Case Presentation
Mitral PVL Closure

Carmen Moldovan, MD, PhD
1st Department of Cardiology
Hippokration Hospital
The broad spectrum of percutaneous MV treatment options and the increasing complexity of percutaneous procedures to treat MV disease necessitate knowledge of normal and abnormal MV anatomy.

Because of the complexity of procedures a combination of different imaging modalities (TEE, CT, MRI) is often required to adequately screen and guide these procedures.
Transcatheter PVL Closure – Safe, Feasible and Efficient treatment
Transcatheter Mitral PVL Closure
Most echo dependent cardiac structural interventions
Technically demanding Procedure

- Imaging (unfeasible without 2D/3D TEE)
- Patients selection (High Risk)
- Steep Learning curve
- Head to head comparison of surgical and catheter based interventions
- Device improvement
- Procedural technique
### Key Points for Successful Paravalvular Mitral Leak Closure

<table>
<thead>
<tr>
<th>Procedural Steps</th>
<th>2D TEE</th>
<th>3D TEE</th>
<th>Fluoroscopy</th>
<th>Pre-Procedural CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-procedural evaluation of the defect(s) (number, size, shape, relationship to neighboring structures and the sewing ring/mechanical valve)</td>
<td>++</td>
<td>+++</td>
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<tr>
<td>Pre-procedural evaluation of the severity of perdevice leakage</td>
<td>+++</td>
<td>+++</td>
<td>-</td>
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<tr>
<td>Guidance of transseptal puncture</td>
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<tr>
<td>Catheter/sheath maneuvering in the left atrium and wiring of the defect (best performed with a steerable sheath; the use of a hydrophilic wire enhances the chance to cross the defect against the direction of the regurgitant jet)</td>
<td>++</td>
<td>+++</td>
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<td>-</td>
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<tr>
<td>Verification of correct canalization of the defect intended for closure</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>-</td>
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<tr>
<td>Advancement of a catheter through the leak and replacement by a support wire over which the delivery sheath is subsequently advanced</td>
<td>+++</td>
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<tr>
<td>Device selection according to the specific anatomy of the defect (crescent shape vs. round)</td>
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<td>+++</td>
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<td>+++</td>
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<tr>
<td>Verification of proper mechanical MV function after device placement</td>
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<td>+++</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Device orientation post-deployment (important when an oval-shaped device is used)</td>
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<td>+++</td>
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<tr>
<td>Evaluation of the location, extent and severity of residual leakage after device deployment</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>-</td>
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Wunderlich et al, J Am Coll Cardiol Img 2018;11:872–901
3D TEE to define the Location of Mitral PVLs - (“en face”) MV view “Clock Model”

It is necessary to refer PVL in relation to anatomic reference points

Wunderlich et al, J Am Coll Cardiol Img 2018;11:872–901)
Paravalvular Leak Localization - Surgeon’s view time-clock Method

Mahjoub et al, J Am Coll Cardiol Intv 2011;4:107–14
A comprehensive description of PVL anatomy is of paramount importance. 3D Color Doppler TEE for Mitral PVL Quantification: ARO versus ERO. CD-mapped flow across PVL with the identification of true VC.

**Anatomic orifice area (ARO):**
Extraction of the 2D plane that includes the anatomic orifice of the leak.

**Effective orifice area (ERO):**
The frame in which the origin of the regurgitant jet is best visualized is selected. Then the multiplanar reconstruction tool allows the selection of the 2D plane that best shows the regurgitant orifice.
### Technical aspects of image acquisition

**Device Selection - Multiplug Devices AVPIII vs Single Device PLD**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Benefit</th>
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<tbody>
<tr>
<td>Zoom mode + CD acquisition of small volume of tissue containing PVL channel only</td>
<td>Highest possible volume rate</td>
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<tr>
<td>Single-beat acquisition only</td>
<td>Avoidance of stitching artifacts</td>
</tr>
<tr>
<td>Multiplanar presentation</td>
<td>Measurements of CSA of VC, minimum and maximum dimensions of VC, channel length</td>
</tr>
</tbody>
</table>

- **Suitable for multiplug AVP III**
  - Irregular/crescent CSA of VC
  - Channel length >5 mm
  - Bulks of calcium within channel or surrounding structures that might impede full expansion of discs

- **Suitable for single PLD**
  - Round/oval CSA of VC
  - Channel length ≤5 mm
  - No structures potentially impeding disc apposition

*Transcatheter Paravalvular Leak Closure, Springer 2017*
Closure Devices

- **Current devices**
  - Off-label use
  - Vascular plugs (AVPII, AVPIII, AVPIV)
  - Duct occluders
  - No clinical trials
  - No head-to-head comparisons

- **Dedicated devices**
  - PLD device (CE-Marked for PVL)

- **Progress**
  - Dedicated devices for TA and TS
  - Imaging (Heart navigator, etc)
  - Hybrid imaging (echo + fluoro, CT + fluoro)
  - Sizing
Occlutech® PLD Occluder remarkably high procedural success rates
Ongoing international multicenter follow up study
Two shapes, two different disk connections
73-year-old male patient who presented with progressive dyspnea (NYHA III).


Labs consistent with hemolysis (hemoglobin level, 9.9 g/dL; reticulocyte count, 3.1%; and lactate dehydrogenase level 1000 U/L).

A TEE showed two localized mitral paravalvular leak that caused moderate to severe regurgitation. On TEE, one defect was anterolateral at 10-11 o'clock position and a smaller at 7-8 o'clock position. After the patient was informed of the treatment options in detail, he agreed to undergo percutaneous closure (antegrade, transseptal approach) of the defect.
Multiple mitral paravalvular leaks

The authors recommend closing the major leak only at first, as if there is significant infection/hemolysis, the offending device can be identified.

The authors place multiple devices or close multiple leaks if there is uncertain follow-up or with two equally sized large leaks.
Occlutech PLD 12x5mm
Assessment of TPVLC acute procedural effect

Reduction of CD mapped flow
Comparison of VC CSA by RT 3D TEE with CD
Reduction in transprosthetic gradient
Normalization of flow pattern in PV
Echo contrast (SEC) in usually dilated LA
Lower LA pressure
• 72-year-old male patient who presented with progressive dyspnea (NYHA III).

• Previous MVR (twice), AVR (2006) for rheumatic valve disease.

• Labs consistent with hemolysis. A TEE showed a localized mitral paravalvular leak that caused moderate regurgitation and the defect was posterolateral and in the 7-8 o’clock position.

• He underwent an percutaneous antegrade (transseptal) attempt one year ago, rejected from cardiac surgeons (3) and he had no other treatment options. After the patient was informed of the treatment options in detail, he agreed to undergo transapical percutaneous closure of the defect.
1st Department of Cardiology, University of Athens
Thank you