

Re-implantation aortic valve sparing in the setting of acute ascending aortic dissection

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Abstract

Objective the purpose of this study is to evaluate early results of re-implantation valve sparing surgical technique in acute aortic dissection.

Methods fifty patients (mean age 52 ± 11 years) operated on between march 2011, and April 2013. Marfan patients were excluded. Patients were followed up for 6 month after surgery.

Results The operative mortality was (12%) . Ischemic time was 154.1 ± 16.67 min . Bypass time was 266.1 ± 17.8 min . ICU stay 4.38 ± 1.85 days . Residual mild aortic regurge in (4/50) patients. At the last echocardiography 6 months after surgery(14/50) patients had no aortic regurge , (9/50) patients had mild regurge and (2/50) had moderate regurge.

Conclusion Valve preserving aortic root replacement (reimplantaion) is safe in the setting of acute aortic replacement. Despite the longer bypass and ischemic times , yet the mortality and the morbidity were within the acceptable average.

Introduction

Despite the popularity of valve sparing aortic surgery¹⁻¹⁰ Yet, remodeling has a high failure rate due to progressive dilation of aortic annulus^{11,12}. Although it respects more the aortic root physiology¹⁰. Reimplantation has a better longevity regarding freedom from reoperation due to aortic regurge (AR), although being technically demanding and lengthy operation^{13,14,15}.

Aortic dissection is a life-threatening emergency with a higher mortality and morbidity¹⁶. Supra-commissural tube graft replacement with re-suspension of the commissures is the easiest and most commonly performed technique¹⁷. However, progressive dilatation of the diseased sinuses may lead eventually to aortic incompetence¹⁸. Composite graft replacement, although it represents a more radical approach to the pathology, it necessitates anticoagulation with it is negative impact on obliteration of the false lumen^{19,20}.

The purpose of this study is to evaluate prospectively the early results for patients undergoing re-implantation for acute ascending aortic dissection.

Patients and Methods

Patients

Between March 2011 and April 2013, 50 Patients with were operated emergently in Kasr El-Aini hospitals using the aortic valve sparing re-implantation technique for acute type "A" aortic dissection.

Surgical indications

All patients had macroscopically intact aortic leaflets, and aortic annular diameter less than 27 mm. Those patients had extensive dissection of more than one sinus of valsalva with or without significant aortic incompetence. Patients with connective tissue disorders(e.g. MARFAN) were excluded from this study. Computed Tomography and transthoracic echocardiography were done in all cases to confirm the diagnosis.

Surgical technique

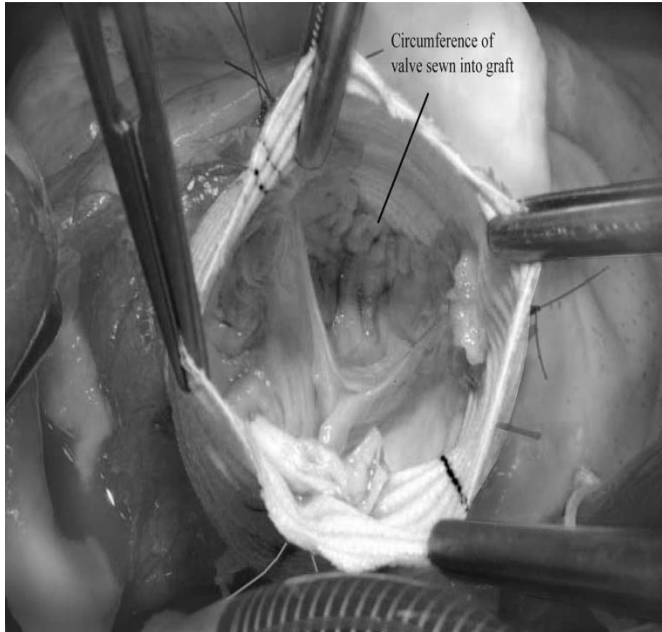
Standard median sternotomy, and femoral artery exposure by a transverse incision above the crease. Followed by femoro-atrial canulation in 43 patients. 7 patients had axillary artery canulation to achieve antegrade flow and avoidance of malperfusion. After establishment of cardiopulmonary bypass, a left ventricular vent was inserted. All patients were cooled to a nasopharyngeal temperature of 25°C to achieve a moderate hypothermic circulatory arrest (HCA). Retrograde cerebral perfusion was implemented a superior vena cava canula . Antegrade cold blood cardioplegia was used for myocardial protection.

The distal end was done first using open clamp technique and hypothermic circulatory arrest. After repair of the dissected aortic layers by several U-stitch Teflon pledgets , a running 3/0 polypropylene suture was used for the anastomosis. In case of presence of intimal tears in the transverse arch , then hemiarch or complete arch replacement was done. Otherwise , the distal anastomosis was done 1 cm proximal to the origin of the innominate artery.

Reimplantation was done via Excision of the diseased sinuses except for 5-8 millimeters, and detaching coronary artery buttons. The left ventricular outflow tract was dissected circumferentially to a level just below the aortic annulus. Then, placing the aortic cusps, annulus and sub-commissural triangles inside a straight tubular Dacron graft. Selection of the size of the graft depends on measuring the size of the aortic annulus with a standard valve sizer, and adding 7mm to it.

Haemostatic closure was secured with two suture lines. One by horizontal interrupted 2/0 braided polyester sutures enforced with Teflon pledgets, through the left ventricular outflow tract underneath the insertion of aortic cusps and tied on the outside. The second is done with a scalloped continuous 4/0 polypropylene sutures to align the base of the sinuses with the graft. The three commissures are suspended inside the graft and secured with pledgeted 3/0 polypropylene suture. Neo-aortic sinuses were created by plicating the graft with 5/0 polypropylene suture at the level of the commissures . (Fig1) The left and right coronary buttons were re-implanted using 5/0 polypropylene running suture enforced with native pericardium . The coaptation level of the cusps are carefully inspected.

Fig(1): Aortic root after reimplantation, Showing proper leaflet coaptation.



Follow- up

Transthoracic Echocardiography was done prior to discharge, and at 6 months postoperatively to grade residual or new aortic regurge. Patients were assessed clinically for complications within this time frame.

Statistical Analysis

It was performed with the SPSS software (SPSS, Inc, Chicago, IL, USA). Values were expressed as mean \pm standard deviation.

Results

The mean age of patients was 51.5 ± 10.8 with a range from 36 to 72 years. 76 % of the patients had more than mild aortic regurge proved by transthoracic echocardiography at the time of initial diagnosis. Preoperative patient characteristics are presented in table (1).

Dacron graft sizes ranged between 28 and 32. Opeative data were presented in Table (2). 5 patients (10%) required a concomitant cardiac procedure. The mean ICU stay was 4.38 ± 1.85 days. The mean hospital stay was 12 ± 2.13 days. 6 patients (12%) had a delayed recovery more than 72 hours. 2 patients regained their conscious level after 5 days. 2

patients(4%) needed a temporary dialysis postoperatively due to renal impairment (serum Creatinine 2.5 mg/dl). 10 Patients had a temporary renal shut down not necessitating dialysis. Excessive drainage more than 1000 ml in the first 12 hours occurred in 7 patients (14%). 3 patients were closed over packs and for 24 hours. Re-opening for bleeding was done in 4 patients (8%). Transient heart block necessitating temporary pacing occurred in 6 patients (12%). Transient elevation of Liver enzymes above 3 folds occurred in 8 patients(16%). 7 patients had superficial wound infection , 1 patient had a deep mediastinitis necessitating rewiring and omental flap.

By the time of discharge from the hospital, 4 patients (8%) had a mild aortic regurge. Two of them deteriorated to moderate regurge at 6 months. 5 new patients developed mild aortic regurge at 6 months follow up. No patients required reoperation for more than moderate AR.

The hospital mortality rate was 12%(6/50). 1/50 patients died due to low cardiac output and failure to wean of bypass. (1/50) patient died due to excessive postoperative bleeding . (3/50) patients died postoperatively in the ICU. One for respiratory failure and two patients died due to multiorgan failure.

Table(1): Preoperative patient characteristics

Age	51.5±10.8
Male gender (N, %)	42/50(84%)
Associated diseases	
Diabetes	11/50(22%)
Hypertension	38/50(76%)
Chronic obstructive lung disease	4/50(8%)
Renal impairment (Cr>2.5)	8/50(16%)
Cerebrovascular stroke	3/50(6%)
Lower Limb ischemia	2/50(4%)
Less than mild aortic regurge	12/50(24%)
Moderate aortic regurge	31/50(62%)
Severe aortic regurge	7/50(14%)
Left ventricular ejection fraction	
Associated cardiovascular pathology	
Mitral insufficiency	5/50(10%)
Bicuspid aortic valve	6/50(12%)
Aortic arch aneurysm	7/50(14%)
Cardiac tamponade	12/50(24%)

*Percentages are shown in parentheses , continuous variable with ± SD

Table (2): Operative data

Aortic annulus (mm)	23.31±1.78
Aortic root diameter	6.3±1
Graft Size (mm)	29.71±1.26
Hemi -arch replacement	7/50(14%)
Mitral valve repair	1/50(0.5%)
Caprol technique	11/50(22%)
Coronary artery bypass graft	4/50(8%)
Cross clamp time, (min)	154.1±15.67
Cardiopulmonary bypass time,(min)	266.1±6.24
Hypothermic circulatory arrest time(min)	17.54±6.24

Data in parentheses were expressed as percentages.

Discussion

Dissection of the ascending aorta proximal to the sinotubular junction necessitates aggressive resection of all dissected tissues. As the main pathology is usually confined to the aortic wall, the valve is rarely found diseased. 40-60% of patients had associated aortic regurgitation related to the dilated sinuses and sinotubular junction²¹. Thus valve sparing ascending aortic reconstruction with Dacron graft seems a logical solution to preserve the left ventricular outflow tract (LVOT) complex function.

Still debates do exist between various techniques as glue repair of the dissected sinuses and resuspension of dissected commissures using layers of Teflon felt. The durability of these techniques are questioned as the diseased parts of the aorta are left behind^{22,23}.

Acute ascending aortic dissection is an absolute emergency with a high risk of mortality and morbidity²². Performing a complex valve sparing operation in this setting should be carefully judged. The mortality in this study was 12% which was within the average range (9.1% - 14.3%)^{24, 25, 26}

Cross clamp time and cardiopulmonary bypass times were acceptable although they were longer at the beginning of the learning curve. All associated pathologies as coronary artery bypass grafting (CABG) and mitral repair done in 5 patients were late in this study. Although no patients had a prior coronary angiography, the 4 patients who had an associated CABG were due to right ventricular dysfunction after removal of the aortic cross clamp. saphenous vein graft was anastomosed to the right coronary artery, and proximally to the graft.

4/50 patients (8%) had mild Aortic incompetence (AI) prior to discharge from hospital out of 38 patients who had more than moderate AI. All other patients had a competent aortic valve. All these patients were operated upon at the beginning of the learning curve. Proper graft sizing and proper suspension of the commissures within the graft are the key for long term durability of aortic valve repair. Sagging of one or more of the aortic valve leaflets and/or failure of coaptation of the leaflets due to large graft size are the direct causes of aortic valve repair failure.

Freedom from aortic regurgitation at 6 months postoperatively was 82%. Murashita T and colleagues reported 89% freedom from postoperative grade

III or greater at 5 years²⁵.

Concluison

Valve preserving aortic root replacement (reimplantaion) is safe in the setting of acute aortic replacement. Despite the longer bypass and ischemic times , yet the mortality and the morbidity were within the acceptable average. All patients were non-Marfan and had dissection extending proximal to the sinotubular junction.

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