Comprehensive 2D and 3D transoesophageal echocardiography assessment of the mitral and aortic valve.

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UCL - Cliniques Saint Luc

EAE - EACTA
Teaching course
No conflict of interest to disclose
Recommendations for transoesophageal echocardiography: update 2010

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1. Mitral valve assessment
2. Aortic valve assessment
MV imaging
Anatomy of the mitral valve
MV imaging
Segmental approaches

The surgical view

The echo view
MV imaging
Segmental approaches

EAE- EACTA recommendations for TEE, Eur J Echo, 2010, 11,557-576
MV imaging
TOE assessment
MV imaging
TOE assessment
MV imaging
TOE assessment
MV imaging
TOE assessment

MID (4cv): A2-P2

High: A1-P1

Low: A3-P3
MV imaging
TOE assessment

M Commissures

M 4 ch V
M LAX
M 2 ch V
M Commissures
MV imaging
Transoesophageal echocardiography

The diagram illustrates different views of the heart using transoesophageal echocardiography. The viewpoints are marked with angles: 0°, 45°, 90°, 135°, and 180°. Each viewpoint shows the orientation of the mitral valve (MV) and the annular segments (P1, P2, P3, A1, A2, A3, A2-1).
MV imaging
TOE assessment

Depth: 30 cm
Rotation: 0°
MV imaging
TOE assessment

Depth: 30 cm
Rotation: 45 - 70°
MV imaging
TOE assessment

Depth: 30 cm
Rotation: 80 - 110°
MV imaging
TOE assessment

Depth: 30 cm
Rotation: 110 - 150°
MV imaging
TOE assessment: transgastric SAX

Depth: 45 cm
Rotation: 0°
MV imaging

TOE assessment of mitral regurgitation

Blood pressure!
( low blood pressure underestimate functionnal MR!)

LV function
( post operative period)
### MV imaging

**TOE assessment of mitral regurgitation**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV morphology</td>
<td>Normal/Abnormal</td>
<td>Normal/Abnormal</td>
<td>Flail leflet/Ruptured PMs</td>
</tr>
<tr>
<td>Colour flow MR jet</td>
<td>Small, central</td>
<td>Intermediate</td>
<td>Very large central jet or eccentric jet adhering, swirling and reaching the posterior wall of the LA</td>
</tr>
<tr>
<td>Flow convergence zone(^a)</td>
<td>No or small</td>
<td>Intermediate</td>
<td>Large</td>
</tr>
<tr>
<td>CW signal of MR jet</td>
<td>Faint/Parabolic</td>
<td>Dense/Parabolic</td>
<td>Dense/Triangular</td>
</tr>
<tr>
<td>Semi-quantitative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC width (mm)</td>
<td>(&lt;3)</td>
<td>Intermediate</td>
<td>(\geq7) ((\geq8) for biplane)(^b)</td>
</tr>
<tr>
<td>Pulmonary vein flow</td>
<td>Systolic dominance</td>
<td>Systolic blunting</td>
<td>Systolic flow reversal(^c)</td>
</tr>
<tr>
<td>Mitral inflow</td>
<td>A wave dominant(^d)</td>
<td>Variable</td>
<td>E wave dominant ((\geq1.5) cm/s)(^e)</td>
</tr>
<tr>
<td>TVI mit / TVI Ao</td>
<td>(\leq1)</td>
<td>Intermediate</td>
<td>(&gt;1.4)</td>
</tr>
<tr>
<td>Quantitative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EROA (mm(^2))</td>
<td>(&lt;20)</td>
<td>20–29; 30–39(^f)</td>
<td>(\geq40)</td>
</tr>
<tr>
<td>R Vol (mL)</td>
<td>(&lt;30)</td>
<td>30–44; 45–59(^f)</td>
<td>(\geq60)</td>
</tr>
<tr>
<td>+ LV and LA size and the systolic pulmonary pressure(^g)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Reference: Eur J Echo, 2010, 11, 307-332

EAE recommendations for valvular regur.part 2_.
MV imaging
3D RT transoesophageal echocardiography
MV imaging
3D RT transoesophageal echocardiography

Live
Full volume
Zoom
MV imaging
TOE 3D RT “surgical view”
MV imaging
TOE 3D RT A3 prolapsus
MV imaging
TOE 3D RT A3 prolapsus
MV imaging
TOE 3D RT mitral valve analysis
MV imaging
3D RT transoesophageal echocardiography: LV volume
1. Mitral valve assessment

2. Aortic valve assessment
Aortic Valve
The normal valve

Orifice of the RCA
Orifice of the LCA
Sinus of valsalva
Interleaflet triangle
Node of Arantius
Leaflet

Lcs
Rcs
Ncs

Sino tubular junction
Zone of coaptation
• JST: 85% annulus diameter
• $H = \text{commissural height} = 70\% \text{ annulus diameter}$

<table>
<thead>
<tr>
<th>Aortic Valve</th>
<th>Aortic root dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aortic annulus</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2.6 ± 0.3 cm</td>
</tr>
<tr>
<td>Female</td>
<td>2.3 ± 0.2 cm</td>
</tr>
<tr>
<td><strong>Sinus of valsalva</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3.4 ± 0.3 cm</td>
</tr>
<tr>
<td>Female</td>
<td>3.0 ± 0.3 cm</td>
</tr>
<tr>
<td><strong>Ascending aorta</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.4-2.1 cm/m²</td>
</tr>
<tr>
<td></td>
<td>&lt; 3.8 cm (2.5-3.8)</td>
</tr>
<tr>
<td></td>
<td>&lt; 3.7 cm</td>
</tr>
<tr>
<td><strong>Descending aorta</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0-1.6 cm/m²</td>
</tr>
<tr>
<td></td>
<td>&lt; 2.8 cm (1.7-2.8)</td>
</tr>
<tr>
<td><strong>Wall thickness</strong></td>
<td>Aortic wall</td>
</tr>
<tr>
<td></td>
<td>&lt; 4 mm</td>
</tr>
<tr>
<td></td>
<td>&lt; 3 mm</td>
</tr>
<tr>
<td></td>
<td>&lt; 4 mm</td>
</tr>
</tbody>
</table>
Aortic Valve
Aortic root dimensions

[Graphs showing dimensions of annulus, sinuses, ST junction, and ascending aorta across different BSA values with error bars]

Roman, AJC 89:64:507-512
Aortic Valve
TOE: SAX

Systole
Diastole

0° 45° 90° 135° 180°

NCS  LCS  RCS

LA  PA  RVOT  AV  RA

ATVL  PV  PTVL
Aortic Valve

TOE: SAX

0 raphe Type 0

1 raphe Type 1

2 raphes Type 2

Aortic Valve
TEE LAX
Aortic Valve
Aortic root echo assessment

Annulus
ST junction
Sinuses
Tubular aorta
Aortic Valve
TEE: Transgastric approach
Aortic Valve

TOE: Transgastric approach

75 mmHg
Aortic Valve
TOE: Ao regurgitation
Aortic Valve
TOE: Ao regurgitation

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<td>Normal/Abnormal</td>
<td>Abnormal/flail/large coaptation defect</td>
</tr>
<tr>
<td>Colour flow AR jet width(^a)</td>
<td>Small in central jets</td>
<td>Intermediate</td>
<td>Large in central jet, variable in eccentric jets</td>
</tr>
<tr>
<td>CW signal of AR jet</td>
<td>Incomplete/faint</td>
<td>Dense</td>
<td>Dense</td>
</tr>
<tr>
<td>Diastolic flow reversal in descending aorta</td>
<td>Brief, protodiastolic flow reversal</td>
<td>Intermediate</td>
<td>Holodiastolic flow reversal (end-diastolic velocity (&gt;20 \text{ cm/s}))</td>
</tr>
<tr>
<td>Semi-quantitative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC width (mm)</td>
<td>(&lt;3)</td>
<td>Intermediate</td>
<td>(&gt;6)</td>
</tr>
<tr>
<td>Pressure half-time (ms)(^b)</td>
<td>(&gt;500)</td>
<td>Intermediate</td>
<td>(&lt;200)</td>
</tr>
<tr>
<td>Quantitative</td>
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\(^a\) Colour flow AR jet width refers to the width of the aortic regurgitation jet on colour flow imaging.

\(^b\) Pressure half-time refers to the time it takes for the pressure in the left ventricle to half.

\(^c\) EROA and R Vol are measured in the aortic root region.

\(^d\) LV size refers to left ventricular size, typically measured on TOE images.
Aortic Valve
Aorta echo assessment
Aortic Valve
3D echo
Aortic valve
RT 3D TOE Assessment of the valve
3D echo and aortic valve
RT 3D TOE Assessment of the valve
3D echo and aortic valve
RT 3D TOE Assessment of the valve
3D echo and aortic valve
RT 3D TOE: biplane
MV and AV imaging

Summary

- TOE remains the principal examination for assessment of aortic and mitral valve lesions.

- Assessment of valve lesions must allow to delineate severity, mechanisms, and reparable of valvular disease.

- Precise assessment must guide the surgical procedure.