Surgical closure of atrial septal defects in adults: effect of age at operation on outcome

S Ghosh, S Chatterjee, E Black, R K Firmin

Objective: To determine whether age has an effect on the long term outcome after surgical closure of atrial septal defects in patients aged 35 years and over.

Methods: Retrospective analysis of 89 patients (64 women) operated on between 1989 and 1999. Patients were divided into two age groups: group I (aged 35–50 years, n = 51) and group II (> 50 years, n = 38). Follow up was between 1–11 years.

Results: One operative death and two late deaths occurred in the study period (both in group II). Preoperatively, 29 (57%) patients were in New York Heart Association functional class III–IV in group I compared with 22 (58%) patients in group II (NS). After operation, 44 (86.2%) patients in group I were found to be in class I–II compared with 25 (71.5%, p < 0.05) in group II. Group I patients had a lower incidence of preoperative atrial fibrillation than those in group II (12 (23.5%) v 17 (43.6%), p < 0.05) and only four (7.8%) patients in group I were in atrial fibrillation requiring long term warfarin after surgery compared with 12 (34%, p < 0.05) in group II. Furthermore, echocardiography showed a greater reduction in right ventricular dimension in group I patients (mean (SD) 4.26 (0.82) v 2.71 (0.41) cm, p < 0.001) than in group II patients (4.36 (0.43) v 3.87 (0.29) cm, p = 0.21). No residual intracardiac shunts were identified during follow up.

Conclusions: Surgical closure of atrial septal defects in adult patients can improve clinical status and prevent right ventricular dilatation. The greatest benefit is seen in younger patients.
There was one early postoperative death and two patients died during follow up. The early postoperative death was caused by ischaemic stroke at the time of the procedure and the patient died on day 3. The two late deaths were the result of renal failure and bronchopneumonia following the procedure and the patient died on day 3. The two late deaths were the result of renal failure and bronchopneumonia following the procedure and the patient died on day 3.

All three patients were in group II. There was one early postoperative death and two patients died during follow up. The early postoperative death was caused by ischaemic stroke at the time of the procedure and the patient died on day 3. The two late deaths were the result of renal failure and bronchopneumonia. All three patients were in group II.

The preoperative clinical status was identical in the two groups. Postoperatively, overall 48 patients (54%) improved from New York Heart Association (NYHA) functional class III–IV to class I, with 36 (70.6%) belonging to group I and 12 to group II. Only six patients were completely asymptomatic, all in group I.

Group I patients had a lower incidence of preoperative atrial fibrillation than group II (12 (23.5%) vs 17 (44.7%), p < 0.05) and only four patients in group I (7.8%) were in atrial fibrillation requiring long term warfarin after surgery compared with 12 (34%, p < 0.05) in group II.

The mean (range) pulmonary artery pressure before operation was 37.8 (21–49) mm Hg in group I and 40.3 (26–51) mm Hg in group II (NS). At the last follow up, mean pulmonary pressure was significantly reduced in group I patients after surgical correction of their ASD (from 4.12 (0.13) cm to 3.51 (0.19) cm, p < 0.05). This was not the case in group II patients following their ASD closure (from 4.29 (0.21) cm to 4.02 (0.1) cm, NS). The seven patients who underwent additional tricuspid valve repair were in group II. Postoperatively, all had only mild insufficiency, with a mean right atrial size of 6.42 (0.59) cm, right ventricular size of 4.41 (0.59) cm, and tricuspid valve annulus size of 4.53 (0.67) cm at follow up.

No residual intracardiac shunt was identified on echocardiographic follow up.

Table 1: Clinical features of patients with complete follow up

<table>
<thead>
<tr>
<th>Variable</th>
<th>At presentation (n=89)</th>
<th>At last follow up (n=86)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group I (35–50 years)</td>
<td>Group II (51–72 years)</td>
</tr>
<tr>
<td></td>
<td>Group I (35–50 years)</td>
<td>Group II (51–72 years)</td>
</tr>
<tr>
<td>Number</td>
<td>51</td>
<td>38</td>
</tr>
<tr>
<td>NYHA class [%]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>4 (8)</td>
<td>3 (7)</td>
</tr>
<tr>
<td>II</td>
<td>18 (35)</td>
<td>13 (24)</td>
</tr>
<tr>
<td>III–IV</td>
<td>29 (57)</td>
<td>22 (56)</td>
</tr>
<tr>
<td>Mean [range] PAP [mm Hg]</td>
<td>37.8 (21–49)</td>
<td>40.3 (26–51)</td>
</tr>
<tr>
<td>In AF [%]</td>
<td>12 (23.5)</td>
<td>17 (34)</td>
</tr>
<tr>
<td>Taking diuretics [%]</td>
<td>13 (24.5)</td>
<td>10 (21.7)</td>
</tr>
<tr>
<td>Taking warfarin [%]</td>
<td>11 (21.5)</td>
<td>17 (34.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking warfarin [%]</td>
<td>11 (21.5)</td>
<td>17 (34.4)</td>
</tr>
</tbody>
</table>

Table 2: Basic cross sectional echocardiographic variables of the heart chambers and walls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before operation (cm)</th>
<th>At last follow up (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group I</td>
<td>Group II</td>
</tr>
<tr>
<td>Aortic root diameter (cm)</td>
<td>2.37 (0.38)</td>
<td>2.72 (0.57)</td>
</tr>
<tr>
<td>Left atrial dimension (cm)</td>
<td>3.16 (0.73)</td>
<td>3.89 (0.29)</td>
</tr>
<tr>
<td>Right atrial dimension (cm)</td>
<td>6.29 (0.94)</td>
<td>6.34 (0.92)</td>
</tr>
<tr>
<td>Right ventricular dimension (cm)</td>
<td>4.26 (0.82)</td>
<td>4.36 (0.43)</td>
</tr>
<tr>
<td>Tricuspid annulus diameter (cm)</td>
<td>4.12 (0.13)</td>
<td>4.29 (0.21)</td>
</tr>
<tr>
<td>Left ventricular end diastolic dimension (cm)</td>
<td>4.03 (0.37)</td>
<td>4.51 (0.44)</td>
</tr>
<tr>
<td>Left ventricular end systolic dimension (cm)</td>
<td>2.59 (0.23)</td>
<td>2.79 (0.36)</td>
</tr>
</tbody>
</table>

Values are mean (SD). *p<0.05 versus before operation in corresponding group.

DISCUSSION

ASDs are relatively common. They account for 10% of all cardiac malformations in childhood. If left uncorrected, they may lead to premature death from congestive cardiac failure.

Surgical management of these defects became a clinical reality in the 1940s. Indeed the initial experience with extracorporeal circulation was closure of these defects. Despite more than 50 years’ experience with surgical correction of ASDs there are still unresolved issues. Of concern is the decision to operate on patients in their fifth decade and beyond.

Children with ASDs usually either are asymptomatic or suffer only mild exertional dyspnoea. The resultant increased pulmonary blood flow, right heart overload, arrhythmias, and pulmonary hypertension tend to increase with age.

Children with ASDs usually either are asymptomatic or suffer only mild exertional dyspnoea. The resultant increased pulmonary blood flow, right heart overload, arrhythmias, and pulmonary hypertension tend to increase with age.

Interestingly, tricuspid valve annulus size was also significantly reduced in group I patients after surgical correction of their ASD (from 4.12 (0.13) cm to 3.51 (0.19) cm, p < 0.05). This was not the case in group II patients following their ASD closure (from 4.29 (0.21) cm to 4.02 (0.1) cm, NS). The seven patients who underwent additional tricuspid valve repair were in group II. Postoperatively, all had only mild insufficiency, with a mean right atrial size of 6.42 (0.59) cm, right ventricular size of 4.41 (0.59) cm, and tricuspid valve annulus size of 4.53 (0.67) cm at follow up.

No residual intracardiac shunt was identified on echocardiographic follow up.

There was one early postoperative death and two patients died during follow up. The early postoperative death was caused by ischaemic stroke at the time of the procedure and the patient died on day 3. The two late deaths were the result of renal failure and bronchopneumonia. All three patients were in group II.
their seventh and eighth decades.16 17 Long term follow up after surgical closure suggests that survival is comparable with that of age matched controls if surgery is performed in the first two decades of life or before the onset of pulmonary hypertension.9 Results for patients operated on in their third and fourth decades were significantly worse than for controls. Other groups have similarly suggested favourable mid to long term survival with a significant difference in survival in the presence of pulmonary hypertension (systolic pulmonary artery pressure > 30 mm Hg).19

Comparisons of surgical closure with medical management, particularly when symptoms have developed, have suggested a significant survival benefit in the surgically treated groups, provided that patients are operated on during their second and third decades of life.9 19

The present study compared 51 patients aged 35–50 and 38 patients aged 51–72. Overall, the mortality was 3.3%, all deaths occurring in the older age group. Our results suggest that surgical closure of ASDs provides good improvement in symptoms, with 48 patients (54%) improving from NYHA class III–IV to class I.

The incidence of atrial fibrillation was not surprisingly higher in the older age group.15 Atrial fibrillation was decreased after closure of the defect but this was also more pronounced in the younger patients (group I). The benefit of reducing right sided overload was also detected in the notable reduction in volume following surgery in the younger patients. Group II patients also had reduced atrial fibrillation and right sided dimensions similarly accompanied by a reduction in pulmonary artery pressure. The reasons why the older patients had a less pronounced reduction in arrhythmias and cardiac dimensions are not clear and warrant further investigation.

Others have suggested that increases in pulmonary artery pressure are not necessarily related to age and shunt size is not related to severity of symptoms.19 20 With our results we find a trend to more pathophysiological deterioration in the older patients. The improvement in symptoms and dimensions mirrors this. The suggestion is that surgery should indeed be performed in the younger patient and probably before structural changes in the myocardium or pulmonary vasculature have occurred.

Surgical repair remains the standard for closure of secundum ASD, although more recently satisfactory results have been reported for transcatheter occlusion of these defects with a number of these devices.21 22 However, in adults, there is very little evidence to support the benefits of transcatheter closure over surgery. Cowley and colleagues23 reported on a series of 45 patients with an average age of 23 years who had their ASD closed with an Amplatzer device and compared them with 44 patients treated with surgery. There were significant advantages to transcatheter closure in terms of a fewer complications, avoidance of cardiopulmonary bypass, shorter hospitalisation, reduced need for blood products, and less patient discomfort. However, they noted that large ASDs with a stretched diameter > 27 mm were not amenable to this type of closure and should be referred for surgery. Certainly, in our unit it is the practice of cardiologists to refer only ASDs > 20 mm in diameter for surgery.

In conclusion, the low mortality and morbidity in patients over 35 years of age who have been operated on for ASD is a strong argument favouring surgical treatment over medical management. Mid to long term outcome has shown the beneficial effects of surgical correction in terms of clinical status in both age groups; however, in the older age group, haemodynamic benefits are much less pronounced and should be taken into account before surgical treatment is advised.

ACKNOWLEDGEMENTS
Presented at the American Heart Association Scientific Sessions, November 2001, Anaheim, California, USA.

Authors’ affiliations
S Ghosh, S Chatterjee, E Black, R K Firmin, Department of Cardiothoracic Surgery, University Hospitals Leicester NHS Trust, Glenfield Hospital, Leicester, UK

REFERENCES
Surgical closure of atrial septal defects in adults: effect of age at operation on outcome

S Ghosh, S Chatterjee, E Black and R K Firmin

Heart 2002 88: 485-487
doi: 10.1136/heart.88.5.485

Updated information and services can be found at:
http://heart.bmj.com/content/88/5/485

These include:

References
This article cites 20 articles, 6 of which you can access for free at:
http://heart.bmj.com/content/88/5/485#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections

- Congenital heart disease (762)
- Clinical diagnostic tests (4779)
- Drugs: cardiovascular system (8842)
- Echocardiography (2127)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/