Original Article

Valve sparing aortic root reconstruction in acute dissection of the ascending aorta

Safaie Naser[1], Afrasiabi Abbas[2], Jodati Ahmadreza[3], Gader Shahmohammadi[4], Negargar Sohrab[5], Ata Mahmoodpoor[6]

ABSTRACT

Objectives: Acute dissection of the ascending aorta requires immediate surgical intervention. Use of the re-implantation technique in patients with severe aortic insufficiency remains controversial. In this study we assessed the feasibility and outcome of the valve-sparing aortic root re-implantation technique in patients with severe preoperative aortic insufficiency.

Methodology: Between April 2005 and March 2008, 19 patients with acute aortic dissection of the ascending aorta (Stanford type A) underwent valve sparing aortic root reconstruction. Their ages ranged from 24 to 76 years (51.7±13.2, 58% males). Transesophageal echocardiography was carried out for diagnosis of disease, left ventricle ejection fraction and valve insufficiency. Length of hospitalization, echocardiographic and clinical follow-up, complications and mortality were analyzed.

Results: Four patients (21%) died of non–valve-related complications. Major complications after operation were seen in three patients (15.8%). Mean length of stay in the intensive care unit (ICU) was nine days, and the mean duration of hospitalization were 16 days. Comparison of pre- operative and post-operative clinical profiles of patients showed that left ventricle ejection fraction and severity of aortic insufficiency were significantly altered ($P<0.05$). Comparison of patients who survived with those who died showed that only cardio pulmonary bypass time had statistically significant difference ($P=0.04$).

Conclusion: Valve sparing aortic root reconstruction in patients with type A dissection can be performed with acceptable intra-operative mortality and morbidity and excellent results during follow-up.

KEY WORDS: Cardiovascular diseases, Valve sparing, Aortic dissection, Reconstruction, Complications.

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INTRODUCTION

An aortic dissection, also called a dissecting aneurysm, is a tear in the inner lining of the aorta. This tear allows blood to flow through the walls of the aorta rather than remaining in the central channel (lumen). The two major types of aortic dissection, type A and type B, are defined by the location of the tear.

* Type A dissection—The tear begins in the ascending aorta and progresses throughout the vessel, often extending as far as the arteries in the leg.
* Type B dissection—The tear is located only in the descending aorta, and may extend into the abdomen.

The distinction between the two types is important, as it guides the management of the disease. Type A is the more common and more

Correspondence:

Ata Mahmoodpoor,
General ICU, Shohada Hospital,
El-Goli Street,
Tabriz, Iran.
E-mail: amahmoodpoor@yahoo.com

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dangerous type, and requires immediate surgery. Type B is considered a chronic condition that can be treated with medications.[1]

Acute dissection of the ascending aorta type A is a rare but life-threatening disease.[2] Cardiac tamponade and possible acute aortic regurgitation require immediate surgical intervention. There are different surgical procedures targeting aortic complications. The recent procedure manages to remove the damaged section of aorta, while preserving the aortic valve. The advantage of the valve-sparing procedure is that it provides excellent survival rate and it helps avoid cardiac events, because anticoagulant therapy is not necessary and there is no risk of long-term complications resulting from implantation of an artificial valve. There are two main operative procedures for valve-sparing aortic root reconstruction: the remodeling method which has been performed since its original description in 1978 by Yacoub[3,4], and the re-implantation method[2] which has been performed since its original description in 1988 by David et al.[5] Use of the re-implantation technique in patients with severe aortic insufficiency remains controversial.[6] To address this problem we analyzed outcome in 19 patients who underwent aortic valve re-implantation but differed with regard to the severity of their preoperative aortic insufficiency. Thus the aim of present study was assessing the feasibility and outcome of the valve-sparing aortic root re-implantation technique in patients with severe preoperative aortic insufficiency.

METHODOLOGY

Between April 2005 and March 2008, all patients (n=19) with acute dissection type A have been treated with aortic valve sparing method in Madani Hospital (heart surgery center of Tabriz city, cited in northwest of Iran). Patients who had valve replacement were excluded from this study. Transesophageal echocardiography was carried out for diagnosis of disease, left ventricle ejection fraction and valve insufficiency. In all patients transesophageal echocardiography or transethoracic echocardiography was performed again after operation for assessing status of valve and left ventricle ejection fraction. Valve morphology as well as systolic and diastolic function was assessed in accordance with published criteria.[7] Aortic regurgitation was assessed semi quantitatively as follows: 0: none, I: minimal, II: mild, III: moderate; or IV: severe. Valve performance, complications, and outcome analysis were reported as suggested by the guidelines of the American Association for Thoracic Surgery/Society of Thoracic Surgeons.[8] Performance was assessed either directly or in a telephone-interview with regard to the classification of the New York Heart Association (NYHA). Patients' demographics and preoperative clinical data are presented in Table-I. As seen in this table mean age of patients was 51.7±13.2 years and majority of patients had severe aortic insufficiency.

Preoperative coronary angiography was performed in 10 patients which showed coronary artery disease in two patients. Heart surgery was done in five patients simultaneously, including mitral valve replacement in two cases and coronary artery bypass grafting (CABG) in three cases. All operations were performed through a median sternotomy. Cardiopulmonary bypass (CPB) was established with either an ascending aortic or femoral arterial cannula. The aortic cusps were inspected for severe calcification or retraction, which would deem the valve unsalvageable. The aortic root was reconstructed using the re-implantation technique.[5] Median follow-up for the study group was 13 months, with a minimum of three months and a maximum of 28 months. Continuous variables are expressed as mean ± SD with maximum and minimum. All data analyses were performed with SPSS 14. The Mann-Whitney, Chi square (or Fisher Exact Test), Spearman's correlation tests were used for statistical analysis. A P value less than 0.05 was considered significant.

RESULTS

Intraoperative findings confirmed the diagnosis of aortic dissection type A in all patients. The aortic valve was successfully preserved in all patients (n=19). Four patients (21%) died of non–valve-related complications. Two patients died in operation room because of uncontrollable bleeding; one patient with history of coronary artery bypass grafting died 24 hours after surgery because of cardiogenic shock; and the fourth patient died 25 days after surgery because of intestinal bleeding. Important complications after operation were seen in 3 patients (15.8%); one case of mediastinal infection and two cases of brains complications.

Mean circulatory arrest time was 32 minutes, (from 13 to 72 min), while mean cardio pulmonary bypass time was 200 minutes, (from 52 to 325 min), and mean aortic cross clamp time was 128 minutes, (from 20 to 215 min). Length of stay in the intensive care unit was nine days, (from 3 to 100) and the mean duration of hospitalization was 16 days, (from10 to 100). Comparison of pre and post-operative clinical profiles of patients are presented in Table-II. As seen

in this table, the left ventricle ejection fraction and severity of aortic insufficiency were significantly altered (P<0.05).

Comparison of patients who survived with those who died showed that only cardio pulmonary bypass time had statistically significant difference (P=0.04), but age, sex, left ventricle ejection fraction, pre-operation severity of aortic insufficiency, post-operation severity of aortic insufficiency, using complete circulatory arrest and aortic cross clamp time had no significant difference (P>0.05 for all variables).

Patients' follow-up was performed with mean duration of 13 months (3-28 months). All patients were in NYHA (New York Heart Association) 1 & 2 functional classes. During follow-up there was no mortality and no need for reoperation and use of anti coagulant drugs was felt.

DISCUSSION

This study assessed the feasibility and outcome of the valve-sparing aortic root reimplantation technique in patients with severe preoperative aortic insufficiency. Results of study clearly demonstrate the feasibility of this technique. Acceptable hospital mortality (21%) and low morbidity coupled with excellent midterm stability of the reconstructed valve may support the use of this surgical strategy. These results are similar to Kallenbach et al. study.[6]

The replacement of the aortic wall and the dissected ascending aorta with a composite graft carrying mechanical valve prosthesis represents an established surgical treatment with excellent results.[9,10] However, the lifelong need for anticoagulation with the risk of bleeding and possible thromboembolic events after mechanical valve replacement cause complications with an annual incidence of 2–4% as reported in the literature.[11,12] These complications can be avoided by the use of the valve-preserving reimplantation technique. After endothelialization of the suture lines, anticoagulation is not required. In a study, authors reported a matched pair analysis of patients with ascending aortic aneurysm treated either with composite replacement or the valve sparing reimplantation technique. They observed no bleeding or thromboembolic complications in the latter group, although there were significantly more events in the first postoperative year after composite replacement.[13]

Recently published studies have demonstrated the feasibility of valve sparing aortic root operations in acute aortic dissection type A. Graeter et al compared composite and supracommissural replacement, remodelling as described by Yacoub et al[3] and reimplantation with regard to aortic regurgitation and proximal aortic reoperation 2 years postoperatively.[14] With limited number of patients (17 remodeling, five reimplantation), both valve-preserving techniques demonstrated excellent stability, while supracommissural replacement showed an insignificant trend towards increased reoperations for secondary Aortic Insufficiency(AI). Similarly, Leyh et al compared 11 patients who underwent remodeling and nine patients with re-implantation. Neither significant increase of AI was noticed nor reoperation was required for a mean follow up of 26±18 months in acute type A dissection.[15]

Reconstructive aortic valve surgery in emergency situations such as acute aortic dissection type A remains challenging. Prolonged operation time with

Table-I: Patients' demographics and preoperative clinical data*

Data	*N0. (%)*
Gender(M/F)	11 /8
History of high blood pressure	n=13(68.4%)
Smoker	n= 7 (36.8)
Aortic insufficiency	
II (mild)	*n*=3 (15.8%)
III (moderate)	*n*=2 (10.5%)
IV (severe)	*n*=14 (73.7%)

* Heart transplantation in the patients' history before acute dissection type A

Table-II: Comparison of pre-operation and post-operation clinical profiles of patients.

Variables	*Pre operation*	*Post operation*
Left ventricular ejection fraction*	(30% - 60%) 50±6.2†	(30% , 55%) 43±12
Aortic insufficiency*		
0	0(0%)	4(11.1%)
I	0(0%)	2(10.5%)
II	3(15.8%)	9(47.4%)
III	2(10.5)	3(15.8%)
IV	14(73.7)	0(0%)

*Statistically significant at level of 0.05.
†mean ±standard deviation.

expansion of aortic cross clamp and extra corporeal circulation time is a potential drawback for application of this technique. In the present study the mean circulatory arrest times was 32 minutes, mean cardio pulmonary bypass time was 200 minutes and mean aortic cross clamp time was 128 minutes. Also, a substantial experience with this technique in elective cases is required if application is carried out under emergency situations. However, it would be highly speculative to link the prolonged procedure time to our observed perioperative mortality of 21%.

Comparison of patients who survived with those who died showed that only cardio pulmonary bypass time had statistically significant difference (P=0.04) but age, sex, left ventricle ejection fraction, pre-operation severity of aortic insufficiency, post-operation severity of aortic insufficiency, using complete circulatory arrest and aortic cross clamp time had not significant difference (P>0.05 for all variables). Discussion about these results is avoided because of very low sample size (15 vs. 4).

In conclusion, valve sparing aortic root reconstruction using the re-implantation technique in patients with acute aortic dissection type A is feasible in selected patients with morphologically intact valve cusps. Our midterm results show excellent valvular stability without an increased operative risk. Rare bleeding complications early postoperatively, no need for anticoagulation as well as complete resection of diseased tissue is particularly appealing and represent unquestionable advantages to established methods. Further long-term studies with larger sample size must prove whether these benefits will outweigh the potential risk for reoperation.

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Authors:

1. Safaie Naser, MD,
   Associate Professor of Cardiovascular Surgery.
2. Afrasiabi Abbas, MD,
   Professor of Cardiovascular Surgery.
3. Jodati Ahmadreza, MD,
   Associate Professor of Cardiovascular Surgery.
4. Gader Shahmohammadi, MD,
   Assistant Professor of Cardiovascular Surgery.
5. Negargar Sohrab, MD,
   Associate Professor of Anesthesiology.
6. Mahmoodpoor Ata, MD,
   Assistant Professor of Anesthesiology,
   Fellowship of Critical Care Medicine.

1-6: Tabriz University of Medical Sciences,
Tabriz, Iran.