

EFFICACY AND SAFETY OF PERCUTANEOUS TRANSVENOUS MITRAL COMMISUROTOMY (PTMC) PERFORMED THROUGH PATENT FORAMEN OVALE (PFO)

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Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

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ABSTRACT

Objective: The aim of this study was to assess efficacy and safety of PTMC in patients with severe mitral stenosis (MS) perform through patent foramen ovale.

Methodology: All symptomatic patients with severe MS were included in the study from January 1998 to December 2010, at Cardiology department, Lady Reading Hospital, Peshawar. Transthoracic and trans-esophageal echocardiogram was performed to exclude left atrial appendage/left atrial clot and check the anatomy of interatrial septum. Severely calcified mitral valve and severe mitral regurgitation were excluded. Patent foramen ovale was crossed in majority of cases to reach left atrium. Stenosed mitral valve was dilated with Inoue balloon.

Results: Total number of patients was 1818. Females were 74% ($p < 0.05$). The mean age was 26.51 ± 7.82 years and mean Body Mass Index (BMI) was $19.05 \pm 1.2 \text{ kg/m}^2$. The number of patients who had PTMC through PFO were 92.08%. Mean valve area was $0.9 \pm 0.19 \text{ cm}^2$ on 2D Echocardiography, which increased to $1.82 \pm 0.17 \text{ cm}^2$ ($p < 0.05$), mean mitral valve gradient decreased from $18 \pm 4.04 \text{ mmHg}$ to $7 \pm 0.25 \text{ mmHg}$ ($p < 0.005$) and mean right ventricular systolic pressure decreased from $70 \pm 17.4 \text{ mmHg}$ to $48 \pm 13 \text{ mmHg}$ (32% drop) ($p < 0.05$) at 24 hours after PTMC. Mean time of crossing interatrial septum via PFO was 17 ± 05 minutes. Post PTMC severe MR in PFO group was 3.6% and 2.8% in inter atrial septum group ($p = 0.21$). Pericardial effusion was noted in 0.11% patients in PFO group and 0.27% in interatrial septum group ($p > 0.05$). Stroke was present in 1.5% patients.

Conclusion: PTMC through patent foramen ovale (PFO) is a safe procedure, with few complications.

Key Words: Severe mitral stenosis, Percutaneous transvenous mitral commissurotomy (PTMC), Patent foramen ovale (PFO).

INTRODUCTION

Mitral stenosis is one of the commonest long term complications of Rheumatic fever¹⁻³ and approximately 25% of all patients with Rheumatic Heart Disease have pure mitral stenosis.⁴ Two thirds of all patients with Rheumatic mitral stenosis are females.^{1,5,6}

The role of percutaneous transvenous mitral commissurotomy (PTMC) in the management of patients with Rheumatic mitral stenosis has continued to evolve during the last 19 years. Patients selection is fundamental in predicting the immediate results of PTMC.⁷⁻¹⁰ Studies have confirmed the efficacy and safety of PTMC in variety of patients employing different technique.^{6,7,11}

The most critical step in PTMC is the puncture of interatrial septum to gain access to left atrium.¹² Puncture of interatrial septum can be difficult because of lack of a satisfactory needle position to attempt the puncture. This may lead to puncture of right atrium, pulmonary artery, or aorta with its related complications.^{6,7,13} If the puncture site is not optimal at the interatrial septum, there may be difficulties in positioning of balloon across the mitral valve. A persistent foramen ovale (PFO), if present, is located at the thinnest portion of the atrial septum just below the mid segment. This position gives the best access to negotiate balloon across the mitral valve.¹⁴⁻¹⁷ Persistent left atrial enlargement stretches the fossa ovalis and this can be used to access left atrium.^{18,19}

PTMC is however not without its share of risks and complication. Some patients develop left to right shunts after percutaneous balloon valvuloplasty related to septal puncture.^{12,20}

We prospectively attempted to probe the interatrial septum for PFO to see whether that would obviate the need for a transeptal puncture and its associated complications. The aim of this study was to assess efficacy and safety of PTMC in patients with severe mitral stenosis (MS) performed through PFO.

METHODOLOGY

All symptomatic patients with severe mitral stenosis were included in the study. The study extended from January 1998 to December 2010. The study was based at Cardiology department, Lady Reading Hospital, Peshawar. All patients had a transthoracic and trans-esophageal echocardiogram by a senior cardiologist to exclude left atrial appendage clot and/or left atrial clot and to check the anatomy of interatrial septum. Color Doppler was used for the quantification of any mitral regurgitation (MR) and more than moderate MR-Mitral regurgitant jet filling more than 45% of the left atrium or eccentric jet, and severely calcified mitral valve were excluded from the study. Informed consent for the procedure was obtained from all patients. Right femoral arterial and

venous accesses were obtained with 6 French sheaths under local anesthesia by seldinger technique, left and right heart pressure studies and left ventriculogram was done, to document pulmonary artery pressure and mitral valve gradient and exclude mitral regurgitation. The Brockenbrough atrial punctures needle along with Mullin's Sheath was advanced to the superior vena cava. With the needle tip within the sheath, both components were brought vertically down with the assembly pointing in the direction of the atrial septum, the interatrial septum was probed for a patent foramen ovale by gentle pressure applied on the atrial septum, particularly in the mid portion. Inoue balloon was used according to the height of the patient. Probing of the septum was done in the anteroposterior or in full lateral view (LAO 90). Access to the left atrium was confirmed by position of sheath, measuring pressure in left lateral position on fluoroscopy and by injecting dye into the left atrium. If access to the left atrium could not be gained, transeptal puncture with Bronkenbrough needle was performed and rest of the procedure done with a standard Inoue balloon. Total time was calculated from the septum till the final dilatation of the mitral valve.

SPSS version 16 was used for analyzing the data. Mean \pm SD of continuous variable was calculated. Paired t test was used to compare pre and post PTMC variable like mitral valve area, mitral valve gradient, right ventricular systolic, pressure and time taken for probing of the septum till final dilation of the mitral valve. P value of ≤ 0.05 was considered significant.

RESULTS

Total number of patients were 1818. Majority of the patients were female, 1345 (74%) while 473 were male (26%) ($p < 0.05$). The mean age was 26.51 ± 7.82 years and mean Body Mass Index (BMI) was 19.05 ± 1.2 kg/m². The number of patients who had PTMC through PFO were 1674 (92.08%) and 144 (7.92%) had PTMC via puncture of interatrial septum. Mean valve area was 0.9 ± 0.19 cm² on 2D Echocardiography, which increased to 1.82 ± 0.17 cm² immediately after PTMC ($p < 0.05$). The mean mitral valve gradient decreased from 18 ± 4.04 mmHg to 7 ± 0.25 mmHg immediately after PTMC ($p < 0.05$). Mean right ventricular systolic pressure decreased from 70 ± 17.4 mmHg to 48 ± 13 mmHg (32% drop) ($p < 0.05$) at 24 hours after PTMC (Table 1). Mean time of crossing interatrial septum via PFO was 17 ± 05 minutes. Post PTMC severe MR in PFO group was 3.6% ($n=66$) and 2.8% ($n=52$) in inter atrial septum group ($p=0.21$). Pericardial effusion was noted in 0.11% ($n=2$) patients in PFO group and 0.27% ($n=5$) in interatrial septum group ($p > 0.05$). Stroke resulting in hemiplegia in the whole study population developed in 27 patients (1.5%, $p < 0.05$) (Table 2).

Table 1: Baseline Clinical and Echocardiographic Characteristics of the Study Population

Variable	Pre PTMC	Post PTMC	P-value
2D MVA (cm ²)	0.9 ± 0.19	1.82 ± 0.17	<0.05
MVG (mmHg)	18 ± 4.04	7 ± 0.25	<0.05
RVSP (mmHg)	70 ± 17.4	48 ± 13	<0.05
Severe MR(%)	0	65 (3.5)	0.15

MVA= mitral valve area, RVSP=right ventricular systolic pressure MVG= mean valve gradient, MR= Mitral regurgitation

Table 2: Comparative Results of PTMC Attempted Via PFO and Interatrial Septal Puncture

Variable	PTMC via PFO 1674 (92.08%)	PTMC via Interatrial Septum 144 (7.92%)	P-value
2D MVA (cm ²)	1.82±0.17	1.7±0.21	0.19
MVG (mmHg)	6±1.3	6±2.1	0.28
Drop in Rt. VSP (mmHg)	32±5	29±7	0.39
MR (%)			
Nil	664 (36.5)	629 (34.8)	
Mild	972 (53.5)	1002 (55.2)	0.21
Moderate	122 (6.4)	132 (7.2)	
Severe	66 (3.6)	52 (2.8)	
Stroke (%)	12 (0.68)	15 (0.82)	0.16
Pericardial Effusion (%)	2 (0.11)	5 (0.27)	0.19

MVA= mitral valve area, MVG= mean valve, RVSP=right ventricular systolic pressure

DISCUSSION

Mitral stenosis is mostly rheumatic in origin in the developing countries. It is more common in young female having average to low socio-economic background. PTMC is a safe procedure through PFO for opening of the stenosed mitral valve, achieving better mitral valve area (MVA), reducing mitral valve gradient (MVG) and right ventricular systolic pressure (RVSP) to acceptable levels with no to minimal associated complications.

The most crucial and risky step in PTMC is the crossing of interatrial septum. The gold standard for diagnosing PFO is contrast enhanced transesophageal echocardiography.^{5,12} During cardiac catheterization patent foramen ovale has been reported in up to 60%. One of the most important step in PTMC is crossing interatrial septum via puncture, which can give rise to dreadful complications like puncture of aorta, right atrium and cardiac tamponade up to 1.5% in one series.^{4,6,7} In our series we were able to cross the PFO in 92.02% of cases without puncturing interatrial septum. We did not come across any needle related complication while

crossing the septum via PFO particularly pericardial effusion or injury to great vessels. Two cases of mild pericardial effusion were observed without significant haemodynamic compromise in patients with puncture of septum.

Our results show similar gain in mitral valve area is similar as reported by Ishikura et al⁴ and Hassan et al¹² There was significant and similar fall in right ventricular systolic pressure as at 24 hours after PTMC via PFO or atrial septal puncture. This is comparable to other series.^{8,14,15}

To confirm the presence of a patent foramen ovale needs to carry out potentially hazardous search, and to cross it reduces the risk and time of the procedure and will further help in optimally crossing and positioning the balloon across the mitral valve. Our study shown that in a large majority (92.08%) of the patients atrial septum can be least 17 minutes probing of atrial septum for patent foramen ovale. This probing time is reported upto 12minutes by Malick NH¹⁸ and upto 35minutes by Harrison⁶ and Treviño.¹⁰ This wide gap of probing time in different regions of the world may be because of the large number of rheumatic mitral stenosis patients in the subcontinent region as compared to the

developed world. This is time well spent at the atrial puncture, with its attendant risks is avoided and also because it gives a good position for Inoue balloon to enter the left ventricle. It is also quite likely that the total fluoroscopy time of the PTMC procedure will be shortened.

CONCLUSION

PTMC through patent foramen ovale (PFO) is a safe procedure, with few complications.

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