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The Effect of Surgical Treatment for Secundum Atrial Septal Defect in Patients More Than 30 Years Old

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ABSTRACT

Background. We prospectively examined whether surgical treatment of secundum atrial septal defects in patients ≥30 years old improves their early- and mid-term clinical outcomes. Our clinical experience is reviewed to assess the importance of surgical management in elderly patients with atrial septal defect.

Methods. We analyzed 41 patients older than 30 years of age who underwent surgical correction of a secundum atrial septal defect. To evaluate the effects of surgical treatment, we compared functional capacity, diuretic administration, rhythm status, and echocardiographic parameters of all patients before and after the operation.

Results. The median follow-up period was 4.2 years (range, 6 months-7 years). There were no operative deaths. Functional class in most of the patients improved after operation. Two patients reverted to normal sinus rhythm after the operation. There was only one new atrial fibrilation among patients in the postoperative term. Right atrial and right ventricular dimensions and pulmonary artery pressures were significantly decreased, and ejection fractions were significantly increased after the operation. The need for diuretic treatment was decreased after surgical repair. No residual intracardiac shunts were identified during follow-up. There were no cerebrovascular thromboembolic accidents in the early postoperative period.

Conclusions. Surgical closure of atrial septal defects in patients over 30 years old can improve their clinical status and prevent right ventricular dilatation and insufficiency. The operation must be performed as soon as possible, even if the symptoms or the hemodynamic impact seem to be minimal.

INTRODUCTION

Atrial septal defect (ASD) is the most common congenital heart lesion in adult life. It is detected in about 10% of heart malformations at birth and in almost 40% of those present in adults [Dave 1973].

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Although operative indication and curability are still controversial concerning elderly patients with ASD [Nasrallah 1976; St. John Sutton 1981], surgical closure of secundum type ASD has become a safe procedure, with minimal risk of mortality or serious morbidity in younger patients [Dalen 1967]. Furthermore, complete surgical correction at that time avoids subsequent congestive heart failure, pulmonary hypertension, thromboembolic complications, and arrhythmias, and thereby increases life expectancy [Campbell 1970; Konstantinides 1991]. The operation must be performed as soon as possible, even when the symptoms and hemodynamic impact seem to be minimal [Dalen 1967; St. John Sutton 1981].

In the present study, we analyzed the early- and mid-term results of patients with ASD to evaluate the effects of surgical treatment in patients over 30 years of age.

MATERIALS AND METHODS

Between August 1995 and August 2006, 41 patients over 30 years of age were diagnosed with ASD at the Department of Cardiovascular Surgery of Atatürk University Medical Faculty.

Twenty of the patients (48.8%) were 50 years old at the time of surgical correction. The diagnosis was established by cardiac catheterization and cross-sectional echocardiography. Preoperative cardiac catheterization was performed in 25 of the patients (61%). Coronary arteriography was performed on all patients over 50 years of age and on younger patients with any risk factors for ischemic heart disease. No significant changes were observed in the coronary arteries of any of the patients. The ratio of pulmonary to systemic blood flow (Qp/Qs) was determined by oximetry. The study patients had predominant left-to-right interatrial shunt with Qp/Qs of at least 1.5:1. In our cases, the mean Qp/Qs rate was between 1.5-2.0, 2.0-3.0, and ≥3.0 in 11 (26.8%), 23 (56.1%), and 7 (17.1%) patients, respectively. Additional cardiac pathologies such as severe comorbid disease, previous cardiac surgery, congenital cardiac malformation, rheumatic valve disease, coronary artery disease at diagnosis, mitral or aortic regurgitation, and left ventricular dysfunction were not included in this study. All patients were followed-up (mean, 4.2 years). Clinical and echocardiographic factors were assessed.

Patients with pulmonary hypertension (PHT) were included in the study. PHT was defined in 3 categories: severe PHT = pulmonary artery pressure (PAP) more than 75 mmHg (n = 8, 19.5%), moderate PHT = PAP between 50 and 75 mmHg (n = 16, 39%) and mild PHT = PAP less than 50 mmHg (n = 17, 41.5%).

To evaluate the effects of surgical treatment on clinical improvement, we compared functional capacity, diuretic administration, rhythm status (as normal sinusal rhythm [NSR] or atrial fibrillation [AF]) and echocardiographic parameters (right atrial dimensions [RADs] and right ventricular dimensions [RVDs], PAP, and ejection fraction [EF]) of all the patients before and after the operation. The functional capacity of the patients was evaluated according to classification of the New York Heart Association (NYHA) as class I, II, III, and IV. The patients were divided into 2 groups regarding functional capacity. The patients in group A (n = 26, 63.4%) had functional class I or II, and the patients in group B (n = 15, 36.6%) had functional class III or IV.

Surgical Procedure

All operations were performed using cardiopulmonary bypass and moderate total body hypothermia of between 28°C and 32°C. The patients were operated on via median sternotomy (n = 37) or right thoracotomy (n = 4). After total cardiopulmonary bypass had been instituted, cold crystalloid cardioplegic solution was given into the root of the aorta for myocardial protection. Through a right atriotomy, defect size and anotomical type were designated and tricuspid valve was controlled in terms of insuffiency. The method used to close the defect depended on its size and anatomical type. ASDs were closed with direct suture as the primary method or with an autologous pericardial dacron patch. The patch was sutured with double layers of prolene 5-0 continuous suture. De Vega annuloplasty was performed advanced for tricuspid regurgitation (TR).

Clinical Follow-up

Early postoperative evaluation was done in the first month after the operation. Later, all patients were followed-up for 6 months to 7 years (mean, 4.2 years) by questionnaire or telephone interview with the patient or the referring physician or both. All patients were advised to appear for clinical and echocardiographic follow-up evaluations at 6- or 8-month intervals, or as soon as possible if either a new symptom appeared or the previous clinical state deteriorated.

Statistical Analysis

Statistical analyses were performed using SPSS 10.0 (SPSS, Chicago, IL, USA) statistical program. All the results are expressed as the mean ± standard deviation. *P* value <.05 was considered significant.

The variables were tested for normal distribution with the Kolmogorov-Smirnov test. Paired *t* tests were used to compare echocardiographic parameters in the patients before and after the operation. McNemar tests were used to compare diuretic administration and rhythm status (as NSR or AF) of all patients before and after the operation. The patients were divided into 2 groups regarding functional capacity. McNemar test was used to compare functional capacity of all patients before and after the operation.

RESULTS

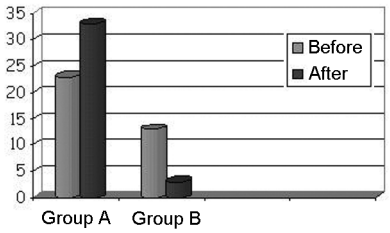
The analysis included 41 patients who underwent surgical repair of secundum ASD; 28 women (68.3%) and 13 men (31.7%), with a mean age of 44 ± 10 years (range, 30 to 72 years). The defect diameter was 1.8 to 3.5 cm (mean; 2.2 ± 0.7 cm). The defect diameter was <20 mm in 8 patients (19.5%), between 20 to 30 mm in 21 patients (51.2%), and ≥30 mm in 12 patients (29.3%). Isolated ASD in 4 patients (9.8%) was closed with a direct suture. The remainder required patch closure (Dacron in 6 patients [14.6%] and pericardial in 31 patients [75.6%]) with prolene 5/0 continuous suture.

In the preoperative term, 6 patients (14.6%) had AF. The EF of the patients was between 45% and 70%. The EF was <45% in 9 patients (22%). The RADs were <45 mm, 45 to 55 mm, and >55 mm in 10 (24.4%), 14 (34.1%), and 17 patients (41.5%), respectively. The RVDs were <30 mm, 30 to 50 mm, and >50 mm in 10 (24.4%), 22 (52.6%), and 9 patients (22%), respectively. The mean of the RADs and the RVDs were 51.5 ± 7.1 and 39.8 ± 9.6 mm, respectively, before the operation. While the highest RAD was 62 mm, the highest RVD was 56 mm among patients. Twenty-two patients (53.6%) had received diuretic treatment before the operation.

Preoperative echocardiography revealed moderate or severe TR in 13 patients (31.7%). TR was trivial in 6 patients. On the basis of water competent test of the tricuspid valve of these 13 patients (moderate or severe TR) during cardiac arrest, DeVega tricuspid annuloplasty (TAP) was performed in only 7 patients. Patients with TAP with DeVega's method did well during the follow-up period. One patient (2.4%) had mitral regurgitation related to mitral cleft and mitral valvuloplasty was performed in this patient. One patient (2.4%) had pulmonary venous drainage anomaly, which was treated with ASD. Eight patients had aortic regurgitation that was not clinically important. All of the patients survived after the operation. The functional capacities of the patients showed a significant improvement after the operation (Table 1). In 31 of 41 patients (75.6%), a substantial improvement in functional capacity after the operation was observed. Furthermore, while 15 patients (36.6%) were in NYHA functional classes III or IV before the operation, only 3 patients (7.3%) were in classes III or IV after the operation (Figure). The percentage of the patients with AF decreased after operation (from 14.6% to 12.2%), but this difference was not significant (Table 1). Although 2 patients reverted NSR after the operation, 1 patient had new AF in the postoperative term. To prevent thromboembolic complications, anticoagulation therapy was started immediately after the removal of the thoracic drainage tubes in 5 patients with AF. Twenty-two patients (53.6%) had received diuretic treatment before the operation, whereas only 10 patients (24.3%) received diuretic treatment after the operation. The need for diuretic treatment was significantly decreased after surgical repair (Table 1) ($P < .001$).

Echocardiographic Parameters

The values of EF, RAD, RVD, and PAP before and after the operation are shown in Table 2. RADs and RVDs were significantly decreased after the operation ($P < .001$). The RADs were more less than 50 mm in the 27 patients. Telecardiography showed significant improvements in pulmonary vascularity and reduction in the size of the right ventricle. The PAPs were



Preoperative and postoperative New York Heart Association functional class changes. Group A: class I and II; group B: class III and IV.

significantly decreased after the operation ($P < .001$). PAPs were more than 60 mmHg in only 3 patients. EFs were significantly increased after the operation ($P < .001$). Before surgery, Doppler echocardiography showed TR in 13 patients (advanced in 4 patients, mild in 9). Seven of these required DeVega TAP. Postoperatively, only 2 patients had mild TR.

Late Follow-up

Thirty-seven patients were followed-up for 6 months to 7 years (mean, 4.2 years). Two patients were lost to follow-up because they moved to another city in Turkey. Two patients were not available for follow-up. Twenty-eight patients were in NYHA functional class I, 7 in class II, and 2 in class III. One patient reverted to sinus rhythm after the operation in the third year. Late arrhythmias did not develop in any patients. Anticoagulant therapy was continued in 2 patients because of continued AF. Advanced mitral valve regurgitation was detected in 1 patient after the operation. Mitral regurgitation, caused by prolapse of antero-posterior leaflet was detected; mitral valve replacement was performed 3 years after the initial operation. TR occurred in 2 patients with DeVega annuloplasty. They have been treated medically.

DISCUSSION

Surgical correction for ASD has been carried out for over 40 years. Perioperative mortality rate was 12.5% in the late 1950s and it decreased to 6% in the 1960s and to below 0.5% today [Konstantinides 1995]. This major improvement in survival appears to be a reflection of both better operative techniques and better postoperative care, so surgical closure of this relatively common anomaly has become widely recommended even for older patients. In spite of the very good results of surgery, even in patients with raised PAP, several studies questioning the policy of routine surgical closure in older patients were published in the past few years [Fiore 1988; Konstantinides 1991; Cheng 1992; Shah 1994; Perloff 1995].

Surgical repair is still the main therapy for ASDs. The previous belief that only 50% of patients with unrepaired ASDs survive beyond the age of 40 years and <10% reach the age of 60 years has not been confirmed in many other observational studies [Nasrallah 1976; St. John Sutton 1981; Konstantinides 1995]. Thus, the life expectancy of patients with unrepaired ASDs is generally thought to be shortened [Campbell 1970; Dave 1973; Driscoll 1990; Murphy 1990; Shah 1994; Brickner 2000]. It was suggested that, particularly when symptoms had developed, there was a significant survival benefit in the surgically treated patients when compared to medical management of patients who were operated on during their second and third decades of life [Fiore 1988]. Because the frequency of AF, pulmonary blood flow, right heart overload, arrhythmias, and PHT tend to increase with age, ASD should be operated even if the patient is asymptomatic.

Age was found to be a significant and independent predictor of surgical mortality and morbidity at late follow-up [St. John Sutton 1981]. Furthermore, Murphy proved that patients undergoing surgery after the age of 40 years were at increased risk of postoperative cardiovascular complications, whereas children and young adults enjoyed an excellent prognosis [Murphy 1990]. The 48.8% of our patients who were over 50 years old at the time of surgical correction had an overall he mortality of 0%. There was no death for any patient. Our results suggest that surgical closure of ASDs provides good improvement in symptoms. The ratio of patients with NYHA class III-IV decreased from 36.6% to 7.3% after the operation. This result compared favorably with others [Nasrallah 1976; Fiore 1988; Shibata 1996]. This was in agreement with the study by Konstantinides, where the clinical course of surgically treated patients with isolated ASDs, diagnosed after the age of 40, was compared with those who received only medical treatment [Konstantinides 1995]. These investigators suggested that the surgical repair of ASDs had substantially increased long-term survival in middle-aged and elderly patients.

The frequency of AF in patients with ASDs increases with age [St. John Sutton 1981; Fiore 1988; Murphy 1990; Chen 1992]. It is possible that the mechanisms leading to atrial rhythm disturbances are different before and after surgery. Preoperatively, atrial distension is the main cause of AF [Hairston 1974]. Although the precise mechanism is unknown, development of AF in patients after ASD closure could be conceivably related to the formation of ectopic focus at the region of surgical repair or the scar at the site of the venous cannulation. RADs decreased from 51.5 ± 7.1 to 47.4 ± 6.8 mm in our patients after the operation, and two patients with

Table 1. Preoperative and Postoperative Functional Capacity, Diuretic Administration, and Rhythm Parameters (statistical significance: $P < .05$)

	Preoperative, %	Postoperative, %	*P*
Functional capacity			<.05
Group A	63.4	92.7	
Group B	36.6	7.3	
Diuretics			<.001
Yes	53.6	24.3	
No	46.4	75.7	
Rhythm			>.05
Normal sinus rhythm	85.4	87.8	
Atrial fibrillation	14.6	12.2	

Table 2. Preoperative and Postoperative Cross-Sectional Echocardiographic Variables of the Heart Chambers

	Preoperative	Postoperative	*P*
Ejection fraction, %	54.6 ± 9.8	56.2 ± 9.5	<.001
Right atrial dimension, mm	51.5 ± 7.1	47.4 ± 6.8	<.001
Right ventricle dimension, mm	39.8 ± 9.6	36.7 ± 8.6	<.001
Pulmonary artery pressure, mmHg	44.6 ± 13.2	37.5 ± 11.5	<.001

AF returned to sinus rhythm, postoperatively. But, this was not significant statistically. One patient returned to AF during the early follow-up period. Furthermore, the ASD closure should be performed before the occurrence of AF.

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 at the time of the operation and the presence of AF [Richmond 1969]. AF is a possible reason for the increased incidence of thromboembolic events in patients operated on to correct an ASD [Hawe 1969; Richmond 1969; Hairston 1974]. Due to the evidence of postoperative brain embolism in elderly patients with AF, we started the administration of warfarin immediately after the removal of the chest drains. Because of the risk of postoperative thromboembolism, we prefer direct suture closure of isolated ASDs and the use of patches for large defects. We avoided Dacron patches because of the increased thromboembolic risk associated with their use. Although routine anticoagulant treatment is not recommended after closure of an ASD [Fiore 1988], we have given anticoagulants for 3 months after the operation, maintaining the international normalized ratio between 2.5 and 3.5 for all patients with pericardial and Dacron patches. It is appropriate that anticoagulation therapy should be continued prophylactically at least for several months after the operation. Patients with persistent AF should always have anticoagulant treatment before and after surgical intervention, as advised by others [Borow 1990; Kirklin 1992].

There was not any thromboembolic complication in patients with AF. It is likely that anticoagulation treatment prevented new embolic events. Shah reported an incidence of systemic embolism in both medically and surgically treated groups [Shah 1994]. We suggest careful monitoring for arrhythmias after closure of ASDs and also the use of anticoagulants to prevent thromboembolic events.

The associated incidence of TR increases with age. In this study, moderate or severe TR was detected in 31.7% of the patients. Echocardiographic examination of the tricuspid valve sometimes has a tendency of overestimation. If preoperative study shows moderate or severe TR, water competent test is advisable to get information about the indication of TAP. Reduction of the cardiothoracic ratio value and improvement of functional class showed the effectiveness of ASD closure with concomitant TAP.

PHT is a serious complication that influences the prognosis of ASD. In general, severe PHT is uncommon in ASD. But it develops between 20 and 40 years of age and may be rapidly progressive, leading to shunt reversal, disability, and death [Craig 1968]. It is difficult to predict in which patient with ASD pulmonary vascular disease will develop. Operating on patients with severe PHT is too hazardous. Fiore and colleagues reported that the operative outcome in their series of ASD patients older than 50 years was not influenced by the presence of PHT in the absence of greatly increased vascular resistance [Fiore 1988]. Others have suggested that increases in PAP are not necessarily related to age and shunt size is not related to severity of symptoms [Craig 1968; Shaheen 2000]. Surgery should indeed be performed in the younger patient and probably before structural changes in the myocardium or pulmonary vasculature have occurred [Ghosh 2002]. Despite rare severe PHT in our patients, we suggest that, in patients with PHT, surgeons should be cautious in deciding to operate, irrespective of their age.

The advanced NYHA classification had a pronounced impact on early and late mortality. We found a significant improvement in functional status that the rate of patients with class I and II (group A) was increased from 63.4% to 92.7% with surgical treatment (Figure) (Table 1).

In conclusion, the results and follow-up have shown satisfactory and beneficial effects to the quality of life in elderly patients who received surgical correction in terms of improvements in clinical status (NYHA functional class), occurrence of arrhythmia, diminishing pulmonary vascularity and congestive heart failure, and a reduction in the size of the right heart. Because there is no safe and effective nonsurgical alternative treatment to surgical closure, we believe that anatomic closure must be performed without delaying the initial treatment for ASD with a Qp/Qs ratio ≥1.5 and increasing PAP for adults >30 years old, even these over 50 years of age, who are in NYHA classes III and IV. Surgically treated patients should be followed closely for the onset of AF or flutter to prevent or reduce morbidity resulting from cerebral thromboembolism and anticoagulation regimen should be continued in patients with sustained AF, even after an operation.

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