PERCUTANEOUS TRANSVENOUS MITRAL COMMISSUROTOMY (PTMC) THROUGH PATENT FORAMEN OVALE (PFO) A NOVEL APPROACH

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ABSTRACT

Objective: *To evaluate the safety and efficacy of percutaneous transvenous mitral commissurotomy (PTMC) via patent foramen ovale (PFO) in patients with severe mitral stenosis (MS).*

Material and Methods: *All patients underwent trans-thoracic and trans-esophageal echocardiogram before PTMC. Patent foramen ovale was probed with assembly pointing posteriorly, a little below aortic valve in lateral view. If access to the left atrium could not be gained, transeptal puncture with Bronkenbrough needle was performed and the rest of the PTMC performed with standard Inoue balloon.*

Results: *Out of 500 patients 370 (64%) were females and 130 (36%) were males. The mean age was 27.51± 7.82 years. PFO was probed and crossed in 435/500 (87%) patients. All PFO's were crossed within 15 ± 04 minutes of commencement of probing. Spending a longer time searching for PFO did not increase the yield. Mean valve area was 0.86 ± 0.19 cm^2, which increased to 1.86 ± 0.17 cm^2 immediately after PTMC ($p < 0.05$). The mean mitral valve gradient decreased from 17 ± 4.04 mmHg to 6.8 + 0.25 mmHg immediately after PTMC ($p < 0.005$). No pericardial effusion/tamponade observed in PFO group. The time to cross mitral valve was significantly reduced while accessing through PFO as compared to interatrial septal puncture.*

Conclusion: *PTMC performed via patent foramen ovale is safe. It associated reduces the time of the procedure and complications.*

Key words: *Mitral stenosis, PTMC, Patent Foramen Ovale.*

INTRODUCTION

In the last two decades percutaneous transvenous mitral commissurotomy (PTMC) has emerged as a promising safe therapeutic alternative to surgical treatment of symptomatic rheumatic mitral stenosis.[1,2] Studies have confirmed the efficacy and safety of PTMC in a variety of patients employing different techniques.[3,4] PTMC is however not without its share of risks and complication.[5,6] The most critical step in PTMC is the puncture of interatrial septum to gain access to left atrium. 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 attendant complications. If the puncture site is not optimal at the interatrial septum, there may be difficulties in positioning of balloon across the mitral valve. Some patients develop left to right shunts after percutaneous balloon valvuloplasty related to septal puncture.[5]

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. Persistent left atrial enlargement stretches the fossa ovalis and this can be used to access left atrium.[7] 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. We undertook study to assess the

BASELINE CLINICAL AND ECHOCARDIOGRAPHIC CHARACTERISTICS OF THE 500 PATIENTS

Variable	Pre PTMC	Post PTMC	P value
2D MVA(cm^2)	0.89 ± 0.22	0.86 ± 0.17	<0.05
MVG(mmHg)	17 ± 4.04	6.8 ± 0.25	<0.05
RVSP(mmHg)	73 ± 16.4	51 ± 11	<0.05
Mitral regurgitation			
Nil	380(76%)	223(44.6%)	
Mild	110(22%)	200(40%)	
Moderate	10(2%)	69(13.8%)	
Severe	0	8(1.6%)	

AF= atrial fibrillation, MVA= mitral valve area, RVSP=right ventricular systolic pressure
MVG= mean valve gradient

Table 1

success rate of crossing PFO, impact on procedure time and rate of complication.

MATERIAL AND METHODS

All symptomatic patients with severe mitral stenosis were included in the study. The study extended from January 2002 till November 2007. 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 or left atrial clot and to check the anatomy of interatrial septum. Color Doppler was used for the quantification of any mitral regurgitation. Informed consent for the procedure was obtained from all patients. A six French femoral arterial and venous sheath were passed under local anesthesia by seldinger technique and 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. Total time was calculated from the septum till the final dilatation of the mitral valve. 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 be confirmed by position of sheath and measuring pressure in left lateral position on fluoroscopy, 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.

Statistical Analysis:

Mean with 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. SPSS version 9 was used for analysis.

RESULTS

Patients were recruited form January 2002 to November 2007. Total number of patients is 500.This comprised 370 females (74%) and 130 males (26 %) {table-1}. Mean age was 27 ± 7.21years. All patients had symptomatic severe mitral stenosis. Mean valve area was 0.86 ± 0.19 cm^2 on 2D echocardiography, which increased to 1.86 ± 0.17 cm^2 immediately after PTMC on 2D echocardiography (p <0.05). The mean mitral valve gradient decreased from 17 ± 4.04 mmHg to 6.8 ± 0.25 mmHg immediately after PTMC (p <0.005). Mean right ventricular systolic pressure decreased from 73 ± 16.4 mmHg to 51 ± 11mmHg (p<0.05) at 24 hours after PTMC. Cerebrovascular accidents resulting in hemiplegia occurred in 4 (1.3%) patients. Three (0.27%) cases of CVA occurred in PFO group as compared to 1(0.76%) in atrial septal puncture group. Mild mitral regurgitation was observed in 201 (40.0%) in PTMC through PFO as compared to 26(40%) in atrial septal puncture group. Moderate MR observed in 60 (13.80%) in PTMC through PFO as compared 5 (12.5%) (p=1.0) to PTMC through atrial septal puncture. Severe mitral regurgitation was observed in 7(1.6%) in PTMC through PFO as compared to

COMPARATIVE RESULTS OF PTMC ATTEMPTED VIA PFO AND INTERATRIAL SEPTAL PUNCTURE

Variable	PTMC via PFO 435 (87%)	PTMC via septal puncture 65 (13%)	P value
Time required to cross the interatrial septum (minutes)	15 ± 04	23 ± 05	0.01
2D MVA (cm2)	1.72 ± 0.13	1.75 ± 0.13	0.21
MVG (mmHg)	7 ± 2.31	7.59 ± 1.90	0.33
Rt.Vent. Systolic pressure (mmHg)	47.95 ± 7.2	49 ± 5.71	0.33
Pericardial effusion	0	2	
Mitral Regurgitation			
Nil	194(44.5%)	29(44.61%)	
Mild	174(40.0%)	26(40.0%)	0.21
Moderate	60(13.80%)	9(13.84%)	0.25
Severe	7(1.6%)	1(1.5%)	0.23

Table 2

1 (1.5%) (p=1.0) in PTMC through atrial septal puncture. They were treated conservatively and patients remained in NYHA Class-II.

In 370 (87%) out of 500 patients we were able to find a PFO and crossed the interatrial septum and enter left atrium. In 65 (13%) patients successfully underwent puncture of inter atrial septum with a Brockenbrough needle. All PFO's were crossed within 15 ± 04 minutes of commencement of probing; spending a longer time did not increase the yield of finding and crossing to left atrium. Puncture of the interatrial septum took 23 ± 05 minutes. There were no complications related to probing pressure. All patients had successful PTMC as measured by significant falls in mitral valve gradient and measurements of mitral valve area by 2D and continuous wave Doppler echocardiography. Two patient operated by PTMC via septal puncture developed mild pericardial effusion without significant haemodynamic compromise (table 2).

An important aspect of our study was that many new operators were performing PTMC for the first time. They learned very quickly to cross the atrial septum via patent foramen ovale. If they were not successful to cross the atrial septum than senior who is expert in atrial septal puncture was called for puncture of the atrial septum.

DISCUSSION

Puncture of atrial septum is the most crucial and potentially, the most risky step in PTMC. The gold standard for diagnosing PFO is contrast enhanced transesophageal echocardiography.[8] During cardiac catheterization patent foramen ovale has been reported in up to 60%.[9] 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.[10] In our series we were able to cross the PFO in 87% 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 Hernandez R et al and Hafizullah M et al.[11,12] 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.[13-15]

The presence of a patent foramen ovale circumvent the need to carry out potentially hazardous procedure, reduces the risk and time of the procedure and because of optimal position to cross mitral valve. Our study shown that in a large majority (87%) of the patients atrial septum can be crossed with needle in sheath if operator spends at least 15 minutes probing of atrial septum for patent foramen ovale. 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. In inoue

technique the mean time taken for the procedure was 40 ± 7 minutes.[16] In our study probing of the septum till final dilatation of the mitral valve via PFO took less time) as compared to puncture of the atrial septum. Initially operators took longer time to find PFO but with experience the total time was reduced as learning curve improved.

Limitation of study

This was not a randomized controlled trial comparing the groups. Further studies and work is needed to see outcome of the procedure time, fluoroscopy time, reduction in mitral valve gradient and increase in mitral valve area and related complications in a randomized trial.

CONCLUSION

PFO in the presence of severe mitral stenosis is common. PTMC to treat mitral valve stenosis is effective, It reduces procedure time and related complications safe way of treatment for symptomatic severe mitral stenosis.

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