When Not To Do a Ross Procedure

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No conflicts to disclose
Ross Procedure

Replacement of the Aortic Valve or Root With a Pulmonary Autograft

- First reported by Donald Ross in 1967
- First report of U.S. series by Selzer and Elkins in 1987
- Substantial experience accumulated worldwide over the last 25 years
Ross Procedure
Pros

• Extremely low early mortality at EXPERIENCED Centers in both adults and children
<table>
<thead>
<tr>
<th>Group</th>
<th>No. of patients</th>
<th>Early Mortality %</th>
<th>Cochran Q statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>1,749</td>
<td>3.2% (1.5-6.6)</td>
<td>N.S.</td>
</tr>
<tr>
<td>Children</td>
<td>672</td>
<td>4.2% (1.4-11.4)</td>
<td>N.S.</td>
</tr>
<tr>
<td>All</td>
<td>2,610</td>
<td>3.0% (1.8-4.9)</td>
<td>N.S.</td>
</tr>
</tbody>
</table>
Ross Procedure

Pros

• Extremely low early mortality at EXPERIENCED Centers in both adults and children

• Excellent 10-15 year survival, approaching that for age- and sex- matched populations
Survival Following the Ross Operation

David et al JTCVS 2010;139:68
Ross Procedure

Pros

• Extremely low early mortality at EXPERIENCED Centers in both adults and children
• Excellent 10-15 year survival, approaching that for age- and sex- matched populations
• Excellent hemodynamic performance-minimal and stable LVOT gradients
Ross Procedure
Pros

- Extremely low early mortality at EXPERIENCED Centers in both adults and children
- Excellent 10-15 year survival, approaching that for age- and sex- matched populations
- Excellent hemodynamic performance-minimal and stable LVOT gradients
- Low prevalence of thromboembolic and infectious complications
Freedom From Thromboembolism

<table>
<thead>
<tr>
<th>Years</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>99</td>
</tr>
<tr>
<td>7</td>
<td>99</td>
</tr>
<tr>
<td>10</td>
<td>99</td>
</tr>
</tbody>
</table>

## Thromboembolic and Infectious Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. of Patients</th>
<th>Complication No.</th>
<th>Complication %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thromboembolism</td>
<td>1660</td>
<td>25</td>
<td>1.5%</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>1660</td>
<td>11</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Pooled data (References 1-7)
Ross Procedure
Pros

- Extremely low early mortality at EXPERIENCED Centers in both adults and children
- Excellent 10-15 year survival, approaching that for age- and sex- matched populations
- Excellent hemodynamic performance-minimal and stable LVOT gradients
- Low prevalence of thromboembolic and infectious complications
- No need for anticoagulant therapy
Ross Procedure

Cons

• Progressive dilatation of the autograft when used as a root replacement
Freedom From Neo-aortic Root Dilatation (N= 126)

Ross Procedure

Postoperative Echocardiographic Measurements of Diameter of the Pulmonary Autograft

Ross Procedure

Cons

• Progressive dilatation of the autograft when used as a root replacement
• Progressive neo-aortic valve regurgitation with both the root replacement and inclusion techniques
Ross Procedure

Freedom From Moderate or Severe (>3+) and Mild (>2+) Neo-aortic Regurgitation

David et al. JTCVS 2010;139:68
Ross Procedure

Freedom From Moderate or Greater Autograft Regurgitation

10 years
Root: 76 ± 10%
Inclusion: 73 ± 14%

deKerchove et al Ann Thor Surg 2009;87:95
Ross Procedure

Cons

- Progressive dilatation of the autograft when used as a root replacement
- Progressive neo-aortic valve regurgitation with both the root replacement and inclusion techniques
- Progressive need for reoperation on the autograft and the allograft in the RVOT
# Freedom From Reoperation

<table>
<thead>
<tr>
<th>Reoperation</th>
<th>No. of Series</th>
<th>Actuarial Freedom at 10 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autograft</td>
<td>6</td>
<td>75%-90%</td>
</tr>
<tr>
<td>(Ref 1-5,7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allograft</td>
<td>7</td>
<td>90%-97%</td>
</tr>
<tr>
<td>(Ref 1-5,6,7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Reoperation</td>
<td>4</td>
<td>73%-90%</td>
</tr>
<tr>
<td>(Ref 1,2,6,7)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Freedom From Autograft Reoperation

10 years
Root: 84 ± 13%
Inclusion: 81 ± 10%

Autograft arterial walls showed:

- variable granulation tissue (early)
- loss of elastin
- accumulation of collagen
- variable disruption of structure
Morphologic Features of Explanted Pulmonary Autografts
(Rabkin-Aikawa et al.)

Autograft valves showed:

- nearly normal 3 layered structure
- intact elastin
- usual outflow surface corrugations
- well-preserved collagen microstructure
- minimal inflammatory cells
- absence of calcification or thrombi
Risk Factors for Autograft Dilatation and Reoperation

Major *

• Aortic regurgitation (as dominant lesion)
• Male gender
• Large aortic annulus (> 27mm)
• Aortic/pulmonary annulus mismatch
• ? Bicuspid aortic valve

* According to prevalence
Risk Factors for Autograft Dilatation and Reoperation

Minor *

• Rheumatic valvular disease
• Pulmonary hypertension
• Previous cardiac surgery (abnormal pulmonary valve)
• Genetically mediated connective tissue disorders
  (Marfan, Ehler-Danlos, Loewys-Dietz, Turner, Shone syndromes, Osteogenesis imperfecta)
• Immune- mediated disorders
  (Rheumatoid arthritis, lupus erythemoatosis, ankylosing spondylitis, antiphospholipid antibody)

* According to prevalence
Chronic Type A Dissection in a Pulmonary Autograft

Abdullah Kaya, Robin H. Heijmen, Willem Vreuls¹, Cornelis A. Seldenrijk¹, Marc A. Schepens

Departments of Cardiothoracic Surgery and ¹Pathology, St. Antonius Hospital Nieuwegein, The Netherlands

A 37-year-old patient presented with severe aortic valve insufficiency due to massive dilatation of the neo-aortic root (77 mm diameter) 14 years after a Ross procedure. Intraoperatively, the dilatation appeared to be caused by a localized chronic dissection of the pulmonary autograft.

Surgery consisted of a modified Bentall procedure with a mechanical composite valve, with an uncomplicated postoperative course.

The Journal of Heart Valve Disease 2007;16:162-164
Dissection in a Pulmonary Autograft

Edward H. Kincaid, MD, James D. Maloney, MD, Sidney W. Lavender II, PA-C, and Neal D. Kon, MD

Department of Cardiothoracic Surgery, Wake Forest University School of Medicine, Winston-Salem, North Carolina

We report the case of a type II aortic dissection involving the pulmonary autograft after a Ross procedure 6 years earlier. A dissection flap was present in both the native ascending aorta and right coronary sinus of the autograft. At reoperation, the valve was spared using a root remodeling technique.

Who Should Have a Ross Procedure?

- Infants and small children for whom no other suitable valve substitute exists
- Highly selected older children and young adults
Who should NOT have the Ross Procedure?
Who should NOT have the Ross Procedure?

EVERYONE ELSE
Aortic PERIMOUNT Pericardial vs. SVD

Carpentier-Edwards PERIMOUNT Aortic Pericardial Bioprosthesis

Actual Freedom From Explant Due to SVD

Years Postoperative

Age 85
Age 75
Age 65
Age 55
Age 45