PERCUTANEOUS BALOON VALVOTOMY IN PATIENTS WITH MITRAL STENOSIS WITH FAVORABLE ECHOCARDIOGRAPHIC SCORE

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ABSTRACT

Objective: To determine the short term and three months' echocardiographic outcomes of percutaneous mitral balloon valvotomy (PMBV) in mitral stenosis patients with low Wilkin's score in a medical teaching institution.

Methodology: This descriptive study was carried out at the Department of Cardiology, Lady Reading Hospital, Peshawar. Patients of all ages and both genders, with isolated mitral stenosis or with ≤ grade II mitral regurgitation, with Wilkin's score ≤ 8 and giving an informed consent to the procedure, were included in the study by non-probability consecutive sampling technique. Echocardiography was performed before, after and three months of the procedure (PMBV).

Results: Total number of patients were 141 and mostly were females (69%). Mean age of patients was 22.69 ±7.93 years. Mean Wilkin's score was 5.7 with a range of 2-8. We observe improvement in mitral valve area, pulmonary artery pressures, mitral valve gradient and left atrial volume in 94.3%, 97.9%, 100% and 97.9% of patients respectively. Worsening of mitral regurgitation occurred in 6.32%. After three months of follow up, the improvement in mitral valve area (from 0.86 ± 0.07 to 1.86 ± 0.34) was quite significant with p value of <0.001.

Conclusion: Percutaneous mitral balloon valvotomy was a safe procedure in patients with favorable Wilkin's score in terms of improvement in mitral valve area, left atrial volume, pulmonary artery pressure and improvement in mitral valve gradient. There were very less chances of worsening of mitral regurgitation.

Key Words: Mitral stenosis, Percutaneous mitral balloon valvotomy, Wilkin's score, Outcome

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INTRODUCTION

Prevalence of rheumatic heart disease (RHD) is more in developing countries including Pakistan and mostly affecting school going age. Its prevalence ranges from 5.7/1000 in rural regions to 22/1000 in urban areas of Pakistan[1]. About one third of patients with rheumatic fever develop rheumatic heart disease. It involves different cardiac valves including mixed mitral valve disease (both mitral stenosis and regurgitation) in 30% cases and isolated mitral stenosis in 28% cases. Other valves like aortic and tricuspid are less commonly involved and pulmonic valve is affected rarely[2].

Percutaneous mitral balloon valvotomy (PMBV) has been practiced in patients with stage C2 and stage D mitral stenosis patients in place of closed and open surgical mitral valvotomy and mitral valve replacement since 1984. It produces significant change in mitral valve morphology. Consequently, increase in mitral valve area and non-worsening of mitral regurgitations is successfully achieved in 82% of patients and improvement occurs in leaflets mobility[3].

Clinically important mitral regurgitation (MR) after PMBV is a grave complication of the procedure which seems to be reduced or remain the same during follow up. In one third of patients, grade 3-4 mitral regurgitation is observed[4]. It has been reported that PMBV can be performed both in low and grey zone Wilkin's score successfully, with clinical and echocardiographic improvements[5,6]. Studies shows different parameter for PMBV success. These include young age, mild MR, no LA/LAA clot and no previous mitral valve surgery[7].

The aim of our study was to determine the short term and three months' echocardiographic outcomes of percutaneous mitral balloon valvotomy in patients with mitral stenosis with low Wilkin's score in a medical teaching institution. Being endemic area of RHD, very little local data is available in such type of patients. The idea behind doing this study developed in our mind while carefully doing the literature search and we found that most of the published data is on Wilkin's score of less than 9 throughout the globe at most places. We are doing quite good number of procedures but did not studied the outcomes based on Wilkin's score. We considered the outcome of PMBV in patients having a lower Wilkin's score to contribute to the research data in such type of patients from an endemic population of RHD and re-evaluated these patients at 3 months after PTMC. It will not only help us to choose specific patients for procedures but also avoid burden on cath. lab as well as reduce the morbidity and mortality in patients. After publishing local data, we will be able to enhance our procedures in more systematic order and also share it at international level.

METHODOLOGY

It was a descriptive study conducted at the Department of Cardiology, Lady Reading Hospital, Peshawar. It was carried out from January 2014 to September 2014 with a duration of eight months. Patients of all ages and both genders, with isolated mitral stenosis or with ≤ grade II mitral regurgitation, with Wilkin's score ≤8 and giving an informed consent to the procedure, were included in the study by non-probability consecutive sampling technique.

All patients were admitted to Cardiology Unit and subjected to detailed history followed by thorough clinical examination. Relevant investigations including ECG and echocardiography was done. Patients of mitral stenosis were diagnosed on transthoracic echocardiographic assessment on planimetry and color doppler methods. Mitral stenosis was graded as severe when mitral valve area was 1.0 -1.5 cm^2 and very severe when mitral valve area was <1.0 cm^2. Mostly stage D severe symptomatic patients were included in this study while some of the patients were in stage C2. Trans-esophageal echocardiography was performed to role out LA/LA appendage clot and quantifying mitral regurgitation (MR). An assessment was made to know the grade of mitral regurgitation using transthoracic echocardiography machine before PMBV. Color Doppler was used for quantification of MR by calculating the ratio of mitral regurgitation jet to left atrial area[8].

Short term echocardiographic outcomes were defined as improvement in mitral valve area, severity of mitral regurgitation and improvement in pulmonary artery pressure. Mitral valve area measured more than double the original area post PMBV by direct planimetry at the parasternal short-axis view on color Doppler echocardiography were considered improvement in mitral valve area. Decrease in pulmonary artery systolic pressure >7mm Hg from baseline after PMBV was taken as improvement, estimated by continuous wave Doppler echocardiography using the modified Bernoulli equation [4x (peak tricuspid regurgitant jet velocity)2] and 10 mmHg was added for the estimated right atrial pressure. The morphological features of the mitral valve were categorized as described by Wilkin, and the total echocardiographic score was obtained by adding the scores for leaflet mobility, thickness, calcification, and sub-valvular lesions. Every category got a score of 0-4 having a maximum score of 16 when combined.

The procedure (PMBV) was performed by an experienced cardiologist through femoral vein under local anesthesia. A pigtail catheter was passed to aortic root to know the pressure as well as to use as a guide for septal puncture. Innova balloon was used to open the mitral valve. Balloon sizing was performed by measuring height of the patient in centimeters divided by 10 and then 10 was added to the result value. It was defined as post procedure mitral regurgitation of grade ≥ +3 or +4 quantified by color Doppler transthoracic echocardiography (Acuson CV 70 Siemens) using MR jet to left atrial (LA) area ratio.

The collected data were stored and analyzed in SPSS version 14 for windows. Mean ±SD were calculated for numerical variables like age and body mass index (BMI). Frequencies and percentages were calculated for categorical variables like gender and short term echocardiographic outcomes. Pre and post PMBV mitral valve area and pulmonary artery pressure were compared by applying paired sample t-test and p value of 0.05 were taken as significant. Three months' echocardiographic outcomes were stratified among age, gender and baseline Wilkin's score to see the effect modifications. All results were presented in the form of tables.

RESULTS

Total number of patients included in the study were 141. Females were predominant (69%) and mean age was 22.69 ±7.93 years. Atrial fibrillation was reported in 10.5%. Mean Wilkin's score was 5.71 (2-8). Demographic and clinical details are shown in Table 1.

Improvement in mitral valve area and pulmonary artery pressure were reported in 94.3% and 97.9% of patients respectively; while worsening of mitral regurgitation was noted in 6.32% (Table 2).

After three months of follow up, the improvement in mitral valve area (from 0.86 ± 0.07 to 1.86 ± 0.34) was

Table 1: Baseline Characteristics of study participants (n=141)

Characteristics	Mean ± SD, n (%)
Age (Years)	22.69 ± 7.93
BMI	19.81 ± 2.89
Wilkin's Score	5.71 ± 1.3
Males	44 (31%)
Females	97 (69%)
Atrial Fibrillation	17 (10.5%)

Table 2: Short term outcomes of PMBV

Outcomes of PMBV	Yes	No
Improvement in Mitral Valve Area	94.3% (n=133)	5.7% (8)
Improvement in Pulmonary Artery Pressure	97.9% (n=138)	2.1% (n=3)
Improvement in Mitral Valve Gradient	100% (n=141)	0%, (n=0)
Improvement in Left Atrial Volume	97.9% (n=138)	2.1% (n=3)
Worsening of Mitral Regurgitation	6.38% (n=09)	93.62% (n=132)

Table 3: Outcomes after three months of PMBV in mitral stenosis patients

Outcomes of PMBV	Pre-PMBV (Mean ± SD)	Post-PMBV (Mean ± SD)	P Value
Mitral Valve Area	0.86 ± 0.07	1.86 ± 0.34	<0.001
Pulmonary Artery Pressure	51.45 ± 10.64	33.58 ± 8.36	<0.001
Mitral Valve Gradient	14.56 ± 1.62	6.21 ± 1.47	<0.001
Left Atrial Volume	59.97 ± 5.54	41.40 ± 5.37	<0.001

quite significant with p value of <0.001. Improvement in other parameters like pulmonary artery pressure, mitral valve gradient and left atrial volume are shown in Table 3.

DISCUSSION

Percutaneous mitral balloon valvotomy (PMBV) has long been considered as the first line therapy for patients with mitral stenosis. It always has a much better outcome in patients with a lower Wilkin's score. Patients with RHD present at an earlier age in our setup as compared to the developed world[1]. That's the reason for a younger mean age of 22.69 ±7.93 in our study; however, it was comparable with other studies done by Ahmed et al7 and Gul et al[9].

We studied the outcome of PMBV in patients with mitral stenosis. Improvement in the area of mitral valve occurred in 94.3% of our patients. The high success rate in our study was attributable to the high number of PMBV done in our center by experienced operators. This higher success rate is also reported in other studies done at local and international levels like Gul et al[9] and Alkhalifa et al[10]. This significant improvement was noted when we re-evaluated these patients after 3 months with echocardiography with a significant p value of <0.001, which was almost comparable with other studies like that done by Park et al[8].

Another important predictor of successful PMBV in patients with mitral stenosis was improvement in pulmonary artery (PA) pressure. We found improvement in PA pressure in 97.9% patients. This decline in PA pressure was noted also at 3 months follow up in these patients. This outcome of improvement in PA pressure was better than some studies like that of Ahmed et al[7] while comparable with others like Gul et al[9] and Ekinic et al[6]. The lower Wilkin's score and younger mean age was the main reason for a better outcome in terms of improvement in PA pressure in our study. Measurement

of the mitral valve gradient is an important step to be considered in patients undergoing PMBV for mitral stenosis. We noticed an improvement in mitral valve gradient in all (100%) patients of our study. The same effect was observed when we re-evaluated these patients at 03 months follow up. Other studies like Ekinic et al[6], Ahmed et al[7] and Gul et al[9] have come up with the comparable results with our study.

Improvement in left atrial (LA) volume is also a good indicator of successful PMBV. We found an improvement in in LA volume in 97.9% patients in our study and the finding persisted at 03 months follow up. This finding was in accordance with the study done by Jehangir et al[11] who actually studied the effect of PMBV on left atrial electromechanical delay and found a significant improvement in LA volume after PMBV with a significant p value as we noted in our study.

Development of either new mitral regurgitation (MR) or worsening of a preexisting MR is an established complication in patients undergoing PMBV for mitral stenosis. Factors contributing to this complication are the presence of preexisting MR, abnormal cusps coaptation, stretching of the valve annulus and excessive commissural splitting[8,12]. In our study we noted this complication in quiet a high number (6.38%) of patients. However, these results are quiet comparable with the data available from other studies done at local level like Ahmed et al[7] and international level like Park et al[8] and Essop et al[12].

Measures can be taken to reduce the frequency of this complication like selection of proper Balloon size for a particular patient and cautionary dilatation especially in patients with preexisting MR. Same reason was also mentioned by Gul et al[9] and Lau et al[13] who reported frequency of MR in these patients in 3.4% and 0% respectively. Emergency surgery is not routinely required in these patients developing severe MR, although studies suggest strict follow up and the need for surgery at some stage in their life especially if the reason for MR is the non-commissural splitting of the mitral valve leaflets[14]. The patients in our study who developed severe MR after PMBV, tolerated it quite well and the need for emergency surgery didn't arise. They were re-evaluated at 03 months follow up as well and most of these patients were found to be tolerating this complication well.

CONCLUSION

Percutaneous mitral balloon valvotomy was successful in patients with mitral stenosis having favorable Wilkin's score. There was significant improvement in mitral valve area, pulmonary artery pressure and left atrial volume. Worsening of mitral regurgitation was significantly lower.

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CONTRIBUTORS

MAR conceived the idea, planned the study, and drafted the manuscript. MAK, AA, S, NK and MH helped acquisition of data, did literature search and statistical analysis. AMG and MH critically revised the manuscript and supervised the study. All authors contributed significantly to the submitted manuscript.