT was converted to sternotomy. Overall complication rate was similar between RAT and ST patients (17% vs 24%; P = .73). RAT was associated with a trend toward shorter length of stay (3 days [2-6] vs 4 days [3-6], P = .07). No difference was seen in R0 resection rate (89% vs 85%, P = .72).

Conclusions: Robotic-assisted thymectomy can be performed safely and effectively in a radical fashion for large thymomas. Future studies are necessary to determine long-term oncologic outcomes.

	Enbetic ornisted Thymschony No.03	Sternotony Thymestony No.34	P-value
Age (years), median (XQR)	59 (86 - 64)	40 (47 - 73)	P=6.37
Conder Femile Male	13 (72%) 5 (28%)	20 (59%) 14 (47%)	2-431
Tumor Nee (co), suches (IQR)	62 (4.7 - 7.7)	6.7 (3.5 - 7.6)	P-8.28
Resertion Adjacent Structure (Acy)	10 (50%)	16 (47%)	P-6.56
Percential Lesection	6-07%	11 (12%)	P-131
Long Reservoir	5(28%)	10(h)	P-876
Plantic New Resetton	3 (17%)	701%	P=9.39
Vascular Resection		1000	P-634
Operative Time (min), median (IQE)	119 (89 - 155)	99 (75 - 124)	P-4.09
Estimated Blood Less [ml], marker (108)	40 (7.5 - 100)	159 (75 - 271)	P-4.092
Extelorism in Operating Room	18 (100%)	20 (65%)	9-439
Length of Step (days), median (IQR)	3(2-4)	4(3-6)	P-4.07
Manaska Stage Path II Path III / IV	5 (20%) 7 (30%) 6 (30%)	11 02% 11 02% 12 02%	P-4.89
R0 Errortion	16 (89%)	29 (83%)	P-6.72

4:15 PM

Multidisciplinary Approach to Catamenial and Endometriosis-Related Pneumothorax

P. Ciriaco, P. Muriana, A. Bandiera, A. Carretta, G. Negri, M. Candiani, P. Zannini San Raffaele Scientific Institute, Vita-Salute San Raffaele University, Milan, Italy

Purpose: Catamenial pneumothorax (CP) is the most clinical presentation of the thoracic endometriosis syndrome (TES). Its treatment requires a combined effort of thoracic surgeons and gynecologists. We have analyzed our experience with catamenial and endometriosis-related pneumothorax in terms of diagnosis, treatment, and outcome.

Methods: From 2001 to 2016, 23 women were surgically treated for CP at our department. Preoperative evaluation was carried out in cooperation with the gynecologists. Surgical treatment consisted of video thoracoscopy in all patients combined with laparoscopy in the case of diagnosed and/or suspected pelvic endometriosis. Staged videothoracoscopy and laparoscopy were carried out when abdominal endometriosis was diagnosed after thoracic operation. Lung bullectomy was performed when required. Endometrial implants were resected when present and diaphragm was repaired in case of fenestrations. Talc pleurodesis was given when diaphragmatic defects were detected. Postoperative hormonal treatment was offered to all patients.

Results: TES was diagnosed in nine patients (39%). Six of them underwent simultaneous videothoracoscopy and laparoscopy; three patients received staged laparoscopy. Diaphragmatic defects were observed in 17 patients with seven of them presenting endometrial implants. One patient presented endometrial tissue in the resected bulla. Apical bulla or blebs alone were detected in six patients. Postoperative complications consisted of one prolonged air leak (4.3%). After surgery, three patients were put on estrogen-progesterone complex treatment and 20 received gonadotropin-releasing hormone agonist. Pneumothorax recurrence occurred in five patients (21%) and was significantly correlated with estrogen-progesterone treatment (P<.005). The mean follow-up was 84 months \pm 51 months (range 1-178 months). One patient with TES underwent new surgery for intestinal occlusion due to localization of endometriosis after 1 year, and two patients required surgery for umbilical endometriosis after 2 and 7 years, respectively. At the present time, all women are well with no sign of pneumothorax recurrence.

Conclusions: All women with CP should be investigated for endometriosis if not already diagnosed. Thoracic and abdominal surgery, along with hormonal treatment, helps for resolution of TES. A close collaboration between thoracic surgeons and gynecologists is therefore advocated.

General Thoracic: Mediastinal/Pulmonary - Continued

4:30 PM Room 361A

Accuracy of Intraoperative Lymph Node Sampling for Predicting Final N Stage in Patients Undergoing Cytoreduction for Malignant Pleural Mesothelioma

D. C. Rice, S. Atay, R. J. Mehran, A. A. Vaporciyan, B. Sepesi

The University of Texas MD Anderson Cancer Center, Houston

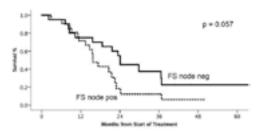
COMMERCIAL RELATIONSHIPS D. C. Rice: Speakers Bureau/Honoraria, Pacira Pharmaceuticals; Speakers Bureau/Honoraria, Intuitive Surgical

Purpose: Extrapleural pneumonectomy (EPP) for cytoreduction of malignant pleural mesothelioma (MPM) is controversial, and patients with nodal metastases rarely derive benefit. Unfortunately, the ability to predict nodal metastases prior to surgery is poor. We hypothesized that intraoperative nodal sampling using immediate frozen section (FS) could help guide which patients should not have EPP.

Methods: We performed a retrospective review of 102 consecutive patients undergoing attempted cytoreductive surgery from 2009 to 2014. Of these, 41 had intraoperative FS analysis of intrathoracic nodes following initial extrapleural mobilization of tumor. We analyzed the distribution of node sampling and accuracy of intraoperative assessment in predicting final pathologic N-stage. We also investigated how knowledge of nodal status contributed to choice of cytoreductive procedure. Finally, we compared survival (from date of first treatment) of patients according to FS node status using the Kaplan-Meier method.

Results: Mean age was 63 years (range 47-75 years). Ten patients (24.4%) were female and 36 (87.8%) received induction chemotherapy. Nine tumors (22.0%) were non-epithelioid on final pathologic review and 34 (82.9%) were p-stage III/IV. 131 nodal stations were analyzed by FS (median three per patient), of which 37% harbored metastases in 21 patients (51.2%). Sixteen patients underwent EPP, of whom them had positive nodes on FS (two had disease extent precluding pleurectomy/decortication [PD], one had a single node involved by direct tumor extension). Twenty patients underwent PD, of whom 13 had FS positive nodes. Three false negatives occurred, all in patients with EPP. Sensitivity and negative predictive value of FS sampling for predicting nodal metastases was 88% and 93%, respectively. Knowledge of FS node status contributed to the surgical plan in 34 cases (83%). A trend existed toward improved survival in patients who had FS-negative nodes (median 24 months vs 15 months, P = .057).

Conclusions: Despite careful preoperative assessment, over half of patients undergoing cytoreductive surgery for MPM have nodal metastases. Intraoperative FS analysis of intrathoracic nodes at the time of cytoreduction accurately identified node-positive patients, influenced choice of cytoreductive procedure, and should be considered if patients are planned to undergo EPP.



4:45 PM

Radical Thymectomy vs Conservative Thymomectomy in the Surgical Treatment of Thymic Malignancies

E. Voulaz¹, P. Novellis¹, G. Veronesi², M. V. Infante³, E. Bottoni¹, P. Zucali¹, E. Passera⁴, M. Alloisio¹

¹Humanitas Research Hospital, Milan, Italy, ²Istituto Clinico Humanitas, Milan, Italy, ³Borgo Trento University Hospital, Verona, Italy, ⁴Humanitas Gavazzeni, Bergamo, Italy

Purpose: To compare oncological outcomes in patients treated for thymic malignancies either by radical thymectomy or by thymus-sparing thymomectomy using minimally invasive or open approaches.

Methods: Patients with primary thymoma or thymic carcinoma operated on from 1997 to 2013 at two Italian centers (members of the same health care organization) were reviewed retrospectively. Patients with associated malignancies were excluded. The World Health Organization histological classification and Masaoka staging system were used. Data collected were: age, sex, comorbidities, presence of myasthenia gravis (MG), thymectomy or thymomectomy, extent of resection, minimally invasive (video-assisted thoracoscopic surgery) or open, postoperative complications, complementary chemotherapy/radiotherapy, recurrence, and vital status. The Kaplan-Meier method was used to construct survival curves. Betweengroup survival was compared by Cox regression analysis. Thymectomy was given usually to MG patients.

Results: A total of 161 cases were operated. Thymomectomy was given to 88 (55%) and thymectomy to 73 (45%). The groups were comparable for prognostic factors and comorbidities. In the thymomectomy and thymectomy groups, respectively: 26.4% and 25.7% (P = ns) were stage 3-4; mean Charlson index was 1.75 ± 1.60 and 1.48 ± 1.46 (P = ns); 32.2% and 38.6% (P = ns) received extended surgery; 11.5% and 10% (P = ns) received neoadjuvant chemotherapy; and 88.6% and 89% (P = ns) had free margins. As expected, MG was significantly more frequent in thymectomy than thymomectomy cases (21/6, P < 0001). Five- and 10-year survival in the thymomectomy group were 86.0% and 77.5%, respectively, and 90.4% and 83.4% in the thymectomy group (P = ns); 17.1% of thymomectomy and 13.7% of thymectomy patients recurred (P = ns). By multivariate analysis, advanced stage, B3 thymoma, and thymic carcinoma were significant predictors of recurrence; extent of surgery and approach (minimally invasive vs open) were not.

Conclusions: In our experience, radical thymectomy and conservative thymomectomy did not differ in terms of disease-free and overall survival. In non-MG patients with resectable thymic malignancy, minimally invasive thymomectomy provided equivalent oncological results to open thymectomy.

TUESDAY, JANUARY 24

General Thoracic: Mediastinal/Pulmonary – Continued

5:00 PM Room 361A

Revision of Failed Prior Nuss in Adult Pectus Excavatum Patients

A. Ashfaq1, M. Ewais1, J. Lackey1, D. E. Jaroszewski2

¹Mayo Clinic, Phoenix, AZ, ²Mayo Clinic, Scottsdale, AZ

COMMERCIAL RELATIONSHIPS D. E. Jaroszewski: Consultant/Advisory Board, Zimmer Biomet

Purpose: In adult pectus excavatum (PE) patients, recurrence after the Nuss procedure or minimally invasive repair of PE (MIRPE) can be related to technical issues, including bar rotation, migration, and failure to lift. The optimal reoperative approach has not been identified for adults. We review our experience with revision of failed adult MIRPE patients.

Methods: A retrospective review was conducted of all adult patients (age ≥18 years) who underwent revision after failed PE repair from December 2010 to April 2016. A cohort of patients with prior failed MIRPE was reviewed and analyzed for this manuscript.

Results: In total, 118 patients underwent PE revision with 42 (35.6%) reviewed after prior failed MIRPE. The most common complaint was inadequate correction (93%) with mean Haller Index 4.5 ± 1.6. All prior procedures were performed at outside institutions at a mean of 3.3 years ± 2.9 years ago (two patients had >1 previous MIRPE). In-dwelling pectus support bars required removal and replacement at the time of revision in 27 patients (64%). Lysis of significant intrathoracic adhesions was performed in 74% of patients. A modified MIRPE successfully corrected 79% of patients; however, in 21%, costosternal and/or sternal osteotomy cuts were necessary in addition to pectus bar placement to adequately repair (hybrid repair). Multiple (two bars, 60%; three bars, 40%) shorter bars were utilized (mean 13" placed vs 15" removed); mean operative time was 205 minutes ± 84 minutes.

Conclusions: Use of a modified minimally invasive pectus excavatum repair can be successfully utilized for revision of the majority of adults with prior failed Nuss.



5:15 PM

The Influence of External Suction on Fluid Output in Chest Drains After Lobectomy – A Randomized Controlled Trial

M. Lijkendijk, K. Neckelmann, P. Licht

Odense University Hospital, Denmark

COMMERCIAL RELATIONSHIPS P. Licht: Speakers Bureau/Honoraria, Ethicon

Purpose: Even when air leakage has ceased completely after lobectomy, some chest drains are not removed because of high fluid output. Accepted levels for removal also vary, typically between 200-500 mL/day. There is no knowledge if fluid output is influenced by the extent of external suction applied to chest drains.

Methods: We included 106 stage I non–small-cell lung cancer (NSCLC) patients who underwent lobectomy by video-assisted thoracoscopic surgery (VATS) or thoracotomy (surgeon's preference). Only one chest drain was permitted. Upon completion of the lobectomy, patients were randomly assigned (closed envelope 1:1) to either low (–5 cm $\rm H_2O$) or high (–20 cm H2O) external suction on a digital chest drainage system. Removal of the chest drain was delegated to staff nurses following a strict algorithm: air leakage <20 mL/hour for 6 consecutive hours during daytime or evenings, regardless of fluid output, provided that fluid was serous. The primary endpoint was fluid output during the first 48 hours.

Results: Low suction was applied in 53 patients (VATS/thoracotomy 34/19) and high suction in the remaining 53 (VATS/thoracotomy 25/28). There was a significant difference in fluid output after 24 hours (low suction 338 mL vs high suction 523 mL, P < .001) and after 48 hours (low suction 616 mL vs high suction 1,067 mL, P = .001). Multivariate regression of suction and surgical approach revealed that suction was the only significant predictor of fluid output during the first 24 hours (P = .001), but after 48 hours, both suction and surgical approach were significant predictors of total fluid output, which was lowest with low suction (P < .001) and VATS (P = .002). Six chest drains were removed on the same day of surgery, but one required reinsertion due to pneumothorax.

Conclusions: After lobectomy for stage I NSCLC, the fluid output in chest drains depends on the level of external suction and the surgical approach. Higher levels of suction and thoracotomy increase fluid output and may therefore prolong chest drain duration if algorithms for chest drain removal include the fluid output.

WEDNESDAY AT A GLANCE

6 АМ			
	6:30 AM - 9:30 AM Registration		
7 AM	negistration	7:00 AM – 9:00 AM STS University	
		STS University	
8 AM			
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9ам			
		9:30 AM - 11:30 AM	
10 AM		9:30 AM — 11:30 AM STS University (courses repeated)	
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6:30 AM - 9:30 AM

Registration

7:00 AM - 9:00 AM

STS University

9:30 AM - 11:30 AM

STS University (courses repeated)

6:30 AM - 9:30 AM Room 360 Lobby and Hall B3

Registration

7:00 AM - 9:00 AM and repeated 9:30 AM - 11:30 AM

Hall B3

STS University

Unless otherwise noted in this Abstract Book or by the speakers, speakers have no commercial relationships to disclose and will be presenting information only on devices, products, or drugs that are FDA approved for the purposes they are discussing.

The physician competencies addressed in each STS University course are medical knowledge and practice-based learning and improvement. These physician competencies will be addressed through hands-on sessions to gain knowledge and practical application experience.

Course 1: Essentials of TAVR

Course Directors: Basel Ramlawi, Winchester, VA, and Eric L. Sarin, Atlanta, GA

Faculty: William T. Brinkman, Plano, TX, Jessica Forcillo, Atlanta, GA, Isaac George, New York, NY, Kevin L. Greason, Rochester, MN, Jefferson M. Lyons, Columbus, OH, S. Christopher Malaisrie, Chicago, IL, Hersh S. Maniar, St Louis, MO, Himanshu J. Patel, Ann Arbor, MI, and George L. Zorn, Kansas City, KS

COMMERCIAL RELATIONSHIPS H. J. Patel: Research Grant, Edwards Lifesciences Corporation, Medtronic; Consultant/ Advisory Board, Edwards Lifesciences Corporation, Medtronic; G. L. Zorn: Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic

Proficiency in transcatheter aortic valve replacement (TAVR) requires knowledge of multiple endovascular principles and techniques. In this course, attendees will get hands-on experience with balloon-expandable and self-expanding TAVR platforms, as well as the various sheaths, guidewires, and catheters relevant to TAVR. Basics of alternative TAVR access will be discussed, and all participants will gain operational knowledge of the various delivery systems.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the decision-making process for choosing a TAVR access point (transfemoral, direct aortic, subclavian artery, and transapical)
- State the salient differences in the deployment of balloon-expanded vs self-expanded devices
- Describe the various types of sheaths and guidewires used during the TAVR procedure and understand reasons for their use

Course 2: TEVAR and Aortic Arch Debranching Procedures

Course Directors: Ali Khoynezhad, Los Angeles, CA, and Ourania A. Preventza, Houston, TX

Faculty: Derek R. Brinster, New York, NY, Panagiotis Kougias, Houston, TX, Aamir S. Shah, Los Angeles, CA, and Gilbert H. Tang, New York, NY

COMMERCIAL RELATIONSHIPS A. Khoynezhad: Research Grant, AtriCure, Medtronic, W. L. Gore & Associates; O. A. Preventza: Consultant/Advisory Board, Medtronic, W. L. Gore & Associates; Other/Travel, Cook Medical; G. H. Tang: Consultant/Advisory Board, Bolton Medical; Research Grant, Bolton Medical; Speakers Bureau/Honoraria, Abbott Vascular, Bolton Medical



This course will review basic catheter and wire skills for thoracic endovascular aortic repair (TEVAR). Participants will have hands-on experience with thoracic stent grafts and intravascular ultrasound (IVUS), as well as using vascular plugs from the brachial or femoral approach. Furthermore, surgical techniques for zone 0-2 aortic arch debranching procedures will be discussed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Identify the most common catheters and wires for TEVAR
- Describe the deployment of commercially available stent grafts
- Explain the use of IVUS and the use of vascular plugs for subclavian artery occlusion
- · Describe the surgical techniques used in aortic arch debranching

Course 3: Mitral Valve Repair

Course Directors: Evelio Rodriguez, Nashville, TN, and Robert L. Smith, Plano, TX

Faculty: Steven F. Bolling, Ann Arbor, MI, W. Randolph Chitwood, Greenville, NC, Scott M. Goldman, Wynnewood, PA, and T. Sloane Guy, New York, NY

COMMERCIAL RELATIONSHIPS E. Rodriguez: Research Grant, Edwards Lifesciences Corporation, Abbott Vascular; R. L. Smith: Speakers Bureau/Honoraria, Intuitive Surgical; Research Grant: Edwards Lifesciences Corporation; Speakers Bureau/Honoraria, Abbott Vascular

In this course, participants will be able to practice different mitral valve repair strategies for both anterior and posterior leaflet pathologies. These will include leaflet resection and non-resection techniques, commissural repair strategies, and different chordal approaches. In addition, different surgical therapies for secondary mitral regurgitation, including ring selection, leaflet extension techniques, and mitral valve replacement, will be reviewed.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe different leaflet resection and non-resection approaches, in addition to the different chordal techniques required for successful mitral valve repair
- Identify advance repair techniques for both primary and secondary mitral regurgitation
- Demonstrate proper mitral valve replacement techniques

Course 4: Valve-Sparing Aortic Root Replacement

Course Directors: Duke E. Cameron, Baltimore, MD, Edward P. Chen, Atlanta, GA, and Bo Yang, Ann Arbor, MI

Faculty: Jeff Brawn, Baltimore, MD, Ruggero De Paulis, Rome, Italy, Gebrine El-Khoury, Brussels, Belgium, Michael P. Fischbein, Stanford, CA, Philip Hess, Indianapolis, IN, John S. Ikonomidis, Charleston, SC, Melissa Jones, Baltimore, MD, Bradley G. Leshnower, Atlanta, GA, and Luca A. Vricella, Baltimore, MD

COMMERCIAL RELATIONSHIPS B. G. Leshnower: Consultant/Advisory Board, Cryolife; Medtronic

This course will provide interactive, hands-on instruction of the surgical techniques and critical steps necessary for performing a successful valve-sparing aortic root replacement (VSRR).



WEDNESDAY, JANUARY 25

Learning Objectives

Upon completion of this activity, participants should be able to:

- · Describe the anatomy of the aortic root
- Summarize the technical steps necessary for a successful VSRR
- List different methods in choosing a graft size
- Discuss leaflet repair and annuloplasty methods

Course 5: Aortic Root Enlarging Procedures and Aortic Valve Leaflet Reconstruction

Course Directors: S. Adil Husain, San Antonio, TX, and Prashanth Vallabhajosyula, Philadelphia, PA

Faculty: Emile A. Bacha, New York, NY, Arminder Singh Jassar, Boston, MA, Alberto Pochettino, Rochester, MN, Edward Y. Sako, San Antonio, TX, Ibrahim Sultan, Pittsburgh, PA, and James S. Tweddell, Cincinnati, OH

COMMERCIAL RELATIONSHIPS E. Y. Sako: Ownership Interest, Medtronic; J. S. Tweddell: Consultant/Advisory Board, CorMatrix

This course will review two specialized subareas of technical expertise required to perform complex aortic root surgery. Participants will learn the anatomic approaches and surgical techniques employed in performing aortic root enlarging procedures, as well as aortic valve leaflet reconstructive techniques and the importance of providing annular stabilization in the context of a repaired aortic valve. Surgical strategies for root enlargement will include Nicks, Manougian, and Ross Konno. Surgical techniques involving aortic valve leaflet reconstruction will include primary simple cusp plication techniques, patch augmentation technique, Gore-Tex free margin shortening technique, and orienting the repaired bicuspid aortic valve into its aortic neoroot.

Learning Objectives

- Identify the anatomy and appropriate surgical landmarks in the left ventricular outflow tract and aortic valve apparatus
- Describe the incision sites and overall surgical techniques for a variety of root enlargement strategies
- · Discuss surgical pitfalls associated with each strategy and mechanisms by which to delineate options based upon patient and anatomic substrate
- Describe how to set up and expose the aortic root for primary valve repair and identify the risk factors for repair failure based on the anatomy of the aortic valve
- Recall the different aortic annular stabilization techniques and recognize the impact of each technique on valve repair—subcommissural annuloplasty, external aortic ring, and root reimplantation
- Identify different bicuspid aortic valve types and explain the implications for valve repair and the choice of annular stabilization
- Demonstrate how to implant a type I bicuspid aortic valve in the context of its neoroot and explain what the different bicuspid subtypes mean for orienting the repaired valve when performing a root reimplantation

Course 6: VATS Lobectomy

Course Directors: Shari L. Meyerson, Chicago, IL, and Betty C. Tong, Durham, NC

Faculty: Mara B. Antonoff, Houston, TX, Scott Balderson, Chapel Hill, NC, Mark F. Berry, Stanford, CA, William R. Burfeind, Bethlehem, PA, DuyKhanh P. Ceppa, Indianapolis, IN, Todd L. Demmy, New Brunswick, NJ, Janet P. Edwards, Calgary, Canada, Ramiro Fernandez, Chicago, IL, Sandeep Jitendra Khandhar, Falls Church, VA, Jeremiah T. Martin, Portsmouth, OH, and Scott I. Reznik, Dallas, TX

COMMERCIAL RELATIONSHIPS S. J. Khandhar: Consultant/Advisory Board, Medtronic

This course will review the indications, patient selection, technical steps, and recent advances for performance of lobectomy using video-assisted thoracic surgery (VATS). Participants will be able to perform a VATS left upper lobectomy on porcine heart-lung blocks.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Describe the indications and steps to perform VATS
- Discuss potential pitfalls and strategies for intraoperative troubleshooting to successfully achieve minimally invasive lobectomy
- Identify instruments and other technologies available to perform minimally invasive lobectomy

Course 7: Advanced Open Esophageal and Tracheal Procedures

Course Directors: David T. Cooke, Sacramento, CA, and Sidharta P. Gangadharan, Boston, MA
Faculty: Rafael S. Andrade, Minneapolis, MN, Daniel J. Boffa, New Haven, CT, Lisa M. Brown,
Sacramento, CA, James Huang, New York, NY, Kiran H. Lagisetty, Ann Arbor, MI, Ryan A.
Macke, Madison, WI, Robert E. Merritt, Columbus, OH, John D. Mitchell, Aurora, CO, David C.
Rice, Houston, TX, Sandra L. Starnes, Cincinnati, OH, and Jennifer L. Wilson, Boston, MA

COMMERCIAL RELATIONSHIPS D. T. Cooke: Consultant/Advisory Board, Core Mobile, Emmi Solutions; J. D. Mitchell: Consultant/Advisory Board, Maquet, Medtronic; Speakers Bureau/Honoraria, Medtronic; D. C. Rice: Speakers Bureau/Honoraria, Intuitive Surgical, Pacira Pharmaceuticals

This course will provide hands-on training for several esophageal anastomosis techniques, as well as airway anastomosis and repair. These advanced operative techniques are not frequently utilized in most general thoracic surgery practices, but competence in these techniques is important.

Learning Objectives

- Describe and perform the appropriate esophageal anastomosis technique depending on anatomic or other considerations
- Perform airway anastomoses and recognize technical pitfalls associated with the various techniques
- · Identify the key steps of tracheobronchoplasty



WEDNESDAY, JANUARY 25

Course 8: Chest Wall Resection and Pectus Surgery

Course Directors: Dawn E. Jaroszewski, Phoenix, AZ, Daniel L. Miller, Marietta, GA, and Mathew Thomas, Jacksonville, FL

Faculty: Staci Beamer, Phoenix, AZ

COMMERCIAL RELATIONSHIPS D. E. Jaroszewski: Consultant/Advisory Board, Zimmer Biomet; D. L. Miller: Consultant/ Advisory Board, Ethicon, Medtronic; Research Grant, Medela; M. Thomas: Research Grant, Acelity, The Thoracic Surgery Foundation

In this hands-on course, participants will learn the various techniques for reconstruction of large chest wall defects after resection. Other highlights of the course will include stabilization of rib and sternal fractures using the most current reconstruction systems and minimally invasive repair of pectus excavatum defects.

Learning Objectives

Upon completion of this activity, participants should be able to:

- Perform rigid and semi-rigid reconstruction of chest wall defects after resection, including the ribs and sternum
- Demonstrate how to stabilize single and multiple rib fractures using rib fixation devices
- Use sternal fixation devices to stabilize the sternum
- · Perform minimally invasive repair of pectus excavatum defects

Course 9: Atrial Fibrillation (Maze Procedure)

Course Directors: Matthew A. Romano, Ann Arbor, MI, and Edward G. Soltesz, Cleveland, OH

Faculty: Gansevoort H. Dunnington, St Helena, CA, Andy C. Kiser, Chapel Hill, NC, and Spencer Melby, St Louis, MO

COMMERCIAL RELATIONSHIPS M. A. Romano: Consultant/Advisory Board, Edwards Lifesciences Corporation; Research Grant, AtriCure, Edwards Lifesciences Corporation; E. G. Soltesz: Speakers Bureau/Honoraria, AtriCure, Edwards Lifesciences Corporation, St Jude Medical; Ownership Interest, JACE Medical

Cardiac surgeons often encounter atrial fibrillation in patients referred for other cardiac surgical procedures. However, surgical ablation of atrial fibrillation continues to be underused at the time of cardiac surgery. Recent data have supported high rates of sinus rhythm restoration and a survival advantage for concomitant treatment of atrial fibrillation during cardiac surgery. Unfamiliarity with recommended lesion sets, energy sources, available devices, and techniques have resulted in an underutilization of the Maze procedure.

Learning Objectives

- Explain the different energy sources for performing the Maze procedure and their appropriate applications
- Perform the Maze IV procedure lesions based on different operative scenarios (mitral valve surgery, coronary artery bypass grafting, aortic valve replacement)
- Explain the technical aspects of a minimally invasive Maze procedure

Course 10: Mechanical Circulatory Support

Course Directors: Aaron M. Cheng, Seattle, WA, Mani A. Daneshmand, Durham, NC, and Nahush A. Mokadam, Seattle, WA

Faculty: Francisco A. Arabia, Los Angeles, CA, David A. D'Alessandro, Bronx, NY, Richard H. Feins, Chapel Hill, NC, Akinobu Itoh, St Louis, MO, Pablo Sanchez, Baltimore, MD, and Hiroo Takayama, New York, NY

COMMERCIAL RELATIONSHIPS F. A. Arabia: Other/Trainer, Medtronic, SynCardia; M. A. Daneshmand: Research Grant, Biom'Up, XVIVO; Speakers Bureau/Honoraria, Maquet; A. Itoh: Speakers Bureau/Honoraria, St Jude Medical; Consultant/Advisory Board, St Jude Medical; N. A. Mokadam: Consultant/Advisory Board, HeartWare, SynCardia; Research Grant, HeartWare, SynCardia

This hands-on course focuses primarily on operative considerations regarding implantation of mechanical circulatory support in adult patients with acute and chronic heart failure. Participants will learn key surgical points for successful implantation of commonly available long-term ventricular assist devices (VADs), as well as technical considerations for the implementation of temporary circulatory support devices, including the use of extracorporeal life support (ECLS)/extracorporeal membrane oxygenation.

Learning Objectives

- List the different VADs currently available to support the failing heart in both acute and chronic heart failure
- Identify the key operative steps for successful VAD implantation
- Explain the important technical considerations for successful insertion of temporary circulatory assist devices, including different cannula configurations for ECLS and different percutaneous devices

Adult Cardiac Surgery

P1

The Impact of Aortic Clamping Strategy on Postoperative Stroke in Coronary Artery Bypass Grafting Operations: A Propensity-Matched Analysis of 52,611 Patients

M. Alaeddine¹, V. Badhwar², M. V. Grau-Sepulveda³, M. E. Halkos⁴, V. H. Thourani⁴, J. P. Jacobs⁵, R. A. Matsouaka⁶, J. Meza⁷, M. Brennan⁸, T. G. Gleason¹, D. Chu⁹

¹University of Pittsburgh, PA, ²West Virginia University, Morgantown, ³Duke Clinical Research Institute, Durham, NC, ⁴Emory University, Atlanta, GA, ⁵Johns Hopkins All Children's Heart Institute, St Petersburg, FL, ⁶Duke University, Durham, NC, ⁷Duke University Medical Center, Durham, NC, ⁸Duke University School of Medicine, Durham, NC, ⁹University of Pittsburgh School of Medicine, UPMC Heart & Vascular Institute, PA

COMMERCIAL RELATIONSHIPS T. G. Gleason: Research Grant, Medtronic; M. E. Halkos: Consultant/Advisory Board, Medtronic

Purpose: Stroke is a rare, but potentially devastating complication of coronary artery bypass grafting (CABG) surgery. The optimal aortic cross clamp management during proximal graft construction and its impact on stroke remain unknown. We evaluated the incidence of postoperative stroke in CABG patients for partial occlusion clamp (POC) or single clamp (SC) technique.

Methods: Utilizing the STS Adult Cardiac Surgery Database from July 1, 2014, to March 31, 2015, we identified 52,611 patients who underwent an on-pump, isolated, primary, elective or urgent, and arrested CABG operation. Propensity scores for POC were calculated based on relevant variables and validated STS predicted risk of postoperative stroke (PROPS) scores, and propensity matching was used to adjust for differences between the two technique groups. Risk ratios (RR) and 95% confidence intervals (CI) were computed to evaluate the effects of aortic clamping strategy on the primary outcome of postoperative stroke.

Results: The propensity score-matched cohort of the POC group (n=17,819) and the SC group (n=17,819) did not differ significantly in any of the STS PROPS variables (standardized difference <10) (Table). The stroke outcome occurred with similar frequency in both matched groups (POC 1.06% vs SC 0.94%; RR 1.12; 95% CI, 0.90-1.39; P=.31) as were mortality rates (POC 1.25% vs SC 1.26%; RR 0.99; 95% CI, 0.81-1.21; P=.93). Despite a similar number of total bypass grafts, myocardial ischemic times (57.0 minutes \pm 23.3 minutes vs 74.1 minutes \pm 29.2 minutes, P<.0001) and cardiopulmonary bypass times (89.6 minutes \pm 34.1 minutes vs 95.0 minutes \pm 34.8 minutes, P<.0001) were shorter for POC group compared to SC group.

Conclusions: In this large, contemporary, multicenter database analysis, aortic clamping strategy for performance of proximal anastomoses in CABG operations did not affect short-term incidence of postoperative stroke or mortality. The use of POC incurred shorter myocardial ischemic and perfusion times compared to SC technique with similar total number of bypass grafts.

Table 1

	Propertity Matchest Cuttors (n = 35630)				
Patient characteristics	POC (n - 17919)	SC (n = 1789)	Standardine Ofference (%		
Age (mean)	1929	110	-9.23		
Famuli (NV.	23 A2 76 35	23.71	-5.7		
Rese Courseau (%)			1.87		
Rase Atrican-American (%)	T.0.F	7 27	2.24		
Sase Hispanic (%)	6.62		-0.29		
Race Ditter (%)	1151	0.43	1,17		
Creativitie (ingel) (mile)	1.06	2.00	0.43		
Body surface area (mean)	2.05	2.80	9.01		
Datebra on makin (%)	(EA)	16.11	0.24		
Diabetas not on insulin (%)	28.05	29.64	0.64		
Eyection fraction (mean)	17.36	12.0	0.17		
Conga data has set facilities and NVHA str-	7.94	1/0	444		
Chronic Lung Disease med-cer (%)	18	+72	157		
Cerebral Vasourar Doease (%)	3.77	9.48	978		
Renal Fature Dialysin (%)	229	330	-3.41		
Hypothersion (%)	87.26	87.23	-5.15		
Pengharal Vastullar Disease (%)	1175	11.54	0.63		
Myscardial eduction v 21 days (%)	5058	36.70	-5.32		
Status - Urgent (%)	5658 8122	61.00	0.02		
Ondica Anges (%)	34,57	MR	-277		
Oquame	POC (n = (/ btil)	EC (e = 1/210)	pvalue		
Pantaparativa sacias (%)	101	0.54	2.37		
Morteley (%)		1.29	5.50		
Myroprisal recisions treat (min)	125 67 d	74.7	<0.0001		
(mases) Cardivasimonery System and (min) (mases)	09.6	95.0	<0.0001		

Long-Term Risk of Ischemic Stroke After the Cox-Maze III Procedure for Atrial Fibrillation

A. Albage¹, U. Sartipy², G. Kennebäck², B. Johansson³, H. Scherstén³, L. Jidéus¹

¹University Hospital, Uppsala, Sweden, ²Karolinska University Hospital, Stockholm, Sweden, ³Sahlgrenska University Hospital, Gothenburg, Sweden

Purpose: The long-term risk of stroke after surgical treatment of atrial fibrillation is not well known. We performed an observational cohort study after the "cut-and-sew" Cox-Maze III procedure (CM-III), including left atrial appendage (LAA) excision, with the aim to analyze the incidence of stroke/transient ischemic attack (TIA) and the association to preoperative CHA₂DS₂-VASc score.

Methods: Pre- and perioperative data were collected in 526 CM-III patients operated in four Swedish centers between 1994 and 2009, of whom 412 were male, with a mean age of 57.1 years ± 8.3 years. The incidence of any stroke/TIA was identified through analyses of the Swedish National Inpatient and Cause-of-Death registries and from review of individual patient records. The cumulative incidence of stroke/TIA and the association with CHA₂DS₂-VASc score were estimated using statistical methods accounting for the competing risk of death.

Results: Mean follow-up was 10.1 years. There were 29 events of any stroke/TIA, including six intracerebral bleedings (two fatal) and four perioperative strokes (0.76%). The remaining 13 ischemic strokes and six TIAs occurred a mean of 7.1 years ± 4.0 years postoperatively, with an incidence of 0.36%/year (19 events/5,231 patient-years). Ongoing anticoagulant medication at time of event was none (47%), aspirin (37%), warfarin (11%), and unknown (5%). In all CHA₂DS₂-VASc groups, the observed ischemic stroke/TIA rate was lower than the predicted rate. There was a higher risk for ischemic stroke/TIA in patients with CHA₂DS₂-VASc score ≥2 compared to score 0-1 (HR 2.15; 95% CI, 0.87-5.32) but no difference by gender or type of operation (standalone vs concomitant procedure). No patient had ischemic stroke as a recorded cause of death.

Conclusions: This multicenter study showed a very low incidence of perioperative and long-term postoperative ischemic stroke/TIA after CM-III with LAA excision. Although general risk of ischemic stroke/TIA was low, patients with CHA₂DS₂-VASc score ≥2 had a higher risk compared to patients with score 0 or 1.

The STS Definition of Post-Coronary Artery Bypass Grafting Atrial Fibrillation (Limited to Events Requiring Treatment) Misses Patients at Increased Risk of Mortality

G. Filardo¹, B. D. Pollock¹, B. da Graca¹, D. Sass¹, T. Phan¹, D. E. Montenegro¹, G. Ailawadi², V. H. Thourani³, R. Damiano⁴

¹Baylor Scott & White Health, Dallas, TX, ²University of Virginia, Charlottesville, ³Emory University, Atlanta, GA, ⁴Washington University School of Medicine, St Louis, MO

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure; R. Damiano: Research Grant, AtriCure; Speakers Bureau/Honoraria, AtriCure, CryoLife, LivaNova; G. Filardo: Research Grant, Gilead Sciences

Purpose: The Society of Thoracic Surgeons (STS) defines atrial fibrillation (AF) following coronary artery bypass graft surgery (CABG) surgery as "AF/flutter requiring treatment." We evaluated the impact this limited definition has on the association between post-CABG AF and survival to determine the clinical significance of the post-CABG AF events it misses.

Methods: In 7,110 consecutive isolated-CABG patients without preoperative AF at four cardiac surgery programs (2004-2010), we assessed incidence of STS-definition post-CABG AF and of physician-documented AF detected via continuous in-hospital electrocardiogram/ telemetry monitoring but missed by the STS definition. Survival, censored at October 31, 2011, was assessed using the Social Security Death Master File (archived before state-owned data were removed). Using a Cox model (adjusted for STS risk of mortality [splined] and accounting for site differences through robust sandwich estimates), survival was compared among patients with: 1) STS-definition post-CABG AF, 2) post-CABG AF missed by the STS definition, and 3) no post-CABG AF.

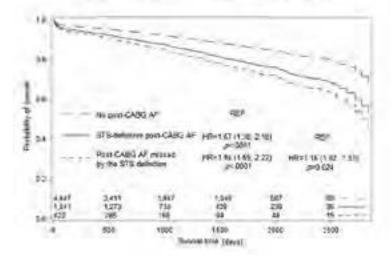
Results: Over the 7-year follow-up, unadjusted mortality was 16.0% (295/1,841) for patients with STS-definition post-CABG AF, 18.7% (79/422) for patients with post-CABG AF missed by the STS definition, and 7.9% (382/4,847) in patients without post-CABG AF. After adjustment, patients with post-CABG AF that was missed by the STS definition had a significantly greater risk of death than both patients with STS-definition post-CABG AF (HR 1.16; 95% CI, 1.02-1.33) and patients who did not experience post-CABG AF (HR 1.94; 95% CI, 1.69-2.22) (Figure).

Conclusions: Patients who experience post-CABG AF, regardless of whether it is deemed to require treatment, have poorer survival. The significantly increased risk of death observed for post-CABG AF missed by the STS definition (16%) raises questions for future research regarding differences in treatment and post-discharge management that might impact survival.

Continued from previous page

Figure Adjusted (STS risk of reortality) survival ourves, hazard ratios (HR) (95% Confidence intervals), and p-values comparing patients experiencing new-onset post-CABO artial fibrillation (AF) according to STS definition vs. patients experiencing new-onset post-CABO AF missed by the STS definition.

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Does Del Nido Cardioplegia Benefit Adult Cardiac Surgery Patients?

J. Goldberg¹, G. Paone², T. Paugh², X. Wu³, S. D. Harrington⁴, M. Romano⁵, A. Delucia⁶, P. F. Theurer³, M. Zhang³, K. Shann⁷, R. L. Prager³, D. S. Likosky³

¹Westchester Medical Center, Valhalla, NY, ²Henry Ford Hospital, Detroit, MI, ³University of Michigan Health System, Ann Arbor, ⁴Henry Ford Macomb Hospital, Clinton Township, MI, ⁵University of Michigan, Ann Arbor, ⁶Bronson Methodist Hospital, Kalamazoo, MI, ⁷Massachusetts General Hospital, Boston

COMMERCIAL RELATIONSHIPS D. S. Likosky: Research Grant, Agency for Healthcare Research and Quality; M. Romano: Research Grant, AtriCure, Edwards Lifesciences Corporation; Consultant/Advisory Board, Edwards Lifesciences Corporation

Purpose: Several small, single-center studies have provided conflicting evidence concerning the myocardial protective benefits of del Nido cardioplegia (DNC) in adults. We used a multicenter database to evaluate postoperative outcomes associated with DNC among adult patients undergoing cardiac surgery.

Methods: We evaluated patients undergoing coronary artery bypass grafting and/or valve procedures between 2014 and 2015 at 12 centers utilizing DNC. Conventional cardioplegia (CC) use (4:1 and 8:1 blood cardioplegia) was compared to DNC through a mixed effects model, accounting for: age, sex, body mass index, hypertension, diabetes, prior cardiac procedures, history or preoperative presentation of myocardial infarction (MI), atrial fibrillation, heart failure, estimated glomerular filtration rate (eGFR), ejection fraction, procedure, surgeon, and center. We compared intra- and postoperative outcomes across DNC and CC groups.

Results: A total of 2,083/5,881 (35.4%) received DNC and 3,798/5,881 (64.6%) received CC. Preoperatively, DNC recipients were older (65.2 years vs 64.2 years, P = .007), more obese (P = .004), had lower eGFR (P = .02), more diabetes (39.7% vs 33.6%, P < .001), and more previous MIs (32.2% vs 28.2%, P = .001). A greater proportion of patients receiving DNC underwent coronary revascularization compared to CC (isolated CABG: 51.4% vs 41.1%, P < .001; and CABG+valve: 11.2% vs 9.4%, P < .001). Mean cross clamp (85.9 minutes vs 102.1 minutes) and bypass times (110.9 minutes vs 132.4 minutes) were shorter, and total cardioplegia volume was less (1.4 liters vs 4.4 liters) among DNC recipients (all P < .0001). Nadir hematocrit and transfusion rates did not differ. Despite these differences, univariate outcomes were not statistically different (P > .05), a finding that persisted after risk adjustment (Table).

Conclusions: In this large, multicenter experience, the use of DNC was associated with equivalent outcomes relative to conventional cardioplegia in adults undergoing cardiac surgery. Future analyses should evaluate the effect of del Nido cardioplegia on patient outcomes across varying pathophysiologic presentations, such as acute ischemia.

POSTER ABSTRACTS

Continued from previous page

Table 1: Incidence and adjusted outcomes of post-operative events among recipients of Del Nido compared to conventional cardioplegia

	Conventional	Del Nido	Adjusted	
	N (%)	N (%)	OR (95% CI)	P-value
	3798 (64.6)	2083 (35.4)		
MCS	83 (2.2)	49 (2.4)	1.05 (0.64, 1.74)	0.85
Prolonged ventilation	317 (8.4)	163 (7.8)	0.88 (0.66, 1.18)	0.41
Renal Failure	91 (2.4)	41 (1.9)	0.80 (0.52, 1.2)	0.32
Atrial Fibrillation	582 (27.9)	1053 (27.7)	0.96 (0.81, 1.13)	0.59
Permanent Pacemaker	117 (3.1)	66 (3.2)	1.24 (0.84, 1.82)	0.27
Stroke	51 (1.3)	34(1.6)	1.24 (0.73, 2.1)	0.42
RBC Transfusion	860 (22.6)	498 (23.9)	0.88 (0.71, 1.08)	0.22
LOS>14 Days	275 (7.2)	145 (6.9)	0.90 (0.67, 1.22)	0.49
Operative Mortality	58 (1.5)	44(2.1)	1.39 (0.85, 2.27)	0.19

^{*}Adjusted for: age, sex, body mass index, hypertension, diabetes, prior cardiac procedures, history or pre-operative presentation of myocardial infarction, atrial fibrillation, heart failure, estimated glomenular filtration rate, ejection fraction, procedure, surgeon and center.

MCS = postoperative mechanical circulatory support (intra-aortic balloon pump, extracorporeal membrane oxygenation, ventricular assist device); LOS = length of stay; RBC = Red Blood Cell

Direct Aortic Access for Transcatheter Aortic Valve Replacement Using a Self-Expanding Device

D. O'Hair¹, T. Bajwa², J. Popma³, D. Watson⁴, S. Yakubov⁴, D. H. Adams⁵, S. Sharma⁵, N. Robinson⁶, G. Petrossian⁶, M. Caskey⁷, T. Byrne⁷, N. Kleiman⁸, M. Reardon⁸

¹Aurora St Luke's, Milwaukee, WI, ²Aurora Health Care, Milwaukee, WI, ³Beth Israel Deaconess Medical Center, Boston, MA, ⁴Riverside Methodist Hospital, Columbus, OH, ⁵Mount Sinai Medical Center, New York, NY, ⁶Saint Francis Hospital, Roslyn, NY, ⁷Banner Good Samaritan Medical Center, Phoenix, AZ, 8Houston Methodist Hospital, TX

COMMERCIAL RELATIONSHIPS D. H. Adams: Other/Royalty Payments, Edwards Lifesciences Corporation; T. Byrne: Speakers Bureau/Honoraria, Medtronic; Consultant/Advisory Board, Medtronic; M. Caskey: Consultant/Advisory Board, Medtronic; N. Kleiman: Research Grant, Medtronic; Speakers Bureau/Honoraria, Medtronic; D. O'Hair: Research Grant, Medtronic; J. Popma: Research Grant, Medtronic, Boston Scientific, Abbott Vascular; Consultant/Advisory Board, Boston Scientific; Other Research Support, Direct Flow Medical; Ownership Interest, Direct Flow Medical; Consultant/ Advisory Board, Direct Flow Medical; M. Reardon: Research Grant, Medtronic; Consultant/Advisory Board, Medtronic; D. Watson: Speakers Bureau/Honoraria: Medtronic; S. Yakubov: Speakers Bureau/Honoraria, Medtronic; Consultant/ Advisory Board, Medtronic

Purpose: Transcatheter aortic valve replacement (TAVR) using a self-expanding valve has been shown to be superior to surgery in high-risk patients, yet in some patients, extensive iliac and femoral peripheral vascular disease prohibits the more common femoral approach. In these cases, direct aortic (DA) implantation may be a suitable option.

Methods: A multidisciplinary screening committee determined eligibility of patients with severe aortic stenosis for TAVR. Patients who underwent attempted implant in the CoreValve US Pivotal Extreme- and High-Risk Trials and Continued Access Studies were evaluated. Echocardiography and multislice computed tomography angiography was used to determine severity of aortic stenosis, valve sizing, and for vascular access planning. DA access was used if iliofemoral or subclavian access was not possible. Access sites were categorized as mini-sternotomy, mini-thoracotomy, or other. The primary endpoints for this analysis included the composite of all-cause mortality or major stroke, and components at 30 days and 1 year.

Results: Of 3,762 patients who underwent TAVR, 478 (12.7%) were treated via the DA approach. Successful valve deployment was achieved in 475 cases (99.4%). Baseline characteristics by access site are in the Table. Mini-thoracotomy patients were older and were more likely to have a history of cerebrovascular disease or previous coronary artery bypass grafting surgery (all P < .05). At 30 days, the rate of all-cause mortality or major stroke was 59 (12.3%) for all patients, nine (7.7%) for mini-thoracotomy patients, 45 (13.9%) for mini-sternotomy patients, and five (13.2%) for other. Death rates for the same groups were 47 (9.8%), eight (6.8%), 34 (10.5%), and five (13.2%). Major stroke rates were 18 (3.8%), two (1.7%), 16 (5.1%), and zero (0%), respectively. Major vascular complications were 16 (3.4%), four (3.4%), 11 (3.4%), and one (2.6%), respectively. There were no valve thromboses or embolic events. At 1 year, the rates of all-cause mortality or major stroke were 149 (31.6%), 33 (28.5%), 103 (32.3%), and 13 (34.3%), respectively. Death rates were 140 (29.7%), 32 (27.7%), 95 (29.9%), and 13 (34.3%), respectively, and major stroke rates were 27 (6.2%), four (3.8%), 23 (7.8%), and zero (0%), respectively. Values represent the number of patients (%).

Conclusions: Direct aortic access for TAVR using a self-expanding TAV is safe and reliable via sternotomy or thoracotomy with low rates of vascular injury and surgical reintervention. The STS score accurately predicted outcome in this study cohort.

Continued on next page

POSTER ABSTRACTS

Continued from previous page

mosasSD or n/N (N)	AT DA (N=479)	Mini-Thoracotomy (N-117)	Mini-Stemetomy (N=323)	Other DA access* (N=20)
Age, years	81.6 ± 7.6	84.3 ± 6.0	82.1 ± 8.0	81.4 ± 7.3
Men	209/478 [43.7]	53/117(453)	139/323 (43.4)	17/38 (44.7)
STS PROM. %	57148	93141	98150	99153
Cerebrovascular disease	148/469 (31.4)	52/116(448)	88/315(27.9)	8/38 (21.1)
Prior CABG	176/478 (16.8)	57/117(487)	106/323 (32.8)	13/38 (34.2)
Chronic lung disease/COFD	283/478 (59.2)	61/117(52.1)	201/323 (62.2)	21/38 (55.3)
Creatinine > 2 mg/dL	21/478(4.4)	3/117(24)	14/323 (43)	4/38 (10.5)
Albumin < 3.3 g/dL	85/471 (18.0)	18/115(15.7)	61/319(19.1)	6/37 (16.2)
IFb/Aflutter	221/473 (46.7)	53/117(45.3)	152/319 (47.6)	16/37 (43.2)
Severe asetic calcification	88/476(18.5)	25/117(214)	47/321 (14.6)	16/38 (42.1)

The other category included fulls, benis, limited, medians, partial-median, or upper steriocomy; anterior thoraccomy; or parasternal

Is Retrograde Cerebral Perfusion an Effective Brain Protection Strategy for Prolonged Periods of Circulatory Arrest?

M. Gaudino, C. Lau, I. Gambardella, M. Munjal, M. Elsayed, A. Di Franco, E. Mills, B. C. Degner, L. N. Girardi

Weill Cornell Medicine, New York, NY

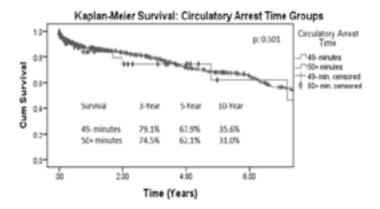
Purpose: The optimal brain protection strategy for prolonged periods of circulatory arrest is still controversial. This study is aimed at evaluating whether retrograde cerebral perfusion (RCP) is an adequate brain protection strategy in the case of prolonged periods of deep hypothermic circulatory arrest (DHCA).

Methods: From January 1997 to December 2014, 1,043 patients had aortic arch surgery using RCP and DHCA at 17°C. Of them, 993 underwent DHCA ≤49 minutes and the remaining 50 had DHCA time ≥50 minutes. Propensity matching between the two groups was performed, taking into account the main preoperative and surgical variables and all the pre- and intraoperative neurologic risk factors. Logistic regression analysis was performed to identify independent predictors of operative death and postoperative cerebral complications.

Results: As in the Table, in the unmatched population, mortality and stroke rate were 2% (1/50) and 2% (1/50) in the ≥50 minutes group and 0.1% (1/993) and 1.2% (12/993), respectively, in the ≤49 minutes series. PPM resulted in two groups of 48 pairs. Operative mortality and incidence of transient and permanent neurologic deficit were similar in the matched groups (P = ns for all comparisons, see Table). No difference in the incidence of other major postoperative complications was found between the two groups. Mid-term survival also was similar between the two series. At regression analysis, DHCA duration was not independently associated with operative mortality nor postoperative neurologic deficits.

Conclusions: RCP is an effective adjunctive brain protection strategy that is not associated with increased mortality or neurologic complications in patients undergoing aortic arch surgery with prolonged DHCA.

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	Subgroups		
	250 min	549 min	p-value
	(H750)	(41993)	
Presperative variables			
Age (mean 150)	61.2 ± 13.4	65.9 ± 13.3	.014
Moles	36 (77)	603 (60.7)	NS
Hypertension	49 (96)	943 (95)	NS
COPD	52 (24)	201 (20.2)	NS
Previous or Active Smoker	28 (56)	529 (18.3)	NS
Dissection	30 (60)	344 (34.6)	< 001
Previous Revosoularization	4 (8)	108 (10.8)	NS
Previous Cardiac Surgery	24 (46)	231 (23.2)	<.001
Previous Myocardial Inforction	6 (32)	155 (15.6)	NS
Previous Stroke	15 (30)	136 (13.7)	.005
Procedure Status			
Unpost	50 (20)	147 (14.8)	
Emergent	21 (42)	306 (31)	NS
Renal insufficiency	13 (26)	182 (18.3)	NS
Circulatory Arrest Time (mean ±90)	58.2 ± 8.2	24.2 ± 8.8	<.001
Unmatched postoperative results			
In-hespital death	1 (2.49)	1 (0.1)	.003
CVA			
Permanent Neurologic Deficit	1 (2.0)	12 (1.2)	.623
Transient Neurologic Deficit	4 (8.0)	29 (2.9)	.045
Myocardial infarction	0 (0.0)	7 (0.7)	NS
Tracheoutomy	4 (9.0)	35 (3.5)	.551
New Dialysis	1 (2.0)	26 (2.6)	NS
Motched postoperative results			
In-hospital death	1(2.1)	0 (0.0)	.315
CVA			
Permanent Neurologic Deficit	1(2.1)	0 (0.0)	.315
Transient Neurologic Deficit	3 (6.3)	1 (2.1)	.307
Myocardial Infarction	0 (0.0)	0 (0.0)	NS.
Tracheostomy	4 (8.3)	4 (8.3)	.842
New Dialysis	1(2.1)	2 (4.2)	765
	Englistic regression		
in-haspital mortality	OR (9	5% CI)	p value
Age		(35-1.086)	.007
Provious Mi		72-50 (089)	<.001
Emergent Procedure		67-10-821)	.026
Pump Time Biosel Transfeaton		(02-1.010)	.005
		84-1.346)	.001

Renal Failure After Cardiac Surgery: Not All Acute Kidney Injury Is the Same

T. C. Crawford¹, J. T. Magruder¹, J. C. Grimm¹, S. Lee², A. Suarez-Pierre², C. Sciortino¹, R. S. Higgins², D. E. Cameron¹, J. V. Conte¹, G. J. Whitman¹

¹The Johns Hopkins Hospital, Baltimore, MD, ²The Johns Hopkins University School of Medicine, Baltimore, MD, ³The Johns Hopkins University School of Public Health, Baltimore, MD

COMMERCIAL RELATIONSHIPS J. V. Conte: Research Grant, Medtronic, Boston Scientific, St Jude Medical; Consultant/ Advisory Board, Medtronic; G. J. Whitman: Research Grant, Abbott Laboratories

Purpose: The STS National Database does not distinguish between a decline in creatinine clearance and a new need for hemodialysis (HD) when qualifying acute renal failure (ARF) after cardiac surgery. We hypothesized that patients requiring HD experience significantly greater postoperative morbidity and mortality.

Methods: We included all patients who underwent STS index cardiac operations at our institution from 2008 to March 2015 and did not have preexisting renal failure. ARF was defined as a three-fold rise in serum creatinine or a rise in creatinine above 4.0 mg/dL (non-HD ARF) or a new need for hemodialysis (ARF-HD). After propensity matching non-HD ARF and ARF-HD groups across 14 variables (including baseline glomerular filtration rate), we compared incidences of our primary outcome, death, and secondary outcomes, ICU and hospital length of stay (LOS), and discharge to a location other than home.

Results: Among 4,154 study patients, we identified 113 (2.7%) who experienced new-onset non-HD ARF (n=57) or ARF-HD (n=56) after surgery. Propensity matching resulted in 51 well-matched pairs experiencing non-HD ARF or ARF-HD (all P > .10). Patients requiring HD suffered significantly greater operative mortality (67% vs 22%, P < .01), longer ICU LOS (326 hours vs 176 hours, P < .01), and greater postoperative hospital LOS (34 days vs 17 days, P < .01) (Table). ARF-HD patients also demonstrated a trend toward higher rates of discharge to a location other than home (71% vs 45%, P = .08).

Conclusions: After cardiac surgery, patients who developed ARF-HD experienced triple the mortality and double the ICU and postoperative hospital LOS in comparison to patients who experienced non-HD ARF. These two renal failure populations should be separated when reporting cardiac surgery outcomes and viewed differently with regard to prognosis.

POSTER ABSTRACTS

Continued from previous page

Matched ARF Population

	Non-HD ARF (n=51)	ARF-HD (n=51)	p-value
Operative Mortality	11 (22%)	34 (67%)	<0.01
ICU LOS (hours)	175.8±167.1	325.6±346.9	<0.01
Postoperative Hospital LOS in those surviving to discharge (days)	16.5±11.9	33.6±21.7	<0.01
Discharge to location other than home (among survivors)	18 (45%) *Out of 40	12 (71%) * Out of 17	0.08

Effect of Anemia and Hemoglobin A1c on Coronary Artery Bypass Grafting Morbidity and Mortality

T. Boeve^t, E. T. Murphy^t, M. Herbert², P. F. Theurer³, D. S. Likosky³, G. Paone⁴, F. L. Shannon⁵, R. L. Prager³

¹Spectrum Health, Grand Rapids, MI, ²Southwest Data Consultants, Dallas, TX, ³University of Michigan Health System, Ann Arbor, ⁴Henry Ford Hospital, Detroit, MI, ⁵Beaumont Cardiovascular Surgery, Royal Oak, MI

COMMERCIAL RELATIONSHIPS D. S. Likosky: Research Grant, Agency for Healthcare Research and Quality; F. L. Shannon: Consultant/Advisory Board, Medtronic, Edwards Lifesciences Corporation

Purpose: Patients presenting for revascularization often have anemia and/or elevated hemoglobin A1c (HbA1c). Given the importance of preoperative risk optimization, we used a statewide cardiac surgery database to assess the effect of elevated HbA1c with and without anemia on postoperative morbidity and mortality.

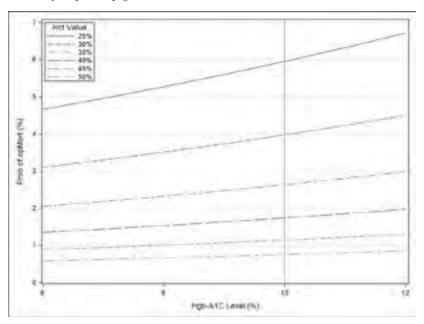
Methods: Data on 23,614 patients presenting for isolated coronary artery bypass grafting (CABG) surgery from July 2011 to December 2015 at 33 institutions were analyzed using the last preoperative hematocrit (Hct) and HbA1c levels. Logistic regression was used to estimate the odds ratios (OR) for changes in Hct and HbA1c levels on major morbidity and mortality after accounting for other parameters in the published STS models. Predicted probabilities for events were calculated for discrete levels of Hct and HbA1c.

Results: Anemia and elevated HbA1c significantly increased a patient's adjusted odds (ORadj) of prolonged ventilation (P < .001, P < .001, respectively), readmission (P < .001, P < .001, respectively), stroke (P = .003, P < .001, respectively), and operative mortality (P < .001, P < .001, respectively). For every 1% increase in HbA1c, the ORadj for mortality increased by 11.6% (P < .001), ORadj for stroke increased 14% (P < .001), and ORadj for renal failure and deep sternal wound infection increased 16% (P < .001), P < .006, respectively). For every 1% increase in Hct, ORadj for hemodialysis decreased 11.2% (P < .001), ORadj for prolonged ventilation decreased 6.1% (P < .001), ORadj for readmission decreased 4.5% (P < .001), ORadj for renal failure decreased 10.7% (P < .001), ORadj for stroke decreased 3.5% (P = .003), and ORadj for mortality decreased 6.9% (P < .001). The Figure shows the interaction of Hct and HbA1c levels. For an HbA1c level of 10%, having an Hct of 25% increases the probability of operative mortality by nine times over an Hct of 50%.

Conclusions: In our statewide experience, both decreasing Hct and increasing HbA1c levels are independent risk factors for morbidity and mortality in patients undergoing CABG. Patients with elevated HbA1c levels and anemia are at particular risk of operative mortality; therefore, strategies to optimize these variables preoperatively may improve CABG outcomes.

POSTER ABSTRACTS

Continued from previous page



Should We Oversize Donor Selection for Recipients With Pulmonary Hypertension Undergoing Heart Transplantation? A Propensity-Matched Analysis of a National Registry

S. Deo¹, A. Vinnakota², S. Altarabsheh³, S. M. Dunlay⁴, N. Sarabu⁵, A. Kilic⁴, G. H. Oliveira⁵, G. C. Fonarow⁻, S. Park¹

¹Case Western Reserve University, Cleveland, OH, ²Case Western Reserve University School of Medicine, Cleveland, OH, ³Queen Alia Heart Institute, Amman, Jordan, ⁴Mayo Clinic College of Medicine, Rochester, MN, ⁵University Hospitals, Cleveland, OH, ⁶The Ohio State University Wexner Medical Center, Columbus, ⁷University of California, Los Angeles

COMMERCIAL RELATIONSHIPS A. Kilic: Speakers Bureau/Honoraria, St Jude Medical, Baxter International; Consultant/ Advisory Board, St Jude Medical, Baxter International

Purpose: Recipients with pulmonary hypertension are more likely to develop right heart failure post-transplant. Selecting bigger donors for these recipients is one strategy to reduce this adverse outcome; however, studies demonstrating the benefit of this method are lacking.

Methods: We retrospectively analyzed the United Network for Organ Sharing database to identify recipients with pulmonary hypertension at listing (transpulmonary gradient > 12 mm Hg or pulmonary vascular resistance >2.5 Wood units). Using a standard algorithm, we calculated the right ventricular mass (RVm) of donors and recipients. We then stratified these patients according to either normal RV mass ratio (NRVm) (80%-120%) or high RV mass ratio (HRVm) (>120%). 1:1 propensity matching (nearest neighbor caliper method) with exact matching on recipient and donor gender was performed to obtain 1,704 well-matched cohort of recipients. McNemars test and robust Cox regression were implemented to

Results: During the 15-year study period, there were 9,585 recipients with pulmonary hypertension according to preoperative right heart catheterization. 5,545 (55%) received donors with RV mass within 120% of recipient RV mass (NRVm cohort), while the remaining 4,454 (45%) received over-sized donors (HRVm). 30-day mortality was comparable between cohorts (5.2% and 5.3%, P= .99). Median unadjusted survival in the NRVm and HRVm cohorts was 11.8 years (11-12.8 years) and 12.2 years (11-13 years), respectively. Analysis of the propensity-matched cohort demonstrated that early mortality was 5.8% (4.8%-7%) and 5.4% (4.4%-7%) in the HRVm and NRVm cohorts, respectively (P= .7). Long-term survival also was comparable in both groups (HR 1.07 [0.9-1.2]).

Conclusions: Selecting larger donors for recipients with pulmonary hypertension undergoing heart transplant appears unwarranted. Routine guidelines should be implemented in matching donors for these patients.

Impact of Off-Pump Coronary Artery Bypass Grafting on Hospital Outcomes in 197,812 Octogenarians: US Nationwide Inpatient Database, 2003-2011

U. Benedetto¹, M. Gaudino², K. Luke², M. Caputo³, C. Lau², I. Gulkarov², G. Angelini⁴, L. N. Girardi²

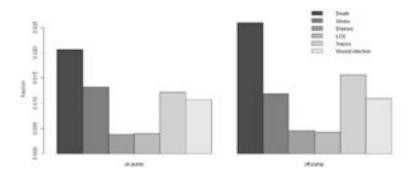
¹Bristol Heart Institute, Weill Cornell Medical College, United Kingdom, ²Weill Cornell Medicine, New York, NY, ³Bristol Royal Hospital for Children, United Kingdom, ⁴University of Bristol, United Kingdom

Purpose: Advanced age is a major determinant of hospital outcomes after coronary artery bypass grafting (CABG) surgery. The potential benefit of off-pump CABG in octogenarians still remains to be determined due to limited sample size of available studies. Using the US Nationwide Inpatient Database from 2003 to 2011, we investigated the impact of off-pump vs on-pump CABG in octogenarians.

Methods: Out of 2,273,220 patients who underwent isolated first-time CABG during the study period, 197,812 subjects were octogenarians. Of those, 58,206 underwent off-pump CABG (29%). Level cluster sampling design and weighted logistic regression were used to assess the impact of off-pump CABG on outcomes (survey R package).

Results: Operative mortality was 3,248 (5.5%) and 7,185 (5.1%) in the off-pump and on-pump groups, respectively, with no significant difference (adjusted OR 1.03; 95% CI, 0.91-1.15; P = .62). Off-pump CABG was associated with a significant risk reduction for stroke (OR 0.74; 95% CI, 0.62-0.89; P = .001) and wound infection (OR 0.67; 95% CI, 0.54-0.83; P < .001), but not for dialysis (OR 1.39; 95% CI, 0.79-2.44; P = .24), sepsis (OR 1.06; 95% CI, 0.89-1.25; P = .45), or low output syndrome (OR 0.82; 95% CI, 0.55-1.23; P = .38). The two groups also were comparable in terms of length of stay (+0.014 days; 95% CI, -0.36 to +0.38 days; P = .94), as well as total costs (-\$2,338; 95% CI, -\$10,454 to +\$5,777; P = .20).

Conclusions: In a contemporary US nationwide database, off-pump CABG did not reduce operative mortality among octogenarians, but it was significantly associated with a lower risk of stroke. Current evidence does not support a routine use of off-pump CABG in octogenarians, but it represents a valuable strategy in subjects at higher risk of stroke.



Surgical Treatment of Hypertrophic Obstructive Cardiomyopathy in Patients With Severe Hypertrophy, Septal Myocardial Fibrosis, and Ventricular Tachycardia

K. Borisov

German-Russian Cardiac Clinic, Moscow, Russia

Purpose: In patients with hypertrophic obstructive cardiomyopathy (HOCM), myocardial fibrosis is an independent predictor of adverse outcome. A new technique for surgically correcting HOCM in patients with severe hypertrophy and septal myocardial fibrosis has been proposed.

Methods: Twelve HOCM patients with severe hypertrophy (NYHA class 3.1), septal myocardial fibrosis, and episodes of ventricular tachycardia (VT) underwent this procedure (mean age 33.7 years ± 18.3 years). Five patients had biventricular obstruction. The follow-up period was 49 months ± 9 months. The excision of the asymmetrical hypertrophied area of the interventricular septum (IVS) causing obstruction was performed from the conal part of the right ventricle corresponding to the zone of obstruction of the left ventricle (LV). The areas of septal myocardial fibrosis were removed corresponding to the zone of delayed enhancement (DE) imaging. This excision was carried out on the right side.

Results: Ten patients were free of symptoms (NYHA class 1), and two patients had only mild limitations. The mean echocardiographic gradient in LV decreased from 89.9 mm Hg \pm 2.6 mm Hg to 9.1 mm Hg \pm 2.2 mm Hg in 12 patients, and the mean value of gradient in right ventricular outflow tract was reduced in five patients from 43.4 mm Hg \pm 5.2 mm Hg to 4.3 mm Hg \pm 1.3 mm Hg. Echocardiographically determined septal thickness was reduced from 34.7 mm \pm 3.1 mm to 15.6 mm \pm 2.1 mm. Sinus rhythm without block of His bundle right branch was noted in all patients after surgery. VT was not registered. None of the patients needed implantation of cardioverter-defibrillator.

Conclusions: This novel technique of HOCM surgical correction provides the precise removal of the areas of septal fibrosis and effective elimination of biventricular obstruction in patients with severe hypertrophy who cannot be treated with the current surgical techniques. The approach avoids mechanical damage to the heart conduction system.

Independent Assessment and Validation of a Long-Term Survival Probability Calculator for Isolated Coronary Artery Bypass Grafting

T. S. Lancaster¹, M. R. Schill^p, J. Greenberg³, C. Ruaengsri¹, R. B. Schuessler³, J. S. Lawton¹, H. S. Maniar¹, M. K. Pasque⁴, M. R. Moon³, R. Damiano¹, S. Melby⁴

¹Washington University School of Medicine, St Louis, MO, ²Washington University School of Medicine, Webster Groves, MO, ³Washington University, St Louis, MO, ⁴Barnes-Jewish Hospital, Washington University, St Louis, MO

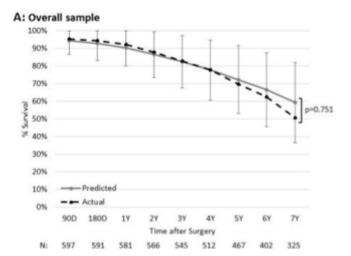
COMMERCIAL RELATIONSHIPS R. Damiano: Research Grant, AtriCure; Speakers Bureau/Honoraria, LivaNova, AtriCure, CryoLife; M. R. Moon: Speakers Bureau/Honoraria, Medtronic; M. K. Pasque: Ownership Interest/Royalty Income, Cardiowise; M. R. Schill: Other Research Support, AtriCure

Purpose: Existing risk prediction tools for short-term morbidity and operative mortality help guide clinical decision making around cardiac surgical procedures. The recently developed STS/ACC ASCERT Long-Term Survival Probability Calculator is a valuable addition to such resources, but has yet to be widely adopted or independently validated.

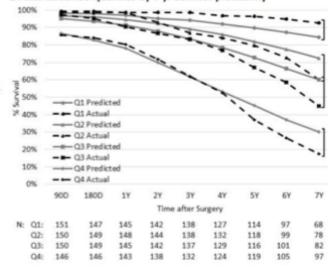
Methods: Institutional data were reviewed on 654 patients ≥65 years of age undergoing isolated coronary artery bypass grafting (CABG) surgery over a 6-year period (2005-2010). Predicted survival probabilities were calculated using the STS/ACC ASCERT Long-Term Survival Probability Calculator. Survival data were collected using the Social Security Death Index and institutional medical records. Predicted survival curves were compared to actual survival curves for the overall sample and for patient subgroups, which were risk-stratified based on predicted 7-year survival probability and predicted risk of operative mortality (PROM) from the widely used STS Risk Calculator. A multivariate logistic regression analysis was performed to evaluate additional perioperative variables contributing to survival.

Results: The median PROM for the overall sample was 2.0%, which was not different than the actual operative mortality of 2.0% (13/654), P = 1.0. Follow-up survival data were obtained in 88.8% (581/654) of patients at 1 year and 71.6% (325/454) at 7 years after surgery. Overall survival was 92.1% (569/597) at 1 year and 50.5% (164/325) at 7 years. There were no significant differences between the predicted and actual survival curves for the overall sample (Figure, panel A) or for the risk-stratified subgroups, whether stratification was performed by predicted 7-year survival (Figure, panel B) or by PROM (not shown). On multivariate analysis, additional variables predictive of 7-year mortality included PROM (OR 1.35; 95% CI, 1.23-1.49; P < .001), postoperative prolonged ventilation (OR 3.11; 95% CI, 1.38-1.02; P = .006), and hospital length of stay (OR 1.10; 95% CI, 1.04-1.17; P = .001).

Conclusions: The STS/ACC ASCERT Long-Term Survival Probability Calculator was independently validated for the estimation of long-term survival after isolated CABG in all risk groups. While the new tool provides useful information for preoperative decision making, the widely used short-term PROM also was predictive of long-term survival.



B: Risk-stratified quartiles by 7 yr survival probability



A Contemporary Strategy for Triaging and Treating Patients With Massive Pulmonary Embolism Utilizing Venoarterial Extracorporeal Membrane Oxygenation

Z.N. Kon¹, C. Pasrija², A. Kronfli¹, M. Raithel¹, S. Pousatis¹, M. Ghoreishi¹, B. S. Taylor³, J. S. Gammie¹, S. Pham², B. P. Griffith¹

¹University of Maryland School of Medicine, Baltimore, ²University of Maryland, Baltimore, ³University of Maryland Medical Center, Baltimore

COMMERCIAL RELATIONSHIPS J. S. Gammie: Ownership Interest/Founder, Harpoon Medical, Correx, Inc; Consultant/ Advisory Board, Edwards Lifesciences Corporation; B. S. Taylor: Speakers Bureau/Honoraria, Medtronic

Purpose: The management of massive pulmonary embolism (MPE) remains challenging, with significant mortality. Although venoarterial extracorporeal membrane oxygenation (VA-ECMO) has been reported, its use as salvage therapy has been associated with poor outcomes. We reviewed our experience with a protocolized, aggressive use of VA-ECMO to triage, optimize, and treat these patients.

Methods: All patients with confirmed MPE that were placed on VA-ECMO (2014-2016) as an initial protocolized intervention were reviewed retrospectively. ECMO support was continued until organ optimization was achieved and/or neurological status was determined. At that time, if the thrombus burden resolved, decannulation was performed. If significant clot burden was still present with evidence of right ventricular (RV) strain, operative therapy was undertaken. Primary outcomes were in-hospital and 90-day survival. Secondary outcomes included pre-discharge RV dysfunction by transthoracic echocardiogram, post-cannulation stroke, sepsis, vascular complications requiring surgical intervention, and new renal failure requiring renal replacement therapy (RRT) at discharge.

Results: Twenty patients with a median age of 50 years were identified. Pre-cannulation, all patients had an RV/LV ratio >1.0 and severe RV dysfunction with a median troponin of 1.3 ng/mL (interquartile range [IQR] 0.5-2.0 ng/mL) and N-terminal pro b-type natriuretic peptide of 3,670 pg/mL (IQR 630-13,400 pg/mL). 30% of patients received fibrinolytics prior to cannulation, and 20% suffered a cardiac arrest with uncertain neurologic status. The median duration of ECMO support was 5.1 days (IQR 3.7-7.0 days), with significant improvement in end-organ function (Table). Ultimately, 40% received only anticoagulation, 55% underwent surgical pulmonary embolectomy, and 5% underwent catheter-directed therapy. Care was withdrawn from one patient with a pre-cannulation arrest after confirmation of neurologic death. In-hospital and 90-day survival from ECMO decannulation was 100%. No patients developed a new stroke or sepsis after cannulation; however, 5% required post-discharge RRT, and one patient suffered a vascular complication. At discharge, 18/19 patients had normal RV function, and one patient, who received catheter-directed therapy, had mild dysfunction.

Conclusions: VA-ECMO appears to be an effective tool to optimize end-organ function as a bridge to recovery or intervention, with excellent outcomes. This approach may allow clinicians to better triage MPE patients to the appropriate therapy based on recovery of RV function, residual thrombus burden, operative risk, and neurologic status.

	Pre-ECMO	Post-ECMO	p-value
Lactate (mmol/L)	5.6 (IQR: 2.3-8.0)	1.3 (IQR: 0.75-2.0)	0.005
pH	7.18 (IQR: 7.10-7.30)	7.39 (IQR: 7.36-7.44)	<0.001
HCO3 (mmol/L)	17 (IQR: 16-21)	23 (IQR: 22-25)	0.001
PaO2/FiO2 (mmHg)	120 (IQR: 98-194)	248 (IQR:205-384)	0.001
Creatinine (mg/dL)	1.65 (IQR: 1.27-2.09)	0.98 (IQR: 0.83-1.68)	0.04
AST (U/L)	342 (IQR: 43-988)	92 (IQR: 74-142)	0.02

Re-Examining the Role of Standard Aortic Valve Replacement Following Mediastinal Radiation Therapy

A. Ghoneim, I. Bouhout, P. Demers, M. Pellerin, L. P. Perrault, M. Carrier, D. Bouchard, R. Cartier, N. Poirier, I. El Hamamsy

Montreal Heart Institute, Canada

COMMERCIAL RELATIONSHIPS D. Bouchard: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, LivaNova

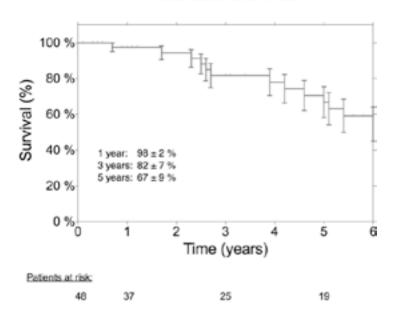
Purpose: The potential perioperative risks for patients after mediastinal radiation therapy (MRT) remain underestimated in traditional risk scores. With the advent of less invasive approaches for aortic valve replacement (AVR), the actual risks should be clearly defined. The aim of this study was to examine perioperative and mid-term outcomes in patients undergoing AVR following MRT.

Methods: From 2000 to 2016, 48 consecutive patients (54% female; mean age 60 years \pm 12 years) previously exposed to MRT underwent AVR with or without concomitant procedures at a single center. Patients were divided into three groups depending on the level of MRT: extensive (n=31), variable (n=7), and tangential (n=10). Data were collected prospectively. The mean Logistic EuroSCORE II was 2.8% \pm 3.4%, and the mean STS score was 1.7% \pm 1.5%. Median follow-up was 6.6 years (range, 0.3-8.5 years) and was 90% complete within 12 months of study closure.

Results: In-hospital mortality was 10.4% (5/48), which is higher than all predicted scores. Causes of death were severe RV dysfunction (n=2), multiorgan failure (n=2), and sudden cardiac arrest 10 days after surgery (n=1). Nine patients (19%) developed acute renal injury, of which six required temporary hemofiltration (12%). Seven patients (15%) required permanent pacemaker implantation. Actuarial survival was 98% ± 2%, 82% ± 7%, and 67% ± 9%, at 1, 3, and 5 years, respectively. A total of 21 patients died at mid-term follow-up. Mean interval of death was 1.5 years ± 2 years from surgery. The cause of death was cardiac in nine patients (43%), noncardiac in five patients (24%), and recurrence of malignancy in seven patients (33%). Four patients (8%) underwent reoperative cardiac surgery. Seven patients (15%) had recurrence of malignancy with a mean interval of 3.5 years ± 2 years from the time of surgery.

Conclusions: AVR in patients with MRT is associated with high perioperative mortality and poor mid-term survival. In addition, commonly used risk scores significantly underestimate the risk of mortality in these patients. Therefore, alternative, less invasive approaches, such as transcatheter AVR, should be strongly considered in this challenging patient population.

Mid-term survival



Operative precedures	N = 48 (N (%) or median)
Mechanical AVR	20 (42%)
Biological AVR	25 (52%)
Ross procedure	3 (6%)
Concernitant procedures	
CABG	24 (50%)
MV replacement	8 (17%)
MV repair	4 (8%)
TV repair	1 (2%)
Aortic root enlargement	2 (4%)
Replacement of ascending sorta	4 (8%)
Reconstruction of the aorto-mittal continuity	3 (6%)
Pericardiectomy	3 (6%)
Septul myectomy	1 (2%)
Postoperative Outcomes	
In-hospital mortality	5 (10%)
ARF (STS)	9 (19%)
LV/RV failure	9 (19%)
Complete AV block/PPM	7 (15%)
Intubation> 24 hours	12 (25%)
ICU stay, d., median (range)	5 (1-30)
Hospital stay, d , median (range)	9 (3-30)

Long-Term Success of the Concomitant Cox-Maze Procedure: Does Energy Source Have an Impact?

N.Ad, S. Holmes, G. Pritchard, D. Lamont, L. M. Fornaresio

Inova Heart and Vascular Institute, Falls Church, VA

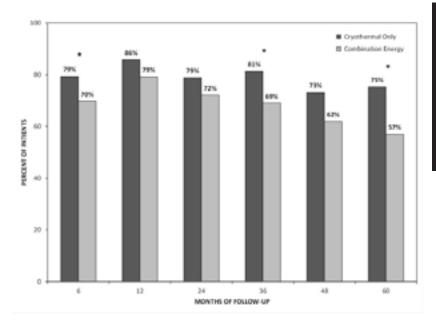
COMMERCIAL RELATIONSHIPS N. Ad: Consultant/Advisory Board, AtriCure, LivaNova; Speakers Bureau/Honoraria, Medtronic; Ownership Interest, Left Atrial Appendage Occluder, LCC

Purpose: The Cox-Maze (CM) procedure routinely is performed utilizing ablation technology. There is only limited information on long-term outcomes of CM, especially for devices with proven consistent transmurality. The purpose of this study was to examine safety and efficacy of concomitant CM and the potential impact of energy source.

Methods: The sample was composed of concomitant CM patients (n=709) between 2005 and 2016 with ablation performed with cryothermal energy only (Group 1; n=386) or a combination of cryothermal+bipolar radiofrequency (Group 2; n=323). Surgeries were performed by multiple surgeons and data were collected prospectively on perioperative outcomes, ablation success per Heart Rhythm Society guidelines, survival, and thromboembolic and bleeding events. The O/E ratio for operative death was calculated using EuroSCORE II for expected values. Propensity score matching was conducted to simulate randomization and compare outcomes by energy source (Group 1 vs Group 2). After matching, 298 patients from each energy source group were included.

Results: In the full sample, perioperative incidence of stroke was 0.6% (n=4), reoperation for bleeding was 3% (n=23), renal failure was 5% (n=33), readmission <30 days was 12% (n=86), and operative death <30 days was 2% (n=16; O/E ratio 0.50). Independent predictors for 1-year and 5-year rhythm success were shorter AF duration (OR 0.93, P=.001; OR 0.93, P=.042) and cryothermia alone (OR 1.77, P=.020; OR 2.29, P=.009). After propensity score matching, sinus rhythm (SR) at 6, 12, 24, and 60 months was similar for Group 1 (90%, 93%, 85%, 83%) and Group 2 (88%, 88%, 82%, 72%). However, Group 1 had higher return to SR off antiarrhythmic drugs at 6 months (P=.016), 36 months (P=.010), and 60 months (P=.008; Figure). Interestingly, stroke incidence was lower for Group 1 (0.7% vs 3%, P=.033), with no difference in major bleeding (10% vs 11%, P=.597). In mean follow-up of 51 months, groups were similar on survival (Log Rank=0.6, P=.452).

Conclusions: Concomitant Cox-Maze procedures performed with cryothermal energy alone or combined with bipolar radiofrequency ablation are safe and exceedingly effective. Our results show that high success is maintained through 5 years of follow-up. The association of cryothermal energy alone with better success and stroke reduction should be investigated further.



POSTER ABSTRACTS

P16

Cardiac Magnetic Resonance Assessment of Right Ventricular Function After Tricuspid Valve Repair for Moderate Functional Tricuspid Regurgitation: A Prospective Randomized Trial

M. Ghoreishi', J. Collins¹, J. Jeudy¹, C. Watkins¹, C. Pasrija², S. Maghami¹, N. Foster¹, B. P. Wehman¹, M. Y. Dawood¹, B. S. Taylor³, B. P. Griffith¹, J. S. Gammie¹

¹University of Maryland School of Medicine, Baltimore, ²University of Maryland, Baltimore, ³University of Maryland Medical Center, Baltimore

COMMERCIAL RELATIONSHIPS J. S. Gammie: Ownership Interest/Founder, Harpoon Medical, Correx, Inc; Consultant/ Advisory Board, Edwards Lifesciences Corporation; B. S. Taylor: Speakers Bureau/Honoraria, Medtronic

Purpose: The purpose of this study was to compare right ventricular (RV) function and volume assessed by serial cardiac magnetic resonance (CMR) among patients enrolled in a prospective randomized trial assessing the worth of tricuspid valve (TV) repair for moderate functional tricuspid regurgitation (FTR) during mitral valve (MV) operation.

Methods: Patients with preoperative moderate FTR undergoing MV operation were randomized to mitral operation alone or with TV repair with an undersized nonplanar rigid tricuspid annuloplasty ring. Electrocardiographic-gated two-dimensional phase-contrast velocity mapping CMR imaging was conducted on each patient preoperatively and at 1-year follow-up to assess ventricular function and volumes and TR severity. The tricuspid annular plan systolic excursion (TAPSE) value was measured with transthoracic echocardiography. All studies were performed in a core laboratory. Preoperative values were compared with follow-up data in each group and a P value < .05 was considered significant.

Results: Of 41 randomized patients, 22 (55%) consented to undergo serial CMR studies and were included in the study (TV repair = 9, no TV repair = 13). The mean age was 70 years \pm 8 years. All patients had preoperative moderate FTR assessed by echocardiography. Preoperative TAPSE was identical in each group (2.2 cm \pm 0.5 cm, P = .4). Operative mortality was 0%. CMR-assessed RV ejection fraction increased from 44% to 53% in the MV group (P = .07) compared with 42% to 61% in the MV+TV group (P = .02). RV reverse remodeling was observed in both groups but was more pronounced in the MV+TV group (Table). RV systolic dimension decreased from 80 mL to 66 mL in the MV group (P = .2) and from 95 mL to 53 mL in MV+TV group (P = .03). At 1 year, no patient had TR > moderate.

Conclusions: This trial demonstrated favorable RV reverse remodeling after MV operation. Addition of TV repair for moderate FTR was associated with greater improvement in RV function/volumes. Comprehensive assessment of TV by CMR is feasible and enables determination of ventricular function/volume and TR severity. Larger prospective trials can provide further evidence for this strategy.

	Preoperative	Follow up	P
CMR data	Preoperative	Follow up	P:
RV EF (%)			
MV	44+18	53±12	0.07
MV+TV	42±19	61±10	0.02*
RVEDV (ml)	Sanna	22000	100
MV	149±83	136±71	0.2
MV+TV	157+85	129467	0.5
RVESV (ml)	100000	1000	
MV	60a50	67±48	0.4
MV+TV	95±74	53±43	0.03*
LV EF (%)	CALCULATION OF THE PARTY OF THE		745 846
MV	58±16	58±11	0.4
MV+TV	54±8.5	56±8	0.2
Echecardiography			
IPAP			
MV	60±21	40+13	0.01*
MV+TV	70+21	41+20	0.003*
TAPSE			
MV	2.2±0.5	1.8+2.8	0.03*
MV+TV	2.2±0.5	1.7±1.	0.02*
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*Statistically significant, CMR: Cardiac magnetic resonance, RV: Right ventricular, MV: Mitral valve, TV: Tricuspid valve, RVEDV: Right ventricular end diastolic volume, RVESV: Right ventricular end systolic function, LVEF: Left ventricular ejection fraction, sPAP: Systolic pulmonary artery pressure, TAPSE: Tricuspid annular plan systolic excursion

Should the Dilated Ascending Aorta Be Repaired at the Time of Bicuspid Aortic Valve Replacement?

T. Kaneko¹, P. S. Shekar¹, V. Ivkovic¹, N. T. Longford¹, M. I. Sigurdsson¹, R. Neely¹, M. Yammine¹, J. I. Ejiofor¹, V. C. Monteiro Vieira¹, J. T. Shahram¹, J. P. Bloom², C. Huang¹, E. M. Isselbacher¹, J. D. Muehlschlegel¹, T. M. Sundt IIP, S. C. Body¹

¹Brigham and Women's Hospital, Boston, MA, ²Massachusetts General Hospital, Boston

COMMERCIAL RELATIONSHIPS T. Kaneko: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation; T. M. Sundt III: Consultant/Advisory Board, Thrasos Therapeutics

Purpose: Bicuspid aortic valve (BAV) aortopathy is repaired at the time of aortic valve replacement (AVR) to prevent future dissection. Current guidelines recommend 4.5 cm as the cutoff diameter; however, there are no strong data to support this. We hypothesized that in specific age and aortic diameter categories, aortic repair yields improved patient outcomes.

Methods: Between January 1, 2002, and June 30, 2014, 2,148 adults with BAV undergoing first aortic valve surgery at two academic institutions were identified from STS and hospital databases. Patients aged <18 years and ≥90 years or with a history of previous aortic/aortic valve surgery, transcatheter AVR, aortic resection for an unclampable aorta, or AVR for endocarditis were excluded from analysis. A composite outcome of mortality or reoperation was compared between AVR only and AVR with concomitant ascending aortic replacement (AVR-AAR) groups and was analyzed using Cox proportional hazards method.

Results: 1,325 patients were analyzed after exclusion. 684 patients underwent AVR only and 641 patients underwent AVR-AAR. AVR-only patients were older (71 years vs 68 years, P < .001), had higher creatinine (1.12 vs 1.04, P < .001), a higher incidence of heart failure (18% vs 15%, P < .001) and coronary artery disease (50% vs 36%, P < .001), more severe aortic stenosis and smaller maximal aortic diameter than the AVR-AAR group (40 mm ± 5 mm vs 49 mm ± 5 mm, P < .001). Operative mortality was 1% in both groups (P = .77), and 1- and 5-year freedom from mortality or reoperation was 94% vs 95% (P = .53) and 94% vs 92% (P = .14), respectively. Cox proportional hazards analysis did not identify age nor maximal aortic diameter to be predictors of the composite outcome. No specific aortic dimension or age category of either operative approach had improved outcomes.

Conclusions: In this series of BAV patients with aortopathy, both AVR-only and AVR-AAR had excellent outcomes. Contrary to our hypothesis, neither age nor diameter were predictors for mortality or reoperation. The cutoff diameter of 4.5 cm in current guidelines should be a flexible criterion when deciding the type of operation in these patients.

Postoperative Outcomes of Cardiac Surgery in Abdominal Solid Organ Transplant Recipients

T. Kohmoto¹, S. Osaki¹, D. Kaufman¹, A. Badami¹, Y. Shan¹, N. DeOliveira¹, S. A. Akhter², L. Lozonschi¹, E. Lushaj¹

¹University of Wisconsin, Madison, ²University of Wisconsin School of Medicine and Public Health, Madison

Purpose: Cardiovascular disease is a cause of morbidity and mortality in organ transplant recipients. Cardiac surgery (CS) is not uncommon in this population. We evaluated 30-day morbidity and mortality in this retrospective study of abdominal transplant (ATx) recipients undergoing CS at our institution.

Methods: 138 patients with previous kidney (n=96), kidney-pancreas (n=23), and liver (n=19) transplants underwent CS (coronary artery bypass grafting, n=71; valve, n=58; other, n=9) between 2000 and 2014. Patients undergoing CS without a history of ATx were used as controls. Propensity scores were used to match control patients (137 of 6,654) for type of CS, year of CS, age, gender, body mass index, history of diabetes, and pre-CS creatinine levels.

Results: Median time from ATx to CS was 83 months (interquartile range 37-144 months). Patients with ATx had a longer hospital stay at CS, 7 days (5-14 days) vs 6 days (4-10 days) (P = .033). ICU stay was similar in both groups, 38 hours (21-63 hours) vs 43 hours (24-64 hours) (P = .52). Patients with a history of ATx had more strokes (3.6% [all in kidney transplanted patients] vs 0%, P = .026) and a higher tendency for developing pneumonia after CS (6% vs 2%, P = .092). Post-CS pneumonia rate was similar between kidney, kidney-pancreas, and liver transplanted patients (P > .05). There was no difference in the incidence of renal failure, postoperative bleeding, infection, atrial fibrillation, and 30-day readmissions between transplanted and non-transplanted patients. Six patients (4%) died within 30 days post-discharge in the ATx group (five kidney, one liver, zero kidney-pancreas) and two (1.4%) in the control group (P > .05).

Conclusions: Previous history of ATx is associated with an increased incidence of stroke, pneumonia, and longer hospital stay after CS. ATx does not affect 30-day mortality after CS. Cardiac surgery can be performed safely in patients after solid organ transplant with low mortality and acceptable morbidity.

Nishinomiya, Japan

Impact of Diabetic Severity on Reverse Left Ventricular Remodeling, Renal Function, and Survival Following Surgical Revascularization for Ischemic Cardiomyopathy

S. Kainuma¹, K. Taniguch², K. Toda³, T. Funatsu⁴, T. Nakamura³, S. Miyagawa³, Y. Yoshikawa³, S. Fukushima², S. Saito³, D. Yoshioka³, H. Nishi⁵, T. Takahashi⁵, M. Sakaki⁰, H. Matsue⁻, T. Sakaguchi⁰, H. Yoshitaka⁰, T. Ueno⁰, T. Kuratani⁰, T. Masai¹, T. Daimon¹⁰, Y. Sawa³
¹Sakurabashi Watanabe Hospital, Osaka, Japan, ²Japan Labor Health and Welfare Organization, Osaka Rosai Hospital, Sakai, Japan, ³Osaka University Graduate School of Medicine, Suita, Japan, ⁴Osaka Rosai Hospital, Sakai, Japan, ⁵Osaka Police Hospital, Osaka, Japan, °Osaka National Hospital, Osaka, Japan, ³The Sakakibara

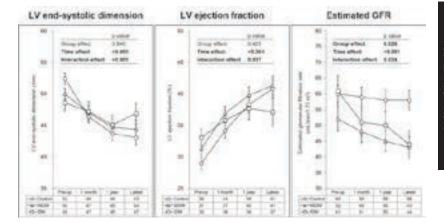
Heart Institute of Okayama, Japan, Osaka University, Suita, Japan, Hyogo College of Medicine,

Purpose: An increasing number of diabetes mellitus (DM) patients with severe left ventricular (LV) dysfunction has led to increased referrals for surgical revascularization. We examined the association of diabetic severity with postoperative LV reverse remodeling, change in renal function, and late outcome following surgical revascularization in patients with advanced ischemic cardiomyopathy.

Methods: We classified 183 patients (67 years ± 9 years, 159 males) with advanced ischemic cardiomyopathy (ejection fraction equal to or less than 40%) who received initial coronary artery bypass grafting (CABG) surgery into non-DM (n=64, control), non-insulin-dependent DM (n=75, NIDM), and insulin-dependent DM (n=44, IDM) groups. Patients with a history of open heart surgery and those who received concomitant valve surgery or surgical ventricular reconstruction were excluded from this study.

Results: Mean predicted 30-day mortality using EuroSCORE II did not differ among the groups (control 9.4%, NIDM 9.3%, IDM 8.5%), while observed operative mortality was 1.6%, 4.0%, and 6.8%, respectively (P = .37). During follow-up (mean 58 months), there were 60 deaths, 57 heart failure readmissions, 27 myocardial infarctions and/or revascularizations, and 13 cerebral infarctions. The 5-year survival rate was 86%, 71%, and 61% in the control, NIDM, and IDM groups, respectively (P < .020), and freedom from those composite events was 65%, 46%, and 28%, respectively (P < .001). After adjusting for baseline demographics, NIDM and IDM were independently associated with composite events (NIDM: adjusted hazards ratio 1.7, 95% CI 1.0-2.8, P = .044; IDM: adjusted hazards ratio 3.4, 95% CI 1.9-6.0, P < .001). Serial echocardiography demonstrated LV function improvement at 1 year after surgery irrespective of treatment group, while IDM patients had a gradual increase in LV end-systolic dimension and worse improvement in LV ejection fraction (interaction effects P < .05 for both, left and center of Figure). During follow-up, estimated glomerular filtration in the NIDM and IDM groups steadily decreased, while that in the control group remained unchanged (interaction effects P = .024, right of Figure).

Conclusions: In ischemic cardiomyopathy patients indicated for surgical revascularization, diabetic severity was significantly associated with increased mortality risk and major adverse events late after surgery. Insulin-dependent diabetes may adversely influence postoperative reverse LV remodeling, accompanied by progressive renal impairment.



Permanent Pacemaker Placement in Transcatheter Aortic Valve Replacement Patients Is Not Associated With Increased Mortality or Readmission

F. H. McCarthy¹, D. Savino², D. Spragan², T. Dibble², K. A. Dufendach³, K. M. McDermott¹, W. Y. Szeto², P. Groeneveld², J. Giri², N. Desai²

¹Hospital of the University of Pennsylvania, Philadelphia, ²University of Pennsylvania,
Philadelphia, ³Perelman School of Medicine at the University of Pennsylvania, Philadelphia

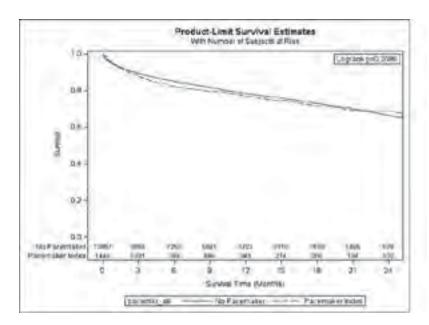
COMMERCIAL RELATIONSHIPS N. Desai: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation, Medtronic,
St Jude Medical, W. L. Gore & Associates; J. Giri: Research Grant, St Jude Medical; W. Y. Szeto: Research Grant, Bolton
Medical, Edwards Lifesciences Corporation, Medtronic; Consultant/Advisory Board, Microinterventional Devices

Purpose: There currently is debate regarding possible protective or harmful effects of permanent pacemaker (PPM) placement in patients following transcatheter aortic valve replacement (TAVR). The purpose of this study is to investigate the relationship between permanent pacemaker implantation and long-term patient outcomes among Medicare beneficiaries undergoing TAVR.

Methods: Medicare carrier claims and Medicare Provider Analysis and Review (MEDPAR) files were used to identify all TAVR patients (n=16,696) between January 2011 and December 2013 collected by the Centers for Medicare & Medicaid Services. Pacemaker procedures were identified using International Classification of Diseases, Ninth Revision (ICD-9) codes. MEDPAR files were used to identify pacemaker implantations at index hospitalization, 30 days, 90 days, and 1 year post-implant. Comorbidities present on implantation were assigned ICD-9 codes and a modified Elixhauser comorbidity index. Univariate Kaplan-Meier survival estimates and multivariate models were used to analyze survival and risk factors for pacemaker implantation.

Results: A total of 14,305 TAVR patients were included in this study. Patients with PPMs placed prior to TAVR were excluded. Mean patient age was 83.3 years ± 7.5 years. 1,744 patients (11%) received PPMs post-TAVR with 1,448 (9%) at index hospitalization, 115 patients (1%) at 30 days post-implant, 72 patients (0.5%) at 90 days post-implant, and 83 patients (1%) at 1 year post-implant. Multivariable regression analysis indicated that age greater than 90 years and renal failure were predictors of PPM placement (Table). Kaplan-Meier estimates revealed no significant difference in long-term survival between patients receiving pacemakers and those without pacemakers (Figure). PPM placement was not a significant predictor of overall mortality with Cox regression analysis (HR 1.03; 95% CI, 0.91-1.16; P = .69). No significant difference was seen in 30-day, 90-day, or 1-year readmissions between patients without a permanent pacemaker and those with pacemakers.

Conclusions: Permanent pacemaker implantation in TAVR patients is common during index hospitalization, although rare thereafter. Permanent pacemaker implantation was not associated with increased or decreased mortality risk or readmission in TAVR patients.



Parameter	Odds Ratio	Lower 95% CI	Upper 95% CI	p value
Male	1.004	0.89	1.12	0.94
White	1.09	0,86	1.37	0.49
CHF	1.09	0.95	1.26	0.21
Pulmonary Hypertension	0.99	0.88	1.12	0.92
PVD	0.84	0.74	0.94	0.003
COPD	0.96	0.85	1.07	0.43
Renal failure	1.17	1.04	1.32	0.009
Liver disease	1.03	0.72	1.48	0.88
Diabetes	1.04	0.93	1.18	0.47
Anemia	1.01	0.89	1.13	0.93
Hypertension	0.96	0.79	1.16	0.65
Patient age 70 - 80	0.95	0.73	1,24	0.71
Patient age 80 - 90	1.25	0.97	1.59	80.0
Patient age > 90	1.68	1.28	2.19	0.0002

The Influence of Ultrafiltration on Red Blood Cell Transfusion During Cardiopulmonary Bypass

A. P. Kypson¹, A. H. Stammers², E. A. Tesdah^p, L. B. Mongero², K. E. Engstad³, S. Weinstein²
¹East Carolina Heart Institute at East Carolina University, Greenville, NC, ²SpecialtyCare,
Nashville, TN, ³Legacy Health, Portland, OR

COMMERCIAL RELATIONSHIPS A. P. Kypson: Speakers Bureau/Honoraria, Edwards Lifesciences Corporation; A. H. Stammers: Employment/Director of Clinical Quality and Outcomes Research, SpecialtyCare; E. A. Tesdahl: Employment, SpecialtyCare; S. Weinstein: Employment/Chief Medical Officer, SpecialtyCare

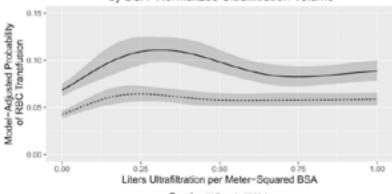
Purpose: Ultrafiltration during cardiopulmonary bypass (CPB) reduces fluid overload and inflammatory mediators associated with open heart surgery. It is thought to reduce morbidity, including reducing the risk of red blood cell (RBC) transfusion. We evaluated its effectiveness in reducing RBC transfusions in a large population of adults undergoing cardiac surgery.

Methods: We reviewed 97,939 cardiac surgery cases at 197 institutions between April 2012 and May 2016. The primary outcome was intraoperative transfusion of ≥1 unit RBC. Ultrafiltration volume (UV) was normalized to body surface area (BSA), and its effect on RBC transfusion risk was analyzed via logistic regression and restricted cubic splines. Controls included were age, gender, two hematocrit readings (first in operating room and nadir on CPB), BSA, acuity, urine output on CPB, volume added on CPB, net CPB priming volume, procedure type, minutes on CPB, use of retrograde autologous priming, and an interaction effect between gender and UV.

Results: Ultrafiltration was used in 42,515 cases (43.4%) and was associated with an increased crude rate of RBC transfusion (29.8% vs 20.9%, P < .001), as well as a statistically significant but small decrease in hematocrit (Table). Model-adjusted probability of transfusion was higher for all patients receiving ultrafiltration compared to those who did not, irrespective of UV removed. There was a statistically significant non-linear interaction between UV and gender (c^2 =21.6, df=6; P=.001) (Figure). After controlling for the 11 factors named above, women had a higher probability of receiving an RBC transfusion across the full range of UV. The probability of a transfusion increased as UV increased from 0 L/m² to 0.31 L/m² for women and from 0 L/m² to 0.25 L/m² for men, then decreased as UV progressed to 0.75 L/m² (women) and 0.50 L/m² (men). There was no additional reduction in risk of RBC transfusion beyond these points.

Conclusions: Ultrafiltration does not appear to reduce the risk of RBC transfusion during cardiac surgery. As UV increases, the associated risk of intraoperative RBC transfusion increases non-linearly. This effect is more pronounced for women. The use of ultrafiltration as a method for reducing intraoperative RBC transfusion warrants further study.

Figure. Model-Adjusted Probability of RBC Transfusion by BSA-Normalized Ultrafiltration Volume



Gender - Female -- Male

	Deat	Ustratitration Not Used	Uttratidration	D-rapie
N	97.000	88.434 (97.6%)	42,616 (65,610)	7570
RBC Transfusion*	24.207 (24.8)	91 (819 (20 N)	12,696 (29.8)	-0.801
Female Gender*	29 181 (29 6)	W6.277 (26.4)	(2.909 (90.4)	3.001
Litraffination Volume (L)*	Date 00 01 00 B	7 / 10 4 10 10 10 10 10 10 10 10 10 10 10 10 10	1.55 (1.00, 2.50)	1.4.1
Utraffication Liters per ESA per 3".	0.00 (0.00 0.00)		6.90 (5.47, 1.29)	-
Procedure Type "				
recipied CARCL	60.437 (61.7)	37 590 (67 8)	22.841 (53.7)	
Acres Surgery	170.00	1600-028	2.122 (5.3)	
AV Surgery + CARC	W DPS 76 76	4 698 (6 %)	4.388 (10.3)	
Compined AVMY Surgery	2.005 (2.0)	767 (1.46)	1,208 (Z.W.	<0.80%
recreted A's Surgery	12.6% (Q.1)	6.425 (11.60	9237 (947)	1
recided MY Surgery	9.797 (6.8)	2.662 (0.2)	1905 (9.2)	1
MV Surgery + CABG	5296 (2.3)	1.645 (2.5)	1.705 (6.2)	10000
Non-Elective Procedure	25.336 (26.5)	14 830 (26.8)	11.505 (27.1)	5.288
EAP Technique Lited	38.192 (27.0)	21,241 (38.3)	14,907 (35.2)	-0.001
ter OPS Crout Prese Volume (L)*	E 40 (9 45, 1 60)	0.60 (0.60, 1.00)	8 80 (0 80, 1 00)	+0.001
Volume Address on CPS (L)*	0.30 (0.06, 0.80)	0.01 (0.05, 0.90)	0.30 (0.07, 0.79)	9.001
Unite Output on OPS (L)*	0.26 (0.10, 6.47)	0.30 (3.10.0.30)	0.22 (0.12, 0.40)	+0.001
First Hernatours in OR *	36.00 (32.60, 36.80)	30 00 (13 46, 40 00)	25 00 (31 00, 30 00)	-0.001
Natir Inematopri on GPB *	25.00 (22.00, 28.00)	25-00-02 80, 29-50)	25 00 (21 89, 29-00)	-0.001
Minutes on CPS*	101 00 (76 00, 104 00)	101 00 (78 80, 131 00)	101:00 [74:00:100:00]	0.354
Age (years)*	87.00 (66.00, 74.00)	66 00 (16 SC, 74 S0)	67 00 (se 36, 75 00)	-0.601
BSA ov.	8.69 (1.82, 2.18)	2.40 (9.83, 2.94)	1.87 (1.80, 2.18)	-0.004

^{*}Continuous variables are given as median (interquantile range), with 3-values derived from Knaskai Walls rank sum tests

Optimal Surgical Management of Coronary Artery Aneurysms

L. E. Greiten, D. Joyce, L. D. Joyce, J. M. Stulak, K. L. Greason, A. Pochettino, R. C. Daly, H. V. Schaff, J. Dearani¹, K. King

Mayo Clinic, Rochester, MN

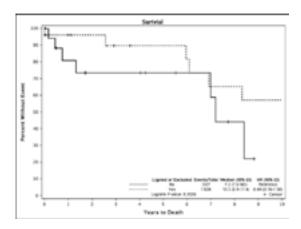
COMMERCIAL RELATIONSHIPS R. C. Daly: Ownership Interest, NeoChord

Purpose: Coronary artery aneurysms (CAA) represent a rare pathology occurring in 1.5%-5% of routine coronary angiograms. Limited data exist on the management of CAA at the time of coronary artery bypass grafting (CABG) surgery.

Methods: A single-institution, retrospective review was performed of 53 patients who underwent isolated CABG in the setting of CAA between 1993 and 2015. Patients were stratified based on treatment strategy: ligation/exclusion and bypass (n=26, ligation group) vs revascularization alone (n=23 CABG and n=4 PCI; non-ligation group). Comparisons were made with respect to mortality, need for further/concomitant interventions, and long-term cardiac function, including myocardial infarctions and congestive heart failure. The Kaplan-Meier estimator was used to compare mortality. Fisher's exact test and Wilcoxon rank sum test were utilized to analyze preoperative and operative characteristics.

Results: Management strategies included ligation and bypass in 26 patients and distal bypass only in 27 patients (with four of the patients in this group undergoing coronary stenting across the aneurysm). There were no significant differences in patient demographics (NYHA class, ejection fraction, congestive heart failure, hypertension) between the two groups. No significant differences were found in either 30-day (P = .74) or long-term mortality when exclusion of the CAA was performed compared with CABG alone (Figure, P = .20). More exclusion procedures were performed earlier in the experience (median surgical date in 2000), whereas bypass alone predominated later in the experience (median surgical date in 2007, P = .002).

Conclusions: The practice of CAA ligation, while still performed in selected cases, has largely been supplanted in patients undergoing CABG. Ligation doesn't appear to offer any advantage over isolated revascularization, supporting the current trends in managing this rare condition.



Is There Gender Discrimination in Coronary Revascularization? A Single-Center Retrospective Analysis of Multiple Arterial Coronary Grafting

H. Jabagi, F. D. Rubens, D. Tran, D. Glineur University of Ottawa Heart Institute, Canada

Purpose: Studies to date have failed to identify causal factors to explain discrepancies between male and female revascularization strategies, even when optimal matching algorithms are applied. We hypothesize that the rate of multiple arterial revascularization has been greater in men opposed to women, and this cannot be justified based upon risk covariates.

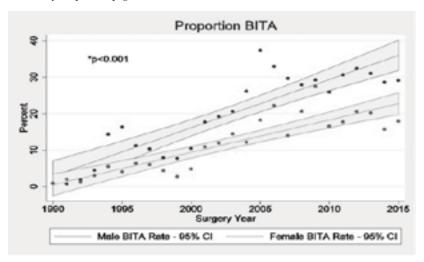
Methods: Data were reported from a single cardiac surgery center from 1990 to 2015 involving 22,636 patients who underwent primary coronary revascularization (5,131 women, 17,505 men). Logistic and linear regression were used to assess factors related to bilateral internal thoracic artery (BITA) grafting and the relative rates of grafting between genders.

Results: The rate of BITA grafting was 19.3% in men and 11.5% in women (P < .001). Factors associated with increased BITA grafting included male gender (OR 0.432; 95% CI, 0.327-0.537; P < .001), year of surgery (OR 0.128; 95% CI, 0.132-0.145; P < .001), decreasing age (P < .001), lower body mass index (P < .001), and decreased level of urgency (P < .001). There was a significant increase per year in the mean age of men who underwent BITA as compared to women (men 0.438, 95% CI, 0.367-0.510; women 0.193, 95% CI, -0.068 to 0.454, P = .038). The rate of growth of BITA was significantly decreased in women in all patients (difference 0.435% per year; 95% CI, 0.220-0.649; P < .001) and in low-risk (age <71 years, elective) patients (difference 0.808% per year; 95% CI, 0.149-1.468; P = .017). Finally, the rate of increase of triple arterial (radial and BITA) grafting was significantly decreased in women (difference 0.259% per year; 95% CI, 0.153-0.364; P < .001).

Conclusions: Our study corroborates previously reported revascularization gender differences. Women with CAD are disadvantaged as they are offered less multiple arterial revascularization, despite the lack of evidence to support this. Future studies should evaluate long-term outcomes of gender-matched cohorts of BITA patients to ascertain the clinical significance of this discrimination.

POSTER ABSTRACTS

Continued from previous page



Transcatheter Aortic Valve Replacement Outcomes in Nonagenarians Stratified by **Transfemoral and Transapical Approach**

C. McNeely¹, A. Zajarias¹, S. Markwell², R. Robbs², C. M. Vassileva³

¹Washington University, St Louis, MO, ²Southern Illinois University School of Medicine, Springfield, ³Medical University of South Carolina, Charleston

COMMERCIAL RELATIONSHIPS A. Zajarias: Research Grant, Edwards Lifesciences Corporation; Speakers Bureau/ Honoraria, Edwards Lifesciences Corporation

Purpose: Transcatheter aortic valve replacement (TAVR) is expanding nationally as a therapeutic option for those at higher operative risk, of which the elderly compose a disproportionate amount. In this study, we describe the survival and other postoperative outcomes of nonagenarians undergoing TAVR via transfemoral (TF) and transapical (TA) approaches using the Medicare database.

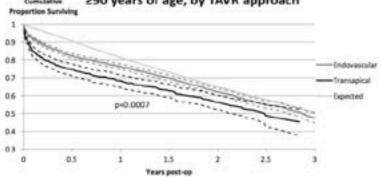
Methods: All Medicare beneficiaries >65 years of age who underwent TAVR from November 2011 to December 2013 were considered for inclusion. Patients with <1 year Medicare Part A coverage were excluded from this study. Comorbidities were determined using ICD-9-CM codes from all hospitalizations occurring in the 1-year period preceding and including the index admission for TAVR. Postoperative events and complications also were determined using ICD-9 codes. Survival curves were calculated using the cumulative proportion of surviving patients. Expected survival was based off an age-matched US cohort.

Results: The study population consisted of 18,283 patients, and 19.3% (3,531) were ≥90 years. Compared to patients <90 years, patients ≥90 years were less likely to have a number of comorbidities, including prior myocardial infarction (17.5% vs 21.8%), prior coronary artery bypass grafting surgery (20.0% vs 35.0%), and chronic obstructive pulmonary disease (25.4% vs 39.0%), among others (P = .0001 for all). Thirty-day mortality and 1-year mortality were 8.4% vs 5.9% (P = .0001) and 25.4% vs 21.5% (P = .0001) in the older and younger groups,respectively. Patients ≥90 years were more likely to undergo permanent pacemaker insertion (11.1% vs 8.3%, P = .0001). Among nonagenarians, when compared to the TA group, patients undergoing TF TAVR had a lower 30-day and 1-year mortality (7.2% vs 13.5% [P = .0001] and 23.8% vs 31.6% [P = .0001], respectively), were more likely to be discharged home (54.4% vs 34.1%, P = .0001), had shorter lengths of stay (6 days vs 8 days, P = .0001), and had lower readmission rates (23.8% vs 31.8%, P = .0001). In patients ≥90 years, those who underwent TF TAVR had lower rates of a number of postoperative complications compared to TA TAVR, including acute blood loss anemia, respiratory complications, postoperative shock, and venous thromboembolism.

Conclusions: In patients undergoing TAVR, 30-day and 1-year mortality rates were slightly worse for nonagenarians compared to those less than 90 years of age, but long-term survival was still good, with 75% of nonagenarians living to 1 year. Transapical TAVR in nonagenarians is associated with significantly worse outcomes including survival.

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Long-term survival following TAVR in patients ≥90 years of age, by TAVR approach



Dashed lines represent 95% confidence intervals Expected denotes age-matched US population

Procedural outcomes of TAVR - <90 vs. ≥90 and ≥ 90 Endovascular vs. ≥ 90 Transapical

	ALTAVR	490 ME TAVE	HISO ME TAUR	d- value	≥ 90 Endovasoular	± 90 Transapiosi	D- value
N	18,283	14.752	3.531		2.862	659	
Mortality rate							
30 days	0.4%	1.8%	8.4%	1000	7.2%	13.8%	.0001
1 year	22.3%	21.5%	25.4%	.0001	23.8%	21.0%	0021
30-day Readmission rate	23.7%	23.4%	25.2%	6283	23.8%	21.8%	1000
LOS	4		7	.0362			.0001
Discharge destination:							
Home	61.7%	63.6%	60.8%	.0001	54.6%	34.1%	10001
Nursing facility	25.9%	24.0%	33.8%	1000	31.8%	42.2%	0001
Reheb	6.0%	5.8%	7.0%	.0000	6.3%	9.7%	.0021
Resperator (SAVR)	0.5%	65%	0.5%	8247	0.6%	-	
Permanent pacemaker implantation:	0.9%	8.2%	11.1%	1000	10.9%	11.4%	7425
Acute anemia/hemorrhage complicating a procedure	33.0%	32.7%	34.2%	.0541	21.1%	47.2%	.0001
Surgicel site infection	0.8%	0.5%	0.8%	.6548	0.4%	460	
Respiratory complications (pne/felure)	6.5%	6.4%	6.0%	2754	8.2%	0.0%	.0008
Postoperative siroke	1.5%	1.4%	1.8%	0564	1.8%	2.0%	4936
Postoperative shock	2.2%	2.1%	2.6%	1155	2.0%	4.7%	80001
VTE	1.1%	1.1%	0.9%	2657	0.7%	1.7%	.0162
AKI post procedure	1.1%	1.0%	1.8%	.0004	1.5%	2.1%	2658

⁻ Denotes that the data is not reportable due to too fine subjects (n=11)

National Trends and Geographic Variation in Bilateral Internal Mammary Artery Use in the United States

A. Iribarne, J. DeSimone, A. W. Discipio, A. M. Flores, J. N. McCullough Dartmouth-Hitchcock Medical Center, Lebanon, NH

Purpose: To characterize the adoption rate and regional variation in bilateral internal mammary artery (BIMA) use during coronary artery bypass grafting (CABG) surgery in the United States.

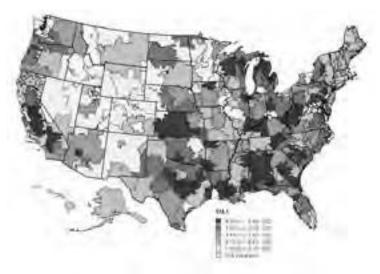
Methods: Observational study of 100% sample of fee-for-service Medicare beneficiaries aged 65 and older, continuously enrolled in Parts A and B for all 12 months of a given calendar year, from 2009 to 2014 (n=162,860,439). Rates of BIMA vs single internal mammary artery (IMA) use during CABG are expressed per 1,000 beneficiaries and aggregated by Hospital Referral Region (HRR). An HRR is a validated unit for quantifying regional variation in health care. There are 306 HRRs in the US, with each HRR containing a minimum population size of 120,000 and at least one hospital that performs major cardiovascular procedures.

Results: The absolute national rate of BIMA use declined during the study period from 0.216 claims per 1,000 beneficiaries in 2009 to 0.143 in 2014 (P < .001). When indexed to overall CABG volume, BIMA use remained constant over time (P = .02). The Figure shows the regional variation in IMA and BIMA use aggregated from 2009 to 2014 by HRR. IMA use ranged from 1.3-8.5 claims per 1,000 Medicare beneficiaries, whereas BIMA use ranged from 0.03-1.5 (P < .001). There was a significant correlation between regional volume of IMA use and likelihood of BIMA use (correlation coefficient=0.673, P < .001). While both IMA and BIMA use correlated with regional volume of diagnostic cardiac catheterization, the correlation was stronger for IMA use (coefficient 0.962 vs 0.682, P < .001). Likewise, while both IMA and BIMA use correlated with regional volume of diagnostic stress tests, the correlation was stronger for IMA (coefficient 0.918 vs 0.641, P < .001).

Conclusions: Over the past 5 years, there was no growth in BIMA use among Medicare beneficiaries, and the frequency of BIMA use during CABG remained low. There was significant regional variation in BIMA use, however, which demonstrates opportunity for continued growth of BIMA grafting in the US.

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Arterial conduit use per 1,000 Medicare beneficiaries from 2009-2014





Trends in Aortic Valve Replacement Procedures and Adverse Events Among Medicare Beneficiaries in US Hospitals From 2009-2014: Has Transcatheter Aortic Valve Replacement Made a Difference?

M. R. Katz¹, D. Cohen², A. D. Kugelmass³, M. R. Reynolds⁴, P. P. Brown⁵, M. Schlosser⁶, S. D. Culler, A. W. Simon⁶

¹Bon Secours Heart & Vascular Institute and the University of Virginia, Richmond, ²Saint Luke's Mid America Heart Institute, Kansas City, MO, ³Baystate Health, Springfield, MA, ⁴Lahey Hospital and Medical Center, Burlington, MA, 5 Nashville, TN, 6 Health Trust, Brentwood, TN, ⁷Emory University, Atlanta, GA

COMMERCIAL RELATIONSHIPS D. Cohen: Research Grant, Boston Scientific, Edwards Lifesciences Corporation, Medtronic; Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic, St Jude Medical; M. R. Katz: Consultant/Advisory Board, Abbott Laboratories, St Jude Medical; M. R. Reynolds: Consultant/Advisory Board, Edwards Lifesciences Corporation, Medtronic, St Jude Medical

Purpose: Aortic valve disease is expected to grow as the US population ages and with transcatheter aortic valve replacement (TAVR) established as a less invasive option. This study examined 6-year trends in aortic valve procedures and selected adverse outcomes among Medicare beneficiaries (MBs).

Methods: A retrospective analysis was conducted using the annual Medicare Provider Analysis and Review data files for fiscal years (FY) 2009 through 2014. The study sample consisted of 182,669 MBs undergoing isolated aortic valve procedures (valvuloplasty, replacement surgery with tissue, replacement surgery with non-tissue, or TAVR) in a US hospital. Up to 25 ICD-9-CM procedure and diagnosis codes were used to identify procedures and six selected adverse events. In-hospital mortality and cumulative all-cause 30- and 90-day post-discharge mortality rates were calculated. The analysis is descriptive.

Results: The number of MBs undergoing aortic valve procedures increased from 22,564 to 40,754 (75.3/100,000 MBs), an average annual growth rate of 15.5%. The Table indicates that the number of aortic valve procedures per 100,000 MBs were relatively stable for all procedures, except TAVR. TAVR procedures per 100,000 MB grew from 9.3 in 2011 to 22.9 in 2014, accounting for 30.4% of aortic valve procedures. In-hospital mortality rates and cumulative 30- and 90-day post-discharge mortality rates declined during the study period. Three adverse events (infection, stroke, and postoperative adult respiratory distress syndrome) declined over the study period. The other three adverse events increased or varied during the study period.

Conclusions: The results indicate a growing rate of aortic valve replacement procedures and lower mortality rates among MBs nationally. However, unadjusted adverse event rates were mixed among the events reported. It appears that TAVR has made a difference in both volume and clinical outcomes.

POSTER ABSTRACTS

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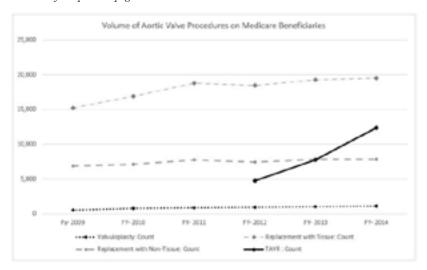


Table: Trends in Aortic Valve Treatment Approaches and Outcomes.

	FY-2011	FY-2012	FY-2013	FY-2014
All Aortic Patients:	27,321	31,467	35,835	40,754
Aortic Patients/100,000 MB	55.8	61.9	68.2	75.3
Valvuloplasty/100,000 MB (% of all patients)	(3.1%)	(3.0%)	(2.8%)	(2.7%)
Replacement with Tissue/100,000 MB (% of all patients)	36.3 (68.7%)	36.3 (58.7%)	36.8 (53.9%)	35.1 (48.0%)
Replacement with Non- Tissue/100,000 MB (% of all patients)	15.9 (28.4%)	14.6 (23.5%)	14.9 (21.9%)	14.5
TAVR/100,000 MB (% of all patients)	-NA-	9.3 (15.1%)	14.8 (21.8%)	(30.4%)
Outcomes:	Toronto.	100000		0.00
In-hospital Mortality	3.32%	3.31%	3:32%	2.97%
Cumulative Mortality Rate through 30-Day Post Discharge	5.26%	5.18%	5.12%	4.70%
Cumulative Mortality Rate through 90-Day Post Discharge	7.09%	7.25%	7.21%	5.64%
New Onset Hemodialysis	1.35%	1.64%	1.65%	1.46%
Vascular Complications	60.45%	61.42%	60.08%	56.43%
Infection	3.58%	3.27%	3.13%	2.67%
Stroke	1.61%	1.67%	1.48%	1,34%
Pulmonary Edema or Congestive Heart Failure	7.23%	6.19%	6.13%	6.16%
Post-Operative Adult Respiratory Distress Syndrome	12.04%	11.48%	10.69%	9.87%

Altered ADAMTS5 Gene Expression and Versican Proteolysis: A Possible Etiology of **Barlow's Disease**

T. S. Absi¹, Y. Su¹, C. Galindo¹, R. Gumina¹, C. Kaiser¹, A. Shah², M. R. Petracek³ ¹Vanderbilt University Medical Center, Nashville, TN, ²Vanderbilt University, Nashville, TN, ³Vanderbilt Heart and Vascular Institute, Nashville, TN

Purpose: The mitral valve (MV) leaflets in Barlow's disease (BD) undergo structural remodeling associated with multiple degenerative and adaptive changes. We hypothesized that in patients with severe mitral regurgitation (MR), the gene expression profiles of MV

leaflets from BD patients are distinct from those with fibroelastic deficiency (FED).

Methods: MVs were obtained from 10 BD patients (seven male, three female; age 61.4 years ± 12.7 years; left ventricular ejection fraction [LVEF] 61.5% ± 5.8%) and 12 FED patients (six male, six female; age 54.1 years ± 6.6 years; LVEF 58.3% ± 5.4%) undergoing surgery for severe MR. Normal MVs were obtained from six donor hearts unmatched for transplant (four male, two female; age 41.5 years ± 10.7 years; LVEF 57.5% ± 8.8%). RNA was extracted and cDNA microarray was carried on the Affymetrix Gene Chip 1.1. Normalization and two-way ANOVA analyses were performed. Only genes that resulted in >1.5-fold difference and P < .05 were considered significantly altered. qRT-PCR was performed to validate the microarray results on selected genes.

Results: Of ~29,000 genes examined, 770 (2.7%) were differentially expressed between the two disease groups. Principal component analysis and hierarchical clustering of the normalized fluorescence signal values for these genes successfully differentiated all the BD from the FED samples (Figure). Among the genes that were differentially expressed, the proteoglycan-degrading metalloprotease ADAMTS5 gene expression was decreased 2.3-fold in BD when compared to FED and to normal controls (-2.3 fold, P < .05 and -2.0 fold, P < .05). TGFbeta2 and TGFbeta3 were equally upregulated in both BD and FED (2.3-fold, P < .05 and 2.4-fold, P < .05) and (1.7-fold, P < .05 and 1.9-fold, P < .05), respectively. qRT-PCR confirmed the microarray data.

Conclusions: MV leaflets in BD and FED exhibit distinct gene expression patterns, suggesting different pathophysiologic mechanisms are involved in the leaflet remodeling processes. Specifically, the downregulation of ADAMTS5 in BD compared to FED and the accumulation of its substrate versican in the valvular extracellular matrix significantly contribute to leaflet thickening and enlargement.

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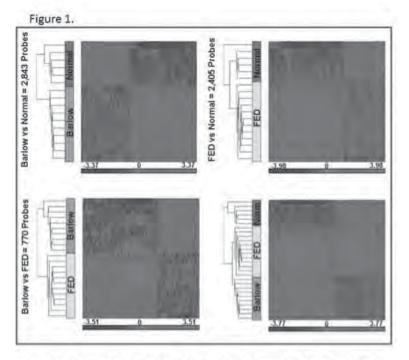


Figure 1. Hierarchical clustering of genes that are significantly differential (at least 1.5-fold, p value < 0.05) between Barlow's, FED and Normal controls. Values shown are log base 2, and bright red, bright blue, and gray indicate the highest, lowest, and median normalized signal values, respectively. Vertical dendrograms represent the individual samples, of which there are three replicates for each sample type.

Changing Etiologies of Pericardial Disease: 80-Year Experience With Pericardiectomy for **Constrictive Pericarditis**

T. Murashita¹, H. V. Schaff², J. Dearani², R. C. Daly², J. Oh², K. L. Greason², J. M. Stulak² ¹West Virginia University, Morgantown, ²Mayo Clinic, Rochester, MN COMMERCIAL RELATIONSHIPS R. C. Daly: Ownership Interest, NeoChord; J. Oh: Consultant/Advisory Board, Medtronic

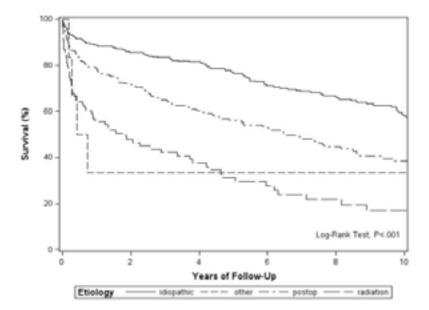
Purpose: The purpose of this study was to evaluate the change in etiologies of constrictive pericarditis in a surgical population over an 80-year interval and to examine risk factors for early and late outcomes in a contemporary cohort.

Methods: We reviewed all patients who underwent pericardiectomy at our institution from 1936 through 2013. The investigation included constrictive pericarditis (CP) cases that were confirmed pre- and intraoperatively, and we excluded patients with effusive, relapsing, or purulent pericarditis; 1,071 pericardiectomies were performed in 1,066 individual patients. Patients were divided into two intervals: a historical group (pre-1990) and a contemporary (1990-2013) group. Survivorship was determined by the Kaplan-Meier method, and risk factors for all-cause mortality were identified by Cox regression analysis.

Results: Patients in the contemporary era were older (49 years vs 61 years, P < .001), more symptomatic (NYHA class III or IV in 71.2% vs 79.6%, P < .001), and more frequently underwent concomitant operations (5.4% vs 21.4%, P < .001) compared to those in the historical era. In contrast to the historical cases in which the etiologies of constriction were mostly idiopathic (81.1%), nearly half of contemporary cases had a non-idiopathic etiology (ie, postoperative 32.3% and radiation 11.4%). Although 30-day mortality dropped from 13.5% in the historical era to 5.2% in the contemporary era (P < .001), survival was similar in the two groups after adjusting for patient characteristics. Risk factors of all-cause mortality in the contemporary group included NYHA class III or IV (HR 2.17; 95% CI, 1.83-2.56; P < .001), etiology of radiation (HR 3.93; 95% CI, 2.81-5.49; P < .001) or post-cardiac surgery (HR 1.47; 95% CI, 1.14-1.88; P < .001), and use of cardiopulmonary bypass (HR 1.35; 95% CI, 1.06-1.71; P = .014).

Conclusions: There was a significant change in disease etiology over the study period with an improvement in 30-day survival in the contemporary era. Long-term survival after pericardiectomy is affected by patient characteristics, including etiology of constrictive pericarditis and severity of symptoms.

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An Interleukin-6-Induced Cell-Free Therapy for Myocardial Preservation

R. Jurakhan¹, G. Makhoul¹, P. Jaiswal², K. Selvasandran¹, R. Cecere³

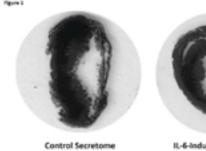
¹McGill University, Montreal, Canada, ²Montreal General Hospital, Canada, ³McGill University Health Centre, Montreal, Canada

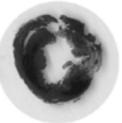
Purpose: The primary mechanism of mesenchymal stem cell (MSC) myocardial repair remains unknown. One hypothesis suggests MSCs secrete a profile of cytokines (secretome) which facilitate myocardial survival. Interleukin-6 (IL-6) is hypothesized to stimulate this by binding CD126 on MSCs. This study explores this activity of the IL-6-induced secretome in infarcted myocardium.

Methods: An IL-6-induced secretome was generated from rat bone marrow MSCs (rBM-MSCs). In vivo, this secretome and a negative control secretome were injected into surgically simulated infarcts of Lewis rats (n=4/group). Fractional shortening (FS) of the hearts was measured 3 weeks after treatment, and heart tissues were collected for histology. In vitro, Western blots and immunofluorescence evaluated the expression of CD126 in rBM-MSCs. Additional Western blots were performed to identify key components of the secretome from IL-6-treated MSCs. Chemo-attractive properties of the secretome toward rBM-MSCs was evaluated via trans-well migration assay. Means were compared using the student's t-test to test for significance.

Results: After 3 weeks, the FS of hearts treated with the IL-6-induced secretome was roughly 10% greater than those of negative controls (P = .0197). Histological analyses also revealed these hearts to heal with significantly less fibrotic scar tissue (Figure). Western blots and receptor immunofluorescence were in agreement, showing CD126 expression to be upregulated in response to hypoxic stress, IL-6 stimulation, and cardiomyocyte secretions in an additive fashion. Western blots revealed IL-6-conditioned rBM-MSCs to be expressing angiopoietin-1, fibroblast growth factor-2/7, vascular endothelial growth factor-1, and transforming growth factor- β , which are cytokines strongly linked to neovascularization, cardiomyocyte survival, and anti-inflammatory properties. Compared to a negative control, the IL-6-induced secretome was found to be significantly chemo-attractive to rBM-MSCs (P = .012).

Conclusions: The IL-6-induced secretome of rBM-MSCs is shown to effectively preserve myocardium following an infarction in Lewis rats, potentially through increased paracrine activation of several anti-apoptotic processes and the recruitment of additional MSCs.





IL-6-Induced Secretome

Axillary Extracorporeal Membrane Oxygenation With Transapical Left Ventricular Vent in Refractory Cardiogenic Shock

K. Takeda¹, H. Takayama², Y. Naka³

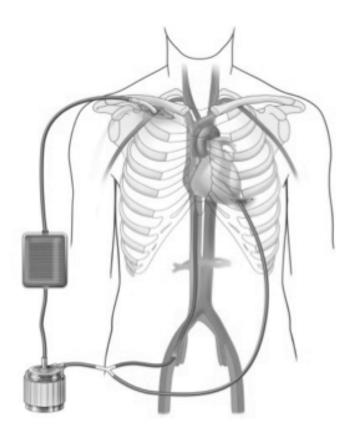
¹Columbia University Medical Center, New York, NY, ²Columbia University, New York, NY, ³Columbia University College of Physicians and Surgeons, New York, NY

Purpose: The use of short-term mechanical circulatory support (ST-MCS) has increased in the treatment of refractory cardiogenic shock (RCS). However, there remain limitations in flow, durability, and left ventricular (LV) unloading. We therefore investigated our surgical approach using axillary extracorporeal membrane oxygenation (ECMO) with transapical LV vent in patients with RCS.

Methods: Twenty patients underwent axillary ECMO with transapical LV vent for various causes of RCS between May 2015 and June 2016. ECMO was established with femoral venous and right axillary artery cannulation. Transapical LV vent was inserted through minithoracotomy incision and connected to the venous inflow line. Once patient hemodynamics and end-organ function stabilized, ECMO was switched to apico-axillary ventricular assist device (AAVAD) by weaning off the femoral venous inflow and oxygenator.

Results: Mean patient age was 58 years \pm 9.6 years, and 80% were male. All patients were in INTERMACS profile 1 RCS. The etiology of RCS was decompensated chronic heart failure in seven (35%), acute myocardial infarction in 12 (60%), and post-cardiotomy shock in one (5%). All received percutaneous ST-MCS prior to surgery with a median duration of 2.0 days: intra-aortic balloon pump in three, femoral ECMO without LV vent in four, Impella in two, and femoral ECMO and Impella in 11. Median size of apical LV vent was 28 Fr. Average flow obtained was 5.5 L/min \pm 0.97 L/min. By adding apical LV vent, diastolic pulmonary artery pressure significantly decreased from 26 mm Hg \pm 7.6 mm Hg to 17 mm Hg \pm 4.3 mm Hg (P < .01). ECMO was converted to external AAVAD after a median of 3.5 days of support. Median duration of AAVAD support was 26 days. Thirty-day mortality was 20%. Eleven patients (55%) survived to next destination, including myocardial recovery in three (27%), device exchange to a durable VAD in seven (64%), and heart transplantation in one (9%). One patient is currently on support. In-hospital survival in patients arrived to these destinations was 10/11 (91%).

Conclusions: Axillary ECMO with transapical LV vent can provide sufficient flow, durability, and LV unloading in RCS patients. Our approach can give the possibility to switch to an AAVAD, facilitating transition to final destinations, including myocardial recovery, durable VAD, and transplant.



No Survival Impact of Single vs Multiple Bypass Grafts to Each Diseased Coronary Territory

C. F. Branco, F. Soares, G. F. Coutinho, P. E. Antunes, M. J. Antunes Center of Cardiothoracic Surgery, Coimbra, Portugal

Purpose: Complete revascularization is the gold standard of coronary artery bypass grafting (CABG) surgery. The rationale of revascularization of all diseased vessels is questionable. Therefore, we aimed to evaluate the impact of placing multiple bypass grafts in each diseased coronary territory (right coronary artery, left anterior descending artery, circumflex artery) on long-term survival.

Methods: From January 2000 to November 2015, 5,694 patients were submitted to isolated CABG, of whom 4,243 patients had complete anatomical revascularization and constituted the study population. Patients were divided into two groups, those who received multiple grafts to each major territory (n=755) and the others with only one graft to each territory (n=3,488). Mean follow-up time was 8.5 years ± 4.4 years and was complete for 96.4% of patients. Cox proportional hazards models were used to analyze risk factors for late mortality. Kaplan-Meier methods were used to plot survival curves. The study population was compared to the general population (age and gender-matched, 1-sample log-rank test).

Results: Mean age of patients (one vs multiple grafts per territory) was 60.9 years \pm 9.5 years vs 63.4 years \pm 9.6 years (P < .001); 13.9% vs 9.7% were female (P = .002); 28.8% vs 27.3% were in Canadian Cardiovascular Society class III/IV (P = .408); and 67.0% vs 78.0% had three-vessel disease (P < .001). No differences were found concerning major postoperative complications (cardiogenic shock, acute myocardial infarction, or stroke). Thirty-day mortality was the same (0.7%; P = .871), and 15-year survival was similar (64.4% \pm 1.3% vs 67.7% \pm 2.9%; P = .232, respectively). Age (HR 1.07; 1.06-1.08; P < .001), chronic pulmonary obstructive disease (HR 1.40; 1.03-1.91; P = .034), peripheral vascular disease (HR 1.47; 1.24-1.75; P < .001), left ventricle systolic dysfunction (HR 1.98; 1.6-2.4; P < .001), current smoking (HR 1.44; 1.11-1.88; P = .006), diabetes (HR 1.44; 1.25-1.66; P < .001), hypertension (HR 1.19; 1.02-1.39; P < .028), preoperative creatinine clearance (HR 0.99; 0.989-0.996; P < .001), and preoperative dialysis (HR 2.45; 1.32-4.57; P < .005) emerged as risk factors for late mortality in the whole group. No difference was found concerning long-term survival in the two groups when compared with that of the general population.

Conclusions: Isolated CABG can be performed safely and with very low mortality. The number of bypass grafts and territory distribution did not adversely affect the perioperative results and long-term survival.

Permanent Pacemaker Implantation After Surgical Aortic Valve Replacement Is Associated With an Increased Risk of Long-Term Mortality

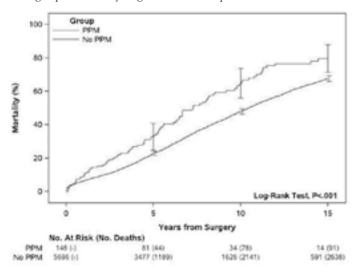
K. L. Greason, B. D. Lahr, J. M. Stulak, Y. Cha, R. F. Rea, H. V. Schaff, J. Dearani Mayo Clinic, Rochester, MN

Purpose: Permanent pacemaker (PPM) implantation is a well-described complication of aortic valve replacement. Not so well described is the effect pacemaker implantation has on survival. We reviewed our >20-year experience with surgical aortic valve replacement to better understand the influence of early postoperative PPM implantation on long-term mortality.

Methods: We reviewed the records of 5,842 patients without previous PPM implantation who underwent surgical aortic valve replacement from January 1993 through June 2014. Patient mean age was 71 years ± 12 years, ejection fraction was 58% ± 14%, and 3,853 (66%) were male. PPM implantation was performed in 146 patients (2.5%) within 30 days of surgical aortic valve replacement. Pacemaker device implanted included 124 dual-chamber devices (85%) and 22 single-chamber devices (15%).

Results: The median follow-up of patients was 11.1 years (IQR 5.8-16.5), and all-cause mortality rates were 2.4% at 30 days, 6.4% at 1 year, 23.1% at 5 years, 48.3% at 10 years, and 67.9% at 15 years postoperatively. PPM implantation was associated with an increased risk of long-term mortality after multivariable adjustment for baseline patient characteristics (HR 1.5; 95% CI, 1.25-1.90; P < .001). Type of pacemaker device implanted, however, had no apparent influence on mortality (dual-chamber device HR 0.85; 95% CI, 0.50-1.43; P = .553).

Conclusions: Permanent pacemaker implantation as a complication of surgical aortic valve replacement is associated with increased risk of long-term mortality. The finding has significant implications with respect to new valve replacement devices and paradigms, which are being implemented in younger and lower-risk patients.



Reduced Ejection Fraction Aortic Stenosis: Is There an Improvement in Ejection Fraction? A Comparison Study of Transcatheter and Surgical Aortic Valve Replacement

M. Malik¹, M. Shareef¹, B. S. George², A. Kilic², B. A. Whitson², J. A. Crestanello², G. D. Rushing¹

The Ohio State University, Columbus, ²The Ohio State University Wexner Medical Center,

Columbus

COMMERCIAL RELATIONSHIPS J. A. Crestanello: Research Grant, Medtronic, Boston Scientific, Abbott Vascular; A. Kilic: Speakers Bureau/Honoraria, St Jude Medical; Consultant/Advisory Board, St Jude Medical; B. A. Whitson: Other, St Jude Medical, HeartWare; Other Research Support, XVIVO

Purpose: The purpose of this study was to determine whether there was an improvement in left ventricular ejection fraction (LVEF) in patients with reduced LVEF after aortic valve replacement (AVR) using transcatheter replacement technique (TAVR), when compared to surgical aortic valve replacement (SAVR).

Methods: Patients undergoing AVR between January 2012 and December 2015 were included in the study. Severe low-flow, low-gradient aortic valve stenosis was defined as aortic valve area <1 cm2, mean pressure gradient <40 mm Hg, peak aortic velocity of <4 m/s, and LVEF <40%. LV dysfunction was considered moderate if the LVEF was 40% to 25% and severe if it was <25%. Patients were followed clinically and by echo at 1, 6, and 12 months post-procedure.

Results: During the study period, 1,042 patients underwent AVR at our institution. Ninetyone patients (27.4% female, 72.6% male) were included in the study. Forty-four patients (48.3%) underwent SAVR and 47 patients had TAVR. LVEF improved in the immediate postoperative period. In the TAVR group, LVEF improved from baseline 28.4% \pm 7.4% to 34.9% \pm 12.69% (P < .05); in the SAVR group, it went from 28.42% \pm 9.76% to 13.22% (P < .05). TAVR patients showed more improvement in the left ventricular systolic dimensions as well as diastolic dimensions when compared to SAVR patients. Patients with severe LV dysfunction showed similar clinical and LV function improvement after both TAVR and SAVR, as those with moderate LV dysfunction. Thirty-day mortality was 6.8% (three patients) in the SAVR group and 4.3% in the TAVR group. One patient (2%) in the SAVR group and six patients (12.8%) in the TAVR group required permanent pacemakers. In the TAVR group, LVEF was improved at 1 week (35%, P < .05), 1 month (32.4%, P < .05), and 1 year (37.76%, P < .05).

Conclusions: Aortic valve replacement can be performed safely in patients with low-flow, low-gradient aortic stenosis, using both TAVR and SAVR. This results in early improvement of LVEF. This improvement also is seen in patients with severe LV impairment.

	SAVR (n=44)	TAVR (n=47)	P-Value
Age, in years	66.4 ± 13.1	78.3 ± 8.9	<0.0001
Male Gender [n(%)]	34 (77.3)	32 (68.1)	0.22
Smoking history [n (%)]	6 (18.2)	21 (45.6)	0.01
HTN [n (%)]	14 (42.4)	13 (28.3)	0.19
Atrial fibrillation (n (%)	11 (33.3)	15 (32.6)	0.95
COPD [n (%)]	11 (33.3)	17 (37.0)	0.74
CAD/MI [n (%)]	19 (57.6)	37 (80.4)	0.03
LVEF, % Baseline Postoperative	28.4±9.76 37.05 ±13.22	28.4 ±7.4 34.9 ± 12.69	0.09
LVEDD, cm Baseline Postoperative	5.74±0.73 5.50±0.77	5.4.3±0.86 5.41±0.94	<0.05

LVEDD: left vestricular end diastolic dimension. LVEF: left ventricular ejection fraction

POSTER ABSTRACTS

P34

Hybrid Repair of Thoracoabdominal Aneurysm: The Two-Stage Approach

R. Di Bartolomeo, G. Murana, L. Di Marco, A. Pantaleo, M. Cefarelli, J. Alfonsi, L. Tozzi, A. Leone, D. Pacini

S. Orsola-Malpighi Hospital, Bologna, Italy

Purpose: The hybrid approach to thoracoabdominal aortic aneurysm (TAAA), which combines surgical and endovascular repair, has been proposed to improve postoperative outcomes in high-risk patients.

Methods: This video describes the TAAA exclusion using a first open visceral arterial rerouting followed by a second endovascular procedure where the remaining aneurysm was covered with a stent graft prosthesis. The video describes the case of a 71-year-old male patient with severe comorbidities that was operated using this dual-stage hybrid approach for a Crawford type III TAAA.

Results: The patient received a total visceral arterial rerouting using a Coselli multi-branched vascular prosthesis through a transperitoneal abdominal approach. A hybrid prosthesis was used for the renal and superior mesenteric arteries reimplantation because it simplified the technique in the presence of small visceral vessels. The TAAA repair was completed 2 weeks after the first procedure with an endovascular stent graft deployment using the Coselli prosthesis as a distal landing zone. Postoperative course was completely uneventful.

Conclusions: Hybrid two-stage TAAA repair appears to be a safe and effective strategy for this selected high-risk patient.

Evolution of Simplified Frozen Elephant Trunk Repair for Acute DeBakey Type I **Dissection: Mid-Term Outcomes in 65 Patients**

E. E. Roselli¹, J. J. Idrees¹, F. Bakaeen¹, M. Tong¹, E. G. Soltesz¹, D. R. Johnston¹, M. Aftab², V. Menon¹, M. J. Eagleton¹, L. G. Svensson¹

¹Cleveland Clinic, OH, ²University of Colorado Anschutz Medical Center, Aurora

COMMERCIAL RELATIONSHIPS F. Bakaeen: Consultant/Advisory Board, JACE Medical; M. J. Eagleton: Consultant/ Advisory Board, Cook Medical, Bolton Medical; D. R. Johnston: Consultant/Advisory Board, Edwards Lifesciences Corporation, JACE Medical, St Jude Medical; E. E. Roselli: Consultant/Advisory Board, W. L. Gore & Associates, Medtronic; Research Grant, Medtronic, Vascutek Ltd a Terumo Company; Speakers Bureau/Honoraria, LivaNova, Vascutek Ltd a Terumo Company; E. G. Soltesz: Ownership Interest, JACE Medical; Speakers Bureau/Honoraria, AtriCure, Edwards Lifesciences Corporation, St Jude Medical; L.G. Svensson: Nonremunerative Position of Influence, Serve as an unpaid Member of the PARTNER Trial Executive Committee

REGULATORY DISCLOSURE This presentation will describe the off-label use of stent grafts by W. L. Gore & Associates and Medtronic during modified elephant trunk repair for acute DeBakey type I dissection.

Purpose: A modified technique for frozen elephant trunk repair (FET) of acute DeBakey type 1 dissection has evolved over the last 7 years. The objectives of this study were to describe procedural modifications and evaluate mid-term outcomes.

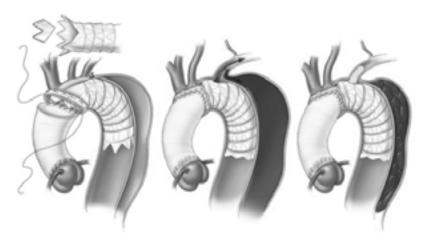
Methods: From 2009 to 2016, 65 patients underwent emergency repair of DeBakey type I dissection using a simplified FET technique. Mean age was 61 years ± 16 years. Eighteen patients (28%) presented with malperfusion, 12 (18%) with rupture, and 34 (52%) had aortic insufficiency. Concomitant procedures included valve replacement (nine), root replacement (11, valve-sparing three), cusp repair (11), and valve re-suspension (21). The first 38 were treated by modifying an early generation stent graft with left subclavian coverage in 18. The next 16 received newer stent grafts modified by intraoperative fenestration, and the last 11 underwent branched single anastomosis technique with left subclavian stent grafting (Figure).

Results: Operative mortality was 4.6% (n=3/65). Two patients presented comatose and did not recover; the other died from coagulopathy complications. Morbidity included stroke (n=3, 4.6%), paralysis (n=1, 1.5%), tracheostomy (n=5, 7.6%), renal failure (n=2, 3%), and reoperation for bleeding (n=5, 7.6%). Median follow-up was 26 months \pm 24 months. Survival at 6 months, 1 year, 3 years, and 5 years was 94%, 89%, 83%, and 72%, respectively. Among 62 survivors, follow-up imaging was available in 58 (94%). Of these, 51 (88%) had false lumen thrombosis of the treated segment, including 31 (53%) who showed shrinkage with a mean reduction of aortic diameter from 42 mm ± 9 mm to 36 mm ± 5 mm. Seven patients from the earlier part of the experience had persistent false lumen perfusion from left subclavian entry tear (Figure); three underwent carotid subclavian bypass, and four were under surveillance without false lumen growth. Freedom from reintervention at 6 months, 1 year, and 3 years was 92%, 85%, and 68%, respectively. Seven patients (11%) required thoracic endovascular aortic repair extension for aneurysmal growth distal to FET.

Conclusions: Simplified FET for treating acute DeBakey type 1 dissection has evolved and remained safe. It is effective at promoting aortic remodeling and simplifies the management of aortic complications that develop during the chronic phase.

POSTER ABSTRACTS

Continued from previous page



First Clinical Experience With Automated Suturing Technology for Minimally Invasive Aortic Valve Replacements

J. K. Wong¹, A. L. Melvin², D. J. Joshi¹, P. A. Knight¹

¹University of Rochester Medical Center, NY, ²University of Rochester, NY

COMMERCIAL RELATIONSHIPS P. A. Knight: Research Grant, LSI Solutions; A. L. Melvin: Research Grant, LSI Solutions; J. K. Wong; Research Grant, LSI Solutions

Purpose: Among the barriers to the adoption of minimally invasive aortic valve replacement (MI-AVR) through anterior mini-thoracotomy are the technical challenges associated with suture placement in the aortic annulus. This report evaluates automated technology intended to enable suturing and the secure placement of a prosthetic valve during MI-AVRs in <30 minutes.

Methods: An automated articulating suturing device simultaneously drove two curved needles through the aortic annulus to engage the ends of a pledgeted horizontal mattress suture; a second device placed the suture through the sewing cuff of a prosthetic heart valve. The first clinical experience with this technology addresses the ease of use and success of automated suture placement, the function of the implanted prosthetic valves, and periprocedural outcomes. All MI-AVRs were performed with video assistance and central arterial cannulation through a 5-cm right anterior mini-thoracotomy incision.

Results: Automated annular suturing during MI-AVRs was performed in five patients (mean age: 75 years \pm 14 years) with one case requiring a concomitant annular enlargement. Sixty-seven valve sutures were placed; 63 (94%) using automated suturing and four (6%) using a needle driver (one in the annulus and three in the Dacron patch). All automated sutures were easily placed by rotating and articulating the device shaft to align the sewing tip to the annulus. Valve knots were secured using titanium fasteners. In the last patient, the 12 annular (17 minutes) and prosthetic (6 minutes) sutures were placed in a total of 23 minutes. With automated knotting requiring 5 minutes, the total time to implant the bioprosthetic valve was 28 minutes. All five procedures were completed with no paravalvular leaks and a competent valve as seen on transesophageal echocardiography (mean AV gradient: 6.4 mm Hg). All five patients were successfully discharged.

Conclusions: Automated suturing technology significantly reduced the challenge of annular suturing through a right anterior mini-thoracotomy and can potentially be used through even smaller incisions for MI-AVRs. Decreasing the technical complexity with this procedure may lead to shorter operative times and a wider acceptance of less invasive techniques for AVRs.



Direct True Lumen Cannulation ("Samurai" Cannulation) for Acute Stanford Type A Aortic Dissection

T. Kitamura, S. Torii, T. Horai, K. Sughimoto, K. Kobayashi, Y. Irisawa, H. Hayashi, T. Matsushiro, Y. Miyata, Y. Tsuchida, K. Miyaji

Kitasato University School of Medicine, Sagamihara, Japan

Purpose: Antegrade perfusion is desirable in cardiopulmonary bypass, but aortic cannulation is sometimes difficult in acute Stanford type A aortic dissection. In this video, we present our surgical technique of direct true lumen cannulation ("Samurai" cannulation) for acute Stanford type A aortic dissection.

Methods: Tourniquets were placed around the aorta. After systemic heparinization, a left ventricular vent, a right atrial drainage cannula, and a retrograde cardioplegia cannula were inserted. With a head-down position, left ventricular venting and right atrial drainage were started. When the blood pressure dropped down to 30 mm Hg, both the adventitial and intimo-medial walls of the dissected ascending aorta were incised at once with large Metzenbaum scissors. Then the true lumen was directly cannulated with a 24-Fr cannula with a flange. The aortic tourniquets were snared and cardiopulmonary bypass is established, followed by retrograde cardioplegia.

Results: From October 2013 to May 2016, a total of 49 patients were operated on using "Samurai" cannulation for acute Stanford type A aortic dissection at our hospital. Mean age was 64 years ± 13 years, and 28 were female. Surgical procedures included four root replacements, 30 ascending replacements, two partial arch replacements with brachiocephalic and carotid reconstruction, 12 total arch replacements, and one David plus total arch replacement. In-hospital mortality occurred in three (6.1%), and there were three disabling or fatal strokes (6.1%). There was no cannulation-related complications.

Conclusions: "Samurat" cannulation is a safe and easy option to establish stable and sufficient perfusion in cardiopulmonary bypass in surgery for acute Stanford type A aortic dissection.

Should the Sinuses of Valsalva Be Preserved in Patients With Bicuspid Aortic Valve Disease and Dilated Ascending Aorta?

Y. Lin, Y. Wang, C. Wang

Zhongshan Hospital of Fudan University, Shanghai, China

Purpose: It is recommended that dilated ascending aorta (≥45 mm) should be replaced at the time of aortic valve replacement (AVR) for bicuspid aortic valves. The risk of progressive sinuses of Valsalva dilatation and dissection after replacement of aortic valve and ascending aorta is less clear.

Methods: We identified 156 patients (age 56.2 years ± 10.8 years, 46 female) who underwent AVR and ascending aorta replacement in our institution from 2010 to 2014, of whom 124 (79%) had bicuspid aortic valve (BAV) disease. Depending on the origins of coronary arteries, BAVs were grouped into two types: BAV-AP (82/124) represented fusion of right and left coronary cusps; BAV-RL (42/124) was fusion of right or left coronary cusp and noncoronary cusp. Aortic root and ascending aorta sizes were determined from the preoperative and the most recent echocardiograms. Mean follow-up time was 34.4 months ± 22.3 months with a completeness of follow-up of 97%.

Results: The operative mortality was 1.3% (two patients). One patient in tricuspid aortic valve (TAV) group died of cerebral hemorrhage 5 months after the operation. At a follow-up of up to 75.2 months, there were no late reoperations for aortic root dissection or rupture. The mean preoperative aortic root diameter of TAV and BAV groups were 42.2 mm \pm 5.4 mm and 37.5 mm \pm 5.4 mm, respectively (P = .69). After operation, most patients had their aortic root size reduced with mean postoperative root diameters of TAV and BAV groups of 39.6 mm \pm 5.2 mm and 35.7 mm \pm 5.1 mm, respectively (P = .99). A total of 16 patients had preoperative root diameter greater than 45 mm (mean root diameter of 48.8 mm), none of whom required late reoperation during follow-up. Regarding the effects of BAV type on the growth of preserved aortic sinuses, there was no statistical significance between BAV-AP and BAV-RL groups (P = .20).

Conclusions: The sinuses of Valsalva of BAV grow less aggressively after separate valve and graft replacement. To avoid the risks associated with aortic root replacement, it is reasonable to spare the aortic sinuses in the setting of AVR for BAV with dilated ascending aorta and relatively normal sinuses of Valsalva.

	TAV	BAV-AP	BAV-RL	Pivalue
N	32	82	42	
Age (years old)	65.7±11.7	56.1±10.8	56.6±10.8	0.75
Female	- 11	20	15	0.07
Mean Follow-up (months)	29.6±25.7	33.2±20.6	40.2±22.4	0.33
Early mortality	1	0	1	
Late mortality	1	0	0	
Reoperation for aertic dissection or rupture	0	0	0	
Preoperative Root Diameter (mm)	42.2±5.4	37,3±5.6	37.7±5.1	0.45
Postoperative Root Diameter (mm)	39.6±5.2	35.814.6	35.415.7	0.25
Root diameter change (mm)	-2.5+2.7	-1.6±3.1	-1.9±3.7	0.20
N of preoperative root diameter ≥ 45mm	5	8	3	0.35
Preoperative aertic insufficiency (AI)	17	20	11	0.62
Preoperative acrtic stenosis (AS)	1	39	22	0.69
Preoperative mixed AI&AS	14	23	9	0.11

TAV, tricuspid acrtic valve; BAV, bicuspid sortic valve BAV-AP; enterior-posterior type of bicuspid sortic valve

BAV-FIL, right-left type of bicuspid acrtic valve

Cardiothoracic Surgical Education

P39

Creation of a Coronary Anastomotic Checklist Using a Delphi Technique Reveals Significant Variability Among Experts

A. A. Vaporciyan¹, V. Fikfak², M. C. Lineberry³, Y. Park⁴, A. S. Tekian⁴

¹The University of Texas MD Anderson Cancer Center, Houston, ²Houston Methodist Hospital, TX, ³Kansas University Medical Center, Kansas City, ⁴The University of Illinois at Chicago

Purpose: Surgical skill assessment tools frequently reflect the opinions of small groups of surgeons. This raises concerns over their generalizability, as well as their utilization when applied broadly. A Delphi approach could engage a broad group of experts to identify key elements for a checklist assessing coronary anastomotic skill, improving generalizability.

Methods: Expert surgeons (≥10 years in practice, actively teaching coronary surgery) in North America were contacted randomly. Consenting surgeons first provided items they felt were mandatory when constructing a coronary anastomosis (CA; defined as dissection of the target, creation of the arteriotomy, preparation of the conduit, management of assistants, performance of the anastomosis, and final testing). Similar items were combined. The participants then performed three Delphi rounds. Items were ranked using a four-point scale (not necessary, desirable, important, and mandatory). Positive consensus was reached when ≥75% of participants ranked an item mandatory. Items without consensus were rejected.

Results: Sixteen faculty (15 male) consented to participate (mean years in practice 20.1 ± 8.1). Each participant provided 25 ± 10 items they felt were mandatory when constructing a CA. The 407 items they provided were condensed by combining similar items. The final core list included 146 items. A section on "general rules" was added to the "performance of the anastomosis" based on the items received. Within each section, between 30% and 61% of the submitted items were core items, the rest being similar. The greatest overlap occurred in dissection of targets and testing, while the least was in general rules. After round one, 23 items reached positive consensus; after round two, 14 more were added, and round three only added three more items. These 40 items represented only 27% of the initial 146 items that the experts had initially felt were mandatory during the construction of a CA (Table).

Conclusions: A randomly selected group of experts using a Delphi approach could generate a checklist to assess construction of a CA. However, there is considerable disagreement among experts across North America regarding what steps are mandatory. This calls into question the generalizability of any locally developed checklist assessing a procedural skill.

NUMBERS OF ITEMS THAT REACHED CONSENSUS AFTER EACH ROUND

	S.Books	Bert	Norre that Reached Consenius			
Section	Master	ngung Roung	Round	Round	Consensus	
Dissection of Targets	17	4	-2	1	7 (4*%)	
Cression of Arteristorny	- 20 -	- 2	.0.	0.	2 (2%)	
Preparation of Conduit	7.6	7	3 -	1	11(09%)	
Management of Assistants	11	- 0	0	0	0 (0%)	
Performance of Anastornosis	40	. 5	2	-0"	7 (18%)	
General Rules	.11	1	-2	- 1	4 (38%)	
Testing and Final Steps	19	- 4	- 5	0.	9(47%)	
Total liens	146					
Total Irems that Reached Consensus		-29	14	3	40 (27%)	

P40

Virtual Reality Simulators Training Curriculum for Video-Assisted Thoracoscopic Lobectomy: An Objective Structured Assessment of Technical Skills Acquisition

L. Bertolaccini¹, **B. Bedetti**², N. Panagiotopoulos², D. Patrini², M. Scarci²

¹Sacro Cuore Don Calabria Research Hospital – Cancer Care Center, Negrar Verona, Italy,

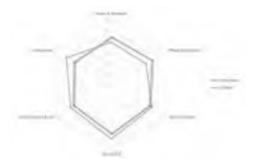
Purpose: Studies have demonstrated the beneficial effect of training novice surgeons on video-assisted thoracoscopic surgery (VATS) using virtual reality (VR) simulators, although there is still no consensus regarding an optimal VR training curriculum. This study aims to establish and validate a structured VR curriculum to provide an evidence-based approach for VATS training programs.

Methods: Skills were evaluated with two tests: Objective Structured Assessment of Technical Skill (OSATS) and Global Operative Assessment of Thoracoscopic Skills (GOATS). On completing operation, surgeons were evaluated for cognitive workload according to NASA—Task Load Index (NASA—TLX), a widely recognized tool for self-reporting workload perception. A comprehensive evaluation questionnaire also was requested. Subjects were stratified into two groups: trainees group and consultants group. Fisher's exact test was used to compare differences in categorical variables and Wilcoxon rank–sum test for continuous variables. Differences in performance between groups was analyzed by the Kruskal–Wallis test for nonparametric data.

Results: Twenty volunteers completed all tasks (trainees = 12, consultants = 8). Comparisons between novice and experienced groups showed that all tests yielded similar results on *P* values. In particular, OSATS (Table A) and GOATS (Table B) performance of both groups were similar without skills differences regarding experience. Median scores of consultants were taken as benchmark levels. Comparison of the trainees' scores with benchmark levels revealed that all were able to achieve the set criteria. The Kiviat diagram (Figure) of the NASA-TLX cognitive workload assessment showed a greater mental and physical demand in the trainees group; in the consultants group, the stress and performance levels, as well as success, were greater than in the trainees group. Nevertheless, these differences between groups were not significant (Table C). Comprehensive evaluation questionnaires showed no significant differences between trainees and consultants groups (Table D).

Conclusions: VR training programs are not intended as substitutes for skills acquisition in the operating theater, but can allow part of learning curve. A graduated VATS training curriculum enables trainees to familiarize, train, and be assessed on VATS VR simulators. This study can aid the incorporation of VR simulation into established surgical training programs.

¹Sacro Cuore Don Calabria Research Hospital – Cancer Care Center, Negrar Verona, Italy, ²University College London Hospitals, United Kingdom



Zable at Objective Street	(OSATS)	umanet of Red	telepid (Ball)
Taik, median (range)	Trainer	Consiliant	
	Group	Greep	
	(n = 12)	(m = 80)	
Respect for those Time and motion instrument handling Knowledge of	4(3-5)	4 (3 - 5)	N.A.
Time and mortion	4(2-5)	4 (4 - 5)	0.778
Instrument handling	+(5-5)	5 (4 - 5)	0.951
Knowledge of	5(4-5)	5 (4 - 5)	NA.
instruments			
the of existents	4(3-5)	4 (5 - 5)	N.A.
How of operation and forward planning	4(5-5)	5 (4 - 5)	0.951
Knowledge of specific	4(4-5)	4 (3 - 5)	0.885
Salah di Albah Albah Albah Albah	or Assessed	ent of these	-
-	in poort		
fash, median (range)	Trainer	Consultant	-
	Gravap	Grava	
	(n = 12)	(m=8)	
Doyals preception Emerced descently (Midency	4(2-5)	4 (2 = 5)	N.A.
Dimensed desterity	6(2-5)	5 (4-5)	0.809
efficiency	4(1-5)	5 (4 - 5)	6327
Steue handing	4(2-5)	5 (4 - 5)	6.809
Automorey	4(2-5)	4 (4 - 5)	0.778
Expendition and dishlers	4(5-5)	4 (4 - 5)	6.950
of right upper later			
unsels and bronches.			
State harding Automore Expeditor and debias of right upper labor sereck and browning Union of right upper	4 (5 - 5)	4 (4 - 5)	6.950
	4(3-5)	5 (4 - 5)	0.951
and staplers			
and staplers Stable automory steedfeation of Mar	4(3-5)	5 (4 - 5)	0.951
Identification of Mar	5(4-5)	5 (4-5)	N.A.
structures of right upper			
loke			
Safe dissection and	4(4-5)	5 (4 - 5)	8.964
division of right upper			
labe Sale dissection and decision of right upper labe resurb and			
toronethus.			
tude right upper liebe Essures districe	4(3-5)	5 (4-5)	0.951
fixeures effetsion			
Accorate usage of second loop, stuplers and other	4(4-5)	4 (1 = 5)	0.488
loop, staplers and other			
Instruments			
Learn how to avoid and	5 (4 - 5)	4 (4 - 5)	0.947

Tobb a MAIN - Tob	STREET, SQUARE,	MASS - NAS	_
Task, mean t standard	Trainer	Considered	7
Ambelon	Group	Group	
		- Care	
		(n = H)	
riow montally demanding	3.88 ± 1.36	4.30 ± 1.18	0.500
mes tack?			
Now physically demanding	8.75 ± 1.80	4.36 ± 0.88	6.736
men tank?			
How harried or nushed	4.38 ± 1.49	4.11±0.74	0.685
was pace of task?			
Now accorded were you	5.15 1 1.56	4.67 ± 0.94	0.854
in accomplishing what you			
were asked to de?			
tions hard did you have to	438 ± 1.22	4.06±0.95	6.906
work to accomplish your			
level of performance?			
Now discouraged or	4.85 ± 1.07	4.00±0.75	6.930
stressed were you?			
stressed were you? Falsir d. Comprehensi	of Production	gentions a	7
face solidity rating, mean	Trainee	Consultant	
t standard deviation	Group	Group	
and a few second state of	(n = 1/2)	9.80±0.75	0.530
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Nephra - camera	9.00 ± 9.87	8.85 ± 1.05	0.872
Nephus - Metrumento	8.75 1 0.97		0.872
Nestion - Noor tendhads	8.13 ± 1.54	8.00 ± 1.53	N.A.
Resilion - Independents	8.75±0.83	8.75 ± 1.23	0.795
Freedom of movement			
Realism - reaction to	8.00 1 1.66	8.58 1 1.19	0.795
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Realism - pleural coulty	9.001036	9.25 ± 0.60	0.825
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Agreement with	Trainee	Consultant	
statements, mean t	Group	Gravp	
standerd deviation	(n = 12)	(n = 10)	
(Martine for training	9.38 ± 0.70	9.50 ± 0.65	0.964
important practice realize	9.11 ± 0.78	9.58 ± 0.76	6.064
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tention expenses of	9.13 ± 0.78	831146	0.562
TAXABLE PARTY AND PROPERTY.			

M.A. = Not Applicable

P41

Implementation of a Technology-Enhanced Surgical Simulation Curriculum Objectively Improves Resident Preparedness During the Transition to Cardiothoracic Training

P. Chan, L. W. Schaheen, E. G. Chan, C. C. Cook, J. D. Luketich, J. D'Cunha University of Pittsburgh Medical Center, PA

COMMERCIAL RELATIONSHIPS J. D. Luketich: Ownership Interest, Johnson & Johnson, Intuitive Surgical; Research Grant, Accuray

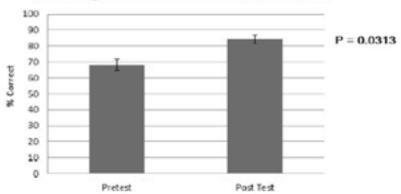
Purpose: Residency training constraints have proposed unique challenges for individuals transitioning from medical school/general surgery to cardiothoracic surgical training. We hypothesized that participation in an intensive simulation program that provided early exposure to a cardiothoracic-focused curriculum would improve cognitive skills and resident readiness to manage common cardiothoracic patient urgencies/emergencies.

Methods: From 2013 to 2015, traditional and integrated cardiothoracic residents at the University of Pittsburgh participated in a technology-enhanced simulation curriculum incorporating knowledge-based, experiential, and practical clinical scenarios simulating on-call cardiothoracic surgical urgencies/emergencies. The course comprised multiple learning components, including didactics, hands-on simulation, virtual models, and mock oral examinations. Resident performance on individual scenarios was graded using a previously validated objective structured clinical examination (OSCE). Residents also were given a validated pre- and post-test to evaluate knowledge retention and integration. Resident perception of course usefulness and relevance was determined through the completion of a perception survey using a standard five-point Likert scale.

Results: Over 3 years, 25 learners participated in the course. Knowledge base significantly increased by 15.9% (pre-test=68% vs post-test=83.9%, *P* = .031). According to trained-rater evaluation, 93.6% of resident responses to each of the 11 individual competencies in the OSCE were deemed adequate. Upon completion of the course, participants completed a perception survey on the usefulness, relevance, and execution of the curriculum that demonstrated that 92% of all participants scored the sessions as important or very important to their development and confidence in managing the specific cardiothoracic scenarios. These findings were present despite the historical assumption that these learners were prepared for complex patient care.

Conclusions: After completing a technology-enhanced course combining attendeedriven didactics, simulation, and real-time assessment, residents demonstrated objective improvements in cognitive skills and readiness in managing cardiothoracic patients. Resident post-course feedback indicated enhanced confidence, suggesting increased preparedness transitioning to cardiothoracic surgery. This has strong implications for improved patient safety during these transition periods.

Average Resident Test Scores



Congenital Heart Surgery

P42

Long-Term Transplant-Free Survival Following Repair of Total Anomalous Pulmonary Venous Connection: A Study From the Pediatric Cardiac Care Consortium

J. D. St. Louis¹, C. E. McCracken², E. M. Turk¹, J. S. Menk³, B. A. Harvey³, J. M. Vinocur⁴, J. E. O'Brien¹, M. E. Oster², J. Moller³, L. G. Spector³, L. Kochilas⁵

¹Children's Mercy Hospital, Kansas City, MO, ²Emory University, Atlanta, GA, ³University of Minnesota, Minneapolis, ⁴University of Rochester, NY, ⁵Emory University, Sibley Heart Center Cardiology, Atlanta, GA

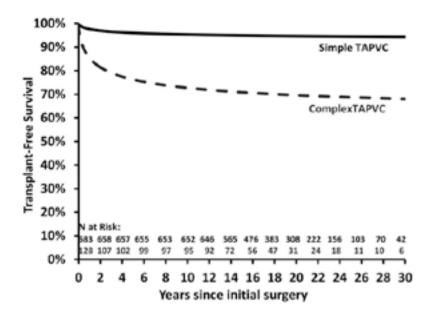
COMMERCIAL RELATIONSHIPS L. Kochilas: Consultant/Advisory Board, Novartis; J. S. Menk: Ownership Interest, Medtronic

Purpose: Survival after total anomalous pulmonary venous connection (TAPVC) repair has been well characterized in previous studies. However, long-term survival, risk of transplantation, and causes of death remain unknown. By linking the Pediatric Cardiac Care Consortium with the National Death Index (NDI) and the United Network for Organ Sharing (UNOS), we address long-term outcomes in children surviving TAPVC repair.

Methods: We identified 811 survivors after TAPVC repair before 1 year of life (median age 20 days [interquartile range, IQR, 5-80 days]) with sufficient identifiers for linkage with NDI and UNOS. There were 66 deaths and nine cardiac transplants identified by the end of 2014. Complex TAPVC was defined as the coexistence of a cardiac anomaly excluding ASD and PDA. Data collected included age/weight at time of procedure, TAPVC type, associated cardiac lesions, and length of postoperative stay (LOS). Parametric survival plots were constructed and risk factor analysis was performed to identify demographic/clinical characteristics associated with long-term outcomes using the PROC HAZARD procedure in SAS.

Results: Overall late mortality or need for transplantation was 9.3% with median follow-up of 18.6 years (IQR 14.5-23.0 years) and median age of death of 0.83 years (IQR 0.38-4.7 years). The risk of mortality/transplant following TAPVC repair was highest in the first 18 months following hospital discharge. Comparison between patients with complex or simple TAPVC is provided in the Table. Parametric model of transplant-free survival for TAPVC conditioned to hospital discharge is presented in the Figure. Cardiac causes accounted for 47% of deaths for patients with simple TAPVC and 65% for those with complex TAPVC. The multivariable parametric regression models for transplant-free survival demonstrated that complex TAPVC (HR 5.07; 95% CI, 3.04-8.45), mixed TAPVC (HR 2.81; 95% CI, 1.56-5.03) and postoperative LOS were associated with increased risk of death or transplant. Surprisingly, birth and surgical weight, age at repair, preoperative obstruction, and need for emergent surgery did not affect long-term transplant-free survival.

Conclusions: Transplant-free survival after TAPVC repair is excellent, with most deaths or transplant events occurring during the first postoperative year. Factors associated with worse long-term outcomes include complex TAPVC, mixed TAPVC, and prolonged postoperative LOS. Known risk factors important during the immediate postoperative period had no significant effect on long-term outcomes.



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Technical Performance Score Is a Predictor for Post-Discharge Reinterventions Following Complete Atrioventricular Septal Defect Repair

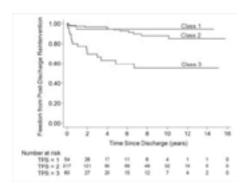
R. IJsselhof, K. Gauvreau, P. J. del Nido, M. Nathan Boston Children's Hospital, MA

Purpose: Technical performance score (TPS) has been shown to be associated with both early and late outcomes across a wide range of congenital cardiac procedures. We wished to evaluate TPS as a predictor of in-hospital outcomes and post-discharge reintervention in patients undergoing complete atrioventricular septal defect (CAVSD) repair.

Methods: We performed a retrospective review of patients who underwent balanced CAVSD repair in a tertiary center between January 1, 2000, and March 1, 2016. We assigned TPS (class 1-no residua, class 2-minor residua, class 3-major residua or reintervention in the anatomic area of repair pre-discharge for residua) based on discharge echocardiograms. In-hospital and follow-up (FU) data were collected. Post-discharge reintervention (primary outcome) and complications and postoperative intensive care unit length of stay (PICULOS) during hospitalization for index surgery (secondary outcomes) were analyzed using logistic and Cox regression.

Results: A total of 350 patients were included in the analysis. Median age was 3.2 months (interquartile range [IQR] 2.4-4.2 months). Fifty-four (16%) had class 1 TPS, 218 (62%) class 2, 63 (18%) class 3, and 15 (4%) could not be scored. Median PICULOS was 3 days (IQR 2-5 days). There were 15 deaths (4%; six pre-discharge and nine post-discharge), 36 complications (10%), and 34 post-discharge reinterventions (10%). Median FU was 2.6 years (IQR 0.09-7.9 years). On univariable analysis, trisomy 21, concomitant procedure, and TPS were associated with post-discharge reintervention. Concomitant procedure, weight, second bypass run, and TPS were associated with complications. Weight, concomitant procedure, heterotaxy, and TPS were associated with PICULOS. On multivariable modeling, class 3 TPS was associated with post-discharge reintervention (HR 5.61; 95% CI, 1.28-24.5; P = .02), complications (OR 5.45; 95% CI, 1.06-28.1; P = .04), and prolonged PICULOS (HR 0.53; 95% CI, 0.36-0.78; P = .001) after adjusting for other covariates (Table/Figure).

Conclusions: At our center, CAVSD repair was associated with low morbidity in hospital and at mid-term FU. Presence of residual lesions pre-discharge, as measured by TPS, was able to accurately identify those who had complications, prolonged PICULOS, and required post-discharge reinterventions.



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en escret principalities	Universitie Analys		Michiganishing Ana	de de
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	3.47 (0.90, 33.4)	6:07		
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belonce, by preoperative action				
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Namy 21	0.25 (0.33, 0.34)	10.005	830034,860	0.002
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Construction of the Constr	A 440 TO 400 A 4 1 11	0.000		(Cindex 6.79
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Gless 34 - Inadequate		0.008	3.61 (3.26, 24.3)	0.00
			201 (0.00) 6100	4100
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tge at surgery 1 60 days	136 (138, 537)	0.00		
Secrete	10.6 (3.47, 32.5)	10.005		
hematurity	6.40 (2.80, 8.90)	40.005		
Norw Zi	0.10 (0.35, 0.70)	0.004		
feteritary	14.7 (2.2% 87.9)	0.004		
kry prior procedure	8 90 (D.56, 33 3)	+0.001		
Balance, by preoperative ache				
Right dominant	3.25 (0.99, 30.7)	0.05		
	1.95 (1.41, 9.30)	0.6		
Concomitant procedure*	8.10 (3.67, 38.6)	10.005	50.3 (3199, 2440)	40.001
				(Cindex 0.80
Weight < 3.5 kg	430 (236, 940)	<0.001	4.91 (2.07, 11.76)	40.001
Second Supress run	4.06 (1.34, 12.3)	0.16	7.37 (2-49, 24-6)	0.003
Discharge 1995				
Class 1 - Optimal	1.00		1.00	
Class 2 - Adequate	2.38 [3.53, 10.4]	0.3	3.40	0.29
Class 3" - Inadequate	8.11 (1.77, 37.4)	0.007	5.45	0.04
Postoperative ICU LOS (Second	dwar Outcomet			
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P44

Reinterventions on the Right Ventricular Outflow Tract After the Arterial Switch Operation: Incidence and Risk Factors

J. Cleuziou, K. Vitanova, J. Kasnar-Samprec, M. Ono, D. Tanase, C. Schreiber, R. Lange German Heart Center Munich

Purpose: A known complication after the arterial switch operation (ASO) is the development of right ventricular outflow tract obstruction (RVOTO). The aim of this study was to evaluate the incidence of and risk factors for the development of RVOTO.

Methods: RVOTO was defined as any reintervention required on the right ventricular outflow tract (RVOT). Risk factor analysis was performed using a Cox regression model.

Results: Between 1983 and 2014, a total of 688 patients underwent ASO for simple transposition of the great arteries (TGA; n=419), TGA with ventricular septal defect (n=207), or Taussig-Bing anomaly (n=62). RVOTO developed in 79 patients (11%) at a median time of 3.8 years (1 day-23.6 years). Freedom from RVOT reintervention was 96% \pm 1%, 89% \pm 1%, and 83% \pm 2% at 1, 10, and 25 years, respectively. Location of the RVOTO was at the level of the pulmonary artery bifurcation in 42%, of the main pulmonary artery in 18%, of the valve in 2%, of the infundibulum in 6%, and at multiple levels in 32%. The peak gradient over the RVOT at discharge after ASO was significantly higher in patients requiring a reintervention than in others (P<.001). Treatment for RVOTO was surgical in 40 patients (50%) and catheter-based in 39 patients (50%). Independent risk factors for the development of RVOTO were side-by-side great arteries (P<.001), aortic arch anomalies (P<.001), use of a pericardial patch for augmentation of the coronary buttons (P<.001), and a peak gradient of more than 20 mm Hg over the RVOT at discharge (P<.001).

Conclusions: The incidence of RVOTO after ASO is not negligible and predominantly affects the pulmonary artery bifurcation. Complex morphology, such as side-by-side great arteries and aortic arch anomalies, influences the development of RVOTO. Variations of the surgical technique may help in the future to decrease the incidence of RVOTO.

Significance of Intraoperative Revision During the Arterial Switch Operation in the Current Era

Y. Nakamura¹, D. Kalfa¹, P. Chai², A. Chelliah¹, L. Freud¹, J. Quaegebeur², E. A. Bacha¹
¹Columbia University Medical Center, New York-Presbyterian/Morgan Stanley Children's
Hospital, NY, ²Columbia University Medical Center, New York, NY

Purpose: The arterial switch operation (ASO) is a relatively safe operation with very low discharge mortality. We hypothesized that intraoperative revision (IntropRev) for coronary malperfusion still plays an important role and evaluated its significance during ASO in the current era.

Methods: From January 2005 to May 2016, 244 patients underwent ASO including palliative ASO (n=6). As for coronary transfer, implantation to a simple incision made at the "appropriate site" in each corresponding sinus with or without neoaortic reconstruction first has been our standard approach, and if other or additional techniques were applied (n=96), it was defined as "modified technique." Seventeen patients (7%) needed IntropRev. Factors related to "modified technique," IntropRev, and discharge mortality were analyzed. Morbidity was compared in patients with/without IntropRev.

Results: Relationship between coronary artery pattern, "modified technique," and IntropRev is described in the Table. Factors related to "modified technique" were complex coronary anatomy (n=46), long distance for transfer (n=26), side-by-side great arteries (n=19), malaligned commissures (n=17), and eccentric coronary artery orifices (n=8). Body weight at surgery <2.5 kg (P=.05) and "modified technique" (P=.03) were risk factors for IntropRev. Discharge mortality was 2% (n=5): two of 17 with IntropRev vs three of 227 without it (P=.04). Patients with IntropRev had higher occurrence of postoperative cardiovascular complications (P=.05) and needed longer ventilation time (P<.001) and postoperative hospitalization (P=.003). At short-term follow-up (median 131 days, range 4-4,053 days), neither postdischarge death nor biventricular dysfunction were observed, and reoperation for late coronary artery stenosis was performed in one patient.

Conclusions: The need for IntropRev was correlated with weight at surgery <2.5 kg and use of "modified technique" (which reflected more complex morphological arrangements). IntropRev led to higher postop morbidity and mortality; however, satisfactory long-term outcomes were expected when IntropRev was successful.

Coronery entiry petern	Oschege mortality (n)	Modified technique (n)	Intresperation revision (n)	intracposative revision without modified technique (n)
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RCA High convey every UCA High convey after; LAD High extens descending convey after; Cs Historian after

P46

Del Nido Cardioplegia Provides Superior Left Ventricle Performance Compared to HTK After Long-Term Ischemia, as Evaluated by Phospholamban Activation

H. Carmo¹, K. Reichert², D. Diogenes de Carvalho¹, L. d. Silveira-Filho, K. Vilarinho¹, P. Oliveira¹, P. Eghtesady³, **O. Petrucci**⁴

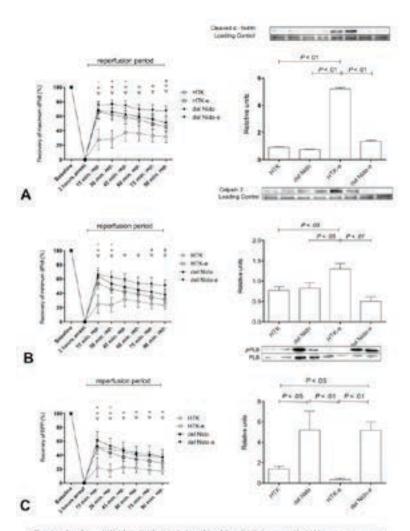
¹Unicamp, Campinas, Brazil, ²University of Campinas, Estância Velha, Brazil, ³St Louis Children's Hospital, MO, ⁴Washington University, St Louis, MO

Purpose: Myocardial ischemia/reperfusion injury is one of main causes of low cardiac output after surgery. The aim of this work was to assess the effects of blood-based and crystalloid cardioplegic solutions on the intracellular calcium machinery by evaluating the activation of phospholamban, which regulates calcium uptake by the sarcoplasmic reticulum.

Methods: Isolated rat hearts were submitted to 3 hours of cold ischemia followed by 90 minutes of reperfusion. Hearts were divided into four groups. Cardiac arrest was induced with a single dose of one of the following cardioplegic solutions: (1) a commercially available crystalloid-based solution (histidine/tryptophan/ketoglutarate [HTK]), (2) a blood-based solution (del Nido), (3) HTK plus lidocaine and pinacidil (HTK-e), or (4) del Nido plus pinacidil and with a lower lidocaine concentration than the original del Nido formula (del Nido-e). Several parameters of ventricle contractility were continuously recorded during reperfusion. Tissue samples of the left ventricle (LV) were analyzed by immunoblotting, ATP determination, and caspase activity levels.

Results: Compared to the crystalloid solutions, del Nido and del Nido-e provided superior LV performance recovery in variables of maximum dP/dt (16% and 32% vs 61% and 72%, respectively), minimum dP/dt (26% and 41% vs 49% and 57%, respectively), and RPP (20% and 38% vs 47% and 43%, respectively) after 90 minutes of reperfusion. Similarly, they provided higher phospholamban activation, lower cellular disruption compared to HTK-e, and higher myocardium ATP levels.

Conclusions: Blood cardioplegic solutions are superior to crystalloid solutions for preserving LV performance and provide greater phospholamban activation while maintaining the sarcolemmal reticulum function and cellular integrity.



Compared to the crystalloid cardioplogic solutions, blood-based solutions provided (A) superior recovery of dPdt cass after 60 measures of superfusion, (B) better preservation of diastolic function after 75 minutes of reperfusion, and (C) better receivery of 8PP. P < .05 for (*) HTK vs.HTK-c, (*) HTK vs.dd. Nido-c, and (0) HTK-c vs.dd. Nido-c. Representative Western blotting results of or (D) fodein , (E) calpain 2, and (F) phosphalamban (PLH).

P47

Surgical Ligation of Patent Ductus Arteriosus in Preterm Infants: An Exceptionally Safe and Beneficial Approach to Management

D. Lebenbauer¹, C. D. Fraser¹, N. Hibino¹, S. Aucott¹, T. C. Crawford¹, J. C. Grimm¹, N. D. Patel¹, J. T. Magruder¹, D. E. Cameron¹, L. A. Vricella²

¹The Johns Hopkins Hospital, Baltimore, MD, ²The Johns Hopkins University, Baltimore, MD

COMMERCIAL RELATIONSHIPS N. Hibino: Research Grant, Secant Medical; Other Research Support, Nanofiber Solutions

Purpose: Observational studies suggest patent ductus arteriosus (PDA) ligation in preterm newborns is associated with greater morbidity when compared to nonoperative management. These results may be confounded by use of PDA ligation as "rescue" therapy. We sought to review our institutional outcomes with PDA ligation and assess safety, surgical morbidity, and mortality.

Methods: A retrospective, observational study analyzed outcomes of all patients with weight ≤1.0 kg undergoing PDA ligation at our institution between 2003 and 2015. Medical records were queried to identify pre- and postoperative ventilator requirements, inotropic support, incidence of acute kidney injury (AKI) and necrotizing enterocolitis (NEC), surgical complications, and 30-day mortality.

Results: 166 preterm newborns underwent surgical PDA ligation. 121 patients (70.3%) failed indomethacin therapy, and 40 (24%) suffered preoperative AKI. Among 164 patients (98.8%) requiring preoperative mechanical ventilation, 79 (48.2%) were extubated within 30 days of surgery. Of 109 patients (66.4%) requiring preoperative inotropic support, 59 (54.1%) were weaned within 24 hours of surgical ligation. Mean duration of postoperative inotrope use was 2.5 days ± 5.2 days. 164 patients (98.8%) did not require a perioperative tube thoracostomy. One patient (0.6%) suffered a recurrent laryngeal nerve injury. Among 39 patients (23.4%) with associated NEC, 26 (66.6%) and 13 (33.3%) were diagnosed preand postoperatively, respectively. Thirty-day all-cause mortality was 1.8% (3/166), with no intraoperative deaths.

Conclusions: PDA ligation in preterm newborns is safe and effective, leading to rapid discontinuation of inotropic support and facilitated weaning from mechanical ventilation. Given the very low procedural morbidity and mortality, PDA ligation should be rapidly considered as a reasonable alternative to prolonged and aggressive medical therapy.

Contemporary Outcomes of Combined Heart-Liver Transplantation in Patients With Congenital Heart Disease

R. Bryant¹, D. L. Morales¹, J. S. Tweddell², F. Zafar¹, R. Rizwan¹, I. Wilmot¹, C. Chin¹
¹Cincinnati Children's Hospital Medical Center, OH, ²Heart Institute, Cincinnati Children's Hospital Medical Center, OH

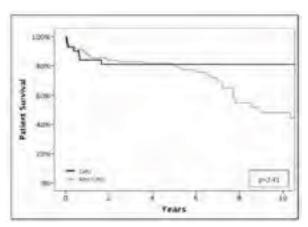
COMMERCIAL RELATIONSHIPS D. L. Morales: Consultant/Advisory Board, Berlin Heart, CorMatrix, HeartWare, SynCardia; Research Grant, CorMatrix; J. S. Tweddell: Consultant/Advisory Board, CorMatrix

Purpose: Transplant centers are seeing more adult patients with congenital heart disease (CHD) who have end-stage cardiac and hepatic failure. These patients may require complex transplant strategies. An understanding of contemporary short- and long-term outcomes with combined heart and liver transplantation (cHLTx), particularly in patients with CHD, is needed.

Methods: A retrospective review of the outcomes of cHLTx was conducted. From October 1, 1987, to June 30, 2015, there were 61,437 total heart transplants reported to the United Network for Organ Sharing. Of those, 190 (0.003%) were cHLTx. Forty-one patients (22%) had CHD. We assessed 30-day and 1-, 5-, and 10-year patient and graft survival. We reviewed demographics, indications, procedural, and postoperative data.

Results: The mean age at the time of transplant was 46 years ± 15 years. Fifty-six patients (29.5%) were female. The most common indications for cHLTx were hepatic congestion/cirrhosis due to cardiac origin (n=61, 32%) and amyloidosis (n=46, 24%). In the 41 patients with CHD, the most common indication for cHLTx was hepatic congestion/cirrhosis due to cardiac origin (n =26, 63%). The overall survival at 30 days, 1 year, 5 years, and 10 years was 95%, 86%, 80%, and 53%, respectively. For patients with CHD, the 30-day, 1-year, 5-year, and 10-year survival was 93%, 84%, 81%, and 81%, respectively.

Conclusions: The short- and long-term outcomes of cHLTx for CHD were comparable to the survival of cHLTx in patients without CHD. These outcomes provide a clinical benchmark when considering this complex therapy in patients with congenital heart disease.



Residual Right Ventricular Outflow Tract Gradients After Transatrial Repair of Tetralogy of Fallot

C. Tan¹, Y. d'Udekem¹, D. Zannino², K. du Plessis², J. Soquet¹, J. Brink¹, I. E. Konstantinov¹, C. P. Brizard¹

¹The Royal Children's Hospital, Melbourne, Australia, ²Murdoch Childrens Research Institute, Parkville. Australia

COMMERCIAL RELATIONSHIPS C. P. Brizard: Ownership Interest, Admedus; Consultant/Advisory Board, Admedus; Y. d'Udekem: Consultant/Advisory Board, MSD, Actelion Pharmaceuticals

Purpose: Keeping a small residual right ventricular outflow tract (RVOT) gradient after tetralogy of Fallot (TOF) repair is beneficial. But residual gradients expose the risk of reintervention for RVOT obstruction. It is unclear whether the gradients observed in the outflow tract may regress and at which speed they will progress.

Methods: A total of 393 patients had TOF repair and were followed up in one institution between 1980 and 2015. A consistent policy of transatrial repair beyond early infancy aiming at leaving a small outflow tract gradient was applied. The median age at repair was 280 days (177-440 days); 294 (75%) had a transannular patch and 100 (25%) had a previous shunt. We identified those who had a peak gradient superior to 36 mm Hg at any stage after repair. Fifty-seven patients (15%) had a residual gradient identified before hospital discharge, and 66 (17%) had a recurrent gradient occurring after hospital discharge, totaling 123 patients.

Results: There were five out of 393 (1.3%) postoperative deaths; three of the five deaths occurred in the 123 patients who had a gradient superior to 36 mm Hg. A total of 45 out of 123 patients (37%) were reoperated at a median of 3 years (1-7 years) after TOF repair and a median of 1.9 years (0.5-4.7 years) after diagnosis of the obstruction. Their median peak gradient decreased from 45 mm Hg (38-55 mm Hg) at the time of the reoperation to 20 mm Hg (12-34) post-reoperation. Over a mean of 7 years ± 6 years of follow-up, 78 of 123 patients (63%) did not require reoperation, with gradients decreasing from a median gradient of 44 mm Hg (39-54 mm Hg) to 34 mm Hg (23-44 mm Hg). Of which, 37 of the 57 (64.9%) with residual obstruction and 41 of the 66 (62.1%) with recurrent obstruction did not have a reoperation.

Conclusions: Two-thirds of the patients who developed a gradient superior to 36 mm Hg did not require reintervention after TOF repair. Mild postoperative gradients can be left in patients after Fallot repair. The long-term benefits of keeping a mild RVOT gradient may outweigh the risk of requiring a reoperation.

Scimitar Syndrome in Children and Adults: Natural History, Outcomes, and Risk Analysis

H. Wang¹, D. Kalfa², M. Rosenbaum³, J. Ginns³, M. Lewis³, J. Glickstein³, E. A. Bacha², P. Chai³

¹Stanford University School of Medicine, Palo Alto, CA, ²Columbia University Medical Center,
New York–Presbyterian/Morgan Stanley Children's Hospital, NY, ³Columbia University Medical
Center, New York, NY

Purpose: Scimitar syndrome, a rare association of congenital cardiopulmonary abnormalities, features anomalous pulmonary venous return to the inferior vena cava. Optimal management remains controversial. We describe the natural history of scimitar syndrome among patients at our institution, examine nonsurgical and surgical outcomes, and identify risk factors for poor outcomes.

Methods: Patients with scimitar syndrome who were evaluated at our institution between January 1994 and January 2015 were reviewed retrospectively. Anomalous pulmonary venous return to the inferior vena cava documented on echocardiography served as the inclusion criteria. The primary outcome variables included mortality and post-repair stenosis of scimitar drainage. Univariate and multivariate analyses toward each of these endpoints were performed. The study protocol was reviewed and approved.

Results: Forty-seven patients were identified. Median follow-up was 3.55 years. Twenty infants (42.6%) had significant associated congenital heart defects, including seven with single ventricle physiology. Isolated scimitar syndrome was observed in 10 infants (21.3%) and 16 non-infants (34.0%). Non-infants exhibited milder disease with lower incidences of right pulmonary artery hypoplasia (P < .001), aorto-pulmonary collaterals (P = .004), and scimitar vein obstruction at the inferior vena cava confluence (P = .032). Eighteen patients (38.3%) underwent surgery. Surgical outcomes for infants were similar using scimitar vein reimplantation or intra-atrial baffle repair, with overall mortality 40% (2/5) and 33% (1/3), respectively. Post-surgical mortality was 0% (0/6) for non-infants. Overall mortality for medically managed infants was 46.7% (7/15) compared to 0% (0/8) for non-infants (P = .052). Multivariable analyses identified infantile onset as an independent risk factor for post-repair stenosis (HR 9.34, P = .048) and single ventricle physiology as an independent risk factor for overall mortality among unrepaired patients (HR 29.8, P = .004).

Conclusions: The severity of scimitar syndrome depends on presenting age and associated congenital heart disease. Non-surgical and surgical outcomes are suboptimal for infantile disease, which is an independent risk factor for post-repair stenosis. Single ventricle physiology is associated with poor prognosis. Additional large-volume experiences are required to guide and improve management.

P51

Differences in Histopathological Findings of Right Ventricle: Hypoplastic Left Heart Syndrome vs Truncus Arteriosus Communis

T. Kido, T. Hoashi, K. Kagisaki, H. Ichikawa

National Cerebral and Cardiovascular Center, Suita, Japan

Purpose: Surgical outcomes for patients with hypoplastic left heart syndrome (HLHS) have improved, but the mortality rate remains high. Some reports have shown that systemic right ventricle (RV) in HLHS has unique myocardial pathology. To eliminate the influence of ventricular pressure afterload, pathophysiological findings of RV in HLHS and truncus arteriosus communis (TAC) were compared.

Methods: Between 2013 and 2016, RV biopsies were obtained from infants undergoing Norwood procedure with RV-PA conduit following bilateral pulmonary artery banding for classical HLHS (n=11) or neonatal repair of TAC (n=6). Histopathological examination was performed in myocardial layer and endocardial layer. In myocardial layer, the evaluated variables were 1) short axis length of myocardial cell, 2) myocardial fibrosis, 3) coronary vascular density, and 4) collagen type 1/type 3 ratios. In endocardial layer, collagen type 1/type 3 ratios were evaluated. Three fields of each layer per slide were analyzed and averaged.

Results: Mean age at operation were 46 days in HLHS group and 55 days in TAC group (P = .8). Myocardial fibrosis was significantly higher in RV myocardium of patients with HLHS (mean 7.4%) compared to TAC (mean 3.2%) (P = .002). Coronary vascular density was significantly lower in HLHS (mean 1,665 U/mm³) than the TAC group (mean 2,231 U/mm³) (P = .02). Both in myocardial layer and endocardial layer, collagen type 1/ type 3 ratios were significantly higher in HLHS (mean 0.50, 4.6) than the TAC group (mean 0.22, 0.57) (P = .01, .03). No significant differences were identified in short axis length of myocardial cells between HLHS (mean 9.0 μ m) and the TAC group (mean 9.5 μ m) (P = .28).

Conclusions: Under the same ventricular pressure overloaded condition, RV in HLHS showed more significant ischemic change than that in TAC. The presented findings may partly explain the poor outcomes of HLHS patients.

Repair of Taussig-Bing Double Outlet Right Ventricle by Arterial Switch: Early and Up to 13-Year Outcomes

H. Najm¹, M. Ahmad¹, M. Yasser², H. Kattan², A. Khan², R. Bhatti², F. Al Habshan², R. Abu-Sulaiman²

¹Cleveland Clinic, OH, ²King Abdulsziz Medical City, Riyadh, Saudi Arabia

Purpose: Anatomical variations in Taussig-Bing double outlet right ventricle (DORV) anomaly are prevalent and require tailored complex surgical repair. The data on long-term outcomes following operative intervention are still limited. We studied the short- and long-term outcomes of repair of this anomaly with the arterial switch operation.

Methods: Retrospective study on 42 consecutive patients who underwent arterial switch operation for Taussig-Bing anomaly between October 2002 and September 2015. Median age at surgery was 36 days (5-739 days), median weight 3.3 kg (2.5-10.6 kg). Twenty-two patients (52.4%) had anomalous coronary arteries; 17 (40.5%) had side-by-side great vessels; seven (16.7%) had commissural malalignment. Hypoplastic aortic arch and/or coarctation was present in 26 (61.9%); of those, 20 (76.9%) had one-stage repair and the rest had two-stage repair. Seven patients (16.7%) had main pulmonary artery translocation. Fourteen patients (33%) had delayed sternal closure. Median bypass time was 190 minutes (139-329 minutes) and median cross-clamp time 114 minutes (80-211 minutes).

Results: There were two early deaths (4.8%); one due to biventricular failure, the other due to abdominal sepsis. 95% of survivors were followed for up to 13 years for a total of 151 patient-years (range, 1-153 months). There was one late death (2.4%) 11 months postoperatively. During follow-up, seven patients underwent 12 percutaneous interventions at a median period of 10 months (range, 1-118 months). Interventions included dilatation/stenting of aortic coarctation (n=7), dilatation/stenting of right ventricular outflow tract (n=2), branch pulmonary artery stenting (n=2), and device closure of residual ventricular septal defect (n=1). Three patients had three reoperations at a median period of 17 months (9-116 months). These included patch augmentation of right ventricular outflow tract (n=1), mitral and tricuspid valve repair (n=1), and right ventricle-to-pulmonary artery conduit placement (n=1). Freedom from all-cause mortality at follow-up was 92.9%, freedom from reinterventions was 82.5%, and freedom from reoperation was 92.5%.

Conclusions: Repair of Taussig-Bing anomaly can be carried out by the arterial switch operation with good short- and long-term results. The operative repair has to be tailored to individual patients based on the coronary anatomy and other associated congenital lesions. Long-term follow-up is important due to need for reinterventions or reoperations.

A Synthetic Bioabsorbable Polymer Polyethylene Glycol Hydrogel Spray May Prevent Postoperative Mediastinal Adhesions in Congenital Heart Surgery: A Randomized Double-Blind Study

N. W. Hasaniya¹, A. J. Razzouk², J. Newcombe³, D. Hassneiah³, J. Heimes², L. L. Bailey²

¹Loma Linda University School of Medicine, CA, ²Loma Linda University Medical Center, CA,

³Loma Linda University Children's Hospital, CA

COMMERCIAL RELATIONSHIPS N. W. Hasaniya: Research Grant, Baxter International

REGULATORY DISCLOSURE This presentation describes the off-label use of the synthetic bioabsorbable polymer polyethylene glycol hydrogel spray Coseal by Baxter International in reducing the adhesions and re-entry time in infants undergoing cardiac reoperation.

Purpose: Adhesions encountered at reoperative cardiac surgery can prolong operative time and increase reoperative risks. A topical polyethylene glycol hydrogel spray was noticed to reduce adhesions. The aim of this clinical study was to investigate the anti-adhesion property of a synthetic bioabsorbable polymer polyethylene glycol hydrogel spray following cardiotomy in infants.

Methods: Forty babies requiring cardiac reoperation were randomized to the hydrogel spray or control groups. Based on previous unpublished data, the appropriate volume was sprayed to the mediastinal surface at the end of the first surgical procedure in study group. On reoperation, adhesions were evaluated using a five-point scoring system by a blinded investigator at five pre-determined anatomical areas, including: 1) retrosternal area, 2) base of the heart (large vessels), 3) right side, 4) left side, and 5) diaphragmatic side of the mediastinum. Incision to pump time, mediastinal drainage up to 24 hours, blood utilization, hospital stay, and demographic data were analyzed.

Results: A total of 40 patients were prospectively randomized to either the control (n=20) or hydrogel spray (n=20). Four babies (two in each group) died before the second operation. The other patients (n=3) either had their second operation in another hospital (n=1) or were missed for evaluation (n=2). The remaining control group (n=16) had longer incision to pump time (38 \pm 10 vs 23 \pm 6, P < .001) than the remaining (n=17) hydrogel spray group. The control patients showed significantly more severe adhesions than the hydrogel spray group at the five mediastinal areas: retrosternal (P < .001), base of the heart (P = .05), right side (P = .01), left side (P = .02), and diaphragmatic side of the mediastinum (P = .001). There was no significant difference between both groups in postoperative drainage, age, gender, diagnosis, blood utilization, and hospital stay and mortality.

Conclusions: Redo operation and adhesions are a major concern in pediatric cardiac surgery. The use of the synthetic bioabsorbable polymer polyethylene glycol hydrogel spray topical surgical sealant at the end of primary pediatric cardiac surgical procedures reduces mediastinal adhesions and re-entry time in pediatric heart reoperations. Further multicenter studies are recommended.

Higher Oxygen Delivery Is an Important Factor for Adequate Peripheral Perfusion During High-Flow Regional Cerebral Perfusion at Aortic Arch Repair in Neonates and Infants

K. Sughimoto, S. Kohira, H. Hayashi, Y. Tsuchida, S. Torii, T. Kitamura, T. Horai, K. Miyaji Kitasato University School of Medicine, Sagamihara, Japan

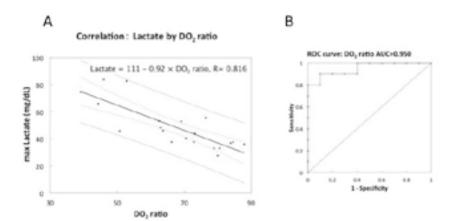
Purpose: High-flow regional cerebral perfusion (HFRCP) from the right innominate artery has been induced to keep sufficient cerebral and somatic oxygen delivery via collateral vessels for aortic arch repair in neonates and small infants. We sought to obtain safety markers of bypass flow to gain adequate peripheral perfusion during HFRCP.

Methods: Between 2009 and 2016, 20 consecutive patients (age: 22 days [6-116 days]; body weight: 3.0 kg ± 0.9 kg; two female and 18 male; coarctation: 18 and interruption: two) who underwent an aortic arch repair using HFRCP were enrolled. Oxygen delivery ratio (DO₂R) was defined as the quotient of DO₂ during HFRCP divided by DO₂ prior to HFRCP. Regional oxygen saturation on the thigh (rSO₂T) was monitored during HFRCP. Postoperative creatinine kinase (CK) and lactate levels were measured as the postoperative outcomes. Multivariate analyses were performed to clarify the effectiveness of DO₂R and rSO,T during HFRCP.

Results: No mortality or brain insult occurred in any case. The durations of cardiopulmonary bypass (CPB) and HFRCP was 150 minutes ± 51 minutes and 39 minutes ± 11 minutes, respectively. The average flow during HFRCP was 86 mL/min/kg ± 19 mL/min/kg with a systemic blood pressure of 43 mm Hg ± 4 mm Hg. The lowest rSO₂T during HFRCP was $80.8\% \pm 24.4\%$. The multivariate analysis revealed that the lowest rSO₂T (P = .0416) and CPB time (P = .029) predicted the postoperative CK level. DO₂R was the only factor to predict postoperative lactate (P < .001), along with the linear regression (R=0.816). The receiver operating characteristic analysis revealed that a DO₂R less than 0.66 predicted a risk for an increased lactate level (>45 mg/dL) with an area under the curve of 0.95.

Conclusions: For arch repair in neonates and infants, the regional oxygen saturation on the thigh and the oxygen delivery during HFRCP were useful markers to predict sufficient peripheral perfusion. Maintaining higher oxygen delivery during HFRCP is very important to prevent postoperative increases in lactate levels.

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Multivariate analysis for outcomes

	Variable	Coefficient	(95% CI)	p
CK (mg/dL)	CPB time (min)	3.83	0.71 - 6.96	0.029
	lowest rSO ₂ on Thigh (%)	-19.2	-36.12.21	0.0416
Lactate (mg/dL)	DO, ratio (%)	-1.00	-1.3720.633	< 0.001

Dismal Outcomes of Second-Run Extracorporeal Life Support in the Pediatric Population

J. Soquet, R. Chiletti, S. Horton, I. E. Konstantinov, J. Brink, C. P. Brizard, W. Butt, Y. d'Udekem The Royal Children's Hospital, Melbourne, Australia

COMMERCIAL RELATIONSHIPS C. P. Brizard: Ownership Interest, Admedus Australia; Consultant/Advisory Board, Admedus Australia; Y. d'Udekem: Consultant/Advisory Board, MSD, Actelion Pharmaceuticals

Purpose: In 2011, our center reported unfavorable outcomes of second-run extracorporeal life support (ECLS) in children. We wanted to investigate whether this previous report affected our strategy. We reviewed our entire experience with second-run ECLS in a pediatric population.

Methods: Second-run ECLS was defined as reinstitution of ECLS at least 3 hours after the cessation of a first ECLS episode and before the end of the same hospital stay. Between 1988 and 2015, 35 patients underwent a second run of support: 29 cardiac patients (82.9%) and six noncardiac patients (17.1%). Median age at the time of first support was 9 days (0-16 years). Median length of support for the first and second run were 3.7 days (0.1-10 days) and 4.9 days (0.5-8.7 days) respectively, with an interval of 3.5 days (0.2-75 days) between supports.

Results: There was an increase in the number of patients undergoing second-run ECLS after our report: 25 patients between 1988 and mid-2010 (six noncardiac) and 10 between mid-2010 and 2015 (one noncardiac). While 60% of patients (21/35) survived weaning of support, only 25.7% (9/35) survived to hospital discharge, and 14.3% (5/35) were still alive at a median of 6.5 years (1.2-11.6 years) after hospital discharge. Outcomes were similar in the two time periods (Table). Two of the five long-term survivors had severe neurological deficits. All three patients who had a positive long-term outcome had the second-run ECLS instituted to allow for the following major cardiac operations: 1) bidirectional cavopulmonary shunt (BCPS) after repair of Ebstein anomaly, 2) arterial switch operation, and 3) pulmonary artery patching and takedown of a BCPS.

Conclusions: Compassionate use of second-run ECLS is difficult to refuse, but one should be aware that its outcomes are dismal. In our center, benefits seem to be limited to cases where the second-run ECLS allows for a major cardiac intervention.

Table 1. Outcomes of Second-Run Pediatric Extracorporeal Life Support at the Royal Children's Hospital Melbourne

	May 1988 – Mid-2010	Mid-2010 – December 2015	Overall
Number of patients	25 (20 cardiac, 5 noncardiac)	10 (9 cardiac, 1 noncardiac)	35 (29 cardiac, 6 noncardiac)
Survival to second run	15 (60%)	6 (60%)	21 (60%)
Survival to discharge	7 (28%)	2 (20%)	9 (25.7%)
Currently alive	3 (12%)	2 (20%)	5 (14.3%)

Single-Stage Repair of Coarctation of the Aorta and Ventricular Septal Defect: A Comparison of Surgical Strategies and Resource Utilization

C. Callahan¹, D. Saudek², A. Shillingford⁸, S. Creighton², W. Johnson², M. E. Mitchell², R. K. Woods²

¹Medical College of Wisconsin, Milwaukee, ²Children's Hospital of Wisconsin, Milwaukee, ³Nemours Cardiac Center, Alfred I. duPont Hospital for Children, Wilmington, DE

COMMERCIAL RELATIONSHIPS M. E. Mitchell: Research Grant, TAI Diagnostics, Ariosa Diagnostics; Ownership Interest, TAI Diagnostics, Ariosa Diagnostics; Consultant/Advisory Board, TAI Diagnostics; C. Callahan: Ownership Interest, TAI Diagnostics

Purpose: We sought to evaluate clinical outcomes and resource utilization of two repair strategies: 1) repair via sternotomy using deep hypothermic cardiopulmonary bypass (CPB) and either antegrade cerebral perfusion or deep hypothermic circulatory arrest; and 2) off-pump arch repair via L thoracotomy followed by sternotomy during the same anesthetic and on-pump repair of ventricular septal defect (VSD) with CPB.

Methods: Twenty-one patients were reviewed retrospectively with concomitant repair of coarctation (CoA) and hypoplastic aortic arch (HAA) and associated VSD between May 1, 2001, and October 1, 2012, at our institution. Patients undergoing single-ventricle palliation were excluded. Primary outcomes included arch reintervention, duration of postoperative mechanical ventilation, length of stay (LOS), and hospital charges (including those for any readmission for arch intervention).

Results: Eight patients underwent thoracotomy followed by sternotomy (Group I), and 13 patients underwent sternotomy alone (Group II). Compared to Group II, Group I had a shorter median LOS (8 days vs 23 days, P = .004), lower duration of postoperative mechanical ventilation (0.5 days vs 4 days, P < .001), lower day of surgery charges (\$37,208 vs \$62,583, P = .001), and lower total charges (\$68,301 vs \$211,723, P < .001). There was one surgical reintervention in Group II. Proximal arch z score was not associated with arch reintervention in a large separate cohort of patients undergoing arch repair alone via thoracotomy (z score of 0 to -6). Discharge survival was 100%.

Conclusions: Compared to sternotomy alone with deep hypothermic CPB for concomitant repair of the arch and cardiac anomalies, off-pump L thoracotomy repair of the arch followed by on-pump repair of VSD appears to be associated with equivalent clinical outcomes for most patients, yet substantially reduced resource utilization.

Persistent Symptoms in Children After Vascular Ring Repair

M. Ramaswamy, A. Beeman, S. Bollard, B. Davies, I. Sullivan, N. Muthialu Great Ormond Street Hospital for Children, London, United Kingdom

Purpose: Vascular rings are rare congenital abnormalities. They cause varied symptoms by compressing the trachea and esophagus. Some children continue to be symptomatic even after relieving this compression. The purpose of this study was to identify risk factors associated with persistence of aerodigestive symptoms in children after vascular ring repair.

Methods: Retrospective study in a single institution between 2005 and 2015. All children who had surgery for true vascular ring (double aortic arch [DAA] and right aortic arch with left duct [RAA]) were included. The factors analyzed were demographic data, symptoms, age at onset of symptoms, diagnostic investigations, associated anomalies, type of vascular ring, age and weight at surgery, surgical technique, and symptoms at follow-up. The following additional factors were analyzed for DAA: patency and dominance of the arches, anterior angle subtended at the level of compression, and position of descending aorta in relation to the airway. Data was analyzed by t-test and ANOVA.

Results: 129 children were identified (RAA = 74, DAA = 55). At surgery, median weight was 8 kg (0.8-66.3 kg) and median age was 8 months (0-201 months). Airway symptoms (RAA = 54/74, DAA = 51/55) were more common than esophageal symptoms (RAA = 39/74, DAA = 15/55). Onset of symptoms was usually in the first year of life (RAA = 52/74, DAA = 31/55). After surgery, symptom relief was seen in nearly 50% children within a year (RAA = 36/74, DAA = 24/55) when both arches were patent in DAA (P < .05) and in the absence of comorbid conditions and esophageal compression in both types. Persistent symptoms in DAA were seen with arch angulation between 45° and 60° . Persistent symptoms in RAA were seen with early onset of symptoms and in the presence of comorbid conditions and Kommerell's diverticulum (KD). KD was not routinely operated in earlier period of the study.

Conclusions: Anterior arch angulation plays a key role in DAA by causing a "nutcracker" phenomenon. This may need a modified repair. Aortopexy in selected cases can offer additional benefit. This requires careful preoperative morphological assessment. Resection of Kommerell's diverticulum is important in repair of RAA. Further prospective studies are essential.

P58

Post-Cardiac Surgery Utilization of Nicardipine Is Safe and Effective in Children Regardless of Age

M. L. Stone¹, M. L. Buck², J. J. Gangemi¹, J. Vergales¹

¹University of Virginia Health System, Charlottesville, ²University of Virginia School of Medicine, Charlottesville

COMMERCIAL RELATIONSHIPS J. Vergales: Other, Volunteer Medical Director, Locus Health; Research Grant, Merck & Co

Purpose: Calcium channel blockers are commonly avoided in children less than 1 year of age, secondary to concerns of safety and efficacy. The purpose of this study was to review a single-institution experience with nicardipine, a selective calcium channel blocker, in pediatric patients following cardiac surgery.

Methods: Children undergoing cardiac surgery at the University of Virginia from 2010 to 2015 were reviewed retrospectively following selection based upon receipt of nicardipine for blood pressure management in the postoperative period. Demographic, operative, laboratory, and postoperative data were collected for side effect analysis and outcomes comparisons between infants less than (Group 1) and greater than 6 months of age (Group 2).

Results: Sixty-eight children (Group 1: n=33, 48%; Group 2: n=35, 52%) received nicardipine during the study period following cardiac surgery (Table). Administration occurred at a median time of 90 minutes postoperatively, yet 33% (n=22) required initiation of therapy in the operating room. Nine patients (13%) demonstrated clinically significant side effects that demonstrated no statistically significant differences between groups (17% vs 9%, *P* = .47).

Conclusions: Nicardipine is well-tolerated following cardiac surgery in children irrespective of age. Thus, nicardipine should be considered as both safe and effective in children of all ages for control of hypertension following cardiac surgery.

Operation	Group 1 Less than 6 months n=33	Group 2 Greater than 6 months n=35
Coarctation repair	22, 66.7%	9, 25.7%
Subaortic AS resection		6, 17.1%
Heart transplant	4, 12.1%	1, 2.9%
Bi-directional Glenn	3, 11.0%	1, 2.9%
Anrtic root replacement		4, 11.4%
Vascular ring repair	1, 3.0%	2,5.7%
AVR/PVR		2, 5.7%
Supravalvaular AS and arch augmentation		2, 5.7%
Aortic valve replacement	21	2,5.7%
Anomalous corosary artery		1, 2.9%
ASD repair		1, 2.9%
Fenestrated Fontan		1, 2.9%
BT shunt	1, 3.0%	
Trancus arteriosas repair	1, 3.0%	
AVR/mitral commisurotomy	1 200000	1, 2.9%
Aortic aneurysm repair		1, 2.9%
VSD/arch reconstruction	1, 3.0%	
Aortic arch reconstruction		1, 2.9%

A5: nortic stenosis

AVR: aortic valve replacement PVR: polmonary valve replacement

ASD: atrial septal defect

BT: Blalock-Taussig shurt

VSD: ventricular septal defect

Outcomes of Children With Trisomy 13 and 18 After Interventions for Congenital Heart Disease

J. K. Peterson¹, K. Catton², L. Kochilas³, S. P. Setty¹

¹Long Beach Memorial/Miller Children's & Women's Hospital, CA, ²Memorial Care Medical Group, Long Beach, CA, ³Emory University, Sibley Heart Center Cardiology, Atlanta, GA COMMERCIAL RELATIONSHIPS L. Kochilas: Consultant/Advisory Board, Novartis

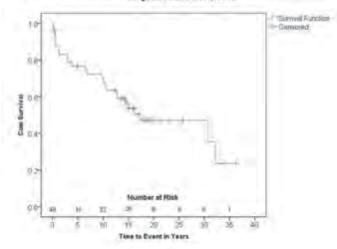
Purpose: Children with trisomy 13 or 18 are thought to have brief lifespans, but care improvements may be changing short- and long-term outcomes. Our objective was to describe outcomes for trisomy 13 and 18 patients offered interventions for congenital heart disease (CHD).

Methods: Retrospective review of patients with trisomy 13 and 18 enrolled in the Pediatric Cardiac Care Consortium from 1982 to 2007. Fifty trisomy 13 patients and 121 trisomy 18 patients were identified. Short-term outcome included in-hospital mortality. National Death Index (NDI) linkage provided long-term outcomes for patients enrolled before April 2003 with sufficient available identifiers. Kaplan-Meier survival analysis was used to examine long-term mortality.

Results: Ninety-eight (35 male, 63 female) of 171 patients (57.3%) were offered at least one surgical or transcatheter intervention. The most common diagnoses were ventricular septal defect (39/98, 39.8%), tetralogy of Fallot (20/98, 20.4%), and aortic coarctation (15/98, 15.3%). The most common surgical interventions were ventricular septal defect closure (32/96, 33%), coarctation repair (14/96, 14%), tetralogy of Fallot repair (12/96, 12%), and aortopulmonary shunt (10/96, 10%). In-hospital mortality was 10/83 (12%) after surgical intervention and 9/68 (13.2%) following transcatheter intervention. NDI linkage identified 25 deaths out of 48 cases submitted (median follow-up time 14 years). The Kaplan-Meier survival plot for the NDI cohort is presented in the Figure. Causes of procedural mortality were cardiac (12/19, 63.2%) multiorgan failure (6/19, 31.6%), and sepsis (1/19, 5.2%). The most common causes of out-of-hospital deaths were cardiac (10/25, 40%) and infections (8/25, 32%).

Conclusions: Procedural mortality for CHD in patients with trisomy 13 and 18 is high. Fourteen-year survival after intervention for CHD reaches 52% (95% CI, 39%-67%). This finding provides an estimate of expected outcome should interventions be offered for this group of patients.

Figure, Replan-Meler Survival Piot for Patients with Trisomy 13 and 18 Patients and Interventions for Congenital Heart Disease, N = 48



P60

Prediction of Degeneration of the Unifocalized Major Aortopulmonary Collateral Arteries With Autologous Pericardium in Pulmonary Atresia and Ventricular Septal Defect Based on Blood Flow Dynamics

N. Kato¹, M. Yamagishi², K. Itatani², H. Yaku²

¹Children's Medical Center, Kyoto Prefectural University of Medicine, Japan, ²Kyoto Prefectural University of Medicine, Japan

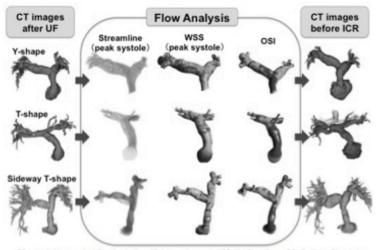
COMMERCIAL RELATIONSHIPS K. Itatani: Research Grant, Medtronic; Consultant/Advisory Board, Cardio Flow Design

Purpose: Regeneration or degeneration of the unifocalized major aortopulmonary collateral arteries (MAPCA) are often problematic in pulmonary atresia with ventricular septal defect (VSD). We assessed the mechanical stress on the endothelial tissue caused by turbulent blood flow in the reconstructed pulmonary artery (PA) with autologous pericardium.

Methods: Patient-specific PA models were made with six patients based on the computed tomography (CT) images taken soon after the palliative right ventricular outflow reconstruction (RVOTR) with unifocalization with autologous pericardium for absent or hypoplastic central PA. Computational fluid dynamics models were created to simulate the physiological pulsatile flow, including the peripheral reflection wave, characteristic impedance, and autonomous regulation system. Flow stream patterns, wall shear stress (WSS), and the oscillatory shear index (OSI) were calculated from the calculated results. PA degeneration or regeneration was evaluated with the computed tomography images before the intracardiac repair with VSD closure.

Results: The shape of the reconstructed PA can be classified into three types: Y-shape in two cases; T-shape in two cases; and sideways T-shape in two cases (Figure). One case of sideways T-shape caused detached vortex flow at the rectangular angle anastomosis site of the right PA, resulting in high OSI with aneurysmal enlargement in pericardium detected. High WSS was detected at the distal anastomosis site and Y-shape bifurcation, and intimal thickening was found in these regions during intracardiac repair. Patch augmentation was required in four cases. The other case of sideways T-shape required additional right PA reconstruction due to shrinking and compression with bronchus on stretched pericardium, even though there were little abnormalities in flow stream, WSS, and OSI. All six cases achieved definitive intracardiac repair in 13 months ± 5 months after the palliative RVOTR.

Conclusions: Endothelial stress caused by blood flow would influence the degeneration and regeneration of autologous pericardium in the reconstructed PA. The high OSI site might induce enlargement or dilatation of pericardium, and the high WSS site of anastomosis might induce intimal thickening.



CT: computed tomography, UF: unifocalization, ICR: intra-cardiac repair, WSS: Wall Shear Stress, OSI: Oscillatory Shear Index

Mechanical Circulatory Support for the Failing Fontan Circulation: Conversion to Assisted Single Ventricle Circulation

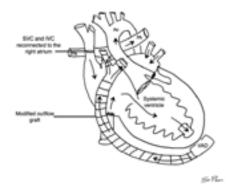
S. Peer¹, K. B. Deatrick², J. W. Haft², F. D. Pagani¹, R. G. Ohye², E. L. Bove², M. Si²¹University of Michigan Health System, Ann Arbor, ²University of Michigan, Ann Arbor

Purpose: Mechanical circulatory support of a failing Fontan circulation remains challenging. We hypothesized that the Fontan circulation could be converted to a mechanically assisted single ventricle circulation (MASVC; Figure A).

Methods: A porcine single ventricle model was created under cardiopulmonary bypass (CPB) by performing an atrial septectomy, tricuspid valvectomy, and interrupting antegrade pulmonary blood flow (Figure B). A centrifugal flow pump was placed with inflow from the common atrium. Eight-mm Dacron grafts anastomosed to the ascending aorta and main pulmonary artery supplied systemic (Qs) and pulmonary (Qp) blood flow. Ultrasonic flow probes were used to measure Qs and Qp after weaning from CPB. Qp:Qs was regulated with an adjustable clamp. Hemodynamic and laboratory data were recorded.

Results: All four animals were successfully weaned from CPB onto the MASVC for a duration of 2 hours. Hematocrit was maintained close to the baseline. MASVC achieved satisfactory hemodynamics (Table). As anticipated, the arterial oxygen saturation and partial pressure of oxygen in arterial blood were lower in MASVC compared to the baseline biventricular circulation. Higher saturations were achieved with a Qp:Qs of 1.5:1 compared to a Qp:Qs of 1:1. Mixed venous saturations were satisfactory. The serum lactate levels plateaued or showed a downward trend after 2 hours of support.

Conclusions: MASVC can be sustained with satisfactory hemodynamics in an animal model. Converting to a MASVC may be an effective strategy for the failing Fontan circulation. The optimum Qp:Qs to achieve satisfactory systemic oxygenation and flows requires further study.



IND-verticular sector device, SVC-expensiv-versi cario, IVC-referent versi cario, Ac-acrio, PA-pulmonary artery

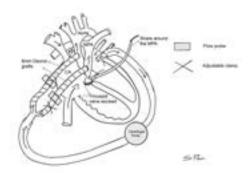


Figure 19. Persons arrive remarks reside insulted in anterprisite pulmonary lotted films CA-common arrun, NPN-main pulmonary artery

Table 1: Succeiptants and laboratory data (n-4)

York	Esoite Chromoler straides	Ox VAQ Op Op 11 Climpto workside consistency	Ox VIQ Op Ox 15.1 (Single mittable decades)
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Cortice Oxford Parts Now (Liver)	23405	2567	1164
MP (res Hg)	60 bid 7	10.5a16.3	HI 567 E
FAP (results)	20,503.6	26.544.7	32 (47 4
CITICAT prenting	744	6621	85431
FeSt (ming)	36350	8134	17 Se 16 4
N2N	100.648	7724113	80x0.1
MAGE CALL	65363	54,3440	6541
Latte (result)	243	4521	45671

Data represented as mean actuaciant deviation.

ICT homotoost, IEAP more artend procure, FAP more palmonary artery procure, CVP central remois procure, CAP-common attiid procure, PaCO partid procure of ongor in artend blood, 1pCO artend ongoin substation, MPCO record wroce ongoin substation.

Noticitive provided waithe ceremiqui pump.

Critical Care

P62

Early Glycemic Variability Is Associated With Adverse Outcomes in Normoglycemic Patients Following Cardiac Surgery

L. E. Johnston¹, M. Sohn¹, J. L. Kirby², R. Thiele², R. K. Ghanta¹, I. L. Kron³, A. McCall², J. Isbell⁴

¹University of Virginia, Charlottesville, ²University of Virginia Health System, Charlottesville,

³University of Virginia Medical Center, Charlottesville, ⁴Memorial Sloan Kettering Cancer Center,
New York, NY

Purpose: It is not known whether glycemic variability affects perioperative outcomes in cardiac surgery patients, in whom glucose levels are monitored frequently and managed with insulin infusion. The objective of this study was to evaluate the glycemic variability in patients following cardiac surgery and its association with perioperative morbidity and mortality.

Methods: Single-institution STS National Database patient records from 2010 to 2014 were merged with clinical data, including blood glucose values measured in the intensive care unit. Patients with a mean postoperative glucose between 120-180 mg/dL in the first 48 hours postoperatively were included. Primary outcomes were operative mortality and major morbidity. Measures of glycemic variability included the mean, maximum, minimum, range, standard deviation, interquartile range (IQR), coefficient of variation, and variation independent of the mean of glucose within 48 hours after surgery. Univariate and multivariable regression models were used to evaluate outcomes.

Results: A total of 2,146 patient records were eligible for analysis. The median postoperative glucose was 142 mg/dL (IQR 135-152 mg/dL). Overall operative mortality was 2.1% (n=44), and major morbidity was 12.8% (n=275). Increases in all measures of variability (or a decrease in minimum glucose) with the exception of mean glucose and IQR were significantly associated with operative mortality. Unadjusted risk of mortality and morbidity, and risks adjusted for STS PROM, age, gender, diabetes, end-stage renal disease, and chronic lung disease, are presented in the Table. Using Akaike's Information Criterion (AIC) to compare model performance across variability measures, total glucose range was generally the best-performing measure.

Conclusions: Historically, glucose control in cardiac surgery patients has focused on controlling peak and/or average glucose values. Our study demonstrates considerable glucose variability even among patients considered well controlled by current standards. The degree of variability, more than peak or average glucose levels, is associated with significant risk for adverse outcomes following cardiac surgery.

Table 1: Odds Ratios for Operative Mortality and Major Morbidly

	Unadjusted Odds Ratio (95% CI)	p-value	Adjusted Odds Ratio (95% Ci)	p-value	c-statistic
Operative Mortality	Pieto (so is og	p-vace	riano jao le Coj	17-1900	U-SHOROKK
Magn Glucose ¹	1.03 (0.82-1.30)	p=0.8	1.12 (0.86-1.44)	p=0.4	0.76
Maximum Glucose ¹	1.09 (1.05-1.13)	p<0.001	1.10 (1.06-1.14)	p<0.001	0.78
Mnimum Gluccae [†]	0.58 (0.58-0.79)	p<0.001	0.72 (0.61-0.85)	p<0.001	0.79
Range ²	1.10 (1.06-1.14)	p<0.001	1.11 (1.06-1.15)	p<0.001	0.79
Standard Deviation/	1.48 (1.20-1.81)	p<0.001	1.49 (1.18-1.88)	p=0.001	0.78
IQR ¹	1.07 (0.91-1.26)	p=0.4	1.04 (0.87-1.25)	p=0.7	0.76
Coefficient of	that gares though	p-0.4	The Agency Theory	p-0.1	
Variation ⁶	1.08 (1.04-1.12)	p<0.001	1.07 (1.03-1.12)	p<0.001	0.79
Major Morbidity			1101 (1110 11110	,	
Mean Gluccee ¹	1.12 (1.02-1.24)	p=0.018	1.16 (1.04-1.30)	p=0.007	0.73
Maximum Glucose ¹	1.05 (1.02-1.07)	p=0.001	1,05 (1,03-1,08)	p<0.001	0.74
Minimum Gluccse [†]	0.80 (0.74-0.86)	p<0.001	0.85 (0.79-0.92)	p<0.001	0.74
Range ²	1.06 (1.04-1.08)	p<0.001	1.06 (1.03-1.09)	p<0.001	0.74
Standard Deviation ⁷	1.29 (1.17-1.43)	p<0.001	1.25 (1.11-1.40)	p-c0.001	0.74
IQR1	1.15 (1.07-1.23)	p<0.001	1.12 (1.04-1.21)	p=0.005	0.74
Coefficient of					
Variation ⁰	1.05 (1.03-1.07)	p<0.001	1.04 (1.02-1.00)	p<0.001	0.74

¹Per 10 mg/dL increase; ⁵CV*100

Outcomes From a Hub-and-Spoke Extracorporeal Membrane Oxygenation Program: Success, Failure, and Lessons Learned From 107 Consecutive Respiratory ECMO Patients

G. Schwartz, O. Hernandez, D. Steimer, R. S. Malyala, B. Lima, J. C. MacHannaford, A. E. Rafael, T. Chamogeorgakis, S. Kearns, M. Medenceles, G. V. Gonzalez-Stawinski, D. Mason Baylor University Medical Center, Dallas, TX

Purpose: Veno-venous extracorporeal membrane oxygenation (VV-ECMO) provides lifesaving support for patients with refractory respiratory failure. For optimal resource utilization, regionalization of ECMO care appears both logical and cost effective. We describe our single-center experience developing a "hub-and-spoke" system of VV-ECMO support for severe respiratory failure.

Methods: In June 2012, our center established an ECMO program in which patients referred for severe respiratory failure were transported by our critical care transport team, including a cardiothoracic surgeon and a perfusionist, to our center for VV-ECMO support. Critical care was standardized and provided by a single multidisciplinary ICU team. Data were collected prospectively and reviewed retrospectively to consider indications, demographics, complications, and survival.

Results: From June 2012 to June 2016, 107 patients were treated with VV-ECMO. Forty were referred through this "hub-and-spoke" system: 32 were cannulated by our team "in the field," six upon arrival, and two by surgeons at referring centers. No patients died in transport. Median age was 49 years (range 18-76 years). Median P/F ratio at cannulation was 64 (mean 76). Indications for ECMO included acute respiratory distress syndrome (ARDS) secondary to infection (n=40; H1N1 influenza: 21); trauma/aspiration (n=16); postoperative respiratory failure (n=19); bridge to lung transplant or decision (n=13); post-lung transplantation (n=5); and other indications (n=14), including airway compromise and anaphylaxis. Median duration of ECMO was 7 days (range 1–37 days). Weaning from ECMO occurred in 75% of patients, with 58% surviving to discharge. 53%-63% of patients with ARDS from infection, trauma, and postoperative respiratory failure survived to discharge, compared to 86% of patients secondary to aspiration. Five of the 13 patients considered for transplantation were transplanted, with four surviving to discharge.

Conclusions: Transfer to a regional ECMO center for respiratory support is feasible and safe. Survival for adult VV-ECMO patients is reasonable, and utilization is warranted with appropriate patient selection. Establishment of regional ECMO referral centers around the country should be considered to improve access to this lifesaving therapy.

The Survival Advantage of Intraoperative Extracorporeal Membrane Oxygenation Use During Complex General Thoracic Surgery

L. W. Schaheen¹, E. G. Chan¹, N. Shigemura¹, B. W. Schaheen², J. D. Luketich¹, J. D'Cunha¹

¹University of Pittshurgh Medical Center, PA, ²University of Virginia Health System,

Charlottesville

COMMERCIAL RELATIONSHIPS J. D. Luketich: Ownership Interest, Johnson & Johnson, Intuitive Surgical; Research Grant, Accuray

Purpose: Extracorporeal membrane oxygenation (ECMO) affords an alternate means of support for patients undergoing complex thoracic surgical procedures when conventional methods are not satisfactory. We aimed to evaluate the indications, outcomes, and complications associated with intraoperative use of ECMO during complex thoracic surgical procedures.

Methods: We reviewed all ECMO cases at our institution from January 1, 2000, to June 1, 2016, to identify cases of intraoperative support for general thoracic surgery. Patients who underwent ECMO preoperatively, postoperatively, or in the transplantation setting were excluded. Our database was reviewed to identify the operative procedure, ECMO support variables, and outcomes.

Results: Twenty-five patients received intraoperative ECMO during thoracic surgical procedures. Veno-venous ECMO was utilized in 84% (n=21), veno-arterial in 8% (n=2), and an intraoperative conversion from VA to VV in 8% (n=2). Group 1 (total respiratory support) was comprised of seven patients who underwent complex tracheobronchial reconstruction necessitating prolonged apnea. Group 2 (partial respiratory support) comprised 13 patients with severe refractory respiratory failure/acute respiratory distress syndrome who were unable to maintain adequate oxygenation with conventional therapies. Group 3 (cardiopulmonary support) was comprised of two patients requiring veno-arterial ECMO. The median duration of ECMO therapy was 129.5 hours. ECMO-related complications, including cannulation site bleeding and gastrointestinal hemorrhage, were noted in 8% of patients. 56% of all patients receiving intraoperative ECMO survived to discharge. The 90-day survival in patients who were discharged was 71.4%.

Conclusions: The intraoperative use of ECMO is a safe and viable alternative for patients requiring partial or complete pulmonary support during thoracic surgery. The excellent outcomes seen in our study suggest that the intraoperative use of ECMO provides a survival advantage for carefully selected patients.

A Disciplined Approach to Standardized Management of Veno-Venous Extra Support Improves Survival: The Ohio State University Algorithm

B. A. Whitson¹, R. Tripathi², A. Bhatt², E. Abel¹, A. Kilic¹, J. A. Crestanello¹, S. D. Moffatt-Bruce¹ The Ohio State University Wexner Medical Center, Columbus, OH, ²The Ohio State University, Columbus

COMMERCIAL RELATIONSHIPS J. A. Crestanello: Research Grant, Medtronic, Boston Scientific, Abbott Vascular; A. Kilic: Speakers Bureau/Honoraria, St Jude Medical; Consultant/Advisory Board: St Jude Medical; B. A. Whitson: Other, St Jude Medical, HeartWare; Other Research Support, XVIVO

REGULATORY DISCLOSURE This presentation will describe the off-label use of extended-duration extracorporeal life support, which is FDA approved for short-term use.

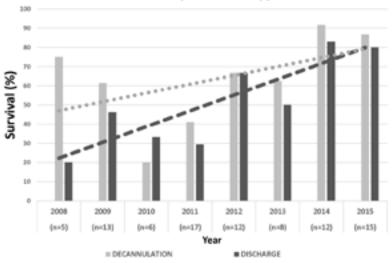
Purpose: Veno-venous extracorporeal life support (VV-ECLS) may be considered in patients with acute respiratory failure failing advanced medical management. Given the high predicted mortality of these patients, outcomes are commonly thought to be premorbid. We evaluated the impact of a structured, interprofessional approach to VV-ECLS patient selection and management, relative to survival.

Methods: We retrospectively reviewed our institutional database of all patients undergoing extracorporeal life support. We limited our analysis to adults who underwent VV-ECLS for the treatment of acute respiratory failure, refractory to medical management, including patients from January 1, 2008, through December 31, 2015. Cohorts were grouped relative to before and after initiation of the Ohio State University algorithm in January 1, 2013. Demographic, clinical, and survival relative to decannulation and discharge outcome data were collected and analyzed.

Results: During the entire study period, there were 275 ECLS performed with 90 meeting inclusion criteria. Fifty-three VV-ECLS were performed prior to initiation of the algorithm and 37 after implementation. All patients were co-managed by cardiothoracic surgeons and anesthesia critical care physicians in a cardiothoracic intensive care unit with substantive support from dedicated pharmacists, respiratory and physical/occupational therapists, and dietitians. There was no difference in proportion of men (51% before vs 57% after, P = .53) or mean age (42.6 years ± 16 years before vs 42.2 years ± 17.5 years after, P = .46). Survival to decannulation increased from 54.9% to 83.3% (P = .006) and survival to discharge or transfer increased from 41.5% to 75% (P = .002). Over the study period, survival to decannulation (P = .048) and discharge or transfer (P = .018) increased (Figure). In a limited, nominal logistic model, gender and before/after algorithm implementation status significantly impacted survival.

Conclusions: Patients with acute respiratory failure refractory to medical management are critically ill and benefit from judicious use of VV-ECLS. A disciplined interprofessional approach with a structured selection, initiation, and management algorithm for VV-ECLS significantly improves survival outcomes.

Veno-Venous Extra-Corporeal Life Support Survival



Methylene Blue for Vasoplegic Syndrome After Cardiopulmonary Bypass: Early Administration Improves Survival

J. H. Mebaffey¹, L. E. Johnston², R. B. Hawkins², E. J. Charles¹, L. T. Yarboro³, G. Ailawadi², I. L. Kron³, R. K. Ghanta²

¹University of Virginia Health System, Charlottesville, ²University of Virginia, Charlottesville, ³University of Virginia Medical Center, Charlottesville

COMMERCIAL RELATIONSHIPS G. Ailawadi: Consultant/Advisory Board, Abbott Laboratories, Edwards Lifesciences Corporation, St Jude Medical; Speakers Bureau/Honoraria, AtriCure

REGULATORY DISCLOSURE This presentation will describe the use of methylene blue for the treatment of post-cardiopulmonary bypass vasoplegia, which is not FDA approved.

Purpose: Vasoplegic syndrome (VS), defined by hypotension despite normal or increased cardiac output, is associated with high mortality after cardiopulmonary bypass (CPB). Methylene blue (MB) has been reported to ameliorate severe hypotension associated with VS through the nitric oxide pathway. We hypothesize that specific factors exist predicting positive clinical response to MB.

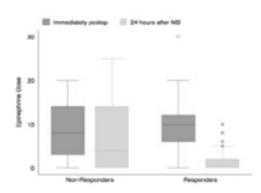
Methods: All patients receiving MB within 72 hours of CPB at our institution from January 1, 2011, to June 30, 2015, were identified through our institutional STS National Database records, pharmacy records, and detailed chart review. Patients were stratified as "responders" or "non-responders" with response defined by mean arterial pressure (MAP) >60 mm Hg 24 hours after MB administration with a 50% reduction in norepinephrine, epinephrine, or vasopressin dose, and a 25% increase in systemic vascular resistance index (SVRI), or a 50% reduction in lactic acid. Mortality, morbidity, and hemodynamics were compared between groups, and logistic regression was performed to identify prognostic factors for MB response.

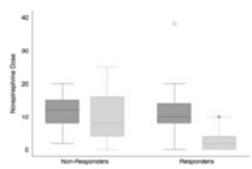
Results: A total of 64 CPB patients received MB for the treatment of VS during the study period with 43 (67%) having a positive clinical response. Responders had reduced 30-day mortality (12% vs 43%, P = .005), renal failure (20% vs 52%, P = .008), pneumonia (4.9% vs 33%, P = .003), cardiac arrest (7.3% vs 38%, P = .003), and vasopressor requirement (Figure). Median intraoperative pH (7.31 vs 7.24, P = .001) and nadir MAP (52 mm Hg vs 47 mm Hg, P = .04) were higher in MB responders. Logistic regression demonstrated increased response to MB in patients with lower pH (OR 3.9, P = .003) and lower nadir MAP (OR 1.07, P = .04) on CPB. Preoperative medications (ACE inhibitors, amidarone, beta-blockers) were not predictive of response to MB (all P > .05; Table). Timing of MB administration also was associated with clinical response to MB, as positive response occurred in 75% of patients who received MB within 24 hours of development of VS and in only 25% of patients who received MB later (OR 10.5, P = .04).

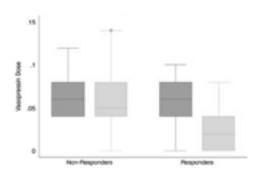
Conclusions: MB leads to positive hemodynamic response with decreasing pressor requirements in most patients with VS after CPB. Early administration of MB is associated with the greatest likelihood of positive hemodynamic response. Specific clinical predictors of response include acidosis and hypotension during CPB, which should prompt early consideration for MB administration.

Table 1. Logistic Regression for Response to Methylene Blue

Predictor for MB Response	Odds Ratio (95% C.I.)	p-value	c-statistic
Amiodarone	1.55 [0.43,5.58]	0.50	0.54
ACE-Inhibitor	2.05 [0.21,19.59]	0.53	0.52
Beta-blocker	2.53 [0.85,7.50]	0.10	0.61
Low MAP on CBP	1.07 [1.01,1.14]	0.04	0.64
Low pH on CPB	3.90 [1.58,9.59]	0.003	0.76







A Novel Rotational Speed Modulation System Used With Venoarterial Extracorporeal Membrane Oxygenation Reduces Left Ventricular Afterload and Augments Coronary Arterial Flow in a Goat Model of Cardiogenic Shock

N. Naito¹, T. Nishimura², K. Iizuka³, Y. Takewa³, M. Ono¹, E. Tatsumi⁴

¹The University of Tokyo Hospital, Japan, ²Tokyo Metropolitan Geriatric Hospital, Japan, ³National Cerebral and Cardiovascular Center, Osaka, Japan, ⁴National Cerebral and Cardiovascular Center, Suita, Japan

Purpose: We have developed a rotational speed (RS) modulation system used for continuous-flow left ventricular assist devices, which changes RS in synchronization with the native cardiac cycle. We have reported that the system could optimize coronary arterial flow and change the left ventricular load. We conducted this study to evaluate our novel RS modulation system used with VA-ECMO.

Methods: VA-ECMO was installed via right atrial drainage and distal abdominal aortic perfusion in five adult goats (43.2 kg \pm 2.3 kg). Cardiogenic shock was induced with a beta-adrenergic antagonist (Esmolol) infusion. An intra-aortic balloon pump (IABP) was placed in the thoracic descending aorta. Left ventricular stroke work (LVSW), left ventricular end-systolic pressure (LVESP), blood flow of the left coronary main trunk (CoF), and pulsatility index of blood flow of the left renal artery (RFPI) were evaluated. Data were collected under four conditions: circuit-clamp (cardiogenic shock without VA-ECMO support), continuous mode (constant RS), counter-pulse mode (increases RS during the diastole), and continuous mode + IABP (constant RS with IABP support).

Results: CoF, LVSW, and LVESP were shown in each mode as percentages of those in the circuit-clamp mode (=100%; Table). Although statistically insignificant, CoF tended to be higher in the counter-pulse mode than in the other modes. LVSW were significantly lower in the counter-pulse mode than in the circuit-clamp. LVESP in the counter-pulse mode was significantly lower than in continuous mode. Considering the lower LVSW and LVESP in the counter-pulse mode, the mode decreased not only the workload of the left ventricle but also afterload of the left ventricle (Figure). In the continuous mode + IABP, pulse pressure and RFPI tended to be higher, implying that IABP provided better pulsatility. On the other hand, central venous pressure and pulmonary artery pressure tended to be higher in the continuous mode + IABP compared with the values in the other modes, implying that inflated balloon during diastole became resistant to the retrograde blood flow provided by VA-ECMO.

Conclusions: Our novel RSM system increased coronary artery blood flow and decreased left ventricular workload and afterload compared with the continuous-mode. Considering that the counter-pulse mode was not inferior to the continuous-mode with IABP support, our novel RSM system can offer the effects of VA-ECMO and IABP with only one device.

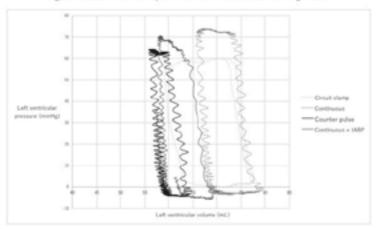


Figure. Pressure volume loops of the left ventricle at each driving mode.

Table. Hemodynamic data and parameters of the left heart system at each driving mode

	Circuit-clamp		Counter-pulse mode	Continuous mode + IABP
PP (mmHg)	22.6 ± 10.4	16.7 ± 9.2	22.5 ± 8.3	41.9 ± 19.3**
CVP (mmHg)	7.2 ± 1.9	5.3 ± 2.1	5.6 ± 1.5	11.4 ± 5.3
PAP (mmHg)	17.1 ± 2.0	14.2 ± 3.0	14.1 ± 2.8	20.3 ± 5.1
RFPI	3.3 ± 0.7	1.0 ± 0.4 °	$1.1\pm0.3^{\bullet}$	22 ± 0.7**
CoF (%)	100.0 ± 0.0	128.2 ± 48.5	152.1 ± 39.9	123.4 ± 27.5
LVESP (%)	100.0 ± 0.0	119.2 ± 11.1*	104.9 ± 5.6**	111.3 ± 4.8
LVSW (%)	100.0 ± 0.0	85.1 ± 29.7	62.9 ± 18.3*	69.3 ± 13.5

PP: Pulse pressure, CVP: Central venous pressure, PAP: Pulmonary artery pressure, REP1: Pulsutility index of nerul artery fine. CoP: Cononary artery fine (left main trunk). LVESP: Left ventricular end-systolic pressure, LVSW: Left ventricular droke work.

Significantly different from data for the circuit clamp.
 Significantly different from data for the the continuous mode.

General Thoracic Surgery

P68

Bypass of the Superior Vena Cava With Spiral Saphenous Vein Graft: Operative Results and Long-Term Follow-Up

Y.M. Menaissy¹, S. Amin²

¹Cairo University, Giza, Egypt, ²Cairo University, ElSherouk City, Egypt

Purpose: Bypassing an obstructed superior vena cava (SVC) represents a challenge due to absence of a suitable graft with a good long-term patency. We conducted this study to assess our technique in fashioning the spiral saphenous vein graft (SVG), clinical improvement of the patients, and postoperative patency with long-term follow-up.

Methods: This prospective study was carried out between March 1999 and December 2015. Sixteen patients aged 21 to 63 years suffering from SVC obstruction were submitted to this study. Indications for surgery were malignancy in 10 patients (62.5%; thymoma, four; lung cancer, three; germ cell, three) and benign symptomatic occlusion in six patients (37.5%; idiopathic fibrosing mediastinitis, four; Behcet syndrome, two). The autologous SVG from the thigh was fashioned spirally and sutured using 7/0 PROLENE to form a tube graft that was anastomosed proximally to the patent left innominate vein and distally to the right atrial appendage. Graft diameter was 8-14 mm.

Results: There were no perioperative mortalities. All 16 patients had prompt relief of their symptoms immediately after surgery, including upper limbs and head and neck congestion together with disappearance of the dilated superficial veins. Nine patients (56%) had chylothorax due to back pressure on the thoracic duct, so they had their chylothorax drained and it didn't reaccummulate. Follow-up averaged 97 months (range, 12-192 months), including three patients (18.75%) who died of their original disease. Fifteen patients (93.75%) remained symptom-free with a patent graft visualized by venography. Only one patient (6.25%), who had hypercoagulability due to Behcet syndrome, needed revision of the graft after he stopped warfarin anticoagulation. This was 7 years after his first surgery.

Conclusions: The fashioned spiral SVG represents an appealing option as a bypass conduit. Using it to bypass the obstructed SVC showed sound safety, alleviated symptomatology, and provided a very good long-term patency rate.

Clinical Significance of Maximum Standardized Uptake Value in Thymic Tumors: Characterization Using an Interactive, International, Prospective Database

R.J. Korst¹, S. Fernando², A. Catlin², N. Girard³, J. Huang⁴, F. C. Detterbeck⁵

¹Valley Health System, Paramus, NJ, ²Purdue University, West Lafayette, IN, ³Louis Pradel Hospital, Lyon, France, ⁴Memorial Sloan Kettering Cancer Center, New York, NY, ⁵Yale University School of Medicine, New Haven, CT

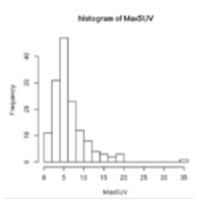
COMMERCIAL RELATIONSHIPS F. C. Detterbeck: Research Grant, Medela; Other/Data Safety Monitoring Board, Olympus

Purpose: To determine the utility of maximum standardized uptake value (MaxSUV) in predicting the histologic type and pathologic Masaoka stage of thymic epithelial tumors (TET) using a novel, interactive database of the International Thymic Malignancy Interest Group (ITMIG).

Methods: The ITMIG prospective database was created by the Rosen Center for Advanced Computing at Purdue University. It is an online database that permits ITMIG to collect data prospectively on patients with TET from all ITMIG members and provides statistical tools for members to use at their discretion to analyze datasets. A tool was developed to calculate the area under the ROC curves (AUC) for patients who had MaxSUV recorded in the database. The outcome variables were histologic type and pathologic Masaoka stage. The mean MaxSUV for each histology and stage also were compared using analysis of variance (ANOVA).

Results: Since 2013, data from 712 patients with TET were entered into the ITMIG prospective database. The Figure shows a histogram revealing the distribution of pretreatment MaxSUV in the 145 patients that had this characteristic reported. The AUC for MaxSUV in predicting histologic type A, AB, B1, and B2 vs B3 and carcinoma was 0.77, while the AUC for predicting pathologic stage 1, 2A, and 2B vs 3, 4A, and 4B also was 0.77. In addition, ANOVA revealed a statistically significant difference in the mean MaxSUV between histologic types (P < .001) and pathologic stages (P < .001).

Conclusions: MaxSUV has clinical utility in predicting both histologic type and pathologic Masaoka stage of TET. Interactive databases, such as the ITMIG prospective database for TET, facilitate the performance of research by allowing users to analyze data in a real-time fashion.



Adjuvant Chemotherapy Does Not Improve Survival After R0 Resection for Pathologic Stage T3N0M0 Non-Small-Cell Lung Cancer With Chest Wall Invasion

L. M. Brown, D. T. Cooke, E. A. David

University of California, Davis Medical Center, Sacramento

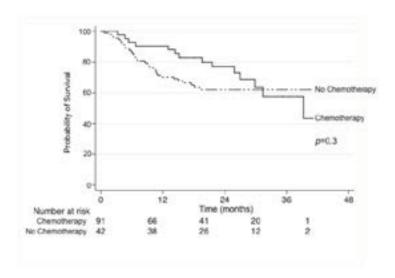
COMMERCIAL RELATIONSHIPS D. T. Cooke: Consultant/Advisory Board, Core Mobile, Emmi Solutions

Purpose: The National Comprehensive Cancer Network guidelines recommend adjuvant chemotherapy (AC) for patients with completely resected (R0) pT3N0M0 non–small-cell lung cancer (NSCLC) with chest wall invasion. There is minimal evidence to support this recommendation. We aimed to determine whether there is a survival benefit with AC for these patients.

Methods: Patients who had undergone R0 resection via lobectomy ± chest wall resection for pT3N0M0 NSCLC with chest wall invasion were identified in the National Cancer Database from 2010 to 2012. Patients were excluded if they had missing data regarding AC, received radiation therapy, or had a history of prior malignancy. A multivariable Cox proportional hazards model, including age, tumor size and differentiation, and extent of resection, was used to determine independent predictors of overall mortality. Kaplan-Meier survival analysis was used to determine long-term overall survival and the log-rank test was used to examine differences in survival between those receiving AC and those not.

Results: Of 197 patients, 72 (36.5%) received AC and 125 (63.5%) did not. The median tumor size for those receiving AC was 5.2 cm (interquartile range [IQR] 4.0-6.8 cm) and for those not was 4.5 cm (IQR 3.0-6.0 cm), P = .07. Lobectomy was done in 137 patients (69.5%) and lobectomy with chest wall resection in 60 (30.5%). Tumor differentiation was well in three (1.5%), moderate in 80 (40.6%), poor in 105 (53.3%), and undifferentiated in five (2.5%). There was no difference in overall survival between those receiving AC and those not, P = .3 (Figure). In a multivariable Cox proportional hazards model, the only independent predictor of mortality was tumor differentiation (HR 2.51; 95% CI, 1.37-4.59; P = .003). There was no difference in the receipt of AC based on tumor differentiation, but the risk of death increased with increasing tumor grade: 0% for well, 27.8% for moderate, 36.2% for poor, and 100% for undifferentiated tumors, P = .015.

Conclusions: For patients with pT3N0M0 NSCLC with chest wall invasion who have undergone R0 resection, there is no survival benefit with AC, regardless of tumor size. Tumor differentiation is an independent predictor of mortality in these patients.



Long-Term Outcomes Following Surgical Management of Bronchopulmonary Carcinoid Tumors Using the National Cancer Database

C. Harrington Brown, A. Kaempf, P. H. Schipper, M. S. Sukumar, J. J. Watson, M. Mori, B. H. Tieu

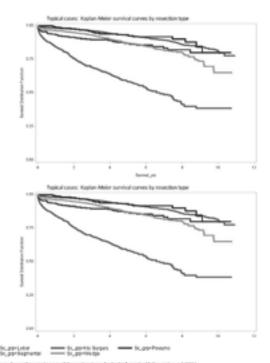
Oregon Health & Science University, Portland

Purpose: The mainstay of treatment for bronchopulmonary carcinoid tumors (BPC) is surgical resection. Previous studies have attempted to evaluate whether a particular resection type is associated with improved overall survival. Unfortunately, given the rarity of this disease, studies thus far have been underpowered and inconclusive, especially when histological subtype is considered.

Methods: Typical and atypical carcinoid cases diagnosed from 2004 to 2012 were identified from the National Cancer Database (NCDB). Patients were excluded for having more than one cancer diagnosis, not being treated at the reporting facility, or receiving radiation or systemic therapy. Resection types were categorized into no surgery, wedge, segmentectomy, lobectomy (including bilobectomy), and pneumonectomy. Survival analysis was performed for all included cases, typical histology, atypical histology, and node-positive subgroups. Kaplan-Meier estimation was used for 2-,5-, and 7-year unadjusted survival rates and Cox PH regression produced all hazard ratios. *P* values were deemed significant if less than 0.008 in accordance with a Bonferroni multiplicity adjustment.

Results: There were 9,362 patients with BPC in the NCDB: 8,659 typical, 703 atypical. Overall survival (OS) of patients undergoing resection for typical disease was 96.8%, 91.5%, and 87.8% at 2, 5, and 7 years. Without resection, OS was 75.9%, 58.4%, and 48.8%. For atypical disease, OS after resection was 90.2%, 76.6%, and 68%. Without resection, OS was 47.9%, 33.4% and 33.4%. On multivariate Cox regression with adjustment for significant variables from univariate analysis (age, gender, histology, tumor size, lymph node involvement, comorbidities, tumor location, margin status, and overall stage), there was no statistical difference in OS associated with lobar vs sublobar (P = 0.481), lobar vs segmental (P = .122), lobar vs wedge (P = .118), or segmental vs wedge resection (P = .027). After segregating by histology, there was still no difference in OS. When comparing lobectomy vs sublobar resection among those with lymph node involvement, type of resection did not impact OS for typical or atypical disease (P > .78).

Conclusions: This is the largest study to examine the effect of various surgical resections on OS for typical and atypical pulmonary carcinoid. Our results support the use of lung-sparing resection when possible compared to more extensive anatomic resection for either histological subtype, even in the presence of lymph node involvement.



Resection Comperison	All Cases: no	1,342	Typical Cases	n=0,659	Atypical Cases:	Ne282
	Outgroup size (% Died)	Adj. HR (all 11 covariates)	Subgroup size (% Died)	Adj. HR (all 10 covariates)	Subgroup size (% Died)	Adj. HR (all 13 covariates)
Lober*	5,912 (8,9%)	0.83 (0.80-1.38)	5,445 (7,5%)	G-84 (2.49-1.43)	467 (29.1%)	0.38 (0.05 = 3.16)
Sub-Icbar	1,971 (12.5%)	p = 0.481	1,842 (11,8%)	p = 0.522	129 (25.4%)	p = 0.374
Lober*	5,912 (8,6%)	0.71 (0.46-1.10)	5,445 (7,5%)	0.77 (0.49 - 1.29)	467 (20.1%)	0.24 (0.00 - 1.00)
Segmental	314 (7.0%)	p = 0.122	297 (7.1%)	p = 0.241	17 (5.0%)	p = 0.170
Lobar*	5,912 (8,5%)	1.17 (0.96=1.43)	5,445 (7.5%)	1.10 (0.88 - 1.37)	467 (23.1%)	1.56 (0.95 = 2.57)
Tilodge	1,657 (13.6%)	p = 0.118	1,545 (12,4%)	p=0.401	112 (29.5N)	p = 0.079
Segmental*	314 (7.2%)	1.65 (1.06-2.67)	297 (7.1%)	1.49 (0.91 - 2.27)	17 (5.0%)	6.38 (0.86 - 48.01)
Wedge	1,857 (134%)	p = 0.327	1,545 (12.4%)	p=0.134	112 (29.5%)	p = 0.072
No Surgery*	1,132 (41.5%)	0.008(40.001 - 0.113)	1,055 (40.1%)	0.003(+0.001=0.123)	77 (61 0%)	0.016 (40.001 = 5.82)
Surgery	8,246 (9,8%)	p = 0.001	7,620 (8.7%)	pm0.002	625 (22.5N)	p + 0.167
Pneumo*	363 (15-4%)	0.61 (0.450.82)	333 (12.9%)	0.65 (0.45-0.86)	50 (43.5%)	0.84 (0.31-1.31)
Lober	5,912 (8.6%)	p = 0.001	5,445 (4.5%)	p= 0.007	467 (30.1%)	p = 0.218
«LN iobar»	091 (16.8%)	2.22 (0.26 - 19.09)	590 (12.9%)	1.36 (0.14 - 14.00)	101 (38.6%)	Unstable estimate
+LN sub-iobar	29 (26.2%)	p = 0.462	29 (29.7%)	p=0.787	10 (90.0%)	p = 0.992

Quality of Life Is Preserved in High-Risk Patients After Pulmonary Lobectomy at Intermediate Follow-Up

S. Kotova¹, J. R. Handy², H. Merry², N. Handy², J. Green², M. Wang², G. L. Grunkemeier²

¹Portland Providence Medical Center, OR, ²Providence Health & Services, Portland, OR

Purpose: Quality of life (QOL) is an overriding factor influencing patient decisions regarding treatment options for early stage lung cancer. Patients deemed high risk based on pulmonary function may be denied or refuse surgery due to perceived poorer outcome. This study evaluates patient-reported quality of life in high-risk patients after lobectomy.

Methods: A prospective, observational lung cancer surgery outcomes database was queried to identify patients with highly suspect or confirmed lung carcinoma who underwent lobectomy. Clinical characteristics and surveys assessing quality of life and health-related function were administered preoperatively (preop) and 6 months postoperatively (postop). Surgical risk was defined as high risk (HR; preop FEV1 or DLCO <50% predicted or postop FEV1 or DLCO <40% predicted) or non-high risk (N-HR). Exclusion criteria included any resection other than anatomic lobectomy or incomplete data. HR patients were compared to N-HR. *P* values < .05 were significant.

Results: Sixty-two HR and 273 N-HR patients were analyzed. Age, preoperative performance status (PS), and postoperative stay were worse in HR group (67.3 years vs 64.4 years, P=.03; 0.7 vs 0.4, P=.02; 8.5 days vs 6.3 days, P<.01, respectively). A smaller portion of HR patients underwent minimally invasive surgery (27.4% vs 41.8%, P=.04). Despite that, there was no difference in immediate and intermediate mortality rates in HR and N-HR groups (1.6% vs 1.5% and 4.8% vs 6.2%, all not significant). Selected patient-reported health outcomes are summarized in the Table. Importantly, while the Medical Research Council dyspnea score worsened in a larger number of HR patients (51% vs 33%, P=.03), change in PS was not different between the groups at 6 months (41% vs 27%, P=NS). Neither SF-36 nor QLI components were different between the two groups at 6 months postop.

Conclusions: High-risk lobectomy based on pulmonary function tests unduly overestimates the negative impact of surgery. Functional recovery and QOL is similar in HR and N-HR patients and is comparable to general population. These conclusions impact patient counseling and nonsurgical treatment options. Further, this questions sublobar resection approach even in HR patients.

Table: Patient reported outcomes.

Components		HR gro	up		N-HR gr	eup.	HR vs. N-HR	General Population
	Presp	6-mos	p-value	Presp	6-mos	p-value	Preop vs. 6-mos	Comparison *
Physical* functioning	66.1	57.3	0.02	76.9	67.5	<0.01	MS .	90.7
Mental" Health	29.8	75,4	NS	74.6	77.3	NS	16	50
General* Health	67.5	31.3	Ni	70.1	69.1	N5	N5.	50
Oversild QOL	29.5	28.2	NS	24.3	29.9	NS	NS	
Health and functioning#	25.7	21.7	NS	22.9	22.6	NS	MS .	1.5
Pain seore	2.5	2.2	MS	1.6	1.8	NS.	MS	~
ENWY (%)	1204	1093	0.01	1337	1229	<0.01	MS .	-

HR- high risk patients; N-HR- non-high risk patients. *Short Form 36 Health Survey component; # Ferrans and Powers Quality of Life component. 6MWT- 6 minute walk test. ^ data from reference 3. NS- not significant.

POSTER ABSTRACTS

P73

Fate of Pneumonectomy Patients Variably Captured by Non–Small-Cell Lung Cancer Staging System

A. P. Dhanasopon, M. C. Salazar, A. W. Kim, F. C. Detterbeck, J. Blasberg, D. J. Boffa Yale University School of Medicine, New Haven, CT

COMMERCIAL RELATIONSHIPS F. C. Detterbeck: Research Grant, Medela; Other/Data Safety Monitoring Board, Olympus

Purpose: Lung cancer patients rely on survival estimates to weigh the risks and benefits of treatment. However, pneumonectomy-requiring lung cancer may have survival implications (oncologic or physiologic) that are not captured by the current staging system. Stage-specific survival was evaluated to refine survival expectations for lung cancer patients with pneumonectomy-requiring disease.

Methods: The National Cancer Database was queried for treatment-naïve patients who underwent a lobectomy or pneumonectomy for stage I-III non-small-cell lung cancer between 2004 and 2012. Patients who died within 30 days after resection were excluded to study long-term survival. Patient characteristics were analyzed using the chi-squared test and t-test. The Kaplan-Meier derived 5-year overall survival (OS) for lobectomy and pneumonectomy was compared across pathologic stage I, II, and III using the log-rank test. Multivariate Cox models were built to compare the adjusted survival of the two types of resections across the three stages.

Results: A total of 73,965 patients met the inclusion criteria: 94% (69,784) underwent lobectomies and 6% (4,181) underwent pneumonectomies. For stage I and II, right pneumonectomy (RP) was associated with worse 5-year OS compared to left pneumonectomy (LP) and lobectomy (L) (stage I: 48% RP vs 55% LP vs 64% L, log-rank P < .001; stage II: 39% RP vs 44% LP vs 44% L, log-rank P < .001). For stage III, lobectomy was associated with superior 5-year OS compared to pneumonectomy; however, the difference between right and left was less clear (lobectomy=37%; pneumonectomy: right=36%, left=35%, log-rank P = .0186). In a Cox model adjusted for demographics, tumor characteristics, and stage, a higher mortality risk was seen in pneumonectomy when compared to lobectomy patients (right pneumonectomy: HR 1.326, 95% CI, 1.241-1.418, P < .0001; left pneumonectomy: HR 1.134, 95% CI, 1.071-1.2, P < .0001).

Conclusions: Pneumonectomy-requiring lung cancer embodies a 5-year mortality risk that is not completely captured by the lung cancer staging system. A refined survival estimate for pneumonectomy patients may enhance shared decision making in this population.

Lung Transplantation for Chronic Obstructive Pulmonary Disease: What Predicts Success?

E. I. Jeng¹, J. Taylor¹, J. A. Gregg¹, T. M. Beaver¹, T. N. Machuca² ¹University of Florida, Gainesville, ²University of Florida College of Medicine, Gainesville

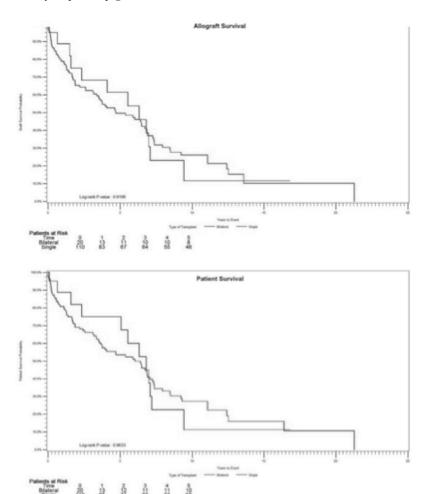
Purpose: Chronic obstructive pulmonary disease (COPD) represents an entity that often leads to respiratory failure requiring lung transplantation (LTx). We hypothesized from our experience that patients with end-stage COPD did not have a significant allograft or patient survival advantage when undergoing SLTx (single) vs BLTx (bilateral) over long-term follow-up.

Methods: Consecutive patients undergoing LTx for COPD between January 1994 and March 2016 at a single institution were identified and analyzed retrospectively. Demographic information was recorded and analyzed using chi-squared analysis. Allograft and patient survival in recipients of SLTx and those receiving BLTx were compared using Kaplan-Meier survival curves and log-rank tests.

Results: 130 patients (64 women, 66 men) underwent LTx for COPD. During this time, 15.4% (20 patients) received BLTx, and 84.6% (110 patients) received SLTx. Recipient ages were categorized into groups (40-49 years, 50-59 years, and ≥60 years), and there was no statistically significant difference between the age groups and receiving SLTx vs BLTx. Donor ages were categorized into groups (<18 years, 18-29 years, 30-39 years, 40-49 years, and ≥50 years), and there was no statistically significant difference between the donor age groups and receiving SLTx vs BLTx. In SLTx, 1-, 5-, and 10-year allograft survival was 78.9%, 49.6%, and 26.1%, respectively. In SLTx, 1-, 5-, and 10- patient survival was 88.7%, 75.0%, and 11.3%, respectively. In BLTx, 1-, 5-, and 10-year allograft survival was 88.7%, 61.4%, and 11.5%, respectively. In BLTx, 1-, 5-, and 10-year patient survival was 88.7%, 75.0%, and 11.3%, respectively. Kaplan-Meier survival curves and log-rank tests showed no significant difference in COPD patients who underwent SLTx vs BLTx.

Conclusions: There is a trend for increased early (1- and 5-year) allograft and patient survival in BLTx vs SLTx with COPD that disappears at 10 years. However, given no statistical significance in this population, SLTx should continue to be considered a therapeutic option as it increases total life-years saved.

Continued from previous page



Single Allograft Survival.

Timdiu	Servival	Suretval Standard Error	Number Failed	Number Lith
6,0000	0.9818	0.0127	2	108
0.2500	0.8818	0.0308	13:	97
0.5000	0.8448	0.0346	17	90
0.7500	0.8166	9.0371	20	57
0.0000	0.7885	0.0392	23	63
2.0000	0.6527	0.0463	-31	67
3.0000	0.6233	0.0472	40	51
4.0000	0.3358	284-0 0	69	-55
5,0000	0.4957	D 049E	57	46
10.0000	0.2609	0.0482	71	15
20 0000	0.1016	0.0336	76	1

Bilateral Allograft Survival

Timelia	Surrival	Survival Standard Error	Number Falled	Number Left
0.0000	1.0000	0	0	- 30
9.2500	0.9500	0.0487		19
6,5000	6,9500	6.0487	1	15
0.7500	0.5567	0.0762	2	14
1 0000	0.5867	0.0762	- 2	13
7.0000	0.7503	0.1097	4	11
3.0000	0.6321	0.1191	3	10
4.0000	0.6821	0.3391	5	10
5.0000	0.6138	6.1252	6	
10 0000	0.1151	0.0997	12	10
20.0000			12.	0.

Analytic Morphomics Predict Outcomes After Lung Transplantation

M. Pienta¹, P. Zhang², B. A. Derstine², B. Enchakalody², R. Goulson², R. M. Reddy², A. C. Chang², S. Wang², J. Lin²

¹University of Michigan Medical School, Ann Arbor, ²University of Michigan, Ann Arbor COMMERCIAL RELATIONSHIPS J. Lin: Speakers Bureau/Honoraria, AtriCure, Intuitive Surgical; R. M. Reddy: Speakers Bureau/Honoraria, Intuitive Surgical

Purpose: Morbidity and mortality remain high after lung transplantation despite efforts to improve patient selection and organ allocation. The purpose of this study was to identify morphomic factors on standard, pre-transplant computed tomography (CT) scans associated with outcomes and survival after lung transplantation.

Methods: A retrospective review of 200 patients undergoing lung transplantation at a single institution from 2003 to 2014 was performed. CT scans obtained within 1 year prior to transplant underwent morphomic analysis. Morphomic characteristics included lung, dorsal muscle group, bone, and subcutaneous and visceral fat area and density. Lung density was divided into five levels of increasing density (LD 1-5) where LD1 represents emphysema. Patient data were gathered from our internal lung transplant database and the United Network for Organ Sharing database. Outcomes, including initial ventilator support greater than 48 hours, length of stay, and survival, were evaluated on univariate and multivariate analysis.

Results: The mean age was 51.7 years with 28% female. The median length of stay was 17 days, and median survival was 8.3 years. On multivariate Cox regression, the ratio of subcutaneous fat to total body area (HR 0.62, P = .002) and LD3 volume (HR 0.67, P = .014) were independent predictors of survival after controlling for clinical factors. Initial ventilator support greater than 48 hours was required in 20% (40/200) of patients and was associated with smaller body dimensions, such as distance from the vertebral body to the abdominal fascia (OR 0.12, P < .001) and total body area (OR 0.11, P = .02), and a Zubrod score of 4 (OR 2.56, P < .001), while outpatient status at transplant decreased this risk (OR 0.19, P = .019). Multivariate Poisson regression showed that decreased bone mineral density (P < .001) and smaller total body area (P < .001) were associated with length of stay after controlling for clinical factors.

Conclusions: Morphomic factors associated with lower metabolic reserve, such as decreased subcutaneous fat and smaller body dimensions, were independent predictors of survival, as well as prolonged ventilation and increased length of stay, respectively. Assessment of body composition with analytic morphomics using pre-transplant CT scans may improve recipient selection and risk stratification.

Table, Multivariate Analysis; Survival

Outcome	Hazard Railn (95% CI)	p value
Subentaneous Fat Area Total Body Area	0.63 (0.47-0.83)	0.002
LD3 Volume	0.67 (0.49 -0.92)	0.014
Medical Condition at Transpinst ICU Hospitalized Outputient	Reference 0.67 (0.26-1.71) 0.37 (0.18-0.76)	NA 0.6 0.007
Post-Transplant Survival Measure (LAS)	0.98 (0.97-0.599)	0.048
Creamane	3.99 (1.26-12-73)	0.019
FVC Percent Producted	0.98 (0.97-0.998)	0.037

POSTER ABSTRACTS

P76

Electromagnetic Navigational Bronchoscopic Airway Recanalization in Patients With Vanishing Bronchus Following Lung Transplantation

D. M. Walters¹, J. P. Kuckelman¹, M. S. Mulligan²

¹University of Washington, Seattle, ²University of Washington Medical Center, Seattle COMMERCIAL RELATIONSHIPS M. S. Mulligan: Consultant/Advisory Board, Covidien/Medtronic

REGULATORY DISCLOSURE This presentation describes the off-label use of electromagnetic navigational bronchoscopy for the purpose of airway recanalization after airway obstruction in patients who have had lung transplantation.

Purpose: Stenosis is the most frequent airway complication after lung transplantation. When complete obstruction is diagnosed without possibility of recanalization, options are limited to resection and retransplantation with increased morbidity and mortality. We describe our experience with a novel technique using electromagnetic navigational bronchoscopy (ENB) to recanalize occluded airways after lung transplantation.

Methods: Patients who underwent lung transplantation between 2010 and 2016 with subsequent development of complete airway obstruction and failed conventional recanalization attempts were included in this study. All patients underwent chest computed tomography scan, followed by attempted recanalization using ENB. Primary outcomes included success of the technique and long-term patency. Secondary outcomes included procedure-related complications.

Results: Four patients met inclusion criteria and underwent attempted recanalization using the ENB platform. Location of the obstruction was the bronchus intermedius in two patients, the lingular bronchus in one patient, and the left basilar bronchus in one patient. Mean length of stenosis was 8.8 mm. Three patients (75%) were successfully recanalized, and all airways remain patent at 1, 48, and 66 months. There were no procedure-related complications. The one patient who was unable to be recanalized successfully underwent bilobectomy and died 7 months later.

Conclusions: ENB is a safe, feasible method of airway recanalization in select patients with bronchial occlusion after lung transplantation. ENB recanalization spares normal parenchyma and avoids risk of surgical resection and retransplantation. This novel technique can be added to the armamentarium for thoracic surgeons who diagnose and treat this complicated problem.

Risk Factor Analysis for Immediate Extracorporeal Membrane Oxygenation Weaning **Failure Following Lung Transplantation**

K. Narm, Y. Do, J. Suh, J. Lee, C. Lee, A. Kim, H. Paik Yonsei University College of Medicine, Seoul, South Korea

Purpose: Extracorporeal membrane oxygenation (ECMO) has been widely used for hemodynamic support during lung transplantation (LTx). ECMO weaning is tried at the end of an operation, although some fail due to unstable vital status. In this study, we evaluated the risk factors associated with failure of weaning of ECMO in the operating room.

Methods: We retrospectively reviewed 76 consecutive patients who had undergone doublelung transplantation from March 2013 to February 2016. Patients who underwent single lung transplantation, multi-organ transplantation, and second double lung transplantation were excluded. All operations were performed under ECMO support and surgical procedures were similar in all cases. Clinical data of donor, recipient, and intraoperative parameter were retrospectively reviewed, and multivariate logistic regression was performed to identify independent risk factors.

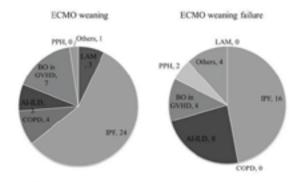
Results: Median age was 54 years (16-73 years) and 43 patients (56%) were male. Donors with shorter mechanical ventilation time (125 minutes ± 74 minutes vs 163 minutes ± 84 minutes, P = .042) and higher partial pressure of oxygen (PaO₂) at 100% oxygen $(455 \text{ mm Hg} \pm 87 \text{ mm Hg vs} 404 \text{ mm Hg} \pm 88 \text{ mm Hg}, P = .013)$ were significantly different in the ECMO weaning group than in the weaning failure group. For recipients, the number of patients who had preoperative ECMO support were significantly less in the weaning group than in the weaning failure group (11.9% vs 35.3%, P = .046). Distribution of underlying disease also showed significant difference between groups (P = .017). The operation time was significantly shorter in the weaning group than in the weaning failure group (392 minutes \pm 66 minutes vs 435 minutes \pm 79 minutes, P = .012). In the multivariate logistic regression analysis, the independent risk factor for ECMO weaning were donor PaO₂ (OR 0.993; 95% CI, 0.987-0.999; *P* = .031) and operation time (OR 1.009; 95% CI, $1.00\overline{1}$ -1.017; P = .023).

Conclusions: Our results showed that donor PaO, and operation time were factors related to successful ECMO weaning in the operating room following LTx. These findings support the importance of donor PaO, and reducing operation time in order to wean ECMO during LT_x.

POSTER ABSTRACTS

Continued from previous page

Figure. Distribution of recipients' underlying disease



ECMO, Extracorporeal membrane oxygenation; LAM, hymphangioleiomyomatosis; IPF, idiopathic pulmonary fibrosis; COPD, chronic obstructive lung disease; Al-ILD, autoimmune disease-related interstitial lung disease; BO, bronchiolitis obliterance; GVIID, graft versus-host-disease; PPII, primonary pulmonary fibrosis Others, military tuberculosis (weaning-group), acute interstitial pneumonia, tuberculosis-destroyed lung, chronic hypersensitivity pneumoniatis, acute fibrinous and organizing pneumonia (weaning failure group)

Table. Risk factors associated to the ECMO weaning failure during operation.

variable	p value	Crass OB(98% CT)	in agine	Adjusted ORIgina (1)
Donor yentilation time	0.048	1.096(1.000-1.012)	9,360	1.094(0.997.1.011)
Donor PaO2	0.018	0.095(0.088-0.999)	0.031	0.003(0.987.0.900)
Peroperative support	0.058	0.677(0.156-2.942)	0.300	0.735(0.142-3.662)
MY	0.692	3.789(1.152-12.470)	0.791	2.546(0.673.9.634)
ECMO-	0.028		0.169	
Operation time	0.017	1.008(1.002-1.015)	0.025	1.069(1.001-1.017)

Statistical method : logistic regression analysis. *reference: ausal cannula

FCMO, extracreporeal membrane oxygenation; OR, odds ratio; CL, confidence interval; PaO2, partial pressure of oxygen; MV, mechanical ventilation

Predictors of Post-Recurrence Survival After Definitive Treatment for Isolated Esophageal Cancer Recurrence Post-Esophagectomy

G. R. Ghaly¹, S. W. Harrison², M. K. Kamel², M. Rahouma², A. Nasar², P. Lee², J. Port¹, B. M. Stiles³, N. K. Altorki²

¹Weill Cornell Medical College, New York, NY, ²New York-Presbyterian Hospital, Weill Cornell Medical College, NY, ³Weill Cornell Medicine, New York, NY

Purpose: Although recurrent esophageal carcinoma (EC) has a dismal prognosis, patients with isolated recurrence may be candidates for definitive therapy. The aim of this study was to identify patients with isolated EC recurrence who were treated with curative intent and determine the predictors of post-recurrence survival (PRS).

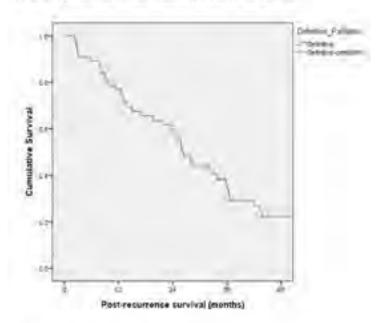
Methods: A retrospective review of a prospective database (1988-2015) was performed to identify all recurrent EC patients after R0 esophagectomy. Demographics and clinicopathological data were reviewed. The probability of PRS was estimated with the Kaplan-Meier method. Predictors of PRS after definitive treatment for isolated EC recurrence were determined by the multivariable Cox proportional hazards model.

Results: Of the 640 R0 esophagectomy patients, 241 (37.7%) developed recurrences. Eightytwo patients had isolated EC recurrence; of those, 56 were treated with curative intent (31 were treated surgically ± chemo/radiotherapy [CTRT] and 25 definitive CTRT only). Sites of recurrences are shown in the Table. Median time to recurrence (TTR) was 19 months. The 1- and 3-year PRS were 77% and 36% (median 26 months). On multivariable analysis, TTR was the only significant independent predictor for PRS (HR 1.93, 95% CI, 1.03-3.63). There was no significant difference in disease–free survival and PRS between recurrent patients treated surgically vs definitive CTRT only.

Conclusions: A select subgroup of patients with isolated EC recurrence can be treated with curative intent. Time to recurrence 19 months was the best predictor for post-recurrence survival.

Continued from previous page

Figure. Post Recurrence Survival for definitively treated recurrences in 56;



PRS years Lyear 2-years 3-years 4-years
Actuarial PRS 77% 60% 56% 22%
Patients at tisk. 45 31 16 0

Table, Location of Recurrences and Treatment

Recurrence Incasine	Sorgical treated a - 31	Definitive CT/RCF p=25	Tetal p < 16
Local			
Anaumotic	1	1	4
Gwelc	3	1 =	1
Regional Lymph modes			
Constation	1	(%)	- 3
Atleberma Us			- 11
Abdominal LN			4.
Cistant of gometasteths		- 2	100
using		1	3-
Billing	1		10
Service	1	1	3
Lieer	1	1	- 1
flevi	1		- 1
Advent gland	1	- 4	.1
Chapming with	1		1
Spiracht-striae J.W		1	1

Surgical Treatment of Esophageal Epiphrenic Diverticula: 42 Years of Experience

L. F. Tapias¹, C. R. Morse¹, D. J. Mathisen¹, H. A. Gaissert¹, C. D. Wright¹, J. S. Allan², M. Lanuti¹

¹Massachusetts General Hospital, Boston, ²Massachusetts General Hospital, Marblehead COMMERCIAL RELATIONSHIPS D. J. Mathisen: Consultant/Advisory Board, Baxter International

Purpose: Epiphrenic esophageal diverticula are infrequent. Although surgical treatment is generally recommended, techniques vary widely, and optimal management remains controversial. This study seeks to evaluate a single institution's experience with the surgical treatment of epiphrenic diverticula.

Methods: Retrospective review of 31 patients surgically treated for epiphrenic diverticula from 1974 to 2016 at a tertiary care center.

Results: Study cohort consisted of 17 men (55%) with a median age of 65 years (range, 42–78 years). Dysphagia (87%) and regurgitation (71%) were most prevalent symptoms. Two patients presented with ruptured diverticula. Median diverticulum size was 4.5 cm. Esophageal motility disorder was found in 24 patients (77%). All patients underwent a transthoracic approach where left thoracotomy (76%) was preferred. Diverticulectomy (D) was performed in 28 patients (90%), esophageal myotomy (M) in 28 (90%), and anti-reflux procedure (A) in six (19%). A total of 22 patients (71%) underwent D+M, four (13%) D+M+A, and two (6%) M+A. There was one (3%) postoperative leak. Major morbidity occurred in five patients (16%). Squamous cell carcinoma was identified in one patient (3%). Mean follow-up was 30 months ± 43 months in 28 patients. Six patients (19%) required esophageal balloon dilations. An excellent outcome (ie, absence of symptoms) was accomplished in 21 patients (75%). Overall survival at 5 and 10 years was 89.4% and 62.6%, respectively.

Conclusions: A tailored transthoracic approach to surgical management of epiphrenic diverticula can provide excellent results. The need for a concomitant antireflux procedure remains controversial and may not be routinely necessary. Intercostal muscle flap coverage may aid in preventing postoperative leaks. Acute presentation is associated with poor outcome.

Depth of Muscularis Propria Invasion Does Not Predict Survival in T2 Esophageal Adenocarcinoma

C. W. Seder¹, B. Mahon¹, M. W. Hennon², M. Thomas³, C. M. LeVea², K. Matkowskyj⁴, M. Krishna³, R. Medairos⁵, J. Blasberg⁶

¹Rush University Medical Center, Chicago, IL, ²Roswell Park Cancer Institute, Buffalo, NY, ³Mayo Clinic, Jacksonville, FL, ⁴University of Wisconsin, Madison, ⁵Rush University, Chicago, IL, ⁶Yale University School of Medicine, New Haven, CT

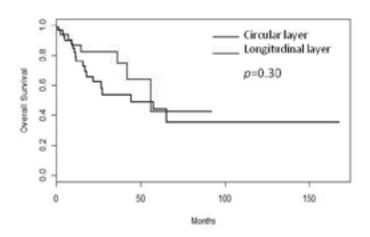
COMMERCIAL RELATIONSHIPS B. Mahon: Employment, Tempus Medical Laboratory; M. Thomas: Research Grant, Thoracic Surgery Foundation, Acelity

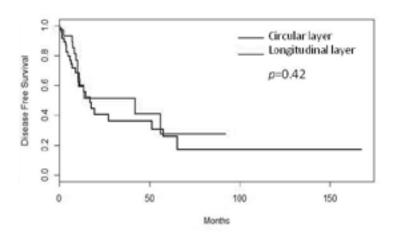
Purpose: Depth of muscularis propria invasion may be prognostic in esophageal squamous cell carcinoma; however, this has not been examined in esophageal adenocarcinoma. We hypothesized that tumor invasion into the longitudinal layer would correlate with reduced survival compared to invasion limited to the circular layer, after controlling for high-risk features.

Methods: Patients with resected pT2N0-3M0 esophageal adenocarcinoma treated between 2005 and 2015 were pooled from four US academic medical centers. Demographic, treatment, and outcome data were collected from the medical record. Two blinded pathologists reviewed all histologic slides to determine depth of muscularis propria tumor invasion. Univariate and Cox proportional hazards regression analyses were performed to identify factors prognostic of overall and disease-free survival. Kaplan-Meier analysis was used to compare survival differences with respect to each prognostic factor.

Results: Eighty-eight patients were identified for analysis (55 with circular invasion; 33 with longitudinal invasion), with a median age of 66 years. 60% of patients (53/88) received induction therapy prior to esophagectomy. The overall 1-, 3-, and 5-year survival rates were 80.5%, 64.9%, and 46.7%, with a median survival of 57.6 months (95% CI: 36.3 months, not reached). Depth of muscularis propria invasion did not correlate with overall or disease-free survival on univariate (OS: P = .30; DFS: P = .42) or multivariate (OS: P = .23; DFS: P = .18) analyses, after adjustment for age, nodal status, tumor grade, and tumor length. These findings did not vary by induction therapy status.

Conclusions: Unlike esophageal squamous cell carcinoma, depth of muscularis propria invasion does not predict survival in patients with esophageal adenocarcinoma.





Status of Lymphatic Metastasis After Neoadjuvant Chemoradiation According to Radiation Field Coverage in Esophageal Cancer

S. Kim, S. Park, K. Hyun, Y. Hwang, H. Lee, I. Park, Y. Kim, C. Kang Seoul National University Hospital, South Korea

Purpose: The role of extensive lymphadenectomy after neoadjuvant chemoradiation (nCRT) in esophageal cancer has been questioned by recent studies. To identify the probability of lymph node metastasis after nCRT and stage-predictive value of lymphadenectomy, we examined metastatic status of lymph node stations according to the radiation field.

Methods: The inclusion criteria of the study were the patients who 1) received extensive lymphadenectomy after nCRT, 2) had detailed information on radiation field, and 3) had information on metastatic status in specific lymph node stations. A total of 90 patients and 4,093 lymph nodes were analyzed in this study. Pre-treatment clinical nodal metastasis were evaluated by computed tomography (CT) and positron emission tomography-CT scan, and the nodal stations were divided into two groups with (cN+) and without (cN-) metastasis. Planning target volume was used for analysis as radiation field and nodal stations were subdivided into infield (IF) and outfield (OF) stations.

Results: The 4,903 nodes were distributed in 882 nodal stations, and 464 nodal stations (52.6%) were included in radiation field. Lymph node metastasis were not different between the IF and OF nodal stations (IF: 39/464 [8.4%]; OF: 40/418 [9.6%]; P = .313). When the lymph node involvement was suspected clinically, the lymph node metastasis was more frequent (cN-: 55/711 [7.7%]; cN+: 24/171 [14.0%]; P = .010). However, when the impact of radiation field was compared between IF and OF in cN+ nodal stations, IF nodal stations showed decreased incidence of metastasis than OF nodal stations (IF/cN+: 15/141 [10.6%]; OF/cN+: 9/21 [30.0%]; P = .010). In cN- stations, whether the nodal station was included in radiation field was not associated with nodal metastasis (IF/cN-: 24/323 [7.4%]; OF/cN-: 31/388 [8.0%]; P = .447).

Conclusions: Radiation therapy in nCRT has a role in decreasing the incidence of nodal metastasis in clinically suspected metastatic lymph nodes. However, significant number of nodal stations had metastatic nodes irrespective of radiation field. Extensive lymphadenectomy is necessary inside and outside of radiation field after nCRT in esophageal cancer.

Table 1. Positive lyaph node station according to coverage of rediction field and clinical empirion of lyaph node involvement

		Under radiation field during aCRT		p-value
		OF	II.	
****	qNo.	31/384 (8.0%)	24/323 (7.4%)	9.447
Clinically suspected	4N1	9/21 (30.0%)	15/341 (10.6%)	0.010
lymph nodes	Total	46/818 (9.0%)	39/464 (8.4%)	9.313

Subglottic Stenosis in Granulomatosis With Polyangiitis: 10 Patients Who Underwent Laryngotracheal Resection and Reconstruction

C. L. Costantino, J. Niles, C. D. Wright, D. J. Mathisen, A. Muniappan

Massachusetts General Hospital, Boston

COMMERCIAL RELATIONSHIPS J. Niles: Research Grant, Genentech, Chemocentryx; D. J. Mathisen: Consultant/Advisory Board, Baxter International

Purpose: This study is intended to propose a definitive treatment option for patients with clinically significant tracheal stenosis secondary to granulomatosis with polyangiitis (GPA). To date, there has been sparse literature to support surgical intervention for definitive treatment given the relapsing nature of this disease. This case series demonstrates clinically significant improvement with surgery in this patient cohort.

Methods: We performed a retrospective chart review of 10 patients from 1988 to 2016 who had been diagnosed with symptomatic subglottic stenosis secondary to GPA and underwent laryngotracheal resection and reconstruction. Seven patients had positive serology for c-ANCA and antibodies to proteinase at the time of operation.

Results: All patients were female. The median age of operation was 45 years. Antineutrophil cytoplasm antibodies were proteinase 3-positive in seven patients. One patient had been aphonic for 2 years preopreratively. Three had other organ involvement: two had kidney failure, and one had ocular damage. Two remained on maintenance immunosuppressants perioperatively. Two required reintubation postoperatively. One patient had a pneumothorax postoperatively that was treated with a chest tube. One required debridement of granulation tissue, while the other nine had no anastomotic complications. Three patients had a temporary tracheostomy placed; however, no patients were discharged with a tracheal appliance. One had a postoperative wound infection post-discharge. Three required dilations postoperatively; however, two of these three patients required just one dilation.

Conclusions: Patients with symptomatic subglottic stenosis secondary to GPA should be referred for evaluation to undergo tracheal resection and reconstruction. In conjunction with improved immunosuppressive medical therapy, symptomatic patients may benefit from surgical intervention after improved medical control of disease. Early postoperative complications are few, and long-term outcomes are promising.

Table 1. Summary of Patient Characteristics

ANCA	Prior intervention	Steroid at time of operation	Length of resection (om) Cricoid/tracheal	Vital status
unknown	Laser, tracheostomy	N	0/15	Υ
Pos	dilations	N	1/2.7	Y
unknown	Dilations, tracheostomy	N	3.0 / 2.1	Y
Pos	none	N	0/24	Υ.
Pos	none	N	0/2.0	Υ:
Neg	Laser, t-tube	Υ	0/2.9	Y
Pos	dilations	Y	0/22	N, d. 8 yrs
Pos	none	N	0/18	Y
Pos	dilations, stent	N	0/5.5	Y
Pos	tracheostomy	N	2.1/4.0	Y.

Serial Airway Stenting Is a Safe and Durable Option for the Management of Benign Central Airway Obstruction

J. M. Karush¹, C. W. Seder¹, A. V. Raman², G. W. Chmielewski¹, M. Liptay³, W. Warren³, A. T. Arndt¹

¹Rush University Medical Center, Chicago, IL, ²Rush Medical College, Chicago, IL, ³Rush University, Chicago, IL

COMMERCIAL RELATIONSHIPS M. Liptay: Speakers Bureau/Honoraria, Medtronic

Purpose: Although an accepted treatment strategy, the literature is devoid of a comprehensive analysis of silicone stenting for benign central airway obstruction. With the largest series in the literature to date, we aim to demonstrate the safety profile, pattern of reintervention, and duration of silicone airway stents.

Methods: All patients with benign airway disease treated with rigid bronchoscopy and silicone airway stenting between 2002 and present were identified from a single institution. Demographic, treatment, and outcome data were collected from the medical record. Mann-Whitney U Test was performed to assess differences in treatment outcomes.

Results: During the study period, 243 stents were utilized in 63 patients with benign central airway obstruction. Etiologies include post-intubation/tracheostomy (68%; 43/63), tracheomalacia (11%; 7/63), both (17%; 11/63), and other (3%; 2/63). Median freedom from reintervention was 104 days (interquartile range [IQR] 167 days). Indications for reintervention included mucus accumulation (59%; 131/211), migration (28%; 62/211), and intubation (8%; 18/211). 3% of patients presented with respiratory distress and required emergent reintervention; however, there were no intraoperative deaths. In patients managed with serial stenting (n=157 stents) and at least 6 months follow-up, the median treatment course was 693 days (IQR 1,333 days) with patients receiving a median of five stents (IQR 5.5 stents). The most common stent diameter and length was 14 mm (n=77) and 40 mm (n=96), respectively. Stent duration did not vary on size when placed for discrete stenosis. However, 14-mm stents outperformed 12 mm when tracheomalacia was present (157 days vs 37 days, respectively; P = .005).

Conclusions: Rigid bronchoscopy with silicone airway stenting is a safe and effective option for the management of benign central airway obstruction. Even in the absence of contraindications to resection, serial stenting is a durable option for patients who do not wish to undergo major tracheal surgery.

P84

Efficacy of Surgical and Percutaneous Management of Chylothorax

J. Reisenauer¹, C. Reisenauer², M. S. Allen², E. Bendel², S. D. Cassivi², F. C. Nichols², K. R. Shen², D. A. Wigle², S. H. Blackmon², J. Friese²

¹Mayo Clinic College of Medicine, Rochester, MN, ²Mayo Clinic, Rochester, MN

Purpose: Postoperative chylothorax can be managed by observation with or without total parenteral nutrition, surgical duct ligation (SDL), pleurodesis, or thoracic duct embolization (TDE). Since no prior publications exist, the objective of this study was to determine the efficacy of percutaneous TDE compared to reoperation for SDL.

Methods: A single-institution retrospective review was conducted from a prospective database from 2008 to 2015 in patients with postoperative chylothorax. Statistical analyses were performed using logistical regression models and Cox models. There were 81 patients and 46 men (57%) with postoperative chylothorax. The mean age was 61 years (range, 25-87 years). Thoracic duct leak followed esophagectomy in 39 patients (48%), pulmonary resection in 22 (27%), and other in 20 (25%).

Results: Regarding initial treatments, SDL was successful in 86% of patients (32/37) compared to TDE, which was successful in 67% (12/18; P = .14), Figure. Regarding salvage therapies after failed initial treatment, SDL was successful in 95% (21/22), and TDE was successful in 100% of patients (5/5; P = 1.0). Of the 49 patients undergoing lymphangiogram, a chyle leak was identified in 84% of patients (41), but the duct could only be cannulated in 45% (22). The remaining 27 patients were then either observed (nine) or treated by SDL (17). Of the patients whose chest tube was removed, the median days to chest tube removal was 6.5 in the SDL group and 7 in the in the TDE group (P = .15). Although preintervention chest tube output did not predict success in either group, a post-intervention reduction of 10% in the TDE group predicted a 30% reduced risk of clinical failure (P = .005).

Conclusions: For patients who fail conservative management, both reoperative surgical ligation and embolization have similar outcomes and can salvage when the other fails.

	Z* impreson					
		Nume	500	Lymphoresce attr	TOE	Total
I ^{ri} Intervention	5DL	3.2	9	1"	9	23
	Lympharging am	2	171	Jr.	0	20
	TDC	12	5	0	1	1.0
	Total	51.	22	1	5	81

^{*}Harristact halonly 1 rases that did not resolve and required a long term indiveding tybe for drainage.

Figure 1. Nequeste of intersections used to treat postoperative digitation at amongst by type:

P85

Robotic Staged vs Simultaneous Bilateral Selective Postganglionic Thoracic Sympathectomy Is Associated With the Lowest Reported Rates of Compensatory Hyperhidrosis

F. Gharagozloo

Celebration Health/Florida Hospital System and University of Central Florida

Purpose: Compensatory hyperhidrosis (CH) has been reported to be as high as 80% in patients following thoracic sympathectomy for upper extremity hyperhidrosis. We have reported robotic simultaneous bilateral selective dorsal sympathectomy with the lowest reported rate of CH at 7.2%. We reviewed the results in patients who underwent staged bilateral selective dorsal sympathectomy.

Methods: A case-series analysis of patients who underwent staged bilateral robotic selective dorsal sympathectomy from November 2011 to May 2016 was performed. The robot was used for division of the postganglionic sympathetic fibers and communicating rami to the second, third and fourth intercostals. The sympathetic chain was left intact. The operation was performed on the dominant side followed by the same procedure on the contralateral side 4 weeks later. The success of the sympathectomy was determined by intraoperative temperature measurement of the ipsilateral hand, patient interviews, and scoring of the symptomatic nature of hyperhidrosis based on the Hyperhidrosis Disease Severity Scale.

Results: There were 47 patients (22 men, 25 women). Median age was 32 years (range 18-43 years). All patients underwent staged unilateral upper extremity robotic selective postganglionic thoracic sympathectomy. There were no conversions to thoracotomy. Minor complications were seen in 4% of patients. One patient had transient heart block after the second side. One patient had a transient partial Horner's syndrome, which resolved at 2 weeks. Nineteen patients (40%) had transient ipsilateral CH, which resolved prior to the contralateral procedure. There were no deaths. Median hospitalization was 3 days. At a mean follow-up of 28 months ± 6 months, all patients (100%) had sustained relief of hyperhidrosis, and no patient exhibited CH.

Conclusions: Robotic thoracoscopic selective dorsal sympathectomy for the second, third, and fourth intercostal nerves with the preservation of the sympathetic chain is effective, feasible, safe, and associated with the lowest reported rate of CH. The rate of CH is lowest when the procedure is performed in a staged, rather than simultaneous, manner.

P86

Video-Assisted "Three-Hole" Subxiphoid Extended Thymectomy for Myasthenia Gravis: A Retrospective Study of 117 Cases

Q. Lu, Y. Zhou, J. Wang, W. Wang

Tangdu Hospital of The Fourth Military Medical University, Xi'an, China

Purpose: We designed a video-assisted "three-hole" subxiphoid thymectomy that could reconcile the minimally invasive and extended thymectomy. Our aim was to evaluate the feasibility, safety, and efficacy of a novel subxiphoid "three-hole" approach for thoracoscopic extended thymectomy in myasthenia gravis (MG).

Methods: A retrospective study was carried out on 117 MG patients who had received thoracoscopic extended thymectomy surgical treatment (subxiphoid "three-hole" approach, n=73; unilateral approach, n=44) between December 2013 and September 2015. The unilateral approach group was the control group. Main outcomes included the operation time, blood loss, hospital stay, and postoperative pain.

Results: Extended thoracoscopic thymectomy was performed safely by using the novel subxiphoid "three-hole" approach. For the patients in the "three-hole" approach group, all evidence of thymic and adipose tissue was totally removed, and no postoperative drainage tubes were needed. The thymoma of three patients was adhesion with left innominate vein. One patient was removed the thymoma with the left innominate vein together (Figure). The other two patients were converted to transsternal approach. No major complications were observed. Compared with the control group, the patients in the "three-hole" approach group experienced significantly shorter operation time (94.5 minutes \pm 26.3 minutes vs 120.2 minutes \pm 24.4 minutes), less blood loss (24.4 mL \pm 11.7 mL vs 54.8 mL \pm 10.7 mL), shorter hospital stay (3.5 days \pm 1.4 days vs 7.4 days \pm 2.4 days), and less degree of postoperative pain (all P < .0001).

Conclusions: This method provides good exposure comparable with the transsternal thymectomy for the anterior mediastinum and reduces surgical injury and postoperative pain. We conclude that video-assisted "three-hole" subxiphoid thymectomy combines the advantages and effectiveness of minimally invasive techniques and can be considered a technically feasible and safe operative technique.

Table 1. The perspendire results in two group

	Voles assisted "Three bale"	The resistant	
Clinical characters	referenced approach.	-	7
	(a=75)	0-10	
Operation (mercipsis)	94.5::363	120/21:26.4	<0.000
Missel lose (ml)	26.41:11.7	54.8 :: 19.7	-0.000
Total drainage (ml)	9"	520.1 = 48.5	
Times of desirage commod	_		
(days after operation)		3.6±1.2	
Empired step after operation (step)	3.54.1.4	74124	-0.000
Perhaps alive pain (3-00)			
26 all o spention	42 1 1 1	26 : 07	10.000
6th after operation	3.8± 1.5	55± 14	-0.900
7 days after operation	2.7 ± 6.8	46 = 14	10.000
Counting some (1-199)	984193	8731123	0.1007

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LPV left innominate vote, SVC: upon veno-care, EL; right long, TM. Thymens

P87

Subxiphoid Approach for Tubeless Uniportal Video-Assisted Thoracoscopic Surgery Is Associated With Less Pain than Transthoracic Approach

W. Lin, Y. Chang

Wanfang Hospital, Taipei Medical University, Taiwan

Purpose: The subxiphoid approach for thoracoscopic surgery seems to cause less pain during and immediately after operation, and this effect may benefit patients undergoing non-intubated anesthesia. Herein, we compare postoperative pain between subxiphoid and transthoracic approaches in tubeless thoracoscopic surgery, ie, no endotracheal tube and no chest drain, to clarify this benefit.

Methods: Clinical data were collected and analyzed for patients who underwent non-intubated uniportal video-assisted thoracoscopic surgery for diagnosis of intrathoracic lesions without placement of a chest drain during operation, either by subxiphoid or transthoracic approach. For pain control, intercostal nerve block was performed during the operation in all cases in the transthoracic group, and only wound infiltration with local anesthetic was performed in the subxiphoid group. Postoperative pain was measured by visual analogue scale (VAS 0-10, 0 for no pain and 10 for most severe pain). The VAS was rescored immediately 1 hour after operation and then every 8-hour period until discharge.

Results: Between April 2015 to April 2016, 20 cases underwent non-intubated uniportal video-assisted thoracoscopic surgery for diagnosis. Nine cases were operated by subxiphoid approach, the others by transthoracic uniportal approach. Eighteen wedge resections (right upper lobe = four, right middle lobe = three, right lower lobe = one, left upper lobe = five, left lower lobe = two), three mediastinal lymph node excisions, two pleura biopsies, and one thymothymectomy were performed. No difference was observed between the subxiphoid and transthoracic groups in age, sex, operative time, blood loss, and postoperative hospital stay. No cases needed placement of chest drain after operation. No complications occurred in all cases. The VAS in the subxiphoid group was significantly less than transthoracic group at 1 hour (1.11 vs 2.45), 8 hours (1.11 vs 2.72), 24 hours (0.67 vs 1.91), 32 hours (0.67 vs 2.13), and 48 hours (0.67 vs 2.0) after operation (P < .05). Less pain also was observed in the subxiphoid group as mean VAS on postoperative day (POD) 1 (0.85 vs 2.18, P < .05) and POD2 (0.42 vs 1.38, P < .05).

Conclusions: In tubeless uniportal video-assisted thoracoscopic surgery, the subxiphoid approach caused less postoperative pain in comparison to the transthoracic approach, even without intercostal nerve block. The subxiphoid approach is as safe as transthoracic approach with similar operative time for diagnostic thoracoscopic surgery.

P88

Integrated Analysis of Somatic Genetic Alterations and Immune Microenvironment in Malignant Pleural Mesothelioma

W.T. Vigneswaran¹, H. Inoue², J. Park², K. Kiyotani², S. Olugbile², Y. Nakamura²

¹Loyola University Health System, Chicago, IL, ²The University of Chicago Medicine, IL

Purpose: Malignant pleural mesothelioma (MPM) is a rare but aggressive tumor that is rapidly fatal when untreated. The current treatment remains only marginally effective. The genomic landscape of MPM is not well understood. Advanced high-throughput sequencing technologies allow comprehensive characterization of genetic alterations and may provide possible targets for developing treatments.

Methods: We examined blood and tumor specimens obtained at the time of surgery from three different sites in patients undergoing pleurectomy and decortication for MPM. These were studied through whole exome sequencing, T cell receptor (TCR) repertoire analysis of tumor-infiltrating T cells (TILs), and expression levels of immune-related genes. We also performed in silico prediction of potent neoantigens derived from non-synonymous somatic mutations in each specimen. For the comparison of tumor tissues from three different sites, we performed hierarchical clustering analysis to assess the tumor heterogeneity and differences in immune environment.

Results: Thirty-six tissue samples (three from separate sites of the tumor in each patient) and blood samples from 12 patients with MPM were analyzed. There were seven pure epithelioid histologies and five biphasic histologies. Significant intra-tumor and inter-tumor heterogeneity was noted. High mutation/neoantigen load correlated with higher clonal expansion of TILs (R=0.46) and high expression levels of immune-associated cytolytic factors, granzyme A (R=0.25) and perforin 1 (R=0.48). In the cluster analysis, intra-tumor heterogeneous MPM cases revealed unique neoantigens and clonotypes of TILs that were restricted to each of tumor sites, suggesting infiltration of the neoantigen-specific T cells within the tumor. Subanalysis according to histologic types showed that biphasic tumors had higher mutation/neoantigen load and stronger oligoclonal T cell expansion (P=.01) than pure epithelioid histology tumors.

Conclusions: Correlations among somatic mutation/neoantigen load, clonality of TILs, and the immune-related tumor microenvironment were observed in MPM. Intra-tumoral heterogeneity of expression levels of immune-related genes were relatively minimal. High mutation/neoantigen load in tumor might promote effective expansion and infiltration of tumorocidal T cells into tumor bed that support immune checkpoint blockade treatment.

P89

H3K9 Histone Methyltransferase G9a Is a Potential Therapeutic Target for K-ras Mutated Lung Adenocarcinoma

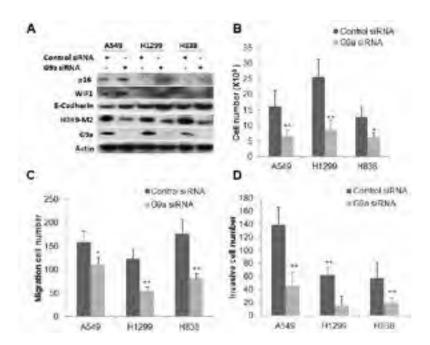
K. Zhang, X. Yun, J. Lopez, T. Reno, J. Y. Kim, D. J. Raz
City of Hope National Medical Center, Duarte, CA
COMMERCIAL RELATIONSHIPS D. J. Raz: Consultant/Advisory Board, Cireca, LLC

Purpose: G9a is a histone methyltransferase responsible for H3K9 methylation. G9a may be a therapeutic target in lung cancer because it participates in epigenetic regulation of gene expression through interaction with DNMT1. Here, we investigated the impact of G9a on lung cancer proliferation, migration, invasion, and expression of epigenetically regulated genes.

Methods: G9a was knocked down using both small interfering RNA (siRNA) and a small molecule inhibitor in K-ras mutated lung adenocarcinoma cells. The impact of G9a knockdown on growth, migration, and invasion were studied in A549, H1299, and H838 cells using a cell proliferation assay and transwell migration and invasion assays. Cytotoxic effects of cisplatin were measured by Anexin V apoptosis detection kit. Impact of G9a knockdown on the expression of H3K9 dimethylation, CDKN2a (p16), and Wnt-inhibitory factor-1 (WIF1) were examined by Western blot analysis. Impact of G9a knockdown on Wnt/β-catenin signaling pathway was studied using TOPFlash luciferase reporter assay.

Results: Western blot analysis showed that G9a siRNA decreased H3K9 dimethylation levels in A549, H1299, and H383 cells. Knockdown of G9a significantly suppressed lung cancer cellular proliferation through inducing a G1/S phase cell cycle arrest. Transwell migration and invasion assays demonstrated that knockdown of G9a also significantly inhibited in vitro migration and invasion of these cancer cells. Furthermore, knockdown of G9a significantly enhanced cisplatin-induced apoptosis. Knockdown of G9a upregulated E-Cadherin, p16, and WIF1 expressions, and significantly suppressed Wnt3a activated Wnt/ β -catenin signaling pathway in these lung cancer cells, suggesting that G9a may promote malignancy through regulating these tumor suppressors. Similarly, UNC0638, a G9a specific inhibitor, also suppressed in vitro cellular proliferation, induced apoptosis, and synergistically increased cisplatin-induced apoptosis.

Conclusions: Targeting G9a inhibited lung cancer cell proliferation and invasion, and improved cisplatin sensitivity. G9a is a potential therapeutic target in K-ras mutated lung adenocarcinoma, and additional studies on the mechanism of G9a-mediated effects on lung cancer are under way.



P90

Increased Variance in Oral and Gastric Microbiome Flora Correlates With Post-Esophagectomy Anastomotic Leaks

R. M. Reddy, W. B. Weir, J. Lin, W. R. Lynch, P. W. Carrott, M. Orringer, A. C. Chang, J. C. Fenno, Y. Kapila, D. Beer

University of Michigan, Ann Arbor

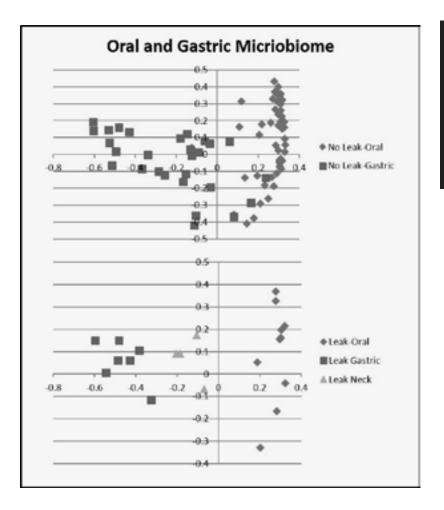
COMMERCIAL RELATIONSHIPS J. Lin: Speakers Bureau/Honoraria, Intuitive Surgical, AtriCure; R. M. Reddy: Speakers Bureau/Honoraria, Intuitive Surgical

Purpose: A cervical esophagogastric anastomotic leak after an esophagectomy for cancer is a major source of morbidity and mortality. As has been shown in colorectal cancer, we hypothesize that oral and gastrointestinal (GI) microbiomes contribute to postoperative anastomotic leaks and can be used to predict leaks.

Methods: A prospective study of esophagectomy patients was performed from May 2013 to August 2014, with the collection of preoperative and postoperative oral saliva, intraoperative esophageal and gastric mucosa, and postoperative leak neck wound swabs. Primary outcomes analyzed were tumor histology, tumor stage, postoperative anastomotic leak, and postoperative pneumonia. Using presence and levels of bacterial probes as endpoints, correlations with tumor histology, tumor stage, and presence of postoperative complications were analyzed by unequal variances t-tests for multiple comparisons and principal coordinate analysis.

Results: Sixty-six patients were enrolled, and 55 patients underwent successful esophagectomy. Among those, 80% (44) had a diagnosis of adenocarcinoma, 13% (seven) squamous cell carcinoma, and 7% (four) benign disease. The 30-day mortality was 2% (1/55), 18% (10/55) had an anastomotic leak treated with cervical wound drainage, and 2% (1/55) experienced postoperative pneumonia. Microbial flora demonstrated consistency with other samples from site of origin, with oral samples having higher rates of *Clostridiales* and *Actinomyces*, while esophageal/gastric samples had *Akkermansia*, *Lactobacillus*, and *E. Shigella*. There was no correlation between GI microbiome flora and tumor histology or tumor stage. There was a difference (*P* = .015) noted when comparing the variance in bacterial composition between the preoperative oral flora and intraoperative gastric flora, ie, the distance between oral and gastric sample datapoints (Figure). Patients who had a leak showed a higher variance, with neck swab flora showing a mixed composition between sources.

Conclusions: GI microbial flora has been implicated as a cause of anastomotic leak. Patients with increased variance in their oral and gastric flora are at increased risk for postesophagectomy leaks. Microbiome analysis could help identify patients at high risk for leak after esophagectomy.



P91

Polytetrafluoroethylene or Collagen Matrix for Diaphragmatic Reconstruction?

J. Bassuner, D. C. Rice, M. B. Antonoff, A. Correa, G. L. Walsh, A. A. Vaporciyan, N. Garg, B. Sepesi, S. G. Swisher, W. L. Hofstetter, J. A. Roth, R. J. Mehran

The University of Texas MD Anderson Cancer Center, Houston

COMMERCIAL RELATIONSHIPS N. Garg: Ownership Interest/Owner, Garglet LLC; D. R. Rice: Speakers Bureau/Honoraria, Pacira Pharmaceuticals, Intuitive Surgical

Purpose: Combined extensive pulmonary and diaphragmatic resection and reconstruction may be required in the management of a number of disease processes. We aimed to evaluate the impact of collagen matrix in the reconstruction of the diaphragm.

Methods: We retrospectively queried a prospective departmental database for all patients who had resection and reconstruction of the diaphragm and simultaneous pulmonary surgery between 2000 and 2015. All reconstructions were performed with either thick synthetic polytetrafluoroethylene (PTFE) or 4-mm collagen matrix. We evaluated the rate of empyema and eventration in each group.

Results: 202 patients met inclusion criteria (Table). PTFE was used in 166 cases (82.2%) and collagen matrix in 36 (17.8%). Collagen matrix was used in eight extrapleural pneumonectomies (5.4%), in 20 pleurectomy decortications (51.3%), and in eight of the other types of resections (50.0%). Patients were followed for a median of 13.0 months in the PTFE group and 11.7 months in the collagen matrix group. Empyema occurred in ten PTFE (6.0%) and four collagen matrix (11.1%; P = .531), although patients in the collagen matrix group had a chest tube for a median of 3 days longer than those with PTFE (P = 0.008). Seven patients (70.0%) with PTFE infection required removal of the graft, while none of the collagen matrix needed removal (P = .351) and were treated with drainage and antibiotherapy only. There were nine eventrations in the PTFE and four in the collagen matrix groups, all acute and due to anchorage failure.

Conclusions: While infection rates were similar between PTFE and collagen matrix, reoperation for removal was not necessary for collagen matrix. There were no delayed eventrations. The use of a thick collagen matrix may be a reasonable option when diaphragmatic resection is potentially associated with a higher risk of infection.

Table 1. Patient demographics and outcome

Variable	PTFE N=100	Collagen matrix N=36	p
Saw Male/Female	126/40	25/11	
Age Median [min-max]	59[11-81]	62[13-74]	p=0.513
Histology Mesothelioma Other	134 32	24	
Follow up Median(min-may)	150(0-143-1)	11.7(0.23-56.6)	p=0.821
Type of surgery EPP P/D Other	139 19 8	6 20 8	
Chest tube drainage Madian[min-max]	3(1-77)	6[1-60]	p=0.008
Empyema EPP PD Other	10 H Z	1 1 2	p=0,531
Removal	7	0	p=0.351
Eventration	9	4	p=0,254

EPP: Extra pieural presimenectomo P.D. Pleurectomo decorricamon

P92

Sublobar Resection for Elderly Patients With Clinical Stage I Non-Small-Cell Lung Cancer

Y. Tsutani, N. Tsubokawa, M. Ito, K. Misumi, H. Hanaki, Y. Miyata, M. Okada Hiroshima University, Japan

Purpose: The standard surgical procedure for early-stage non-small-cell lung cancer (NSCLC) is lobectomy. However, the optimal procedure for elderly patients with early stage NSCLC is controversial. The purpose of this study was to investigate the surgical outcomes of sublobar resection for elderly patients with early-stage NSCLC.

Methods: Of 794 consecutive patients with clinical stage I NSCLC who underwent complete resection between April 2007 and December 2015, 205 elderly patients (>75 years) were identified. Surgical outcomes between lobectomy and sublobar resection were compared. To adjust confounding factors, propensity scores were generated, including factors such as age, sex, smoking history, histology, SUVmax, clinical stage, %VC, FEV1.0 (%), %DLCO, and Charlson comorbidity index. Kaplan-Meier method was used to assess overall survival (OS), and OS was compared using log-rank tests. Multivariate Cox analysis was used to assess the potential independent effects of the surgical procedure on OS.

Results: Sublobar resection (n=99) was performed for higher age (P = .027), lower SUVmax (P < .001), lower clinical stage (P < .001), lower %VC (P = .007), and lower %DLCO (P = .025) patients compared with lobectomy (n=106). Postoperative severe complications (>Grade IIIa) occurred more frequently for lobectomy (11 of 106, 10.4%) than sublobar resection (five of 99, 5.1%; P = .16). Propensity score-adjusted multivariate analysis showed that surgical procedure was an independent predictive factor for postoperative severe complication (OR 3.5 for lobectomy; 95% CI, 1.0-12.1; P = .048). OS was not significantly different between lobectomy (5-year OS, 67.2%) and sublobar resection (5-year OS, 73.9%; P = .93). Propensity score-adjusted multivariate Cox analysis revealed that surgical procedure was not an independent factor for OS (HR 1.03 for lobectomy; 95% CI, 0.49-2.2; P = .94). Propensity score-matched comparison between lobectomy and sublobar resection also supported these results.

Conclusions: Sublobar resection is associated with less severe postoperative complications and similar OS compared with lobectomy. Sublobar resection may be an optimal procedure for elderly patients with clinical stage I NSCLC.

P93

Optimal Methods to Evaluate the Solid Component of Part-Solid Lung Cancer on Thin-Section Computed Tomography

S. Hirayama¹, A. Hattori², T. Matsunaga², K. Takamochi², S. Oh², K. Suzuki¹

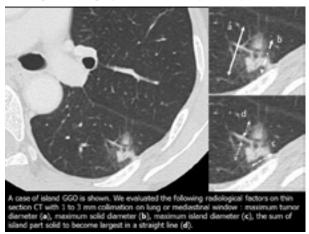
¹Juntendo University School of Medicine, Tokyo, Japan, ²Juntendo University, Tokyo, Japan

Purpose: T factor will be decided by the size of solid part instead of the maximum tumor dimension, according to the new 8th Edition of the TNM Classification for Lung Cancer. However, how to measure the size of solid part in lung cancer with ground glass opacity (GGO) remains controversial, especially for tumors having scattered solid parts.

Methods: A retrospective study was done on 748 patients with resected clinical stage IA lung adenocarcinoma between 2009 and 2014. We evaluated the following radiological factors on thin-section computed tomography with 1- to 3-mm collimation to evaluate the size of solid part on lung and mediastinal window. We defined islands solid GGO (ISGGO) having more than one solid part. We measured the solid size of maximum, the sum of each island, and the largest island on lung or mediastinal window with all tumor. We investigated the relationship between the methods of measuring the size of solid parts and prognosis.

Results: Median follow-up period was 3.1 years. There were 322 men, and median age was 71 years. Lymph node metastasis was pathologically confirmed in 7.5%. In the 5-year survival rate by the maximum solid, the sum of each solid, and the largest island size, there were no significant differences between 0 mm and 1-10 mm in solid size on lung window, respectively (P = .490, P = .410, and P = .423). The 5-year survival rate by the maximum solid size for 0 mm, 1-10 mm, 11-20 mm, and 21-30 mm on mediastinal window was 99.5%, 96.1%, 86.1%, and 70.1% (P = .115, P < .001, and P = .090), whereas that by the sum of each solid size was 99.5%, 95.5%, 83.6%, and 70.8%, respectively (P = .077, P < .001, and P = .042). The 5-year survival rate by the largest island size for 0 mm, 1-10 mm, 11-20 mm, and 21-30 mm on mediastinal window was 99.5%, 94.3%, 84.6%, and 68.5%, respectively (P = .025, P = .006, and P = .013). Thus, measurement of largest island has to reflect the most prognosis.

Conclusions: The size of largest island in solid part on mediastinal window appeared to be the best predictor of prognosis in clinical stage IA lung adenocarcinoma.



P94

Long-Term Results of Robotic Modified Belsey Fundoplication: Greater Reflux Control and Lower Rates of Dysphagia and Gas Bloat than Nissen Fundoplication

F. Gharagozloo

Celebration Health/Florida Hospital System and University of Central Florida

Purpose: The Nissen fundoplication is the most common antireflux procedure. This procedure is associated with poor long-term durability, as well as dysphagia and gas bloat. We report the long-term results of a modified Belsy procedure performed laparoscopically using the surgical robot.

Methods: All patients who underwent robot-assisted modified Belsey fundoplasty were reviewed retrospectively. Operations were performed through five ports and included robotic dissection of the esophageal hiatus, primary closure of the hiatus, followed by intussusception of a 2-cm segment of esophagus into the stomach for 270 degrees with suspension of the fundoplasty onto the crural closure as described by Belsey. Results were assessed by preoperative and postoperative endoscopy, manometry, pH study, contrast esophagography, subjective symptom questionnaire, and objective Visick grading.

Results: There were 291 patients (156 male, 135 female), and the mean age was 51 years \pm 14 years. Indications were intractability (73%) and pulmonary symptoms (27%). Mean operative time was 130 minutes \pm 52 minutes. There were six minor complications (pneumothorax, atrial fibrillation) and no mortality. Mean hospitalization was 2.8 days \pm 1.7 days (median 2 days). Mean follow-up was 85 months \pm 7 months. The subjective questionnaire score for heartburn, regurgitation, pain, and dysphagia decreased from 8.3 \pm 0.6 to 0.7 \pm 0.2 (P < .05). There was no long-term dysphagia or gas bloat. At the time of follow-up, 95% of patients were graded as Visick I, 5% as Visick II, and 1% as Visick III. Hiatal hernias recurred in two patients (1%).

Conclusions: Robotic laparoscopic modified Belsey fundoplication is associated with excellent long-term durability, reflux control, and low rates of dysphagia and gas bloat. This procedure may represent an alternative to medical antireflux therapy and surgical antireflux procedures, such as the Nissen fundoplication.

P95

Gender Differences in Outcomes Following Neoadjuvant Chemoradiotherapy and Esophagogastrectomy for Locally Advanced Esophageal Carcinoma

P. G. Rowse¹, D. E. Jaroszewski², M. Thomas³, K. Harold⁴, W. S. Harmsen¹, K. R. Shen¹

¹Mayo Clinic, Rochester, MN, ²Mayo Clinic, Scottsdale, AZ, ³Mayo Clinic, Jacksonville, FL, ⁴Mayo Clinic, Phoenix, AZ

COMMERCIAL RELATIONSHIPS M. Thomas: Research Grant, Thoracic Surgery Foundation, Acelity

Purpose: The role of gender in the outcomes of locally advanced esophageal carcinoma is not clearly defined. This study evaluates the impact of gender on response to induction chemoradiotherapy, tumor recurrence, and survival.

Methods: From January 1990 through December 2013, all female patients from three affiliated centers that received neoadjuvant chemoradiotherapy followed by esophagogastrectomy were compared with control males. Matching was based on age, pre-treatment clinical stage, tumor type (adenocarcinoma, squamous cell), and surgical era. Outcomes were analyzed.

Results: There were 366 patients (145 female, 221 male). Median female age was 64 years (range, 22-81 years), whereas males were 61 years (range, 33-82 years). Adenocarcinoma existed in 105 women (72%) and 192 men (87%), whereas squamous cell carcinoma existed in 40 women (28%) and 29 men (13%), P = .005. Women were more likely to obtain either complete or near-complete pathologic response to induction therapy (84; 58%) compared to men (103; 47%), P = .034. Men had an 80% increased risk of recurrence (HR 1.80; 95% CI, 1.15-2.68; P = .008). There was no gender association with risk of death, P = .538. A partial responder (relative to a complete or near complete responder), irrespective of gender, was three times more likely to have recurrence (HR 2.96; 95% CI, 1.98-4.43; P < .001) and 2.6 times more likely to die (HR 2.56; 95% CI, 1.88-3.48; P < .001).

Conclusions: Female gender correlated with improved rates of achieving either complete or near complete pathologic response to induction therapy. In addition, women were less likely to experience tumor recurrence in comparison to men with equivalent neoadjuvant response.

A	Alshehri, Khalid	98, 116
Aalaei-Andabili, Seyed Hossein149	Altarabsheh, Salah	387
Abd Alhadi, Firas146	Altorki, Nasser K.	358, 495
Abdelsattar, Zaid177	Alu, Maria	336
Abel, Erik472	Amarasekara, Hiruni	326
Absi, Tarek S417	Amin, Samy	478
Abu-Sulaiman, Riyadh453	Andersen, Stina W	284
Accola, Kevin	Anderson, Brett R	70
Acevedo, Julissa134	Anderson, Rick	36
Acker, Michael A	Andrade, Rafael S.	369
Ad, Niv	Angelini, Gianni	388
Adachi, Hideo325	Anstadt, Mark P	89
Adachi, Iki61, 344	Antonoff, Mara B 12, 284	, 312, 369, 512
Adams, Carl W223	Antunes, Manuel J.	424
Adams, David H379	Antunes, Pedro E.	424
Adamson, Robert298	Anwaruddin, Saif	328
Afifi, Rana O	Appoo, Jehangir J1	2, 91, 318, 327
Aftab, Muhammad429	Arabia, Francisco A3	5, 45, 303, 371
Aggarwal, Sanjeev199	Arai, Sadahiko	206
Ahlsson, Anders318	Arenz, Claudia	348
Ahmad, Munir453	Argenziano, Michael	140, 244
Aidietis, Audrius242	Arnaoutakis, George J	144, 198
Ailawadi, Gorav 12, 22, 52, 53, 80, 126, 128, 129, 130, 221, 231, 245, 336, 375, 474	Arndt, Andrew T.	
Akhter, Shahab A401	Arora, Rakesh	
Al Habshan, Fahad453	Asfour, Boulos	
*	Ashfaq, Awais	
Al-Ayoubi, Adnan M116, 296 Alaeddine, Mohamad372	Atay, Scott	
Alaklabi, Mohammed M349	Atluri, Pavan12, 22, 84, 221	
Albage, Anders	Attwood, Kristopher	
Alban, Rodrigo	Aucott, Susan	
Albanese, Sonia B	Augoustides, John	
Alfonsi, Jacopo428	Ayub, Adil	
Allan, James S	Azizzadeh, Ali	320
Allen, Keith B		
Allen, Mark S	В	
Allen, Mark S 12, 78, 120,177, 266, 274, 583	Babaliaros, Vasilis	
Alloisio, Marco361	Bacchetta, Matthew	223

Bacha, Emile A	22, 250, 368, 445, 451	Beddoes, Richard	91
Backer, Carl L	45	Bedetti, Benedetta	436
Badami, Abbasali	401	Beeman, Arun	459
Badhwar, Vinay	13, 22, 50, 54, 74, 80, 372	Beer, David	97, 510
Baek, Jae Suk	348	Bell, Richard S.	58
Bagozzi, Lorenzo	162	Belli, Emre	104, 250
Bagur, Rodrigo	160	Bendel, Emily	503
Bailey, Leonard L	454	Bender, Edward M	13, 22, 314
Bainbridge, Daniel	160	Benedetto, Umberto	388
Bajwa, Tanvir	379	Benzaquen, Sadia	34
Bakaeen, Faisal	13, 68, 128, 159, 429	Berg, Kent	149
Baker, David	179	Berggren, Hakan	162, 250
Balch, Charles	308	Bermudez, Christian A	
Balderson, Scott	369	Berna, Pascal	292
Balkhy, Husam H	52	Berry, Mark F 12, 22,	
Bandiera, Alessandro	359	Bertolaccini, Luca	
Bang, Ji Hyun	106	Besola, Laura	242
Bapat, Vinayak	30	Beste, David	204
	300, 304	Beyersdorf, Friedhelm	22, 86
Baribeau, Yvon R	156	Bhagat, Rohun	282
Barnard, James	234	Bhat, Aarti	61
Baron, Suzanne	199	Bhatt, Amar	472
Bartoli, Carlo	302	Bhatti, Riaz	453
	322	Bhora, Faiz	
Bassuner, Juri	512	Biaghoshi, Ellie	
Batirel, Hasan F	353	Bianchi, Giacomo	
Battoo, Athar	176	Bierbach, Benjamin	
Bauer, Kelly	40	Bilfinger, Thomas V	294
Bavaria, Joseph E	4, 13, 40, 44, 66, 67,	Biocina, Bojan	232
	226, 258, 259, 264, 323,	Biswas Roy, Sreeja	188
328, 336		Bizzotto, Eleonora	242
-	212	Blackmon, Shanda H	13, 37, 56, 78, 177,
	370	220, 274, 503	
	148	Blackstone, Eugene	68, 70, 238, 336
	22, 149, 487	Blasberg, Justin	78, 486, 498
	194	Bloom, Jordan P13,	37, 56, 78, 177, 220,
· · · · · · · · · · · · · · · · · · ·	284	274, 503	
Beckmann, Erik	146	Bober, Carley M	166

Body, Simon C400	Burt, Bryan M	356
Boeve, Theodore111, 385	Bush, Errol L.	184
Boffa, Daniel J32, 72, 369, 486	Butt, Warwick	457
Bollard, Stephanie459	Byrne, Timothy	379
Bolling, Steven F		
Bonnet, Damien104	C	
Boodhwani, Munir148	Caldarone, Christopher A	61,70
Borger, Michael A32, 54, 244	Calderon, Johanna	104
Borgman, Andrew111	Callahan, Connor	458
Borisov, Konstantin389	Callaway-Lane, Carol	179
Borkon, A. Michael199	Camacho, Margarita T2	22, 300, 304
Bottoni, Edoardo361	Cameron, Duke E45, 76, 16	2, 322, 367,
Bouchard, Denis394	383, 448	
Bouhout, Ismail394	Candiani, Massimo	
Bousamra, Michael32	Candioti, Mariano	
Bove, Edward L466	Canter, Robert J	
Bowdish, Michael E140	Caputo, Massimo	
Boyd, W. Douglas30	Caranasos, Thomas G	53
Bradley, Scott M61	Caress, Ann-Louise	234
Branco, Carlos F424	Carey, John	234
Brandt, Mary218	Carmo, Helison Rafael Pereira	446
Brawn, Jeff367	Carotti, Adriano	170
Bremner, Ross M22, 188	Carrel, Thierry P.	162
Brennan, Matthew372	Carretta, Angelo	359
Brink, Johann	Carrier, Michel	394
Brinkman, William T366	Carrott, Philip W.	97, 510
Brinster, Derek R22, 196, 366	Cartier, Raymond	394
Brizard, Christian P102,172, 450, 457	Caskey, Michael	379
Brown, Lisa M 36, 284, 288, 369, 480	Cassivi, Stephen D23, 7	78, 274, 503
Brown, Phillip P415	Catlin, Ann Christine	479
Brown, Richard K97	Catton, Kirsti	340, 462
Bruckner, Brian A185	Cavarocchi, Nicholas	108
Bryant, Roosevelt449	Caviezel, Claudio	184
Buck, Marcia L460	Cebotari, Serghei	146
Burfeind, William R78, 369	Cecere, Renzo	88, 421
Burg, Jennifer M330	Cefarelli, Mariano	428
Burkhoff, Daniel35	Ceppa, DuyKhanh P	34, 369
Burkion, Danier	Cerillo, Alfredo G	334

Çetinkaya, Gamze212	Ciriaco, Paola359
Cetrano, Enrico170	Clavo, Bernardino98
Cha, Yong-Mei425	Cleuziou, Julie162, 444
Chai, Paul70, 445, 451	Cobanoglu, Adnan192
Chamogeorgakis, Themistokles470	Codreanu, Maria E320
Chan, Edward Y185	Cohen, David199, 415
Chan, Ernest G268, 438, 471	Colditz, Graham A214
Chan, Joshua L142	Colli, Andrea242
Chan, Patrick438	Colligan, Michael64
Chang, Andrew C13, 23, 78, 97, 490, 510	Collins, Julia398
Chang, Helena140	Concistrè, Giovanni334
Chang, Yin506	Connolly, Heidi164
Chao, Yin-Kai270	Conte, John V23, 50, 383
Charles, Eric J128, 474	Cook, Chris C438
Charlton-Ouw, Kristofer M320	Cooke, David T14, 23, 174, 284, 288,
Chauhan, Dhaval300, 304	369, 480
Chelliah, Anjali445	Cornwell, Lorraine228
Chen, Chih-Yi270	Correa, Arlene512
Chen, Edward P 13, 56, 144, 152, 154, 260,	Corso, Paul J
367	Coselli, Joseph S228, 326
Chen, Frederick Y56	Costache, Victor S
Chen, Guoan97	Costantino, Christina L501
Chen, Jonathan	Coutinho, Gonçalo F424
Cheng, Aaron M13, 23, 48, 108, 278, 371	Coutinho, Thais148
Chhatriwalla, Adnan199	Cowden, Amanda246
Chiaramonti, Francesca334	Cowper, Patricia72
Chiletti, Roberto457	Crabtree, Traves14, 23, 220
Chin, Clifford	Crawford, Todd C383, 448
Chitwood, W. Randolph367	Creighton, Sara458
Chmielewski, Gary W502	Crestanello, Juan A14, 23, 426, 472
Cho, Jong Ho354	Critchley, William R234
Choi, Jae-Woong240	Culler, Steven D415
Choi, Se Hoon354	Czerny, Martin86
Choi, Yong Soo354	
Choi, Young Ho211	D
Chu, Danny23, 372	D'Alessandro, David A371
Chu, Michael160	D'Amico, Thomas A63
Chung, Kyung Young354	D'Cunha, Jonathan438, 471

D'Ovidio, Frank352	Derstine, Brian A490
d'Udekem, Yves 102, 172, 450, 457	Desai, Nimesh 12, 14, 33, 198, 202, 259, 264
da Graca, Briget80, 375	323, 328, 404
Daimon, Takashi402	DeSimone, Joseph156, 158, 413
Daly, Richard C23, 408, 419	Detterbeck, Frank C352, 479, 486
Damiano, Ralph J 74, 80, 83, 375, 390	Dexter, Elisabeth U176
Daneshmand, Mani A371	Dhanasopon, Andrew P486
Danner, Bernhard C242	Dhillon, Samjot176
Darling, Gail276	Dhupar, Rajeev100
David, Elizabeth A14, 23, 56, 284, 288,	Di Bartolomeo, Roberto306, 428
354, 480	di Carlo, Duccio250
David, Tirone E126	Di Franco, Antonino381
Davies, Ben459	Di Marco, Luca428
Davis, J. Russell	Di Martino, Elena S91
Davis, Robert Duane190	Diaconescu, Andrada C142
Dawood, Murtaza Y237, 398	Diamantouros, Pantelis160
De Dominicis, Florence292	Dibble, Taylor264, 323, 404
de la Cruz, Kim I228	Dickinson, Michael G111
De Leon, Luis E344	DiMaio, J. Michael14, 23, 309
De Paulis, Ruggero258, 259, 367	Diogenes de Carvalho, Daniela446
Dearani, Joseph 14, 23, 44, 102, 164, 245,	Discipio, Anthony W156, 158, 413
408, 419, 425	Dittus, Robert S179
Deatrick, Kristopher B466	Do, Nhue76
DeCamp, Malcolm M23, 78, 353	Do, Young Woo493
Decampli, William M70, 246	Donahoe, Laura205
Degner, Benjamin C381	Doud, Kristen140
DeGrauw, Xi154	Downs, Emily A130
del Nido, Pedro J14, 442	Drake, Daniel H50
Delgado Donayre, Jose40	Drasutiene, Agne242
Delucia, Alphonse377	Drizin, Gary287
Demchuk, Carley134	du Plessis, Karin450
Demers, Philippe394	Dufendach, Keith A202, 323, 404
Demmy, Todd L176, 369	Dunlay, Shannon M387
Denault, Andre49	Dunning, Joel34, 58, 322
DeNino, Walter F310	Dunnington, Gansevoort H53, 370
Deo, Salil387	Duwayri, Yazan260
DeOliveira, Nilto401	Dvir, Danny199
Deppen, Stephen A	,,

E	Ferguson, Mark K24, 134
Eagleton, Matthew J33, 429	Ferguson, T. Bruce68
Ebels, Tjark250, 252	Fernandez, Felix G 15, 24, 72, 78, 219
Edwards, Janet P352, 369	Fernandez, Ramiro369
Edwards, Melanie A14, 23, 62, 208	Fernando, Hiran C24, 182
Eghbalzadeh, Kaveh236	Fernando, Sumudinie
Eghtesady, Pirooz446	Ferraro, Pasquale119, 208
Eilers, Amanda L310	Ferri, Lorenzo E132
Eisenberg, Steven B312	Feudtner, Chris253
Ejiofor, Julius I400	Fiedler, Amy G310
El Hamamsy, Ismail394	Fikfak, Vid434
El-Khoury, Gebrine367	Filardo, Giovanni80, 375
Elhelali, Ala262	Fildes, James234
Ellison, Trevor136	Fino, Nora F
Elsayed, Mohamed381	Firstenberg, Michael S 15, 24, 49, 299
Emani, Sitaram M60	Fischbein, Michael P15, 367
Enchakalody, Binu490	Fishman, Neil O42
Engstad, Kai E406	Fitch, Stephen111
Erol, Mehmet M212	Fitzgerald, Meghann M196
Estrera, Anthony L312, 320	Fiuza, María D98
Ewais, MennatAllah362	Flores, Alyssa M413
	Flores, Raja M24, 116, 290, 296
F	Flum, David278
Fakioglu, Harun246	Foerster, Katharina86
Falk, Volkmar201	Fok, Matthew322
Fang, Bingliang96	Fonarow, Gregg C
Farjah, Farhood 14, 24, 78, 278, 284	Fonner, Clifford E128, 231
Farnan, Jeanne M	Forcillo, Jessica
Farneti, Pier Andrea	Fornaresio, Lisa M396
Farviar, Robert S	Foster, Nathaniel237, 398
Favaloro, Roberto R	Fourdrain, Alex292
Fazzalari, Frank L14, 24, 46	Fowler, Clara312
Feins, Richard H371	Fox, Matthew186
Feldman, Liane132	Fox, Stephanie A160
Fenno, J. Christopher510	Fragata, Jose I162, 252
Fenton, Kathleen N	Franco-Cereceda, Anders318
Ferdinand, Francis D24, 228	Francois, Lacour-Gayet250

Franzen, Daniel184	Geronikola, Nikoletta	104
Fraser, Charles D., Jr344, 448	Gerosa, Gino	
Freud, Lindsay445	Ghaly, Galal R	358, 495
Friese, Jeremy503	Ghanayem, Nancy S	204, 256
Fuglsang, Simon318	Ghanta, Ravi K 56, 1	30, 140, 468, 474
Fukushima, Satsuki402	Gharagozloo, Farid	118, 504, 516
Fullerton, David A15, 49, 122, 126,	Ghoneim, Aly	394
193, 282	Ghoreishi, Mehrdad	237, 392, 398
Fumakia, Nishit140	Giambruno, Vincenzo	160
Funatsu, Toshihiro402	Giannico, Salvatore	170
Furnary, Anthony P72	Gilbert, Monica	332
	Gillaspie, Erin A.	310
G	Gillinov, A. Marc	74, 238
Gabbe, Steven308	Gilmanov, Daniyar S	334
Gaissert, Henning A497	Ginns, Jonathan	451
Galetta, Domenico286	Girard, Nicolas	479
Galindo, Cristi417	Girardi, Leonard N	
Galloway, Aubrey C31	Giri, Jay	328, 404
Gambardella, Ivancarmine381	Giunta, Gustavo	
Gammie, James S 15, 24, 237, 392, 398	Gleason, Thomas G	
Gangadharan, Sidharta P 15, 24, 56,	153,372	
57, 369	Glebova, Natalia O	282
Gangemi, James J24, 204, 460	Glickstein, Julie	451
Ganum, Guillermo332	Glineur, David	409
Gardner, Julia M136	Goebel, Ulrich	86
Garg, Naveen512	Goerlinger, Klaus	232
Gasbarri, Tommaso334	Goldberg, Joshua	377
Gasparovic, Hrvoje232	Goldenberg, Neil	76
Gaudino, Mario381, 388	Goldman, Scott M	367
Gaughan, Colleen B94	Goldstone, Andrew B	310
Gauvreau, Kimberlee442	Goltsov, Alexei	96
Gaynor, J. William 24, 45, 166, 222, 253	Gonzalez-Stawinski, Gonzalo	
Gebitekin, Cengiz212	Goodarzi, Ahmad	
Geiger, James37	Gottlieb, Erin A.	
Geirsson, Arnar24, 318	Goudie, Eric	
George, Barry S426	Goulson, Rebecca	
George, Isaac244, 366	Grau, Juan	
Gergori, Dario162	Grau-Sepulveda, Maria V	

Graviss, Edward185	Halbreiner, Michael S310
Gray DeAngelis, Kathryn15, 64	Halkos, Michael E 154, 161, 222, 372
Greason, Kevin L15, 24, 336, 366, 408,	Hammel, James M70
419, 425	Han, Kook Nam211
Greco, Giampaolo140	Hanaki, Hideaki514
Green, Janelle484	Handy, John R24, 484
Green, Susan Y228, 326	Handy, Nicketti484
Greenberg, Jason390	Hansson, Emma318
Gregg, Jon A487	Harmsen, William S517
Gregoric, Igor54	Harold, Kristi517
Greiten, Lawrence E408	Harrington, Steven D377
Griffith, Bartley P392, 398	Harrington Brown, Caitlin482
Grigioni, Francesco	Harrison, Sebron W495
Grimm, Joshua C383, 448	Hart, Anthoney199
Groeneveld, Peter404	Hart, Chris165
Groff, James294	Harvey, Brian A440
Grogan, Eric L36, 78, 179	Hasaniya, Nahidh W454
Grondin, Sean C	Hashimi, Samad
Groth, Shawn356	Hassneiah, Dana
Grunkemeier, Gary L484	Hattori, Aritoshi
Gudbjartsson, Tomas318	Hattori, Takashi
Guitron, Julian36	Haverich, Axel
Gulack, Brian140	Hawkins, Robert B
Guleserian, Kristine J	Hayashi, Hidenori432, 455
Gulkarov, Iosif388	Hazekamp, Mark
Gumina, Richard417	He, Hao
Gunn, Jarmo318	Heaton, Michael N
Guy, T. Sloane 12, 15, 30, 196, 367	Heiden, Brendan
Guyton, Robert154	Heimes, Jessica454
	Heinle, Jeffrey24, 344
н	Henderson, William G282
Habertheuer, Andreas144	Henley, Paul
Habib, Robert219	Hennon, Mark W
Hachey, Krista182	Herbert, Morley
Haft, Jonathan W 35, 49, 186, 299, 466	Hermann, Matthew
Hage, Fadi148	Hermsen, Joshua L
Hahn, Rebecca336	Hernandez, Omar470
Haik, Nicky300	11011mira02, O111a1770

Herrmann, Howard C	328, 336	Hughes, G. Chad	54, 262
Hess, Philip	149, 367	Huisingh-Scheetz, Megan	134
Hibino, Narutoshi	448	Hunting, John	154
Hickey, Edward	70	Hurwitz, Jodie	124, 125
Higgins, Robert S. D	15, 383	Husain, S. Adil	16, 138, 368
Hill, Kevin	76	Hwang, Ho Young	240
Hillinger, Sven	184	Hwang, Yoohwa	354, 500
Hinokiyama, Kazuhiro	342	Hynes, Niamh	262
Hirahara, Norimichi	346	Hyun, Kwanyong	354, 500
Hirata, Yasutaka	346		
Hirayama, Shunki	515	T	
Hiroaki, Komatsu	206	Ichikawa, Hajime	346, 351, 452
Hirose, Hitoshi	108	Idrees, Jay J.	151, 429
Hjortdal, Vibeke E	318	Iglesias, Ivan	160
Hoashi, Takaya	346, 351, 452	Iizuka, Kei	476
Hobbes, Benjamin	172	IJsselhof, Rinske	442
Hoedt, Ashley C	202	Ikonomidis, John S.	16, 24, 367
Hoffman, George	256	Inci, Ilhan	184
Hofstetter, Wayne L	96, 183, 512	Infante, Maurizio V	361
Holmes, Sari	396	Inoue, Hiroyuki	507
Holst, Kimberly	164	Iorio, Fiore Salvatore	170
Hong, Jonathan	136	Iquille, Jules	292
Honig, Jacqueline	113	Iribarne, Alexander	156, 158, 413
Hopkins, Richard A	40	Irisawa, Yusuke	432
Horai, Tetsuya	432, 455	Irons, Mallory L	253
Hörer, Jürgen	250	Isbell, James	16, 468
Horton, Stephen	457	Isselbacher, Eric M	400
Horvath, Keith A	15, 142	Itatani, Keiichi	464
Houghtaling, Penny L	68	Ito, Masaoki	514
Howard, Jessica	302	Itoh, Akinobu	371
Howington, John A	63, 174	Ivkovic, Vladimir	400
Hraska, Viktor	162, 165, 248		
Huang, Chuan-Chin	400	J	
Huang, James	369, 479	Jabagi, Habib	409
Huang, Jasmine L	188	Jaber, Wael	336
Huang, Miriam	176	Jacob, Binu J	276
Huebler, Michael	207	Jacobs, Jeffrey P 16, 24, 72, 138, 219, 252, 372	,74,76,128,135,

Jacobs, Marshall L 16, 70, 76, 138, 219	Kagisaki, Koji	351, 452
Jaiswal, Prashant88, 421	Kainuma, Satoshi	402
Jakob, Heinz G261	Kaiser, Clayton	417
Janelle, Gregory149	Kakuta, Takashi	351
Janusauskas, Vilius242	Kaleekal, Thomas A	185
Jaquiss, Robert B16, 44, 70	Kalfa, David	104, 250, 445, 451
Jaroszewski, Dawn E362, 370, 517	Kamel, Mohamed K	358, 495
Jarrar, Doraid94, 287	Kane, Lauren C.	25, 138, 344
Jarvela, Kati318	Kane, Tracy	287
Jasak, Robert225	Kaneko, Tsuyoshi	400
Jasinski, Marek338	Kang, Chang-Hyun	354, 500
Jassar, Arminder Singh368	Kang, Jooeun	302
Jeevanandam, Valluvan24, 49, 54	Kang, Paul	188
Jeng, Eric I487	Kansy, Andrzej	252
Jeppsson, Anders318	Kapadia, Samir R	336
Jeudy, Jean398	Kapila, Yvonne	510
Jidéus, Lena374	Kappetein, A. Pieter	16, 42, 192
Johansson, Birgitta374	Kar, Saibal	32
Johnson, Jeffrey C223	Kari, Fabian	86
Johnson, William458	Karl, Tom R	76
Johnston, Douglas R151, 429	Karush, Justin M.	502
Johnston, Lily E128, 130, 468, 474	Kasahara, Shingo	206
Jones, Melissa367	Kasmi, Leila	104
Jones, Philip160	Kasnar-Samprec, Jelena	444
Joshi, Devang J431	Katlic, Mark R	16, 25, 218
Jouquan, Adeline119, 208	Kato, Nobuyasu	464
Jovinge, Stefan111	Kattan, Hani	453
Joyce, David L35, 316, 408	Katz, Marc R	415
Joyce, Lyle D316, 408	Kaufeld, Tim	146
Juarez-Colunga, Elizabeth282	Kaufman, Dixon	401
Jungraithmayr, Wolfgang184	Kavanagh, Edel P	262
Jurakhan, Rishi88, 421	Kavarana, Minoo N	114
	Kaya, Sürreya	236
K	Kearns, Sara	470
Kadner, Alexander162	Keating, Jane J	94
Kado, Hideaki342	Keeling, W. Brent	55, 152, 154
Kaempf, Andy482	Kelly, Karen	284

Kennebäck, Göran374	King, Katherine	408
Keshavjee, Shaf205	Kirby, Jennifer L	468
Kesler, Kenneth A25, 63	Kirklin, James K	70
Khaghani, Asghar111	Kirkwood, Katherine A.	140
Khaliel, Feras160	Kirtane, Ajay	328
Khan, Asah453	Kiser, Andy C	370
Khandhar, Sandeep Jitendra369	Kishawi, Sami	246
Khoynezhad, Ali	Kitamura, Tadashi	432, 455
Kiaii, Bob160	Kiyotani, Kazuma	507
Kidane, Biniam276	Klatt, Maryanna	308
Kido, Takashi452	Kleiman, Neal	379
Kilic, Ahmet387, 426, 472	Klemperer, John D	156, 158
Kilic, Arman198, 264	Klodell, Charles	149
Kim, Anes493	Kneuertz, Peter	358
Kim, Anthony W	Knight, Ariel	274
Kim, Dae Joon354	Knight, Peter A	431
Kim, Dong Kwan354	Ko, Jae-Kon	348
Kim, Eung Re106	Kobayashi, Kensuke	432
Kim, Hong Kwan354	Kochilas, Lazaros	340, 440, 462
Kim, Hyeong Ryul354	Kodali, Susheel	336
Kim, Hyun Koo211	Kohira, Satoshi	455
Kim, Jae Y508	Kohman, Leslie J	120, 218
Kim, Jhingook354	Kohmoto, Takushi	401
Kim, Ki Wan174	Koirala, Bhagawan	82
Kim, Kyung-Hwan240	Kon, Zachary N	392
Kim, Peter Y34	Konosic, Lucija	232
Kim, Richard W70	Konstantinov, Igor E	102, 172, 450, 457
Kim, Sang Yoon500	Koprivanac, Marijan	68
Kim, Sue Hyun240	Kopson, Mark	47
Kim, Sunghee72	Kormos, Robert L	16, 25, 298, 303
Kim, Woong-Han106	Korst, Robert J	479
Kim, Yong Jin106	Kosinski, Andrzej S	72, 78, 294
Kim, Yong-Hee354	Kosko, James	246
Kim, Young Tae354, 500	Kostolny, Martin	162, 250
Kim, Young-Hwue348	Kotani, Yasuhiro	206
Kimura, Naoyuki325	Kotova, Svetlana	484
Kindel, Steven I45	Kougias, Panagiotis	366

Koutlas, Theodore C223	Lange, Richard40
Kozlowski, Michal162	Lange, Ruediger444
Kozower, Benjamin D16, 78	Langer, Nathaniel B244
Krabatsch, Thomas201	Lanuti, Michael25, 497
Kramer, Robert S156, 158	LaPar, Damien16, 310
Krantz, Joshua21, 120	Laschinger, John C37
Krantz, Seth B174	Lattouf, Omar M154
Krause, Sonja86	Lau, Christopher381, 388
Kreisel, Daniel184	Lavi, Shahar160
Kretschmar, Oliver207	Lawton, Jennifer S25, 84, 390
Krishna, Murli498	Leavitt, Bruce J156, 158
Krishnamoorthy, Bhuvaneswari234	Lebovics, Robert116
Kron, Irving L128, 468, 474	Lee, ChangYoung354, 493
Kronfli, Anthony392	Lee, Dong-Seok D290
Krueger, Heike146	Lee, Hyun Joo354, 500
Kucharczuk, John C16, 94	Lee, Hyun-Sung356
Kuckelman, John P492	Lee, Jason T194
Kugelmass, Aaron D415	Lee, Jin Gu354, 493
Kumar Baral, Ravi82	Lee, Lawrence132
Kuratani, Toru402	Lee, Melissa102
Kurnicka, Katarzyna242	Lee, Paul495
Kuzdzal, Jaroslaw352	Lee, Richard 12, 16, 25, 31, 36, 74, 120, 238
Kwak, Jae Gun106	Lee, Shin-Rong383
Kypson, Alan P406	Lehenbauer, David448
	LeMaire, Scott A228, 326
L	Lenge De Rosen, Veronica356
Lackey, Jesse362	Leon, Martin B336
Lafitte, Sophie	Leoncini, Emanuele290
Lafontaine, Edwin119	Leone, Alessandro428
Lagisetty, Kiran H369	Leshnower, Bradley G 25, 152, 154, 196,
Lahey, Stephen J	260, 367
Lahr, Brian D316, 425	LeVea, Charles M498
Lambert, Virginie104, 250	Levy, Paul S17, 46
Lambright, Eric S179	Lewis, Matthew451
Lamont, Deborah369	Ley, Sondra J
Lamounier, Fernando N36	Li, Hao230
Lancaster, Timothy S390	Li, Jianfeng
	Li, Li88

Li, Robert	Lynch, William R	97, 510
Li, Shoujun249	Lyons, Jefferson M	366
Li, Zhoukai328		
Liberman, Moishe119, 208	M	
Licht, Peter363	MacGillivray, Thomas E.	17, 25, 228, 339
Lijkendijk, Marike363	MacHannaford, Juan C	470
Likosky, Donald S128, 129, 377, 385	Machuca, Tiago N	487
Lima, Brian140, 470	Mack, Michael J	37, 125, 336, 339
Lin, Jules	Macke, Ryan A	17, 369
Lin, Wei-Cheng506	Madani, Amin	132
Lin, Yi433	Madershahian, Navid	236
Lineberry, Matthew C434	Madzar, Tomislav	232
Liou, Douglas Z280	Magee, Mitchell J	17, 78
Lipnevicius, Arturas242	Maghami, Sam	237, 398
Liptay, Michael502	Magruder, J. Trent	136, 322, 383, 448
Litle, Virginia R182	Mahmood, Feroze	50,51
Liu, Bian290	Mahon, Brett	498
Liu, Hanning230	Maier, Sven	86
Liu, Tsang-Wu270	Maiga, Amelia	179
Llontop, Pedro98	Makhoul, Georges	88, 421
Lobdell, Kevin W	Makkar, Raj	37, 336
Loforte, Antonio306	Malaisrie, S. Chris	336
Lonchyna, Vassyl A17, 25, 48	Malenka, David J	156, 158
Longford, Nicholas T400	Malik, Mahim	426
Lopez, Joshua508	Maltais, Simon	54, 316
Lorts, Angela	Malyala, Rajasekhar S	470
Lotze, Michael T100	Maniar, Hersh S	53, 336, 366, 390
Lou, Xiaoying260	Manoukian, Steven V	47
Low, Phillip94	Manzan, Erica	242
Lowry, Ashley336	Marco, Greg	111
Lozonschi, Lucian401	Marders, Julia A	40
Lu, Qiang210, 505	Margaryan, Rafik	334
Luc, Jessica312	Marinelli, Giuseppe	306
Luke, Kim	Markwell, Stephen	411
Luketich, James D 12, 17, 31, 37, 100, 268,	Marshall, M. Blair	17, 25, 221, 353
438, 471	Martens, Andreas	
Lushaj, Entela401	Martens, Sven	110
Lutfi, Waseem174		

Martin, Billie-Jean349	Mehaffey, J. Hunter	128, 474
Martin, Jeremiah31, 36, 369	Mehran, Reza J	360, 512
Martin, Linda220	Mehran, Roxana	124, 125
Martin, Tomas149	Melby, Spencer	370, 390
Maru, Dipen96	Melek, Huseyin	212
Maruszewski, Bohdan 17, 162, 250, 252	Melnikow, Joy A	284
Masai, Takafumi402	Melody, Ricks	113
Mascio, Christopher E 17, 25, 60, 61, 102,	Melvin, Amber L	431
166, 222	Menaissy, Yasser M	478
Mason, David470	Menk, Jeremiah S	440
Massion, Pierre P179	Mennander, Ari	
Masters, Roy148	Menon, Rohan S	144
Mata, Juan132	Menon, Venu	
Mathisen, Douglas J 17, 120, 497, 501	Merlo, Aurelie	
Matkowskyj, Kristina498	Merlusca, Geoni	
Matsouaka, Roland A328, 372	Merritt, Robert E	
Matsue, Hajime402	Merry, Heather	
Matsumura, Goki103	Mery, Carlos M	
Matsunaga, Takeshi180, 515	Meyers, Bryan F	
Matsushiro, Takuya432	Meyerson, Shari L	
Matsushita, Akihito263	314, 369	
Mattila, Ilkka162	Meza, James	70, 372
Mavroudis, Constantine25, 76	Mick, Stephanie L	238
McCall, Anthony468	Mihalj, Mario	232
McCarthy, Fenton H 17, 323, 328, 404	Mihara, Wahei	263
McCarthy, Patrick M25, 37, 74, 83	Mikus, Mislav	232
McCracken, Courtney E440	Milano, Carmelo A	17, 303
McCrindle, Brian W70	Miller, Charles C	320
McCullough, Jock N156, 158, 413	Miller, D. Craig	336
McDermott, Katherine M323, 404	Miller, Daniel L	
McGee, Edwin C224	Miller, Jeffrey	154
McKenna, Robert J63	Miller, Kelley D	166
McKenzie, Emmett D76, 344	Miller, Marissa A	140
McMullan, David M17, 224	Milligan, Nicole	
McNeely, Christian411	Mills, Erin	
Medairos, Robert498	Milosevic, Milan	
Medenceles, Mark470	Mirocha, James	
Meguid, Robert A	Misumi, Keizo	

Mitchell, John D26, 61, 70, 204, 282,	Murashita, Takashi	
294, 369	Muriana, Piergiorgio	
Mitchell, Michael E256, 458	Murphy, Edward T	
Mitzman, Brian A	Murphy, Michael	194
Miyagawa, Shigeru402	Murzi, Michele	334
Miyaji, Kagami232	Musani, Ali	32
Miyata, Yoshihiro514	Mussatto, Kathleen A	256
Miyata, Yurie432	Musumeci, Francesco	306
Moazami, Nader35	Muthialu, Nagarajan	459
Moffatt-Bruce, Susan D	Myers, Patrick	18, 162
Mohajeri, Sepideh148	N	
Mohanakumar, T188	Nagashima, Mitsugi	103
Mokadam, Nahush A 18, 26, 266, 371	Naito, Noritsugu	
Molena, Daniela31, 268	Najam, Farzad	
Moller, James440	Najm, Hani	
Mongero, Linda B406	Naka, Yoshifumi	
Montalto, Andrea306	Nakamura, Teruya	
Monteiro Vieira, Vanessa C400	Nakamura, Yuki	
Montenegro, Debbie E80, 375	Nakamura, Yusuke	
Montenegro, Lisa M166	Nakano, Toshihide	
Montreuil, Michele104	Nandi, Deipanjan	
Moon, Marc R125, 327, 390	Narita, Yuji	
Morales, David L168, 449	Narm, Kyoung Shik	
Mori, Motomi482	Nasar, Abu	
Moront, Michael18, 46	Nashef, Samer	
Morse, Christopher R 18, 26, 268, 497		
Morton, Aaron58	Nason, Katie S.	
Mosca, Ralph S26, 162	Nathan, Meena	
Muehlschlegel, Jochen D400	Naunheim, Keith S	
Mulder, David S400	Navia, Jose Luis L	
Mullen, John C140	Nazari, Stefano	
Muller, Ralph W	Neckelmann, Kirsten	
Mulligan, Michael S	Neely, Robert	
Muniappan, Ashok501	Negri, Giampiero	
Munjal, Monica381	Nelson, Jennifer S.	
Murakami, Arata346	Nesbitt, Jonathan C	
Murana, Giacomo	Newcombe, Jennifer	454

Newman, Sherri113	Olugbile, Sope507
Nguyen, Duc185	Omeje, Ikenna162
Nguyen, Tom C125, 312	Omer, Shuab228
Nicastri, Daniel G290	Onaitis, Mark72
Nichols, Francis C142, 274, 503	Ono, Masamichi444
Nicoara, Alina50, 51	Ono, Minoru476
Niebler, Robert A256	Oo, Aung
Nieto, Raymond M344	Opitz, Isabelle184
Niles, John501	Orringer, Mark97, 510
Nishi, Hiroyuki402	Osaki, Satoru401
Nishimura, Takashi476	Oshima, Hideki84
Nosal, Matej162, 250	Oster, Matthew E440
Novellis, Pierluigi361	Ouyang, Wenbin249
Nozohoor, Shahab318	Overman, David M70
Nwogu, Chukwumere E176	
Nyman, Charles B50	P
	Paci, Philip132
0	Pacini, Davide
O'Brien, James E440	Padalino, Massimo162
O'Brien, Michael C246	Padula, William V136
O'Gara, Patrick T124, 125, 126	Pagani, Francis D18, 26, 298, 466
O'Hair, Daniel379	Paik, Hyo Chae354, 493
O'Leary, Patrick164	Pak, Alexander F199
Obeid, Thaer	Pal, Jay D18, 298
Oda, Shinichiro342	Pan, Emily318
Oelschlager, Brant K278	Pan, Xiangbin249
Oh, Jae419	Panagiotopoulos, Nikolaos436
Oh, Shiaki180, 515	Panchanathan, Roshan188
Ohye, Richard G26, 45, 466	Pandita, Tej K96
Okada, Morihito514	Pang, Kunjing249
Olivares, Gabriel68	Pantaleo, Antonio428
Oliveira, Guilherme H387	Paone, Gaetano377, 385
Oliveira, Pedro Paulo Martins de446	Park, Bernard J
Oliveira, Ricardo L119, 208	Park, Chun Soo168, 348
Olmstead, Elaine156, 158	Park, In Kyu354, 500
Olsen, Margaret214	Park, Jae-Hyun507
Olsson, Christian318	Park, Jeong-Jun348

Park, Joo-Eun244	Pike, Roxann164
Park, Samina354, 500	Pinkerman, Rhonda179
Park, Seung-I1354	Pittarello, Demetrio242
Park, Soon387	Pizarro, Christian
Park, Yoon Soo234	Pochettino, Alberto368, 408
Pasquali, Sara K76, 138	Pocock, Elizabeth S113
Pasque, Michael K390	Poirier, Nancy394
Pasrija, Chetan392, 398	Polizzi, Vincenzo306
Passera, Eliseo361	Pollock, Benjamin D80, 375
Patel, Amit N194	Popma, Jeffrey379
Patel, Himanshu J 12, 18, 26, 32, 366	Port, Jeffrey358
Patel, Nishant D448	Potapov, Evgenij V201
Patel, Prakash64	Pourmoghadam, Kamal K246
Patrini, Davide436	Pousatis, Sheelagh392
Patterson, G. Alexander 18, 26, 214	Prager, Richard L 4, 18, 40, 66, 67, 79, 128,
Paugh, Theron377	154, 377, 385
Payne, Katherine234	Pratt, Wande320
Pechet, Taine T94	Predina, Jarrod94
Peel, John276	Preston, Randy32
Peer, Syed Murfad466	Preventza, Ourania A
Pellerin, Michel394	Price, Matt228
Peng, Yong149	Price, Theolyn
Pennathur, Arjun26, 100	Pritchard, Graciela396
Perrault, Louis P140, 394	Prospero, Carol162
Peterson, Jennifer K340, 462	Protopapas, Eleftherios162
Petracek, Michael R417	Proudfoot, Alastair11
Petricevic, Mate232	Puri, Varun214
Petrossian, George379	Puskas, John140
Petrucci, Orlando446	Putnam, Joe B
Pettersson, Gosta B151, 238	Puttfarcken, Luisa86
Pham, Duc T35	
Pham, Si392	Q
Phan, Teresa80, 375	Quader, Mohammed A26, 130, 231
Pichard, Augusto336	Quaegebeur, Jan445
Picone, Anthony L176	Quin, Jacquelyn A294
Pienta, Michael490	Quinn, Reed D156, 158
Piggott, Kurt D246	Quintessenza, James A76

R	Reno, Theresa	508
Raad, Wissam	Restle, David	302
Rabin, Joseph	Reynolds, David B	89
Rafael, Aldo E470	Reynolds, Matthew R	415
Ragalie, William204	Reznik, Scott I.	369
Rahmanian, Parwis B236	Rice, David C.	. 209, 360, 369, 512
Rahouma, Mohamed495	Rich, Jeffrey B.	128, 130, 231
Raithel, Maxwell392	Ridwan, Khalid	88
Rajeswaran, Jeevanantham238	Riley, Jeffrey	316
Raman, Anish V502	Rinaldi, Mauro	242
Raman, Jai S330	Rizwan, Raheel	449
Ramaswamy, Madhavan459	Robbs, Randall	411
Rame, J. Eduardo303	Robinson, Aaron	46
Ramlawi, Basel366	Robinson, Clifford	220
Randhawa, Simran	Robinson, Newell	379
Rankin, J. Scott74	Rodriguez, Evelio	27, 53, 367
Ranzenbach, Edward A19, 64	Rodriguez, J. Ruben	344
Rasic, Mario232	Romano, Matthew A	19, 27, 370, 377
Ravichandren, Kirthi68, 238	Rose, Eric	140
Raymond, Daniel P19, 26, 78	Roselli, Eric E	27, 33, 54, 151, 429
Raz, Dan J	Rosen, Amy K.	182
Raza, Sajjad68, 238	Rosenbaum, Marlon	451
Razzouk, Anees J454	Rosengart, Todd K	19, 27, 194, 228
Rea, Robert F425	Rosenthal, Tami	166
Reardon, Michael J30, 379	Ross, Cathy S	156, 158
Rebeyka, Ivan M349	Ross, David B	349
Reddy, Rishindra M26, 97, 490, 510	Rossano, Joseph W	166
Redline, Gretchen302	Rosu, Cristian C.	151
Reece, T. Brett	Roth, Jack A	512
Reed, Michael F 12, 19, 26, 34	Rowse, Phillip G	517
Rehmani, Sadiq116, 296	Ruaengsri, Chawannuch	390
Reichert, Karla446	Rubens, Fraser D	409
Reilly, Thomas J287	Rucinskas, Kestutis	242
Reinersman, J. Matthew274	Rueckert, Jens C.	63
Reinke, Mary M202	Ruel, Marc	27, 52, 125
Reisenauer, Chris503	Ruffini, Enrico	352
Reisenauer, Janani19, 503	Rusch, Valerie W	27,63

Rushing, Gregory D	19, 426	Savini, Carlo	242
Russo, Mark J	300, 304	Savino, Danielle	323, 404
Ruzmetov, Mark	246	Sawa, Yoshiki	402
Rylski, Bartosz	86	Scarci, Marco	436
		Schaff, Hartzell V	408, 419, 425
S		Schaheen, Basil W.	268, 471
Sabik, Joseph F 19, 27, 5	2, 68, 124, 151,	Schaheen, Lara W	268, 438, 471
238, 328		Scheinin, Scott	185
Sade, Robert M		Scherer, Mirela	110
Safi, Hazim J	320	Scherner, Maximilian	236
Said, Sameh	,	Scherstén, Henrik	374
Saito, Shunsuke	402	Schieman, Colin	122
Sakaguchi, Taichi		Schill, Matthew R	390
Sakaki, Masayuki	402	Schindler, Ehrenfried	165, 248
Sakamoto, Takahiko	103	Schindler, John	222
Sako, Edward Y	368	Schipper, Paul H	482
Salazar, Michelle C	486	Schlosser, Michael	
Salizzoni, Stefano	242	Schmitt, Benjamin	
Salminen, Jukka	162, 250	Schmitto, Jan	
Sambuco, Bruno V	113	Schmoker, Joseph D	
Sanchez, Pablo	371	Schneider, Martin	
Sandhu, Harleen K	320	Schneiter, Didier	
Sano, Shunji	206	Scholl, Frank G.	
Santana-Rodríguez, Norberto .	98, 296	Schoof, Paul H	
Saqib, Naveed U	320	Schreiber, Christian	
Sarabu, Nagaraju	387	Schuchert, Matthew J	
Saraswat, Manoj K	136	Schuessler, Richard B	
Saravi, Babak E	86	Schumer, Erin	
Sardella, Gerald L	156, 158	Schwartz, Gary	
Sarikouch, Samir	33	Schwartz, Suzanne B.	
Sarin, Eric L	19, 366	Schweiger, Martin	
Sarkaria, Inderpal	221	Sciortino, Christopher	
Sarris, George E	162, 250, 252	Scott, John P	
Sartipy, Ulrik	374	Seder, Christopher W	
Saskin, Refik	276	Seely, Andrew J.	
Sass, Danielle	80, 375	Selvasandran, Kaviyanka	
Saudek, David	458	Sepesi, Boris	
Saunders, Michael		ocpesi, noris	

Serna-Gallegos, Derek280	Sinha, Neeraj185
Setty, Shaun P340, 462	Skubas, Nikolaos196
Shah, Aamir S366	Slaughter, Mark48, 303
Shah, Asad A	Sledz-Joyce, Nancy M140
Shah, Ashish417	Smalling, Richard W125
Shahian, David M 19, 74, 78, 135	Smith, Craig244, 336
Shahram, Jasmine T400	Smith, Jason W299
Shake, Jay G	Smith, Michael27, 188
Shan, Ying401	Smith, Robert L31, 53, 367
Shann, Kenneth42, 377	Soares, Filipe424
Shannon, Francis L	Sohmer, Benjamin148
Shareef, Muhammad426	Sohn, Min-Woong468
Sharma, Samin379	Sojak, Vladimir162
Shaw, Matthew322	Solinas, Marco334
Shears, Larry42	Soltesz, Edward G 27, 80, 151, 370, 429
Shekar, Prem S400	Son, Minnette138
Shen, K. Robert27, 274, 503, 517	Song, Grace Y287
Shen, Yu276	Song, Howard27, 330
Sheridan, Brett C19, 27, 238	Soquet, Jerome450
Sherif, Sultan262	Sorabella, Robert A244
Shigemura, Norihisa471	Sotile, Wayne308
Shillingford, Amanda458	Soukiasian, Harmik J20, 280
Shim, Young Mog354	Sousa Uva, Miguel42
Shimada, Masatoshi351	Spaggiari, Lorenzo286
Shimada, Shogo108	Spector, Logan G440
Shrager, Joseph B19, 27, 62, 63, 94, 354	Speir, Alan M20, 27, 47, 128, 130, 161,
Shrestha, Malakh L146	225, 231
Shroyer, A. Laurie W294	Speroff, Theodore179
Si, Ming-Sing466	Spicer, Jonathan132
Siepe, Matthias86	Spiliotopoulos, Konstantinos228
Sievert, Horst242	Spragan, Danielle323, 404
Sigurdsson, Martin I400	Spray, Thomas L27, 253
Siki, Mary A144, 198, 202, 264	Sridhar, Kumar160
Silveira-Filho, Lindemberg D446	St. Louis, James D20, 440
Simon, April W415	Stammers, Alfred H406
Sindermann, Jürgen110	Starnes, Sandra L20, 28, 369
Singhal, Sunil94	Stefanescu Schmidt, Ada C310
0 ,	Stefanov, Florian262

Steimer, Desiree470	Takayama, Hiroo	
Stellin, Giovanni162	Takeda, Koji	
Stephens, Elizabeth H310	Takewa, Yoshiaki	
Sterbling, Helene182	Tan, Charis	
Sternbach, Joel M314	Tanaka, Akiko	
Stiles, Brendon M358, 495	Tanaka, Daizo	
Stirling, Madeleine120	Tanase, Daniel	444
Stone, Matthew L460	Tang, Gilbert H	53, 366
Strueber, Martin35, 111	Taniguchi, Kazuhiro	402
Stulak, John M12, 20, 35, 316, 408,	Tapias, Luis F	497
419, 425	Tatsumi, Eisuke	476
Stuth, Eckehard E256	Taylor, Bradley S	392, 398
Su, Yan Ru417	Taylor, Jeremy	487
Suarez, Erik E185	Taylor, Richard	138
Suarez-Pierre, Alejandro383	Tchantchaleishvili, Vakhtang	310
Suchowerskyj, Philipp165, 248	Tedford, Ryan J	49
Sugarbaker, David356	Teefy, Patrick	160
Sughimoto, Koichi432, 455	Tekian, Ara S	434
Suh, Jee Won493	Tekwani, Chandra	36
Sukumar, Mithran S482	Tesdahl, Eric A.	406
Sullivan, Ian459	Theurer, Patricia F	128, 377, 385
Sullivan, Jennifer L272	Thiele, Robert	468
Sultan, Ibrahim144, 198, 264, 368	Thiffault, Vicky	119, 208
Sundt, Thoralf M42, 400	Thomas, Mathew	
Suri, Rakesh M	Thompson, Alexander	
Suzuki, Kenji180, 515	Thompson, Jess L	
Svensson, Lars G 151, 153, 336, 429	Thompson, Katherine	
Swanson, Scott J63	Thornblade, Lucas	
Swisher, Stephen G96	Thourani, Vinod H 20,	28, 45, 50, 54, 74
Szeto, Wilson Y20, 28, 52, 54, 144, 194,	80, 124, 126, 154, 328, 336, 37	
198, 202, 264, 323, 328, 336, 404	Tian, David	152
	Tibayan, Frederick A	330
Г	Tieu, Brandon H.	
Taeed, Roozbeh138	Timek, Tomasz	111
Taioli, Emanuela290	Timmerman, Robert	37
Takahashi, Toshiki402	Tlaskal, Tomas	
Takamochi, Kazuya180, 515	Tobota, Zdzislaw	252
Takamoto, Shinichi346	Toda, Koichi	

Tong, Betty C	Vaporciyan, Ara A20, 56, 266, 310, 312,
Tong, Michael151, 429	360, 434, 512
Torii, Shinzo432, 455	Vardas, Panos N310
Tozzi, Luigi428	Varghese, Thomas K21, 36, 174
Tran, Diem409	Varsch, Katherine188
Trento, Alfredo336	Vassileva, Christina M411
Trezzi, Matteo170	Veeraswamy, Ravi260
Tripathi, Ravi472	Vellanki , Nirupama S182
Trivedi, Jaimin186	Vemulapalli, Sreekanth328
Tseng, Elaine E28, 154	Venkateswaran, Rajamiyer234
Tsubokawa, Norifumi514	Vergales, Jeffery460
Tsuchida, Yuta432, 455	Vergnat, Mathieu165, 248
Tsunoda, Yu263	Veronesi, Giulia361
Tsutani, Yasuhiro514	Verrier, Edward D21, 266
Tullos, Adam326	Vida, Vladimiro162
Turek, Joseph W	Vigneswaran, Wickii T507
Turk, Elizabeth M	Vilarinho, Karlos Alexandre de Souza446
Turnbull, Jessica	Villa, Chet168
Turrentine, Mark W	Villa Sanchez, Manuel A268
Tweddell, James S20, 28, 168, 256, 340,	Vinnakota, Anirudh387
368, 449	Vinocur, Jeffrey M440
	Vitanova, Keti444
U	Voulaz, Emanuele361
Uchida, Wataru84	Vricella, Luca A
Ueno, Takayoshi402	
Umana, Juan P20, 192	W
Umminger, Julia146	Waddell, Thomas K21, 190, 276
Uriel, Nir	Wahlers, Thorsten C236
Usui, Akihiko84	Wald, Ori356
	Walia, Rajat188
V	Wallace, Amelia76
Vallabhajosyula, Prashanth 28, 144, 198,	Wallen, Tyler144
323, 328, 368	Waller, David353
Van Arsdell, Glen S 20, 28, 60, 205	Walsh, Garrett L512
van Berkel, Victor H186	Walters, Dustin M310, 492
Van Boxtel, Benjamin S244	Walther, Thomas54
Van Der Kraak, Lauren100	Wang, Chi-Hsiung174
Van Raemdonck, Dirk E20, 352	Wang, Chunsheng433

Wang, Hanjay451	Wilton, Penny	111
Wang, Juzheng210, 505	Wittmann, Karin	86
Wang, Mansen484	Wolf, Andrea S	290
Wang, Shouzheng249	Wolf, Randall K	312
Wang, Stewart490	Wong, Joshua K	431
Wang, Wuping210, 505	Wood, Douglas E	28, 278
Wang, Yulin433	Woodford, Edward	162
Warren, William502	Woods, Ronald K	458
Watkins, Claire398	Woodside, Sandra J	326
Watson, Daniel379	Woodward, Cathy	138
Watson, Justin J482	Wormuth, David W	78
Weder, Walter184	Wright, Cameron D	21, 28, 72, 497, 501
Wehman, Brody P237, 398	Wright, Nathan V	89
Wei, Benjamin31	Wróbel, Krzysztof	242
Weinstein, Samuel406	Wroblewski, Kristen	134
Weir, William B510	Wu, Darrell	326
Weisel, Richard D140	Wu, Xiaoting	377
Weksler, Benny28, 272	Wu, Yeu Sanz	244
Weldner, Paul W156, 158		
Welp, Henryk A110	Υ	
Wentz, Catherine P40	Yaku, Hitoshi	464
Westbrook, Benjamin M158	Yakubov, Steven	379
Weyant, Michael J21, 282	Yamagishi, Masaaki	464
White, Rodney33	Yamaguchi, Atsushi	325
Whitlock, John58	Yamawaki-Ogata, Aika .	84
Whitman, Glenn J. R 21, 28, 48, 136, 383	Yamazaki, Kenji	103
Whitson, Bryan A 21, 140, 303, 426, 472	Yammine, Maroun	400
Whyte, Richard I21, 28, 47	Yang, Bo	367
Wickbom, Anders318	Yang, Stephen C	21, 28, 266
Wigle, Dennis A274, 503	Yarboro, Leora T	21, 28, 54, 130, 474
Williams, Deborah140	Yasser, Mohammed	453
Williams, Mathew R 12, 21, 31, 124, 336	Yemets, Illya	250
Williams, Matthew L323, 328	Yendamuri, Sai	176
Williams, Valerie A218	Yeom, Sang Yoon	240
Williams, William G70	Yerokun, Babatunde	294
Wilmot, Ivan449	Yohe, Courtney	22, 225
Wilson, Jennifer L	Yonan, Nizar	234

Yoshikawa, Yasushi	402
Yoshioka, Daisuke	402
Yoshitaka, Hidenori	402
Yount, Kenan W	128
Youssef, George	185
Yu, Jeong Jin	348
Yuh, David D.	40
Yun, Tae-Jin	348
Yun, Xinwei	508
Yuri, Koichi	325
Z	
Zafar, Farhan	168, 449
Zajarias, Alan	411
Zakarkait, Diana	242
Zannini, Piero	359
Zannino, Diana	172, 450
Zanotto, Lorenza	162
Zartner, Peter	165
Zeh, Herbert J	100
Zervos, Michael	34
Zhang, David	302
Zhang, Keqiang	508
Zhang, Min	377
Zhang, Peng	490
Zhang, Qianzi	228, 326
Zhang, Wei	344
Zheng, Zhe	230
Zhou, Yirong	89
Zhou, Yongan	210, 505
Zilla, Peter	192
Zindovic, Igor	318
Zo, Jae	354
Zorn, George L.	366
Zucali, Paolo	
Zucchetta, Fabio	242
Zucker, Mark	
Zwischenberger, Joseph B	314

NOTES

NOTES

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- COSEAL swells up to four times its volume within 24 hours of application and additional swelling
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 possible effect on surrounding anatomic structures potentially sensitive to compression.
- Apply only as a thin layer.
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- Do not inject COSEAL into vessels.
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- Rx Only. For safe and proper use of these devices, refer to the appropriate full device Instructions for Use.

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Reference: 1. Nasso G, Piancone F, Bonifazi R, et al. Prospective, randomized clinical trial of the FloSeal matrix sealant in cardiac surgery. *Ann Thorac Surg.* 2009;88:1520-1526.

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