Perventricular VSD Closure
Plugging Holes in the Basement

Daniel H. Gruenstein, M.D.
Assoc. Professor, Pediatrics
University of Minnesota Amplatz Children’s Hospital
• Objectives:
  – Available Devices/Equipment
  – Selection of Device
  – Selection of Approach
  – Technique for Closure
  – Pitfalls/Challenges
PICES

- Pediatric/Congenital Interventional Cardiology Early-Career Society
- Taskforce within the Congenital Heart Council of SCAI
- AlexGoldenMD@gmail.com
SCAI – Fellow Course 2013

Objectives:
- Available Devices/Equipment
- Selection of Device
- Selection of Approach
- Technique for Closure
- Pitfalls/Challenges
Devices for Congenital Interventions

Off Label
Off Label Use of Amplatzer Occlusion Devices

Amplatzer ASO for pulmonary AVM

Uthaman, et al
Catheterization and Cardiovascular Interventions
70:422–428 (2007)
Off Label Use of Amplatzer Occlusion Devices

Amplatzer ADO-I
For AP window

Atiq, Quereshi - Pediatr Cardiol 24:298–299, 2003
Off Label Use of Amplatzer Occlusion Devices

ADO-I for mitral peri-valvar leak
Off Label Use of Amplatzer Occlusion Devices

Trans-catheter closure of the native aortic valve with an Amplatzer® Occluder to treat progressive aortic regurgitation after implantation of a left-ventricular assist device.

Off Label Use of Amplatzer Occlusion Devices

Sweet Off-Road Trip Saved from Totally Gnarly Flat -
Off-label Use for Amplatzer ASO Device
Off Label Use of Amplatzer Occlusion Devices

Half-way Decent Bottle of Wine Saved for Second Night –
Off-label Use for Amplatzer Vascular Plug

Levi D, et al
Wine Enthusiast - Chinese
February 2012

University of Minnesota
Amplatz Children's Hospital
Off Label Use of Amplatzer Occlusion Devices

Emergency Patch Work with Amplatzer PFO occluder

Gillespie M. et al
On label Use!!!
Off label approach…

AMPLATZER® Muscular VSD Occluder
Device Description

- The AMPLATZER Muscular VSD Occluder is a self-expandable double disc device made from nitinol wire mesh.

- The two discs are linked together by a short cylindrical waist corresponding to the size of the VSD.

- In order to increase its closing ability, the discs and waist are filled with polyester fabric.

- The polyester fabric is securely sewn to the device by polyester thread.
- Self-Expandable
- Nitinol Wire .004” - .008”
- Sizes: 4 - 18 mm

<table>
<thead>
<tr>
<th>Device Size (Waist = A)</th>
<th>4mm</th>
<th>6mm</th>
<th>8mm</th>
<th>10mm</th>
<th>12mm</th>
<th>14mm</th>
<th>16mm</th>
<th>18mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA Disc (B)</td>
<td>9mm</td>
<td>14mm</td>
<td>16mm</td>
<td>18mm</td>
<td>20mm</td>
<td>22mm</td>
<td>24mm</td>
<td>26mm</td>
</tr>
<tr>
<td>LA Disc (C)</td>
<td>9mm</td>
<td>14mm</td>
<td>16mm</td>
<td>18mm</td>
<td>20mm</td>
<td>22mm</td>
<td>24mm</td>
<td>26mm</td>
</tr>
<tr>
<td>Length of Waist (D)</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
<td>7mm</td>
</tr>
</tbody>
</table>

**Discs are same size**

**Discs are 8 mm > waist**

(4 mm beyond waist in all directions)
AMPLATZER Delivery Systems

AMPLATZER® Delivery System

AMPLATZER® TorqVue® Delivery System
<table>
<thead>
<tr>
<th>Order Number</th>
<th>Device Size</th>
<th>AMPLATZER Delivery System Smallest Recommended Sheath Size</th>
<th>AMPLATZER TorqVue Delivery System Smallest Recommended Sheath Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-VSDMUSC-004</td>
<td>4 mm</td>
<td>6-7 French, 45 or 180° curve</td>
<td>6 French, 45 or 5 French, 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-006</td>
<td>6 mm</td>
<td>6-7 French, 45 or 180° curve</td>
<td>6 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-008</td>
<td>8 mm</td>
<td>7-8 French, 45 or 180° curve</td>
<td>6 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-010</td>
<td>10 mm</td>
<td>7-8 French, 45 or 180° curve</td>
<td>6 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-012</td>
<td>12 mm</td>
<td>8-9 French, 45 or 180° curve</td>
<td>7 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-014</td>
<td>14 mm</td>
<td>8-9 French, 45 or 180° curve</td>
<td>8 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-016</td>
<td>16 mm</td>
<td>8-9 French, 45 or 180° curve</td>
<td>8 French, 45 or 180° curve</td>
</tr>
<tr>
<td>9-VSDMUSC-018</td>
<td>18 mm</td>
<td>8-9 French, 45 or 180° curve</td>
<td>9 French, 45 or 180° curve</td>
</tr>
</tbody>
</table>

Sheath size (somewhat) less important with ventricular access
Delivery “System” for Perventricular VSD Device Closure

Advance angiocath past needle tip to minimize trauma.

Do not fully withdraw needle to avoid kinking of plastic.
The AMPLATZER Noodlewire provides an atraumatic “J” tip and flexibility which is designed to facilitate the crossing of the VSD for device delivery.

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Wire Size</th>
<th>Type</th>
<th>Tip Type</th>
<th>Usable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-GW-004</td>
<td>.035&quot;</td>
<td>Soft Fixed Core</td>
<td>6mm J-Tip</td>
<td>300cm</td>
</tr>
</tbody>
</table>
• Pearl:
  – Imaging
    • Visualization of distal tip – J
HOW – 2011: VSD Closure

• Objectives:
  – Available Devices/Equipment
  – Selection of Device
  – Selection of Approach
  – Technique for Closure
  – Pitfalls/Challenges
Device Size Selection

- Transesophageal and/or epicardial echo guidance
- The defect is demonstrated by echo and the distance of the communication to the extreme apex and the aortic valve is determined and measured by angiography or TEE
- Chose a device up to 2mm larger than the defect
  - Which dimension?
  - Larger? Smaller?
  - Average?
Ideal Defect

Apical 4-Chamber

En Face
Device Size

**Diameters**

- $3.2 + 6.8 = 10$
- $10/2 = 5\text{ mm}$

**Circumference**

- $\text{Circumference} = 17\text{ mm}$
- $17/\pi = 5.4\text{ mm}$
HOW – 2011: VSD Closure

• Objectives:
  – Available Devices/Equipment
  – Selection of Device
  – Selection of Approach
  – Technique for Closure
  – Pitfalls/Challenges
Approach:
- Femoral vein
- IJ – low septal defects
- Perventricular
  - simultaneous surgery
  - limited vascular access
  - difficult approach (Ebstein)
  - high risk
• Pearl:
  – Imaging
    • Identification of site of approach – imaging palpation
    • Give enough distance to allow for complete exposure of RV disc (May need to approach apical defects from mid RV free wall)
TEE images in four-chamber views (except H) demonstrating the closure procedure

HOW – 2011: VSD Closure

• Objectives:
  – Available Devices/Equipment
  – Selection of Device
  – Selection of Approach
  – Technique for Closure
  – Pitfalls/Challenges
Pitfalls/Challenges

• Surrounding Structures:
  – Valves:
    • Tricuspid valve - Can cover defect
    • Mitral/Tricuspid valve – can become ensnared
    • Aortic valve – can distort (more common in PMVSD)
Tricuspid Valve Follow-up

1-Year Follow-up

2-Year Follow-up
Ebstein
Microscrew Caught on Chordae?

Fractured Device

Tricuspid Valve Damage
Pitfalls/Challenges

• Infant with CoA and VSD – multiple comorbidities
  – PA band and CoA repair
  – Recoarctation – decision to stent
  – Bilateral femoral arterial occlusion
  – Hybrid stent from AAo, deband/VSD
crap
What now????

- Suctioned blood from the field
- Turned the heart over – perforation by the LAD
- Quick stitches to close the perforation
- DONE!
- Repositioned the heart and imaged
Proximity of the LV Free Wall

A  B
Cause of Perforation?

Proximity of the LV Free Wall

Protrusion of the Device?
Pitfalls/Challenges

Surrounding Structures:

- Ventricular free wall:
  - LV free wall –
    - Advancing device, rather than “unsheathing”
    - Perventricular – can pass wire/sheath too far from RV
  - Apex
    - can limit space for device expansion/distort device
Insufficient Inferior Rim

No Apical Ventricular Septum

Color Flow Doppler

LV
D
Pearl:

- **Imaging – Determining puncture site**
  - Identification of site of approach – imaging palpation
  - Give enough distance to allow for complete exposure of RV disc (May need to approach apical defects from mid RV free wall)
Pearl:
- Imaging – Avoid trauma
  - Visualization of distal tip – J
  - If you aren’t POSITIVE where the tip of a wire/sheath is – DON’T advance – pull back and re-image
Pearl:
- Exposure of LV disc
  - Expose by pulling back sheath, NOT by advancing device
Thank you for listening

My butt hurts.

What?
No Caption Found

No Caption Found

No Caption Found