SURGICAL RISK IN VALVULAR HEART DISEASE: WHAT 2D AND 3D ECHO CAN TELL YOU AND WHAT THEY CAN’T

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Outline
- Valvular Surgery - surgical risk
- Strengths and limitations of Echocardiography in surgery and interventions for:
  - Stenotic lesions
    - TAVR
  - Low gradient aortic stenosis
  - Regurgitant lesions
    - Aortic insufficiency secondary to aortic root disease
    - Ischemic mitral regurgitation

Society of Thoracic Surgeons Score

EuroScore II

Guidelines on the management of valvular heart disease (version 2012)


http://www.euroscore.org/calc.html

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European Heart Journal (2012) 33, 2451–2496
AORTIC STENOSIS

Valvular Stenosis Severity

<table>
<thead>
<tr>
<th>Valve Area (cm²)</th>
<th>Aortic stenosis</th>
<th>Mitral stenosis</th>
<th>Tricuspid stenosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.6</td>
<td>&lt;1.0</td>
<td>&gt;1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Indexed valve area (cm²/m² BSA)</td>
<td>&lt;0.6</td>
<td>&gt;1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Mean gradient (mmHg)</td>
<td>&gt;40</td>
<td>&gt;10</td>
<td>≥5</td>
</tr>
<tr>
<td>Maximum jet velocity (m/s)</td>
<td>&gt;4.0</td>
<td>&gt;10</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Echo Doppler Assessment of AS Severity

Severe Aortic Stenosis

Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery

Underestimation of LVOT Diameter by 2D Echocardiography in a Patient with Aortic Stenosis

3D TEE and CT for Aortic Annular Dimensions

Vascular Access for TAVR

Choosing the Proper C Arm Position for TAVR Deployment
Relationship Between Mean Gradient (Y Axis) and Transvalvular Flow (X Axis) According to the Gorlin Formula for 3 Different AVA Values (0.7, 1.0, and 1.5 cm²)

Dobutamine Stress Echo in a Patient With Low Gradient Severe Aortic Stenosis

- Peak velocity 3.2 m/s, mean gradient 25 mm Hg, calculated AVA 0.45 cm²

- Peak velocity increased to 4.1 m/s, mean gradient to 39 mm Hg, and AVA remained at 0.5 cm²

- Results of global longitudinal strain, which was −5.5%, indicating severely abnormal myocardial function

Pseudo Aortic Stenosis
Dobutamine Stress Echo

- Peak velocity remained fairly constant, but AVA increased from 1.0 cm² to 1.4 cm², demonstrating both contractile reserve and absence of severe AS

Aortic Regurgitation Secondary to Aortic Root Disease

Dilation of the Sino tubular junction causing aortic insufficiency

Aortic Valve short and Long Axis Views

David T Prog Cardiovasc Dis 2010;52:438-444
Aortic valve–sparing operations for aortic root aneurysm

Aortic valve–sparing surgery for aortic root aneurysm 2D and M mode Echo

Aortic valve–sparing surgery for aortic root aneurysm 2D Color

Aortic valve–sparing surgery for aortic root aneurysm 2D Color and Spectral Doppler

Aortic valve–sparing surgery for aortic root aneurysm 3D Multiplane Reconstruction

Aortic valve–sparing surgery for aortic root aneurysm 3D Volume Rendition
The main mechanism of ischemic mitral regurgitation (MR) relates to distortion of the spatial relationships between the mitral valve and papillary muscles secondary to ventricular remodeling. This process can then become self-perpetuating as MR leads to ventricular dilatation, which in turn leads to further papillary muscle displacement, annular dilatation, and then more MR. Echocardiography provides mechanistic insights into the complex pathophysiology that involves the myocardium, the mitral subvalvular apparatus, and mitral annulus.
Ischemic Mitral Regurgitation
Ischemic Mitral Regurgitation

Anterior leaflet bend by papillary muscle displacement and leaflet tethering producing mitral regurgitation

Restoration of coaptation after cut of basal chordal, relieving tethering on the anterior leaflet

Szymanski, C Archives of Cardiovascular Disease (2013) 106, 183—187

Comprehensive Annular and Subvalvular Repair of Chronic Ischemic Mitral Regurgitation Improves Long-Term Results With the Least Ventricular Remodeling

Normal Leaflet Coaptation
Clockwise Basal Rotation

Abnormal Leaflet Coaptation
Impaired Basal Rotation
Conclusions

- Echocardiography plays a central role in the diagnosis and management of patients with advanced and complex valvular heart disease.
- Echocardiography is uniquely qualified to provide structural and functional information regarding valve dysfunction and its effects in ventricular remodeling.
- TAVR, Low grade aortic stenosis, aortic regurgitation secondary to aortic root disease and ischemic mitral regurgitation exemplify clinical scenarios where echocardiography provide unique information to enhance the diagnosis and treatment of patients with valvular heart disease.