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Study of Efficacy of Balloon Mitral Valvotomy in Juvenile Rheumatic Mitral Stenosis

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Abstract

Aims: The objective was to study the clinical, echocardiographic and haemodynamic profile of juvenile rheumatic mitral stenosis (age 20 years), both before and immediately after balloon mitral valvotomy and also to evaluate the safety and efficacy of the procedure in juvenile patients. *Methods:* Forty juvenile patients aged 20 years or younger were analysed who underwent balloon mitral valvotomy using Accura balloon in our institution. The procedure was successful in all the patients. The clinical, echocardiographic and haemodynamic parameters were compared pre and post-balloon mitral valvotomy. *Results:* New York Heart Association functional class was II and III in 62.5% and 37.5% respectively. Atrial fibrillation was not seen in the juvenile group. Mitral valve deformity asper Wilkins Score was 8.57±0.67. Mitral valve area index by 2D echo was 0.62 ± 0.097 cm2/m2 and was larger (1.38 ± 0.19) after the procedure (p value < 0.0001). Mitral valve gradient (19.85±7.31 mm hg) and mean PASP (70.15±19.2 mm hg) was higher before balloon mitral valvotomy, after balloon mitral valvotomy the values were 7.45 ± 2.57 (P < 0.001) and 40.48±10.30 respectively (p = 0.0001). The mean value for left atrial pressure was 27.48±6.02 and 14.95±5.92 both pre and post-balloon mitral valvotomy (P value 0.0001 and 0.0001 respectively). The procedural success was 95%. *Conclusion:* Balloon mitral valvotomy is safe and effective in young with rheumatic mitral stenosis and provides better immediate results.

Keywords: Valvuloplasty; Accura Balloon; Mitral Valve; Atrial Fibrillation.

Introduction

Severe rheumatic heart disease is rarely seen in children and adolescents in developed countries whereas it is still endemic in developing countries. Rheumatic mitral stenosis in India commonly affects children and young adults less than 20 years old (Juvenile Mitral stenosis) [1–3]. Severe Mitral stenosis is often present with frequent episodes of pulmonary oedema requiring interventional procedures or surgical management [1–5]. Until the mid–1980s, surgical closed or open valvotomy was the only available treatment. However, the drawback of the disease itself was necessity of reintervention may be after 10 to 15 years. In adults, balloon mitral valvotomy yielded similar results to those obtained after open mitral valvotomy [6,7] and better results than those obtained after closed mitral valvotomy [6]. As this procedure has been extensively used in adult and elderly patients, there is not much published data in juvenile patients. Thus, the purpose of this study was to evaluate the immediate results of balloon mitral valvotomy in patients 20 years or younger.

Methods

Study Population

Clinical Characteristics

Forty consecutive juvenile patients with severe rheumatic mitral stenosis who underwent balloon mitral valvotomy in our institution between October 2011 and November 2012 were included in the study. The baseline characteristics are shown in Table 1. Patients were having NYHA class II (no. 25, 62.5%)

and III (no. 15, 37.5%) symptoms prior to the procedure. Mean age was 16.98±3.22 years (range 10-20). There were no patients with atrial fibrillation, all had sinus rhythm.

Echocardiographic Evaulation

All patients underwent a 2D Echo-Doppler examination before the procedure. Mitral valve structure was assessed using Wilkins score [8] (Table 1).

Table 1:

Baseline characteristics	Juvenile group (N = 40)
Age (yrs) mean ± SD	16.98 ±3.22
Females	24 (60%)
Atrial fibrillation	0 (0%)
NYHA Functional Class	
≥II	25 (62.5%)
≥III	15 (37.5%)
Left Atrial enlargement	31 (77.5%)
Bi – Atrial enlargement	9 (22.5%)
Wilkins Score	8.57 ± 0.67
Body surface area	1.25

Mitral valve area was determined by 2D echo planimetry. Mitral regurgitation was assessed by colour Doppler using Helmake classification [9] which is based on a scale of 1 to 4 according to the degree of jet extension into the left atrium. Any clots in the left atrium or the left atrial appendage were ruled out by transoesophageal echocardiography. Echo-Doppler examination was repeated 24 hours after the procedure to evaluate mitral valve area, to assess the severity of mitral regurgitation and other parameters.

Mitral Valvotomy Procedure

Informed consent was taken from all the patient or the parents, the procedure was performed under local anaesthesia. Right and left heart catheterisation was done. Before and after the procedure Intracardiac pressures were taken in all the patients. Transseptal puncture was performed using a Brockenbrough needle (Medtronic, USA) and Mullins sheath (Medtronic, USA). Optimal size of Accura (Vascular Company Limited, Doddaballapur, Karnataka, India) balloon was decided according to the height of the patient (height (cm)/10) + 10 mm = recommended balloon size). Diluted contrast was used to inflate the balloon. Serial dilatations was done starting with balloon size 2 to 4 mm less than the recommended balloon size and upgraded till optimal result obtained.

Statistical Analysis

Descriptive statistical analysis has been carried out in the present study. Results on categorical measurements are presented in number (%) and continuous measurements are presented as mean ± standard deviation. Significance is assessed at 5% level of significance.

Student ''t'' test (two-tailed, independent) has been used to find the significance of study parameters on continuous scale. Chi-square/2x2, 2x4, 2x5 Fisher extract test has been used to find the significance of study parameters on categorical scale. Student ''t'' test (two-tailed, independent) has been used to test the homogeneity samples based on age (or continuous parameters) and Chi-square test to test the homogeneity of samples based on parameters on categorical.

The statistical software (SPSS 15.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0) were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs and tables.

Results

The procedure was successfully completed in all juvenile patients. There was no death noted during the study. Haemodynamic parameters significantly improved as shown in Table 2 (all $p < 0.001$). Mitral valve area increased from 0.8±0.2 to 1.72±0.28 cm^2. Mitral valve area index which was 0.629±0.097 cm^2/m^2, significantly increased to 1.38±0.19 ($p = 0.0001$) (Figure 1). Severe mitral regurgitation was observed in two (5%) patients. Procedural success, defined as a mitral valve area of ≥ 1.5 cm^2, mitral valve are

Table 2: Comparison of Pre-BMV and Post BMV echocardiographic and hemodynamic parameters in juvenile group(mean± SD).

Echo & hemodynamic parameters	Pre	Post	P Value
MVA (cm2)	0.80 ±0.20	1.72 ± 0.28	< 0.0001
Indexed MVA (cm2/m2)	0.621 ± 0.097	1.38 ±0.19	< 0.0001
Mean MV gradient (mm of hg)	19.85 ± 7.31	7.45 ± 2.57	< 0.001
PASP (mm of hg)	70.15 ± 19.2	40.48 ± 10.30	< 0.0001
LAP (mm of hg)	27.48 ± 6.02	14.95 ± 5.92	< 0.0001

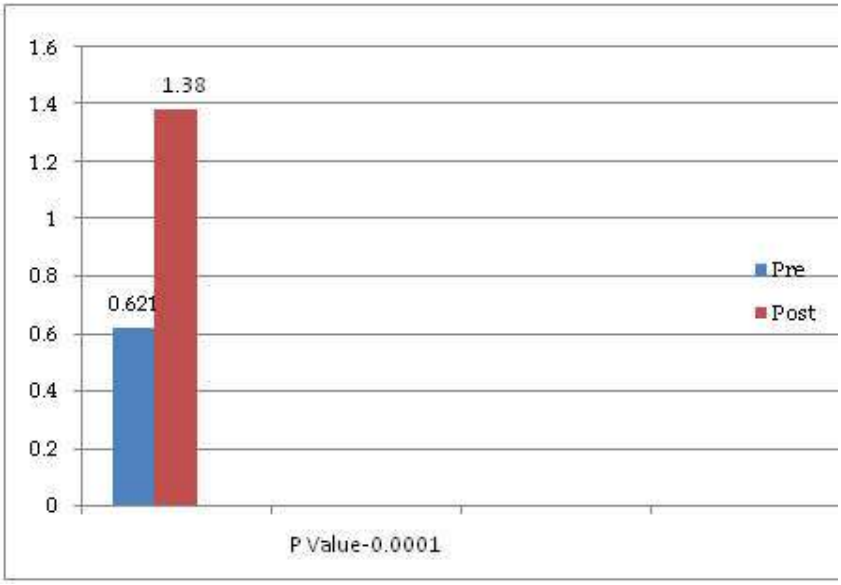

Fig. 1: Mitral valve index area before (pre) and after (post) balloon mitral valotomy.

index ≥ 0.9 cm^2/m^2 and percentage increase of mitral valve area ≥ 50% in the absence of severe mitral regurgitation after the procedure, was obtained in 38 (95%) patients ($p < 0.0001$).

Discussion

The immediate results in juvenile patients were very good with a significantly larger mitral valve area and no significant complications. Following balloon mitral valvotomy the gain in mitral valve area index was statistically significant ($p < 0.0001$). The juvenile group of patients showed larger immediate gain in mitral valve area. Other investigators also have reported similar findings [10,11]. For example, in Gamra et al.'s study [11] the better results in juvenile patients were attributed to smaller left atrial dimensions and more pliable valve which is comparable to our study. Although wilkins mitral valve score was 8.57±0.67, Pliability of the mitral valve was better in our juvenile patients but with more subvalvar disease. Similar severe subvalvar disease was noted in Kothari et al.'s [12] study. No mortality was observed during the study. Procedural success was very good. Similar results were observed by other investigators [11–13]. Choice of balloon size in juvenile patients is not well defined. We used balloon size 2-4 mm less than what is recommended based on adult nomograms. Despite this, severe mitral regurgitation was seen in two patients in our study.

In summary, balloon mitral valvotomy in younger patients is effective, safe, better and the results are excellent. This study extends the observation on safety and efficacy of balloon mitral valvotomy in the juvenile group. Balloon mitral valvotomy results in an increased valve area, symptom relief and decrease in pulmonary artery systolic pressure.

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