A STUDY OF CLINICAL AND ECHOCARDIOGRAPHIC OUTCOMES OF PERCUTANEOUS TRANSVENOUS MITRAL COMMISSUROTOMY FOR MITRAL STENOSIS

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ABSTRACT

Objective: Toassess clinical and echocardiographic outcomes of mitral stenosis (MS) patients treated with Percutaneous trans-venous mitral commissurotomy (PTMC) with regard to mitral valve area and dyspnea functional class NYHA.

Study Design: A single center, descriptive cross-sectional study.

Place and Duration of Study: Adult Cardiology department of AFIC/NIHD, from 1st Jan 2016 till 31st Dec 2017.

Material and Methods: Fifty patients with severe mitral stenosis were recruited in the study using consecutive sampling technique that underwent PTMC. Wilkin's scoring system was used to ascertain the appropriateness of these patients for the procedure. The results of the procedure were evaluated using 2-D Echocardiography by tracing mitral valve area via planimetry method 24 hours after PTMC.

Results: There were 86.0% females (n=43) and 14.0% males (n=7) in the study, with mean age 40.3 ± 2.8 years. Age of the patients ranged from 20-79 years. About 44 (88%) patients had rheumatic heart disease. Mean End-diastolic trans-mitral gradient before PTMC was 25.5 ± 2.1mm Hg which reduced to 5.3 ± 1.6 mm Hg after PTMC. Mean mitral valve area prior to PTMC was 0.81 ± 0.1cm^2 which became 1.52 ± 0.1cm^2 post PTMC. No gross complications like hemodynamically significant hematoma, significant mitral regurgitation or circulatory compromise were noted. Septal punctures were all successful though the balloon could not cross the mitral orifice in one patient, in whom the procedure had to be abandoned. Paired samples t-test was used to assess the statistical significance. The results turned out to be statistically significant (p<0.05) on the basis of area of mitral valve and End-diastolic trans-mitral gradient.

Conclusion: PTMC is a procedure that has quite high success rates and in addition to the favorable outcomes it has a high safety profile when performed in patients who have optimal Wilkin's scores.

Keywords: End-diastolic trans-mitral gradient, Percutaneous transvenous mitral Commissurotomy, Mitral Stenosis.

INTRODUCTION

One of the major causative agent leading to mitral stenosis (MS) is Rheumatic fever (RF)[1]. Worldwide, more than 15 million rheumatic heart disease cases are reported, out of which 282,000 are new cases/year and 233,000 lead to death/year[2]. Since the introduction of the Inoue balloon catheter in 1984 ,the safest treatment modality for MS is reported to be PTMC[3,4]. There are reports of valvuloplasty for bio-prosthetic MV stenosis and there is balanced opinion regarding its efficacy and safety[5].

Mitral stenosis (MS) generally follows rheumaticcarditis occurring in childhood[6]. It is observed in developing countries in particular[1]. Heart failure (HF) and systemic thrombo-embolism cause large number of morbidity and mortality in those cases[8,9]. Atrial fibrillation (AF) has been documented in 23.9% (22.1%–25.8%) of patients[10]. Untreated patients can develop irreversible right ventricular failure[1].

PTMC is effective in mitral stenosis due to rheumatic fever as commissural fusion is the

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underlying etiology[1]. Pre-procedural assessment is based on Wilkins score, based on 2-D echocardiographic assessment thickening of leaflet, inclusion of subvalvular apparatus and calcification, with a score >8 precluding PTMC[7].

PTMC is favoured over surgery due to low procedure related mortality, short hospital stay and low costs[11]. Favourable immediate and mid-term followup results are reported, long term data are sparse[12].

MATERIAL AND METHODS

Descriptive cross-sectional study was performed at Armed Forces Institute of Cardiology (AFIC) Rawalpindi from 1st January 2016 till 31st December 2017. In total, 50 patients with severe mitral stenosis were recruited who were fulfilling the set criteria for PTMC. Consecutive sampling technique was used in order to select the cases. Pre procedural trans-esophageal echocardiography was performed to rule out left atrial thrombus. Wilkins score was calculated for each patient as follows.

Patients were assessed according to Wilkins score for suitability of PTMC. This included severity and extent of leaflet thickening, calcification, and involvement of the subvalvular apparatus. Each feature is graded on a scale of 1 to 4, yielding a maximal score of 16. Patients with a Wilkin's score of <9 were included in the study.

Contraindications to PTMC were- MVA >1.5 cm^2, left atrial/left atrial appendage thrombus, MR that is more than mild, severe or bicommissural calcification, the absence of commissural fusion, severe concomitant valve disease, concomitant coronary artery disease requiring bypass surgery[13].

For most PTMC cases, the preferred puncture site for transseptal access to the left atrium was chosen to be the posterior, more inferior region of the fossa ovalis. A Brocken brough needle was used for transeptal puncture, its tip identified by a tent-like deformation ("tenting") of the Interatrial septum on transesophageal echocardiography (TEE). Balloon size was chosen using the formula: Height (cm)/10 + 10 (68). In selected cases balloon size was optimized by the echocardiographic measurement of the maximal inter-commissural diameter on a parasternal short-axis view from the anterolateral to the posteromedial commissure in mid-diastole[14].

Procedural success was defined as Post-PTMC MVA>1 cm^2/m^2 body surface area, complete commissural opening in at least 1 commissure and occurrence of or increase in MR +1.

Post PTMC assessment: Immediately after balloon inflation, left atrial pressure and left ventricular end-diastolic pressure were compared for residual gradient. In addition echocardiographic assessment of mitral valve area with planimetery and transvalvular gradient as well as degree of mitral regurgitation was done.

Table-I: Baseline characteristics of patients.

Variables	N (%)
Age	(mean ± S.D) 40.3 ± 2.8 years (Range) 20-79 years
Gender	
Female	43 (86.0%)
Male	7 (14.0%)
Diabetes Mellitus	3 (6.0%)
Coronary Artery Disease	2 (4.1%)
Hypertension	5 (10.3%)
Rheumatic Heart Disease	44 (88.0%)

Table-II: Pre and post PTMC procedural NYHA.

Clinical characteristics	Pre-PTMC N (%)	Post-PTMC N (%)
NYHA I/II	20 (40)	45 (90)
NYHA III/IV	30 (60)	5 (10)

Data collection tool was used to collect the data on different variables. Data was enteredand analyzed by using SPSS-23 Version. Formal approval for the study was taken from institutional ethical review board of AFIC/NIHD, Rawalpindi.

RESULTS

There were 86.0% females (n=43) and 14.0% males (n=7) in the study, with mean age 40.3 ± 2.8 years. Age of the patients ranged from 20-79

years (table-I). 44 (88%) patients had rheumatic heart disease as shown in table-I.

Mean mitral valve area of the patients, prior to the procedure was 0.81 ± 0.1cm^2 and post PTMC, mean mitral valve area became 1.52 ± 0.1cm^2. Mean End-diastolic trans-mitral gradient before PTMC was 25.5 ± 2.1 mmHg and after PTMC reduced to 5.3 ± 1.6 mmHg. The results were statistically significant (p<0.05) as regards the End-diastolic trans mitral gradient and mitral valve area as shown in table-III.

There were no cases of pericardial effusion, cardiac tamponade or clinically significant hematoma formation. None of the patients required surgery as a complication of the procedure. No significant mitral regurgitation was found to be present post procedure. In one of the cases, the balloon could not cross the mitral orifice and the procedure couldn't be completed and therefore had to be abandoned.

Table-III: Pre and Post PTMC End-Diastolic Trans mitral Gradient and Mitral valve area.

Variables	Pre-PTMC (Mean ± S.D)	Post-PTMC (Mean ± S.D)	*p*-value
End-Diastolic trans mitral Gradient	25.5 ± 2.1 mmHg	5.3 ± 1.6 mmHg	0.03
Mitral Valve Area	0.81 ± 0.1 cm^2	1.52 ± 0.1 cm^2	0.01

DISCUSSION

In our study, 50 consecutive patients were recruited and the calculated mitral valve area was 0.81 ± 0.1cm^2 prior to procedure and raised to 1.52 ± 0.1 cm^2 at the end of procedure. There was a marked fall in pressure of left atrial and also of gradient of mean mitral in direct proportion to the increase in mitral valve area. In the Registry of 736 cases reported in the National Heart, Lung Blood Institute Balloon Valvotomy, transthoracic echocardiography was used to measure the mitral valve areaas 1.09 ± 0.29cm^2 prior to the procedure and raised to 1.8 ± 0.15cm^2 post PTMC[15]. Our findings are consistent with other studies[16]. In a study by SK Kundu, there was an evidence of 31% decline in mitral valve gradient promptly after the procedure which demonstrated statistical significance, similar to our study[17]. Out of 50 patients 86.0% (n=43) were females and mean age was 40.3 ± 2.8 years, this is consistent with other studies[18]. No complication was observed in our series with no significant increase in degree of mitral regurgitation. Severe MR was not recorded in our study, which is better than that reported in other studies in which frequency was reported to be between from 1.4% to 9.4%[19].

Procedural failure was obseved in onepatient (2%) which was due to inability to cross the balloon across mitral valve, which is better than reported in other studies. In a study by Rafael *et al* acute success rate was 90.9%[20]. Failure to cross mitral valve has been circumvented by a novel technique involving veno-arterial looping[21]. The Inoue balloon used in our study has shown high success over the period of time (>95%) and less in hospital mortality. Following, PTMC , there was an increase in MVA from 1.9 to 2.0 cm. 90% patients showed good in hospital results, 60% showed improvement in NYHA class III/IVto functional of class I/II[22].

Mitral stenosis causes right ventricular dysfunction and dilatation due to Increase in LA pressure leading to pulmonary hypertension[23]. LV dysfunction may also occur due to decreased preload, myocardial fibrosis altered interaction between two ventricles[24]. TVI-tissue velocity imaging has been used to assess either left[25] or right ventricularfunctions before and after PBMV[26]. Considerable improvement in Mitral lateral annulus has been reported after PBMV these improvements are not correlated with the augmentation in MVA[27].

In United States an increasing trend in procedural complication has been observed from 1998 to 2010[28]. Ina series of 912 consecutive pati-

ents that were followed for 20 years, independent predictors of primary end point included advanced NYHA class, age, lower MVA, previous valvularsurgical history, prevalence of MR, Wilkins score ≤8, raised mitral gradient followed by PBMV, presence of atrial fibrillation and pulmonary hypertension[29].

Our study demonstrates the importance of appropriate selection of patients for the procedure. AFIC/NIHD Rawalpindi being a tertiary referral hospital has a high volume of patients which has added to the improved results of our centre.

CONCLUSION

This study demonstrated that the procedural outcomes of PTMC are excellent and it is a low risk intervention. It should be the first choice in patients with mitral valve stenosis with suitable valve morphological characteristics, fulfilling Wilkin's criteria for PTMC.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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