Big Data in Aortic Surgery: Update on the STS Aortic Database

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Why did we need to update the Aortic Component of the STS database?
Aortic Surgery has the highest SERIOUS complication rates of any cardiac Surgical procedures

Mortality by Procedure Type, Years 2005-2014

- Operative Mortality
- In-Hosp Mortality

- Total-All Procedures
- Ascending Aorta
- Aortic Arch
- Descending Aorta
- Thoracoabdominal Aorta

Aortic Surgery has the highest SERIOUS complication rates of any cardiac Surgical procedures.
Endovascular Revolution is Here!
Key Functionality of STS National Database Aortic Component

- Clear identification of patient phenotype
- Implantation details/Device-specific information
- Accommodation for Concurrent and Staged Hybrid procedures
- Detailed perioprocudural/30 day outcomes
- Aortic-Specific long-term follow-up for post-marketing analyses

** DUE TO COMPLEXITY – SURGEON INPUT INTO DATA ELEMENTS **
Clear Definition of Patient Phenotype
Clear Definition of Patient Anatomy

Sievers Classification for Bicuspid AV

Dissection Anatomy

Zone Anatomy

Diverticulum of Kommerrell

Sinus of Valsalva Aneurysm
Aneurysm Types

Saccular

Fusiform
Anatomy Examples

Sievers Classification for Bicuspid AV

Aorto-Annular Ectasia

Diverticulum of Kommerrell

Sinus of Valsalva Aneurysm
Aortic Dissection

A (I)

A (II)

B (IIIa)

B (IIIb)
Malperfusion Syndromes

- **Fixed Malperfusion**
  - Left carotid
  - Left subclavian
- **Dynamic Malperfusion**
  - Thrombus
  - Left renal
SURGICAL PROCEDURES

HYBRID/ENDOVOASCULAR PROCEDURES
Examples ‘Standard’ open Aortic repairs

Zone 3 Arch

Ascending only

Hemi Arch

Zone 2 Arch

Zone 3 Arch Elephant trunk

Zone 3 Arch Frozen Elephant trunk

Ascending only

Hemi Arch

Zone 2 Arch
Aortic Valve Procedures

- Ascending/valve resuspension
- Root Remodelling (Yacoub)
- Root Reimplantation
- Florida Sleeve
- Composite Root Replacement
- Aortic Valve External ring
HYBRID / ENDOVASCULAR PROCEDURES
Zone 0 Landing: Hybrid Arches
Total Endovascular Examples

- Zone 0 Single branch with double transposition
- Zone 1 Single Branch with C-S Bypass
- Zone 3 TEVAR
- Single Branched Graft for Zone 2
- Ascending TEVAR Graft

ZONE 0
Endo TAAA Examples

Fenestrated and Branched Grafts

Hybrid Abdominal Repair
Endoleaks
Aorta 2.9:
First YEAR!
July 1, 2017 to Jun 30, 2018

DID SURGEON PROVIDE INPUT FOR AORTIC SURGERY DATA ABSTRACTION?

- **YES**: 55%
- **NO**: 38%
- **UNKNOWN**: 7%
Aorta 2.9: First YEAR!
July 1, 2017 to Jun 30, 2018.

Aortic Procedures: 22014 cases in 12 mos
7.3% of all Adult Cardiac Surgery

Primary Indication of Aortic Surgery

- Aneurysm: 57.8%
- Dissection: 25.4%
- Valvular Dysfunction: 6.4%
- Obstruction: 0.4%
- Intramural Hematoma: 0.8%
- Infection: 3.0%
- Stenosis: 1.1%
- Coarctation: 0.3%
- Unknown: 4.8%
Aorta 2.9: First YEAR!
July 1, 2017 to Jun 30, 2018.
Aorta 2.9: First YEAR!

July 1, 2017 to June 30, 2018

Annualized Volume of Aortic Aneurysm Procedures

- Aortic Aneurysm (Total)
- Ascending Aorta
- Aortic Arch
- Descending Aorta
- Thoracoabdominal Aorta
Aorta 2.9: First YEAR!
July 1, 2017 to Dec 31, 2017
6072 Aneurysms

Aneurysm Location
Aorta 2.9: Roots for Aortic Insufficiency

VOLUME OF ROOT REPLACEMENT PROCEDURES (7/1/17-6/30/18)

VOLUME OF VALVE SPARING ROOT REPLACEMENT FOR AI (7/1/17-6/30/18)
Aorta 2.9: Dissection July 1, 2017 to Jun 30, 2018.

AORTIC DISSECTION: TIMING
5846 Aortic Dissections
AORTIC DISSECTION: PRIMARY TEAR LOCATION

- Below STJ: 21%
- STJ-Midascending: 37%
- Midascending to distal ascending: 13%
- Zone 1: 4%
- Zone 2: 4%
AORTIC DISSECTION: MALPERFUSION

PERCENTAGE OF CASES (%)

- 20% YES
- 62% NO
- 18% UNKNOWN

AORTIC DISSECTION: MALPERFUSION
AORTIC DISSECTION: MALPERFUSION BED

NUMBER OF CASES

CORONARY: 204 (Yes), 932 (No)
RIGHT COMMON CAROTID: 264 (Yes), 880 (No)
LEFT COMMON CAROTID: 183 (Yes), 954 (No)
VISCERAL: 329 (Yes), 1937 (No)
RENAL: 534 (Yes), 1735 (No)
ILIOFEMORAL: 352 (Yes), 780 (No)
DTA/Thoraco Abdominal Procedures

VOLUME OF DESCENDING AORTIC PROCEDURES

NUMBER OF CASES

- OPEN DESCENDING THORACIC AORTA: 886
- TEVAR: 1646
Aorta 2.9: First YEAR!
July 1, 2017 to June 30, 2018

TEVAR 1647 cases

Graphs showing the distribution of cases for open descending thoracic aorta and TEVAR, with details for proximal and distal lesions.
Final Endovascular Frontiers: Arch and Ascending Aorta
Circulatory arrest (both low/moderate and deep/profound) with no cerebral protection had significantly worse composite endpoint (mortality or poor neurologic outcome) [OR: 1.6; p<0.01]

60% more likely to have stroke/death if HCA only

Future Directions: Quality Improvement in Arch Surgery

Overall OP Mort: 12%
Overall Neuro/OP MORT 23%
Straight circulatory arrest with no cerebral perfusion strategy was the **MOST commonly used strategy** (36% of all cases)

**Major area for Quality Improvement**
Aorta 2.9: First YEAR!

July 1, 2017 to Jun 30, 2018.

CIRCULATORY ARREST

- AORTIC PROCEDURES: 22014
- CIRCULATORY ARREST: 10027
- ANTEGRADE PERFUSION: 4819
- RETROGRADE PERFUSION: 1793
- NO PERFUSION: 3067

30.5%
Aortic Surgery Risk Model Development

- Proximal Aortic Repair Risk model – Star-Rating

- Volume Thresholds, Regionalization of Aortic care?

- NOW HAVE ENOUGH DATA TO START MODEL DEVELOPMENT

Mori, Geirsson et al ATS 2018
THANK YOU!