The Binkley Visiting Professor Lecture

Thoracic Aortic Disease: A 25-year Perspective

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Massachusetts General Hospital
Professor of Surgery, Harvard Medical School

OUTLINE

• The Boston origins and evolution of surgery of the DTA/TAAA
• Lessons from open surgical experience esp. with SCI and its established and future role
• Impact of TEVAR to date and evolving role in a variety of thoracic aortic pathologies

LINTON – INTRASACULAR WIRING - 1952

50 YEAR FOLLOW-UP!

TOTAL ENDOVASCULAR REPAIR

• B/O variation in topography branched (vs. fenestration) is considered superior design
• ≈ 1,500 patients treated worldwide

All grafts custom designed
In U.S. limited to M.D. sponsored IDE sites
BRANCHED ENDOGRAFT FOR TAA

Endovascular treatment of thoracoabdominal aortic aneurysms

- 22 pts unfit for open surgery
- 9.1% mortality – 1 paraplegia/3 paresis
- 18% SCI of any degree !!
- 98% branch grafts patent @ one month

(J Vasc Surg 2008;47:6-16)

BOSTON ORIGINS OF DTA SURGERY

- Robert Gross, M.D. @ The Children’s Hospital 1945 → first direct repair coarc.

- At MGH Dr. Linton’s coarc. repairs

DR. GROSS AND SVS AT ITS INCEPTION

First Annual Meeting
Atlantic City, N.J.
Dennis Hotel
Sunday, June 8, 1947

Scientific Sessions

4. Surgical Treatment of Coarctation of the Aorta.

Program Committee
Arthur W. Allen, Chairman
Robert Linton
Etta Heroux
Arthur Drahoeck
Myrs Miss Gage

LINTON BEGINS THORACOABDOMINAL AORTIC SURGERY - 1956

- Dr. Linton begins thoracoabdominal aortic surgery in 1956.
**DR. LINTON’S CELEBRATED CASE**

- MGH Surgical Grand Rounds 1970
- 13 anastomoses, 5 scrub nurses, 7 residents – one of whom developed phlebitis, and Dr. Linton carried on for some 20 consecutive hours

**TAA REPAIR: THE BEGINNING**

*IT MUST BE DONE RIGHT*

**Prior to 1985 TAA repair @ MGH → 50% mortality!**
- Initial experience after 1986 in 30 patients → 8% mortality
- Impact of elective operation, ↓ op time, blood loss, x-clamp times

**Thoracoabdominal Aneurysm**

- Clamp/sew ≈ 80%
- Mortality ≈ 10%
- PParalysis/Paresis → 16%
  - half (8%) devastating pplegia

(J Vasc Surg 1993;17:357-70)

(Arch Surg 1989; 124:620)
**IMPACT OF SPINAL CORD ISCHEMIA**

- Adjuncts to prevent paraplegia → operative conduct

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**MGH APPROACH**

**CLAMP/SEW WITH ADJUNCTS**

- Cold perfusion in renal arteries
- In line mesenteric shunt
- Left renal bypass
- Intercostal reconstruction

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**REGIONAL HYPOTHERMIA FOR CORD PROTECTION**

A new technique for spinal cord protection

(Epidural cooling for regional spinal cord hypothermia during thoracoabdominal aneurysm repair)

**REFERENCES**


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**EPIDURAL COOLING**

- CSF Temperature and Pressure During Operation

**Graphical Representation**

- CSF Temperature Over Time
- Epidural Cooling Effectiveness

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**Construction Notes**

- Epidural cooling appears to be a revolutionary method of achieving regional spinal cord hypothermia in patients requiring resection of thoracic or thoracoabdominal aortic aneurysms. (*J Vasc Surg* 1994;20:304-10)
SUMMARY OF OPERATIVE TECHNIQUE

- Emphasis on expediency and simplicity
  - Clamp/sew without external bypass/perfusion
- In-line mesenteric shunt to decrease visceral ischemia
- Cold renal perfusion
- Epidural cooling for spinal cord protection
- Aggressive reimplantation of T9-L1 intercostals

MGH RESULTS

- 23% non-elective cases
- Overall mortality 8%
- Major SCI in 9.5%
- Significant Impact of cooling

OPERATIVE STRATEGY - DISTAL AO PERFUSION

**PRO**
- “Removes” pressure of x-clamp time
- Preferred in ↑ing proximal complexity, e.g. Ao dissection
- Many prefer for extent I/II

**CON**
- More time + blood turnover
- Complications of technique itself
  - Selective use preferred in past
DISTRIBUTION OF ANEURYSM EXTENT

Type I: 27%  
Type II: 15%  
Type III: 36%  
Type IV: 22%

42% WITH STRICT CRAWFORD DESIGNATION

TAA Characteristics
(455 operations)

- Age: 71.1 ± 9.5 yrs
- M/F: 219/236 = 0.48
- Creat ≥ 1.8 mg/dL: 64 (14.1%)

Pathology
- Degenerative: 368 (80.1)
- Dissection: 68 (14.9)
- Infected: 5 (1.1)
- Aortitis: 5 (1.1)
- Marfan’s: 9 (2.0)

“Dissection-Specific” Issues

Prior Aortic Resection (32.7%) n=149 (%)
- AAA: 88 (59)
- Descending or TAAA: 30 (20)
- Ascending/Arch: 31 (21)

Clinical Presentation
- Elective: 347 (76.3)
- Urgent non-ruptured: 51 (11.2)
- Ruptured: 52 (11.4)

TAA OUTCOMES: EFFECT OF CHRONIC DISSECTION

Effect of chronic dissection on early and late outcomes after descending thoracic and thoracoabdominal aneurysm repair

- No differences in periop mortality
- No differences in paraplegia (7% vs 5%)

(J Vasc Surg 2011;53:600-7)
**Freedom from Late Aortic Events**

- **Dissection**: 74%
- **Degenerative**: 70%

\[ p = 0.36 \]

\[ 0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10 \]

% Complication Free

**Survival**

- Dissection: 60%
- Degenerative: 56%

\[ 0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \quad 14 \quad 16 \]

% Survival

\[ p = 0.049 \]

**TAA Repair**

(455 operations)

**Independent Predictors of SCI**

<table>
<thead>
<tr>
<th>Variable</th>
<th>( p ) (OR; 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-elective OR</td>
<td>0.02 (2.1; 1.1-4.0)</td>
</tr>
<tr>
<td>TAA extent (I/II)</td>
<td>0.015 (2.2; 1.17-4.1)</td>
</tr>
<tr>
<td>Intra-Operative Hypotension</td>
<td>0.0049 (3.3; 1.4-7.7)</td>
</tr>
<tr>
<td>Total Cross-clamp time</td>
<td>0.012</td>
</tr>
<tr>
<td>Epidural Cooling (Protective)</td>
<td>0.02 (0.4; 0.2-0.8)</td>
</tr>
<tr>
<td>Severe Renal Failure</td>
<td>0.031 (2.4; 1.1-5.2)</td>
</tr>
<tr>
<td>Pulmonary Complications</td>
<td>0.0003 (4.0; 1.9-8.6)</td>
</tr>
</tbody>
</table>

**Spinal cord complications after thoracic aortic surgery: Long-term survival and functional status**

- 576 pts with DTA/TAA repair 1987-2005
- SCI of any severity 11% [6.6 % TEVAR vs. 12 % open]
- SCI ↑ 30 day mortality 3-fold
- 40% of SCI total paraplegia → but those with lesser deficits fared well

(J Vasc Surg 2008;48:47-53)
SPINAL CORD ISCHEMIC COMPLICATIONS

- Relevant anatomy esp. with reference intercostal vessels
- Spectrum of timing/severity/clinical impact
- Operative strategies and protective adjuncts

SPINAL CORD BLOOD SUPPLY: LEGEND AND MYTH

- Variations of I.C. vessels with pathology
- “Misinformation” from angiographic studies

GRA only identified in ≈45% “Did not improve overall results”

- Variations of I.C. vessels with pathology
- “Misinformation” from angiographic studies
- Development of the collateral network concept. Refutes the concept of “singularly important IC vessels”
MRA DEMONSTRATES CORD COLLATERALS

- 85 TAA pts studied with MRA and intraoperative MEVOK potentials
- p < .0015 correlation between collateral demonstration of preservation MEVOK with x-clamp
- Most collaterals originated caudal to the distal clamp → pelvic arteries

SCI EXTENT I VS. II

- The importance of lumbar/pelvic collaterals
- Implications for I.C. repair despite nl MEVOP in Extent II TAA
Meta-analysis inc. 3 RCT with 289 pts
SCI 12% vs. 33% with CSFD
Pooled OR 0.26 p = .0002
Support for CSFD

Intraoperative Monitoring of Motor-Evoked Potentials
- Monitors ischemia of ventral horns
- Technical/methodologic
- Modification of anesthetic
- Can’t use with epidural cooling or significant hypothermia
- Can guide a selective approach to IC reconstruction

Assessment of Spinal Cord Integrity During Thoracoabdominal Aortic Aneurysm Repair

Conclusions: In patients with TAAA, blood supply to the spinal cord depends upon a highly variable collateral system.

Posture Towards Intercostal Reconstruction
- The empiric albeit “blind” approach → indeed the majority opinion till……?
- Why not do it?
  - time/bleeding
  - technical
  - patency
- The evidence re: the collateral network concept/TEVAR data
Conclusions: Paraplegia causation is anatomic but paraplegia prevention is physiologic (non-anatomic)

**SUMMARY DATA**

<table>
<thead>
<tr>
<th>Year</th>
<th>Patients</th>
<th>OP Mort: n(%)</th>
<th>SCI: n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Svensson (1993)</td>
<td>1509</td>
<td>155 (10)</td>
<td>234 (16)</td>
</tr>
<tr>
<td>Coselli (2007)</td>
<td>2286</td>
<td>115 (5)</td>
<td>87 (3.8)</td>
</tr>
<tr>
<td>Safi (2003)</td>
<td>1004</td>
<td>141 (14)</td>
<td>36 (3.6)</td>
</tr>
<tr>
<td>Grabitz (1996)</td>
<td>260</td>
<td>37 (14.2)</td>
<td>39 (15)</td>
</tr>
<tr>
<td>*Estrera (2001)</td>
<td>656</td>
<td>106 (16)</td>
<td>33 (5)</td>
</tr>
<tr>
<td>Jacobs (2002)</td>
<td>184</td>
<td>20 (10.8)</td>
<td>5 (2.7)</td>
</tr>
<tr>
<td>MGH (2007)</td>
<td>455</td>
<td>39 (8.2)</td>
<td>43 (9.5)</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>6352</td>
<td>613 (9.7)</td>
<td>477 (7.5)</td>
</tr>
</tbody>
</table>

**SUMMARY OF PROGRESS WITH TAA OUTCOMES OVER TIME**

- Mortality (single center) 12.5% → 8.84%
- Age/acute presentation/paraplegia ↓ GFR

591 patients over 20 years
Mortality 12%
PPlegia/paresis → 8%
CURRENT RESULTS WITH OPEN REPAIR

Outcomes and operative strategies vary with TAA extent

Type I   Type II   Type III   Type IV

Conduct of Operation

- Risk of SCI << in Type IV
- Adjuncts not utilized in Type IV repair:
  - Atrial-femoral bypass
  - CSF drain
  - Motor evoked potential monitoring
  - Permissive hypothermia
- Type IV  ? Open  ? Endo  ? hybrid

TYPE IV RESULTS

Continued favorable results with open surgical repair of type IV thoracoabdominal aortic


• Adjuncts produced low (<5%) SCI but op. mortality ≈ 14% and 40% pts DTA only!
STANDARDIZED CLAMP/SEW OPERATION

Cold renal perfusion
Preserve diaphragm
Beveled prox. suture line
Routine lt. renal sidearm

Type IV Specific Outcomes

Type IV Thoracoabdominal Aneurysm Repair: Predictors of Postoperative Mortality, Spinal Cord Injury, and Acute Intestinal Ischemia

- Operative Mortality 13%
- Paraplegia 5%

Role of Somatosensory Evoked Potentials in Predicting Outcome During Thoracoabdominal Aortic Repair

- Operative Mortality 18%
- Paraplegia 3%

Clinical features in 178 Type IV pts

- Age: 73 ± 8
- HTN: 153 (86%)
- Smoker: 147 (83%)
- CRI (>1.8mg/dl): 32 (18%)
- Symptomatic: 32 (18%)
Predictors of Mortality/Complications

Composite outcome: death + any complication

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRInsuff</td>
<td>3.4</td>
<td>[1.4 – 8]</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Long term survival

- 1 year: 89 ± 2%
- 5 year: 64 ± 4%

NEJM 2010;362:1863-71
NEJM 2010;362:1881-9

Impact of Collateral Network Concept

Evolution of operative strategies in open thoracoabdominal aneurysm repair

Mark E. Corneli, MD, MMMc, Remi A. Erp, MA, Vincenzo J. Pietra, MD, Matthew R. Cammisa, BS, Olwen M. Leithangha, BBD, Bethica Stasios, MD, and Richard P. Cammisa, MD, Boston, MA

Objective: To analyze the outcomes of an initial series of patients undergoing endovascular aortic repair with a clamp and snare (clamp/new) approach compared with a protamine-assisted distal aortic perfusion (PaAP) approach. Methods: From November 2006 to April 2009, 14 patients underwent initial clamp/new repair and 7 PaAP repairs. Endovascular aortic occlusion (EAO) time was defined as the time from the initial femoral occlusion to the time when the iliac arteries were thromboendarterectomized. Results: The PaAP group had a significantly lower incidence of endoleak compared with the clamp/new group (14% vs 62%, P = .03). Conclusions: PaAP is a safe and effective method for controlling distal perfusion during aortic occlusion. PaAP appeared to reduce the need for iliac limb extension, with no paraplegia or death. PaAP with PaAP is the preferred operative strategy for delay in seal in TAA repair. (J Vasc Surg 2011;53:1195-201)

Shift in Spinal Cord Protection

- Support of the cord collateral network with distal aortic perfusion
- Monitoring of MEVOP during sequential clamping
Evolution of operative approach
use of At-fem/MEVOP in Extent I-III clamp/sew in Extent IV

128 pts (70% Extent I-III)
mortality 5/128 = 4%
*paraplegia 3/128 = 2.3%
*plus 1 sig. pparesis

MGH RESULTS UPDATE 2007-2010

• 2 years of current operative strategies compared with PROPENSITY SCORE-MATCHED HISTORICAL COHORT
  • Ruptures excluded
  • Variety of clinical/anatomic variables

Propensity Matched Cohort

<table>
<thead>
<tr>
<th>Variable</th>
<th>DAP/MEP (n=52)</th>
<th>Clamp/Sew (n=127)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I Thoracoabdominal</td>
<td>27 (52%)</td>
<td>46 (36%)</td>
<td>0.20</td>
</tr>
<tr>
<td>Type II Thoracoabdominal</td>
<td>9 (17%)</td>
<td>22 (17%)</td>
<td></td>
</tr>
<tr>
<td>Type III Thoracoabdominal</td>
<td>16 (31%)</td>
<td>59 (46%)</td>
<td></td>
</tr>
<tr>
<td>Dissection</td>
<td>19 (37%)</td>
<td>10 (8%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Urgent</td>
<td>5 (10%)</td>
<td>8 (6%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Aneurysm Diameter</td>
<td>6.23 ± 0.88</td>
<td>6.34 ± 0.92</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Operative Details

• 95 (75%) clamp/sew had epidural cooling
• Mesenteric Shunting:
  Clamp/Sew = 46%  p=ns
  DAP/MEP = 31%
• Intercostal Re-implantation:
  Clamp/Sew = 34%  p<0.0001
  DAP/MEP = 10%
### 30 Day Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>DAP/MEP (n=52)</th>
<th>Clamp/Sew (n=127)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death/Paraplegia</td>
<td>1 (2%)</td>
<td>11 (9%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Mortality</td>
<td>1 (2%)</td>
<td>6 (5%)</td>
<td>0.38</td>
</tr>
<tr>
<td>Paraplegia</td>
<td>0 (0%)</td>
<td>6 (5%)</td>
<td>0.39</td>
</tr>
</tbody>
</table>

### CONCLUSIONS

**Evolution of operative strategies/spinal cord protection for open TAA repair**

Regional hypothermia/intercostal reconstruction yields to:

1. intraoperative support collateral network with DAP
2. Selective IC reconstruction

**Implications for TEVAR adjuncts to prevent SCI**

### CONCLUSIONS

**Evolution of operative strategies/spinal cord protection for open TAA repair**

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1. intraoperative support collateral network with DAP
2. Selective IC reconstruction

**Implications for TEVAR adjuncts to prevent SCI**

### THORACIC STENT GRAFT

**ANATOMY LIMITATION?**

Not applicable with present technology to genuine TAA extent??? ⇒Not so after 4/05

### Surgical treatment of intact thoracoabdominal aortic aneurysms in the United States: Hospital and surgeon volume-related outcomes

John A. Cowen, Jr., MD,* Justin B. Ditmack, MD,* Peter K. Henke, MD,* Thomas S. Huh, MD, PhD,* James C. Stanford, MD,* and Gilbert R. Upchurch, Jr., MD,* Jwa Jw, Mich, and Genovese, (Va)

Objective: Surgical treatment of intact TAA is associated with high perioperative mortality, which is higher in patients undergoing TAA than TAAA repairs. In this study, we evaluated the impact of hospital and surgeon volume on outcomes of TAAA repair, controlling for patient demographics, preoperative characteristics, and complications.

Methods: A total of 76,955 patients from the National Inpatient Sample were evaluated for TAAA repair. After hospital and surgeon volume adjustment, there was no difference in mortality between hospital and surgeon volume categories. However, there was a linear trend for a higher mortality rate with a higher surgeon volume. The adjusted odds ratio (OR) was 1.50 (95% CI: 1.25, 1.80; P < .001). The adjusted risk of mortality was increased in patients older than 70 years, males, and those with chronic obstructive pulmonary disease (COPD). The adjusted risk of mortality was also increased in patients who underwent TAAA repair with a higher surgeon volume (OR 1.29, 95% CI: 1.10, 1.51; P < .001).

Results: Overall mortality was 22.3% for elective cases!
HYBRID OPERATION? ROLE

WILL STENT GRAFT REPAIR IN THE THORACIC AORTA DECREASE THE RISK OF PARAPLEGIA?

Comparative trials suggest it can

The transition from custom-made to standardized multibranched thoracoabdominal aortic stent grafts

Comparative trials suggest it can

TAG INVESTIGATORS: FIRST TRIAL

- Mortality 2.1% TEVAR vs. 11.7% open (p < .001)
- SCI 3% TEVAR vs. 14% open (p < .001)

(J Vasc Surg 2011;54:660-8)

(J Thorac Cardiovasc Surg 2007;133:369-77)
**TX2 CLINICAL TRIAL**

International controlled clinical trial of thoracic endovascular aneurysm repair with the Zenith TX2 endovascular graft: 1-year results


- 42 study sites; 160 TEVAR vs. 70 open in good risk patients
- No significant diff. in 30 day/1 yr survival
- 30 day morbidity (p < .01) favors TEVAR
- Paraplegia → 1.3% TEVAR/5.7% open (p = .07)

**VALOR TRIAL RESULTS**

Post hoc “control” group

MGH/CCF/U Penn

- Mortality (2% vs. 8%) – p < .001 Favors TEVAR!

**CLINICAL TRIAL SUMMARY**

Thoracic Stent Graft

TAG/ TX2/ VALOR

<table>
<thead>
<tr>
<th></th>
<th>TEVAR</th>
<th>OPEN</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. Mortality</td>
<td>10/495 (2%)</td>
<td>30/353 (8.5%)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Pplegia/Pparesis</td>
<td>31/495 (6.2%)</td>
<td>46/353 (13%)</td>
<td>&lt; .007</td>
</tr>
<tr>
<td>Total Paraplegia</td>
<td>8/495 (1.6%)</td>
<td>18/353 (5.1%)</td>
<td>&lt; .0037</td>
</tr>
</tbody>
</table>

TEVAR IS THE TREATMENT FOR DEGENERATIVE ANEURYSM OF THE DTA
Open DTA Repair: “Real World” Data

Population-based outcomes of open descending thoracic aortic aneurysm repair

- Op mortality – 10% intact TA
- Op mortality – 17% for pts ≥ 75 yrs
- Op mortality – 45% ruptured TA

Results – Management Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>TEVAR</th>
<th>OPEN</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>352 (25%)</td>
<td>1073 (75%)</td>
<td>1425</td>
</tr>
<tr>
<td>2005</td>
<td>777 (45%)</td>
<td>963 (55%)</td>
<td>1740</td>
</tr>
<tr>
<td>2006</td>
<td>1184 (58%)</td>
<td>866 (42%)</td>
<td>2050</td>
</tr>
<tr>
<td>2007</td>
<td>1216 (60%)</td>
<td>816 (40%)</td>
<td>2032</td>
</tr>
<tr>
<td>Total</td>
<td>3529 (49%)</td>
<td>3718 (51%)</td>
<td>7247</td>
</tr>
</tbody>
</table>

30-Day Mortality

<table>
<thead>
<tr>
<th>Variable</th>
<th>TEVAR</th>
<th>OPEN</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort (n=11165)</td>
<td>7.4%</td>
<td>18.6%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Intact Aneurysm (n=7247)</td>
<td>5.2%</td>
<td>12%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Ruptured Aneurysm (n=1033)</td>
<td>24%</td>
<td>45%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Dissection (n=2701)</td>
<td>9.1%</td>
<td>21%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Trauma (n=185)</td>
<td>14%</td>
<td>35%</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

STENT GRAFT REPAIR OF ACUTE CATASTROPHES OF THE DESCENDING THORACIC AORTA: Multicenter Clinical Trial

Richard P. Cambria, Christopher J. Kwolek, Venkatesh Ramaiah, Joseph Bavaria, Alan Lumsden, W. Anthony Lee, Mark Farber, Jae Cho for the TAG INVESTIGATORS
Combined 30 day death/paraplegia of 13.6% in 59 patients. Significant (p = .008) benefit for TEVAR vs. open surgery historical controls.

Low incidence of graft related complications

1. Multiplanar forces: torsion stress, bending / shearing
2. Waterhammer effect

### Traumatic Aortic Tear: Modern Meta-Analysis

Reduced mortality, paraplegia, and stroke with stent graft repair of blunt aortic transections: A modern meta-analysis

- 699 pts (370 TEVAR/329 open) Rx 2001-06
- Profiles (age/ISS) similar
- Outcomes favor TEVAR!
  - Mortality (7.6% vs 15.2% p < .007)
  - Paraplegia (0% vs 5.6% p < .001)
  - Stroke (0.85% vs 5.3% p = .003)

### Traumatic Aortic Tear: Modern Registry Study

- AATS prospective registry study of 193 traumatic aortic tear
- Mortality OR 8.4, p < .001
  - Open 23.5% vs TEVAR 7.2%
Ruptured TAA -- Mortality of Open Repair

Contemporary results of open repair of ruptured descending thoracic and thoracoabdominal aortic aneurysms

From the Eastern Vascular Registry

Overall operative mortality of 27%

Open DTA Repair: “Real World” Data

Population-based outcomes of open descending thoracic aortic aneurysm repair

- Op mortality – 10% intact TA
- Op mortality – 17% for pts ≥ 75 yrs
- Op mortality – 45% ruptured TA

TEVAR for Type B Dissection

Stent Graft Repair of Acute Dissection

Anatomic Principles
Aortic Dissection Chronic Phase

- Aneurysmal degeneration of outer wall false lumen is the principle late complication
- Groups at risk
- Continued patency of false lumen flow is demonstrated risk factor
- 40-50% of pts irrespective of initial surgical vs. medical Rx will require interval aortic resection for aneurysm

Implications for CT surveillance, B-blockade + BP control

IMPORTANCE OF BRANCH COMPROMISE

Vascular complications associated with spontaneous aortic dissection

<table>
<thead>
<tr>
<th>Branch Compromise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic</td>
</tr>
<tr>
<td>+ 18/20 (90)</td>
</tr>
<tr>
<td>- 38/84 (45)</td>
</tr>
<tr>
<td>Rupture</td>
</tr>
<tr>
<td>+ 34/38 (89)</td>
</tr>
<tr>
<td>- 30/178 (17)</td>
</tr>
</tbody>
</table>

⇒ NS
⇒ p<.0001

ACUTE DISSECTIONS CONTEMPORARY PERSPECTIVE

- IRAD study group results
  - nearly 500 patients treated 1996-1998
- Overall mortality → 27%
- Urgent asc. aortic graft → 26% op mortality
- Distal dissections
  - 10% with medical Rx
  - 31% with interventions

CURRENT IRAD STUDY

- 571 acute type B – 70% Rx medical therapy
- Open vs. TEVAR in 22%

Mortality

34% vs. 10% → p = .002

(Hagan et al. IRAD, JAMA 2000)
99 cases of TBAoD treated by 5 experts
Rupture 32%; Malperfusion 72%
Op mortality 10.6%/Paraplegia 9%

Standards for Trials

40 pts → 5% mortality
Favorable Aortic remodeling with Distal Bare Stent
Ruptures/Retrograde Dissections/Reinterventions

GORE TAG 08-01
Acute Complicated Dissection Study

The primary objective of the study is to assess safety and effectiveness of treatment with the Conformable GORE® TAG® Device for patients with Acute Complicated Type B Dissection.

Dissection Study Population
- Acute - symptom onset to diagnosis ≤ 14 days and treatment within 48 hours of diagnosis
- Enrollment (50 pts) completed
- 30 day results presented soon
- Class I Aortic Dissection - classic aortic dissection with intimal flap between true and false lumen (double barrel lumen)

Study Status
- Enrollment complete (n=50)
- 5 year follow-up ongoing
- Data analysis in process

Management of Disease in the Descending Thoracic Aorta in the Endovascular Era: A Multicenter Prospective Study

### 30 day mortality: TEVAR vs. OPEN for DTA pathologies

<table>
<thead>
<tr>
<th>Variable</th>
<th>TEVAR</th>
<th>OPEN</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort (n=11166)</td>
<td>7.4%</td>
<td>18.6%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Intact Aneurysm (n=7247)</td>
<td>5.2%</td>
<td>12%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Ruptured Aneurysm (n=1033)</td>
<td>24%</td>
<td>45%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Dissection (n=2701)</td>
<td>9.1%</td>
<td>21%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Trauma (n=185)</td>
<td>14%</td>
<td>35%</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

### Aortic Dissection Summary

- Results of treatment have improved with improved diagnostics/prompt institution of therapy

  overall mortality still ≈ 25%

- Recognition of the importance and management of critical branch compromise has diminished impact of same → potential for stent-graft Rx

- Trials of medical vs. stent graft therapy for Type B patients on the horizon (and needed!)