16th Annual

Multidisciplinary Cardiovascular and Thoracic Critical Care Conference

September 26-28, 2019
Baltimore Marriott Waterfront
Baltimore, MD

The Society of Thoracic Surgeons

PROGRAM

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Continuing Medical Education Information

Course Description

The 16th Annual Multidisciplinary Cardiovascular and Thoracic (CVT) Critical Care Conference is designed to advance knowledge and expertise in CVT critical care and enhanced recovery after surgery (ERAS). Its goal is to bring together the entire team of health professionals who provide care for patients undergoing CVT operations and interventional procedures.

This 2.5-day conference will address the complex nature of critical care and ERAS cases, incorporating lectures, panel discussions, case-based breakouts, and original scientific abstracts. Leading experts will present new concepts, technologies, management protocols, and clinical experiences in their respective disciplines. New for 2019, a half-day session will be dedicated to ERAS, giving attendees the chance to learn from the experiences of leading centers in optimizing preoperative and postoperative care to improve outcomes.

Target Audience

The conference is designed for all members of the CVT critical care team, including surgeons, cardiologists, interventionalists, intensivists, anesthesiologists, hospitalists, critical care nurses/nurse practitioners, perioperative registered nurses, physician assistants, catheter lab technicians, perfusionists, pharmacists, nutritionists, and respiratory therapists. In addition, surgical residents and cardiothoracic surgical fellows in training are encouraged to attend.

Learning Objectives

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

- Apply the latest concepts, technologies, and developments in CVT critical care and ERAS to optimize patient outcomes
- Describe the latest protocols to provide safe and effective cardiac, respiratory, and renal support
- Explain the importance of the multidisciplinary team in providing optimal CVT critical care

Continuing Medical Education (CME) Credit

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 18.75 *AMA PRA Category 1 Credits*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Please visit **sts.org/2019criticalcare** to record your CME credit and evaluate the conference. Although this website will not generate your certificate, your credit amount will be recorded. Please complete this evaluation at the end of the program, as you should claim your credit and evaluate the sessions only once before submitting. Certificates will be available at **learningcenter.sts.org** approximately 2-4 weeks after the course. If you have questions, contact the STS Education Department at 312-202-5800 or education@sts.org.

Nursing Continuing Education (CE) Credit

The nursing continuing education credit for this conference is being brought to you through a joint providership agreement between The Society of Thoracic Surgeons and Corexcel.

Corexcel is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's (ANCC) Commission on Accreditation.

The maximum number of hours awarded for this CE activity is 18.75 contact hours.

Perfusion Continuing Education Credit

The Society of Thoracic Surgeons has been approved by the American Board of Cardiovascular Perfusion to award 21.8 Category 1 CEUs for this activity.

The Society of Thoracic Surgeons 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 non-remunerative 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

Disclosure Information

Unless otherwise noted, the individuals listed below have no commercial relationships to disclose.

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The Society of Thoracic Surgeons would like to acknowledge the following for their support of the 16th Annual Multidisciplinary Cardiovascular and Thoracic Critical Care Conference:

EDUCATIONAL GRANTS

Ethicon – $5,000

EXHIBITORS

AtriCure
bioMérieux
ClearFlow Inc.
Edwards Lifesciences
La Jolla Pharmaceutical Company
Mallinckrodt Pharmaceuticals
Medela Healthcare
Tower Health

As of September 11, 2019

AGENDA

Unless otherwise noted, all educational sessions take place in Harbor A-C.

Thursday, September 26

11:30 a.m. – 6:00 p.m.
Registration

12:30 p.m. – 12:40 p.m.
Welcome, Announcements, and Introductory Remarks
Thomas E. MacGillivray, MD (Houston, TX), and Daniel T. Engelman, MD (Springfield, MA)

12:40 p.m. – 2:40 p.m.
Session I: Enhanced Recovery after Surgery (ERAS) – Preoperative and Intraoperative Considerations
Moderators: *Daniel T. Engelman, MD (Springfield, MA), and Michael C. Grant, MD (Baltimore, MD)*

12:40 p.m. – 12:55 p.m.	What Is ERAS and Why Should I Change My Practice? *Michael C. Grant, MD (Baltimore, MD)*
12:55 p.m. – 1:10 p.m.	Prehabilitation: Hype versus Reality *Rakesh C. Arora, MD, PhD (Winnipeg, Canada)*
1:10 p.m. – 1:25 p.m.	Preoperative Nutritional Optimization *Rakesh C. Arora, MD, PhD (Winnipeg, Canada)*
1:25 p.m. – 1:40 p.m.	Preoperative/Intraoperative Opioid Reduction Strategies *Michael C. Grant, MD (Baltimore, MD)*
1:40 p.m. – 1:55 p.m.	Goal-Directed Perfusion Strategies *Karim Jabr, CCP, LP, CSSBB (Macon, GA)*
1:55 p.m. – 2:10 p.m.	ERAS Implementation Strategies *Gina McConnell, RN, BSN, CCRN (Raleigh, NC)*
2:10 p.m. – 2:40 p.m.	Panel Discussion

1:30 p.m. – 6:30 p.m.
Exhibits Open

2:40 p.m. – 3:10 p.m.
Break / Visit Exhibits

3:10 p.m. – 6:00 p.m.
Session 2: Enhanced Recovery after Surgery (ERAS) – Postoperative Considerations
Moderators: *Daniel T. Engelman, MD (Springfield, MA), and Rakesh C. Arora, MD, PhD (Winnipeg, Canada)*

3:10 p.m. – 3:25 p.m.	Postoperative Opioid Reduction Strategies *Jessica Crow, PharmD (Baltimore, MD)*
3:25 p.m. – 3:40 p.m.	Transfusion Management: Untangling Conflicting Data *Rawn R. Salenger, MD (Baltimore, MD)*
3:40 p.m. – 4:00 p.m.	Say Goodbye to Acute Kidney Injury: Developing an Acute Kidney Response Team *Daniel T. Engelman, MD (Springfield, MA)*
4:00 p.m. – 4:15 p.m.	Patient Engagement: The Key to Reducing Readmissions *Cheryl Crisafi, MSN, RN (Springfield, MA)*
4:15 p.m. – 4:30 p.m.	Thoracic ERAS versus Cardiac ERAS: Special Considerations *Linda W. Martin, MD, MPH (Charlottesville, VA)*
4:30 p.m. – 5:00 p.m.	Panel Discussion
5:00 p.m. – 6:00 p.m.	First International Presentation of Peer-Reviewed Guidelines for Perioperative Care in Cardiac Surgery: ERAS Society Recommendations *Daniel T. Engelman, MD (Springfield, MA), and Michael C. Grant, MD (Baltimore, MD)*

Friday, September 27

7:00 a.m. – 5:00 p.m.
Registration

7:00 a.m. – 8:00 a.m.
Breakfast

7:00 a.m. – 6:00 p.m.
Exhibits Open

8:00 a.m. – 9:45 a.m.
Session 3: Extracorporeal Membrane Oxygenation (ECMO)
Moderators: *Glenn J.R. Whitman, MD (Baltimore, MD), and Mary Zellinger, RN (Atlanta, GA)*

8:00 a.m. – 8:15 a.m.	Extracorporeal Cardiopulmonary Resuscitation Outcomes *Dan W. Choi, MD (Baltimore, MD)*
8:15 a.m. – 8:30 a.m.	Postcardiotomy Shock: When to Pull the ECMO Trigger *Jonathan W. Haft, MD (Ann Arbor, MI)*

8:30 a.m. – 8:45 a.m.	Postcardiotomy Shock: To Vent or Not to Vent *Glenn J.R. Whitman, MD (Baltimore, MD)*
8:45 a.m. – 9:00 a.m.	Harlequin Syndrome: Recognition and Resolution *Pavan Atluri, MD (Philadelphia, PA)*
9:00 a.m. – 9:15 a.m.	Anticoagulation: When, How, with What *Charles E. Murphy, MD (Falls Church, VA)*
9:15 a.m. – 9:45 a.m.	Panel Discussion

9:45 a.m. – 10:15 a.m.
Break / Visit Exhibits

10:15 a.m. – 12:15 p.m.
Session 4: Life-Threatening Emergencies after Cardiac Surgery
Moderators: *Subhasis Chatterjee, MD (Houston, TX), and Karim Jabr, CCP, LP, CSSBB (Macon, GA)*

10:15 a.m. – 10:30 a.m.	Bleeding and Tamponade after Cardiac Surgery *Rita C. Milewski, MD, PhD (Philadelphia, PA)*
10:30 a.m. – 10:45 a.m.	Myocardial Infarction after Coronary Artery Bypass Grafting: How to Detect, When to Treat, Which Intervention? *Thomas S. Metkus, MD (Baltimore, MD)*
10:45 a.m. – 11:00 a.m.	Vasoplegic Shock: Latest Management Strategies *Subhasis Chatterjee, MD (Houston, TX)*
11:00 a.m. – 11:15 a.m.	Right Ventricular Failure after Left Ventricular Assist Device Implantation *Pavan Atluri, MD (Philadelphia, PA)*
11:15 a.m. – 11:45 a.m.	Pulmonary Embolism: Algorithm-Based Management with Early Extracorporeal Membrane Oxygenation *Thomas E. MacGillivray, MD (Houston, TX)*
11:45 a.m. – 12:15 p.m.	Panel Discussion

12:15 p.m. – 1:00 p.m.
Keynote Address: The Next Wave of Innovation to Keep Patients Safe
Speaker: *Kathleen M. Sutcliffe, PhD (Baltimore, MD)*
Moderators: *Daniel T. Engelman, MD (Springfield, MA), and Thomas E. MacGillivray, MD (Houston, TX)*

1:00 p.m. – 2:00 p.m.
Lunch

2:00 p.m. – 4:15 p.m.

Case-Based Multidisciplinary Breakouts

Room 1 (Harbor A-C): Bleeding and Anticoagulation
Glenn J.R. Whitman, MD (Baltimore, MD), and Jonathan W. Haft, MD (Ann Arbor, MI)

Room 2 (Harbor D): The Costs of Caring—Burnout, Stressors, Team Conflicts, and Challenging Families
Charles E. Murphy, MD (Falls Church, VA), Subhasis Chatterjee, MD (Houston, TX), and Cheryl Crisafi, MSN, RN (Springfield, MA)

Room 3 (Harbor E): Palliative Care and Hospice
Namrata Patil, MD, MPH (Boston, MA), and Alison E. Turnbull, DVM, MPH, PhD (Baltimore, MD)

Room 4 (Laurel A-D): Comprehensive Advanced Life Support
Mary Zellinger, RN (Atlanta, GA), and Rakesh C. Arora, MD, PhD (Winnipeg, Canada)

4:15 p.m. – 4:45 p.m.

Break / Visit Exhibits

4:45 p.m. – 5:30 p.m.

Session 5: Abstract Presentations

Moderators: *Nevin M. Katz, MD (McLean, VA), and Thomas E. MacGillivray, MD (Houston, TX)*

4:45 p.m. – 5:00 p.m.	Perioperative Acuity Assessment for Pulmonary Complications in Cardiac Surgery Patients *Steven Insler, DO (Cleveland, OH)* For full abstract text, see page 11
5:00 p.m. – 5:15 p.m.	Long-Term Survival over 10 Years among 219 Patients Treated with Extracorporeal Membrane Oxygenation *Julian Macedo, MD (Salt Lake City, UT)* For full abstract text, see page 12
5:15 p.m. – 5:30 p.m.	Machine Learning Prediction Model for Early Prognosis of Extracorporeal Membrane Oxygenation Support *Brian C. Ayers, MBA (Rochester, NY)* For full abstract text, see page 13

5:30 p.m. – 6:45 p.m.

Networking Event and Poster Rounds

Moderator: *Nevin M. Katz, MD (McLean, VA)*

Saturday, September 28

7:00 a.m. – 8:00 a.m.
Breakfast

7:00 a.m. – 12:45 p.m.
Exhibits Open

8:00 a.m. – 9:45 a.m.
Session 6: I Have Fallen and I Can't Get Up
Moderator: *Rakesh C. Arora, MD, PhD (Winnipeg, Canada), and Thomas E. MacGillivray, MD (Houston, TX)*

8:00 a.m. – 8:25 a.m.	Update on the PADIS Guidelines for the Cardiothoracic Surgery Team *Nathan E. Brummel, MD (Columbus, OH)*
8:25 a.m. – 8:40 a.m.	Early Mobilization in the Cardiothoracic Intensive Care Unit (ICU) Patient *Heidi Engel, PT, DPT (San Francisco, CA)*
8:40 a.m. – 8:55 a.m.	"G" Is for Grow: Nutrition in the Cardiothoracic Surgery Patient *Patricia M. Brown, RD-AP, LDN, CNSC (Baltimore, MD)*
8:55 a.m. – 9:10 a.m.	ICU Survivorship: I'm "Recovered"… Now What? *Ann M. Parker, MD (Baltimore, MD)*
9:10 a.m. – 9:45 a.m.	Panel Discussion

9:45 a.m. – 10:15 a.m.
Break / Visit Exhibits

10:15 a.m. – 12:00 p.m.
Session 7: Respiratory
Moderators: *Namrata Patil, MD, MPH (Boston, MA), and Mary Zellinger, RN (Atlanta, GA)*

10:15 a.m. – 10:30 a.m.	Postpneumonectomy Complications and Management *Namrata Patil, MD, MPH (Boston, MA)*
10:30 a.m. – 10:45 a.m.	The Diagnosis and Management of Aspiration Pneumonia *Subhasis Chatterjee, MD (Houston, TX)*
10:45 a.m. – 11:00 a.m.	Ventilation Strategies in Thoracic Surgery Patients *Rana Hejal, MD (Cleveland, OH)*
11:00 a.m. – 11:15 a.m.	Hemoptysis Management Strategies in Thoracic Surgery Patients *Errol L. Bush, MD (Baltimore, MD)*
11:15 a.m. – 11:30 a.m.	Continuum of Care: Rehabilitation Postdischarge *Heidi Engel, PT, DPT (San Francisco, CA)*
11:30 a.m. – 12:00 p.m.	Panel Discussion

12:00 p.m. – 12:45 p.m.
Lunch

12:45 p.m. – 2:45 p.m.
Session 8: Sepsis
Moderators: *Charles E. Murphy, MD (Falls Church, VA), and Patrick Bradley, MSN, RN (Washington, DC)*

12:45 p.m. – 1:00 p.m.	Empyema: Implications in the Critically Ill *Namrata Patil, MD, MPH (Boston, MA)*
1:00 p.m. – 1:15 p.m.	Early Warning Systems and the Management of Sepsis *Patrick Bradley, MSN, RN (Washington, DC)*
1:15 p.m. – 1:30 p.m.	Immunomodulation in Sepsis *Rita C. Milewski, MD, PhD (Philadelphia, PA)*
1:30 p.m. – 1:45 p.m.	The Management of Ventricular Assist Device Infections *Jonathan W. Haft, MD (Ann Arbor, MI)*
1:45 p.m. – 2:00 p.m.	Extracorporeal Membrane Oxygenation and Bloodstream Infections *Charles E. Murphy, MD (Falls Church, VA)*
2:00 p.m. – 2:30 p.m.	Panel Discussion

2:30 p.m. – 2:45 p.m.
Closing Comments

ORAL ABSTRACTS

(listed in order of presentation)

Unless otherwise noted in this program 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.

Abstract content appears as it was submitted; only titles have been edited for clarity and consistency. Presenting authors are listed in ***bold.***

Perioperative Acuity Assessment for Pulmonary Complications in Cardiac Surgery Patients

Steven Insler, *Faisal Bakaeen, Natalya Makarova, Donna Tanner, Louis Campiri, Eric Roselli*
Cleveland Clinic, OH

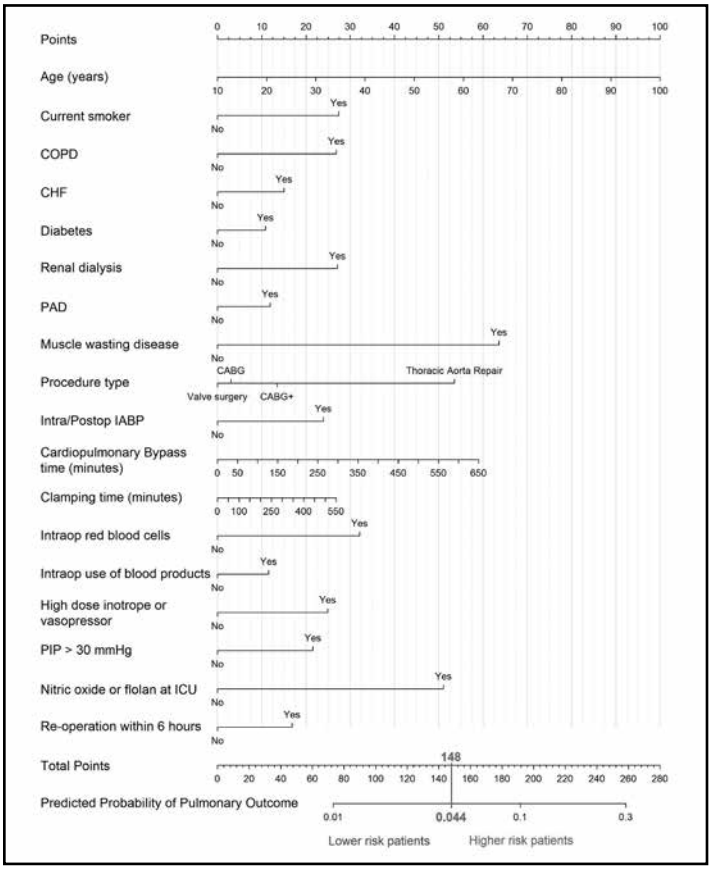
COMMERCIAL RELATIONSHIPS F. Bakaeen: Speakers Bureau/ Honoraria, JACE Medical

Purpose: Pulmonary complications in critically ill patients following cardiac surgery contribute to increased morbidity, resource use and mortality. Importantly, these remain common and largely unpredictable. We aimed to develop and validate risk models for postoperative pulmonary complication based upon baseline, intraoperative and admission to ICU risk factors in patients undergoing cardiac

Methods: We included patients who underwent CABG and or valve or thoracic aorta surgery from January 2009 to March 2015. A postoperative pulmonary complication was identified if a patient required prolonged postoperative mechanical ventilation (> 48 hours) or re-intubation or developed pneumonia. The data was divided into 70% training subset and 30% validation subset. Elastic net logistic regression was used to build prediction models based on training dataset with remaining validation subset used to select the best predictors via minimum five-fold cross validation of average squared error (ASE) criterion. The predictive efficacy of models was assessed with calibration and discrimination statistics.

Results: This study incorporated 17,433 patients used for building prediction models. Incidence of postoperative pulmonary complication was 4.4%. Two models were constructed: 1) a model which incorporates baseline, demographic and surgical characteristics only ('base set') and 2) an augmented model with intraoperative and ICU predictors in addition to the 'base set'. The C-statistics of augmented prediction models (0.80 (95% CI: 0.79, 0.82)) was significantly higher compared to the 'base set' model (0.77 (95% CI: 0.75, 0.78)) (P-value < 0 .001). Thus, we selected a prediction model based on eighteen baseline, intraoperative and ICU risk factors (Figure). The maximum calibration error was 0.01 and the corrected Brier score was 0.04.

Conclusions: Our model accurately predicts pulmonary complications after cardiac surgery and identifies high risk patients. This provides an opportunity for targeted proactive therapeutic interventions to reduce adverse outcomes and improve patient care.



Long-Term Survival over 10 Years among 219 Patients Treated with Extracorporeal Membrane Oxygenation

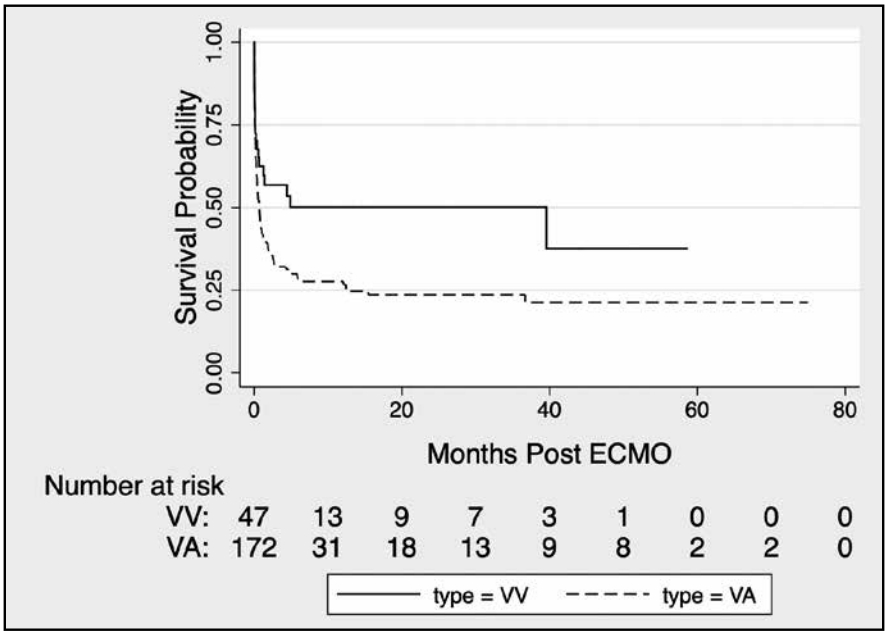
Joseph Tonna, Stephen McKellar, ***Julian Macedo,*** *Jason Glotzbach, Vikas Sharma, Craig Selzman*
University of Utah, Salt Lake City

Purpose: As ECMO involves extended periods of intensive care and thus cost, the cost effectiveness of ECMO is dependent upon the long term survival of patients. Herein, we describe the term survival over 10 years of patients from our institution treated with ECMO.

Methods: This single center observational cohort study describes the long term survival of all ECMO patients from 2009 to 2018. Survival was analyzed separately before and after July 1, 2015, and by post-cardiotomy status. Descriptive statistics, including mean (SD) and median (IQR), were used to assess patient characteristics. Continuous characteristics were compared using independent samples t-test. Coefficients, 95% CI's and p-values were reported from all models. We analyzed survival over time using a cox survival model, and analyzed long term survival using multivariate regression adjusted for age, sex, chronic health points, date and duration of ECMO, and post-cardiotomy status.

Results: Two hundred and nineteen patients were treated with ECMO, 47 VV and 172 VA. Age was 42 years [±18] for VV and 55 years [±15] for VA. Duration of support on ECMO was 9.0 days [IQR, 2.4 – 22.0] for VV and 7.0 days [3.0 – 20.0] for VA. Overall, survival to discharge was 63% for VV and 35% for VA. Prior to July 1, 2015, VA ECMO averaged 29.2%, whereas after, survival averaged 39.8% [p=0.15]. Among VA ECMO patients, survival post cardiotomy was 40.2%, vs 29.8% among non-cardiotomy patients [p=0.22]. Compared to patients without congestive heart failure (CHF), VA ECMO patients with a history CHF had improved survival [51.6 vs 26.4%; p=0.02]. In multivariate analysis, the odds of survival improved with each year of placement, over time [OR 1.001; 95% CI: 1.000 – 1.002] for VA, but not for VV [OR 1.000; 95% CI: 0.999 – 1.002].

Conclusions: Long term survival after VA and VV ECMO remains high after discharge. In adjusted multivariate regression, survival improved over time with each progressive year of initiation of VA ECMO, suggesting a benefit from institutional experience.



Machine Learning Prediction Model for Early Prognosis of Extracorporeal Membrane Oxygenation Support

Brian Ayers, *Katherine Wood, Igor Gosev, Sunil Prasad*
University of Rochester, NY

Purpose: Current prognostic models for venous-arterial extracorporeal membrane oxygenation (VA-ECMO) leave room for improvement. We aimed to develop a machine learning algorithm to augment clinical decision making related to VA-ECMO.

Methods: Patients supported by VA-ECMO at a single institution from May 2011 to January 2018 were retrospectively reviewed. Patient characteristics, laboratory values and blood product transfusions while on VA-ECMO were collected. Patients were excluded if they were supported by VA-ECMO for less than 48 hours. A Deep Neural Network (DNN) was built using patient characteristics and laboratory values over the initial 48 hours of VA-ECMO support. Data was split into 85% for training and 15% of patients were withheld for independent testing of the final model.

Results: Of the 247 adult patients supported by VA-ECMO, 190 (77%) survived at least 48 hours. A total of 1.03 million laboratory values were collected for the study cohort, from which 184 statistical variables were derived for each patient. Data augmentation was implemented to create 39,000 simulated patients from the original training cohort. L2 regularization and dropout were utilized to minimize overfitting and the final DNN produced 97.7% accuracy on the training data. Testing the model on the separate 35 patient cohort not used during training, produced 80% overall prediction accuracy. Specificity (91%) was prioritized over sensitivity (58%) to maximize the clinical utility of the model in regard to aiding clinicians in deciding when to consider withdrawal of ECMO support.

Conclusions: Machine learning models can predict outcomes for VA-ECMO support with moderate accuracy. These models show potential to augment clinicians in determining the often difficult to predict prognosis of patients on VA-ECMO. Further study with more data from multiple institutions is warranted to further improve model accuracy.

POSTER ABSTRACTS

Unless otherwise noted in this program 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.

Abstract content appears as it was submitted; only titles have been edited for clarity and consistency. Presenting authors are listed in ***bold.***

Poster #6

Treatment of Severe Protamine Allergy in Cardiac Surgery

Jiaxin Ye
Nanjing Drum Tower Hospital, China

Purpose: To conclude the clinical management of circulatory collapse after protamine inject during open heart operation under cardiopulmonary bypass.

Methods: To review the clinical data of patients those happened circulatory collapse after protamine inject from January 2015 to October 2017. To analyse common clinical character and risk factors.

Results: Fives cases happened circulatory collapse after protamine inject during open heart operation, 15 to 25 min after protamine was began to give (mean 19.2 min). Two became circulation stable after immediately cardiac massage and injecting vasoactive medicine, the other four were received re-heparinization and re-extracorporeal circulation. All the group were saved.

Conclusions: Circulatory collapse induced by protamine cannot be predicted.Prophylaxis and effective management are important to save life.

Poster #7

Multidisciplinary Team Engagement in Cardiothoracic Surgical Patients

Zoe Goldthwaite, ***Monica Wininger,*** *Michael Firstenberg*
The Medical Center of Aurora, CO

Purpose: The aim of this quality improvement study (QI) was to investigate the potential beneficial effects of employing a multidisciplinary team approach to improve patient-specific outcomes and quality of life following coronary artery bypass graft (CABG) surgery.

Methods: Metrics were collected before (June 2017) and after (July 2017-2018) the establishment of Heart Huddle, a multidisciplinary collaboration composed of patient care representatives from pre-op, intra-op and post-op. The group included physicians, nurses, ancillary department representatives and leadership. The value of Heart Huddle was measured with the following analysis based on a subset of patients that underwent coronary artery bypass surgery (CABG) during June 2017-2018 (n=9) compared to previous CABG patients (n=19) after Heart Huddle was initiated. Society of Thoracic Surgery collects and publishes data specifically for isolated (CABG) patients, enabling data analysis to be conducted.

Results: The study revealed significant improvements in patient specific metrics and overall quality of care. In-hospital mortality was decreased from 8.6% to 0% and operative mortality from 13% to 0% with a national benchmark of 2.0% and 1.8% respectively. Moreover, median total vent hours decreased from 4.5 to 3.8, occurrences of reintubation dropped from 15.8% to 0% and prolonged ventilation, mechanical ventilation greater than 24 hours, from 9.7% to 0%. Occurrences of renal failure also went down from 9.3% to 0%. Total length of stay is stable at 8.0, equivalent to the national benchmark, and post procedure length of stay decreased from 6.0 to 5.0. These findings show how essential effective collaboration and teamwork is to provide high-quality care and avoiding adverse outcomes and future complications. By creating a synergized environment amongst perspectives of different disciplines, provider initiatives can properly align with patient goals to achieve better outcomes.

Conclusions: Remarkable outcomes emphasize the importance of interdisciplinary care in improving modern critical care medicine. Success of Heart Huddle can be contributed to the beneficial effects of engaging a pre-operative multidisciplinary consultation across disciplines. Heart Huddle continues for each CV surgery patient and potential avenues to enrich collaboration are explored.

Poster #8

Evaluation of Erythropoietin-Stimulating Agents and Their Effect on Blood Optimization in Cardiac Surgery

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Purpose: The objective of this study was to evaluate the effect of erythropoietin stimulating agents (ESAs) administration on blood product utilization in postoperative cardiac surgery patients. This study also evaluated the risks and adverse effects that may be associated with the use of ESAs.

Methods: This was a retrospective chart review from May 2017 to May 2018 which utilized the electronic medical record system, the study institution's cardiothoracic surgery patient database and registry, and the clinical pharmacist workflow software, Vigilanz©, to identify patients for the study. Per the institution-based ESA protocol, the target hemoglobin level is >12 grams/deciliter post-ESA administration. This study primarily evaluated the change in hemoglobin after ESA administration and secondarily evaluated the risks and adverse effects associated with ESA administration.

Results: A total of 52 patients were identified who underwent cardiac surgery and received ESAs for blood optimization. Of the 52 patients, 17 were excluded. The study included 35 patients (21 = ESA alone, 14 = ESA plus blood transfusion). Of the 35 patients, 60% did not require a blood transfusion while 40% did require a blood transfusion (p = 0.597). The change in hemoglobin (ESA alone = 0.773, ESA + blood transfusion = 1.7, p = 0.002) and hematocrit (ESA alone = 2.31, ESA + blood transfusion = 4.3, p = 0.04) was significantly different in patients who did not receive a blood transfusion versus those who did. Additionally, the length of stay (days) in the ICU (ESA alone = 7, ESA + blood transfusion = 12, p = 0.0016) and in the hospital (ESA alone = 8, ESA + blood transfusion = 12, p = 0.007) were significantly different.

Conclusions: From 2016 to 2018, the overall blood use decreased at the study institution, however this study was unable to correlate this decrease with ESA alone. Secondary endpoints were significant including the increase in hemoglobin and hematocrit in ESA plus blood transfusions and reduced length of stay.

	ESA alone (n=21)	*ESA + blood transfusion (n=14)*	*p-value*
Change in hemoglobin	***0.773 (0.4-1.1)***	***1.7 (1.3-2.2)***	***0.002***
Change in hematocrit	2.31 (1.1-3.3)	4.3 (2.5-6.2)	0.04
LOS, ICU	7 (6-9)	12 (9-16)	0.0016
Los, Hospital	8 (6-13)	12 (10-16)	0.007
ADR: Hypertension, n (%)	4 (19)	10 (71)	0.05
ADR: Fever, n (%)	2 (9.5)	2 (14)	0.55
ADR: VTE	0 (0)	0 (0)	-
Pro-Coagulants, n (%)			
Prothrombin complex concentrate	0	0	
Phytonadione	0	3 (21)	
Protamine	0	1 (7)	

Data are shown as the median (IQR) unless otherwise stated.
Abbreviations: LOS – length of stay

Poster #9

Bolus Potassium in Frustrated Ventricular Fibrillation Storm

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Purpose: Since long time ago; ventricular fibrillation (VF) is a well-known ominous complication of ischemic heart disease. While firm structured algorithm has been adopted for its management, yet its mortality rate remains high.

Methods: This is a case report of a 46-year–old gentleman who was a victim of recurrent cardiac arrest in the ward while awaiting for emergency coronary artery bypass surgery, intra-operatively, he had recurrent VF and was sent to CSICU with open chest on ECMO support with IABP and epicardial pacemaker. Post-operatively still had malignant ventricular arrhythmia with dropping of his EF to less than 10%. Latest episodes of VF was long lasting more than an hour (while was on ECMO support) with failure of various antiarrhythmic medications to abort the arrhythmia

Results: Finally, a decision was taken to give him 20 mmol of KCL IV push aiming at producing a state of asystole but the rhythm changed to sinus rhythm.

Conclusions: This report tried to spotlight the fact that the optimum management of ventricular fibrillation is still lacking and necessitates further studies and researches. The appropriate effective dose of potassium replacement during VF needs to be reconsidered in patient with persistent VF, as nearly all studies were done on non-fibrillating heart.

Poster #10

Nursing-Driven Early Mobility after Cardiac Surgery

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Purpose: Some large medical centers with cardiac programs have been successfully utilizing early mobility programs with post-CABG patients. We noticed that the patients on the unit were not mobilizing for a median time of 10 hours post-extubation, had an increased use of narcotics, and a high fall rate while admitted.

Methods: A literature review was performed searching for early mobility recommendations on cardiac surgery patients. To establish a baseline practice, data was collected for two months. A PICO question was developed to guide practice change: In open heart surgery patients, does the use of an early mobilization protocol (or algorithm) improve patient outcomes compared to standard of care? Our goal directed early mobilization strategy included mobilization within 4-6 hours after surgery. Delivery was peer lead and done through education, huddle/staff meetings, and 1:1 discussion with unit leaders. The team also worked to develop a reward and recognition program.

Results: Preliminary data shows the median time for initial mobilization decreased from 10 hours to 3.1 hours (pre (63) and the post (83) cardiac surgery groups). During their stay, each patient ambulated on average, 25 times pre-early mobility and 40 times post-early mobility. Some other important findings included a decrease in falls; our patients had 0 falls on average with increased mobility. Also, opioid use for pain relief was reduced from an average of 18 doses to 11 doses post-operatively.

Conclusions: The CVICU team was able to increase early mobility for our post-op open heart patients. Patients were out of bed sooner, ambulated more often, used less pain medication, and had fewer falls throughout their stay. Developing a comprehensive, peer lead, protocol to initiate a culture change benefits patient outcomes.

Poster #11

Rapid Deployment of a Venovenous Extracorporeal Membrane Oxygenation Program

Dianne McCallister, *Jennifer Hanna, Linda Pilon, Chakradhar Kotaru, Joseph Forrester, Gregory Hickey, Ahmad Alsaleem, Michael Firstenberg*
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Purpose: A community hospital with existing high-level cardiothoracic (CT) surgery and critical care programs created rapid deployment of pulmonary extracorporeal membrane oxygenation (ECMO) program and competencies, and target Extracorporeal Life Support Organization (ELSO) outcomes, in an accelerated time frame of 6 months—12 months more rapidly than described in existing literature.

Methods: A multidisciplinary guiding coalition met every other week, led by an experienced CT surgeon with program development and technical expertise in venovenous (VV) ECMO and with strong executive support. Criteria for use of VV ECMO were established in the first month and used for training critical care and support physicians in the use and early identification of appropriate patients. Key achievements included development of an operating room ECMO cart, creation of a phone tree through the Access Center to simplify referrals, and procurement and education on new technology. The use of rapid change management accelerated the timeline.

Results: Eight patients were saved in a hospital with no previous VV ECMO program in the first 12 months. The time from initiation of program development to first patient saved was 3 months, and complete program development was achieved in six months, 12 months faster than previous recorded rapid development. Survival rates were equivalent to those in the ELSO database.

Conclusions: It is possible to rapidly deploy a successful VV ECMO program in a community hospital with an existing CT surgery program and achieve benchmark survival data using a team-based approach with experienced leadership, multidisciplinary decision making, and rapid change management business processes.

Poster #12

Risk Factors for Acute Kidney Injury and Hemodialysis in Patients Who Underwent Surgery for Type A Acute Aortic Dissection

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Purpose: Acute kidney injury (AKI) is relatively common after cardiothoracic surgery for type A acute aortic dissection (TA-AAD) and increases mortality. Some of them need further hemodialysis therapies. We studied risk factors of acute kidney injury and hemodialysis in patients undergoing thoracic aortic surgery.

Methods: We retrospectively analyzed 712 patients with acute type A dissection and deep hypothermic circulatory surgery from January 2014 to December 2018, focusing on clinical outcome and acute kidney injury defined by consensus RIFLE criteria. Logistic regression models were used to identify univariate and multivariate predictors for AKI. Univariate logistic regression analysis was used first to identify possible risk factors for AKI, and the multivariate model included variables that were significant on univariate analysis. For all analyses, a probability value of less than 0.05 was considered statistically significant.

Results: There were 359 patients (50.4%) with acute renal injury, including 133 patients defined Risk (18.7%), 126 patients defined Injury (17.7%), 100 patients defined Failure (14.0%), and 353 patients without acute renal injury. Perioperative hemodialysis was performed in 111 patients (15.9%). Multivariate analysis showed that preoperative cystatin C level (OR=4.759, 95% CI:1.059-21.388, P = 0.042), preoperative erythrocyte count (OR=13.347, 95% CI:2.997-68.680, P = 0.001) and intraoperative cardiopulmonary bypass assist time (OR=1.061, 95% CI:1.015-1.110, P = 0.009) were independent risk factors for renal failure. Preoperative cystatin C level (OR=3.023, 95% CI: 1.108-8.244, P = 0.031), preoperative glutamic oxaloacetic transaminase level (OR=1.003, 95% CI: 1.000-1.007, P = 0.045), intraoperative cardiopulmonary bypass assistance time (OR=0.930, 95% CI: 0.872-0.991, P = 0.026), ascending aortic block time (OR=0.946, 95% CI: 0.896-1.000, P = 0.048) and cardiopulmonary bypass time (OR=1.078, P = 0.026). 95% CI: 1.016-1.143, P = 0.012) were independent risk factors for renal hemodialysis.

Conclusions: Preoperative cystatin level and intraoperative cardiopulmonary bypass time are independent risk factors for both perioperative renal failure and hemodialysis. Preoperative glutamic oxalate transaminase level and intraoperative cardiopulmonary bypass time are independent risk factors for perioperative renal hemodialysis.

Poster #14

Predictors of Heparin-Induced Thrombocytopenia in Adult Cardiac Surgery Patients

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Purpose: The 4Ts, HIT-Expert Probability (HEP), and Post-Cardiopulmonary Bypass (CPB) screening tools for heparin-induced thrombocytopenia (HIT) have not been evaluated or validated in cardiac surgery patients. Evidence remains unclear indicating which screening tool most accurately predicts HIT in these patients, for whom many potential causes of thrombocytopenia exist.

Methods: HIT-positive and HIT-negative patients who underwent on-pump cardiac surgery within a 6-year period were matched 1:2 in a case-control design. Two to three reviewers blinded to assay results independently scored each patient with the 4Ts, HEP, and CPB clinical scoring tools. Sensitivities and specificities of each tool were calculated using standard cut-offs used in clinical practice. The Youden method was utilized to determine optimal cut-offs in receiver operating characteristic (ROC) curves of each score, and sensitivities and specificities were recalculated using new cut-offs if applicable. Individual variables were added via forward selection process to develop a multivariable logistic regression model.

Results: Using standard cut-offs for the scoring tools, sensitivities were 100%, 93.9%, and 69.4% for the CPB, HEP, and 4Ts tools respectively, and specificities were 51%, 49%, and 71.4% respectively. The optimal thresholds for high-probability of HIT were determined to be a CPB score ³3, HEP score ³2, and 4Ts score ³5. Using the model-derived optimal cut-offs, sensitivity of the CPB score was 100%, compared to 93.9% for the HEP score (p = 0.083) and 51% for the 4Ts score (p < 0 .0001). Specificity of the CPB score was 88.8%, compared to 49% for the HEP score (p < 0 .0001) and 93.9% for the 4Ts score (p = 0.095). Changing the cut-off of the CPB score maintained sensitivity of 100% and increased specificity by 37.8%. Pattern of platelet decline, absence of clinically significant bleeding, coronary artery bypass surgery, body mass index, and postoperative heparin were the factors most significantly associated with HIT in a multivariable model.

Conclusions: This is the first validation of the CPB screening tool. The 4Ts and HEP scores have limited utility in cardiac surgery patients, whereas the CPB score demonstrated high sensitivity and specificity. A cut-off of ³ 3 points for the CPB score could increase specificity while preserving high sensitivity.

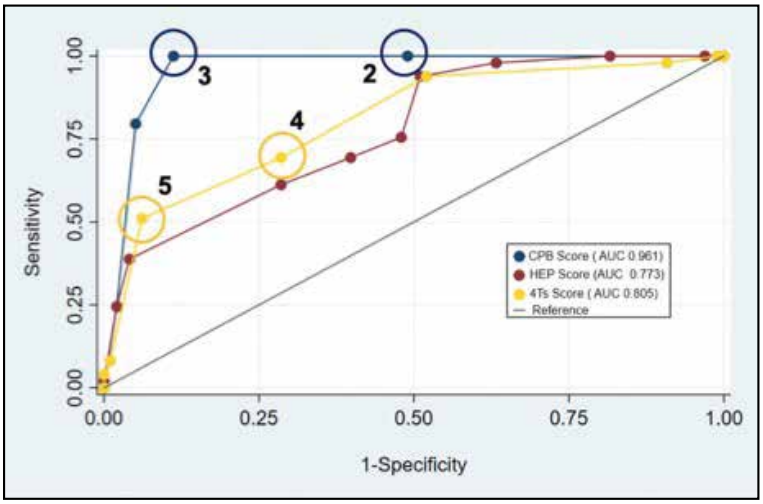

Table: Calculated sensitivities and specificities of the 4Ts, HEP, and CPB screening tools using standard cut-offs

Screening Tool with Cut-Off	Sensitivity (95% CI)	Specificity (95% CI)
4Ts Score ≥ 4 points	69.4 (54.6 – 81.7)	71.4 (61.4 – 80.1)
4Ts Score ≥ 5 points	51 (36.3-65.6)	93.9 (87.1-97.7)
HEP Score ≥ 2 points	93.9 (83.1 – 98.7)	49 (38.7 – 59.3)
CPB Score ≥ 2 points	100 (92.7 – 100)	51 (40.7 – 61.3)
CPB Score ≥ 3 points	100 (92.7-100)	88.9 (80.8-94.3)

Poster #15

A Formal Pre-Incision Time-Out Promotes Team Workload Synchronization in Cardiac Surgery

Lauren Kennedy-Metz*[1]*, *Roger Dias*[2]*, Kay Leissner*[1]*, Steven Yule*[2]*, Marco Zenati*[2]
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Purpose: Surgical time-outs are designed to promote teamwork and error-prevention. Furthermore, the pre-incision time-out aims to facilitate shared mental models prior to initiating surgery. We hypothesized that providers' mental workload (MWL) would reveal team workload synchrony during a formal, well-executed pre-incision time-out.

Methods: Audio/video data were collected during cardiac procedures. Heart rate variability (HRV) was collected using wireless Polar H10 sensors (equipped to surgeon, anesthesiologist, perfusionist). Data were analyzed via a mixed-model ANOVA and Tukey post-hoc tests (mean ± standard deviation, P-value) for a subset of cases (N=4 CABG, 5 AVR) from patient arrival until sternal closure. Annotation of surgical phases followed previously developed standardized process models of AVR and CABG, producing thirteen surgical phases. Psychophysiological analysis relied on calculating the root mean square of the successive differences (RMSSD), a well-established HRV component reflective of MWL, with an inverse relationship. Significance is reported at $P < 0.05$.

Results: Significant simple main effects were found ($F(12,60)=2.814$, $P=0.024$). During pre-induction, anesthesiologists experienced higher MWL (15.15 ms ± 3.00 ms) than perfusionists (20.68 ms ±0.98 ms, $P=0.024$), and during anesthesia induction anesthesiologists experienced higher MWL (15.32 ms ± 2.77 ms) than perfusionists (21.56 ms ± 1.19 ms, $P=0.011$) and surgeons (20.94 ms ± 0.94 ms, $P=0.025$). During anastomoses, surgeons (10.19 ms ± 2.24 ms) experienced significantly higher MWL compared to perfusionists (20.59 ms ± 6.39 ms, $P=0.045$), as well as during separation from bypass (surgeon: 11.19 ms ± 1.55 ms versus perfusionist: 20.71 ms ± 5.09 ms, $P=0.029$). Despite these observed differences between providers over various surgical phases, the pre-incision time-out phase revealed almost negligible differences across roles (range: 2.45 ms), indicating team workload synchronization.

Conclusions: This preliminary work supports the utility of a well-executed pre-incision time-out to focus the attention of surgical team members and promote shared team mental models via psychophysiological synchrony, using an objective MWL measure. Analysis of larger sample sizes may generate the opportunity to discern the effectiveness of pre-incision time-out huddles.

Poster #18

Analytics-Driven, Team-Based Patient Care Interventions to Drive Enhanced Recovery after Cardiothoracic Surgery

*Angelia Nadiak, **Faisal Bakaeen,** Douglas Johnston, Edward Soltesz, Alice Kim, Kathryn Piccolo, Justin Rasmussen, Steven Insler, Nikolaos Skubas, Murali Dodla, Suma Thomas, Kathleen Kravitz, A. Marc Gillinov, Lars Svensson, Eric Roselli*
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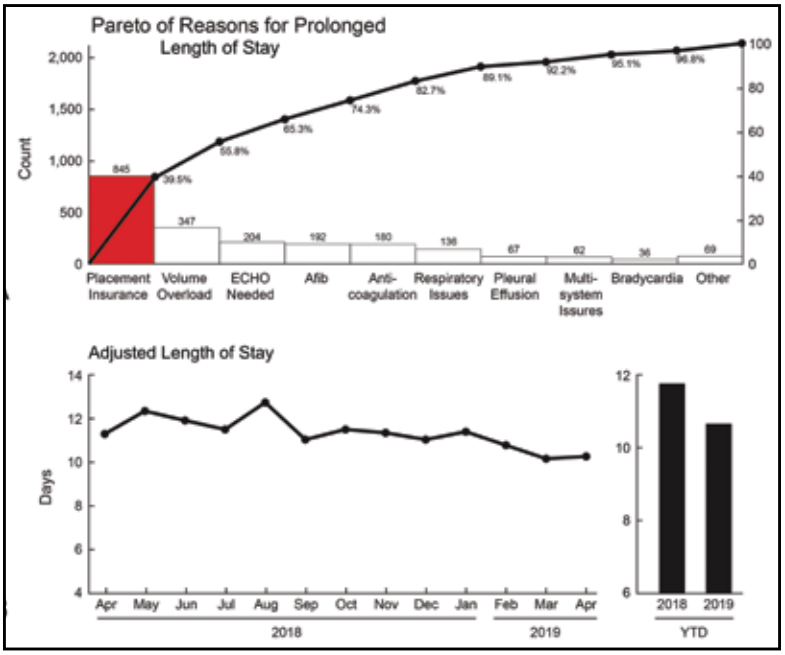
COMMERCIAL RELATIONSHIPS F. Bakaeen: Speakers Bureau/ Honoraria, JACE Medical

Purpose: In response to a hospital-wide initiative to improve patient care coordination and bed utilization, cardiothoracic surgery and anesthesiology joined forces with other care disciplines and business intelligence to identify high impact interventions to enhance patient flow and care. We report on the feasibility and early results of an analytics-driven approach.

Methods: A multidisciplinary task force (TF) identified the following priority interventions based on their potential effectiveness and readiness for implementation: 1: Electronic medical records (EMR)-based, real-time analytics to identify barriers for hospital discharge. 2: Length of stay (LOS) surveillance to track patients with length of stay >30 days. 3: Consistent use of narcotic-sparing pain and delirium protocols. 4:Facilitated, timely tracheal extubation by EMR-based decision support tools. 5: Standardization of surgical protocols for routine care of chest tube, temporary pacing wires, atrial fibrillation, and anticoagulation management. 6: Daily multidisciplinary huddles and bedside rounds by LOS champions tasked with care coordination.

Results: In the 4th quarter (Q4) of 2018, the TF ran an educational campaign targeting stakeholders and simultaneously developed the necessary analytic tools. Bundled interventions were implemented before 2019. Barriers for hospital discharge included post hospital placement/insurance issues, fluid overload, delays in obtaining echocardiograms, and atrial fibrillation (Figure 1A). These became new targets for additional intervention. Risk-adjusted LOS was reduced by 1 day in Q1 of 2019 (for 410 operations performed through the end of February) compared to 2018 (Vizient report, Figure 1B). There was no increase in the rate of patient readmissions. In addition, the Society of Thoracic Surgeons (STS) outcomes data revealed no hospital deaths for all STS category cases and no increase in major complication rates.

Conclusions: Analytics-driven multidisciplinary patient care interventions to drive enhanced recovery after cardiothoracic surgery (ERAS-C) can be rapidly effective without compromising safety or quality. Additional studies are needed to confirm our findings, assess sustainability, and evaluate the impact on morale from enhanced communication and the benefits of delivering efficient care.



Poster #19

Improving Postoperative Cardiac Surgery Patient Outcomes through Preoperative Clinical Education, Inspiratory Muscle Training, and Mechanical Ventilation Protocol: A Multidisciplinary Approach

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Purpose: Note Improvement in early extubation goals through the addition of a pre-operative incentive muscle training program including a patient and family education module. Interdisciplinary team collaboration efforts are used to decrease our post-operative ventilation hours, display 2016-18 improvement of the process and how it correlates towards to STS national database.

Methods: Outpatient method: Patients and their families are educated pre-operatively by both respiratory care and nursing separately to provide hyperawareness of the process of the care ahead of them. Goals are communicated about extubation hours, mobility, oxygen demand days, and length of stay. Each patient is given an inspiratory muscle training plan of care. The achieved inspiratory capacity (IC) pre-operatively is set as their IC goal post-operatively. Inpatient method: For post beside pre-op PFTs that reflected a FEV1 > 80%. then patients are protocolled, given an inspiratory respiratory plan of care, including an inspiratory muscle trainer.

Results: In our largest category, isolated CABG, we were able to bring our total ventilation time down from 13.5 hours in 2016 to 8.6 hours in 2018 which is a 36% decrease over 3 years. Of note, in 2018, total ventilation times were nearly 48% lower than the national average. Our initial ventilation time of < 6 hours increased from 66.5% to 77.1% in these 3 years and at the final year we were almost 20% higher than the national average. Our next highest category, isolated AVR, results continue to excel with a decrease of 78% in ventilation time over 3 years; in 2016 our ventilation time was 23.2 hours and we were able to decrease that to 5.1 in 2018. In the latter year, our ventilation time was 64% lower than the national average and able to extubate 77.2% of our patients in < 6 hours. Average post-operative oxygen days: 2.9.

Conclusions: During 2016-2018, combination of strong team collaboration and addition of a pre-operative inspiratory muscle training plan of care we have been able to improve our patient outcomes. We have improvements regarding enhanced patient/ family awareness and satisfaction with both decreased ventilation hours and post-operative oxygen demand days.

Poster #20

Validation of the Cardiac Surgery-Associated NGAL Score for Risk Stratification of Postoperative Acute Kidney Injury

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Purpose: The Cardiac Surgery–Associated NGAL Score (CSA-NGAL score) has been introduced, recently, by experts consensus as a tool to improve awareness of acute tubular damage, which may change the management considerations in Cardiac Surgery Associated-Acute Kidney Injury (CSA-AKI). However, its effectiveness and applicability is still to be studied.

Methods: One-hundred and thirty consecutive patients undergoing cardiac surgery with cardiopulmonary bypass (CPB) were enrolled in this prospective study. Patients with pre-existing chronic renal failure were excluded. Serum creatinine was determined preoperatively and daily after surgery. U-NGAL was measured 12 hours after surgery and CSA-NGAL score was determined. The diagnosis and severity of AKI was assessed using RIFLE criteria.

Results: Among 130 patients, 89 (68.4%) patients developed CSA-AKI as defined by NGAL score versus 86 (66.1%) patients as defined by RIFLE criteria. 3 patients (2.3%) were classified as NGAL score (0). 38 (29.2%) patients were classified as NGAL score “1”; 23 of them didn’t develop AKI, 10 patients were at ”Risk”, 4 patients were at “Injury”, and one patient was at” Failure” according to RIFLE criteria . 55 (42.3%) patients were classified as NGAL score “2”; 17 of them didn’t develop AKI, 27 patients were at ”Risk” and 10 patients were at ”Injury” and one patient was at ” Failure” according to RIFLE criteria. 34 (26.2%) patients were classified as NGAL score “3”; one of them didn’t develop AKI, 20 patients were at “Risk”, 9 patients were at ”Injury” and 4 patients were at” Failure” according to RIFLE criteria, ($p<0.0001$).

Conclusions: The cardiac surgery–associated NGAL Score is an effective tool for early risk stratification of CSA-AKI which adds to its potential utility to improve patients’ outcome by early interventions and better plan of management strategies.

Poster #22

On-Table Extubation Combined with an Enhanced Recovery Protocol for All Cardiac Surgeries Further Reduces Postoperative Length of Stay

***Jonathan Parmet*[1]**, *Satoshi Furukawa*[2], *Darryl Berkowitz*[3], *Pietro Colonna-Romano*[3], *Kevin Schmanek*[1], *Adrian Rodrigo*[1], *Brittany Lucca*[1], *Bryan Blanchard*[3], *Katherine Hilliard*[2]
[1]*Society Hill Anesthesia Consultants, Cherry Hill, NJ,* [2]*University of Pennsylvania, Philadelphia,* [3]*Pennsylvania Hospital, Philadelphia*

Purpose: Previously, we reported a decreased postopLOS in OTE CABGs (2015-2018, OTE = 70%, avg OTE CABG postopLOS = 5.5 ± 2.6 days vs. STS OTE = 2.9%, STS avg CABG postopLOS = 6.9 days). In 2019, we combined OTE with an ERP for all cardiac surgeries to further reduce postopLOS.

Methods: We implemented an OTE+ERP for all cardiac surgeries by performing the following: 1. p.o. Gabapentin (GABA) night before surgery, 2. Preoperative IT narcotic, and p.o. GABA, 3. Intraoperative infusions of ketamine and dexmedetomidine, pre-incision bilateral serratus anterior blocks (liposomal bupivacaine), and IV acetaminophen post CPB along with OTE, 4. Postoperative IV acetaminophen q 8 hrs then p.o. postop days 1-5, p.o. GABA q 8hrs as tolerated for 5 days, out of bed the night of surgery, and ambulation postop day 1. Review of the EMR determined the OTE rate, postopLOS, and the incidence of postop A-fib. We report preliminary results.

Results: From 1/7/19- 6/17/19, 38 cardiac surgeries occurred with CPB (1 OPCAB). OTE rate = 89% (34/38) with OTE+ERP = 80% (31/38). OTE+ERP patients avg postopLOS decreased to 4.5 ±3.3 days (median = 3 days) vs., all previous cardiac surgeries (2015-18, n= 393) avg NonERP postopLOS = 7.23 ±6.23 (median 6 days) (student's t-test p = 0.0001, figure-1). After excluding patients with a history of preoperative A-fib, the new onset postoperative A-fib rate for OTE+ERP cases decreased to 7 % (2/29) vs. the STS database of 35 %. For OTE+ERP cases the following occurred: 1. 65 % (20/31) out of bed postop day 0 with 87 % (27/31) postop day 1, and 2. 26% (8/31) ambulating postop day 0 with 74 % (23/31) postop day 1. OTE+ERP patient's intraop fentanyl requirements decreased compared to all cardiac surgeries 2015-2018, (135 ?g vs 585 ?g student's t-test p= 0.00001).

Conclusions: OTE+ERP reduces intraoperative narcotic administration, accelerates patient mobility thereby further reducing postopLOS for cardiac surgeries, and perhaps reduces new onset postoperative A-fib incidence. If a majority of cardiac surgical programs adopt OTE+ERPs as a standard for cardiac surgery, a significant reduction in national cardiac surgical health care spending could occur.

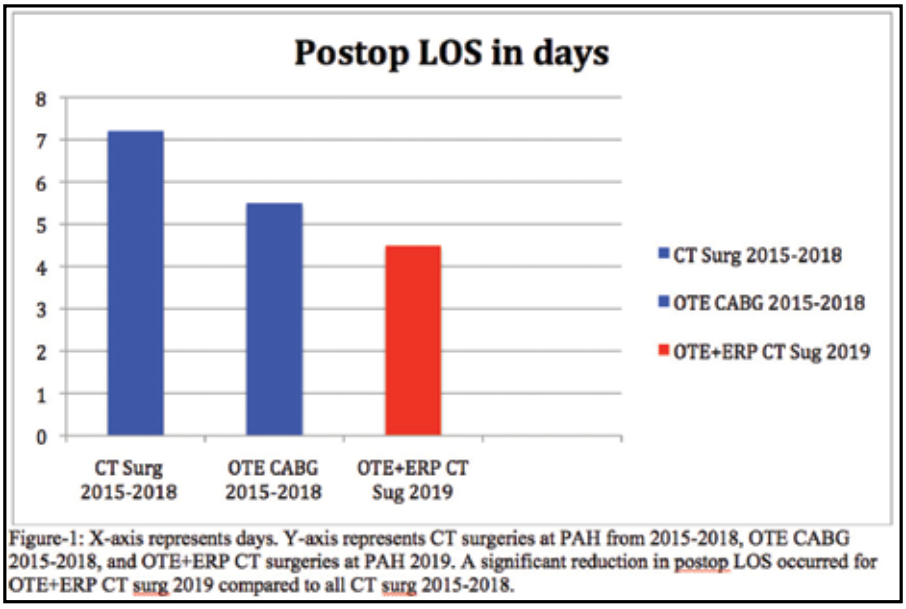

Figure-1: X-axis represents days. Y-axis represents CT surgeries at PAH from 2015-2018, OTE CABG 2015-2018, and OTE+ERP CT surgeries at PAH 2019. A significant reduction in postop LOS occurred for OTE+ERP CT surg 2019 compared to all CT surg 2015-2018.

Poster #23

A Bundle Circuit to Improve Extubation Times after Cardiac Surgery from 2014 to 2018

Jiaxin Ye
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Purpose: Prolonged intubation after cardiac surgery is associated with significant morbidity. A fasttrack extubation protocol primarily driven by bedside providers was instituted for all postoperative cardiac surgery patients to facilitate safe and expeditious extubation.

Methods: A retrospective review of 5894 cardiac surgery patients over a 5-year-period was performed. Before 2017, nonprotocolized standard perioperative management was utilized (n =3072). From 2017, a fast-track extubation (FTE) protocol directed by bedside providers was instituted (n=2822). Postoperatively, patients were placed on pressure-regulated volume control and titrated down to minimal support to maintain peripheral capillary oxygen saturation greater than 94% but less than 100%. For patients deemed ready for weaning, a 30-minute continuous positive airway pressure trial was performed. Patients meeting all neurologic, respiratory, and cardiovascular criteria were extubated. The impact of the FTE algorithm on timely extubation, clinical outcomes,

Results: Baseline preoperative and intraoperative characteristics were similar between pre-FTE and FTE groups. Before instituting the FTE protocol, the rate of early extubation (less than 6 hours) was 34.1%, and increased to 65.7% during the FTE era ($p < 0.05$). Median time to extubation was also found to be significantly decreased: 10 hours versus 4.8 hours ($p < 0.05$). There was no statistically significant difference in reintubation rates or 30-day mortality.

Conclusions: The institution of a bedside provider directed FTE pathway reduced overall intubation times and increased the rate of early extubation, without an increase in reintubation or mortality. This program-wide multidisciplinary approach appears to promote safe and expeditious extubation of cardiac surgery patients.

Poster #24

Chronic Drainage for Deep Mechanical Circulatory Support Device Infections

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Virginia Commonwealth University, Richmond

Purpose: Use of durable mechanical circulatory support (MCS) is growing and required for longer periods. MCS infection is a serious complication. Transplant is limited by donor organ availability and device replacement is associated with significant morbidity and mortality. Outcomes of patients who underwent chronic drainage for deep device infection are analyzed.

Methods: Sixteen patients with culture proven deep device infection (excluding patients with isolated driveline infections) who underwent mediastinal re-exploration for drainage at a single institution from 2009 to 2019 were retrospectively reviewed. Devices implanted as Destination Therapy (DT) in 11 and Bridge to Transplantation (BTT) in 5 patients. MCS devices included 9 axial continuous flow left ventricular assist device (CFLVAD), 3 centrifugal CFLVAD, and 4 total artificial heart (TAH). The surgical interventions included: drainage with or without continuous irrigation, device replacement, and transplantation. Survival at 90 day and 1-year is reported.

Results: Twelve male patients (75%). Median age at device implant was 39.5 years (range 20-68). Infections identified at a median of 220.5 days (43-1551). Fourteen patients (88%) underwent continuous irrigation. Chronic drains were maintained for median 116 days (10-887), Figure 1. Isolated bacteria were Staphylococcus aureus in 9; coagulase-negative staphylococci in 2; Serratia marcescens in 1; Pseudomonas aeruginosa in 1; Klebsiella oxytoca in 1; Mycobacterium abscessus in 1 and Candida albicans in 1 patient. Five patients received heart transplant at a median of 72 days (11-186) after infection diagnosis. Two patients had device replacement after drainage, 3 patients had device replacement before drainage. Intraoperative cultures at time of transplant or device replacement were negative in 5 of 7 patients. Six patients received no other intervention beyond drainage. Four patients remained on chronic antibiotic therapy at a median of 3.65 years (0.25 to 4.47). Overall 90 day and 1-year survival were 94% (15/16) and 81% (13/16).

Conclusions: Deep MCS device infection remains a challenging clinical problem with limited therapeutic options. Continuous irrigation with chronic drainage may be a temporizing option for patients who are not able to undergo timely device replacement or transplant.

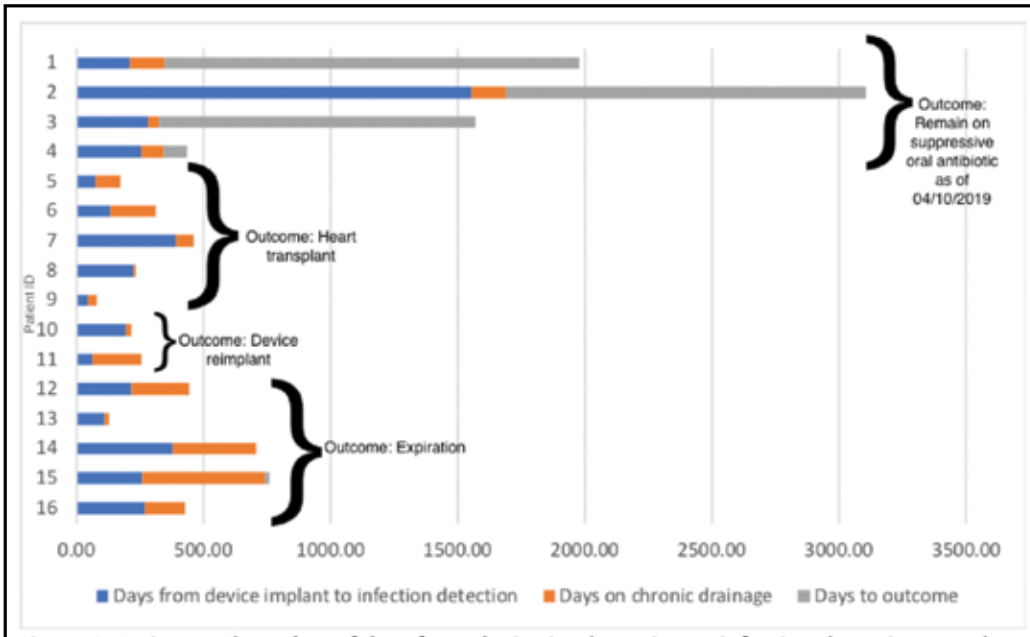

Figure 1. Patient and number of days form device implantation to infection detection, number of days on chronic drainage and number of days to outcome.

Poster #25

A Culture of Postoperative 60% FiO_2 – Are We Subjecting Surgical Patients to Oxygen Toxicity?

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Purpose: Oxygen is the most commonly used therapeutic drug in hospitals. Oxygen titration is extremely critical in mechanically ventilated patient owing to the narrow margin between therapeutic and toxic doses. We postulated that the practice of keeping FiO2 at 0.6 in postoperative mechanically ventilated patients may cause unintended toxicity.

Methods: This is a cross-sectional observational study conducted in a 36 bed post cardio-thoracic ICU. Over a period of four weeks, first Arterial Blood Gas (ABG) on 139 patients were obtained. 79 patients were excluded due to underlying respiratory diseases, complications or hypoxia in OR and severe hemodynamic instability. A sample size of 60 fresh post-op patients with non-complicated cardiac and valve surgery patients was obtained with two constant variables of FiO2 60% and PEEP of 8. Patients were stratified into 4 groups based on the PaO2 values on first ABG i.e., 70-100, 101-150, 151-200 and >200 mm Hg.

Results: With standard prevalent practice of FiO2 0.6 and PEEP of 8 at a single tertiary cardiac surgery center, Only 3 patients fall in group 1 (PO2 70-100 mm Hg), 19 patients in group 2 (PO2 101-150 mm Hg), 15 patients in group 3 (PO2 151-200 mm Hg) and 23 patients in group 4 (PO2 >200 mm Hg). Our study was limited by small sample size, single unit, cross-sectional study design, types of ventilators, and undetermined demographic biases including gender and BMI. Although data was available for time to extubation, secondary analysis was not obtained due to the lack of similar comparing group with lower FiO2 and/or PEEP. With 0.6 FiO2 and PEEP of 8 prescribed as constant dependent variables to each group in a single set of population, the calculated (Chi-square =20.8), with $p < .05$.

Conclusions: Uncomplicated immediate post-surgical patients may have unintended arterial hyperoxia and possible toxicity. Oxygen toxicity has shown to be associated with poor hospital outcomes. Further studies are warranted to address this issue. Secondary analysis for time to extubation may also be helpful, if compared to lower FiO2 and PEEP values.

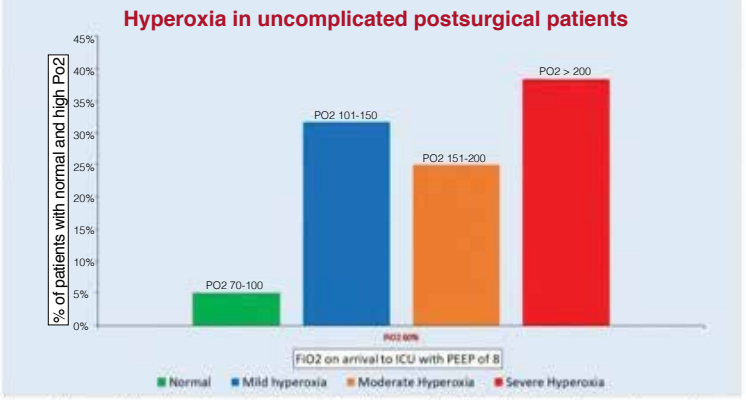

Figure: *Bar graph showing categories of patients with normal, mild, moderate and severe hyperoxia*

	Normal PO2 (PO2 70-100 mm Hg)	Mild hyperoxia (PO2 101-150 mm Hg)	Moderate Hyperoxia (PO2 151-200 mm Hg)	Severe hyperoxia (PO2 >200 mm Hg)
Number of patients	3	19	15	23
Percentage of patients	5%	31.67%	25%	38.33%

All patients were at FiO2 60% with PEEP of 8 (our constant variable)

Table: *Number and percentage of patients with normal, mild, moderate and severe hyperoxia*

Poster #26

Hemodynamic Management of Bilateral Lung Transplantation with Cardiac Surgery for Eisenmenger Syndrome

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Purpose: To study the hemodynamic management of bilateral lung transplantation accompanied by correction of congenital heart disease for Eisenmenger Syndrome.

Methods: The first recipient diagnosed ventricular septal defect with Eisenmenger Syndrome presented severe hypoxemia after cesarean section, and the second recipient was diagnosed aorta-pulmonary septal defect and patent ductus arteriosus with Eisenmenger Syndrome. These two recipients were both underwent the deformity correction followed with bilateral lung transplantation through the fourth intercostal shell incision under cardiopulmonary bypass. Restrictive liquid management, colloid supplementation, blood transfusion and diuresis were given in the early postoperative period, while heart rates controlling and heart function adjustment in the middle-late postoperative period.

Results: On the day of surgery, low cardiac output, hypotension, hypoxemia and oliguria were obvious in the first recipient who weighed 67kg. The improvement of these symptoms was observed after fluid resuscitation and vasoconstrictors application. Because of the primary graft dysfunction(PGD), restrictive liquid management was applicated on the following days. In the second recipient who weighed 40kg, the occurrence of acute kidney injury(AKI) followed by strict fluid control and excessive diuresis under stable circulation in the first two postoperative days. However, the PGD of this recipient was not obvious. Dynamic right ventricular outflow tract(RVOT) obstruction occurred in both two recipients due to the decline of pulmonary artery pressure. The reduction of RVOT obstruction and improvement of cardiac function approached after controlling of heart rates. The first recipient was well at follow-up six postoperative months, and the second patient at three months as well.

Conclusions: The circulation, weight and PGD degree should be considered in the volume management of bilateral lung transplantation and heart surgery for ES. Alleviated diuresis, appropriate preload maintainment, beta-receptor blockers usage and less inotropic agents usage are recommended. Surgical relief of the RVOT obstruction may be an alternative treatment during the

Poster #27

Predictors of Cognitive Dysfunction in the Cardiovascular Surgical Intensive Care Unit: A Single-Center Experience

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Purpose: Cognitive dysfunction, known commonly as delirium after cardiac surgery leads to prolonged ICU stay, and is associated with poor outcome, including increased longterm mortality and worsened functional status, one year after surgery. In this analysis, evaluation of chronic conditions as predictors of delirium is done, with plans to develop delirium risk score.

Methods: This study is a retrospective analysis of patients electronic medical records, admitted in cardiovascular surgical ICU, from January 2017 to December 2017. An outcome variable of Delirium vs. not was evaluated with 14 different demographic and clinical patient characteristics. Delirium was defined as positive CAM-ICU done by nursing staff while in ICU. Descriptive statistics and group differences were examined using Chi-Square for categorical, and t-test for continuous variables. Multivariate logistic regression was used to investigate predictors of delirium with a significance level of p < 0 .05. The analysis was performed using SAS 9.4.

Results: A total of 2394 patients were included, of which 1040 were identified with delirium. 1242 patients underwent cardiac surgical procedure, 550 had CAM-ICU positive. The overall incidence of delirium was 43.46%. Majority of patients with delirium were surgical 87.12%, of which 52.88% were cardiac surgical patients. The adjusted multivariate logistic regression model shows that the patients between 65-79 years (OR1.211; [95%CI 1.010-1.452; p=0.03)], and patients above 80 yrs (OR1.605; [95%CI 1.184-2.176; p=0.002)], chronic anemia (OR1.733; [95%CI 1.396-2.153; p < 0 .0001)], COPD (OR1.248; [95%CI 1.008-1.544; p=0.04]), CKD (OR1.575; [95%CI 1.301-1.906; p < 0 .0001]), CHF (OR1.262; [95%CI 1.049-1.517; p=0.01]), and alcohol dependence (OR2.462; [95%CI 1.355-4.475; p=0.003]) are associated with increased risk of delirium. Patients between age 65-79 years are 21.1%, and patients older than 80 are 60.5% more likely to develop delirium. Patients with anemia have 73.3% higher risk, while CKD patients have 57.5% increased risk of odds of delirium. COPD and CHF increase the risk by 24.8% and 26.2% respectively. Alcohol dependence is associated with 2.462 times higher risk.

Conclusions: Incidence of delirium was 43.46%, no statistical difference noted between cardiac surgical and non cardiac surgery patients. Statistically significant predictors include older age, anemia, CKD, COPD, CHF and alcohol. Need for analysis using beta coefficients to create predictive score to stratify patients at increased risk of developing delirium, to use proactively for prevention.

TABLE-1 LOGISTIC REGRESSION ANALYSIS FOR PREDICTING DELIRIUM

VARIABLES	ODDS RATIO	CI	P VALUE
GENDER			
FEMALE	REFERENCE		0.12
MALE	0.869	0.726-1.040	
AGE GROUP			
BELOW 65	REFERENCE		
65-79	1.211	1.010-1.452	0.03
ABOVE 80	1.605	1.184-2.176	0.002
BMI			
NORMAL WEIGHT (18.5- 24.9)	REFERENCE		
UNDERWEIGHT (12 - 18.5)	1.332	0.719-2.467	0.36
OVERWEIGHT (24.9- 29.9)	0.814	0.643-1.032	0.08
OBESE (ABOVE 30)	0.853	0.676-1.077	0.18
RACE			
BLACK	REFERENCE		
CAUCASIAN	0.803	0.637-1.011	0.06
ASIAN	0.810	0.477-1.378	0.43
NATIVE AMERICAN	0.830	0.322-2.137	0.69
DECLINED	1.303	0.801-2.119	0.28
CASE TYPE			
SURGICAL	REFERENCE		0.11
MEDICAL	0.160	0.016-1.578	
ANEMIA			
WITHOUT ANEMIA	REFERENCE		<.0001
WITH ANEMIA	1.733	1.396-2.153	
COPD			
WITHOUT COPD	REFERENCE		0.04
WITH COPD	1.248	1.008-1.544	
CKD			
WITHOUT CKD	REFERENCE		<.0001
WITH CKD	1.575	1.301-1.906	
CHF			0.01
WITHOUT CHF	REFERENCE		
WITH CHF	1.262	1.049-1.517	
PVD			
WITHOUT PVD	REFERENCE		0.009
WITH PVD	0.655	0.476-0.901	
AF			
WITHOUT AF	REFERENCE		0.83
WITH AF	0.971	0.738-1.277	
ALCOHOL			
WITHOUT ALCOHOL	REFERENCE		
WITH ALCOHOL	2.462	1.355-4.475	0.003
NICOTINE DEPENDENCE			
WITHOUT NICOTINE DEPENDENCE	REFERENCE		0.34
WITH NICOTINE DEPENDENCE	0.919	0.771-1.096	
PSYCHOSIS			
WITHOUT PSYCHOSIS	REFERENCE		0.73
WITH PSYCHOSIS	1.387	0.209-9.209	
SURGERY			
NON-SURGICAL	REFERENCE		
NON-CARDIAC SURGERY	0.266	0.027-2.623	0.25
CARDIAC SURGERY	0.255	0.026-2.251	0.24

Poster #28

Renal Recovery in Survivors of Venoarterial Extracorporeal Membrane Oxygenation

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Purpose: Acute Kidney Injury is frequently encountered in shock and is associated with higher mortality. Patients supported by veno-arterial extracorporeal membrane oxygenation (VA-ECMO) commonly require renal replacement therapy. The purpose of this study is to assess the prevalence of RRT and the renal outcomes of adult patients who survive VA-ECMO.

Methods: A single center retrospective review was performed on all VA-ECMO patients from January 1, 2017, to December 31, 2018. Patients were included for review if they were successfully de-cannulated from ECMO support. Initiation of renal replacement therapy with respect to indication, timing and duration were reviewed along with kidney function at the time of discharge.

Results: Of 184 adult VA-ECMO patients, 93 (51%) patients survived to de-cannulation and were included in this study. Thirty-eight (41%) of the survivors were treated with renal replacement therapy (RRT) during their hospitalization (Table 1). Of those that required RRT, 16 (42%) experienced recovery in kidney function and were off RRT by the time of discharge or death. Overall, 76% of VA-ECMO survivors did not require RRT at time of discharge.

Conclusions: These findings suggest that while acute kidney injury requiring RRT is common for VA-ECMO patients, there is a high likelihood of renal recovery for patients that survive. This favorable probability for renal recovery should be considered in the complex clinical decision making surrounding these patients.

Table 1. Patients requiring renal replacement therapy before, during or after VA ECMO

Timing of RRT	VA ECMO Patients (n=93)
Start Before ECMO	4 (4%)
Off RRT before discharge	1 (25%)
Start During ECMO	20 (22%)
Off RRT before discharge	10 (50%)
Start After ECMO	14 (15%)
Off RRT before discharge	5 (36%)
Total	38 (41%)
Off RRT before discharge	16 (42%)

Poster #29

The Impact of Peak Lactate Levels on Risk-Adjusted Morbidity and Mortality following Coronary Artery Bypass Grafting

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Purpose: Serum lactate is a biomarker of decreased organ perfusion. Prior studies have evaluated the changes in biochemical markers during and after cardiac surgery. However, the effect of lactate level on risk adjusted morbidity and mortality after coronary artery bypass grafting (CABG) has not been previously studied.

Methods: This study included CABG patients from our institutional Society of Thoracic Surgery (STS) Database between 2016 and 2018. Peak lactate levels within 24 hours of surgery were extracted. Patients were divided into four groups by lactate level: less than 2 mmol/L, 2 to 5 mmol/L, 5 to 10 mmol/L, and greater than 10 mmol/L. The ratio of observed to expected morbidity and mortality were calculated. A univariate logistic regression analysis was performed to assess for associations between lactate level and mortality.

Results: 183 patients were included in the analysis. Of those, 69/183 (38%) had a peak lactate less than 2.0 mmol/L, 63/183 (34%) had a lactate between 2 to 5 mmol/L, 40/183 (22%) had a lactate between 5 to 10 mmol/L, and 11/183 (6%) had a lactate greater than 10 mmol/L. Ratios of observed to expected events as predicted by the STS risk model are presented in Table 1. Lactate levels between 2 to 5mmol/L were associated with a risk adjusted increase in re-operation. Lactate levels between 5 to 10 mmol/L were associated with a risk adjusted increase in combined morbidity and mortality, prolonged ventilation, and permanent stroke. Lactate levels greater than 10mmol/L were associated with a risk adjusted increase in mortality, combined morbidity and mortality, prolonged ventilation, permanent stroke and reoperation. On univariate logistic regression, serum lactate was significantly associated with mortality (OR 1.33, 95% CI 1.12-1.61).

Conclusions: The degree of elevation in serum lactate levels within 24 hours after CABG are correlated with an incremental increase in risk adjusted morbidity and mortality as defined by the STS model. Routine monitoring of lactate levels could promote early perioperative identification of patients at risk for adverse outcomes.

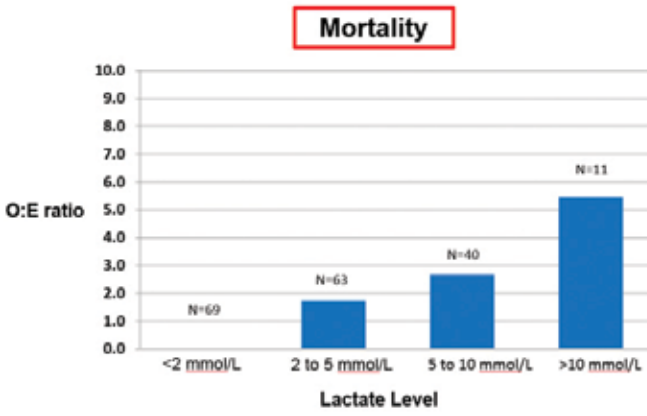

Table 1: O:E mortality ratio based on peak post-operative lactate.

TABLE 1: O:E Ratios for Morbidity and Mortality

O:E (95% CI)	Lactate 0-2 mmol/L	Lactate 2-5 mmol/L	Lactate 5-10 mmol/L	Lactate > 10 mmol/L
Mortality	0	1.74 (0.30-3.17)	2.67 (0.89-4.45)	5.46 (2.36-8.55)
Morbidity + Mortality	1.46 (1.00-1.97)	1.33 (0.89-1.77)	1.71 (1.17-2.26)	3.73 (2.79-4.67)
Prolonged ventilation	1.28 (0.66-1.89)	1.30 (0.80-1.80)	1.91 (1.23-2.58)	3.58 (2.52-4.64)
Permanent stroke	1.14 (0-3.22)	2.32 (0.23-4.40)	4.67 (2.25-7.09)	20 (15.35-25.46)
New renal failure	0.96 (0-2.22)	0.46 (0-1.70)	0.67 (0-2.22)	2.69 (0-5.73)
Re operation	1.15 (0-2.33)	2.85 (1.72-3.98)	1.91 (0.62-3.21)	7.90 (5.56-10.24)

Poster #31

Dedicated Adult Intensivist Extracorporeal Membrane Oxygenation Team Cannulation and Management Decreases Blood Utilization

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Purpose: ECMO patients are high utilizers of blood products. Our adult ECMO program transitioned from cannulation and management by cardiothoracic surgery and pediatric intensivists (Phase 1) to cannulation and management by a dedicated adult intensivist ECMO team (Phase 2). We hypothesized that this transition would decrease blood utilization.

Methods: All ECMO patients at our academic institution from 01/01/2005 to 05/31/2019 were reviewed. Data collected included age, gender, diagnosis requiring ECMO, days on ECMO, ECMO circuit type (VA, VV, or hybrid), and final disposition. Transfusion data included units of red blood cells (RBC), plasma, platelets (PLT), and cryoprecipitate (Cryo) administered while on ECMO. Exclusion criteria were patient age < 18 years or ECMO post-cardiotomy. Phase 1 patients required ECMO from 01/01/2005 to 12/31/2016 and Phase 2 from 08/01/2016 to 05/31/2019. Unpaired t-test was used and p-value < 0 .05 was statistically significant.

Results: During the inclusion period, 182 patients were treated with ECMO; of these, 111 were included for analysis. There were 36 patients in the Phase 1 group, with transfusion data available for 25 patients. All 75 patients in the Phase 2 group had transfusion data available. Overall blood product usage was significantly higher in Phase 1 patients (see Table 1). When considering specific underlying diagnoses, Hantavirus Cardiopulmonary Syndrome (HCPS) required ECMO in 26 Phase 1 patients compared with 5 Phase 2 patients (p < 0 .0001). Transfusion data was available for 17 Phase 1 HCPS patients and all Phase 2 HCPS patients; no significant differences were observed. For non-HCPS patients, blood product usage again was significantly higher in Phase 1 patients for total blood products (p=0.0261), platelets (p= 0.0047), and plasma (p=0.0139). There was no difference in mortality outcome between the two groups (p=1.00).

Conclusions: With a dedicated adult intensivist team cannulating and managing ECMO patients, more adult ECMO patients were placed on ECMO and, excluding HCPS patients, transfusion requirements decreased without any mortality difference. Future investigations include a diagnosis-based analysis of transfusion requirements in adult ECMO patients to evaluate where differences exist.

Table 1: Blood Product Usage in ECMO patients (* = p <0.05)

	Phase 1 (mean units ± standard deviation)	**Phase 2** (mean units ± standard deviation)	**p-value**
Overall Blood Product Usage	n = 25	n = 75	
Total units of blood products	55.4 (± 45.4)	19.6 (± 29.3)	0.0009 *
Total RBC units	32.1 (± 31.6)	11.3 (± 14.6)	0.0037 *
Total plasma units	9.4 (± 7.5)	4.1 (± 8.5)	0.0048 *
Total PLT units	13.2 (± 12.3)	2.8 (± 5.9)	0.0003 *
Total Cryo units	1.2 (± 1.8)	1.6 (± 3.0)	0.4455
Blood Product Usage: HCPS patients	n = 17	n = 5	
Total units of blood products	53.7 (± 47.3)	80 (± 55.2)	0.3726
Total RBC units	29.6 (± 27.6)	38.0 (± 25.0)	0.5414
Total Plasma units	10.1 (± 8.4)	19.0 (± 15.1)	0.2640
Total PLT units	13.4 (± 14.1)	17.6 (± 14.2)	0.5761
Total Cryo units	1.0 (± 2.0)	5.4 (± 6.7)	0.2474
Blood Product Usage: non-HCPS patients	n = 8	n = 70	
Total units of blood products	59 (± 44.0)	15.3 (± 21.4)	0.0261 *
Total RBC units	37.3 (± 40.5)	9.0 (± 11.7)	0.0923
Total Plasma units	8.0 (± 4.3)	3.0 (± 6.8)	0.0139 *
Total PLT units	12.9 (± 7.8)	2.0 (± 2.8)	0.0047 *
Total Cryo units	0.9 (± 1.5)	1.0 (± 2.4)	0.4706

Poster #32

Hospital-Acquired Pressure Injury Prevention Utilizing Prophylactic Silicone Foam Dressings in Cardiac Surgery Patients

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Purpose: Hospital acquired pressure injury (HAPI) is a common and costly complication during hospitalization. Cardiac surgery patients are at particular risk with reported incidence as high as 29%. Routine prevention methods appear inadequate for this unique population. This study sought to determine whether a prophylactic silicone foam dressing could decrease occurrence.

Methods: Utilizing a prospective study design, over an 18 month period from November, 2017 through April, 2019, 211 consecutive open heart surgery patients underwent placement of a silicone foam dressing on the sacrum immediately prior to the procedure. Elective, urgent, and emergent surgeries were included consisting of CABG, AVR, MV repair/replacement, CABG/valve, and aortic procedures. All were performed on pump via sternotomy. The only exclusion criterion was allergy to the dressing material of which there were none. Sacral skin integrity was examined preoperatively, following dressing removal at the time of first shower, prior to discharge, and 30 days postoperatively.

Results: Prior to the initiation of this study, the cardiac surgery program at a suburban community health system had only anecdotal reports of HAPI following procedures as no formal monitoring/tracking program was in place. After adoption of an initiative to place prophylactic sacral silicone foam dressings, only 1 of 211 consecutive patients developed a suspected deep tissue injury of the buttocks with no sequela. HAPI risk factors include compressive and shearing forces that directly contribute to pressure and the tissue's tolerance for such pressure ultimately mediates damage. Silicone foam dressings allow for the redistribution of pressure over a larger area, translation of shear forces beyond the immediate region, reduction of friction, and maintenance of a balanced microclimate. Application of such dressings resulted in significant potential cost savings, length of stay reduction, as well as improved patient, family, and staff satisfaction.

Conclusions: Following application of a prophylactic silicone foam dressing to the sacrum of open heart surgery patients, a HAPI incidence of 0.005% was achieved. This low cost intervention in association with other HAPI prevention methods including skin risk assessment, appropriate surface support, turning/repositioning, and adequate nutrition should be more widely adopted.

Poster #33

Initial Experience with Enhanced Recovery after Surgery at a North American Academic Cardiac Surgery Center: A Comparative Analysis

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Purpose: Enhanced Recovery After Surgery(ERAS) pathways have led to improved patient satisfaction, cost-effectiveness and morbidity across many surgical fields. Cardiac centers have increasingly adopted ERAS. However, reports of outcomes are scarce in literature. The aim of this study was to determine the effect of our recently adopted ERAS pathway on outcomes.

Methods: Patients enrolled in the ERAS pathway in our institution who underwent isolated CABG, isolated AVR, and MV repair or replacement. Exclusion criteria included, age>76, previous cardiac surgery, urgent/emergent cases, EF < 5 0%, severe COPD, renal failure, liver dysfunction, carotid stenosis, previous CVA, poorly-controlled diabetes, bleeding disorders, frailty, dementia, pulmonary hypertension, atrial fibrillation and previous chest radiation. Selected patients were treated with multimodal protocol aimed at pre-, intra-, and post-operative interventions in concert to optimize outcomes and the patient experience. A retrospective cohort of non-ERAS patients were identified using the same criteria for comparison.

Results: One hundred and two patients underwent cardiac surgery in the ERAS pathway from May 2018-March 2019 at our institution (ERAS group). 303 patients were identified as the control cohort retrospectively from Jan 2016-March 2018 (non-ERAS group). Preoperative characteristics were comparable between the two groups (Table). The ERAS group was extubated earlier after surgery, had significantly shorter median ICU stay (29 vs. 45 hours; p 0.01). There were no readmissions to the ICU in either group. Reoperation for bleeding, stroke, new atrial fibrillation, and readmission within 30 days, were similar between groups.

Conclusions: Despite the small sample size of this study, we found shorter ICU stay and one day shorter hospital stay in the ERAS pathway patients. A larger analysis of ERAS in cardiac surgery is warranted, which may show benefit in terms cost reduction while improving outcome.

Table. Comparison of preoperative characteristics, operative details, and post-operative outcomes between control cohort during pre-ERAS era and ERAS pathway patients. Data presented as mean (SD) or numbers (%) or median (range).

	Pre-ERAS Patients	***ERAS Patients***	
Number of patients	303	102	*P* ≤
Demographics and characteristics			
Age	61.5(10.6)	62.1 (10.3)	0.610
≥80	0(0.0)	1 (1.0)	0.252
Women	82 (27.1)	45 (44.1)	0.010
BMI	28.7 (5.0)	28.8 (4.9)	0.960
CKD (GFR<60)	40 (13.2)	23 (22.5)	0.028
Preop GFR	75.3 (15.5)	74.1 (20.5)	0.593
Dyslipidemia	81 (26.7)	32 (31.4)	0.374
Diabetes	48 (15.8)	22 (21.6)	0.225
Hypertension	77 (25.4)	32 (31.4)	0.248
CVD	0 (0.0)	13 (12.7)	0.001
Previous stroke	0 (0.0)	5 (4.9)	0.001
PVD	9 (3.0)	2 (2.0)	0.738
Arrhythmia	66 (21.8)	20 (19.6)	0.677
CHF in previous 2 weeks	42 (13.9)	10 (9.8)	0.392
NYHA class III/IV	15 (5.0)	8 (7.8)	0.322
EF %	60 (57, 65)	60 (57, 65)	0.600
Operative details			
Reoperation	0 (0.0)	3 (2.9)	0.016
Procedure			
Iso CABG	115 (38.0)	27 (26.5)	
Iso AVR	92 (30.4)	36 (35.3)	
Iso MVR	14 (4.6)	5 (4.9)	
Iso MVP	82 (27.1)	24 (23.5)	
Other	0 (0.0)	10 (9.8)	
Perfusion time (min)	99 (80, 125)	99 (86, 120)	0.479
Cross-clamp time (min)	76 (63, 119)	74 (64, 96)	0.602
Extubation in the OR	4 (1.3)	1 (1.0)	1.000
Postoperative outcomes			
Reop for bleeding	3 (1.0)	1 (1.0)	0.575
Stroke	7 (2.3)	1 (1.0)	0.747
AKI	3 (1.0)	0 (0.0)	0.575
New AF	58 (19.1)	13 (12.7)	0.175
Vent time (hrs)	4.9 (3.6, 7.0)	3.6 (3.1, 6.4)	0.025
Vent>24h	7 (2.3)	2 (2.0)	1.000
Reintubation	5 (1.7)	0 (0.0)	0.337
ICU stay (hrs)	45 (25, 65)	29 (23, 48)	0.003
LOS (days)	6 (5, 7)	5 (4, 7)	0.017
Operative mortality	1 (0.3)	0 (0.0)	1.000
Discharge location			0.640
Home	280 (92.7)	97 (95.1)	
Rehab	20 (6.6)	5 (4.9)	
Readmission <30d	33 (10.9)	14 (13.7)	0.471

Poster #34

Standard Central Venous Catheter-Directed Thrombolysis for Massive Pulmonary Embolism with High Bleeding Risk

Molly Johnson, *Keith Azevedo, Todd Dettmer, Isaac Tawil*
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Purpose: Systemic thrombolysis via bolus administration is standard treatment for massive PE. For patients with bleeding risk, ultrasound assisted PA catheter directed thrombolysis using low dose continuous infusion offers a safe alternative. We present a case of massive PE treated with low dose continuous thrombolytic infusion via standard central venous catheter.

Methods: We performed a retrospective chart review and subsequent review of the literature, evaluating options for massive PE management in patients with high risk of hemorrhagic complications.

Results: A 61-year-old male with prostatic hypertrophy and ongoing gross hematuria requiring continuous bladder irrigation was found to have occlusive and nonocclusive bilateral main pulmonary artery emboli with evidence of right heart strain. Echocardiography demonstrated RV/LV ratio of 1.3 with moderate pulmonary HTN (PASP 49), reduced RV function (TAPSE 1.5) and thrombus in the RV. Patient was hypoxemic and hypotensive requiring supplemental oxygen and norepinephrine support. Despite these interventions and a heparin infusion patient remained unstable. Ongoing hematuria excluded patient from both systemic thrombolysis and standard catheter directed management protocols. A right internal jugular central venous catheter (CVC) was deliberately placed at 20 centimeters with the tip in the RV and tissue plasminogen activator (tPA) infused at a rate of 1mg/hour for 24 hours. Patient received 2 unit packed red cells during this time, and was weaned off vasopressor support. Post thrombolysis echocardiogram showed improved RV dilatation, function, with decreasing pulmonary hypertension and RV thrombus.

Conclusions: In a patient in whom systemic thrombolysis and PA catheter directed thrombolysis was contra-indicated, low dose tPA infusion administered in the RV via standard CVC was effective in treating a massive PE and resolving right heart strain. This may be a safe alternative for patients with high risk of hemorrhage.

Poster #35

Early Results from a Ketamine-Based Multimodal Analgesic Regimen for Enhanced Recovery after Surgery

***Rawn Salenger*[1]**, *Rebecca Sandler*[1], *Elizabeth Holderness*[1], *James Hensley*[1], *Kyungsook Gartrell*[2], *Michael Boss*[1], *Linda Barr*[1]
[1]*University of Maryland St. Joseph Medical Center, Towson,* [2]*Towson University, MD*

COMMERCIAL RELATIONSHIPS R. Salenger: Speakers Bureau/ Honoraria, Edwards Lifesciences

Purpose: The optimal opioid-sparing regimen following cardiac surgery has yet to be defined. There are few cardiac surgery specific studies assessing continuous ketamine infusion postoperatively. We sought to define the feasibility and opioid-sparing efficacy of a ketamine based multimodal analgesic regimen in the cardiac surgery intensive care unit (CSICU).

Methods: We performed a retrospective analysis comparing opioid requirements in the first twenty-four hours following coronary artery bypass, before and after implementation of a ketamine-based protocol. Group 1, pre-ERAS, was 56 patients from March and April, 2018 treated postoperatively with intravenous dexmedetomidate, and demand opioids and benzodiazepines. Group 2, the ERAS group, was 71 patients from March and April, 2019 who received a multimodal analgesic regimen of intravenous ketamine, oral acetaminophen, gabapentin, and dexmedetomidate, with minimal opioids. Ketamine was started in the operating room with a 0.5 mg/kg intravenous bolus and continued as an infusion in the CSICU of 0.1-0.5 mg/kg/hr.

Results: Total opioids, measured in mean morphine equivalents (mg), was significantly lower for the ERAS patients over the first postoperative twenty-four hours with Group 1 (non-ERAS) receiving a mean of 87.6mg and Group 2 (ERAS) receiving 55.8mg (95% CI = 16.8 to 46.7, p

Conclusions: Continuous ketamine infusion appears safe and potentially effective as part of an opioid-sparing strategy in the first twenty-four hours post cardiac surgery. More study is needed to define the efficacy of ketamine and the ideal multimodal analgesic regimen post cardiac surgery.

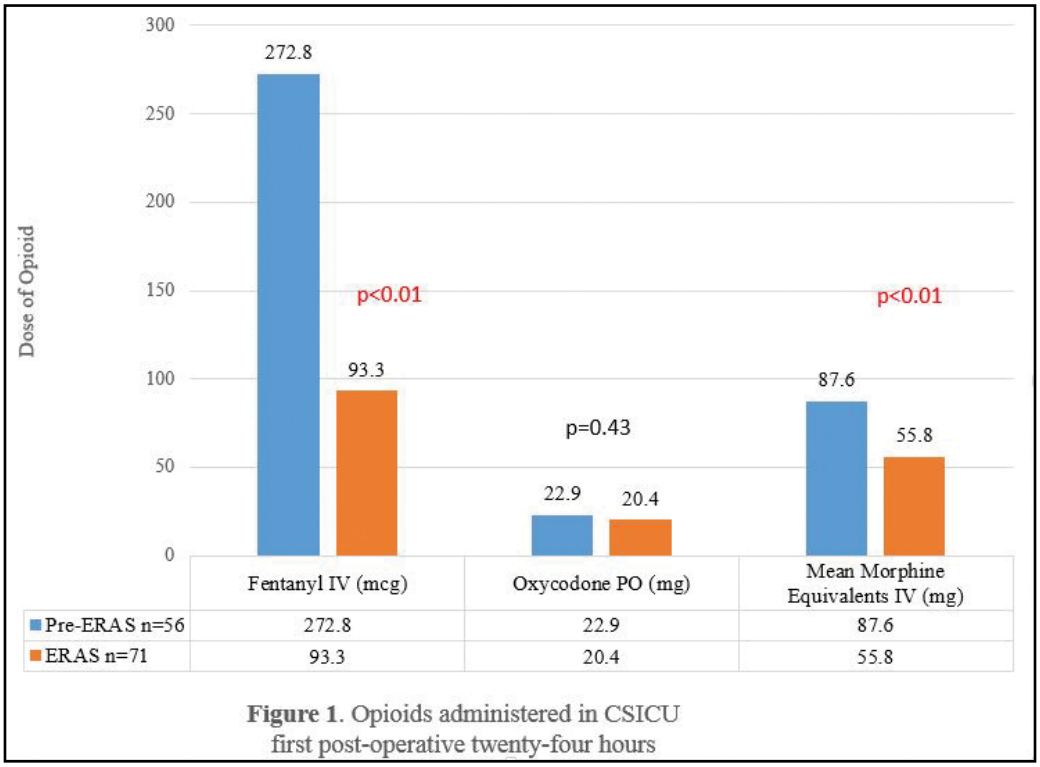

Figure 1. Opioids administered in CSICU first post-operative twenty-four hours

Poster #39

Serial Measurement of Immune Cells in Patients with Aortic Dissection

In Seok Jeong
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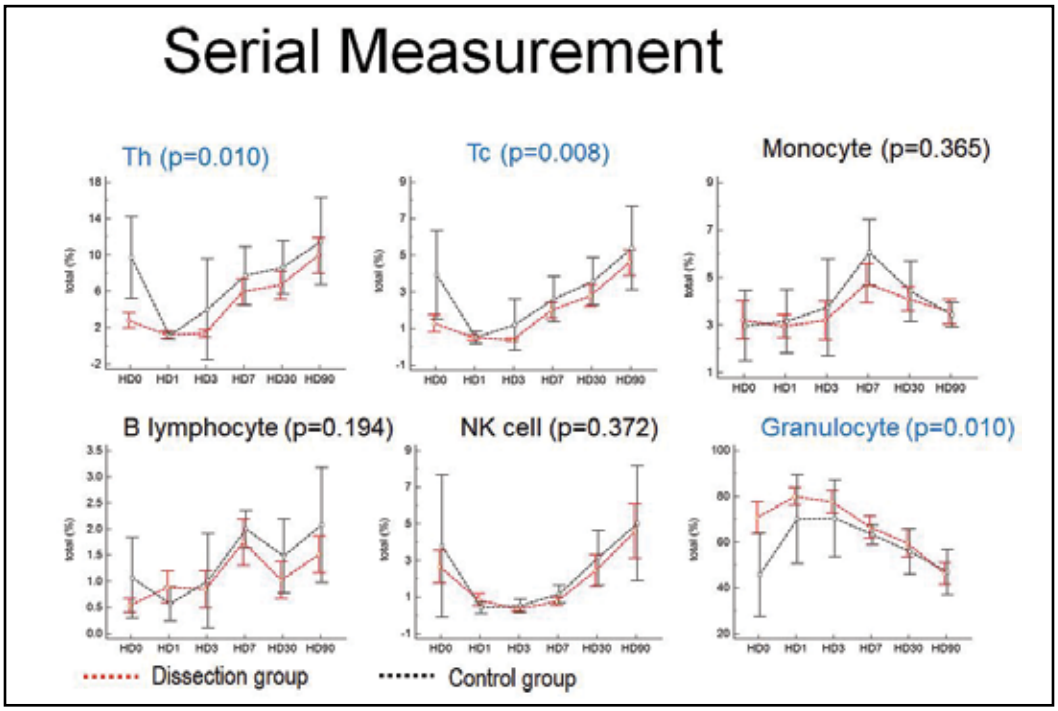
Purpose: Acute aortic dissection is a life-threatening condition and is expected to cause many adverse effects on immune system. Cardiopulmonary bypass also activates various immune responses to produce pro- and anti-inflammatory mediators. We examined the serial measurement of major immune cells in patients with acute aortic dissection.

Methods: We retrospectively evaluated 41 consecutive patients who had undergone the aortic surgery. Patients were divided into 2 groups: Aortic Dissection group and Control group (patients with surgically repaired aortic aneurysm). All clinical characteristics were compared between the 2 groups. Blood sample tests were performed on the day of admission, day1, day3, day7, day 30 and day90 of admission. Granulocyte, helper T cell, cytotoxic T cell, regulatory T cell, B-cell, NK cell subtypes, Monocyte subtypes level were measured in the peripheral blood by flow cytometry.

Results: Mean age was 68.0±12.7 (32~90) years old and male were 21 patients (51.2%). In-hospital mortality occurred in 1 patient (2.4%). At the time of admission, most of immune cells were statistically significantly decreased in Dissection group, compared to Control group, while granulocyte was significantly increased in Dissection group ($p < 0.0001$). These immune dysfunctions were significantly more aggravated in patients with hemopericardium and longer CPB time. Immune dysfunction was the most severe at 3 days postoperatively ($p < 0.05$), and was not recovered until 3 months.

Conclusions: We observed more severe immune dysfunction in the dissection group, and this phenomenon persisted for several months postoperatively.



Poster #41

Incidence and Clinical Pattern of Atrial Fibrillation after Esophagectomy, Pleurectomy, and Pneumonectomy

Luis De León, *Michael Jaklitsch, Namrata Patil*
Brigham and Women's Hospital/Harvard Medical School, Boston, MA

Purpose: New-onset atrial fibrillation (AF) after thoracic surgery is a common event. Incidence has been reported between 12–44%. The purpose of this study is to determine the incidence of atrial fibrillation, in patients undergoing major thoracic surgery including esophagectomy, pneumonectomy or pleurectomy at a single, large volume academic center.

Methods: All patients undergoing esophagectomy, pneumonectomy or pleurectomy between May 2016 and October 2018 were prospectively included in this study. Patients were divided into two groups based on whether they developed atrial fibrillation on telemetry or EKG, and only incident cases were included in the AF group. Data regarding patient demographics, number of cardiac medications given, any complications, hospital length of stay (LOS) and disposition was collected prospectively.

Results: The study included 433 patients: 253(58%) underwent an esophagectomy, 128(30%) a pleurectomy and 52(12%) a pneumonectomy. Median age at surgery was 66 years (18–96), and 77% of the cohort was male. Overall, 79(18%) patients developed new-onset AF. Of these, patients with esophagectomies had the highest rate (58%). The incidence of AF for esophagectomy, pleurectomy and pneumonectomy was 46(18%), 26(20%) and 7(13%) respectively. Table 1 shows the characteristics and outcomes of the cohort. Patients with AF were more likely to be male and older at the time of surgery. Hospital LOS was significantly higher in those with AF, however when stratifying by surgery, this remained significant only for esophagectomies and pleurectomies. Patients undergoing esophagectomy who developed AF had a higher incidence of esophageal leak. Patients in the AF group were more likely to experience pulmonary and genitourinary complications, and less likely to be discharged home without services.

Conclusions: Patients undergoing pleurectomy appear to have the highest incidence of AF. New-onset AF was associated with pulmonary and genitourinary complications, and longer hospital LOS. For esophagectomy patients, AF was associated with anastomotic leaks. Development of AF should prompt vigilance for the presence of other complications in these thoracic surgery patients.

Variable	Total Cases n=433	Atrial Fibrillation n=79	No Atrial Fibrillation n=354	p-value
Gender, male, n (%)	98 (23)	71 (90)	264 (75)	**0.003***
Age, median (range)	66 (18 – 96)	68 (46 – 87)	66 (18 – 96)	**0.02***
Surgery Type, n (%)				
Esophagectomy	253 (58)	46 (58)	207 (58)	0.96
LOS, median (range)	**9 (6 – 47)**	**11 (7 – 38)**	**9 (6 – 47)**	**0.001***
Pleurectomy	128 (30)	26 (33)	102 (28)	0.47
LOS, median (range)	**14 (3 – 86)**	**18 (7 – 108)**	**14 (1 – 86)**	**0.03***
Pneumonectomy	52 (12)	7 (9)	45 (13)	0.34
LOS, median (range)	**7 (3 – 130)**	**6 (5 – 130)**	**7 (3 – 41)**	0.96
Open Operative Approach	196	40 (51)	156 (44)	0.28
Patients with Complications other than Afib	223 (52)	48 (61)	175 (49)	0.06
Esophageal Leak+	13/253 (5)	8/46 (17)	5/207 (2)	**<0.001***
Pulmonary Complications	117 (27)	29 (37)	88 (25)	**0.03***
Genitourinary Complications	32 (7)	10 (13)	22 (6)	**0.04***
DVT/PE	47 (11)	12 (15)	35 (10)	0.17*
Hospital LOS, days, median (range)	10 (1 – 130)	14 (5 – 130)	10 (1 – 86)	**<0.001***
Operative Mortality, n (%)	10 (2)	4 (5)	6 (2)	0.08
Disposition, n (%)				
Home	41 (9)	2 (3)	39 (11)	**0.01***
Home w/ Service	310 (72)	56 (71)	254 (72)	0.87
Rehab	62 (14)	14 (18)	48 (14)	0.33
Nursing Home	8 (2)	2 (3)	6 (2)	0.64
Hospice	2 (0.4)	0	2 (0.5)	1.0

*Statistically Significant
+Only for patients undergoing esophagectomy

Poster #42

Taking Patient Engagement Technology from Pilot to Standard-of-Care

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Purpose: Patient engagement is fundamental for desirable health outcomes. Hospitals pilot many new patient-centered innovations, with varying success in going from a small pilot study to becoming standard-of-care. This project reviews strategies employed by two cardiac centers to successfully pilot, achieve results and operationalize patient engagement technology at their institutions.

Methods: Two cardiac centers utilized a Lean Six Sigma methodology and PDSA (Plan-Do-Study-Act) approach to implement a patient engagement technology in the form of a web and mobile application for peri-operative cardiac care. A nursing lead from each hospital led a multi-stakeholder engagement process and implementation, and closely monitored the pilot. Goals included reducing length-of stay, readmissions and patients being discharged to a skilled nursing facility. At multiple points throughout the pilot, teams completed outcomes analyses of increasingly larger sample sizes, which were used to gain the necessary buy-in of institutional leadership to transition the technology from pilot to standard-of-care.

Results: Early engagement with the full multi-disciplinary care team was critical to create a sense of ownership and achieve buy-in throughout the pilot. Weekly check-ins to review patient activity data and feedback allowed for continuous iterations and identifying ways to improve patient adoption over time. Quarterly reviews of the data with the full multi-disciplinary care team were crucial to celebrating success and sustaining momentum during and after the pilot. Assessment of patients' willingness to embrace the use of technology was critical to demonstrate the value of continued investment in engagement technology. Findings from the pilots were presented to institutional leadership. Each institution showed reductions of at least 1 day in length of stay, a relative 21-45% reduction in readmissions and a 25-64% relative reduction in patients being discharged to a skilled nursing facility. After completing a return-on-investment analysis, hospital leadership agreed to continue funding the technology for the following year.

Conclusions: Important factors in moving this project from pilot to standard-of-care were sustained engagement of stakeholders, frequently reviewing and sharing results, and clearly demonstrating a return-on-investment for leadership while proving that such a program could be managed sustainably in an environment where team members are already working at or above capacity.

Poster #43

Prolonged Ventilation Rates in Complex Cardiac Surgery Patients

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Purpose: Advanced heart failure patients undergoing durable LVAD (dLVAD) and orthotopic heart transplant (OHT) have described rates of prolonged ventilation ranging as high as 40%. Minimizing prolonged ventilation is a component of Enhanced Recovery After Surgery (ERAS) protocols in CABG and valve surgeries, and is a focus at our institution.

Methods: A retrospective chart review of cardiac surgery patients who underwent OHT and dLVAD placement at an academic tertiary care center from June 2014 to May 2019 was performed using of the electronic medical record (EMR). CPT codes (33945, 33979) were used to identify patients who had undergone the pre-specified procedures. Post-operative ventilation times were determined using available EMR chart data. The rate of prolonged ventilation was determined using the currently defined criteria for prolonged ventilation specified by the Society for Thoracic Surgeons (STS).

Results: In unadjusted analysis, over 5 years, among 101 OHT patients and 181 dLVAD patients, the observed rate of prolonged ventilation >24 hours was 37.6% and 38.7 %, respectively.

Conclusions: Our findings suggest that amongst the most complex cardiac surgery patients (OHT, dLVAD), up to 60% can be extubated in <24 hours. This may be related to our instructional use of ERAS protocols. ERAS protocols addressing prolonged ventilation should be considered for all cardiac surgery patients, regardless of surgery performed.

Prolonged Ventilation By Surgery, Year

Year	2014	2015	2016	2017	2018	2019
OHT	(6/9)	(2/14)	(4/16)	(8/25)	(11/25)	(7/12)
dLVAD	(8/20)	(12/44)	(18/44)	(12/34)	(17/33)	(3/6)

OHT n=101	OHT rate= (38/101)= **37.6%**
dLVAD n=181	dLVAD rate= (70/181)=**38.7%**
Total n=282	Total rate= (108/282)=**38.3%**

Poster #44

Effect of Enhanced Recovery after Surgery on Cardiac Surgery Outcomes

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Robert Wood Johnson Medical School, New Brunswick, NJ

Purpose: Enhanced Recovery After Surgery (ERAS) is a multimodal, multidisciplinary approach to the care of the surgical patient. The effect of ERAS on cardiac surgery patients has not been well reviewed. The purpose of the study is to determine the impact of ERAS on cardiac surgery patients.

Methods: A comprehensive literature search was made on PubMed, CINAHL, Ovid, ProQuest, ScienceDirect, Scopus, Web of Science, and the Cochrane database between 1995 and 2015. Eight randomized controlled trials were included. Data analysis was performed with RevMan software and created the Supplementary Appendix using the GRADE approach.

Results: Meta-analysis showed that ERAS reduced length of stay (LOS) from 8 days to 7 days (P value 0.0022) on cardiac surgery patients. There was also an overall reduction in the number of total postoperative complications for the patients that were treated under the ERAS protocol, 5.7% to 6.0%, p value < 0 .05). A difference in mortality could not be assessed as the majority of the studies did not include mortality as a variable.

Conclusions: Enhanced Recovery After Surgery is an evidence-based care improvement process for surgical patients. Implementation of ERAS programs suggest there are improvements in clinical outcomes particularly LOS and overall complications. Further prospective studies will elucidate other areas of enhancement.

Poster #45

Decreasing Ventilator Hours through a Nurse-Led Weaning Protocol

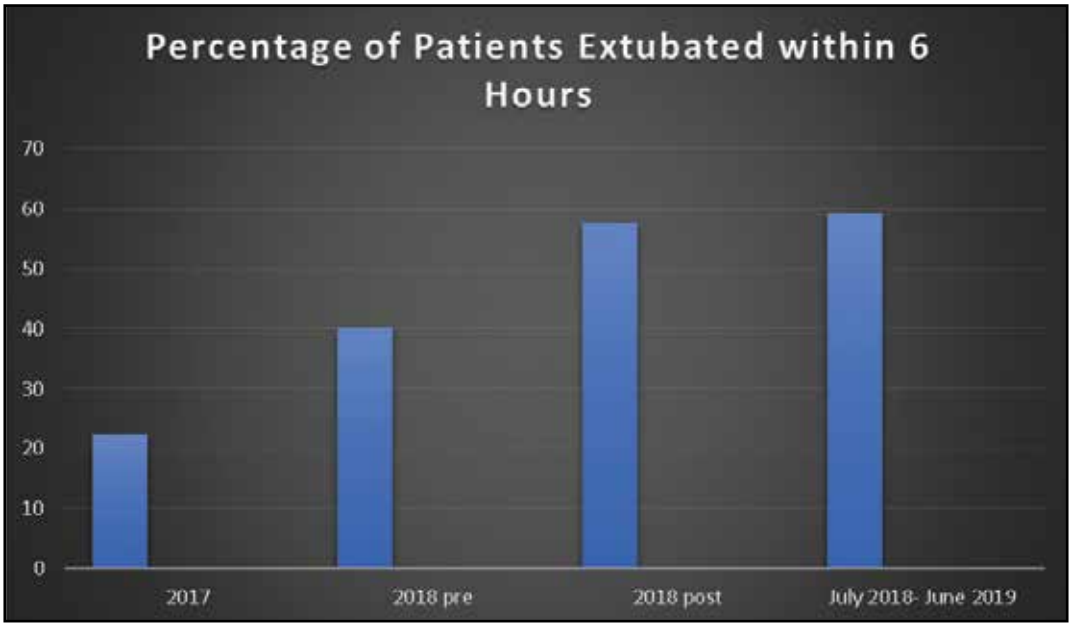
Catherine Tierney, *Maria Jurlano*
Virginia Hospital Center, Arlington

Purpose: Lack of standardization in ventilator weaning increases anxiety, exposure to sedation and risk of infection for patients after cardiac surgery. Extubating patients within 6 hours improves outcomes, reduces costs and optimizes resources without increasing risks. Despite this, many programs do not meet this 6-hour goal for their patients.

Methods: This quality improvement (QI) project compared the percentage of patients extubated within 6 hours before and after the implementation of a nurse-led ventilator weaning protocol in our cardiac surgery intensive care unit (CVICU). The sample included all isolated coronary artery bypass surgery (CABG) patients who met the criteria for protocol use. Emergency cases and patients with postoperative assistive devices were excluded. An interprofessional committee was formed to create the algorithm to guide the nurse to assess patient readiness to wean and to extubate. The protocol was implemented on July 1, 2018. Data were collected from that date to May 31, 2019.

Results: In 2017, 22.3 % of our isolated CABG patients were extubated within the Society of Thoracic Surgery (STS) recommended 6-hour window. Data were gathered in early 2018 to assess barriers to ventilator weaning. It was discovered that there was much variation in the methods nurses used to wean patients from the ventilator and in their experience with ventilator weaning. After raising awareness, we tracked the pre-intervention patients in 2018 from January to July, and found that extubation within 6-hours rose to 40%. Following the implementation of the nurse-led ventilator weaning protocol, from July 1 to December 31, 2018, 57.7% of patients met the STS guidelines of extubation within six hours. This change has been sustained for 11 months. Of the 174 solo cardiac surgery patients who met criteria since the protocol was implemented, 103 (59.2%) were extubated within 6 hours of admission to the CVICU.

Conclusions: Implementation of a nurse-led weaning protocol for cardiac surgery patients is successful in decreasing ventilator hours. These results are shown to be sustainable for one year. To further improve outcomes, emphasis should be placed on continued nursing education and improved patient comfort and anxiety.



Poster #46

To Vent or Not to Vent? Left Ventricle Decompression in Peripheral Venoarterial Extracorporeal Membrane Oxygenation

Patricia Raval, *Jason Johnson*
AdventHealth Orlando, FL

Purpose: This analysis summarizes available literature surrounding the concept of pathologic pulmonary edemaLV distention and the associated sequelae, in patients on peripheral VA ECMO. Simultaneously, it seeks to determine whether an LV venting strategy can be used to successfully treat or prevent these complications.

Methods: A PubMed literature search was conducted with search terms VA ECMO, peripheral, acute lung injury (ALI), pulmonary edema, left ventricle (LV) vent, and LV distention. Twenty-one articles were available for review and are the basis for this analysis.

Results: A poorly contractile LV may not allow for aortic valve opening against the increased afterload caused by the retrograde blood flow in peripherally inserted VA ECMO. Consequently, LV distention and resultant pressure/volume overload will result. This causes pulmonary edema, increased LV wall strain, increased myocardial oxygen consumption, and increased risk of LV thrombus formation as complications of peripheral VA ECMO under these conditions. Decompressing the LV by means of a percutaneous or surgical vent, can potentially prevent these complications by decreasing the the left ventricular end diastolic pressure and subsequent reflected fluid pressure/volume into the lungs. Observational studies have shown that patients who do not suffer acute lung injury (ALI) from pulmonary edema have improved survival compared to subjects who suffer from pulmonary edema and ALI.

Conclusions: Complications of peripheral VA ECMO can limit survival. Pulmonary edema, LV thrombus formation and increased myocardial oxygen consumption may result in higher morbidity and mortality. A randomized trial of LV vents in patients requiring VA ECMO, may elucidate if LV venting would decrease these complications and increase survival to discharge.

Poster #47

Systemic Thrombolysis in Massive Pulmonary Embolism Patients Requiring Extracorporeal Membrane Oxygenation Does Not Significantly Impact Bleeding Events, Blood Utilization, or Mortality

Kathleen Madden, *Preeyaporn Sarangarm, Jamie Shaffer, Jay Raval, Sundeep Guliani, Jonathan Marinaro*
University of New Mexico, Albuquerque

Purpose: Systemic thrombolysis is the standard of care for acute massive pulmonary embolism (PE). At our institution, we employ an ECMO-first strategy for massive PE. With accompanying cardiac arrest, massive PE patients may still receive Alteplase. We hypothesized patients treated with systemic thrombolysis and ECMO may bleed more.

Methods: All adult massive PE patients cannulated for ECMO from 03/01/2017 to 04/30/2019 were retrospectively reviewed. Clinical data collected included whether the patient received systemic thrombolysis with Alteplase, occurrence of bleeding events while on ECMO, and mortality. Transfusion information collected included whether patients required massive transfusion protocol (MTP) activation and the numbers of red blood cell (RBC), plasma, platelet, and cryoprecipitate units transfused while on ECMO. Unpaired t-test and Fischer's exact test were used and p < 0 .05 was statistically significant.

Results: During the study period, 14 patients required ECMO as part of treatment for massive PE. Three patients received systemic Alteplase (group 1) and 11 patients did not (group 2). Alteplase dose was variable and at the intensivist's discretion. Clinically significant bleeding events occurred in two group 1 patients (67%) and six group 2 patients (55%) (p=1.000). There were no significant differences in blood product utilization between the two groups (see Table 1). Two patients in group 1 (67%) required MTP activation compared with one patient in group 2 (9%) (p=0.0934). There was no significant difference in mortality between the two groups (p=0.3956).

Conclusions: Although our intra-arrest patient numbers are small, systemic thrombolysis did not significantly increase bleeding nor blood product usage, with no mortality difference seen in adult massive PE patients requiring ECMO cannulation. Future studies should focus on attaining greater numbers of patients in both groups to evaluate the validity of this data.

Table 1: Blood Product Utilization in Massive PE Patients Requiring ECMO*

	All Patients (n=14)	**Systemic Alteplase Patients** (n=3)	**No Systemic Alteplase Patients** (n=11)	**p-value**
Total blood products	11.9 (± 13.8)	12.2 (± 8.3)	12.0 (± 15.1)	0.9307
RBC units	7.0 (± 7.7)	7.0 (± 5.0)	7.0 (± 8.3)	1.0000
Plasma units	2.1 (± 3.8)	3.0 (± 2.2)	2.0 (± 4.2)	0.7415
Platelet units	1.1 (± 1.6)	1.0 (± 0.8)	1.2 (± 1.8)	0.4319
Cryoprecipitate units	1.6 (± 2.6)	1.3 (± 1.5)	1.8 (± 2.9)	0.5603

*Data presented as mean (± standard deviation)

Poster #48

Inhaled Nitric Oxide Utilization in Primary Lung Transplantation—Preoperative Donor and Recipient Risk Factors and the Impact on Postoperative Outcomes: A Single-Center Retrospective Analysis

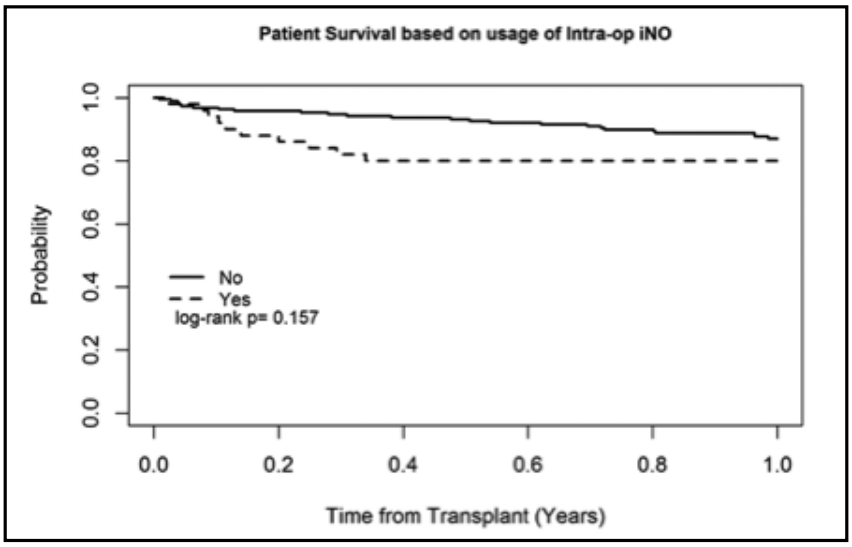
Austin Kluis, *Stephen Huddleston, Scott Jackson, Nicholas Lemke*
University of Minnesota, Minneapolis

Purpose: Inhaled nitric oxide (iNO) is used in lung transplantation to decrease pulmonary arterial pressure and pulmonary vascular resistance, while ameliorating hypoxia and right ventricular dysfunction. This study aims to determine preoperative donor or recipient characteristics associated with intraoperative utilization of iNO and the effect iNO has on postoperative outcomes in lung transplantation.

Methods: We performed a retrospective review of all primary lung transplant patients at the University of Minnesota from 1/01/2014 to 12/31/2018 corresponding to 239 patients. 50 Patients received iNO and 189 patients did not. Recipient and donor characteristics were compared using a Wilcoxon test for continuous values, or a Chi-square test for categorical values. Kaplan-Meier curves for patient survival (censored at one year) were compared using a log-rank test. All analysis was performed in R (ver. 3.6.0).

Results: 50 of 239 patients received intaoperative iNO and these recipients had a statistically significant higher BMI(28.4 vs. 24.9 p = < 0 .001), UNOS LAS(44.8 vs. 36.4 p = < 0 .001), mPAP(27.0 vs 24.0 mmHg p= 0.016) and sPAP(38.0 vs. 35.0 mmHg p = 0.011), FEV1(38.5% vs. 27.0% p=0.007), and lower FVC(41.5% vs. 49.0% p = 0.002). Use of iNO was not associated with any donor characteristics, single versus bilateral transplant, or maximum ischemic time. Postoperatively, iNO receiving patients had increased ventilator duration(32 (64.0%) vs. 47 (24.9%) p = < 0 .001), tracheostomy(18 (36.0%) vs. 27 (14.3%) p = < 0 .001), PGD3(15 (31.2%) vs. 14 (8.05%) p = < 0 .001) and dialysis(12 (24.0%) vs. 7 (3.70%) p = < 0 .001%), but no difference in one year mortality (p=0.157).

Conclusions: Patients receiving iNO have higher BMI, LAS, mPAP, sPAP, FEV1, and lower FVC. Use of iNO is not associated with any donor characteristics, single versus bilateral transplant, or maximum ischemic time. Postoperatively, iNO patients have increased ventilator duration, tracheostomy, PGD3 and dialysis, but no difference in one year mortality.



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Characteristics by iNO use - Median [IQR] or n (%)	N=189 (No iNO)	N=50 (iNO)	pvalue
Recipient Characteristics			
Female	90 (47.6%)	19 (38.0%)	0.292
Age	59.9 [53.8;64.7]	58.7 [50.8;64.6]	0.46
White	180 (95.2%)	43 (86.0%)	0.049
UNOS LAS Score	36.4 [33.7;43.2]	44.8 [39.1;84.8]	<0.001
BMI	24.9 [21.1;28.4]	28.4 [25.3;30.3]	<0.001
Bilateral Transplant	132 (69.8%)	35 (70.0%)	>0.999
Max Ischemic Time	343 [286;408]	372 [318;435]	0.071
Chronic steroid use	90 (47.9%)	29 (58.0%)	0.265
Blood type:			0.601
A	78 (41.3%)	17 (34.0%)	
AB	9 (4.76%)	1 (2.00%)	
B	20 (10.6%)	7 (14.0%)	
O	82 (43.4%)	25 (50.0%)	
CMV positive Serology	97 (51.3%)	22 (44.0%)	0.446
EBV positive Serology	181 (95.8%)	48 (98.0%)	0.69
Systolic Pulmonary artery Pressure	35.0 [31.0;42.0]	38.0 [35.0;53.0]	0.011
Mean Pulmonary artery Pressure	24.0 [20.2;29.0]	27.0 [23.0;32.0]	0.016
Pulmonary Capillary Wedge Pressure	10.0 [7.25;13.0]	10.0 [9.00;14.2]	0.294
Forced Vital Capacity	49.0 [40.0;59.0]	41.5 [35.0;50.5]	0.002
Forced Expiratory Volume 1 second	27.0 [19.0;47.5]	38.5 [27.0;51.2]	0.007
PCO2	47.0 [43.0;53.0]	48.0 [43.0;53.0]	0.672
Donor Characteristics			
Donor Age	35.0 [23.2;47.8]	39.4 [28.2;49.5]	0.208
BMI	25.6 [22.4;28.5]	26.0 [23.6;30.5]	0.352
Donation after circulatory death	25 (13.2%)	11 (22.0%)	0.187
Cause of Death:			0.447
Brain anoxia	63 (33.7%)	18 (36.7%)	
CVA	49 (26.2%)	16 (32.7%)	
Head trauma	75 (40.1%)	15 (30.6%)	
Coronary Artery Disease	5 (2.65%)	1 (2.00%)	>0.999
Lung infection	88 (46.6%)	19 (38.0%)	0.356
CMV positive Serology	105 (55.6%)	27 (54.0%)	0.971
EBV positive Serology	171 (90.5%)	47 (94.0%)	0.58
Hx Cigarette use	24 (13.0%)	7 (14.0%)	>0.999
Hx of Diabetes	14 (7.45%)	3 (6.00%)	>0.999
Hx of Hypertension	49 (26.1%)	15 (30.0%)	0.705
Recipient Outcomes			
Tracheostomy prior to discharge	27 (14.3%)	18 (36.0%)	0.001
PGD3	14 (8.05%)	15 (31.2%)	<0.001
Reintubation	47 (25.0%)	10 (20.0%)	0.582
Postop ventilator duration:			<0.001
Off Ventilator within 48 hrs	107 (56.6%)	8 (16.0%)	
Ventilator >= 48 hrs < 5 days	35 (18.5%)	10 (20.0%)	
Ventilator support >= 5 days	47 (24.9%)	32 (64.0%)	
Dialysis within 1st week	7 (3.70%)	12 (24.0%)	<0.001

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New Orleans, Louisiana
October 23-25, 2019

ACS/STS Cardiothoracic Surgery in Your Future

San Francisco, California
October 28, 2019

STS/EACTS Latin America Cardiovascular Surgery Conference

Cancun, Mexico
November 22-24, 2019

STS Coding Workshop

New Orleans, Louisiana
January 24-25, 2020

STS 56th Annual Meeting

New Orleans, Louisiana
January 25-28, 2020

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