ORIGINAL ARTICLE

Comparison of semi-continuous and interrupted suture techniques for mitral valve replacement

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Abstract

Objectives: To compare the efficacy of semi-continuous technique and interrupted suture technique for mitral valve replacement in early post-operative period.

Method: The randomised prospective study was conducted at Chaudhry Pervaiz Elahi Institute of Cardiology, Multan, Pakistan, from December 2012 to December 2014 The patients were divided into two equal groups: Group I patients underwent semi-continuous technique for mitral valve replacement, and Group II underwent interrupted technique. Data was analysed using SPSS 16.

Results: The 100 patients were divided into two equal groups of 50(50%) each. There was no significant difference in terms of age, gender and pre-operative echocardiographic characteristics ($p>0.05$ each). Total bypass and cross-clamp times were significantly higher in Group II ($p<0.0001$ and $p<0.0001$). The incidence of peri-prosthetic leakage was low in Group II compared to Group I but it was not significantly different ($p=0.64$).

Conclusions: Semi-continuous technique was found to be a safe and reliable method of mitral valve replacement.

Keywords: Mitral valve prosthesis, Mitral valve surgery. (JPMA 65: 844; 2015)

Introduction

Heart valve replacement is a well-established and safe procedure with a low mortality risk, and results in considerable benefits to patients with chronic valvular disease. Mitral valve replacement (MVR) is performed using either semi-continuous (SC) technique or interrupted suture technique. The SC technique is quicker, with shorter aortic cross-clamp and cardiopulmonary bypass times.[1] Incidence of para-prosthetic leakage (PPL) detected by trans-oesophageal echocardiograph (TEE) is about 15% after MVR in the immediate post-operative period[2] and 12.5% without the use of TEE.[3-5] The degree of annular calcification, infection, type of suture technique, and size and type of prosthesis are considered to be the main contributing factors for PPL.[4,6] It has been reported that the rate of PPL in SC method is high following the surgery[7] compared to the interrupted suture technique. This leakage is not high in rheumatic valvular disease because of the thick and fibrotic annulus.[8] A study demonstrated that suture technique does not predict the incidence of PPL in valve replacement surgery for non-infective indications.[4] We conducted this study to find the incidence of PPL using both SC and interrupted suturing of prosthetic valve in MVR.

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Patients and Methods

The randomised prospective study was conducted at Chaudhry Pervaiz Elahi Institute of Cardiology, Multan, Pakistan, from December 2012 to December 2014. Patients undergoing isolated MVR surgery were randomly divided into two groups: Group I patients underwent SC technique, while Group II patients underwent interrupted suture technique.

All operations were performed through median sternotomy, using cardiopulmonary bypass and moderate hypothermia. Cardiopulmonary bypass was instituted using two-stage single venous cannula or 2 single-stage venous cannulas and a straight tip ascending aortic cannula. An antegrade aortic root cardioplaegia cannula was used to administer cardioplaegia. Warm blood cardioplaegia was used to arrest and protect the heart. Manual cardioplaegia system using pressure bag was used for warm blood cardioplaegia delivery. Cardiac Index during surgery was maintained at ~2.0-2.4 $l/min.m^{-2}$ at mild hypothermia. Arterial pressure was maintained at about 55-70mmHg. Haematocrit during cardiopulmonary bypass was maintained between 25%-35%. Systemic temperature was lowered to 28 to 32°C to achieve moderate hypothermia.

The patients were followed for a period of 1 month after surgery. Presence of new holosystolic regurgitant murmur after MVR was considered an indication of PPL, which was further evaluated using trans-thoracic or trans-oesophageal Echocardiogram (TEE) in early post-

operative and follow-up period. TEE is considered the gold standard for the detection of PPL.

The sample size was calculated using the prevalence rate of PPL in MVR patients. At level of significance (α) of 0.05 and maximum tolerable error 0.1, the calculated sample size was 49 individuals. We took 50 individuals in each group to make our results more reliable.

Data was analysed using SPSS 16. Shapiro-Wilk's test was used to check if the quantitative variables were skewed. Quantitative variables were expressed as mean and standard deviation (SD). For qualitative variables, frequencies and percentages were used. Independent sample t-test and Mann-Whitney U test were used to compare quantitative variables. Chi-square test and Fisher's exact test were used to compare qualitative variables.

Results

The 100 patients were divided into two equal groups of 50(50%) each. Overall, there were 74(74%) males and 26(26%) female patients. There was no significant difference in terms of age, gender and pre-operative echocardiographic characteristics in the two groups (Table). Pre-operative risk stratification of patients e.g. Log-euro and Parsonnet scores, were also not significantly different (p=0.48 and p=0.86 respectively). Add-euro score was slightly high in Group II 3.18±1.44 versus 2.74±0.83 in Group I, but it was statistically insignificant (p=0.13). Total bypass and cross-clamp times were significantly higher in Group II (p<0.0001 and p<0.0001 respectively). Incidence of PPL was low in Group II 2(4%) compared to Group I 3(6%) but this difference was statistically insignificant (p=0.64).

Discussion

The first successful prosthetic MVR was achieved in 1960.[9] A year later, a study published results for what was to become the first commercially available prosthesis - the Starr-Edwards ball and cage mitral valve.[6] This was the gold standard until the Bjork-Shiley tilting disk valve (1969) and then the St. Jude Medical bi-leaflet valve (1977) emerged. These second and third generation valves had superior haemodynamic profiles and fewer valve-related adverse events.

Applying SC method abates the duration of valve implantation and clamping time. It is a simple, secure and reliable method for valve replacement. The method minimises the risk of injury to aortic valve leaflets and left circumflex artery (LCX) where the sutures of aorto-mitral continuity and left half of the annulus are performed by direct viewing.

On the other hand, PPL has been reported to increase about 10% within 4 years post-operation.[10] It is suggested that application of at least 4-5 polypropylene sutures for each MVR, tightening up the sutures by a nerve hook, causes low PPL. This method is recommended for patients requiring valve replacement due to rheumatic valve disease, especially in cases of severe mitral stenosis and small atrium, but it is not recommended for patients with degenerative valvular disease. In these cases, the use of pledgeted interrupted sutures is preferred.[11] Using Interrupted technique, excessive traction on the valve should be avoided, particularly keeping in mind the risk of overstretching and rupturing the adjacent posterior left ventricular wall.

The SC suture technique has the advantage of speed. This technique should only be used when the surgeon is

Table-1: Comparison of pre-operative, operative and post-operative characteristics of patients of Group I and Group II.

Name of Variable		Semi continuous Technique (group I) n= 50	Interrupted technique (group II) n=50	P-Value
Age (Mean±S.D)		40.18±20.13	47.16±20.00	0.07
Gender (%)	Male	36 (72%)	38 (76%)	0.64
	Female	14 (28%)	12 (24%)	
Type of Mitral Valve Disease (%)	Predominantly Stenosis	26 (52%)	19 (38%)	0.16
	Predominantly Regurgitation	24 (48%)	31 (62%)	
Pre-operative Ejection Fraction (Mean±S.D)		57.96±5.24	58.46±6.71	0.48
Add-euro Score		2.74±0.83	3.18±1.44	0.13
Log-euro Score		2.21±1.14	2.15±0.79	0.48
Parsonnet Score		5.90±1.58	6.10±1.97	0.86
Bypass Time (Mean±S.D)		78.84±25.95	114.92±19.38	<0.0001
Cross-clamp time (Mean+S.D)		49.18±13.21	80.34±14.89	<0.0001
Para-prosthetic Leakage (%)		3 (6.0%)	2 (4%)	0.64

SD: Standard deviation.

confident of its ease and security. Placement of interrupted sutures with pledgets is more consistently reliable, particularly with restricted access and friable tissues.

A new holo-systolic regurgitant murmur after MVR is an indication of the presence of a PPL. Echocardiography is a gold standard procedure for diagnosis of a PPL in the mitral position.[12-14] PPLs can lead to heart failure, haemolytic complications,[15] and thromboembolic complications[12] and are one of the most common reasons for repeat of MVR surgery[16-18] with a low operative mortality risk[19] resulting in improved survival and a reduction in symptoms.

In this study, there was no significant difference in PPLs in the two groups. But the bypass time and cross-clamp time were significantly low in patients in whom SC technique was used. The incidence of PPL was low in our study compared to other studies. The reason for this may be that in our study the follow-up of patients lasted only 1 month and PPL can occur at some later stages after surgery as well.

Conclusions

Semi-continuous technique was found to be a safer and more reliable method of MVR, having short cross-clamp and cardiopulmonary bypass times.

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