PFO-ASD Closure: How to Treat and With What?

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## Conflict of Interest Statement

<table>
<thead>
<tr>
<th>Physician name</th>
<th>Company</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Horst Sievert</td>
<td>Abbott, Access Closure, AGA, Angiomed, Boston, CardioKinetix, Cierra, Coaptus, Cordis, CSI, Edwards, EndoTex, ev3, Gore, Guidant, Kensey Nash, Mind Guard, NDC, Neovasc, NMT, Percardia, Sorin, St. Jude, Terumo, Topspin, Velocimed, Lumen Biomedical</td>
<td>Consulting fees, Honoraria, Travel expenses, Study honoraria</td>
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<td>Cardiokinetics, Access Closure, Velocimed, Cierra, CoAptus, Lumen Biomedical</td>
<td>Stock options, Stocks</td>
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Amplatzer

Nitinol wire frame mesh with Dacron patches inside

The two discs are linked together by a short connecting waist

18, 25, 30, 35 mm
CardioSEAL and CardioSEAL-STARflex

Two rectangular discs each consisting of four wire spring arms Covered with a polyester patch Microspring system (CardioSEAL-STARflex)
Helex

Two discs formed by one continuous Nitinol wire in the shape of a spiral.

ePTFE patch is attached to the wire.

15-35 mm
Premere™ (St. Jude)

- Self-expanding dual-anchor arm occlusion device
- Right anchor is sandwiched between two layers of knitted polyester fabric
- A flexible polyester braided tether running through the center of the anchor holds the two anchors together
- The anchors are locked together after delivery and then the tether is cut
Step by Step

- Local anesthesia
- Transvenous 8-11 F sheath
- 10,000 E Heparin
- Multipurpose catheter → pulmonary vein
- Stiff wire
- LAO projection (40°)
- Balloon sizing
- Device implantation
- < 30 min
- Hospital stay < 24 hours
Balloon sizing

14 mm
Observe balloon pressure!!
Pressure inside of the balloon

Avoid pressure increase
Usually straight forward...

...but it may be difficult
Long Tunnel
Long Tunnel
Long tunnel
Implantation after transseptal puncture
Premere Occluder
Variable Distance between the disks

Long Track

Short Track
Can we close PFOs with septal aneurysm?

Balloon Sizing: 20 mm
Yes, we can!

Immediately after closure
Yes, we can!

6 months later
Can we do it...?

- **Without balloon sizing?**
  - Yes, we can
    - With some rare exceptions
- **Without TEE or ICE?**
  - Yes, we can, fluoro alone works
- **Without fluoro?**
  - Yes, we can, TEE or ICE alone works
- **Without patients?**
  - Yes, we now have simulators
- **Without physicians?**
  - Yes, like all interventional procedures: it is just a question of training
New Devices
Solysafe® (Carag)
Prof. Laszlo Solymar

- **Self-centering**
- **Two foldable Polyester patches**
  - attached to eight Phynox wires
- **Stretched device fits into 10 F introducer**
- **In the defect, wire-holders are moved towards each other**
- **Clicking mechanism keeps the wire-holders together**
Occlutech

- Self-expanding Nitinol wire mesh
- "modified Amplatzer design"
  - Only one fixation sleeve
- Clinical trials have started
BioSTAR (NMT)

- CardioSEAL® framework
- STARFlex® self-centering mechanism
- Tissue-engineered collagen matrix
  - derived from the submucosal layer of the porcine small intestine (ICL)
  - Heparin coating
BioTREK

- Based on CardioSEAL-BioSTAR technology
- Completely resorbable
- Animal tests
PFO Closure by Radiofrequency

Nothing left behind
ASDs
Amplatzer ASD Occluder

- The only device suitable for ASDs >> 20 mm
- The only device which can be used in the majority of adult patients
- Standard of care worldwide
Percutaneous ASD-closure
- Experience with 851 occluders -
Large ASD's
Technical Considerations

- Almost all large ASD's have no anterior septal rim
  - No problem!
- They may have a small inferior or posterior rim
  - May be critical but you still can try
- If they do not have a cranial rim
  - Be careful!
Tips and Tricks
Large ASD's

- Balloon sizing
  - Stiff wire in the left upper pulmonary vein
  - Pull back technique
    - Inflate the balloon in the LA and pull it back
  - In defects >35 mm
    - 40 mm Meditech sizing balloon
- Measure the pressure in the balloon
  - to avoid over-stretching
Tips and Tricks
Large ASD's

• Sheath
  - New AGA sheath or
  - transseptal Mullins sheath
    • 2 F sizes larger than Amplatzer sheath!
  - Avoid air embolism!
Hausdorf Sheath
Tips and Tricks
Large ASD's

- Device selection
  - Do not over-size device by more than 2-4 mm
    - Larger devices may perforate
What is the most common problem in large ASDs?

- Missing anterior (retro-aortic) rim
  - Causes protrusion of the anterior edge of the device into the right atrium
  - The device becomes perpendicular to the plane of atrial septum
    - A short cranial rim can and will aggravate the situation
Tips and Tricks

How to align the left atrial disc?

- Look at TEE, not fluoroscopy
- Keep the anterior edge of the device away from the septum
  - Place the sheath in the left or right upper pulmonary vein
  - Sheath should point posteriorly and the tip towards the pulmonary veins
  - Rotate the sheath (and the delivery cable) to keep it pointing posteriorly
• Rotate the sheath clock-wise
• Keep tension !!
Important!

- Open the left atrial disc and the waist in the LA
- Start opening the right atrial disc before the LA disc is really touching the septum
- Open the RA disc quickly
This almost ever works!!
If it fails

- Left upper pulmonary vein technique
  - Start opening the left atrial disc in the left upper pulmonary vein
  - Keep the cable on tension
  - Pull the sheath back completely with the LA disc fixed in the pulmonary vein
  - Then pull the LA disc until the occluder "jumps into the defect"
.... or

- **Right upper pulmonary vein technique**
  - Start opening the left atrial disc in the right upper pulmonary vein
  - Pull back the sheath and open the RA disc in a continuous movement
"2nd Catheter Technique"

- 2nd venous access
- 8F MP Guiding catheter/stiff wire
- Keep the cranial anterior part of the LA disc in the LA
- Open RA disc and pull back the 2nd catheter simultaneously
Where are the limits?

56 mm

40 mm

50 mm
10th International Congress
June 7 – 9, 2007
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