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Aortic valve repair in patients with ventricular septal defect or subaortic membrane

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Abstract

Background: The delay in the surgical intervention of subaortic ventricular septal defect (VSD) and subaortic membrane leads to significant damage in the aortic valve, and multiple surgical interventions may be needed. We aimed to describe the pathology of the aortic valve in patients with subaortic membrane or VSD and different surgical strategies to manage the aortic regurgitation in those patients.

Methods: The study included patients who had surgery for subaortic membrane or VSD from 2017 to 2021. We reviewed strategies and surgical techniques to deal with aortic regurgitation in patients with subaortic membrane or VSD and the short and midterm outcomes.

Results: Twelve cases were included in the study; 5 cases had subaortic membrane, and 7 cases had subaortic VSD. The age ranged from 1.5 to 10 years old. Postoperative follow-up ranged from 1 to 3.5 years. We performed sub-commissural stitches and peeling of the leaflets to correct residual regurgitation. Four patients with subaortic membrane achieved satisfactory outcomes, and one patient had severe aortic regurgitation. Two patients with VSD had progression of the aortic regurgitation. Patients with failed repair had severe prolapse and thickening of the valve.

Conclusion: Severe prolapse and dense thickening of the valve were difficult pathologies to repair. The sub-commissural stitches could be mandatory to achieve good midterm results. Complete freeing and peeling of the leaflets till restoring the natural appearance is crucial.

KEYWORDS

Aortic valve repair; Ventricular septal defect; Subaortic membrane

Introduction

In developing countries, many patients with congenital heart diseases still have a late presentation. Delayed repair of the aortic valve regurgitation (AR) associated with ventricular septal defects (VSD) and subaortic membrane may lead to poor surgical outcomes. Several surgical techniques have been refined over the last decades to decrease the need for re-interventions after repairing the aortic valve in children. The current operative techniques for children with aortic regurgitation (AR) present a surgical dilemma. Mechanical and bioprosthetic aortic valve replacement (AVR) may be unsuitable and result in patient-prosthesis size mismatch, low quality of life, and anticoagulation-related complications [1]. The Ross procedure is currently the gold standard for aortic valve replacement surgery for older children [2]. This study aims to describe the pathology of the aortic valve and

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different surgical strategies to manage AR in patients with subaortic membrane or VSD and their outcomes.

Patients and methods:

Study Design and patients:

This retrospective descriptive study included all patients who underwent subaortic VSD or membrane surgery and had associated mild degree or more of AR. The patients underwent surgery between June 2017 and June 2021 in Assiut University hospital, Egypt. We excluded patients with active or healed infective endocarditis and redo aortic valve repair. The study was approved by the local Ethical Committee (Reference number: 17300636).

Surgical techniques

We have used several strategies to deal with different degrees of aortic regurgitation. We did not interfere on mild AR cases of subaortic VSDs, hoping that just closure of the VSD will stop the deterioration in the valve structure and lead to some support of the prolapsing cusp. On the other side, in cases of the subaortic membrane, it was necessary to free any adhesion on the leaflets and peel any thickening to get the natural-looking of the valve. Other techniques described were plication and shortening the free margin of the prolapsing leaflet at a healthy, non-thickened point near the commissure. We tried to thin the thickened leaflets, suspend stitches to the aortic wall, and close the sub-commissural triangle to increase the coaptation surface in the leaflets.

Statistical analysis

The patients' numerical data were expressed as mean and range and categorical data as frequencies and percentages. SPSS vs. 25 (IBM Corp- Armonk- NY- USA) was used to perform the descriptive analysis.

Results:

Twelve cases were included in the study, five patients had a subaortic membrane, and seven cases had a subaortic VSD.

Subaortic membrane cases

The age ranged from 4 to 10 years old, and the mean was 6.6 years. One case was a ten-year-old boy with subaortic membrane and moderate left ventricular outflow tract obstruction (LVOTO) with a mean gradient of 30 mmHg and a severe degree of Aortic regurgitation. The aortic valve was trileaflets with severe dense thickening of the three cusps. A trial of thinning by shaving the leaflets was done but failed to achieve a satisfactory result. Therefore, we inserted three sub-commissural sutures. Intraoperative and early postoperative echocardiography showed a mild to moderate degree of aortic regurgitation. On the follow-up, severe aortic regurgitation was detected at 2.5 years after surgery, and we planned a redo aortic valve replacement.

One case was five years old with a subaortic membrane and mild AR (1/4). The pathology was mild endothelial thickening of the right coronary cusp; only peeling the cusp to the normal appearance was done. Immediate and follow-up echocardiography at one year showed trivial AR.
The other three cases had SAM and moderate degree AR (2/4). Their age ranged from four to nine years, and the pathology was thickening and adhesion of the subaortic membrane to the right and non-coronary cusps. We released the adhesions and peeled the cusps. Immediate and follow-up echocardiography revealed mild AR (1/4) not progressing at one year follow up in two cases and 3 .5 years follow up in one case.

VSD cases

The age range was from 1.5 to 7 years (the mean age was four years). There were 3 cases with mild AR. The decision was not to open the aorta but to close the VSD. In the follow-up, in one case, the AR was reduced to trivial AR at one month, while the other two cases remained mild AR at one year.

Two cases had moderate degree AR (2/4). The pathologies were thickening and prolapse of the right coronary cusp. The decision was to peel the leaflet, but the result was unsatisfactory. We did two sub-commissural stitches at the sides of the right coronary cusp to close the sub-commissural triangle. The prolapse was not severe, so no shortening of the free margin of the leaflet was done. Immediate and one-year follow-up revealed a reduction of the AR to a mild degree.

In another two cases, the AR was moderate to severe (3/4). The pathology was severe prolapse of the right coronary cusp and mild to moderate thickening. In one case, shortening of the free margin was done at a healthy non thickened point of the leaflet near the right and left coronary cusps commissure and a suspension stitch to the aortic wall at the same commissure. The intraoperative result was satisfactory, so we did not do any sub-commissural stitches. The intraoperative and immediate postoperative echocardiography revealed mild AR. But at two months follow up, the AR was moderate to severe 3/4 degree, and we planned for medical treatment.

In the second case, shortening of the free margin of the leaflet was done at a healthy non thickened point of the leaflet near the right and left coronary cusps commissure plus two sub-commissural stitches around the right coronary cusp. The intraoperative and immediate postoperative result was mild AR (1/4). But at six months and one-year follow-up, the AR was moderate (2/4), and we planned for medical treatment and follow-up.

Discussion

In our experience, aortic valve repair strategies showed satisfactory results in the short and midterm results concerning mild and moderate degrees of AR. However, it may not offer an advantage in severe or moderate to severe AR in the long-term results. In a study of 17 patients who underwent aortic valve repair for aortic regurgitation (3-17 years, mean 8.1± 3.7 years), 6 (35%) patients had bicuspid valves, and 11 (65%) had tricuspid valves. Type of repair varied with valve type, but repair generally consisted of commissure resuspension, partial commissure closure, triangular resection of redundant leaflets, or some combination. According to echocardiography, three of 17 (17.6%) patients had mild aortic regurgitation, and 6 (35.2%) had moderate aortic regurgitation. In 8 of 17 cases (47.1%), the repair failed, requiring reoperation from 0.5 to 73 months after the original operation (mean 18.9 months) [3]. In another study, aortic valve repair in pediatric populations was effective in postponing reintervention. The longevity of the repair was shorter after cusp extension especially when performed in infants. Caution should be taken when performing tricsupidization and cusp extension of bicuspid valves because it can be responsible for mortality related to occlusion of the coronary ostia by patches [4]. The Ross procedure is currently the gold standard for aortic valve replacement surgery for older children [2]. But pulmonary homograft reoperation is also an important limitation for Ross procedures, especially when performed in very young children [5]. A large study of aortic valve repair concerning AR in older children showed that it is not unexpected for the Ross procedure to exhibit excellent freedom from reoperation after only six years. Repair strategies were associated with a 34% reoperation rate over the same time course. It was disappointing that more than 1/3 of children undergoing a repair operation required an invasive reintervention within five years. [6].

Limitations of mechanical aortic prostheses, anticoagulation, and the complexity and late results of Ross procedures have encouraged some surgeons to do native aortic valve repair. Aortic valve repair avoids the need for long-term anticoagulation. It allows the native aortic annulus to continue growing, thereby expanding future prosthetic aortic valve replacement options and durability. Thus, repair techniques theoretically lessen complications associated with replacement procedures in the younger population and act as a bridge till a good-sized mechanical aortic prosthesis can be inserted. A variety of repair techniques have been reported, including shaving, leaflet extensions, commisuroplasties, suspension stitches, partial resection of a nodular thickening, resection of the thickened free margin and replacing it with several types of patch materials, plication, and suspension of the free margin by Gortex sutures, patch extension of the leaflet and total leaflets replacements (Ozaki technique) [7 - 9]. The available results of aortic valve repair techniques are not well defined. Individual reports of durability and intraoperative judgment made this technique not generalizable to the wider surgical community [10].

Strengths and limitations:

The strength of our study is that the same surgeon operated all cases, and at least a one-year

follow-up was achieved. However, there are insufficient materials and limited experience in aortic valve repair in adults or pediatric populations in Assiut university hospital.

Conclusion

Severe prolapse and dense thickening of the valve were difficult pathologies to repair. The sub-commissural stitches could be mandatory to achieve good midterm results. Complete freeing and peeling of the leaflets till restoring the natural appearance is crucial.

Conflict of interest: Authors declare no conflict of interest.

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