Atrial Septal Defect Size and Rims on Transesophageal Echocardiogram

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ABSTRACT

Background and aims: Rims and size of atrial septal defect (ASD) are crucial for the success of transcatheter ASD closure. The maximal diameter and dimensions of various rims of the ASD are essential for sizing and optimal placement of the device. We aimed to study the size and rims of ASD in our patients.

Methods: This was a prospective study that was done at Shahid Gangalal National Heart Centre. All patients aged over 18 and referred to a unit IV in the Department of Cardiology for ASD device closure were included in the study. The study duration was six months, from April to September 2018. The size and rims of ASD were evaluated by transesophageal echocardiogram.

Results: During the study, 173 patients underwent transesophageal echocardiogram. Most of them [122 (70.1%)] were women. Age ranged from 18 to 68 (mean, 35 years). The most common symptom was shortness of breath. Twenty-one (12.1%) patients were incidentally detected with ASDs. Sinus rhythm with right bundle branch block was present in 148 (85.5%) subjects. Right atrium and right ventricle were dilated in 162 (93.6%) patients. One patient had dextrocardia with situs inversus. More than half of all patients (54.9%) had mild tricuspid regurgitation. Mean tricuspid regurgitation pressure gradient was 39.5±16.8 mm Hg. More than one ASD was present in 11 (6.3%) patients. ASD size ranged from 2 mm to 43 mm in 4-chamber view, 2 mm to 44 mm in short axis view, and 2 mm to 47 mm in bicaval view. The mean ASD size was 18.6±7.7 mm in 4-chamber view, 19.6±8.5 mm in short axis view, and 18.7±8.0 mm in bicaval view. In only 11 (6.4%) patients, all rims were present and not floppy, while in other 11 (6.4%) subjects all rims were present, but floppy. With the exception of aortic rim, all other rims were present and good in 55 (33.9%) patients, while in 45 (27.7%) patients, other rims were present but floppy.

Conclusion: Many ASD have absent, inadequate and floppy rims.

Keywords: tASD, ASD device closure, rims, transesophageal echocardiogram.
INTRODUCTION

The atrial septal secundum defect (ASD) is one of the most common lesions in adult congenital heart disease. Transcatheter closure of ASD has become the treatment of choice, rather than surgery (1). However, not all ASDs are anatomically suitable for transcatheter closure. ASD size should be limited and sufficient rims of interatrial septal tissue between the defect and adjacent structures are required to position the ASD device. Morphological variations of secundum type ASD are common and their recognition is crucial for selection of suitability for percutaneous closure (2). Transesophageal echocardiogram (TEE) remains the gold standard for imaging in ASD closure (3). The assessment of ASD using TEE includes evaluation of the number and localization of the defect(s), dimensions and adequacy of the rims (4). In Nepal, there was an audit to study the rims of ASD in patients with ASD secundum (5) but it was a retrospective study, and therefore we aimed to study the size and rims of ASD in our patients in a prospective study.

METHODS

In our prospective study, done at Shahid Gangalal National Heart Centre, we included all ASD secundum patients aged over 18 and referred to unit IV of the Department of Cardiology for ASD device closure. The study duration was six months, from April to September 2018. The size and rims of ASD were evaluated by TEE. A performa was designed to collect information about age, gender, electrocardiogram (ECG), echocardiogram and TTE. Transesophageal echocardiogram was done to access size and rims in three different views (Four chamber view ME 0°, Short axis view ME 45° and bicaval view ME 90-110°). A TEE was performed in presence of the operators. AV rim and posterior superior rim in four chamber view, aortic and infero-posterior rim in Short axis view and IVC and SVC rim in bicaval view were measured and documented. Views used for ASD assessment by TEE were as per the Guidelines for the Echocardiographic Assessment of Atrial Septal Defect and Patent Foramen Ovale of the American Society of Echocardiography and Society for Cardiac Angiography and Interventions (6). A rim less than 5 mm was termed deficient or inadequate and absent if it was <1 mm. The sizes of the ASD were recorded in all three views (Four chamber, Short axis and bicaval view). The number of defects was recorded if more than one ASD was present. Rim was defined as being floppy if it was moving back and forth with blood flow and flutters.

Rims measurement were done as per Podnar et al. (2).

1) The superior anterior rim was measured in the transverse view in the plane of the aortic valve, as the minimal distance from the anterior margin of the defect to the aortic wall.

2) Infero-posterior rim was measured in the transverse view in the plane of the aortic valve, as the minimal distance from the posterior margin of the defect to the posterior atrial wall.

3) In the four-chamber view, the minimal distance between the margin of the defect and atrioventricular valves were measured – the inferior anterior rim.

4) The posterior superior rim was measured in the 4 chamber view. The posterior rim was measured from the posterior margin of the defect to the posterior atrial wall.

5) Longitudinal view in the plane of the caval veins was used for the measurement of the SVC and IVC rims, the former being measured from the superior defect margin to the opening of the superior vena cava and the latter from the inferior margin of the defect to the opening of the inferior vena cava.

ASD was defined as round (circular index less than 1.5) and oval (circular index over 1.5). A circular index of the ASD was defined as the ratio of its maximal to minimal diameters (7).

The study protocol was approved by the institutional review committee of the Shahid Gangalal National Heart Centre.

RESULTS

During the study, 173 patients underwent TEE. In the study population, women represented 70.1%. Age ranged from 18 to 68 (mean, 35.5±12.4 years). The most common symptom was shortness of breath. Incidentally detected ASD was present in 21 (12.1%) patients, as shown in Table 1. Sinus rhythm was present in
172 (99.4%) patients. Right bundle branch block occurred in 148 (85.5%) subjects. Right atrium and right ventricle were dilated in 162 (93.6%) patients. More than half of all patients (54.9%) had mild tricuspid regurgitation (TR). The mean TR pressure gradient was 39.5±16.8 mm Hg. Distribution of TR degree and TR pressure gradients are shown in Tables 3 and 4. More than one ASD was present in 11 (6.3%) patients. The mean AV rim was 12.0±3.5 mm and the posterior-superior rim was 10.1±5.8 mm in 4 chamber view. In short axis view, the mean aortic rim was 2.3±4.0 mm and the mean infero-posterior rim 10.7±6.7 mm. In bicaval view, the mean IVC rim was 10.9±7.1 mm and the mean SVC rim 13.7±4.8 mm. When 11 (6.3%) patients with multiple ASD were excluded, AV rim was absent in one (0.6%) patient, inadequate in three (1.8%)
and floppy in three (1.8%). Posterio-superior rim in 4 chamber view was absent in 17 (10.4%) patients, inadequate in nine (5.5%) and floppy in 41 (25.3%). Aortic rim was absent in 111 (68.5%) patients an inadequate in 28 (17.2%). Infero-posterior rim in short axis view was absent in 21 (12.9%) patients, inadequate in 12 (7.4%) and floppy in 37 (22.8%). IVC rim was absent in 23 (14.1%) patients, inadequate in 12 (7.4%) and floppy in 40 (24.6%). SVC rim was absent in one (0.6%) patient and inadequate in three (1.8%) patients, as shown in Table 5. ASD size ranged from 2 mm to 43 mm in 4-chamber view, 2 mm to 44 mm in short axis view, and 2 mm to 47 mm in bicaval view. The mean ASD size was 18.6±7.7 mm in 4-chamber view, 19.6±8.5 mm in short axis view and 18.7±8.0 mm in bicaval view. Only 11 (6.7%) patients had all rims which were good. In other 11 (6.7%) patients, all rims were present, but floppy. Except aortic rim, all other rims were present and good in 55 (33.9%) patients, while in 45 (27.7%) patients other rims were present but floppy. In five cases (3%), two rims were absent when IVC rim was present.

Among the 162 patients with single ASD, 35 (21.6%) had absent or deficient IVC rim and were referred to surgery. In five (3%) patients, two rims were absent when IVC rim was present, and they have been also referred to surgery. In 13 (8%) cases, ASD was more than 34 mm and patients were referred to surgery.

Among the 162 single ASD, the mean circular index was 1.2. Only 17 (10.4%) patients had a circular index over 1.5.

**DISCUSSION**

It is well known that morphological variations of ASD are frequent, and appropriate patient selection for transcatheter ASD closure is crucial for a successful procedure. In this prospective study we analyzed the size and rims of ASD.

In our study, 6.3% of all patients had more than one ASD. The presence of multiple defects of the inter-atrial septum have been reported in 5.3% to 7.3% of patients with ostium secundum ASD (2, 8, 9).

In our study, aortic rim was absent or deficient in 85.5% of patients. Though absent aortic rim is not a contraindication for device closure, its absence increases procedural complexity in device closure. When Podnar et al (2) defined 10 morphological variations of defects, the most common type was the defect with deficient aortic rim, which was absent in 42.1% of patients. Pillai et al (8) considered that deficient aortic rim was a rather common morphologic feature of ASD and it was present in up to 30–50% of ASDs that are deemed complex. If 5 mm is considered an adequate rim size, then aortic rim deficiency will be common because more than 40% of patients with ASD have an aortic rim that is <5 mm (2). Deficient aortic rim has been associated with an increased risk of device impingement on the aorta (10). Ostermayer et al. (11) found that small aortic rim was independently associated with procedural failure. O’Byrne et al. (12) reported that deficient aortic rim is highly prevalent but does not seem to increase the risk of adverse outcomes. Romanelli et al. (13) found that procedural failure mainly occurs in patients with extremely large defects (≥40 mm), regardless of whether an aortic rim is present.

IVC rim is the most important rim for successful ASD device closure. Absence of IVC rim is considered contraindication for device closure of ASD. In the present study, 35 (21.6%) patients with absent or deficient IVC rim were

<table>
<thead>
<tr>
<th>Rims</th>
<th>Good n (%)</th>
<th>Deficient n (%)</th>
<th>Absent N (%)</th>
<th>Floppy n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV</td>
<td>156 (96.2)</td>
<td>3 (1.8)</td>
<td>0</td>
<td>3 (1.8)</td>
</tr>
<tr>
<td>Posterio-superior</td>
<td>95 (58.6)</td>
<td>9 (5.5)</td>
<td>17 (10.4)</td>
<td>41 (25.3)</td>
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<tr>
<td>Aortic</td>
<td>23 (14.1)</td>
<td>28 (17.2)</td>
<td>111 (68.50)</td>
<td>0</td>
</tr>
<tr>
<td>Infero-posterior</td>
<td>92 (56.7)</td>
<td>12 (7.4)</td>
<td>21 (12.9)</td>
<td>37 (22.8)</td>
</tr>
<tr>
<td>IVC</td>
<td>87 (53.7)</td>
<td>12 (7.4)</td>
<td>23 (14.1)</td>
<td>40 (24.6)</td>
</tr>
<tr>
<td>SVC</td>
<td>158 (97.5)</td>
<td>3 (1.8)</td>
<td>1 (0.6)</td>
<td>0</td>
</tr>
</tbody>
</table>

**TABLE 5. Rims of ASD (n=162)**
referred for surgery. IVC rim was floppy in 40 patients, while in a study done by Podnar et al. (2) it was absent in 12% of patients. In our study, good SVC and AV rim was present in the majority of patients, while Podnar et al. (2) reported an absence of SVC rim in only 1% of patients.

Based upon the circular index of ASD, most of our patients had circular ASD.

The major limitation of this study was that it was conducted in a single centre and a single unit.

**CONCLUSION**

Only few patients have all the rims of ASD. Majority of the ASD have absent, inadequate and floppy rims which makes the ASD device closure procedure complicated. Further prospective, large study is needed to describe the character of rims of ASD in Nepalese population.

Conflicts of interest: none declared.

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Patient informed consent: obtained.

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**REFERENCES**


