

Outcome of Surgery for Aortic Regurgitation Associated with Ventricular Septal Defect

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Abstract

Background: To evaluate the short term outcome of patients undergoing surgery for aortic valve regurgitation (AR) associated with ventricular septal defect (VSD).

Patients and Methods: In this prospective study forty patients of aortic regurgitation with ventricular septal defect were studied. All patients underwent VSD closure and aortic valve repair if AR was moderate or more in intensity.

Results: The mean age of the study population was 7.64 ± 3.6 years with 33(82.5%) males and 7(17.5%) females. Mean weight was 20.95 ± 8.3 Kgs. Peri membranous type VSD was more frequently observed (85%). Severe Pulmonary Hypertension was observed in 60%. Aortic Regurgitation was severe in 30%. Isolated VSD closure was performed in 15%. Post operative echocardiography revealed no AR in 52.5%. One year survival rate was 97.5%.

Conclusion: As a result of aortic valve repair there is improvement in aortic regurgitation in patients with more than moderate AR preoperatively.

Key Words: Ventricular Septal Defect; Aortic Regurgitation; Aortic valve repair;

Introduction

Ventricular septal defect is the most common congenital heart lesion. Subarterial ventricular septal defect, synonymous with supracristal, conal, infundibular, and type I VSDs, is relatively common among Asians. Its association with prolapse of the right and noncoronary aortic cusps and aortic regurgitation (AR) has been well documented.¹

Prolapse of an aortic cusp occurs in over 5% of patients with ventricular septal defect. This association is common with subarterial doubly committed VSD (up to 72%) which is prevalent in the Oriental population. In Caucasians, where perimembranous VSD predominates, aortic valve prolapse rarely occurs. Aortic regurgitation associated with a ventricular septal defect is relatively common among Asians. Once it appears, the severity will gradually progress and an aortic valve operation may become

necessary. Interest in aortic valve repair as an alternative to replacement has been stimulated, but the unsatisfactory outcome in some patients has usually resulted in re-operation. Surgical closure of the defect is indicated for patients with heart failure and those with associated aortic valve complications, and advocated by some even in the absence of aortic valve deformities to prevent occurrence of the latter.^{2,3}

It has been reported that closure of the VSD alone is effective in eliminating the progression of mild aortic regurgitation, especially in young patients with doubly committed VSD. Valvuloplasty of the aortic valve has been reported to be efficient in improving aortic regurgitation in both the early and long term.⁴

Patients and Methods

The study was conducted at the department of Paediatric Cardiac Surgery, Children Hospital Lahore and department of Paediatric Surgery, Ittefaq Hospital, Lahore, from January 2003 to December 2010. Out of 442 patients 42(9.5%) had associated aortic regurgitation with ventricular septal defect and underwent VSD closure and aortic valve repair

The operation was performed using a median sternotomy. A piece of pericardium was harvested and treated in glutaraldehyde solution for 10 minutes and then rinsed with normal saline solution. Cardiopulmonary bypass with systemic hypothermia to 30°C was used. Myocardial protection was achieved by injection of cold blood cardioplegia into the coronary artery ostia and coronary sinus. The VSD was closed with a synthetic patch using a transpulmonary artery approach for a subpulmonic VSD and a transatrial approach for a perimembranous VSD. A transverse aortotomy was performed, and the aortic valve was carefully inspected. The autologous pericardium was trimmed into a rectangular strip. The length of pericardial strip was adjusted according to the length of the free edge of the prolapsed cusp. The height of pericardial strip was adjusted to be 2 mm

higher than its commissure, usually about 5 to 6 mm in height. Then, the pericardial strip was sutured to the free edge of the prolapsed cusp using a 6-0 polypropylene suture.

The correction of relative prolapses due to unequal length of one or more cusps was achieved by using either a double radial plication of the area of excess tissue or by a single central plication, depending on the quality of the cusp tissue and the degree of prolapse. In patients with poor tissue quality and in whom suture plication was not possible, a triangular resection was performed. Careful inspection of the valve was always performed in order to determine adequate coaptation at the appropriate level. If coaptation was still inadequate or below the annular level, free edge reinforcement was applied.

The quality of aortic valve repair was assessed by measuring the diastolic arterial pressure after the operation. Intraoperative transesophageal echocardiography was performed in 3 patients and the remainder had a transthoracic echocardiography before discharge (5 to 7 days after the operation).

When severe AR and prolapse was found with a lack of coaptation and fibrosis of the valve leaflets, aortic valve replacement was undertaken with interrupted 2/0 Ethibond (Ethicon, Inc., Somerville, NJ, USA) sutures with Teflon pledgets placed above the ring. A valve size of 19 mm was used in 2 patients. Oral anticoagulant (Warfarin Sodium) and aspirin were started from the first postoperative day, and the INR was maintained between 2 and 3.

The amount of left ventricular vent was checked after release of aortic cross-clamp and after weaning from cardiopulmonary bypass. Transthoracic echocardiography was performed before discharge, 3-6 months after operation and periodically thereafter. The Doppler echocardiographic grade of AR was measured with color Doppler flow and graded from the width and length of the regurgitant jet in the left ventricle (grades 0-IV).

Results

The mean age of the study population was 7.64±3.6 years. Peri membranous type VSD was the commonest(85%). At the time of operation severe Pulmonary Hypertension (PH) was observed in 60% (Table 1) VSD closure was performed in 15%, rest underwent aortic valve repair. Majority of patients (67.5%) had involvement of non coronary cusp so repair pertaining to its correction was performed while 12.5% patients underwent repair of right coronary cusp. Non coronary cusp resuspension was performed

in 40%(Table 2) Post operative echocardiography revealed no AR in 52.5% (Table 3). Patients with mild and moderate AR were treated medically and are doing well till the end of follow-up. The operation had a high 39(97.5%) one year survival rate. One late death occurred 8 months post OP in a patient with moderate AR suffering from infective endocarditis.

Table 1. Baseline Characteristics(n=40)

Characteristic	Number(%)
Age mean years	7.64±3.6
Gender	
Male	33(82.5%)
Female	7(17.5%)
Type of Ventricular Septal Defect	
Peri membranous	34(85%)
Doubly committed	2(5%)
Subaortic	4(10%)
Size of Ventricular Septal Defect	
Large	15(37.5%)
Moderate	23(57.5%)
Small	2(5%)
Pulmonary Hypertension	
Severe	24(60%)
Moderate	15(37.5%)
Mild	1(2.5%)
Aortic Regurgitation	
Severe	12(30%)
Moderate	18(45%)
Mild	6(15%)
Trivial	4(10%)

Table 2. Operations Performed(n=40)

Operation	Number(%)
VSD closure	6(15%)
Aortic valve repair	
NCC	27(67.5%)
RCC	5(12.5%)
NCC and RCC	2(5%)
NCC	
Resuspension	16(40%)
Extension	6(15%)
Resuspension+ triangular resection	5(12.5%)
RCC	
Resuspension	3(7.5%)
Resuspension+ triangular resection	2(5%)
NCC and RCC	
Resuspension+ triangular resection	2(5%)

NCC=Non coronary cusp; RCC=Right coronary cusp; VSD=Ventricular septal defect

Table 3. Outcome of Study Population.(n=40)

Outcome	Numbers (%)
Residual AR	
None	21(52.5%)
Trivial	14(35%)
Mild	2(5%)
Moderate	3(7.5%)
Alive	40(100%)

AR=Aortic regurgitation

Discussion

Various techniques of repair of the aortic valve have been described. ⁵In present study majority of patients had involvement of non coronary cusp so NCC repair was performed while 5 patients underwent repair of right coronary cusp and 2 patients underwent repair of both cusps. Post operative echocardiography revealed no AR in 52.5%.

Rathore et al reported the outcome in patients who had aortic valve replacement compared to those who underwent aortic valve repair for aortic regurgitation associated with a ventricular septal defect. The freedom from re-operation after valve repair was 76% after 4 years. After one year of follow-up in 35 patients, 27 were in New York Heart Association class I and 8 were in class II. After 8 years, 12/21 patients were in class I, 5 in class II, and 2 in class III. They concluded that valve repair is preferred, but increasing age makes valve replacement a better alternative. ⁶ In present study none of patients underwent valve replacement while 34 patients underwent valve repair as in 6 direct VSD closure was done keeping in view trivial to mild AR. In valve repair group there were 3 patients having moderate residual AR while rest of the patients had successful repair.

The morbidity and mortality associated with VSD closure combined with aortic valvuloplasty is low. In our series, there was 1 hospital and 1 late postoperative death. Okita and colleagues reported a hospital mortality of 1.6% with no late deaths, resulting in a 15-year actuarial survival of 98.3%.⁷ Trusler and associates experienced no hospital deaths with two late deaths, yielding a 10-year actuarial survival of 96% which is similar to our study.⁸

As an Institutional Policy we advocate closure of VSDs, regardless of the type, the size, or the apparent absence of aortic valve prolapse, when any degree of AR is identified. When the VSD is associated with trivial AR, we perform patch closure of the VSD without exploring the aortic valve. When the AR is

mild, exploration of the aortic valve is sometimes undertaken if preoperative echocardiographic findings suggest significant aortic valve prolapse or if other parameters, such as wide pulse pressure or low aortic root pressure with cardioplegic administration, suggest that the degree of preoperative AR was underestimated. All patients with moderate or severe AR undergo aortic valvuloplasty in addition to VSD closure. We also close all subarterial VSDs associated with aortic valve prolapse, even in the absence of AR, because the likelihood of spontaneous VSD closure is low. For asymptomatic, perimembranous VSDs in patients with aortic valve prolapse but without AR or other classical indications for VSD closure, the decision for surgical repair is more controversial; however, we tend to repair these patients also.

Conclusion

Surgery for ventricular septal defect and associated aortic regurgitation is well tolerated.

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