Management of Aortic Dissection: Impact of Technique of Proximal and Distal Repair on the Need for Reoperation

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Disclosures: NONE
Acute Aortic Dissection

**CARDINAL FEATURES**

- Most common catastrophe involving the aorta
- Relatively rare cause of chest pain
  - prevalence of CAD 100-200 times > AAD
  - 3 ADD for each 1,000 pts presenting to ER with CP/BP
- Morbidity and mortality remain high
Acute Aortic Dissection

NATURAL HISTORY

- Lethal if undiagnosed early & not treated appropriately
  - 30% mortality by 24 hrs, 50% by 48 hrs, 90% by 3 months
- Hirst et al. – 505 patients with acute Ao dissection (1958)
Acute Aortic Dissection

**IMPACT of TECHNIQUE on REOPERATION**

- Clinical presentation / diagnosis
- How do we treat them?
- Late reoperation / aortic growth
- Impact of extended distal resection
• **Indications for Surgical Therapy**
  – All patients deemed survivable (>80, CVA, CPR in OR)

• **Goals of Surgical Therapy**
  – Obviate usual causes of death (local phenomenon in 60-90%)
  – Reconstitute distal flow in the true lumen
  – Correct compromise of contiguous Ao branches (coronary, innominate, carotid)
  – Restore aortic valve competence
  – Resect primary intimal tear (if exposed)
  – Eliminate flow in false lumen?
Type IV Ehlers-Danlos Syndrome:
- Minor arterial injury → dangerous vascular tearing & damage
- Sutures cut arteries, ties cut branches, clamps tear vessels
- Arterial procedures should be avoided whenever possible
- When mandatory, simplest available techniques should be performed
Acute Type A Dissection

SURGICAL INTERVENTION

Distal anastomosis with felt buttress reconstruction

Hemiarch replacement (if tear extends into arch)
Acute Type A Dissection
What is a Safe and Durable Surgical Strategy?

Surgery for Acute Type A Aortic Dissection
Tirone E. David, MD, Susan Armstrong, MSc, Joan Ivanov, MSc, and Sion Barnard, MB
Division of Cardiovascular Surgery, Toronto General Hospital, University of Toronto, Toronto, Ontario, Canada

- Pts were dying despite their best efforts!
- Dramatic reduction in mortality after adoption of reproducible repair technique
  - no cross clamp, resection of primary tear, antegrade reperfusion
- Suggested improved early and late outcomes

ATS 1999; 67:1999
Unstable Patient:
- Femoral perfusion reverses flow in FL
- Aortic clamping should be avoided
- Distal anastomosis under HCA
- Antegrade rewarming
Stable Patient:
- Axillary perfusion pumps blood into TL
- Minimizes malperfusion
- Ascending aorta may be clamped without increasing risk of malperfusion
Acute Type A Dissection

What is a Safe and Durable Surgical Strategy?

- At Wash U, 196 acute type A (1996-2012)
  - Group 1 (Classic David): No X-clamp, DHCA, antegrade reperfusion – 49 pts
  - Group 2-6: All other strategies – 147 pts

<table>
<thead>
<tr>
<th>Group</th>
<th>Aortic Cross Clamp</th>
<th>DHCA</th>
<th>Antegrade Reperfusion</th>
<th>Number of Patients</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>49</td>
</tr>
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<td>2</td>
<td>No</td>
<td>Yes</td>
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<td>3</td>
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<td>Yes</td>
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<td>6</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>56</td>
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Acute Type A Dissection
What is a Safe and Durable Surgical Strategy?

- **Classic David** (No X-clamp, DHCA, antegrade reperfusion) vs Other Strategies:
  - No difference in operative mortality or morbidity
  - No difference in FL patency
  - Long-term survival impaired with non-David strategy

![Survival Probability Graph](image)
• Clinical presentation / diagnosis
• How do we treat them?
• Late reoperation / aortic growth
• Impact of extended distal resection
Acute Type A Dissection

Extent of Proximal and Distal Resection

Does the Extent of Proximal or Distal Resection Influence Outcome for Type A Dissections?
Marc R. Moon, MD, Thoralf M. Sundt III, MD, Michael K. Pasque, MD, Hendrick B. Barner, MD, Charles B. Huddleston, MD, Ralph J. Damiano, Jr, MD, and William A. Gay, Jr, MD
Division of Cardiothoracic Surgery, Washington University School of Medicine, St. Louis, Missouri

- Proximal resection:
  - Valve preservation: ↓ operative risk? ↑ risk of late AVR?
- Distal resection:
  - Hemiarch: ↓ risk of late reoperation? ↑ operative risk?
- Determine how extent of proximal & distal resection influences OR M&M, long-term survival, late reoperation

ATS 2001; 71:1244
Acute Type A Dissection
SURGICAL RESULTS – Wash U.

- 32-year period:
  - 1984 to 2015, 34 surgeons

- 430 patients:
  - 266 men (62%), 164 women (38%)

- Mean age:
  - 59 years, range 18 to 90 years
Acute Type A Dissection
Extent of Proximal and Distal Resection

valve preservation  composite valve-graft  separate graft-valve

Incidence of AVR

<table>
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<tr>
<td>Incidence</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
</tr>
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$p < 0.001$
Impact of Proximal Surgical Technique on Late Reoperation:

![Graph showing impact of surgical technique on late reoperation](image)

- preservation
- CVG
- separate GV

$p > 0.36$

ATS 2001; 71:1244
Acute Type A Dissection
Extent of Proximal and Distal Resection

ascending only

hemiarch

total arch

Incidence of Hemiarch

$0\%$, $20\%$, $40\%$, $60\%$

1984-
1990
1991-
1995
1996-
2000
2001-
2006
2007-
2015

$p < 0.001$

CHRONIC ONLY

ATS 2001; 71:1244
Impact of Distal Surgical Technique on Late Reoperation:

- None of Hemiarch survivors required anterior reoperation
- 8% who survived initial Asc Ao Replacement required anterior reoperation for aneurysmal dilatation of residual Asc Ao / arch
- Non-resected primary tear \( (p = 0.05) \)
- Marfan syndrome \( (p < 0.001) \)
- Elevated systolic BP at late F/U \( (p = 0.008) \)
- Absence of \( \beta \)-blocker \( (p = 0.02) \)
- Unrelated to initial surgical technique

Freedom from Reoperation

\[
\begin{align*}
0\% & \quad 90 \pm 3\% \\
20\% & \quad 74 \pm 5\% \\
40\% & \quad 65 \pm 7\%
\end{align*}
\]

\[ z \text{ Years} \]

\[ \text{op survivors} \]

Zierer et al. 
ATS 2007;84:479
Impact of late systolic BP control:

Impact of Late BP Control
LATE REOPERATION – Wash U.

Impact of late systolic BP control:

Impact of late $\beta$-blocker use:

**Impact of Late $\beta$-blocker Use**

**LATE REOPERATION – Wash U.**

Impact of late $\beta$-blocker use: $p = 0.04$

Method to determine aortic expansion over time:

- **412 total CT scans:**
  - 6 ± 5 scans/patient
  - mean interval: 11 ± 16 mo
  - mean total F/U: 7 ± 6 mo
- **343 CT intervals for analysis**

Zierer et al.
ATS 2007, 84:479
Acute Type A Dissection
Method to determine Ao expansion

Descending Aorta

Diaphragmatic Hiatus

Abdominal Aorta

Zierer et al.
ATS 2007, 84:479
• **Aortic expansion:**
  - 18% (62/343) CT scan intervals, 49% pts

• **Onset of growth unpredictable:**
  - most often > 1 year postoperatively
  - mean: 59 ± 45 months (maximum: 167 months)

• **Independent predictors of aortic growth:**
  - Greater aortic diameter  \( (p < 0.001) \)
  - Elevated systolic BP at late F/U  \( (p = 0.04) \)
  - Patent false lumen  \( (p = 0.05) \)
  - Unrelated to initial surgical technique (prox/distal extent)

**Median growth rate** (mm/year)

- Desc. 6.0
- Diaphr. 3.8
- Abdo. 4.1

\( p < 0.001 \)
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Late F/U after Type A Repair
AORTIC EXPANSION OVER TIME – Wash U.

Zierer et al.
ATS 2007, 84:479
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IMPACT of TECHNIQUE on REOPERATION

• Clinical presentation / diagnosis
• How do we treat them?
• Late reoperation / aortic growth
• Impact of extended distal resection
• 451 op survivors: 62% FL patent overall
  – 4%: late rupture – FL patent in 94%
  – 8%: distal aortic reoperation – FL patent in 92%
  – 88% no reoperation, no rupture – FL patent in 58%
• Multivariate analysis:
  – FL patent: ↓survival OR=1.70, ↑distal aortic event OR=4.11

Kimura et al.
*JTCVS* 2015; 149:S91
Impact of FL patency on survival

IRAD – TYPE B DISSECTION

- 201 hospital survivors with Type B – 3-yr F/U
- Status of false lumen:
  - patent 56%, partial thrombosis 34%, complete 10%
- Partial thrombosis independent risk factor: OR 2.7 (p=.002)

3-yr mortality
32 ± 12%
23 ± 23%
14 ± 7%

\{ p=.003 \}

Tsai et al.
NEJM 2007;357:349
Impact of FL patency on survival
IRAD Database – TYPE B DISSECTION

Tsai et al.  
NEJM 2007;357:349
Total Arch for Dissection
Impact on False Lumen Patency

- 8 studies, 1602 patients – ascd/hemiarch vs. total arch +/- S-G
  - 5 “total arch is safe”, 3 ↑ mortality with total arch
  - Freedom from reop is similar with hemiarch or total arch at 5-10 years
  - complete FL thrombosis was seen more often with total arch
- Recommend extended resection when entry tear is in the arch
- Total arch may be justified in experienced hands
Type A Dissection
EXTENDED DISTAL RESECTION

• Baylor / Texas Heart – 157 pts (2005-2013)
  – conservative approach to arch replacement (7%)
  – ↑ACP, CPB, and cardiac ischemia → mortality (p<.04 for all)
  – HCA > 30 min associated with CVA (p=.03)

• Conclusion #1: “In this intrinsically complex disease, survival is the most important outcome.”
• Conclusion #2: “A conservative approach to the distal end of the repair can address the primary objectives”
  – prevent rupture
  – re-establish TL flow to correct malperfusion
  – maintain a competent AoV

ATS 2015;99:80-7
JTCVS 2015; 148:2123
• Surgical treatment does not cure the generalized disease
• Postoperatively, close medical follow-up mandates:
  – Strict BP control
  – Negative inotropic therapy (β-blockers even if normotensive)
  – Serial (imaging) surveillance (indefinitely)
• Life-long surveillance with radiographic follow-up
• Initial goal: “Get the patient out of the OR & hospital”
Thank you for your attention.