



PERCUTANEOUS TRANSMITRAL COMMISSUROTOMY (PTMC); PROCEDURAL SUCCESS AND IMMEDIATE RESULTS, A TERTIARY CARE HOSPITAL EXPERIENCE FROM DEVELOPING COUNTRY

Dr. Liaqat Ali¹, Dr. Naeem Asghar², Dr. Rehan Riaz³, Dr. Maqbool Hussain⁴

1. MBBS, DIP- CARD (Pb), FCPS (Cardiology)
Associate Professor of Cardiology, Punjab Medical College / Allied Hospital, Faisalabad.
2. MBBS, FCPS (Cardiology)
Consultant Cardiologist FIC, Faisalabad.
3. MBBS, FCPS (Cardiology)
Senior Registrar FIC, Faisalabad.
4. MBBS, Dip-Card
Cardiologist
Allied Hospital, Faisalabad

Correspondence Address:

Dr. Liaqat Ali
MBBS, DIP-CARD (Pb), FCPS (Cardiology)
Associate Professor of Cardiology, Punjab Medical College / Allied Hospital, Faisalabad.
hudadr1@hotmail.com

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ABSTRACT... Background: Mitral stenosis is one of the grave consequences of rheumatic heart disease. Balloon valvuloplasty for stenosed mitral and pulmonary valves has been practiced with good results in the world. Since Inoue et al. introduced balloon valvuloplasty in 1982, percutaneous transmitral commissurotomy (PTMC) has become the treatment of choice for mitral stenosis replacing surgical commissurotomy and mitral valve replacement in many cases. **Objective:** The aim of this study was to audit the procedural success, in hospital outcome in patients undergoing percutaneous trans-mitral balloon commissurotomy (PTMC) in our set up. **Study Design:** Observational cross sectional study. **Place and Duration:** The study was conducted at Faisalabad Institute of Cardiology Faisalabad from March 2011 to December 2013. **Materials and Methods:** Total one hundred and twenty four patients underwent percutaneous transmitral commissurotomy from March 2011 to December 2013. Any patient of age ≥ 10 years with mitral stenosis who fulfills the inclusion and exclusion criteria for PTMC was enrolled in this study. A full history particularly, age, sex, occupation, address, symptoms regarding their referral for medical checkup was noted. Detailed clinical examination especially relevant cardiovascular examination of all the patients was done. ECG of every patient was done. Baseline routine investigations including blood complete with ESR, electrolytes, CRP, LFT, RFT was done in each case. A baseline echocardiography was performed in all patients. Mitral valve area was calculated by planimetry and by pressure half time method. Severity of mitral stenosis was graded as: very severe stenosis (valve area $< 1\text{cm}^2$), severe (valve area $1 - 1.5\text{ cm}^2$) moderate (valve area $1.5 - 2\text{ cm}^2$) and mild (valve area $> 2.0\text{ cm}^2$). To exclude any clot in LA and LA appendage Transesophageal echocardiography (TEE) was performed. In Cath Lab pre and post PTMC invasive hemodynamics including LA, RA, RV, left ventricular end-diastolic pressure (LVEDP), and transmitral pressure gradient (PG) was calculated. Those patients who have echo contrast on echocardiography were given 5000 IU heparin IV after septal puncture. Antibiotic prophylaxis was initiated in all patients thereafter. The procedure was performed under local anesthesia, if needed moderate sedation was given with midazolam. The procedure was ended when either at least one commissure was splitted, adequate increase in mitral valve area or increase in degree of MR or decrease in mean LA pressure to $\frac{1}{2}$ of pre PTMC value or decrease in mitral valve gradient was observed. After 24-48 hours patient was discharged and before discharge transthoracic echo was done to measure all the parameters as pre PTMC along with any echo finding of pericardial effusion. **Results:** Total 124 patients were studied, 92(74.2%) were female and 32(25.8%) were male showing a female predominance. The mean age was 27.29 ± 9.3 . Most of the patients 58(46.8%) were in age group 21-30 years. 87(70.16%) patients were in atrial fibrillation and 37(29.83%) had sinus rhythm. The procedure was successful in 118(95.16%) patients. 2(1.6%) patients need urgent MVR due to severe MR and 1 (0.8%) died during procedure. Most of the patients 85(68.55%) were in NYHA class III. After PTMC, ASD was present in 13(10.5%) patients. After PTMC moderate MR was seen in 2(1.6%) and severe MR was observed in 4(2.173%) patients. Most of the patients 115(92.7%) before PTMC were in severe pulmonary hypertension and after PTMC most of the patients 91(73.4%) were in mild pulmonary hypertension. Pre PTMC mean MVA (cm^2) was 0.684 ± 0.1226 and post PTMC it was $1.533 \pm 0.281\text{ cm}^2$. Mean MVPG pre PTMC was $26.178 \pm 5.94\text{ mmHg}$ and post PTMC it was $7.62 \pm 5.007\text{ mmHg}$ with significant p value 0.0001. Mean LA pressure before procedure was $29.68 \pm 8.137\text{ mmHg}$ and post PTMC it was 12.28 ± 6.99 and p value was 0.0001. 10 patients had special problems, 3 had previous H/O PTMC, 3 were pregnant lady, one has kyphoscoliosis, one had large IAS aneurysm, one had H/O CVA and one patient was suffering from renal cell carcinoma. **Conclusions:** The outcome of this study suggests that PTMC is a safe procedure in experienced hand with good success rate and optimal results even in patients with special problems like pregnancy, previous CVA and redo cases.

Key words: Mitral stenosis, Percutaneous Transmitral Commissurotomy, Immediate results

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INTRODUCTION

Rheumatic heart disease is still a common prob-

lem in Pakistan and other developing countries, though its incidence is on decline in the western

world.¹ The prevalence of rheumatic fever in Pakistan is 22/1000 population and this very high prevalence has put the Pakistan at top of the world's rheumatic fever list.² Most frequently affected valve in rheumatic heart disease is Mitral valve, in 40% cases other heart valves are also affected along with Mitral valve but in 25% patients' Mitral valve solely affected.³ Mitral stenosis is more common in female while in male mitral regurgitation is more common. Male are more prone to suffer from aortic valve disease than female⁴ and it results in increased morbidity and mortality.⁵ Mitral stenosis alone or in combination with other valvular lesions is almost always rheumatic in origin⁶ while other valvular lesions may have etiologies other than rheumatic fever. An exceedingly rare form of mitral stenosis is congenital stenosis which is associated with high mortality in first few years of life.⁷ In our world, during pregnancy most common cardiac lesion detected is mitral stenosis, rheumatic in origin⁸ and it is due to overcrowding and poor socioeconomic status of population. Late diagnosis and late referral for management to specialized cardiac centers are the main problems responsible for these complications and sometimes lack of resources are also responsible for it.

In 1982, Inoue K and colleagues were the first to perform Percutaneous Trans- Mitral Commissurotomy (PTMC) and since then PTMC is the treatment of choice for symptomatic patients with moderate to severe M.S having suitable valves for PTMC. In pregnancy, medical treatment is the first line of treatment and PTMC is only indicated when patients do not respond to medical treatment and / or patients presented with repetitive or persistent heart failure. Due to high maternal (1.7% - 3.1%) and fetal (5% - 33%) mortality rate, surgical commissurotomy is not good option in pregnancy.⁹ In literature, there is almost more than 10 years documented experience of PTMC for mitral stenosis in pregnancy.¹⁰ We can delay mitral valve replacement surgery for ten or more years in patients who benefited from PTMC with additional option to redo PTMC later on in suitable cases.^{11,12} Two main techniques of commissurotomy are in the world; the balloon and the

Metallic Commissurotomy .The Inoue balloon is the most commonly used technique today world-wide and it was also used by the authors. Other balloon techniques are:

- (a) Double balloon technique.
- (b) Multitrack technique; it is the refinement of the double balloon technique that employ a monorail system first described by Bonhoeffer et al.¹³

Metallic commissurotomy was introduced by Cribier et al in 1990s.¹⁴ It carries a high risk of haemopericardium due to stiff guide wire in LV cavity and now it is not commonly used. The potential advantage of this technique is its cost effectiveness.

Mitral regurgitation is a major complication of PTMC¹⁵ and its incidence is 1.4% - 7.5% as documented in the literature.¹⁶ Immediate results of PTMC are predicted from mitral valve anatomy as was evident in many studies. Regarding the procedural success and hemodynamic effects of PTMC very few studies have been done and data in Pakistan is not sufficient. The objective of this study was to audit all my cases of PTMC, so far I have done from March 2011 to December 2013 at Faisalabad Institute of Cardiology Faisalabad Pakistan.

MATERIALS AND METHODS

This study was conducted at Faisalabad Institute of Cardiology Faisalabad from March 2011 to December 2013.

Inclusion Criteria

Any patient (Male or Female) of age ≥ 10 years having symptomatic MS with NYHA functional class II or more with mitral valve area (MVA) ≤ 1.5 cm² and mitral valve Echocardiographic score ≤ 11 according to scoring system described by Wilkins et al.

Exclusion Criteria

- 1) Patients with significant mitral regurgitation (MR ≥ 2).
- 2) Bilateral Commissural calcification.

- 3) Clot in LA and/or LAA.
- 4) Presence of other lesions which need open heart surgery.
- 5) Wilkin Score > 12.
- 6) Patients were excluded if valve area measurement was performed using other methods than area tracing technique (like mean transmitral diastolic pressure gradient technique or pressure-half-time technique) in a setting of associated mitral regurgitation.
- 7) End stage renal or liver disease.
- 8) Patients with severe COPD.

We prospectively included 124 consecutive patients with rheumatic mitral stenosis who fulfill the inclusion and exclusion criteria for PTMC and they undergone PTMC using Inoue balloon technique during the period from March 2011 to December 2013 at Faisalabad Institute of Cardiology Faisalabad. Only those cases in which PTMC was performed by the authors were included in the study. Informed consent from all the patients who participate in the study was taken. These patients were selected from cardiology outpatient department, referral cases from other cities / medical units and from cardiology emergency of Faisalabad Institute of Cardiology, Faisalabad.

The demographic data regarding age, gender, occupation etc was collected and a detailed physical examination especially relevant cardiovascular examination of all the patients was done. Symptoms regarding their referral for medical checkup were recorded. Height, weight and other anthropometric measurements of all the patients were taken at the hospital using standardized techniques. Previous record of each patient was scrutinized and noted. Baseline routine investigations including blood complete with ESR, electrolytes, CRP, LFT, RFT was done in each case. Any rheumatic activity was assessed by looking the ESR, CRP of the patient. To evaluate rate and arrhythmia like atrial fibrillation ECG was performed at the time of examination and at morning on procedure day. To see signs of pulmonary oedema, pulmonary hypertension and other lung pathology like pulmonary infarction and infection, X-ray chest PA view was done. From clinical symptoms

and signs functional status of the patients was graded according to the New York Heart Association (NYHA).

A baseline echocardiogram was performed in all patients. Examination was acquired by using a commercially available system (Vingmed Vivid Seven, General Electric—Vingmed, Milwaukee, WI, USA) equipped with 2.5 and 3.5MHz transducers and 5MHz transesophageal transducer.

Mitral stenosis was assessed with 2D, spectral and colour Doppler echocardiography. At least two operators performed echocardiography to assess anatomic score and mitral valve morphology to avoid any personal bias and in case of disparity, third one performed echo to ensure correct findings. In all patients, both atrial and ventricular sizes were taken. LV function was assessed by Cube's method. Left atrium (LA) was searched for any clots in apical 4 chamber view.

Mitral valve area was calculated by planimetry using 2D Echo in parasternal short axis view and by pressure half time method. Every patient was subjected to Continuous Wave (CW) and Pulse Wave (PW) Doppler studies in apical 4 chambers view. Mitral valve gradient (Peak and Mean) was observed in left ventricular inflow in each case. In apical 4 chamber view tricuspid pressure gradient was used to assess pulmonary artery pressure.

Severity of mitral stenosis was graded as: very severe stenosis (valve area < 1cm²), severe (valve area 1- 1.5 cm²) moderate (valve area 1.5- 2 cm²) and mild (valve area > 2.0 cm²). Transthoracic echocardiographic and Doppler examinations were done within a week before intervention and one day after the procedure. To assess the mitral valve morphology different scoring systems were used. Wilkins score by Wilkins et al of Massachusetts General Hospital score, MR-echo score by Padiyal et al, and Commissural score by Sutaria et al were used. Presence of MR with its severity was noted. Color flow mapping was used to assess MR severity by expressing the ratio of maximal jet area to left atrial area in the same view and was graded from one to four according to Essop

et al. In cases of uncertainty, PISA method was used to assess MR severity. To exclude any clot in LA and LA appendage, to assess interatrial septal thickening, and reassessment of transthoracic echocardiographic findings, Transesophageal echocardiography (TEE) was performed one day preintervention. Presence of commissural calcification is another important factor to determine the suitability for PTMC and was assessed on 2D echocardiographic short-axis view. Commissural calcification (1 or both commissures) is an independent predictor of near-term success during the procedure, as well as long-term outcome.¹⁷ In Cath. Lab pre and post PTMC invasive hemodynamics including LA, RA, RV, left ventricular end-diastolic pressure (LVEDP), and transmitral pressure gradient (PG) was calculated. The patient remained in the supine position during the procedure. There are two approaches to reach mitral valve, retrograde (Transarterial) and antegrade (Transvenous) approach. The retrograde approach has a potential risk of arterial damage but eliminates risk of residual ASD after PTMC.¹⁸ Most commonly used approach in the world is antegrade through right femoral vein¹⁹ and it was adopted by the authors. Interatrial puncture was done in lateral projection with Brockenbrough needle at 4° clock to 6° clock at fossa ovalis level. In supine position when we look from foot side of the patient atrial septum runs from 1° clock to 7° clock. Successful entry into the left atrium was confirmed by pressure tracing, by withdrawing oxygenated blood from LA and typical fluoroscopic picture during contrast injection. Those patients who have echo contrast on echocardiography were given 5000 IU heparin IV after septal puncture. As described in literature, standard protocol for PTMC was adopted.¹⁴ Antibiotic prophylaxis was initiated in all patients thereafter. The procedure was performed under local anesthesia, if needed moderate sedation was given with midazolam.

As a rule of thumb following equation was used to choose balloon size in PTMC:

$$\text{BALLOON SIZE} = \frac{\text{Patient height (cm)}}{10} + 10$$

In some special cases for septal puncture transthoracic echo was used. After each inflation, balloon was withdrawn in LA to measure LA pressure or to assess MR on color Doppler. Abrupt increased in LA or pulmonary artery pressure, suggests acute severe MR. The procedure was ended when either adequate increase in mitral valve area or increase in degree of MR or decrease in mitral valve gradient was observed. In Cath Lab. on the basis of hemodynamic criteria we can evaluate immediate results. For good immediate results frequently two definitions are used:

- 1) Valve area $\geq 1.5\text{cm}^2$ without mitral regurgitation ≥ 2 .
- 2) Valve area $\geq 1.5\text{cm}^2$ with an increase in valve area of at least 25% of pre PTMC area.

At the end of procedure RA, RV, pulmonary artery pressure, LA pressure, LVEDP, was measured with multipurpose catheter. After 24-48 hours patient was discharged and before discharge transthoracic echo was done to measure all the parameters as pre PTMC along with any echo finding of pericardial effusion.

STATISTICAL ANALYSIS

All the data was analyzed by SPSS (Statistical Package for Social Sciences) Version 17.0 for Windows. A categorical variable were expressed as frequencies and percentages and continues variables were presented as means \pm SD (Standard Deviation). Qualitative variables were compared using Chi sq test. 5% level of significance was used. All tests applied were two tailed.

RESULTS

Total 124 patients were studied, 92(74.2%) were female and 32(25.8%) were male showing a female predominance. The mean age was 27.29 ± 9.3 , ranged from 10 to 60 years. Most of the patients 58(46.8%) were in age group 21-30 years followed by in age group 10-20, 33 (26.6%) (Table-II, Fig-1). Mild to moderate AR was present in 31(25%) and moderate to severe TS were present in 6(4.8%) (Table II).

87(70.16%) patients were in atrial fibrillation and 37(29.83%) had sinus rythym. The procedure was

Grade	Mobility	Valvular Thickening	Calcification	Subvalvular Thickening
1	Only tips of leaflet restricted	Thickness of leaflets is near normal (4-5 mm)	Echo brightness increased at a single area	Just below the mitral valve there is minimal thickening.
2	Leaflets show reduced mobility in basal and middle portions	Margins of leaflet are markedly thickened	Leaflet margins show scattered areas of brightness	1/3 rd of chordal length show thickening of chordal structures.
3	Mainly base of leaflet move forward in diastole	Entire leaflet show thickening (5-8 mm)	Up to mid portion of leaflet brightness extends	Thickening extends up to distal 1/3 rd of chordate
4	In diastole leaflet show minimal forward movement	Whole leaflet tissue show marked thickening (> 8-10 mm)	Most of the leaflet tissue show extensive brightness	Subvalvular apparatus shortened and extensively thickened up to papillary muscles

Table-I. Echocardiographic Wilkin's scoring system to predict PTMC outcome

Variables	Frequency	Percentage
Total number of PTMC	124	100%
Female	92	74.2%
Male	32	25.8%
Age		
10-20 Years	33	26.6%
21-30 Years	58	46.8 %
31-40 Years	20	16.1%
41-50 Years	12	9.7%
51-60 Years	1	0.8 %
Wilkin Score (Mean)	9.15±0.776	
Rhythm		
Atrial Fibrillation	87	70.16%
Sinus Rhythm	37	29.83%
Other Associated Lesions		
Mild to Moderate AR	31	25%
Moderate to Severe TS	6	4.8%
Successful PTMC	118	95.16%
PTMC Abandoned / Unsuccessful	05	4%
NYHA Class		
NYHA Class II	29	23.39%
NYHA Class III	85	68.55%
NYHA Class IV	10	8.06%
Patients need Urgent MVR	2	1.6%
Mortality from PTMC	1	0.8%
Ischemic Stroke	Nil	
ASD after PTMC	13	10.5%

Table-II. Base line characteristics of patients

successful in 118(95.16%) patients and PTMC was either unsuccessful or/and was abandoned in 5(4.03%) patients (Table II). In one patient we failed to dilate a tough septum, in two patient,

the balloon got stuck to the septum and failed to cross the MV.

In two patients we cannot puncture the septum in spite of multiple attempts. 2(1.6%) patients need

PARAMETERS	PRE PTMC	POST PTMC	P value
MVA (cm ²) Mean ±SD	0.684 ±0.1226	1.533 ±0.281	0.0001
Mean MVPG (mmHg) (Mean ± SD)	26.17 ±5.94	7.62 ±5.007	0.0001
Pulmonary Hypertension(mmHg)			
Mild	2 (1.6%)	91(73.4%)	0.0002
Moderate	7(5.6%)	15(12.1%)	
Severe	115(92.7%)	18(14.5%)	
Mitral Regurgitation			
Mild	15(12.1%)	36(29.03%)	
Moderate	Nil	2(1.6%)	
Severe	Nil	4(2.173%)	

Table-III. Pre & Post PTMC Echo Doppler data

PARAMETERS	PRE PTMC	POST PTMC	P value
LA Pressure (mmHg) (Mean ±SD)	29.68 ±8.137	12.28 ±6.99	0.0001
RV Pressure (mmHg) (Mean ±SD)	63.3 ±9.65	41.92 ±8.79	0.0001
LVEDP (mmHg) (Mean ±SD)	3.4±2.0	6.3±2.4	0.0003
Transmitral PG(mmHg) (Mean ±SD)	25.1±4.2	8.3±3.7	0.0001

Table-IV. Pre & post PTMC hemodynamic and procedural data

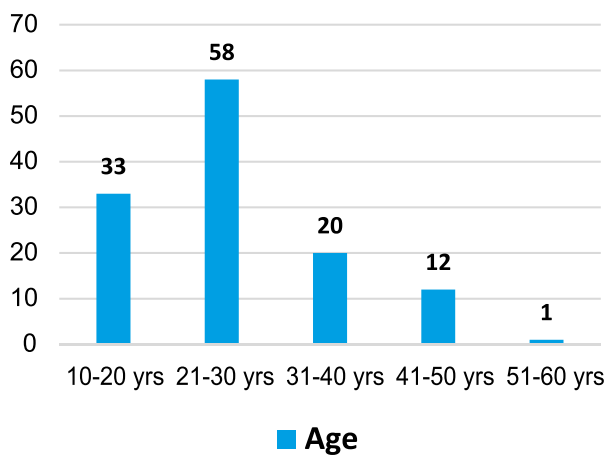
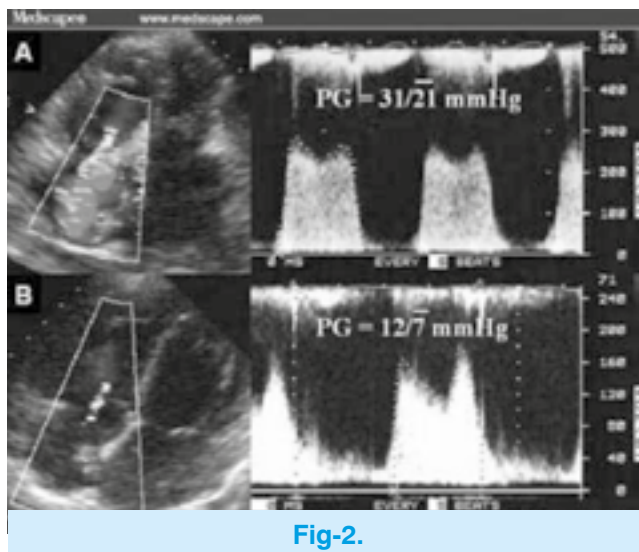


Fig-1. Age wise distribution of patients

urgent MVR due to severe MR and 1 (0.8%) died during procedure. Most of the patients 85(68.55%) were in NYHA class III and 29(23.39%) were in class II (Table II). After PTMC, ASD was present in 13(10.5%) patients. Before procedure 15(12.1%) patients had mild MR. After PTMC mild MR was present in 36(29.03%) patients, moderate MR was seen in 2(1.6%) and severe MR was observed in 4(2.173%) and out of these 2 patients undergone urgent MVR (Table III). The image below depicts tricuspid regurgitation and Mitral Valve Gradient after PTMC.



Most of the patients 115(92.7%) before PTMC were in severe pulmonary hypertension and 7(5.6%) had moderate pulmonary hypertension. After PTMC most of the patients 91(73.4%) were in mild pulmonary hypertension. There was marked decrease in pulmonary hypertension after the procedure and p value was significant 0.0002. (Table III). Pre PTMC mean MVA (cm²) was 0.684±0.1226 and post PTMC it was 1.533±0.281cm² with significant p value 0.0001 (Table III). Mean MVPG (mmHg) pre PTMC was 26.178±5.94 and post PTMC it was 7.62±5.007 with significant p value 0.0001 (Table III). Mean LA pressure before

procedure was 29.68 ± 8.137 mmHg and post PTMC it was 12.28 ± 6.99 . There was significant decrease in mean LA pressure and p value was 0.0001. 10 patients had special problems, 3 had previous H/O PTMC, 3 were pregnant lady, one has kyphoscoliosis, one had large IAS aneurysm, one had H/O CVA and one patient was suffering from renal cell carcinoma.

DISCUSSION

Rheumatic heart disease is the most frequent cause of abnormal valvular function. In the United States the prevalence of rheumatic fever is less than 1/100000 people and in India and other developing countries prevalence is 100–150 cases per 100,000 people. Due to aggressive initial attack, rheumatic heart disease may develop as early as in teenage.

In the Pakistan and other developing countries Mitral stenosis is mostly rheumatic in origin. Due to overcrowding and low socioeconomic background it is more common in young female. Mitral valve surgery is most often performed for mitral regurgitation (MR) and Percutaneous Trans Mitral Commissurotomy (PTMC) is treatment of choice for symptomatic mitral stenosis patients¹² since 1982, after the first mitral valvuloplasty by Inoue et al.²⁰

Prediction of procedural success and immediate results is multifactorial. Independent predictors for procedural success and immediate results are; severity of mitral stenosis, presence of MR before PTMC, annular or commissural calcification, pulmonary artery pressure, severity of TR, history of previous commissurotomy, age of patient, NYHA functional class and morphologic factors.¹⁸

In the study, procedure was successful in 118(95.16%) patients. These results coincide with the results of international studies conducted by M S Alkhalife et al²¹ and Syed Dawood Md et al²² in which procedural success was 94.5% and 95% respectively. One local study conducted at Peshawar, Pakistan by Sher Bahader Khan et al²³ showed procedural success in 96% patients

which coincides with our results. In 1% to 17% patients PTMC may be unsuccessful and this failure result due to unfavorable anatomy i.e giant LA, thick septum, during initial portion of learning curve of the operator, subvalvular disease or heavy calcification or special problem like hiatus hernia, kyphoscoliosis and in our study PTMC was unsuccessful or/ and abandoned in 5(4%) patients and these results coincide with other international studies. The PTMC was considered unsuccessful if we could not succeed to puncture the septum, failure to cross the balloon through septum, or cannot cross MV or both commissures remained fused after balloon inflation.

Most commonly documented complication of PTMC is mitral regurgitation and frequency of severe MR varies from 2% to 19%.²⁴ Our results showed that 20(16.12%) got mild MR, 2(1.6%) had moderate MR and 4(2.173%) severe MR and these results coincide with other studies. Significant MR is defined as MR of $\geq 2/4$ grade. Factors predicting severe MR during PTMC are not fully understood and rather controversial.²⁵ This complication is related to tear of the posterior or anterior leaflet. Sometimes due to asymmetrical significant commissural calcification severe MR can occur due to the non-calcified commissural tear.

After balloon valvuloplasty, the frequency of atrial septal defects in different studies ranges from 10% to 90% and these shunts are very small and left to right restrictive shunt. Sometimes, though rare due to very severe pulmonary hypertension these shunts are right-to-left. In this study frequency of ASD was observed in 13(10.5%) patients and it coincides with other studies results. In this study one patient who got severe MR due to leaflet tear also got significant ASD with right to left shunt. She undergone urgent MVR along with ASD closure and the patient was discharged without any surgical complication. 1(0.8%) died during PTMC due to LA perforation during septal puncture, patient was resuscitated and PTMC was completed. Blood from pericardium was aspirated and auto transfusion was done through left femoral vein but patient could not survive.

Incidence of procedural mortality is documented 0-3% in other studies which coincide with our results. Poor general health and left ventricular perforation are the main causes of mortality. 0.5% to 12.0% patients may develop hemopericardium and this is due to LV apex perforation by guide wires or balloon or during septal puncture. If haemopericardium occurs emergency pericardiocentesis should be done and patient should be transfer immediately to cardiac surgery after stabilization. During PTMC incidence of embolic events ranges 0.5% to 5.0% and sometimes but rarely this embolic event can cause death or permanent disability and in our study no patient got ischemic / embolic event. To avoid this complication TEE is must especially in patients having atrial fibrillation or previous history of TIA or stroke and high risk patients having lot of echo contrast in LA/ LAA must be given heparin after septal puncture.

1.5% patients may develop complete heart block during PTMC and it is mostly transient and very rarely may require a permanent pacemaker. In our study 1 (0.8%) patient got this complication but it reverts after few minutes in Cath. Lab.

The frequency of restenosis in different studies at 3-10 years interval after percutaneous mitral valvuloplasty is 2% to 40%. It is defined as loss of more than 50% of area gained during PTMC with a valve area less than 1.5 cm². Re do balloon valvuloplasty or surgical mitral valve replacement are options for restenosis after PTMC.^{18, 26, 27}

CONCLUSION

Percutaneous transmitral valvuloplasty is a safe and effective intervention for patients with severe MS and suitable valve in expert hand and even during special situations like pregnancy and re do cases.

LIMITATIONS

This study has a number of limitations because it is a hospital-based study. There is possibility that only patients with advanced disease and significantly symptomatic cases were referred to our hospital, representing the proverbial tip of a very

great iceberg. The patients included in the study are not likely to be representative of the disease burden in our community.

FUTURE RECOMMENDATIONS

In our population, large definitive studies to be executed. A screening program on echocardiography-based is the need of time to determine the true prevalence of rheumatic valvular disease especially in our childhood population, and to strengthen the commitment to primary and secondary prevention programs.

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“The only thing that overcomes hard luck is hard work ”

Harry Golden



AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Liaqat Ali	Chief operator & writing of article	
2	Dr. Naeem Asghar	Data collection	
3	Dr. Rehan Riaz	Statistical analysis	
4	Dr. Maqbool Hussain	Writing & interpretation	