Use of Cryopreserved Aortic Allografts for Aortic Reconstruction

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Graft Excision with Extra-anatomic Revascularization

- 1st described by Blaisdell in 1961
- Gold standard for aortic infection involving more than isolated area of graft
- Early results resulted in 40% mortality and 25% amputation
- Recent results with improved anesthesia and sequencing of procedures have 25% mortality

Alternatives to the Extra-anatomic Bypass

- Antibiotic irrigation
- Neo-aortoiliac procedure (NAIS)
- Inline reconstruction
  - Prosthetic graft
  - Biologic tissue
  - Fresh aorta
  - Bovine pericardium
  - Cryopreserved aorta

Kieffer E, et al

Allograft replacement for infrarenal aortic graft infection: Early and late results in 179 patients

- Mean age = 65 ± 9 years
- Indication for allograft use:
  - Primary graft infection (n=125, 70%)
  - Secondary aorto-enteric fistula (n=54, 30%)
- 62% of patients underwent 3 ± 2 repeat operations before allograft replacement

- Late mortality = 25.9% (allograft-related = 2.1%)
  - All 3 patient deaths were due to allograft rupture at 9, 10, and 27 months
  - 2 patients received fresh allograft (60%)

Allograft-related complications are significantly reduced by using cryopreserved allografts rather than fresh allografts
Cyropreserved Allograft

Previous aneurysm concerns have been addressed with changes in preservation options. Options include Cryovein and Cryoartery. Expensive—are Cryoartery costs justified by better outcomes?

Uses of Allograft

On behalf of the Investigators

The Use of Cyropreserved Aortoiliac Allograft for Aortic Reconstruction in the United States

Results

220 Patients at 14 institutions (M:F = 1.6/1, Mean age = 65±12 yrs)

Indication for Use of CAA n (%)

- Prosthetic graft infection: 134 (61%)
- Primary abdominal aortic infection: 35 (16%)
- Graft enteric fistula/erosion: 33 (15%)
- Infection pseudoaneurysm: 9 (4%)
- Other, including high risk of graft infection: 9 (4%)

Type of Initial Aortic Procedure n (%)

- Open reconstruction: 209 (95%)
- Endovascular: 11 (5%)

Early and Late Complications

- Persistent sepsis: 17 (8%)
- CAA thrombosis/occlusion: 9 (4%)
- CAA rupture: 8 (4%)
- Recurrent CAA infection: 8 (4%)
- CAA pseudoaneurysm: 6 (3%)
- Fistula recurrence: 4 (2%)
- Lower extremity compartment syndrome: 1 (<1%)
- Colonic perforation: 1 (<1%)
- Lower limb ischemia: 1 (<1%)

Mean follow-up = 30 ± 3 months

Range = 1 to 160 months

Factors Associated with Graft Related Complications

31 Patients (15%) had CAA related complications

<table>
<thead>
<tr>
<th>Factor</th>
<th>Hazard Ratio</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 70</td>
<td>1.957</td>
<td>1.288 - 2.952</td>
<td>.003</td>
</tr>
<tr>
<td>Peripheral arterial disease</td>
<td>2.005</td>
<td>1.048 - 3.748</td>
<td>.037</td>
</tr>
<tr>
<td>Prosthetic graft infection</td>
<td>2.023</td>
<td>1.291 - 3.108</td>
<td>.008</td>
</tr>
<tr>
<td>Primary graft infection</td>
<td>2.035</td>
<td>1.349 - 3.046</td>
<td>.003</td>
</tr>
</tbody>
</table>

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Patient Survival, Graft Patency, and Limb Loss

Mean follow-up = 30 months; Range = 1 to 160 months

Aortic Endograft Infection- A New Epidemic?
Peter Lawrence, MD
UCLA Division of Vascular and Endovascular Surgery

On behalf of the Vascular Low-Frequency Disease Consortium:
Audra Duncan, Matthew Smelick, Michael Hartleider-Locke, Peter Lawrence, Sean Lyttle, Sean Stavroula, Jennifer Yapa, Debbie Strong, Yark Cheung, Avery An, Hugh Cryptoz, Daniel Van, Nicholas Chariton-Dyer, Mark Mokrich, Rishi Nagarapalak, Peter Nelson, Godfrey Parkerson, Shamesh Shah, Paul Stover, Gregory Modrall, Victor Davila, Samuel Money, Nasim Hedayati, Ahmed Abou-Zamzam, Christopher Abularrage, Catherine Wilkie

Increasing reports of endograft infection (~35 papers since 2005)
Incidence ranges from 0.2 to 0.7%
1431 aortic endografts placed evaluated with 11 graft infections (EVAR + TEVAR) = 0.6%

Endograft Infection

Original Aortic Grafts Implanted

Complications of Index EVAR/TEVAR

Possible infection sources

<table>
<thead>
<tr>
<th>Source</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval procedures</td>
<td>69 (34)</td>
</tr>
<tr>
<td>Interval known infections</td>
<td>78 (38)</td>
</tr>
<tr>
<td>Contaminated index EVAR/TEVAR</td>
<td>25 (14)</td>
</tr>
</tbody>
</table>
**Patient Management**

Complete explantation

Surgery
- Infected (59)
- 27 TEVAR
- 32 EVAR

Medication
- Infected (59)
- 3 TEVAR

Intra-Aortic balloon
- Infected (59)
- 12 TEVAR

Stent graft
- Infected (59)
- 11 TEVAR

**Operative Details**

- **Blood Loss**
- **Operative Time**

- **Operative Complications**
  - 30-day mortality = 11%
  - Perioperative morbidity = 68 patients (35%)

<table>
<thead>
<tr>
<th>Common complications</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent sepsis</td>
<td>27</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>9</td>
</tr>
<tr>
<td>Recurrent infection</td>
<td>9</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>8</td>
</tr>
<tr>
<td>Acute kidney injury</td>
<td>6</td>
</tr>
<tr>
<td>Stroke</td>
<td>5</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>5</td>
</tr>
<tr>
<td>Ischemic colitis</td>
<td>4</td>
</tr>
<tr>
<td>Acute respiratory failure</td>
<td>4</td>
</tr>
</tbody>
</table>

**Medically Managed Patients**

- Mean length of follow-up = 2 months
- Patients = 9 (4%)
  - TEVAR = 5 pts
  - EVAR = 4 pts

- Mortality (TEVAR)
  - 4 pts (50%) after mean of 56 days post endograft infection diagnosis – all grafts remained infected

- Mortality (EVAR)
  - 2 pts (50%) – hemorrhage from AE fistula (1wk)
  - graft infected, cardiac arrest (10yrs)
Clinicians should have a high index of suspicion to diagnose symptomatic post-operative aortic infections, especially in those patients with chronic infections or contaminated index procedures.

Cryopreserved or NAIS, then antibiotic soaked prosthetic grafts, should be considered for reconstruction after complete explantation.

The traditional approach of graft excision with extra-anatomic bypass is currently not often used.