Current Management of Acute Aortic Injuries

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Disclosures

Consultant:
WL Gore, Medtronic, Cordis

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Edwards Life Sciences, Bolton, Lombard

Acute Aortic Injuries

- Location
  - Thoracic
  - Abdominal
- Mechanism:
  - Penetrating
  - Blunt
  - Iatrogenic Injuries to aorta and its branches
- Severity
  - Intimal tear
  - Contained injury
  - Free disruption into cavity

Thoracic Aortic Injuries

- US: >8000/year
- High Prehospital Mortality (80%)
- 1200-1500 reach hospital alive
- 30% die from aortic injury
- Site: Majority at isthmus of aorta
- 70-80% have associated injuries
- Non fatal Unrecognized lesions develop false aneurysms over time.
Traumatic Aortic Transection

**Standard Open repair**
- Left Thoracotomy
- Single lung ventilation
- Systemic Anticoagulation
- Aortic Cross Clamping
- Possible left Heart Bypass

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Benefits of TEVAR
- Possible under Local anesthesia
- No cross clamping
- Short procedure
- Minimal or No Anticoagulation

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FS: Use of Thoracic Endografts

FS: 45 year old Male / MVA accident
Multiple Injuries: Long bone/ Abdomen
21-22 mm aorta → 26mm Thoracic Endograft

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Acute Aortic Trauma: Challenges

- Small Access vessels
- Small Aortic Diameter
- Acute Arch Curvature
- Tapering lumens
JT: Use of Cuffs for Transection

JT: 29 year old Female / ATV vs Tree accident
Multiple Injuries: Head/ Abdomen / Pulmonary / Spine

Proximal Aorta: 17.7 mm
Distal Aorta: 17.2 mm

Potential Drawbacks of TEVAR
- Possible residual endoleak and bleeding
- Possible migration or fistula formation
- Young Patients
- No Long term durability data/ Long FU
- Approved grafts only available recently
- Graft Collapse
Causes: Oversizing and poor apposition

Traumatic Aortic Transection

Apr 08: 9 Year FU
Traumatic Aortic Transection

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Traumatic Aortic Transection

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New Approved Device Modification

Despite All The Actual and The Theoretical Shortcomings

What are the Results?
**Traumatic Aortic Transection**

*Open results*

<table>
<thead>
<tr>
<th></th>
<th>Clamp and Sew</th>
<th>Distal Perfusion</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Paraplegia</td>
<td>Mortality</td>
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<tr>
<td>Von Oppell (94)</td>
<td>19.0%</td>
<td>16.0%</td>
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<td>1492 pts</td>
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<tr>
<td>Kadali (91)</td>
<td>28.5%</td>
<td>3.8%</td>
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</table>


**Standard Open Repair**

*Single Center Series over 27 years*

*Attar et al Ann Thor Surg 1999*

- 263 patients over 27 years
- **Operative Mortality**
  - 1971-1975: 19%
  - 1976-1984: 36%
  - 1985-1994: 26%
  - 1995-1998: 16%
- **Paraplegia**: 17%

**Prospective Multicenter AAST trial**

*Fabian et al J Trauma 1997*

- 274 patients over 2.5 years from 50 centers
- From injury to thoracotomy: 16.5 hours
- **Mortality 31%** two thirds from Aortic source
- **Paraplegia**
  - Full Bypass: 4.5%
  - Partial Bypass: 7.7%
  - Clamp and Saw: 16.4%

**Endovascular treatment of traumatic thoracic aortic injury—should this be the new standard of treatment?**

Peter H. Lim, MD, Ruth L. Bish, MD, Wei Zhou, MD, Eric K. Paden, MD, and Alan B. Lumsden, MD, Houston, Texas

**INTRODUCTION**

Blunt trauma to the thoracic aorta is a potentially life-threatening condition that can lead to death in 75% of cases at the time of injury, as a result of either aortic transection or acute rupture. Although it accounts for <5% of adult admissions to level I trauma centers, blunt aortic injury represents the second most common cause of death due to blunt trauma, second to head injury. It is estimated that only 25% of patients who sustain aortic injuries due to blunt thoracic trauma remain alive upon arrival at a trauma center. The overall mortality is 30% due to surgical complications, the most notable of which is paraplegia. The remaining 75% of patients who survive the initial trauma are at high risk for late complications, including paraplegia, limb amputation, and other organ failure that are not only compounded by the ongoing management of blunt aortic injury, but also increase their overall morbidity and mortality. The objectives of this chapter are to review current management strategies of blunt aortic injury, including both conventional open repair and endovascular treatment approaches. Further discussions are provided on technical issues and potential limitations of endovascular therapy, and clinical results of this treatment modality in blunt aortic injury.
Endo Results 17 Reports

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Patients</th>
<th>Technical Success (%)</th>
<th>Endograft type</th>
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</tbody>
</table>

Total: 146 Patients 99% Technical Success 2% Mortality 0 Paraplegia


Traumatic Aortic Transection at UPMC 1999-2011

- 41 open Repairs 1999-2011
  - 8 deaths Mortality 19.5%
  - 2 Paraplegia Paraplegia 4.4%
- 50 TEVAR: 46 Acute within 3 days of injury
  - 3 deaths Mortality 6.1%
  - No paraplegia Paraplegia 0%

Last Open Case Jan 2007: 18 year old with isolated injury
8 hour procedure, massive bleeding and Death
Since Feb 2007 All Transections Rx by TEVAR


Traumatic Aortic Transection

TEVAR at UPMC 1999-2011

- 50 TEVAR
  - 38 Men and 12 women
  - Mean Age: 39 years
  - Youngest 17 years Oldest 79 years
- Grafts
  - Thoracic endografts: 34 TAG / 3 TX2 / 2 Talent
  - Abdominal Cuffs: 9 Excluder / 2 AneuRx
Traumatic Aortic Transection

**Lessons Learned From Early Results**

- TEVAR is Superior to open repair for aortic trauma
- Conduits are almost never needed
- Coverage of L. Subclavian artery is rarely needed
- Use of abdominal cuffs is feasible and quite safe

**Conclusions:**

Comparison between the two AAST studies in 1997 and 2007 showed a major shift in the diagnosis of the aortic injury, with the widespread use of CT scan and the almost complete elimination of aortography and TEE. The concept of delayed definitive repair has gained wide acceptance. Endovascular repair has replaced open repair to a great extent. These changes have resulted in a major reduction of mortality and procedure-related paraplegia but also a significant increase of graft related complications.

Graft Related Complications: 8 patients (16%)

- 4 isolated graft collapses treated with second TEVAR
- 1 conversion @ 6 m after graft collapse and AEF
- 1 conversion @ 3 yrs for Sx dynamic Carotid obstruction
- 1 conversion @ 2yrs for Carotid obstruction. No Sxs
- 1 conversion @ 18 months for arm hypertension

No DEATHS or PARAPLEGIA

J Trauma 2008;64:1415-19
WM: Open Conversion for Collapse and AEF

WM: 50 year old Man with Sky diving accident
Multiple Injuries: Long bones, pelvis, abdominal, chest, spine and Closed head Injury

POST BALLOON

Esophagectomy and Subsequent Substernal Stomach Pull-up
In Situ Reconstruction Rifampin Impregnated Graft

One Year Later
LS: Conversion for dynamic obstruction of LCCA

LS: 17 year old Female / Car accident
Multiple Injuries: Pelvic and facial fractures / Bladder and Liver injuries / Intracranial injuries

TAG 26 x 10

LS: Conversion for dynamic obstruction of LCCA

LS: 27 month FU: Left Amaurosis and Light headedness
To and Fro motion in Left CCA on Duplex Angiogram and Pressure measurement in LCCA

LCCA SAP 15mmHg < Proximal Aorta

BC: Conversion for obstruction of Aorta

BC: 21 year old Male / Snowmobile accident
Multiple Injuries: Diaphragm / Abdomen / Pulmonary
22mm Aorta / 26mm TAG’s

1 month CT: Collapse of inner graft

BC: Conversion for obstruction of Aorta

BC: 22 year old Male / Snowmobile accident
Multiple Injuries: Diaphragm / Abdomen / Pulmonary
10 months Later. SEVERE Hypertension R Arm 180/110
Summary: Thoracic aortic Transection

Endovascular is the Treatment of choice for Aortic Transection

Abdominal Aortic Injury

- Less Common than Thoracic
  - < 25% of abdominal vascular trauma
  - Blunt injuries very rare.
- Very high Mortality
- Endovascular therapy replacing open repair
Conclusion

Endovascular Options are becoming quickly the standard of care for most Aortic and Arterial Trauma