Immediate post-procedural complications of percutaneous transvenous mitral commissurotomy (PTMC) with special reference to valvular and neurologic outcomes.

Tariq Mehmood Khan[1], Hafiz Muhammad Asif Zarif[1], Ammar Akhtar[2], Ikram Fareed[3]
Gul Zaman Khan Niazi[1], Muhammad Abdul Rehman Sikandar[1]

ABSTRACT

Objective: To assess the frequency of worsening pre-existing mitral regurgitation, development of new mitral regurgitation and the evidence of cerebral embolization in patients developing neurological deficit after the percutaneous transvenous mitral commissurotomy

Study Design: Descriptive Observational study

Place and Duration: From 1st of January 2019 to 30th of June, 2019 at Chaudhary Pervaiz Elahi Institute of Cardiology, Multan

Methodology: Patients with severe rheumatic mitral valve area of 1 cm^2 planned for percutaneous transvenous mitral commissurotomy (PTMC) were included. Pre-procedural echocardiography was done to determine mitral valve area (MVA), pulmonary artery systolic pressure (PASP), trans-mitral pressure gradient (TMPG) and for presence and severity of mitral regurgitation and compared to 24 hours post-procedural echocardiography for results. Any patient complaining of any neurological deficit was evaluated clinically and CT-scan brain was also done.

Results: Among total of 142 patients included the mean age of the patients was 34.54±12.10 years and majority (55.63%) were female patients. Mitral regurgitation was diagnosed in 38.73% patients. Worsening of pre-existing mitral regurgitation on transthoracic echocardiography was noted in 16.90% patients. All patients were managed medically. New mitral regurgitation was developed in 21.83%. Only two patients (0.14%) developed neurological symptoms but were discharged without any deficit after 24 hours

Conclusion: Percutaneous Transvenous Mitral Commissurotomy for mitral stenosis is a safe procedure for severe mitral stenosis. PTMC is associated with minimal valve related and neurologic complications.

Keywords: Mitral stenosis, Percutaneous transvenous mitral commissurotomy, Mitral regurgitation, Cerebral embolization, Rheumatic heart disease, Mitral valve area

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1. Senior Registrar of Cardiology
2. Post-Graduate Resident of Cardiology
3. Assistant Professor of Cardiology

Chaudhary Pervaiz Elahi Institute of Cardiology, Multan.

Correspondence:
Ammar Akhtar
Post-Graduate Resident of Cardiology
Chaudhary Pervaiz Elahi Institute of Cardiology, Multan
Email: ammarakhtar176@gmail.com

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INTRODUCTION

Rheumatic heart disease is not only a common problem in Pakistan but it is prevalent in many other similar developing countries[1]. But at the same moment its incidence is reducing in the developed world[1]. Mitral valve is one of the most commonly affected valves and the most common lesion is mitral stenosis (MS)[2]. The prevalence of rheumatic fever in Pakistan is 22/1000 population putting Pakistan at top of the countries where rheumatic fever is prevalence[3].

Since the introduction of percutaneous transvenous mitral commissurotomy (PTMC) for MS in 1984 by Inoue and his colleagues, PTMC is the treatment of choice for moderate to severe mitral stenosis (MS) in symptomatic patients[4,5] PTMC is a safe and sound procedure with good short-term outcomes e.g; improvement in mitral valve area, pulmonary artery pressure, mitral valve gradient and left atrial volume[6]. However mitral regurgitation (MR) is one of the potential complications of PTMC, particularly severe mitral regurgitation[7]. In these cases often valve replacement is required. The incidence of MR

is reported from 1.4% - 7.5% in the literature(5)[5]On the other hand development of embolization after PTMC is also a concern[8]. It was considered that the rigidity and calcification of the mitral valve could lead to systemic embolization. However the incidence of clinically apparent embolism has been reported only from 1.7% to 3.7%[9].

Our institute is the largest referral hospital for diagnosis and management of cardiovascular diseases in the South Punjab Region of Pakistan. We also have a well developed department of interventional cardiology. A large number of patients are referred to us for management and diagnosis of rheumatic mitral stenosis. PTMC is considered to be a comparatively safe procedure in terms of postprocedural complications. We decided to conduct this study to find out the complications of PTMC in patients of rheumatic mitral stenosis in terms of development of new MR after the procedure or worsening of preexisting MR and embolization after PTMC leading to stroke. This study will reflect the complications of PTMC that can be seen in local population of South Punjab, Pakistan. With this back ground, this study was conducted with an objective to assess the frequency of worsening pre-existing mitral regurgitation, development of new mitral regurgitation and the evidence of cerebral embolization in patients developing neurological deficit after the percutaneous transvenous mitral commissurotomy.

METHODOLOGY

This descriptive observational study was conducted in indoor Cardiology unit of Chaudhary Pervaiz Elahi Institute of Cardiology, Multan from 1st October 2019 to 30th April 2020 (ERB letter no. 205-098). Patients with severe rheumatic MS with mitral valve area reduced to 1cm^2 or less and mitral valve echocardiographic score ≤11, and do not having thrombus in left atrium or left atrial appendage on transesophageal echocardiography were included in this study. Pre-procedure transthoracic echocardiography (TTE) was performed by two consultant cardiologist with 5 years post fellowship experience to determine mitral valve area (MVA), pulmonary artery systolic pressure (PASP), trans-mitral pressure gradient (TMPG) and for presence and severity of MR. MVA was calculated on TTE via planimetry. Doppler Echo can measure PASP by measuring maximal tricuspid regurgitation velocity, and applying the modified Bernoulli equation to convert this value into pressure values. Estimated right atrial pressure must be added to this obtained value to calculate PASP. TMPG was calculated by measuring trans-mitral flow velocity with CW Doppler echocardiography. Mitral regurgitation was diagnosed on transthoracic echocardiography and severity was graded on the base of color Doppler jet area covering left atrium and width of vena contracta. Mild MR was labeled if color Doppler jet area covering less than 20% area of LA and width of vena contracta less than 0.3cm, moderate MR was labeled if color Doppler jet area covering 20 to 40 % area of LA and width of vena contracta less than 0.3-0.69cm and severe MR was labeled if color Doppler jet area covering greater than 40% area of LA and width of vena contracta greater than 0.7cm. Patients having pre-existing moderate or severe mitral regurgitation, or commissural calcifications were excluded.

PTMC were performed on 142 of the patients via transvenous approach with the Inoue balloon. Patients were keep admitted for 24 hours and post-procedure transthoracic echocardiography (TTE) was performed by two consultant cardiologist with 5 year post fellowship experience to determine mitral valve area (MVA), pulmonary artery systolic pressure (PASP), trans-mitral pressure gradient (TMPG) and for presence and severity of MR.

Any patient who complained of any neurological symptoms like weakness of any side of the body or deviation of mouth to one side or diplopia within 24 hours of procedure was assessed thoroughly clinically by a neurologist and CT-scan Brain was also done to look for any infarct or hemorrhage in brain.

All the data regarding age, gender, pre-PTMC and post-PTMC MVA, PASP, TMPG and MR was recorded on a preformed performa. Detail of neurologic symptoms and CT scan finding were also noted on the performa.

Data Analysis: Computer software 20.0 was used to enter and then analyze the data. Mean and standard deviation was calculated for age. Frequency and percentages were calculated for gender, preprocedural MR, development of new MR worsening of MR and severity of MR. Pre-procedural and post-procedural MVA, TMPG and PASP were compared using paired sample t-test taking p-value ≤0.05 as significant difference. Frequency and percentages for patients with neurological symptoms and documented cardiovascular event on CT-brain was calculated.

RESULTS

Out of these 142 patients, 63(44.37%) patients were male and 79 (55.63%) were female. Mean age of the patients was 34.54±12.10 years. Mild MR was present in 67 patients before the procedure.

There was significant improvement in mitral valve area (MVA) after PTMC. While there was significant reduction in Trans-mitral pressure gradient (TMPG) and pulmonary artery systolic pressure (PASP) after PTMC (Table-I).

Table-I: Comparison of Pre-PTMC and post-PTMC Echo-cardiographic Variables (N=142)

Variables	Pre-PTMC	Post-PTMC	p-Value
MVA (cm)^2	0.73±0.15	1.51±0.18	<0.001
TMPG (mmHg)	25.9±5.8	12.0±2.3	<0.001
PASP	55.69±16.8	30.21±8.3	<0.001

New MR was diagnosed in 31 patients (21.83%), 25 patients (17.60%) developed mild MR, 4 (2.81%) patients moderate MR and 2 (1.40%) patients developed new severe MR. All of these patients remained stable and were discharged on medical treatment. Worsening of pre-existing MR was noted in 24 patients (16.90%). Out of these 24 patients, only 2 patients (1.40%) worsened from mild to severe MR but all patients remained asymptomatic and were discharged after 24 hours on medical treatment (Table-II).

Table-II: Immediate post-procedural complications. (N=142)

Mitral Valve Outcomes	
New MR	**31 (21.83%)**
Mild MR	25 (17.60%)
Moderate MR	4 (2.81%)
Severe MR	2 (1.40%)
Worsening of pre-Existing MR	**24 (16.90%)**
Mild to Moderate MR	22 (15.49%)
Mild to Severe MR	2 (01.40%)
Neurologic Symptoms	**2 (1.40%)**
Cardiac Tamponade	**0.0**
Operative Mortality	**0.0**

Out of 142 patients only two patients (1.40%) complained of neurological symptoms like diplopia and slight deviation of angle of mouth to one side. Both the patients have normal CT scan of brain. They were given heparin bolus dose of 60 units/kg and then infusion of 15 units/kg/hr for 24 hours after the CT-scan. Both patients recovered completely within 24 hours after the onset of symptoms and were discharged without any neurological deficit. There was no incidence of cardiac tamponade and operative mortality in any patient.

DISCUSSION

The management of patients with symptomatic severe MS has changed drastically since the establishment of PTMC as the first line therapy in patients with favorable valve anatomy[6]. Failure and complication rate of PTMC is declining nowadays as cardiologists are achieving experience with the use of Inoue balloon[6].

The development of MR especially severe MR is one of the most-deadly complications of PTMC leading to pulmonary edema and even death[10]. A study carried out by Ahmad et al. reported mild MR after PTMC in 62% patients and moderate MR in 16.0% patients after PTMC[11]. Ali et al. reported mild MR in 16.12% patients and, moderate MR in 1.6% and severe MR in 2.17% patients after PTMC[5]. In their study, 12.1% patients were having mild MR Pre-PTMC, but they did not separately reported worsening of MR after PTMC in these patients[5]. Moreover, in their study two patients required MV replacement (MVR) after PTMC due to hemodynamic instability. In our study, none of the patient became unstable and required MVR. Another study by Khan et al. reported mild MR in 58.3% patients, moderate in 39% and severe MR in 2.1% patients after PTMC[12].A study by Arslanabadi et al. reported change in MR severity in 21.9% patients. They reported reduction in MR severity in 4.8% patients and increase in MR severity in 17.1% patients. They reported mild to moderate increase in 9.5% patients and mild to severe in 7.6% patients[13]. In present study 16.90% patients had worsening of pre-existing MR and mild to severe MR severity was noted in only 1.40% patients.

The routine pre-procedure and post-procedure echocardiographic parameters depict the success of PTMC. Beig et al reported pre-procedure MVA 0.74 ± 0.13 cm^2, PASP 58.68 ± 13.14 mmHg and TMPG 15.60 ± 4.23 mmHg and post procedure MVA 1.80 ± 0.22 cm^2, PASP 45.92 ± 11.56 mmHg and TMPG 6.40 ± 1.91mmHg[14]. Our study, in consistency with the previous well-established studies like Nishimura et al, Arora et al and coronel et al demonstrated significant increase in MVA and significant decrease in PASP and TMPG[14-16].

Systemic embolization especially to the cerebral circulation used to be a matter of concern after PTMC[9]. Kay et al. showed that subclinical embolism may occur during PTMC [8].A study by Rehman et al. reported thromboembolic events in 0.4% patients, and transient ischemic attack in 0.2% patients[17]. Another study reported seizures in 2.0% patients after PTMC[18]. In present study, one patient developed diplopia and one patient developed slight deviation of angle of mouth to one side. Both of these patients recovered completely within 24 hours of PTMC and were discharged.

Braiteh et al. reported immediate post-procedural complications in only 2.8% patients after PTMC, they reported myocardial infarction in 0.6% patients, pericardial effusion in 0.3%, cardiac tamponade in 1.9% patients and no operative mortality[19]. In our study, none of these complications were noted.

The limitation of present study is being the single center and we only noticed immediate complications of PTMC. However, this study highlighted the important aspect of PTMC that is development of new MR and worsening of already existing MR. A follow-up study is needed to be conducted in patients who develop MR during PTMC for determining the time course of MR in these patients.

CONCLUSION

PTMC for severe symptomatic mitral stenosis is a safe and effective procedure for severe rheumatic mitral stenosis. PTMC is associated with minimal risk of mitral regurgitation and neurologic complications.

AUTHOR'S CONTRIBUTION

Khan TM: Conceived idea, Designed study, Statistical analysis, Data interpretation, Manuscript writing

Zarif HMA: Designed research methodology, Data collection, Literature search, Data interpretation

Akhtar A: Literature search, Literature review, Statistical analysis, Final reading and approval

Fareed I: Data collection, Data interpretation, Statistical analysis, Manuscript writing

Niazi GZK: Literature search, Data collection and compilation, Final reading and approval

Sikandar MAR: Data interpretation, Statistical analysis, Literature review

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