Biological Heart Valves

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Heart Valves: Form and Function

- 4 valves
  - Tricuspid
  - Pulmonary
  - Mitral
  - Aortic
- Trileaflet structure
  - Except Mitral (bileaf)
- Prevents backflow of blood in the heart
Heart Valve Disease

- 82,000 valve surgeries in 2001
- Calcification leads to “stenosis”
- Leaky valves leads to regurgitation and backflow
Heart Valve Replacements

- Mechanical Valves
- Biological Tissue Valves
Advantages and Disadvantages of Bioprosthesis

Advantages:

• No anticoagulation

• No foreign material (non-biological)

Disadvantages:

• Short durability

• Calcification
Cadaveric Homografts

- Limited Supplies!
- Possible immune reaction
Tissue Valve Types

• Porcine or Bovine tissue
• Stented valves
• Stentless valves
Glutaraldehyde treatment for tissue

- Glutaraldehyde sterilizes valve tissue, renders it bioacceptable by destroying antigenicity, and stabilizes the collagen crosslinks for durability.
- Subject to calcification after an extended time!
Stented Heart Valves

- Mosaic® by Medtronic, inc.
- Carpentier-Edwards PERIMOUNT Bioprosthesi
  sby Edwards Lifesciences
- Hancock® II by Medtronic, inc.
## Comparison of Available Stented Valves

<table>
<thead>
<tr>
<th>Product</th>
<th>Treatment</th>
<th>Placement</th>
<th>Material</th>
<th>Experience</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic</td>
<td>AOA tissue treatment</td>
<td>Supra-annular</td>
<td>Acetal homopolymer stent</td>
<td>5 years</td>
<td>N/A</td>
</tr>
<tr>
<td>Perimount</td>
<td>XenoLogiX</td>
<td>N/A</td>
<td>N/A</td>
<td>15 years</td>
<td>Smaller valves 19 mm +</td>
</tr>
<tr>
<td>Hancock II</td>
<td>None</td>
<td>Supra-annular</td>
<td>Acetal homopolymer stent</td>
<td>15 years</td>
<td>Larger valves 21 mm +</td>
</tr>
</tbody>
</table>
Stentless Heart Valves

• Freestyle® Aortic Root bioprosthesis by Medtronic, inc.

• Toronto SPV® Valve by St. Jude Medical, inc
Advantages of Stentless Valves

• Natural shape

• Superior hemodynamics

• Larger valves can be implanted
Heart Valve Procedure

- Heart Valve Surgery
The Future!

Tissue-Engineered Alternatives: Valves in a Dish
Decellularized allograft valves seeded with vascular endothelial cells

- Decellularized allograft tissue
  - SynerGraft procedure
- Seeded with endothelial cells
- Implanted
- Cellular repopulation and procollagen synthesizing
Promising Outcomes

- Long-lasting
- No anticoagulation treatment needed
- Your own tissue!
The End!

Thank You!