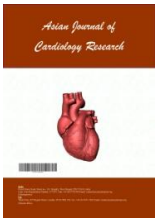

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A Comparison of Immediate Outcomes of Redo Percutaneous Transvenous Mitral Commissurotomy with the First Percutaneous Transvenous Mitral Commissurotomy - A Retrospective Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims and objectives: To compare immediate and in hospital outcomes of patients undergoing Redo Percutaneous Transvenous Mitral Commissurotomy(PTMC) with outcomes in patients undergoing PTMC for the first time. To compare the grading of Mitral Regurgitation(MR) and Mean Mitral Valve Area(MVA) in patients undergoing Redo PTMC and PTMC first time at the end of one year of follow-up.

Materials and methods: It is a retrospective study conducted at Southern Railway Headquarters Hospital- a tertiary hospital in Chennai on a total of 148 patients who underwent First and Redo Percutaneous Transvenous Mitral Commissurotomy (PTMC) as part of the treatment for the same during the period from 1st January 2010 to 31st December 2018, and having minimum follow up of atleast 1 year, were taken into study based on inclusion and exclusion criteria.

Results: A total of 148 patients were included in the study, of which seventy four patients were in the First Percutaneous Transvenous Mitral Commissurotomy (PTMC) group and other seventy four patients were in the Redo PTMC group. After PTMC procedure, mean Mitral valve area increased to 1.95 ± 0.14 cm^2 in the First PTMC group and 1.82 ± 0.09 cm^2 in the Redo PTMC

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group(p=0.001). Immediately after PTMC procedure, 73 patients (98.7%) had grade I and grade II Mitral regurgitation and 1 patient (1.3%) had grade III Mitral regurgitation in the First PTMC group. Immediately after PTMC procedure, 70 patients (94.6%) had grade I and grade II Mitral regurgitation and 4 patients (5.4%) had grade III and grade IV Mitral regurgitation in the Redo PTMC group (p=0.02). Immediate procedural success was observed in 73 patients (98.6%) in the First PTMC group and 70 patients (94.5%) in the Redo PTMC group. At the end of 1 year after PTMC procedure, mean Mitral valve area in the First PTMC group was 1.90 ± 0.11 cm^2 and in Redo PTMC group it was 1.77 ± 0.09 cm^2(p=0.001). At the end of 1 year after PTMC procedure, 71 patients (95.9%) had grade I and grade II Mitral regurgitation and 3 patients (4.1%) had grade III Mitral regurgitation in the First PTMC group. 63 patients (86.4%) had grade I and grade II Mitral regurgitation and 10 patients (13.6%) had grade III and grade IV Mitral regurgitation at the end of 1 year after PTMC procedure in the Redo PTMC group (0.03).

Conclusion:-Redo Percutaneous Transvenous Mitral Commissurotomy(PTMC) for the patients who have mitral valve restenosis can be performed with a high success rate and low risk, although immediate and mid-term results are marginally inferior compared with patients who undergo PTMC as an initial procedure.

Keywords: Percutaneous transvenous mitral commissurotomy; wilkins score; NYHA (New York heart association) class; atrial fibrillation; mitral valve area; mean mitral valve gradient; pulmonary artery mean pressure; pulmonary artery systolic pressure; mean left atrium – left ventricle end diastolic pressure gradient; mitral regurgitation.

1. INTRODUCTION

Rheumatic Heart Disease is a late sequel of Acute Rheumatic Fever, which in turn is an autoimmune reaction to Group A Beta Hemolytic Streptococcal infection [1,2]. A recent study by Indian Council of Medical Research (ICMR) between 2000 and 2010 in 10 different, mostly urban, locations of the country found the prevalence to range from 0.2 to 1.1/1000 for Rheumatic Heart Disease and 0.0007 to 0.2 /1000 for Acute Rheumatic Fever.[3] On an average, one third of the patients after an attack of rheumatic fever develop chronic valvular lesions, the most common being mitral stenosis. [4,5]

There are several pathophysiological implications in Rheumatic Mitral Stenosis(MS), the worst being pulmonary hypertension and progressive right ventricular dysfunction. Progressive increase in severity of clinical symptoms like dyspnea, edema, hemoptysis and palpitations occur with increasing severity of mitral stenosis. [6]

Diuretics and rate control drugs like beta blockers, calcium channel blockers and digoxin are the initial treatment of choice followed by percutaneous intervention or valve replacement depending upon the severity of the disease [7]. Treatment of severe mitral stenosis by Closed Mitral Commissurotomy(CMC) was first developed in 1940.[8] Percutaneous balloon dilatation technique was described by Inoue in 1984 [9] and Lock et al in 1985 [10], and with further modifications of their technique have led to improved results. The incidence of mitral restenosis, as assessed by sequential echocardiography, is approximately 40% after 7 years.[11] In certain other studies, rate of mitral restenosis after Percutaneous Transvenous Mitral Commissurotomy(PTMC) is in the range of 4% to 39%.[12]

When surgery is needed for restenosis, it is often Mitral Valve Replacement (MVR), with the inherent operative mortality and long term risk of prosthesis related complications.[13] Patients with favorable valve morphology have procedural success rate of more than 90% for PTMC. Procedural mortality nowadays is less than one percent and urgent mitral valve surgery for severe MR(Mitral Regurgitation) during PTMC is rarely required.[14] Few studies comparing results of PTMC done in patients with mitral restenosis following initial PTMC showed varying results in success. The feasibility of Redo PTMC has been demonstrated in a few series with generally equal or slightly inferior results and encouraging results in selected patients with favourable characteristics.[15-19] Nearly half of all patients who undergo PTMC remain free from cardiovascular death or surgery at 20 years and 25% of them need repeat procedure.[20] Our study aims to compare the immediate results of Redo PTMC with first PTMC in patients with severe mitral stenosis.

2. MATERIAL AND METHODS

This study is a retrospective observational study, of case records of the patients in the study population, and also clinical follow up on an outpatient basis in our Southern Railway Headquarters Hospital, Chennai. Patients with Rheumatic Heart Disease with Severe Mitral Stenosis were studied. A total of 148 patients underwent Percutaneous Transvenous Mitral Commissurotomy(PTMC) after Echocardiographic evaluation for suitability of PTMC. 74 patients underwent PTMC for the first time and 74 patients underwent Redo PTMC for mitral restenosis. These patients were evaluated depending on the variables obtained through electrocardiogram, echocardiography and cardiac catheterization. Among 74 patients in Redo PTMC group, 1 patient underwent urgent mitral valve replacement surgery immediately after PTMC procedure in view of severe mitral regurgitation. Parameters such as normal sinus rhythm and atrial fibrillation were obtained through Electrocardiogram (ECG). Various 2D-Echocardiographic parameters like Wilkins Echo score of mitral valve, Mitral valve area (Doppler by Pressure Half Time) and grading of Mitral regurgitation obtained before PTMC and within 48 hours after PTMC. During follow up after one year, Mitral valve area (Doppler by Pressure Half Time) and grading of Mitral regurgitation were obtained. Hemodynamic data from the catheterisation during and after PTMC like mean Mitral valve gradient, peak Mitral valve gradient, Pulmonary artery mean pressure, Pulmonary artery systolic pressure, Left Atrium- Left Ventricular End Diastolic Pressure Gradient, were included. Procedural success of PTMC was defined as Mitral valve area ≥ 1.5 cm^2 and Mitral regurgitation grade ≤ 2.

2.1 Intervention Details

All eligible patients was administered intravenous pre operative antibiotics 30 minutes before the procedure. Catheterisation was done through both femoral vein and femoral artery on the right side by modified Seldinger technique. Interatrial septal puncture was performed by Hung's technique using the Mullins sheath and Brockenbrough needle. A coiled Left Atrium spring guidewire was introduced through the sheath into the left atrium. The puncture site was dilated with septal dilator. Various mitral balloon (Accura, Sym, Inoue) of corresponding size (decided based on the patients' height using Hung's formula) was positioned into the left atrium over the guidewire. By various techniques, mitral valve was crossed with the balloon and the balloon was inflated to dilate the orifice. The procedure was done under transthoracic echocardiographic and fluoroscopic guidance. Before dilatation, left atrial mean pressure and left ventricular end diastolic pressure were assessed. After each dilatation, the mitral valve area by planimetry and Doppler by pressure half time, severity of MR, left atrial mean pressure and left ventricular end diastolic pressure were assessed. The dilatation was repeated until the MVA increased to ≥1.5 cm^2 and development of MR grade ≥2.

All the quantitative variables were checked for normal distribution within each study group using visual inspection of histograms and normality Q-Q plots. Shapiro Wilk test P values were also assessed. Descriptive analysis was carried out by mean and standard deviation for normally distributed quantitative variables, median and IQR for non-normally distributed quantitative variables, frequency and proportion for categorical variables. Descriptive statistics included computation of percentages, means and standard deviations. The mean values of the normally distributed quantitative variables were compared between two groups, using independent sample t-test. Categorical variables were compared by Chi square test. P value < 0.05 were considered statistically significant.

3. RESULTS

There were greater number of female patients (64.9% in First PTMC group and 71.6% in Redo PTMC group) than male patients (35.1% in First PTMC group and 28.4% in Redo PTMC group) (Table No-1).

The present study comprised of patients aged from 18 years to 71 years in the First PTMC group and 27 years to 74 years in the Redo PTMC group (Table No- 2).

39.2% patients in the First PTMC group and 81.1% patients in the Redo PTMC group had atrial fibrillation before the PTMC procedure (Table No-1).

58.1% patients were in NYHA class II, 39.2% patients were in NYHA class III and 2.7% patients in NYHA class IV in the First PTMC group. In the Redo PTMC group, 40.5% patients were in NYHA class II, 56.8% patients were in

NYHA class III and 2.7% patients were in NYHA class IV (Table No-1)

Mean wilkins score were 10.28 ± 0.76 and 12.12 ± 0.99 in the First PTMC and Redo PTMC groups, respectively. All patients (100%) had wilkins score 8-12 in the First PTMC group. In the Redo PTMC group, 63.5% patients had wilkins score 8-12 and 36.5% patients had wilkins score >12 (Table No- 1 and Table No-2).

Before PTMC mean mitral valve area were 1.01 ± 0.17 cm^2 and 1.07 ± 0.16 cm^2 in the First PTMC group and Redo PTMC group, respectively. Immediately after PTMC, mean mitral valve area increased to 1.95 ± 0.14 cm^2 and 1.82 ± 0.09 cm^2 in the First PTMC group and Redo PTMC group, respectively. At the end of 1 year, mean mitral valve area was higher in the First PTMC group (1.90 ± 0.11 cm^2) as compared to the Redo PTMC group (1.77 ± 0.09 cm^2) (Table No-2, Fig.1).

Before PTMC, mean Mitral valve gradient were 11.57 ± 4.73 mmHg and 15.28 ± 4.09 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, mean Mitral valve gradient decreased to 5.45 ± 1.94 mmHg and 7.34 ± 1.29 mmHg in the First PTMC group and Redo PTMC group, respectively (Table No-2, Fig-2).

Before PTMC, peak Mitral valve gradient were 19.49 ± 6.16 mmHg and 29.24 ± 5.42 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, peak Mitral valve gradient decreased to 10.92 ± 2.77 mmHg and 15.78 ± 2.09 mmHg in the First PTMC group and Redo PTMC group, respectively (Table No-2).

Before PTMC, Pulmonary artery mean pressure were 31.74 ± 10.38 mmHg and 35.97 ± 10.47 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, Pulmonary artery mean pressure decreased to 22.53 ± 6.34 mmHg and 24.89 ± 8.25 mmHg in the First PTMC group and Redo PTMC group, respectively (Table No-2, Fig-3).

Before PTMC, Pulmonary artery systolic pressure were 49.15 ± 14.50 mmHg and 56.30 ± 16.53 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, Pulmonary artery systolic pressure decreased to 36.84 ± 9.35 mmHg and 42.41 ± 12.71 mmHg in the First PTMC group and Redo PTMC group, respectively (Table No-2).

Before PTMC, mean Left Atrium – Left Ventricle end diastolic pressure gradient were 11.74 ± 2.05 mmHg and 13.80 ± 5.29 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, mean Left Atrium – Left Ventricle end diastolic pressure gradient decreased to 2.64 ± 1.83 mmHg and 5.26 ± 4.38 mmHg in the First PTMC group and Redo PTMC group, respectively (Table No-2, Fig-4)

Before PTMC, 18.9% patients had grade 0 Mitral regurgitation, 77% patients had grade I mitral regurgitation and 4.1% patients had grade II mitral regurgitation in the First PTMC group. Before PTMC, 4.1% patients had grade 0 Mitral regurgitation, 91.8% patients had grade I Mitral regurgitation and 4.1% patients had grade II Mitral regurgitation in the Redo PTMC group. Immediately after PTMC, 98.7% patients had grade I and grade II Mitral regurgitation and 1.3% patients had grade III and grade IV Mitral regurgitation in the First PTMC group. Immediately after PTMC, 94.6% patients had grade I and grade II Mitral regurgitation and 5.4% patients had grade III and grade IV Mitral regurgitation in the Redo PTMC group. One patient had grade IV mitral regurgitation after PTMC procedure in the Redo PTMC group requiring urgent Mitral valve replacement surgery. At the end of one year after PTMC procedure, 95.9% patients in the First PTMC group and 86.4% patients in the Redo PTMC group had grade I and grade II Mitral regurgitation. 4.1% patients in the First PTMC group and 13.6% patients in the Redo PTMC group had grade III and grade IV Mitral regurgitation at the end of one year after PTMC procedure. None of the patients with grade III and grade IV Mitral regurgitation at one year required surgical interventions (Table No-3, Fig-5).

98.6% patients underwent successful PTMC in the First PTMC group and 94.5% patients underwent successful PTMC in the Redo PTMC group.

4. DISCUSSION

Rheumatic heart disease continues to be prevalent in developing countries, with mitral stenosis being the most frequent valve disorder.[21] During the past two decades, Percutaneous Transvenous Mitral

Table 1. Baseline Characteristics of the patients before the First PTMC and Redo PTMC

Variables	First PTMC	Redo PTMC	P Value
Female Patients	48(64.9%)	53(71.6%)	0.37
Male Patients	26(35.1%)	21(28.4%)	
Normal Sinus Rhythm	45(60.8%)	14(18.9%)	0.001
Atrial Fibrillation	29(39.2%)	60(81.1%)	
NYHA Functional Class II	43(58.1%)	30(40.5%)	0.09
NYHA Functional Class III	29(39.2%)	42(56.8%)	
NYHA Functional Class IV	2(2.7%)	2(2.7%)	
Wilkins Score between 8-12	74(100%)	47(63.5%)	0.001
Wilkins Score >12	0(0%)	27(36.5%)	
Successful PTMC	73(98.6%)	70(94.5%)	

Abbreviation:-NYHA- New York Heart Association

Table 2. Haemodynamic data of PTMC for First PTMC and Redo PTMC group

Variables	First PTMC		Redo PTMC		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
Mean Age in Years	44.49	12.26	49.57	10.19	0.007
Mean Wilkins Score	10.28	0.76	12.12	0.99	0.001
Before PTMC mean MVA(cm^2)	1.01	0.17	1.07	0.16	0.03
Immediately after PTMC Mean MVA(cm^2)	1.95	0.14	1.82	0.09	0.001
MVA(cm^2) at the end of one year after PTMC	1.90	0.11	1.77	0.09	0.001
Before PTMC mean Mitral valve gradient(mmhg)	11.57	4.73	15.28	4.09	0.001
After PTMC mean Mitral valve gradient(mmhg)	5.45	1.94	7.34	1.29	0.001
Before PTMC peak Mitral valve gradient(mmhg)	19.49	6.16	29.24	5.42	0.001
After PTMC peak Mitral valve gradient(mmhg)	10.92	2.77	15.78	2.09	0.001
Before PTMC Pulmonary artery mean pressure(mmhg)	31.74	10.38	35.97	10.47	0.01
After PTMC Pulmonary artery mean pressure(mmhg)	22.53	6.34	24.89	8.25	0.04
Before PTMC Pulmonary artery systolic pressure(mmhg)	49.15	14.50	56.30	16.53	0.001
After PTMC Pulmonary artery systolic pressure(mmhg)	36.84	9.35	42.41	12.71	0.003
Before PTMC mean LA-LVEDP gradient(mmhg)	11.74	2.05	13.80	5.29	0.001
After PTMC mean LA-LVEDP gradient(mmhg)	2.64	1.83	5.26	4.38	0.001

Abbreviation:-PTMC- Percutaneous Transvenous Mitral Commissurotomy, MVA- Mitral Valve Area, LA-LVEDP- Left Atrium- Left Ventricular End Diastolic Pressure Gradient, Std. Deviation- Standard Deviation

Table 3. Grading of Mitral Regurgitation in First PTMC group and Redo PTMC group

	Grading of MR	First PTMC	Redo PTMC	Total	P Value
Before PTMC	0	0(0%)	0(0%)	0(0%)	0.03
	I	66(89.2%)	52(70.3%)	118(79.7%)	
	II	7(9.5%)	18(24.3%)	25(16.9%)	
	III	1(1.3%)	3(4.1%)	4(2.7%)	
	IV	0(0%)	1(1.3%)	1(0.7%)	
Immediately after PTMC	Grade I + Grade II(Clinically Insignificant)	73(98.7%)	70(94.6%)	143(96.6%)	
	Grade III + Grade IV(Clinically Significant)	1(1.3%)	4(5.4%)	5(3.4%)	0.02
At the end of one year after PTMC	Grade I + Grade II(Clinically Insignificant)	71(95.9%)	63(86.4%)	134(91.15%)	
	Grade III + Grade IV(Clinically Significant)	3(4.1%)	10(13.6%)	13(8.85%)	0.03

Abbreviation:-PTMC- Percutaneous Transvenous Mitral Commissurotomy, MR- Mitral Regurgitation

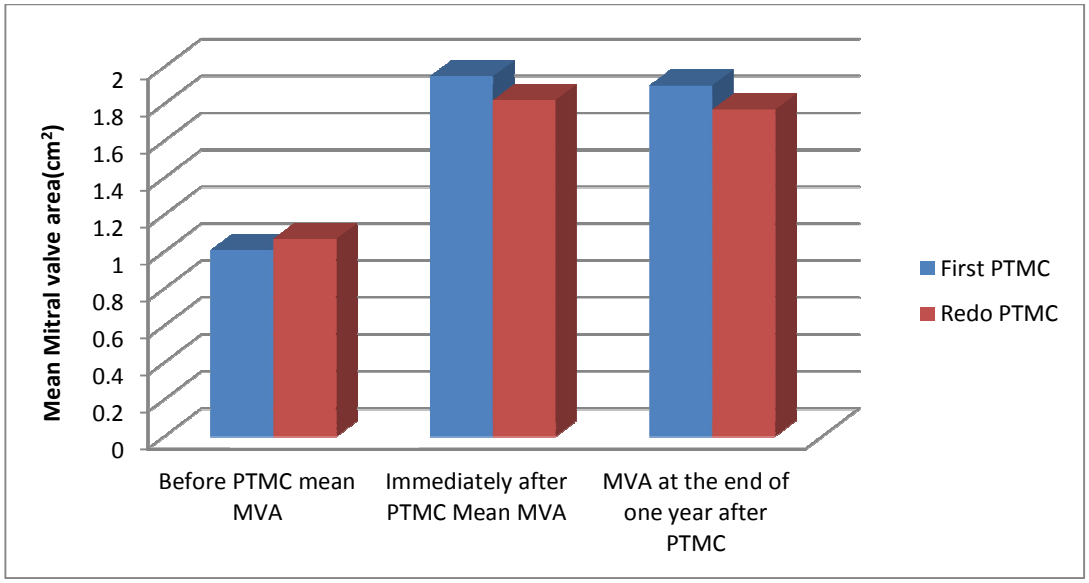

Fig. 1. Distribution of study population according to Mean Mitral Valve area (cm^2)

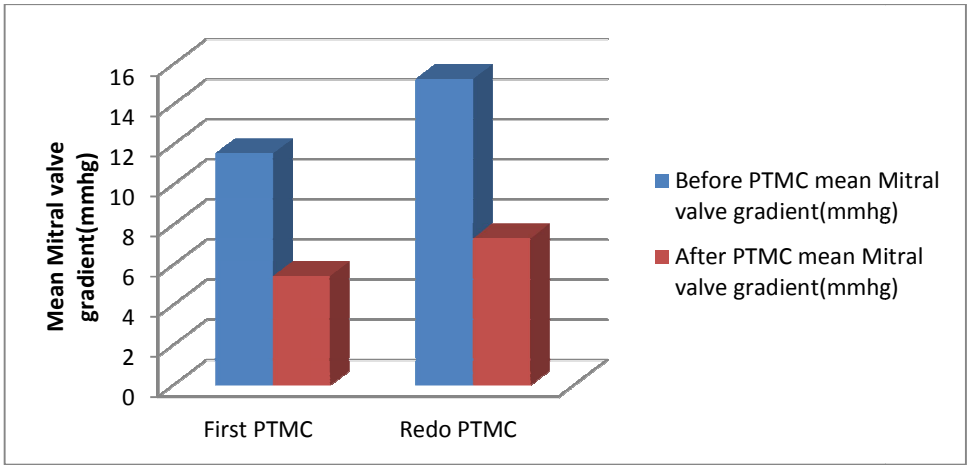

Fig. 2. Distribution of study population according to Mean Mitral Valve Gradient(mmhg)

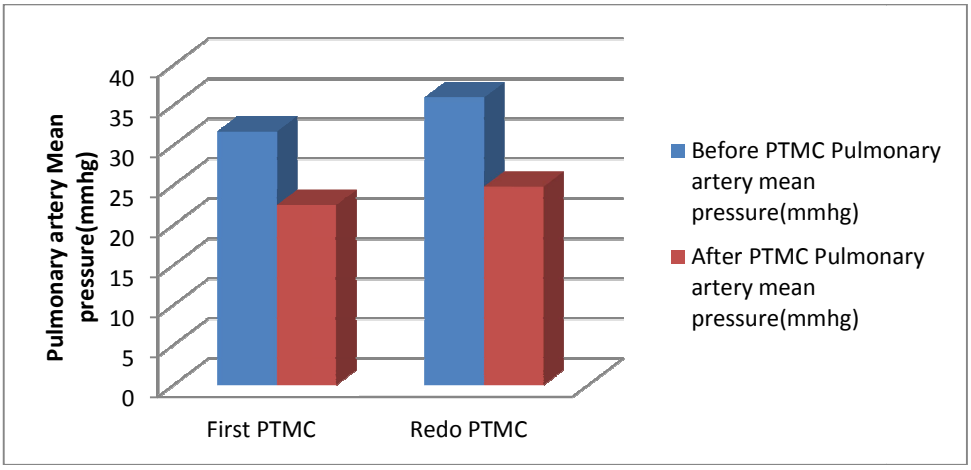

Fig. 3. Distribution of study population according to Pulmonary Artery Mean Pressure(mmhg)

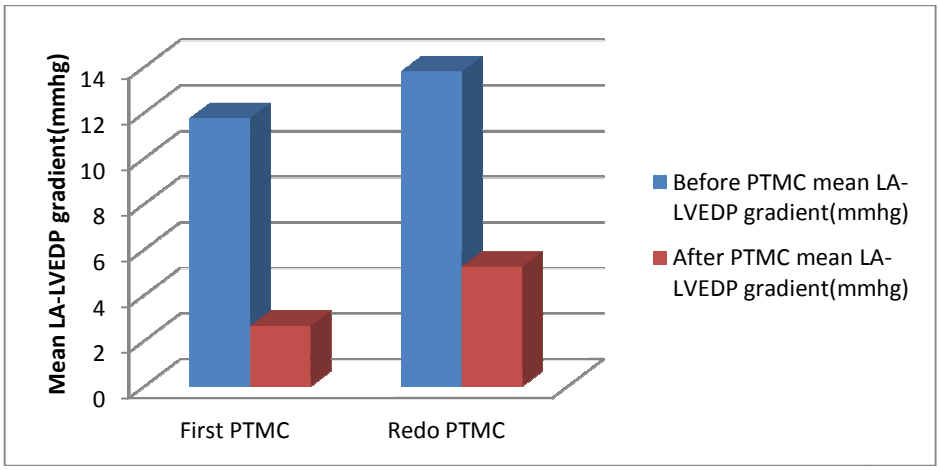

Fig. 4. Distribution of study population according to mean Left Atrium-Left Ventricle End Diastolic Pressure (LA-LVEDP) Gradient

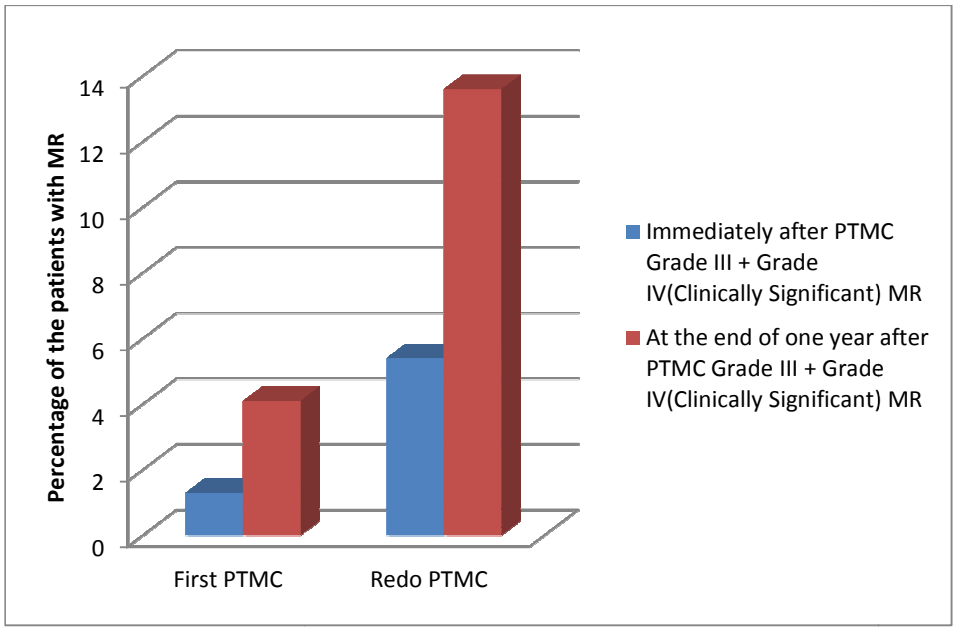

Fig. 5. Distribution of study population according to presence Clinically Significant (Grade III + Grade IV) Mitral Regurguitation

Commissurotomy (PTMC) has emerged as the procedure of choice in most patients with symptomatic mitral stenosis. Surgical mitral valve replacement surgery or Open Mitral Valvotomy (OMV) is reserved in patients having calcific valves, severe infra valvular pathology, clinically significant mitral regurgitation and persistent left atrial appendage clot.[22] After a successful first PTMC, mitral restenosis is the major cause of reintervention and is becoming a frequent presentation.[23] Mitral restenosis is a frequent cause of deterioration after an initially successful PTMC or surgical commissurotomy. However Redo PTMC is still an alternative to the Closed Mitral Valvotomy (CMV), Open Mitral Valvotomy (OMV) or Mitral valve replacement surgery for this group of patients.[24-28] Patients with mitral restenosis who underwent Redo PTMC may have different results as compared to First PTMC for mitral stenosis. Our study was a retrospective study comparing characteristics and the results of Redo PTMC in patients with mitral restenosis after a successful First PTMC. Mean age in the First PTMC group and Redo PTMC group were 44.49 ± 12.26 years and 49.57 ± 10.19 years, respectively, which was consistent with the study conducted by Song JK et al and Pathan et al who also reported that mean age in the Redo PTMC group were 43.6 ± 11 years and 58 ± 13 years, respectively.[12,29] In present study, there were greater number of female patients (64.9% in First PTMC group and 71.6% in Redo PTMC group) than male patients(35.1% in First PTMC group and 28.4% in Redo PTMC group). These were similar to the study conducted by Song JK et al, Pathan et al, Shamraj et al, Sharma et al and Rifaie et al who concluded that 74.9%, 75%, 70.98%, 75%, and 72.5% patients were female in the Redo PTMC group, respectively.[12,29,30,31,32] In present study, 39.2% patients in the First PTMC group and 81.1% patients in the Redo PTMC group had atrial fibrillation before the PTMC procedure. Pathan et al reported 61% patients with atrial fibrillation before the procedure in the Redo PTMC group.[29] Iung et al and Cohen et al concluded that patients with atrial fibrillation are at higher risk of poor outcome after PTMC procedure.[28,33] The present study had all patients(100%) with wilkins score 8-12 in the First PTMC group. In the Redo PTMC group, 63.5% patients had wilkins score 8-12 and 36.5% patients had wilkins score >12. This was consistent with the study conducted by Yazicioglu et al who reported that 15% patients had wilkins score <8 and 85% patients had wilkins score 8-12 in the Redo PTMC group.[34] In the present study, immediately after PTMC, mean mitral valve area increased to 1.95 ± 0.14 cm^2 and 1.82 ± 0.09 cm^2 in the First PTMC group and Redo PTMC group, respectively. In our study, the slightly lower gain in mitral valve

area in the Redo PTMC group was due to high wilkins score. This was in line with the study conducted by Pathan et al who observed that before PTMC, mean mitral valve area were 1.0 ± 0.3 cm^2 and 1.1 ± 0.4 cm^2 in the First PTMC group and Redo PTMC group, respectively. Similar results were found in the study conducted by Pathan et al who reported that immediately after PTMC procedure, mean mitral valve area increased to 1.9 ± 0.7 cm^2 and 1.8 ± 0.7 cm^2 in the First PTMC group and Redo PTMC group, respectively.[29] These results were also similar to the study conducted by Iung et al(1.86 ± 0.32 cm^2), and Yazicioglu et al(1.9 ± 0.2 cm^2).[16,34] In the present study, at the end of 1 year, mean mitral valve area was higher in the First PTMC group (1.90 ± 0.11 cm^2) as compared to the Redo PTMC group (1.77 ± 0.09 cm^2). Similar study conducted by Fawzy et al who followed the patients for 0.5 years to 14.5 years and found that mean mitral valve area were decreased to 1.7 ± 0.4 cm^2 and 1.5 ± 0.3 cm^2 in the First PTMC and Redo PTMC group, respectively.[35] In our study, after PTMC, mean Mitral valve gradient decreased to 5.45 ± 1.94 mmHg and 7.34 ± 1.29 mmHg in the First PTMC group and Redo PTMC group, respectively. This was consistent with study conducted by Fawzy et al who observed that after PTMC, mean Mitral valve gradient decreased to 5.0 ± 2.0 mmHg and 6.0 ± 3.0 mmHg in the First PTMC group and Redo PTMC group, respectively.[35] In the present study, after PTMC, peak Mitral valve gradient decreased to 10.92 ± 2.77 mmHg and 15.78 ± 2.09 mmHg in the First PTMC group and Redo PTMC group, respectively. This were similar to the study conducted by Choudhary et al who observed that after PTMC, peak Mitral valve gradient decreased to 7.14 ± 3.39 mmHg and 9.54 ± 2.52 mmHg in optimal and suboptimal subgroup, respectively of the Redo PTMC group.[36] In the present study, after PTMC, Pulmonary artery mean pressure decreased to 22.53 ± 6.34 mmHg and 24.89 ± 8.25 mmHg in the First PTMC group and Redo PTMC group, respectively. This was consistent with study conducted by Pathan et al who observed that after PTMC, Pulmonary artery mean pressure decreased to 28.0 ± 11.0 mmHg and 30.0 ± 12.0 mmHg in the First PTMC group and Redo PTMC group, respectively.[29] In the present study, after PTMC, Pulmonary artery systolic pressure decreased to 36.84 ± 9.35 mmHg and 42.41 ± 12.71 mmHg in the First PTMC group and Redo PTMC group, respectively. This was in line with the study conducted by Fawzy et al who observed that after PTMC, Pulmonary artery systolic pressure decreased to 40.0 ± 14.0 mmHg and 41.0 ± 18.2 mmHg in the First PTMC group and Redo PTMC group, respectively.[35] These results were also going with the study conducted by Nair et al and Sharma et al who concluded that after PTMC, Pulmonary artery systolic pressure decreased to 40.7 ± 11.0 mmHg and 40.11 ± 9.04 mmHg in the Redo PTMC group, respectively.[15,31] In the present study, before PTMC, mean Left Atrium – Left Ventricle end diastolic pressure gradient were 11.74 ± 2.05 mmHg and 13.80 ± 5.29 mmHg in the First PTMC group and Redo PTMC group, respectively. After PTMC, mean Left Atrium – Left Ventricle end diastolic pressure gradient decreased to 2.64 ± 1.83 mmHg and 5.26 ± 4.38 mmHg in the First PTMC group and Redo PTMC group, respectively. This was consistent with the study conducted by Choudhary et al who observed that after PTMC, mean Left Atrium – Left Ventricle end diastolic pressure gradient decreased to 1.14 ± 0.81 mmHg and 5.42 ± 1.9 mmHg in optimal and suboptimal subgroup, respectively of the Redo PTMC group.[36] The most common acute complication reported following PTMC is severe mitral regurgitation, which occurs in 2-10% of the patients undergoing PTMC.[37] In our study, immediately after PTMC procedure, the incidence of clinically significant mitral regurgitation(grade III + grade IV mitral regurgitation) were 1.3% and 5.4% in the First PTMC group and the Redo PTMC group, respectively. One patient had grade IV mitral regurgitation after PTMC procedure in the Redo PTMC group requiring urgent Mitral valve replacement surgery. Pathan et el, Sharma et al, and Rifaie et al reported clinically significant mitral regurgitation in 5.6%, 6.8% and 5% of patients, respectively after the Redo PTMC procedure.[29,31,32] In the present study, at the end of one year after PTMC procedure, 95.9% patients in the First PTMC group and 86.4% patients in the Redo PTMC group had grade I and grade II Mitral regurgitation. 4.1% patients in the First PTMC group and 13.6% patients in the Redo PTMC group had grade III and grade IV Mitral regurgitation at the end of one year after PTMC procedure. None of the patients with grade III and grade IV Mitral regurgitation at one year required surgical interventions. Medium term results of Redo PTMC procedure was acceptable and comparable to the First PTMC in our study. In the present study, 98.6% patients underwent successful PTMC in the First PTMC group and 94.5% patients underwent successful PTMC in the Redo PTMC group. Slightly lower rate of success in Redo PTMC group had been

attributed to a greater extent of valve pathology (higher wilkins score and more valvular calcification) and less favourable patients characteristics (higher age of the patients and more atrial fibrillation) during the Redo PTMC procedure. The immediate procedural success rate with Redo PTMC in our study compares well with that previously reported by Iung et al, Bouleti et al and Yazicioglu et al with success rate of 91%, 94% and 90%, respectively.[16,20,34] Pathan et al concluded that Redo PTMC results with good immediate and long term outcome in patients with low wilkins scores and without comorbid disease.[29] Rifaie et al demonstrated that Redo PTMC can be safely performed in selected patients, with an immediate procedural success rate of 92.5%, an adequate final mitral valve area comparable to that of First PTMC (with a gain of mitral valve area rather lower than that of First PTMC), a relatively low complication profile, and a satisfactory long term outcome [32]. Our study was consistent with the study conducted by Fawzy et al who observed that 96% patients underwent successful PTMC in the First PTMC group and 93% patients underwent successful PTMC in the Redo PTMC group.[35]

5. CONCLUSION

Redo PTMC in patients with mitral valve restenosis after a prior PTMC is feasible and can be accomplished with acceptable morbidity and mortality. Redo PTMC is a safe and effective method with acceptable rates of mitral regurgitation and mitral valve restenosis and should be considered as the first therapeutic option in suitable patients with mitral valve restenosis after a successful first PTMC procedure. When the lower costs compared to surgery is considered together with the restricted resources of the developing countries, where rheumatic heart disease is still prevalent, Redo PTMC is particularly attractive. In patients with low echo scores and no comorbid diseases, Redo PTMC should be the procedure of choice for the patients with severe mitral restenosis. Although mitral valve surgery should be the treatment of choice for patients with more extensive valvular and subvalvular deformity, Redo PTMC can be used as a palliative technique in these patients when they are at high risk for mitral valve replacement surgery due to the presence of associated significant comorbid diseases. The possibility of repeating PTMC in these sick patients with severe mitral valve restenosis as a palliative procedure is one of the potential interests of this non-surgical treatment.

6. LIMITATIONS

Our findings are based on a single-center study with a relatively small sample size of the cohort, a fact that makes it difficult to generalize our results to all patients with mitral restenosis. Multicenter studies using the same protocol and examining a larger number of patients are needed before reaching definitive conclusions. A valid comparison of Redo PTMC with First PTMC could be made only in larger randomized studies.The number of patients in our series and the low diversity of this selected population limit our scope for analysing the predictive factors of the results of Redo PTMC. These limitations are inherent in our choice of a prior selection criteria.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline patients consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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