

# LONG TERM ECHOCARDIOGRAPHIC FOLLOW UP OF PERCUTANEOUS TRANSVENOUS MITRAL COMMISSUROTOMY (PTMC)

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## ABSTRACT

**Objective:** This study was conducted to report the local experience of long-term echocardiographic follow up of Percutaneous Transvenous Mitral Commissurotomy in symptomatic severe mitral stenosis (MS) patients.

**Material and Methods:** We conducted this retrospective computer data base echocardiographic study of symptomatic severe MS patients (who underwent PTMC from 1992 to 1995 in our cardiology unit) to evaluate the immediate and long term echocardiographic results of PTMC in 269 patients. We did transthoracic and Transoesophageal echocardiographic study of all symptomatic severe Mitral stenosis patients. Those patients who were found eligible and underwent PTMC were selected for the study. Total of 269 patients were evaluated.

**Results:** Female constituted 67.7% and Male were 32.3% of total patient population. The mean age of patients was 27.51 $\pm$ 7.82 years. Mean Mitral valve area on day one increased from  $<1.0\text{cm}^2$  to  $>1.5\text{cm}^2$  in 72.9% of patients. At four years the mean area was  $1.4\text{cm}^2\pm 0.10$  (p=NS). Peak and mean Mitral valve gradients increased from 10.07mmHg  $\pm$ 4.59 at day one to 14.57mmHg  $\pm$ 6.66 at four year (p=NS). Mean MVG was 6.31 $\pm$ 3.50mmHg on day one and 10.29 $\pm$ 5.62 at four years (p=NS). Mean right ventricular systolic pressure post PTMC was 46.35 $\pm$ 14.35mmHg and decreased to 13.50 $\pm$ 30.37 mmHg (p=0.120) at four years. The RV size was found to decrease from 2.16 $\pm$ 0.48cm to 1.7 $\pm$ 0.45cm at four years (p=NS). The LA size did not change much (from 4.15 $\pm$ 0.59 cm to 4.24 $\pm$ 0.43, p=NS) Very few patients (2.2%) developed significant restenosis (MVA  $< 1.0\text{cm}^2$ ).

**Conclusion:** The study shows that PTMC is an effective and safe method to relieve MS and it improves the haemodynamics and the results are sustained over prolonged period.

**Key words:** Percutaneous, Mitral commissurotomy, Echocardiographic, Long Term follow up

## INTRODUCTION

Rheumatic heart disease is the most common cause of Mitral valve stenosis in our country. Children and young adult age group constitute the largest part of such patients.

Patients with Mitral stenosis of milder degree show no or minimal symptoms for many years. Some of these patients develop symptoms at later stage of life but those with moderate to severe disease present with severe disability if their valvular stenosis is not relieved mechanically. In untreated patients the pathological process culminates into congestive heart failure. Valvotomy should therefore be carried out in all symptomatic patients in order to not only prevent complication of the disease process but also to halt the deterioration of haemodynamics<sup>1</sup>.

Mechanical relief of stenosed valve has been done via closed surgical Mitral valve Commissurotomy (CMV). But the newer techniques which make use of balloons and metallic valvotome have shown promising results and have largely replaced the older surgical technique because the former method is less traumatizing, the hospitalization period is shorter, patient is able to go home on the same or next day, the procedure can be repeated if required and the results are more predictable than CMV<sup>2,3</sup>.

Balloon Mitral Commissurotomy results are especially impressive in younger patients who have no or minimal valvular thickening and calcification<sup>4</sup>. The elevated pulmonary

vascular resistance decline rapidly, although usually not completely in all cases<sup>5,6</sup>. The reported mortality rates have ranged from 1 to 2 percent in some studies<sup>1</sup>. Complications include cerebral emboli, cardiac perforation with tamponade, and severe acute Mitral regurgitation (MR) requiring emergency surgery in 2% of cases due to excessive valvular dilatation<sup>1</sup>.

After balloon dilatation of Mitral valve patients are usually followed non-invasively by serial echocardiographic examinations to assess the effects on pulmonary artery pressure, restenosis and quality of life.

The purpose of our study is to report the local experience of long term echocardiographic follow up of (PTMC).

## MATERIAL AND METHODS

This is a retrospective computer data base study conducted in the Department of Cardiology PGMI Govt Lady Reading Hospital Peshawar. Cases treated from 1992 to 1995 were included in this study.

Trans thoracic 2-D echocardiography with CW and Colour Doppler and Transoesophageal echo (TEE) was done in each case to assess the severity of Mitral stenosis and document presence or otherwise of left atrial (LA) and Left atrial appendage clot.

The echocardiographic study was done with GE 680 Colour Doppler system and recorded on VHS videotapes for review.

TEE was done on Aloka colour Doppler system. Two experienced echo cardiographers carried out the echo study and the data was re-analyzed by a senior consultant cardiologist.

The data of all those cases was analyzed who were having symptomatic severe Mitral stenosis (MS) and had undergone PTMC successfully and were alive and available for the follow up at the end of four years.

The selected patients had pre PTMC Mitral valve area  $< 1\text{cm}^2$  with no LA /LAA clot. Those patients with moderate to severe mitral regurgitation were excluded from the study. Stepwise dilatations of MV were done with Inoue Balloon till the waist of balloon (produced by stenosed Mitral valve) disappeared and optimal Mitral valve gradient was achieved<sup>7,8</sup>. The size of balloon was selected on the basis of formula of height of the patient and stepwise dilatations were done. According to this method the height of patient in centimeters was rounded to nearest zero and divided by 10. To this ratio 10 is added. The answer is the size of balloon required for this particular patient<sup>8,9</sup>. After PTMC left atrial (LA) size, fractional shortening, right ventricular(RV)size, Mitral regurgitation(MR), RV systolic pressure, 2-D Mitral valve area , Doppler Mitral valve area , and Mitral valve gradient ( peak and mean) were recorded on day one and then at six monthly interval up to four years.

All data was entered and analyzed by the statistical software package SPSS 8.0 for Windows. Paired t test was used for analysis of mean and a p value of  $< 0.05$  was considered significant statistically.

## RESULTS

Total of 269 patients were studied. Females were 182(67.7%) and Males were 87(32.3%). The mean age of patients was  $27.51 \pm 7.82$  years. Mean Mitral valve area

immediately after PTMC of  $> 1.5\text{cm}^2$  was obtained in 196 patients (72.9%) on day one. Mitral valve area of  $< 1.5\text{cm}^2$  after PTMC was seen in only 73 patients (27.1%). The increase in valve area was maintained at four years i.e. MVA of  $1.4\text{cm}^2 \pm 0.19$  (p = NS). The Doppler valve area was  $1.7 \pm 0.427\text{cm}^2$  on day one and it did not deteriorate significantly after four years of follow up it was  $1.5 \pm 0.369\text{cm}^2$  (p=NS).

The Peak Mitral valve gradient post PTMC on day one was  $10.07 \pm 4.59\text{mmHg}$ , which was  $11.73 \pm 5.17\text{mmHg}$  at two years (p=0.75) and was  $14.57 \pm 6.66$ , at four years (p=0.357)

The Mean Mitral valve gradient at day one was  $6.31 \pm 3.50\text{mmHg}$  and it increased to  $10.29 \pm 5.26$  (p=0.816) at the end of four years follow up.

The Mean RV systolic pressure post PTMC at day one was  $46.35 \pm 14.35\text{mmHg}$  and it declined to  $13.50 \pm 30.37\text{mmHg}$ , (p=0.120) at end of follow up time.

The right ventricular (RV) size was  $2.16 \pm 0.48\text{cm}$  on day one after the valvotomy and it remained the same at first six-month follow up. The RV size further decreased to  $1.7\text{cm} \pm 0.45$  at the end of four years (p= 0.410).

The left atrial (LA) size almost remained the same at last follow up  $4.15 \pm 0.59\text{cm}$  and  $4.24 \pm 0.439$  on day one and at four

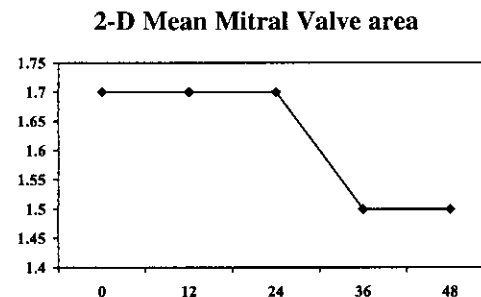


Fig. 1

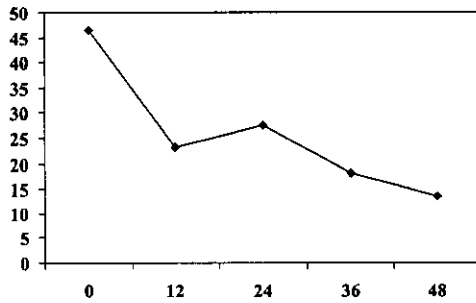
**RVSP (mmHg) Over 4 Years followup**

Fig. 2

years respectively  $p=0.729$ , the change in LA size was not significant statistically.

Significant restenosis was seen in only six patients (2.2), who had MVA  $<1.0\text{cm}^2$  at the end of four years. An area of  $<1.0\text{cm}^2$  at a follow-up study was defined to be restenosis and any valve area  $>1.5\text{cm}^2$  was categorized as mild and a satisfactory result.

## DISCUSSION

Out of 269 study patients majority are female (67.7%) as compared to 32.3% male. There was no selection bias.

In order to evaluate the long term effects of PTMC we have analyzed the data of all patients up to four years and our Echocardiographic follow-up period is comparable to other studies, such as that of Fumihiko<sup>10</sup> in which the mean follow up was  $6.1\pm 1.4$  years. Turi GZ followed their patients for 4 years and their results are similar to our study<sup>11</sup>. In series of Cohen the follows up period was 5 years.

Our study shows very low restenosis rate and only 3% of patients had MVA  $<1.0\text{cm}^2$  and 79% of patients had MVA of  $>1.5\text{cm}^2$  at the end of four years follow up. Similarly Fumihiko have shown preservation of MVA ( $>2.0\text{cm}^2$ ) after PTMC in 95% of their cases at the end of 6 years of follow up.

The late follow up results of preservation of MVA in our patients are also comparable to the results of one North American study<sup>12</sup>. In the same study the average age of the patients is higher than our patients. The mean age of our patients was  $27.51\pm 7.82$  where as in the European series of Pan the average age of patients was 46 years. Since rheumatic fever is common among our children and adult age group, we receive younger patients, where as in western countries rheumatic fever has become less prevalent and only previously affected people present with rheumatic heart disease at older age. The results of PTMC are much better in younger age group because these patients have less valvular and subvalvular fibrosis and calcification.

In very elderly patients the valves become deformed and less suitable for balloon dilatations. Moreover in advanced age the LV function also decline due to chronic rheumatic carditis which adversely affects overall outcome of the procedure.

The parameters evaluated in our study are slightly different from reference study of Fumihiko. We mainly focused on the echocardiographic parameters of our follow-up patients whereas in study of Fumihiko other clinical parameters such as MVR, CHF, thromboembolism, death and combined events were also addressed.

The rate of serious complication in our study is very low and only 0.8% of our patients had severe or grade III MR after balloon valvotomy. This low incidence of MR is attributable to the technique of stepwise dilatation of MV and selection of patients with suitable valvular anatomy for balloon dilatation<sup>8</sup>.

The improvement in haemodynamics in our patients in term of decrease in RV size and RV systolic pressure and improvement in pulmonary function is comparable to the study of T.Yoshioka<sup>6</sup>. The relief of me-

chanical obstruction of Mitral valve(MV) is considered to be the main determinant of RV dilatation and raised pulmonary artery pressure. The improvement in pulmonary functions is related to improvement in RV function after valvotomy. Valvotomy reduces the obstruction to the blood flow from LA to left ventricle hence reducing the LA pressure and this in turn relieves the pulmonary venous congestion. Fall in pulmonary venous pressures in the long run eliminates the right ventricular after load which in turn improves the RV function<sup>6</sup>.

With the passage of time the sustained reduced after load to RV results in further reduction in pulmonary artery and RV systolic pressures, the phenomenon seen at later dates during our follow up. This reduction in RV pressure translated in reduction of right ventricular pressure (RVSP) from 46+/-14.35 mmHg on day one to 13.50+/-0.45 mmHg at the end of four years (p=0.81).

The decrease in progressive LA enlargement after PTMC (due to the mechanical relief of mitral valvular obstruction was observed and suggest satisfactory results in our study<sup>6,13</sup> (p=NS).

Failure to relieve valvular obstruction results in persistently raised RVSP and results in advanced right heart failure. It dictates that early intervention to relieve the mitral stenosis helps to prevent or delay the consequences of the disease process in rheumatic patients and this has been proved by several studies.

The balloon dilatation in our cases resulted in immediate decrease in peak mitral valve gradient of 10.07+/-4.5 mmHg and it did not increase significantly after four years of follow up (14.57+/-6.66mmHg, (p=NS). The mean mitral valve gradient also did not increase significantly over follow-up period (6.31+/-3.50 mmHg to 10.29+/-5.62 mmHg, p=NS). Minor difference in valvular gradi-

ents on day one and end of four years, are indicative of well sustained effects of balloon valvotomy.

Mean MVG was reported to decrease from 8+/-2 to 4+/-1 by T.Tamai and his workers which indicate that valvotomy results were well sustained and our results are comparable to the quoted study.

J.Tamai and his co workers<sup>14</sup> studied the post valvotomy haemodynamics at rest and during exercise, whereas we evaluated these parameters only during resting state. In both our and reference study CW Doppler was used for non invasive evaluation of mitral flow dynamics.

The other Western and Japanese studies also evaluated, resting, exercise haemodynamics, and other clinical end points such as thromboembolism, congestive heart failure, need for mitral valve replacement, death and all combined end points.

We also suggest to extend our research work to other clinical end points used in reference studies so that broader aspects of our scientific work in the related subject are known to us. In some of the results despite of notable improvement the insignificant P value is due to lesser number of patients available at the end of follow up period.

## CONCLUSION

Our data indicates that the mean age of our population is lesser than that of western countries and that rheumatic valvular heart disease is rampant in our paediatric and adult age group.

It is evident from our data that PTMC is a suitable and effective procedure and its benefits are sustained over longer period of time and the restenosis rate is very low in our long term follow up.

## REFERENCES

1. Lynette A, Yakes. Follow up of 201 PTMC cases over 11 years at Monash Med Centre Australia Heart. Lung and Circulation, 2001;10,83-85.
2. Vahanian-A; Michel -PL . Results of PTMC in 200 patients. Am J Cardiol.; 1989 63: 847-52.
3. Sharma S, Nair. "Is it good time to say good bye to thoracotomy for treatment of Rheumatic Mitral stenosis" JPGM, 1992. 38(1) 2-4,
4. Takahide ito, Michihiro : Comparison of Immediate and long Term out come of PTMC Jpn.Circ.Jr. 1997,61:218-222.
5. Colin, Patrice. Improved effective arterial elastance after PTMC. J. Applied. Physiology 1997 83(4):1083-1089.
6. T. Yoshioka N. Improvement in pulmonary function in MS patients after PTMC. Chest, 1990, 98, 290-294.
7. Inoue K, Okawi T. Application of PTMC by a new balloon catheter. Jr. Thorasic Cardiovascular Surgery; 1984, 87:394-402.
8. Gao; Immediate and Long Term results of PTMC with Inoue Balloon with use of simple Height derived sizing stepwise dilatation method. Research; 1996; 71: 556-563.
9. Lan KW. Hung JS: A simple balloon sizing method in Inoue Balloon PTMC. Cathet. Cardiovasc. Diagn, 1994; 33:120-129
10. Fumihiko, Saeki MD Long Term clinical and Echocardiographic outcome in MS treated with PTMC. Japn. Circ. Jrn 1999. 63, 597-604,
11. Turi GZ; Percutaneous Balloon Valvotomy versus surgical closed commissurotomy for MS, a prospective randomized trial: Circulation. 1991; 83:1179-1185.
12. J S N Murthy, S Thanikachalam Catheter Interventions in Valvular Obstruction and Long Term Results. JIMA 2003;2: 101.
13. Tylor, Francisl. Poor EF pre op in PTMC shows poor valvotomy results. Int J of Cardiovasc. Interventions 2004; 5: 4.
14. J. Tamai S, Nagat. Improvement in Mitral valve flow dynamics during exercise after PTMC evaluation with CW Doppler. Circ. 1990; 81: 46-51.

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