IMMEDIATE RESULTS OF PERCUTANEOUS TRANS-MITRAL COMMISSOROTOMY IN JUVENILE MITRAL STENOSIS

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ABSTRACT

Objectives: Immediate result of PTMC in juvenile (5-12 years) rheumatic mitral stenosis.

Study Design: Observational descriptive and retrospective study.

Place and Duration of Study: Institute of Cardiology, Multan from 2009 to Jun 2020.

Methodology: This is an observational descriptive and retrospective study carried out at Institute of Cardiology, Multan from 2009 to Jun 2020. Patients with clinical evidence of significant mitral stenosis were undergone transthoracic echocardiography. Mitral stenosis was defined as mitral valve area <1.0 cm². Mean mitral valve gradient was calculated by mitral valve inflow velocities. Patients with Wilkins score <8 were included. Patients with significant MR, left atrial or atrial appendage clot, infective endocarditis, significant aortic regurgitation or any other indication for bypass surgery were excluded. Patients with Wilkins score >8 were also excluded from the study. Variables recorded on a performa were age, weight, left atrial size, mean mitral valve gradient, pre-procedure MR. Reduction of mitral valve mean pressure gradients to less than <50% of the initial value was defined as success (without significant or moderate MR). After the procedure, variables recorded on performa were mean left atrial pressures in mmHg (on angio), mean mitral valve gradients and degree of MR (mild, mild to moderate, moderate or severe MR) on transthoracic echocardiography. Paired t-test of significance (p<0.05) was evaluated using SPSS (version 20).

Results: Forty three juvenile patients were included the in the study (2009 to June 2019). Mean age was 10.8 ± 1.4 (range 7-12) years. Mean weight was 28.9 ± 5.2 (20-37) kg. Mean mitral valve gradient (on TTE) before the procedure was 20 ± 6 mmHg. Mean left atrial size and mean area of mitral valve were 42 ± 5 mm and 0.8 ± 0.2 cm² respectively. Balloon sizes used were 26 mm (n=19) and 24 mm (n=24). After PTMC, mean mitral valve reduced to 7 ± 2 mmHg (p<0.005) and left atrial pressure to 18 ± 7 mmHg. Post procedure transthoracic echocardiography showed 4.7% (n=2/43) patients developed moderate to severe MR. So the success rate was 95.3% (n=41/43).

Conclusion: PTMC is safe and effective procedure for juvenile patients mitral stenosis. Long term follow-up is needed to find out period of re-intervention/surgery free duration from the time of PTMC.

Keywords: Acute rheumatic fever, Juvenile mitral stenosis, PTMC, Percutaneous trans mitral commissorotomy, Rheumatic heart disease.

INTRODUCTION

Acute rheumatic fever (ARF) is a result of body’s autoimmune response to a throat infection caused by group A Streptococcus bacteria. Rheumatic heart disease (RHD) refers to the long-term cardiac damage caused by either a single severe episode or multiple recurrent episodes of ARF. RHD is worldwide cause of significant morbidity and mortality, particularly in resource-poor settings1. Globally, there were 33.4 million cases of RHD and 10.5 million disability-adjusted life years in year 2015 due to RHD. Pakistan is high risk country for RF and RHD2. Lack of education, poverty, over-crowding and lack of health facilities are contributing factors3. Commonest lesion with RHD is mitral regurgitation4. But over years, we have seen significant mitral stenosis (MS) in children as well 5-12, years of age).

Surgical commissorotomy was started in 1923 and became a standard treatment in late
1940’s. Inoue balloon catheter was introduced in 1984. Afterwards percutaneous balloon mitral valvotomy (PTMC) proved to be effective and safe. It is now standard treatment in selected patients with rheumatic mitral stenosis (MS). AHA/ACC has described PTMC as class I indication for rheumatic MS with favorable mitral valve (MV) morphology. Several local authors have published their results in adults. No local study has reported the immediate results in children (<12 years) with severe MS.

**METHODOLOGY**

This is an observational descriptive and retrospective study carried out at Institute of Cardiology, Multan from 2009 to June 2020. Pediatric patients (5-12 years) were evaluated by history, physical evaluation, x-ray chest PA view. Patients with clinical evidence of significant mitral stenosis were undergone transthoracic echocardiography (TTE) using 3S probe of Vivid 7 machine (GE healthcare, Norway). Operators were well trained for the assessment of RHD patients. Activity of the disease was ruled out by blood test (Normal ESR <30 mm in 1st hr., ASOT titers <240 units).

The TTE was the main tool for look for suitable/favorable morphology of MV. Planimetry was used to calculate mitral valve area. Mitral stenosis was defined as mitral valve area <1.0 cm². Mean mitral valve gradient (MVPG) was calculated by MV inflow velocities in 4 chamber apical view using continuous wave (CW) and pulse wave (PW). Pulmonary artery systolic flow (PAP) calculated from TR jet pressure gradient (TVPG) and right atrial pressure (RAP) whereas PAP=TVPG ± RAP. Planimetry was used to calculate mitral valve area. Patients with Wilkins score <8 were included. Patients with significant MR, left atrial or atrial appendage clot, infective endocarditis, significant aortic regurgitation or any other indication for bypass surgery were excluded. Patients with Wilkins score >8 were also excluded from the study.

Variables recorded on a performa were age, weight, left atrial (LA) size, mean MV gradient, pre-procedure MR. After informed consent procedure performed in catheterization lab under local anesthesia using femoral venous approach. Prophylactic antibiotics are started a day before the procedure. After sepal puncture, heparin was give 75 units/kg intravenously. Inoue balloon (Toray International America. INC. Medical) was used in all cases (fig-2). Balloon size was calculated from the following equation.

Balloon size in mm=patients height in cm/10 ± 10. LA pressures (mean) are documented in mmHg. First inflation was done 1-2mm less than maximum diameter of the balloon. If results were suboptimal, balloon was inflated to the maximum

![Figure-1: Inoue balloon inflated across MV.](image)

![Figure-2: MV mean pressures (before and after PTMC).](image)
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MV gradients and MR. Patients who developed severe MR (failure of the procedure) were referred for surgical MV replacement.

After the procedure, variables recorded were mean LA pressures in mmHg (on angio), mean MV gradients and degree of MR (mild, mild to moderate, moderate or severe MR) on TTE. Paired t-test of significance (p<0.05) was evaluated using SPSS (version 20).

RESULTS

Forty three juvenile patients were included the in the study (2009 to June 2019). Mean age was 10.8 ± 1.4 (range 7-12) years. Mean weight was 28.9 ± 5.2 (20-37) kg. Mean MV gradient (on TTE) before the procedure was 20 ± 6 mmHg. Mean LA size and mean area of MV were 42 ± 5 mm and 0.8 ± 0.2 cm² respectively (table).

Balloons sizes used were 26 mm (n=19) and 24 mm (n=24). After PTMC, mean MV reduced to 7 ± 2 mmHg (p<0.005) and LA pressure to 18 ± 7 mmHg fig-1. Post procedure TTE showed 4.7% (n=2/43) patients developed moderate to severe or severe MR. So the success rate was 95.3% (n=41/43). We did not any cardiac perforation or death. No patient had significant bleeding.

DISCUSSION

Developed world has low prevalence of RHD (1 in as 100000 for Unites States). However developing countries are endemic (estimated childhood mortality due to RHD >0.15 deaths per 100,000 population among children 5 to 9 years of age) 2 Commonest cause of valvular heart disease in Pakistan is RHD3. Risk factors for RHD (Overcrowding, poor hygienic conditions, low socio-economic status, and illiteracy) remain unchanged over years in Pakistan3. This leads to rheumatic mitral stenosis even in juvenile patients (5-12 years).

PTMC is effective therapy for mitral stenosis. Severe authors have reported the results in adult patients9,10,11. However none of local experience for juvenile patients is not reported. Authors from India (age <20 years) and Africa (age <21 years) has reported results in juvenile patients15,16. The age groups in these studies were <20 years or <21 years. The success is dependent on multiple factors including preexisting MR, Wilkins scoring. Our success rate was 95.3%. Our results are parallel to other studies17. One local study conducted at Peshawar showed procedural success in 96% patients18.

Most important complication is increase of severity of MR. Reports documented frequency of severe MR varies from 2% to 19%. Two of patients developed severe MR which was referred for surgical MV replacement. Factors which lead to severe MR remain controversial20, fic 25. It could be due to tear of anterior or posterior leaflets. Frequency of atrial septal defect has not been evaluated in our study. Other authors have

Table: Data and hemodynamics (no, percentages, means and standard deviation).

| Total PTMC performed | n=71 |
|----------------------|------|
| Incomplete data      | n=28 |
| Total patients included in the study | n= 43 |
| Male: Female         | 21:23 |
| Mean age (years)     | 10.8 ± 1.4 (range 7-12) |
| Mean weight (in kg)  | 28.9 ± 5.2 (20-37) kg |
| Pre-PTMC Mean MV gradient (mmHg) | 30.5 ± 7.7 mm Hg |
| Post-PTMC Mean MV gradient (mmHg) | 7 ± 2 mmHg |
| Pre-PTMC Mean LA pressures (mmHg) | 30 ± 7mmHg |
| Post-PTMC Mean LA pressures (mmHg) | 19 ± 7 mmHg |
| Pre- mean LA size (mm) | 42 ± 5 mm |
| Pre- mean MV area (cm²) | 0.8 ± 0.2 cm² |
| Balloon size used     | 24 mm (n=24) and 26 mm (n=19) |
| Success rate          | 95.3% (n=41/43) |
| Complication rate (>moderate MR) | 4.7% (n=2/43) |
| Death / cardiac perforation | - |
| Pre-existing atrial tachyarrhythmia | - |
| Significant bleed (and transfusion) | - |

was 10.8 ± 1.4 (range 7-12) years. Mean weight was 28.9 ± 5.2 (20-37) kg. Mean MV gradient (on TTE) before the procedure was 20 ± 6 mmHg.
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reported frequency from 10-90%. But these are small residual shunts. Long term follow-up is needed to find out period of re-intervention/surgery free duration from the time of PTMC.

The restenosis is defined as reduction of MV area by 50% compared to post PTMC MV area. Re-stenosis is not documented in our study. T-restenosis rate after PTMC has ranged from 3% to 70% at 1 to 3 years21.

CONCLUSION

PTMC is safe and effective procedure for juvenile patients with mitral stenosis. Long term follow-up is needed to find out period of re-intervention/surgery free duration from the time of PTMC.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Karthikeyan G, Guilherme L. Acute rheumatic fever. Lancet 2018; 392(10142): 161-74.
2. Watkins DA, Johnson CO, Colquhoun SM, Karthikeyan G, Beaton A, Bukhman G, et al. Global, Regional, and National Burden of Rheumatic Heart Disease, 1990-2015. N Engl J Med 2017; 377(8): 713-22.
3. Beg DA, Younas DM, Asma Ch DT. Rheumatic Heart Disease (RhD); Socio-Economic And Environmental Risk Factors For Acute Rheumatic Fever (Arf) And Rheumatic Heart Disease (RhD) Patients In Pakistan. Prof Med J 2006; 23(3): 324-27.
4. Russell EA, Walsh WF, Costello B, Mc Lellan AJA, BrownA, Reid CM, et al. Medical Management of Rheumatic Heart Disease. Cardiol Rev 2018; 26(4): 187-95.
5. Noobi F, Sadeghpour A, Alizadehsh A. Valvular Heart Disease. In Practical Cardiology (pp. 395–441). 2018 Elsevier. [Internet] https://doi.org/10.1016/b978-0-323-51149-0.00025-0.
6. Tawn Z, Hibbert D, Brochet E, Messika-Zeitoun D, Iung B, Vahanian A. Percutaneous valve procedures: present and future. Int J Cardio Interv 2005; 7(1): 14-20.
7. Vahanian A, Acar C. Percutaneous valve procedures: what is the future?. Curr Opin Cardiol 2005; 20(2): 100-06.
8. Nishimura RA, Otto CM, Bonow RO, Carabello BA, Erwin JP, Fleisher LA, et al. AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease. J Am Coll Cardiol 2017; 70(2): 252–89.
9. BABAR HAK, SAAD AA, BUTT ZR, KHAN Z, DASTGEER S, IQBAL MM. Severe mitral stenosis; in-hospital outcomes of percutaneous transvenous mitral commissurotomy (ptmc) in patients. Prof Med J 2017; 24(6): 850-54.
10. Walia T, Bhardwaj P, Chaudhury S, Aneja A, Jetley V, Mujawar S. Assessment of quality of life before and after successful percutaneous transvenous mitral commissurotomy in patients with severe mitral stenosis. Indusl Psy J 2019; 58: 1-21.
11. Ali L, Asghar N, Riaz R, Hussain M. Percutaneous transmirtal commissurotomy (PTMC); Procedural success and immediate results, a tertiary care hospital experience from developing country. Prof Med J 2016; 23(1): 104-13.
12. Chetlin MD, Alpert JS, Armstrong WF, Aurigemma GP, Beller GA, Bierman FZ. ACC/AHA Guidelines for the Clinical Application of Echocardiography. Circulation, 1997; 95(6): 1686–44.
13. Wilkins GT, Weyman AE, Abascal VM. Percutaneous balloon dilatation of the mitral valve: an analysis of echocardiographic variables related to outcome and the mechanism of dilatation. Br Hear J 1988; 60(4): 299-08.
14. Vahanian A, Luxereau P, Brochet E, Cormier B, Iung B. Percutaneous mitral commissurotomy: technique, results, and selection of patients. Przeglad Lekarski 2004; 61(6): 543-46.
15. Adhikari CM, Malla R, Rajbhandari R. Percutaneous transvenous mitral commissurotomy in juvenile mitral stenosis. Cardiovasc Diagn Ther 2016; 6(1): 20-24.
16. Yonga GO, Bonhoeffer P. Percutaneous transvenous mitral commissurotomy in juvenile mitral stenosis. East Afr Med J 2003; 80(4): 172-74.
17. Dawood S, Karim MR, Haq M, Ali M, Chowdhury MZ. Percutaneous transvenous mitral commissurotomy. in-hospital outcome of patients with mitral stenosis. Ibrahim Card. Med J 2011; 1(2): 24-28.
18. Khan SB, Ali J, Zeb RS, Irfan M, Gul AM. Percutaneous Commisurotomy (PTMC): Procedural Success and Immediate Results. PJC 2013; 24(1&2): 5-10.
19. Varma PK, Theodore S, Neema PK, Ramachandran P, Sivadasanpillai H, Nair KK, et al. Emergency surgery after percutaneuos transmitral commissurotomy: operative versus echocardiographic findings, mechanisms of complications, and outcomes. J Thorac Cardiovasc Surg 2005; 130(3): 772-76.
20. Eseo MR, Wisenbaugh T, Skoularigis J, Middlemost S, Sareli P. "Mitril regurgitation following mitral balloon valvotomy. Differing mechanisms for severe versus mild-tomoderate lesions," Circulation 1991; 84(4): pp.1669–79.
21. Srimat MJ, Venkata BJ, Sadagopan T, Ramamurthy MT. Immediate, intermediate and long term clinical outcomes of percutaneous transvenous mitral commissurotomy. IJC Heart Vascul 2015; 6(1): 66-70.