Clinical usefulness of real-time three dimensional transesophageal echocardiography during transcatheter closure of atrial septal defect in the catheterization laboratory

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Disclosure

none
Background

- Transcatheter closure of atrial septal defect (ASD) has become a reliable treatment and echocardiography plays an essential role for the patient selection and guiding the procedure.

- Limited studies demonstrated that clinical advantages of transcatheter closure of ASD using real-time (RT) three dimensional (3D) transesophageal echocardiography (TEE) against two dimensional (2D) TEE for obtaining easily understandable en-face ASD image or correct measurements of the maximal ASD diameter.
Maximal ASD diameter

Surrounding rims

<table>
<thead>
<tr>
<th>Rim</th>
<th>RT3D-TEE</th>
<th>2D-TEE</th>
<th>Mean difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superoanterior rim</td>
<td>2.4 ± 3.3</td>
<td>2.5 ± 2.8</td>
<td>0.03 ± 2.1</td>
<td>NS</td>
</tr>
<tr>
<td>Inferoanterior rim</td>
<td>18.8 ± 5.8</td>
<td>18.3 ± 5.8</td>
<td>0.4 ± 3.9</td>
<td>NS</td>
</tr>
<tr>
<td>Superoposterior rim</td>
<td>13.5 ± 3.9</td>
<td>13.6 ± 5.1</td>
<td>0.5 ± 3.9</td>
<td>NS</td>
</tr>
<tr>
<td>Inferoposterior rim</td>
<td>13.2 ± 7.2</td>
<td>13.9 ± 7.7</td>
<td>0.7 ± 3.6</td>
<td>NS</td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD.

(n=48)

• There is no study with a large number of patients about the safety and feasibility of RT3D TEE during the procedures including pediatric patients.
Aim

To investigate the clinical usefulness of RT3D TEE using a matrix array 3D TEE probe during transcatheter closure of ASD in the catheterization laboratory.
Methods

• Patients: Between January 2008 and May 2010, 207 consecutive patients scheduled for transcatheter closure of ASD with the Amplatzer septal occluder (AGA Medical Corporation, Plymouth, MN) under TEE guidance

• Indication for transcatheter ASD closure:
  ✓ Secundum type
  ✓ Hemodynamically significant atrial shunt
  ✓ Presence of right ventricular volume overload
  ✓ Pulmonary vascular resistance < 8 Wood units with 100% oxygen
  ✓ Maximal ASD diameter < 40 mm
  ✓ Body weight > 15kg

• Exclusion criteria in this study:
  ✓ Permanent atrial fibrillation
• 2D TEE and RT3D TEE using a matrix array 3D TEE probe (X7-2t; Philips Medical Systems, Andover, MA) were performed before and during the procedures under general anesthesia.

• Classification of the surrounding rim

- Rim length < 5mm
- "Deficient rim"
RT 3DTEE image

3D zoom

- assessing the shape and number of defects

3D full-volume

- measuring maximal ASD diameters
- assessing surrounding rims
## Result (n=207)
(Patient characteristics)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>35.8±22.0 y.o. (5-83 y.o.)</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>75/132</td>
</tr>
<tr>
<td>Body weight</td>
<td>51.0±15.5 kg (17-92 kg)</td>
</tr>
<tr>
<td>Body weight &lt; 25 kg</td>
<td>21 cases (10.1%)</td>
</tr>
<tr>
<td>Body surface area</td>
<td>1.46±0.29 cm² (0.76-2.15 cm²)</td>
</tr>
<tr>
<td>Maximal ASD size</td>
<td>17.2±6.8 mm (2-39 mm)</td>
</tr>
<tr>
<td>Qp/Qs</td>
<td>2.3±0.7 (1.1-5.4)</td>
</tr>
<tr>
<td>Deficient rim</td>
<td>158 cases (76.3%)</td>
</tr>
<tr>
<td>Multiple defects</td>
<td>22 cases (10.6%)</td>
</tr>
<tr>
<td>Procedural success</td>
<td>200/207 cases (96.6%)</td>
</tr>
<tr>
<td>Device size</td>
<td>20.4±6.7 mm (6-38 mm)</td>
</tr>
</tbody>
</table>
Feasibility of RT 3DTEE

• Insertion of 3D TEE probe
  206/207 cases (99.5%)

  Case of an inability to insert the 3DTEE probe:
  7 year-old girl with small jaw (BW 21.6kg)

• Complication from the use of 3D TEE probe
  0/207 cases (0%)
Image quality

% of patients with or without optimal 3D image

- 3D zoom: 91.3% optimal, 8.7% suboptimal
- 3D full-volume: 82.0% optimal, 18.0% suboptimal

Logistic regression analysis of less likely to be obtained good-quality full-volume data for the measurements

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95%CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>1.06</td>
<td>1.03-1.09</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Deficient IP rim</td>
<td>0.22</td>
<td>0.07-0.64</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Other variables: multiple defects, maximal ASD size, body weight, BSA, Qp/Qs
Complex ASD morphology

2DTEE (0°)

2DTEE (130°)

3DTEE (RA en-face view)
2DTEE (100°)

3DTEE (LA en-face view)
Guiding the procedure
Checking position of the device before the detachment
Conclusion

- RT3D TEE is feasible and effective imaging modality during transcatheter closure of ASD.
- However, in young pediatric patients or patients with inferoposterior rim deficiency, optimal 3D TEE images are less likely to be obtained.