Introduction

Atrial septal defect is usually an asymptomatic disease. However, children with atrial septal defects are at increased risk for several complications, such as endocarditis (if associated mitral valve insufficiency is present) and respiratory tract infections. Any individual with an atrial level shunt is at risk for a paradoxical embolus from a venous thrombus, but in children, this is exceedingly rare, unless there is an underlying hypercoagulable state [1]. Children with clinically significant and untreated atrial septal defects are at risk for various cardiac complications, including CHF, pulmonary hypertension, and arrhythmias treated with diuretics, afterload reduction, and digoxin. Medical therapy is of no benefit in children with asymptomatic atrial septal defects (ASDs) [2].

With the exception of ostium secundum types, atrial septal defects are structural defects that do not spontaneously close. Occasionally, small primum ASDs may not require closure, but due to their association with mitral valve abnormalities, they may be closed at the time of mitral valve repair, if such a repair is indicated. An ostium secundum atrial septal defect that measures 6 mm in diameter or smaller in the patient’s first year of life is likely to spontaneously close. Definitive therapy for an atrial septal defect has historically been limited to surgical closure. However, with the advent of transcatheter techniques, many children undergo successful treatment in the cardiac catheterization laboratory [3].

Materials and Methods

This study is a review of 27 patients out of the 300 patients
who underwent transcatheter closure of ostium secundum ASD between August 2007 to August 2017 in whom the device embolized and surgery was required for its retrieval and ASD closure. All the patients are in age group of 6 to 44 years with 16 female and 11 male. Majority of patients out of 27 were detected with device embolisation on the same day of device closure of ASD in evening round of 2 D Echo. Risk factors for device embolization, its management and subsequent prognosis were discussed.

**Results**

Emergency operation was done in all cases via midline sternotomy. Under cardiopulmonary bypass the device was retrieved followed by pericardial patch closure of ASD. Most common sites for device embolization was shown in Table 1.

Three patients had developed pericardial tamponade post cardiac perforation, three patients developed femoral artery thrombosis at the catheter puncture site for which embolectomy was required and one patient developed transient ischaemic attack on postoperative day one. All other patients recovered well (Table 2).

More than half patients had inadequate rims more commonly IVC rim, rest of patients has size mismatch, inexperienced operator and small left atrium as reason for device embolization (Table 3).

**Discussion**

Transcatheter approaches to atrial septal defect closure are well accepted in the pediatric population. Various types of devices available but the maximum size available is less than 40 mm (Figure 1). Secundum atrial septal defects are currently the only subtype of atrial septal defect that are amenable to this approach [4].

The preference for timing of catheter-based closure is institution / interventionalist specific, but generally around age 4-6 years with a known, hemodynamically significant defect [5]. Benefits of the transcatheter approach include its minimal invasiveness, the lack of median sternotomy, the avoidance of cardiopulmonary bypass, and the relatively quick recovery time (Figure 2). Potential drawbacks and concerns include residual shunting around the device, embolization during placement requiring surgical intervention, lack of adequate septal rims to properly seat the device and the need for specific technical expertise and equipment [6].

Complications of percutaneous ASD closure are air embolism, vascular trauma resulting from large sheaths, device embolization, clot embolization through the aortic valve, occlusion of pulmonary or systemic venous return, perforation of the atrial septum, aortic perforation, infective endocarditis, atrial arrhythmia, device malposition necessitating removal, delayed breakdown of device. Among these, device embolization is a potential life-threatening complication requiring immediate removal via percutaneous or surgical intervention [7]. Although the reported incidence is 0.01% to 0.55%, it would be higher in less-experienced operators (Figure 3).

The most common surgical approach to the defect is primary repair with suture closure or with patch repair (generally with glutaraldehyde treated autologous pericardium, Gore Tex patch or fabric made of polyester fiber) (Figure 4). Candidates for surgery are children with clinically significant left-to-right

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**Table 1: Common sites for device embolisation in Children and Adults.**

<table>
<thead>
<tr>
<th>Site of device embolisation</th>
<th>Number of Patients</th>
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<tbody>
<tr>
<td></td>
<td>Children</td>
<td>Adults</td>
<td>Total</td>
</tr>
<tr>
<td>Right Atrium</td>
<td>4</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Right Ventricle</td>
<td>1</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Left Atrium</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Pulmonary Artery</td>
<td>0</td>
<td>1</td>
<td>1</td>
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shunting and whose defects are not amenable for device closure. The prognosis for a child with an atrial septal defect is good; the rate of surgical mortality is less than 1% [8].

Newer, minimally invasive surgical techniques like minithoracotomy, ministernotomy are developed. These improve cosmetic appearances and decrease hospital stays. These techniques are ideally suited for simple closure of a secundum atrial septal defect [9]. Overall however, the medium- to long-term outcomes of ASD closure, either surgically or percutaneously, appear very good [10]. In our study we managed the ASD device embolized patients as an emergency so no mortality with minimum morbidity. From our study it looks that if proper guidelines for ASD device closure are followed then its complications will be less. Morbidity to patient, cardiologist and cardiac surgeon will be less.

Conclusion

Closure of ostium secundum atrial septal defects by percutaneous occlude devices has significant advantages, however device embolization continues to be a major complication with chances of added morbidity of vascular complications, stroke and transient ischaemic attacks. Patient selection is of as much importance as device selection to prevent patient – device mismatch. After device embolization, the device can be retrieved and the septal defect can still be closed surgically with good success and minimal morbidity if acted upon on an urgent basis.

References