Procedural TEE for Native Mitral Valve-in-Valve (VinV) and Valve-in-Ring (ViR)

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G. Burkhard Mackensen, MD, PhD, FASE
Professor & Chief, Division of Cardiothoracic Anesthesiology
Department of Anesthesiology & Pain Medicine
UW Medicine Research & Education Endowed Professor in Anesthesiology
DISCLOSURE

• NONE
Role of Echocardiography in Transcatheter Mitral Valve Replacement in Native Mitral Valves and Mitral Rings

G. Burkhard Mackensen, MD, PhD, FASE, James C. Lee, MD, Dee Dee Wang, MD, FASE, Paul J. Pearson, MD, PhD, Philipp Blanke, MD, Danny Dvir, MD, and James N. Kirkpatrick, MD, FASE, Seattle, Washington; Detroit, Michigan; Milwaukee, Wisconsin; and Vancouver, British Columbia, Canada
CASE#1: Complex MAC

- 67 yo F – current inpatient with severe symptomatic calcific mitral stenosis admitted for consideration of TMVR
- PMH: severe COPD, 2 renal transplants secondary to urethral reflux (1981, 2002), CAD s/p PCI 8/30/17, parathyroidectomy, OSA, HTN, HLD, PVD
- Symptoms: currently hospitalized for progressive SOB; NYHA III-IV
- Ht= 154 cm  Wt= 76.5 Kg  BMI= 32.3 kg/m2
- BNP= NA  Cr= 2.1 mg/dL
- STS score: 12% for surgical mitral replacement
CASE#1: Operability statement

"Given the patient's comorbidities, but specifically immunosuppression, severe peripheral vascular disease, but specifically chronic obstructive pulmonary disease, I believe the patient is a poor surgical candidate with a much more significant risk of pulmonary complications or healing complications. ”

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## CASE#1: Transthoracic Echo

<table>
<thead>
<tr>
<th>Echo Variable (TTE)</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak MVG (mmHg)</td>
<td>26-28</td>
</tr>
<tr>
<td>Mean MVG (mmHg)</td>
<td>13-15</td>
</tr>
<tr>
<td>Calculated MVA by PHT (cm²)</td>
<td>1.0</td>
</tr>
<tr>
<td>Severity of MR</td>
<td>Mild-Mod</td>
</tr>
<tr>
<td>Severity of AR</td>
<td>Trace</td>
</tr>
<tr>
<td>Ejection Fraction (%)</td>
<td>70%</td>
</tr>
<tr>
<td>PASP (mmHg)</td>
<td>37-42</td>
</tr>
</tbody>
</table>

Mean PG = 13 mmHg
CASE#1: CT assessment, LVOT evaluation and 3D printing

Aorto-mitral angle: 47°
### LVOT Obstruction evaluation:

<table>
<thead>
<tr>
<th>Valve</th>
<th>Position</th>
<th>Baseline LVOT surface area (mm²)</th>
<th>Predicted Neo-LVOT Surface area (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 S3</td>
<td>60LV / 40LA</td>
<td>302.1</td>
<td>95.6</td>
</tr>
<tr>
<td>26 S3</td>
<td>80LV / 20LA</td>
<td>319.4</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Courtesy of Dee Dee Wang MD, Henry Ford Hospital
CASE#1 - Question: what should be done next?

1. Forget about TMVR - the risk of LVOT obstruction is too large
2. Patient should undergo alcohol ablation to increase LVOT
3. Consider left atrial access/surgical hybrid approach for TMVR and resection of the anterior mitral valve leaflet
4. Plan for LAMPOON procedure followed by TMVR
CASE#1 - Answer: what should be done next?

1. Forget about TMVR - the risk of LVOT obstruction is too large
2. Patient should undergo alcohol ablation to increase LVOT
3. Consider left atrial access/surgical hybrid approach for TMVR and resection of the anterior mitral valve leaflet
4. Plan for LAMPOON procedure followed by TMVR
• The valve implant displaces the anterior mitral leaflet towards the septum
• Current options
  – Deny TMVI
  – Surgical anterior leaflet resection – thoracotomy/cardiopulmonary bypass
  – Alcohol septal ablation – sacrifices myocardium/conduction tissue, requires thick septum with appropriate perforator, delays procedure by 4-6 weeks in symptomatic patients
  – LAMPOON: Laceration of the Anterior Mitral leaflet to Prevent Outflow Obstruction

JM Khan, JACC Cardiovasc Interv. 2016; Sep 12, 9(17):1835
Laceration of the Anterior Mitral leaflet to Prevent Outflow Obstruction
CASE#1: Transesophageal Echo - procedure
CASE#1: Transesophageal Echo - procedure

Deep TG view of LVOT

PW Doppler in LVOT
CASE#1: TEE - Approaching AML and LA snare

Wire approaching AML from aortic valve

LA snare
CASE#1: TEE - value of procedural monitoring

Wire tension causing severe MR

Wires relaxed, MR improved
CASE#1: TEE - LAMPOON happening
CASE#1: TEE - importance of image-guidance
CASE#1: TEE - LAMPOON happening

Laceration of AML causing severe MR
CASE#1: TEE - after TMVR (VinV)
CASE#1: TEE - after TMVR (VinV)
CASE#1: TEE - after TMVR (VinV)

LVOT Mean PG = 2 mmHg
CASE#2: Complex MAC in patient with AVR

- Now presents with symptomatic severe MS and MAC, porcelain aorta, deemed at prohibitive risk for REDO surgery
- Pulmonary artery hypertension
- Elevated wedge pressures (28/41/27)
- Elevated creatinine
- Patient was excluded from MITRAL study due to high LVOT obstruction
CASE#1: Initial CT
CASE: Initial TEE images
CASE: Initial TEE images
CASE: Initial TEE images
CASE: Initial TEE images
How to circumvent mechanical AV and still do LAMPOON?

- Transapical access established
- Tested and optimized in cadaveric specimen (Mark Reisman and Dmitry Levin)
- LAMPOON approach from LV to undersurface of anterior mitral valve leaflet aiming for middle of A2
- TEE and Fluoroscopy guidance to optimize position
- Transeptal approach for TMVR, advancing valve into LA
- LAMPOON followed by deployment
CASE: procedural imaging
Challenging hemodynamics due to wires
Piercing of AML
More MR after LAMPOON
Valve-in-native Valve: deployment
TMVR result
Final TMVR result

• Successful primary transapical LAMPOON and TMVR
• Value of preparations (cadaveric specimen)
• Great team effort with Jamie McCabe, Gabriel Aldea, Mark Reisman
• Expertise of NIH team around Drs. R. Ledderman, J. Khan
CASE#3: failed MV annuloplasty

- 74 y.o M
- uncontrolled DM, hypothyroidism, CKD (creatinine 2.0)
- Symptoms: NYHA II-III
- Ht= 188 cm  Wt= 93 kg  BMI= 26.32 kg/m2
- BNP= 282 pg/mL (5/23/17)  Cr= 2.00 mg/dL (5/23/17)
- STS score: 8.99% for mitral replacement
CASE#3: initial assessment with CT and echocardiography

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CASE#3: initial assessment with CT and echocardiography
CASE#3: 3D TEE during deployment of TMVR in ring 80/20 deployment of a 29 Sapien 3
CASE#3: 3D TEE during deployment of TMVR in ring
CASE#3: Fluoro deployment of TMVR in ring and TEE post
CASE#3: Post-procedural assessment with TEE
CASE#3: Post-procedural assessment with TEE

Utility of islice to assess LVOT
CASE#3: Post-procedural assessment with TEE

Utility of islice to assess LVOT
CASE#3: Post-procedural assessment with TEE

AV
LA
LV
CASE#3: Post-procedural assessment with TTE
Conclusion

• Echocardiography is key to determining complex mitral valve pathology and suitability for the right percutaneous approach.

• 2D and 3D TEE is invaluable for percutaneous procedural guidance, confirming success, and exclusion of complications.

• The role of interventional echocardiography will increase with the development of novel new devices & therapies for the MV.
THANK YOU

@gb_mackensen

gbmac@uw.edu

https://www.linkedin.com/in/gbmackensen/