Isolated Tricuspid Valve Replacement for Severe Infective Endocarditis: Beating Heart versus Arrested Heart

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Abstract

Objective prospective evaluation of the technique of isolated tricuspid valve replacement on beating heart, compared to the classic aortic cross clamp and cardiolplegia administration. ***Methods*** Between May 2004 and May 2014, 30 patients underwent surgery for isolated tricuspid valve infective endocarditis (TVIE), in Cairo University hospitals**.** Patients were divided into two equal groups. 15 patients had TV replacement on beating heart (Group A), while the other 15 patients had TV replacement on arrested heart and cardiolplegia administration (Group B). Patients were followed for 3 months postoperatively regarding recurrence of endocarditis and conduction abnormalities. ***Results*** Operative mortality was 13.3% in group A versus 20% in group B. The mean ischemic time for group B was 43.86±9.13 min. Bypass time was insignificantly shorter in group A (71.26±7.88 min versus 87.93±8.25 min). 26.6% of patients needed inotropic support in group B versus 26.6% in group A. (p=0.028). Atrio-ventricular block occurred in 13.3% of patients in group A versus 53.3% in group B (p=0.025). There was no recurrence of infection, new onset of heart block or thrombembolic events during the follow up. ***Conclusion*** Tricuspid valve replacement on beating heart was superior regarding the incidence of temporary AV block, and the need for inotropic support. However, permanent pacemaker implantation, bypass time and mortality were comparable.

Introduction

Tricuspid valve infective endocarditis (TVIE) occurs only in 5% to 10% of cases with infective endocarditis[1]. The most common etiologies are intravenous drug abuse, pace maker implantation, central venous catheter and haemodialysis. Despite the advances in antimicrobial treatment, still surgery is needed in 25% of cases[2].

Tricuspid valve (TV) replacement on arrested heart caries the advantages of better exposure of the valve, no movement of the leaflets (facilitates resection the diseased segments), and no posterior movement of the annulus[3]. On the other hand, TV replacement on beating heart abolishes the risk of myocardial ischemia and aortic clamp adverse events[4, 5]. Moreover, early recognition of AV block secondary to atrioverntricular node and/ or bundle damage by septal sutures is feasible and possibly corrected[3].

The aim of this study is to evaluate prospectively tricuspid valve replacement on beating heart in comparison to the classic arrested heart with cross clamp and cardiolplegia administration.

Patients and Methods

Between May 2004 and May 2014, 30 patients underwent surgery for isolated tricuspid valve infective endocarditis (TVIE), in Cairo University hospitals. All patients had massive destruction of the tricuspid valve and had a tissue valve replacement. Redo patients, and patients with other valve diseases were excluded.

Patients were divided into two equal groups. 15 patients had TV replacement on beating heart (Group A), while the other 15 patients had TV replacement on arrested heart and cardiolplegia administration (Group B). Transthoracic echocardiography and blood cultures were the key for the diagnosis of infective endocarditis. Presences of huge mobile vegetations, more than moderate tricuspid regurge, and / or pulmonary emboli (abscesses) were the indications for surgery. Valve replacement was done whenever residual tricuspid valve tissue after resection of diseased segments is not amenable for repair by autologous pericardium.

Surgical technique

All patients had a median sternotomy. Cardiopulmonary bypass was initiated via aorto-bicaval canulation. In group "B" myocardial protection was achieved by moderate hypothermia (30°c), and antegrade cold blood cardiolplegia. In Both groups the right atrium was opened after snaring the superior and inferior vena cavies. The tricuspid valve was inspected for infection and regurge. All infected tissues and vegetation were resected and sent for cultures.

The Decision of tricuspid valve replacement was taken intra-operatively, when repair is impossible due to lack of healthy tissues and proper leaflet cooptation could never been achieved . The annulus was reconstructed as needed by autologous pericardium. Remaining healthy leaflets and chordae was left in place to avoid ballooning of the right ventricle.

In both groups, interrupted, pledgeted 2/0 braided polyethylene sutures were taken around the annulus. Valve seizers designated for the type of the stented tissue valve used to define the proper size. The valve was fixed in place with care to avoid passing the needle in the area of the anteroseptal commisures. After tightening the sutures in group"A", the heart rhythm was noticed for 5 minutes. Whenever, a conduction abnormality was noticed the sutures around the anteroseptal commisures were cut and a pericardial strip bridge was used to fix the valve to avoid this area.

The right atrium was closed by continuous 4/0 polypropylene sutures in an inverted vertical mattress pattern. Rewarming, and recirculation was needed in group B. Weaning of bypass and routine decanulation and closure was done.

Data Collection and statistical analysis

Preoperative, operative, and postoperative data were collected prospectively and tabulated using Microsoft Excel® program. Continuous variables were expressed as mean ± standard deviation and analyzed by student *t* test. Categorical data expressed as percentages and analyzed by Chi square test or exact Fisher test as appropriate. Statistical analysis was done using SPSS version 10 (SPSS Inc, Chicago, IL). A *p* value less than 0.05 was considered as statistically significant.

Follow up

Patients were followed for 3 months postoperatively regarding recurrence of endocarditis and conduction abnormalities.

Results

Patient characteristics were shown in table (1). The main etiologies for TV infective endocarditis were infection on a permanent pacemaker wire, intravenous drug abuse and haemodialysis. Most patients had grade 3-4 tricuspid regurge. Preoperative echocardiography showed huge vegetations in all patients. Operative data were listed in table (2).

Six Patients with pulmonary emboli had bilateral multiple pyemic abscesses. Two of them had associated empyema due to ruptured abscesses. They were managed by intercostals tube drainage and appropriate antibiotics. Four patients achieved complete healing after surgery within 10-21 days. Two patients died (33.3%), one due to septicemia and one due to respiratory failure.

The overall operative mortality was 16.6% (5/30). There was no statistically significant difference between the two group regarding mortality. Causes of mortality were septic shock (1), low cardiac output (2), multiorgan failure (1) and respiratory failure (1). There were no postoperative neurological complications or new onset of renal impairment in both groups.

Postoperative results were shown in table (3). Atrio-ventricular (AV) block lasting less than 2 weeks was significantly less in group A. However permanent pacing was needed in 1 patient of group A versus 2 patients of group B with no statistical significance. Postoperative echocardiography showed no paravalvular leaks or residual regurge in both groups during hospital stay.

All survivors completed a 6 weeks course on antibiotics in the hospital. Vancomycin- gentamicin was the most commonly used combination. Voriconazle was used in cases of persistent sepsis or when blood cultures prove a fungal infection (4/30 patients). Echocardiography and clinical examination was done monthly after discharge. Patients were instructed to do a fever chart at home, and followed up by a weekly phone interview.

There was no recurrence of infection, new onset of heart block or thrombembolic events during the follow up. All patients received warfarin to adjust the INR around 2.5-3 and was advised to continue warfarin for life.

Table (1): Preoperative patient characteristics

	Group A	Group B	*P* Value
Age (years)	32.26±11	30.46±12	NS
Male sex	13(86.6%)	12(80%)	NS
Permanent pace maker infection	0(0%)	1(6.6%)	NS
Intravenous drug abuse	7(46.6%)	9(60%)	NS
Haemodialysis	4(26.6%)	3(20%)	NS
Unknown etiology	4(26.6%)	2(13.3%)	NS
Atrial fibrillation	2(13.3%)	3(20%)	NS
LVEF (%)	58±8	58.3±7.1	NS
TAPSE	1.54±0.2	1.52±0.21	NS
Pulmonary embolization**	2(13.3%)	4(26.6%)	NS

G=grade, NS=non significant, LVEF= left ventricular ejection fraction, TAPSE=**tricuspid annular plane systolic excursion** , ** presented with bilateral lung pyemic abscesses

Table (2): Operative data

	Group A	Group B	*P* Value
Ischemic time (min)	-	43.86±9.13	-
Bypass time (min)	71.26±7.88	87.93±8.25	NS
Size 29	3(20%)	4(26.6%)	NS
Size 31	11(73.3%)	9(81.8%)	NS
Size 33	1(6.6%)	2(13.3%)	NS
St Jude Epic® porcine valve	6(40%)	7(46.6%)	NS
Medtronic Hancock® porcine valve	9(60%)	8(53.3%)	NS

Table (3): postoperative data

	Group A	Group B	*P* Value
Mortality	2(13.3%)	3 (20%)	NS
Need for inotropic support	4(26.6%)	10(66.6%)	0.028
AV block *(<2weeks)	2(13.3%)	8(53.3%)	0.025
Permanent pacemaker	1(6.6%)	2 (13.3%)	NS
ICU stay (days)	2.93±1.43	3.66±1.71	NS
Mechanical ventilation(hours)	5.8±1.65	6.02±2.39	NS

* Atrioventricular

Discussion

TVEI is mainly a medical issue with a very good response to antibiotics[6]. Surgery is indicated in patients with persistent sepsis refractory to antibiotics, huge vegetations, previous pulmonary embolization and severe tricuspid regurge. Surgery aims to eradicate the infection and correct mechanical complications[7]. Surgical options are vegetectomy, repair with autologous pericardium, ring implantation, excision, and valve replacement[8, 9, 10]. Tricuspid valve replacement (TVR) is mandatory where it is impossible to repair the valve after total eradication of infected tissues.

TVR is a rare procedure. Only 425 patients had a TVR out of 63,000 patients who had valve replacements according to United Kingdom Heart valve Registry between 1986 and 1996[11]. In the setting of endocarditis, mechanical valves are not preferred as the main principle is to use the least possible foreign bodies[12,13].

There is no clear advantage of tissue valves over mechanical valves in the tricuspid position. Filsoufi et al reported 34 patients with TVR by a tissue valve versus 47 patients with a mechanical valve. The overall operative mortality was 22% (heart failure was the commonest cause of death). Survival at 5 and 10 years was 60% and 45% for biological valves and 69% and 59% for mechanical valves[14]. Carrier et al reported a mortality of 17% in patients who had TVR by a tissue valve versus 20% in patients with mechanical valves. One year survival rate were 67±5% with bioprosthesis and 60±13% with mechanical valves[15]. In this series, the overall operative mortality was 16.6%. Most patients were young patients with relatively

good cardiac functions with no other cardiac comorbidity apart from tricuspid valve malfunction.

Temporary AV block was significantly less in the beating heart group in this series. Pfannmüller et al reported insignificant difference in the incidence of postoperative AV block between TVR with beating heart (63 patients) and arrested heart (42 patients). Pace maker implantation was needed in 6.4% patients (beating) versus 7.1% (arrested)[3] . Jokinen et al reported a rate of 11.1% AV block with pace maker implantation post tricuspid valve surgery[16].

Pulmonary embolism is a clinical finding in 75-100% of patients with TV infective endocarditis[17]. In this series, the overall incidence of bilateral lung pyemic abscesses secondary to pulmonary embolism was 18%. They had the worst outcome with a high incidence of prolonged mechanical ventilation and mortality secondary to respiratory failure.

Conclusion

Tricuspid valve replacement on beating heart was superior regarding the incidence of temporary AV block and the need for inotropic support. However, permanent pacemaker implantation, bypass time and mortality were comparable.

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