

## TWENTY YEARS EXPERIENCE OF SUCCESSFUL PERCUTANEOUS TRANSMITRAL COMMISUROTOMY PERFORMED THROUGH PATENT FORAMEN OVALE

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### Contribution

AMG conceived the idea, planned the study and drafted the manuscript. TN & MSJ collected data, did statistical analysis, drafted the manuscript and critically reviewed manuscript. All authors contributed significantly to the submitted manuscript.

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### ABSTRACT

**Objectives:** To assess the efficacy and effectiveness of PTMC through patent foramen ovale in patients with symptomatic mitral stenosis.

**Methodology:** This cross sectional study included patients with symptomatic mitral stenosis from January 1995 to December 2016, at Lady Reading Hospital, Cardiology Department. All patients were subjected to detailed clinical examination. BLIs were performed. Echocardiography (TTE and TEE) was performed to exclude LA/LAA clot, to assess the calcification of mitral valve and check the anatomy of inter ventricular septum. Patients with severely calcified mitral valve and with +2 mitral regurgitation were excluded. PFO was crossed in majority of cases to reach LA. Mitral valve stenosis was relieved with Inoue balloon.

**Results:** Total number of patients enrolled was 3751. Females were 76%. The mean age was  $27.5 \pm 7.2$  years. Mean BMI was  $19.8 \pm 2.1$  kg/m<sup>2</sup>. PTMC of 92.08% patients was performed through PFO. Mean valve area was  $0.9 \pm 0.21$  cm<sup>2</sup> on 2D echocardiography, which was successfully dilated upto  $1.82 \pm 0.17$  cm<sup>2</sup> ( $p > 0.05$ ). Mitral valve gradient decreased from  $18 \pm 4.08$  mm of Hg to  $7.0 \pm 0.25$  mm of Hg ( $p < 0.005$ ). Mean right ventricular systolic pressure decreased from  $70 \pm 17.4$  mm of Hg to  $48 \pm 13$  mm of Hg with 32% drop of pressure at 24 hrs post PTMC ( $p < 0.05$ ). Post PTMC mitral regurgitation was found in 3.6% in PFO group and 2.8% in inter atrial septum group. Pericardial effusion was found in 0.11% patients in PFO group and 0.27% in interatrial septum group ( $p > 0.05$ ). Abandonment rate of PTMC through PFO was quite less 0.57% as compared to PTMC through septal puncture 2.69%.

**Conclusion:** PTMC through PFO is effective, safe and user friendly procedure with fewer complication rates.

**Key Words:** Percutaneous transmitral commisurotomy, Patent foramen ovale, Transesophageal echocardiography, Transthoracic echocardiography, Left atrium.

## INTRODUCTION

One of the serious complications of rheumatic heart disease is mitral stenosis. Approximately 40% of all patients with rheumatic heart disease end up in having pure mitral stenosis.<sup>1</sup> Due to high incidence of rheumatic fever in our country MS is common.<sup>1</sup> Before the onset of symptoms, latency period is 10 to 20 years after the episode of rheumatic fever.<sup>2</sup> Almost 2/3 of patients are females.<sup>3,4</sup> The role of PTMC, since it was begun in 1984, has continued to evolve over the past three decades.<sup>5-7</sup> Patient selection is a key factor in determining the results.<sup>8</sup> The effectiveness and efficacy of PTMC is determined by the technique used.<sup>9</sup>

Inter atrial septal puncture is a critical step in PTMC.<sup>10</sup> It is a risky procedure, with multiple complications related to puncture of right atrium, pulmonary artery and aorta, due to lack of appropriate needle position.<sup>4,7,11</sup> Poor puncture site makes the balloon positioning across the mitral valve difficult.<sup>12,13</sup> Patent foramen ovale is the thinnest portion of inter atrial septum just below the mid segment. Persistent large atrial size further stretches the fossa ovalis. This site makes the access to LA and balloon positioning across the mitral valve much more easier.

PTMC has its own complications. Patients may develop left to right shunts secondary to septal puncture. In this study we performed the septal puncture through PFO. The aim of this study was to check the effectiveness and safety of PTMC through PFO.

## METHODOLOGY

This cross sectional study was conducted from January 1995 to December 2016. Patients presenting with rheumatic mitral valve stenosis were assessed and those meeting the inclusion criteria were included in the study. The study was based at Cardiology Department, Lady Reading Hospital, Peshawar. History was obtained from all the patients who also underwent physical examination. All patients had a trans-thoracic and trans-esophageal echocardiogram by a senior cardiologist to exclude left atrial and left atrial appendage clot and to check the anatomy of inter atrial septum. Color Doppler was used for quantification of any mitral regurgitation (MR). Moderate to severe 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. 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 inter atrial 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 Brockenbrough needle was performed and rest of the procedure done with a standard Inoue balloon. Total time was calculated from the septum till the final dilation of mitral valve.

Data was collected on a pre tested questionnaire. Again a verbal consent was taken from all the patients before entering their information. SPSS version 20 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.  $P \leq 0.05$  was considered significant.

## RESULTS

Total number of patients were 3751. Majority of the patients were females, 2851 (76%). The mean age was  $27.5 \pm 7.2$  years and mean body mass index (BMI) was  $19.8 \pm 2.1 \text{ kg/m}^2$ . The number of patients who had PTMC through PFO was 3454 (92.08%) while 297 (7.01%) had PTMC via puncture of inter atrial septum. Mean valve area was  $0.9 \pm 0.2 \text{ cm}^2$  on 2D Echocardiography, which increased to  $1.82 \pm 0.17 \text{ cm}^2$  immediately after PTMC ( $p < 0.05$ ). The mean mitral valve gradient decreased from  $18 \pm 4.08$  mmHg to  $7 \pm 0.25$  mm Hg immediately after PTMC ( $p < 0.05$ ). Mean right ventricular systolic pressure decreased from  $70 \pm 17.4$  mmHg to  $48 \pm 13$  mmHg ( $p < 0.05$ ) at 24 hours after PTMC (Table 1). Post PTMC severe MR in PFO group was 3.6% ( $n=124$ ) and 2.8% ( $n=9$ ) in inter atrial septum group ( $p = 0.21$ ). Pericardial effusion was noted in 0.11% ( $n=4$ ) patients in PFO group and 0.27% ( $n=1$ ) in inter atrial septum group ( $p > 0.05$ ). Abandonment rate of PTMC through PFO was found to be quite less 0.57% ( $n=20$ ) in comparison to PTMC through septal puncture 2.69% ( $n=8$ ) (Table 2).

**Table1: Baseline Clinical and Echocardiographic Characteristics of the Study Population (n=3751)**

VARIABLE	Pre PTMC (M±SD)	Post PTMC (M±SD)	p-value
2D MVA cm <sup>2</sup>	0.9 ± 0.2	1.82 ± 0.17	<0.05
MVG mmHg	18 ± 4.08	7 ± 0.25	<0.05
RVSP mmHg	70 ± 17.4	48 ± 13	<0.05
SEVER MR %	0	3.6	0.21

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 (n=3751)**

VARIABLE	PTMC Via PFO (M±SD) 3454	PTMC Via Intratrial Septum (M±SD) 297	p-value
2D MVA cm <sup>2</sup>	1.82±0.17	1.7±0.21	0.19
MVG mmHg	11±3.2	10±2.1	0.28
DROP IN RVSP mmHg	32±5	29±7	0.39
MR %(n)	3.6(124)	2.8(9)	0.21
PERICARDIAL EFFUSION %(n)	0.11(4)	0.27(1)	0.19
ABANDONED CASES %(n)	0.57(20)	2.69(8)	0.20

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

## DISCUSSION

Mitral stenosis is the most common complication of Rheumatic fever in our country. It is more common in young females with low socioeconomic backgrounds. PTMC is an effective procedure to open mitral valve area, reduce the gradient across the mitral valve, decrease the right ventricular systolic pressures to acceptable without causing significant complications.

The most critical step in PTMC is crossing the inter atrial septum. The gold standard in locating the PFO is contrast enhanced trans esophageal echocardiography.<sup>4,10</sup> In 60% of cases PFO has located in cardiac cath. Inter atrial septal puncture was its own dreadful complications like aortic root puncture, pulmonary artery puncture, right atrial puncture resulting in cardiac tamponade.<sup>4,7,14</sup> In our study we were able to cross PFO in 92.08% cases with out immediate complications and needle related injuries. Only four cases got complicated with mild pericardial effusion without any

significant hemodynamic compromise. About 96 cases developed severe MR. Mean time of crossing mitral valve decreased from 17± 5 mins in the beginning of study to 6±3 mins in the end.

Our results show similar gain in mitral valve area is similar as reported by Ishikura et al and Hassan et al. There was a significant drop in right ventricular systolic pressure 24 hours after PTMC via PFO or atrial septal puncture. This is comparable to other series.<sup>1,12,15,16</sup> The probing time in our study was 6±3 mins however, the probing time was reported up to 12 minutes by Malick NH and up to 35 minutes by Harrison.<sup>17</sup> The incidence of complication rates was quite low when compared with Ahmed Noor et al and Hikmatullah jan et al with in terms of cerebrovascular events, pericardial effusion, sever MR and death.<sup>18</sup> PTMC through PFO is a quicker procedure but requires expertise to locate PFO. It gives a better positioning of balloon through mitral valve. It is also likely that the fluoroscopy time is shortened because of shorter procedure.

## CONCLUSION

PTMC through PFO is an effective, safe, user friendly and quicker procedure with few complication rates.

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