Original Article

Surgical management of atrial septal defect in patients over 40 years of age

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ABSTRACT

Objective: Atrial septal defect (ASD) makes up about 10% of all congenital heart diseases diagnosed after delivery and up to 30-40% of heart defects diagnosed in patients aged over 40 years. The objective of this study was to evaluate the effects of surgical ASD repair on functional status, right ventricular size, cardiothoracic ratio and pulmonary hypertension in patients over 40 years of age.

Methodology: Between the period of August 2001 and August 2010, 20 of the patients who had undergone surgical repair of a secundum ASD when they were aged >40 years at our institution were included in this study. To evaluate the effects of surgery on clinical outcome, we compared functional status, echocardiographic and radiographic findings of the patients before and after surgery. The defect was closed with either a running nonabsorbable suture or an autologous pericardial patch.

Results: Postoperatively, clinical status of the patients improved significantly. The mean NYHA functional class decreased from 2.8±0.4 to 1.5±1.1 ($P < 0.001$). Postoperatively, mean right ventricle diameter was found regressed from 38.2± 9.3 mm to 34.8±6.2 mm ($P < 0.002$) at a median interval of four months. The pulmonary artery pressures were also significantly decreased ($p < 0.002$).

Conclusion: The data provided by this study suggest that surgical repair of ASD improves functional status and relieves symptoms. Therefore, we suggest that ASDs that are unsuitable for transcatheter closure or requiring additional surgical intervention should undergo surgical repair to reduce subsequent morbidity and mortality, in patients including over 40 years of age.

KEY WORDS: Atrial Septal Defect, Surgical Closure.

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INTRODUCTION

Atrial septal defect (ASD) was first described in 1875.[1] This congenital defect makes up about 10% of all congenital heart diseases diagnosed after delivery and up to 30-40% of heart defects diagnosed in patients aged over 40 years. Isolated ASD is the most common form of congenital heart disease presenting in adulthood after bicuspid aortic valve and mitral valve prolapse.[2,3]

Although the long-term survival of patients with ASD operated on after age 40 years remains controversial[4], recent advances in surgical and cardiopulmonary bypass (CPB) techniques and improved postoperative care have decreased the mortality and morbidity of operation to the extent that surgical closure of ASDs at any age is now justified even in the presence of pulmonary hypertension.[5] However, over the past years, transcatheter ASD device closure has been shown to be a safe and effective

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management alternative to surgical repair.[6] It has been suggested that transcatheter closure in patients greater than 40 years of age should be the first option of management irrespective of their clinical symptoms.[7] Consequently, surgical closure has been significantly decreased in patients with ASD. The aim of this study was, therefore, to evaluate the effects of surgical ASD repair on functional status, right ventricular size, cardiothoracic ratio and pulmonary hypertension in patients over 40 years of age.

METHODOLOGY

Between the period of August 2001 and August 2010, 20 of the patients who had undergone surgical repair of a secundum ASD when they were aged >40 years at the Department of Cardiovascular Surgery of Yuzuncu Yil University Medical Faculty were included in this study. Patients with ostium primum defect, congenital mitral valve disease, or other congenital heart diseases were excluded. Patients with left ventricular restrictive physiology were also excluded. In all patients, a detailed history was taken. The diagnosis of ASD was confirmed by transthoracic echocardiography (Figure 1, 2). The cardiovascular functional capacity of all patients was assessed using New York Heart Association (NYHA) classification. The pulmonary-systemic flow ratio had been investigated by means of cardiac catheterization. All patients had evidence of right heart volume overloading, with a clinical indication for surgical closure. Before closure, the size and morphology of the defect had been evaluated by transesophageal echocardiography. Recently, temporary balloon occlusion of the defects was performed to identify patients with left ventricular restrictive physiology, as previously described.[6] During transesophageal echocardiography, transcatheter closure was performed in suitable cases. Additionally, Coronary angiography was performed in all patients.

To evaluate the effects of surgical ASD closure on clinical outcome, we compared NYHA functional class, echocardiographic and radiographic findings of all the patients before and after surgical management.

The operation was performed with median sternotomy and standard CPB techniques using ascending aortic and bicaval cannulation. Myocardial protection with isothermic blood cardioplegia and moderate hypothermia was used in all patients. Both cavae were looped and snugged down before the right atriotomy. Then, right atriotomy was performed and defect size and anatomical type were designated. Tricuspid valve was controlled in terms of insufficiency. The method used to repair the ASD depended on its size and location. The defect was closed with either a running nonabsorbable monofilament suture or an autologous pericardial patch. Right atrial closure and de-airing were done in routine fashion. Early postoperative clinical evaluation was performed within the first month, fourth months and then every 6 months after surgery.

Statistical analysis: Clinical data were collected retrospectively. All data were presented as mean ± standard deviations of the mean. Values were compared by means of Student's paired or unpaired t test. A p value of less than or equal to 0.05 was accepted as being statistically significant.

RESULTS

There were 14 women and 6 men with an age range at operation of 40 to 68 years (mean 46.3 years). Thirteen patients were considered to be ineligible for percutaneous closure because of very large defect or insufficient rims. In six patients, surgical closure was preferred instead of transcatheter closure because of associated cardiac lesions requiring open heart surgery. The remaining one patient also had surgical closure because of ASD device embolization. The mean ASDs diameter was 26±4 mm, with a range from 22 to 38 mm. Primary surgical ASD closure was performed by direct suturing in 11 patients, and 9 patients had surgical closure of ASD with a pericardial patch. In addition to the ASD repair, additional surgical procedures were performed due to additional lesions in 7 patients. The associated surgical procedures were tricuspid valve repair in three cases, coronary artery bypass grafting (CABG) in two, mitral valve replacement in one, and ASD device removal in one. Preoperative echocardiography revealed tricuspid regurgitation in 8 patients. During operation, the tricuspid regurgitation was considered trivial and tricuspid annuloplasty was found unnecessary in five of these patients. The remaining three patients had DeVega annuloplasty. Two patients presenting with angina pectoris had concomitant coronary artery bypass grafting. Both had left internal mammary artery bypass graft to the left anterior descending artery. Mitral valve implantation with posterior leaflet preservation was performed in one patient who had severe mitral regurgitation. The remaining one was operated on due to ASD device embolization to the pulmonary artery.

Total duration of bypass ranged from 25 through 80 minutes (mean, 47.12± 12.11 min), and the duration of cross-clamping ranged from 15 through 65 minutes (mean, 30.12± 12.11 min). All patients were

Fig-1: Preoperative echocardiographic image showing secundum ASD.
Abbreviations: RA: right atrium; LA: left atrium; RV: right ventricle; LV: left ventricle, ASD: atrial septal defect.

Fig-2: Color mode echocardiography representing left to right shunting.

extubated within six hours after operation. There were no operative or postoperative deaths.

In all cases, postoperative echocardiography revealed normal left ventricular function and no residual shunt across the interatrial septum. Postoperatively, clinical status of the patients improved significantly (Table-I). The mean NYHA functional class decreased from 2.8±0.4 to 1.5±1.1 (P<0.001). A significant decrease in right ventricular size and pulmonary artery pressure was observed after surgery in all patients. Postoperatively, mean right ventricle diameter was found regressed from 38.2± 9.3 mm to 34.8±6.2 mm (P<0.002) at a median interval of four months. The pulmonary artery pressures were also significantly decreased (p<0.002). Although the preoperative chest radiographs showed that all patients had increased cardiothoracic ratio, postoperative chest radiographs showed significant improvements in pulmonary vascularity and reduction in the size of cardiac contour. Supraventricular arrhythmias in the form of atrial fibrillation (AF) were present in three cases preoperatively. Although one patient reverted normal sinus rhythm after ASD closure, one patient had new AF in the postoperative term.

Postoperative inotropic support was used in four patients. Postoperative anticoagulant therapy was administered in three patients with sustained AF. All patients were uneventfully discharged. Follow-up care ranged from 4 months to 8 years, which included clinical examinations, echocardiographic and electrocardiographic recordings.

DISCUSSION

The explanations for the power of age at operation as a predictor of late mortality are speculative and probably multifactorial.[8] Complications associated with uncorrected or long-standing ASD may include volume overload, right ventricular failure, pulmonary hypertension, cardiac dysrhythmias, stroke, and disability.[9] The objectives of surgical repair of ASD are the reversal of hemodynamic abnormalities and the prevention of complications, including cardiac failure and irreversible pulmonary vascular obstructive changes.[10]

Jones and Ferrans[11] found that interstitial fibrosis, myofibrillar lysis, Z bands and other abnormalities increased progressively with age and were universally present by the age of 30 years or later. These changes would be consistent with an adverse effect

Table-I: Comparison of preoperative and postoperative functional class, cardiothoracic ratio and echocardiography parameters.

	Preoperative	*Postoperative*	*P*
Mean NYHA functional status	2.8±0.4	1.5±1.1	<0.001
Mean pulmonary artery pressure	51.12±14.11 mmHg	42.16± 10.13 mmHg	<0.002
Mean cardiothoracic ratio	67±5 %	60±4 %	<0.001
Mean right ventricle diameter	38.2±9.3 mm	34.8±6.2 mm	<0.002
Mean right atrial diameter	48.1±7.2	43.9±6.8	<0.001

on cardiac reserve and myocardial contractility.[8] In addition it would be speculated that chronically reduced preload of the left ventricle may have led to a reversible shortening of muscle fibers or myocardial connective tissue.[6]

Secundum ASD closure in adults greater than 40 years of age can be performed either a low operative mortality leading to reduced arrhythmias, increased functional capacity, and improved quality of life in long-term follow-up.[12] The principal importance of AF or atrial flutter lies in its association with embolic events and stroke. Therefore early closure of ASDs may protect against the late development of AF.[8]

Because the frequency of AF, increased pulmonary blood flow, right heart overload, arrhythmias, and pulmonary hypertension tend to increase with age, ASD should be operated on even if the patient is asymptomatic. Additionally, the surgical ASD closure had substantially increased long-term survival in middle-aged and elderly patients.[13]

Mean right atrial diameter decreased from 48.8±7.2 to 43.9±6.8 mm in our series after the surgical repair, and one patient with AF returned to normal sinus rhythm, postoperatively. Postoperative abolition of AF may occur due to the relief of atrial distention, reducing the tendency for atrial ectopy and thus reducing the initiating mechanism of arrhythmias.[10]

It is possible that mechanisms leading to atrial rhythm disturbances are different before and after surgery. Preoperatively, atrial distension is the main cause of AF.[13] Although the precise mechanism is unknown, development of AF in patients after ASD repair could be related to the formation of an ectopic focus at the site of surgical repair, or the resulting scar. There is also evidence that venous cannulation at the time of operation may contribute to the incidence of arrhythmias observed at long term follow-up.[13,14]

Primary closure may distort atrial septal anatomy, leading to postoperative arrhythmias and, particularly in large defects where the tissue is thin or friable, may be associated with a higher incidence of recurrence.[15] In these circumstances, patch closure should be preferred to prevent possible complications. Additionally, Dacron patch should be avoided because of the increased thrombotic risk associated with their use.[13] Therefore, we performed pericardial patch closure instead of primary closure or Dacron patch closure in 9 patients.

Postoperative embolism is an important complication after repair of ASD and a cause of prolonged hospitalization and long-term disability. This incidence is related to the age of the patient, presence of AF, and use of synthetic patch graft.[13] Although routine anticoagulant therapy is not recommended after surgical closure, we started the anticoagulant therapy for at least three months after patch closure, maintaining the international normalized ratio between 2 and 3 in three patients with AF. In these circumstances, we believe that anticoagulant therapy should be used to avoid embolic events.

Transcatheter closure has the advantage of avoiding the need for sternotomy, CPB and intensive care stay, facilitates rapid patient recovery, and confers tangible social benefits and financial returns.[16] However, transcatheter closure can lead to serious complications, both early and, importantly, also late, regardless of the size or type of current devices. These complications (device embolization, thrombosis, transient cerebral ischemia or stroke, incomplete ASD closure with significant residual shunt, atrial and/or aortic injury or erosion, hemopericardium with tamponade, aortic or mitral valve injury and endocarditis) may necessitate surgical intervention, which is highly effective, but is nevertheless associated with higher mortality than primary surgical ASD repair.[17]

While transcatheter closure of ASDs has been shown to be safe and effective in the short term compared with surgical closure, the serious complication of cardiac perforation or erosion has been identified as a concern not seen in early studies. Though rare, cardiac rupture can be sudden and potentially lethal.[18] Therefore, after transcatheter closure, patients should remain under permanent surveillance to detect potentially serious long-term device-related complications, in contrast to what is known for patients who have had successful surgical ASD closure (who do not require specialized long-term follow-up).[17] In patients requiring off-pump coronary artery bypass surgery, intraoperative device closure should be performed as an alternative to transcatheter closure. Compared with the transcatheter approach, surgical device closure may be easier in guiding the delivery sheath across the defect and properly anchoring the device.[19] However, we postulate that above mentioned late complications may occur after intraoperative device closure. Therefore, patients who had intraoperative device closure should remain under permanent surveillance similar to transcatheter counterparts.

Results for patients operated on in their third or fourth decade were significantly worse than for controls due to structural changes in the myocardium or pulmonary vascular system.[2] Reported that the long-term results of ASD repair at older ages are

unfavorable as compared with those of repair at earlier ages. However, St. John Sutton et al[20] reported the beneficial effect of ASD repair in a series of patients 60 years old or older.

CONCLUSION

Although many individuals with ASD are asymptomatic for years, almost all eventually develop symptoms (most commonly right ventricular dysfunction and failure, atria tachyarrhythmias, or stroke).[21] Additionally, the results of surgical treatment were favorable regardless of age.[15] The data provided by this study suggest that surgical repair of ASD improves functional status and relieves symptoms. Therefore, we suggest that ASDs that are unsuitable for transcatheter closure or requiring additional surgical intervention should be operated to reduce subsequent morbidity and mortality, in patients including over 40 years of age.

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