Original Article

Subvalvular apparatus and adverse outcome of balloon valvotomy in rheumatic mitral stenosis[☆]

Parag Bhalgat [a,*], *Shrivallabh Karlekar* [a], *Santosh Modani* [a], *Ashish Agrawal* [a], *Charan Lanjewar* [a], *Ashish Nabar* [a], *Prafulla Kerkar* [a], *Nandu Agrawal* [b], *Pradeep Vaideeswar* [c]

[a] Department of Cardiology, King Edward VII Memorial Hospital and Seth G S Medical College, Mumbai 400012, India
[b] Department of Cardiothoracic Surgery, King Edward VII Memorial Hospital and Seth G S Medical College, Mumbai 400012, India
[c] Department of Cardiac Pathology, King Edward VII Memorial Hospital and Seth G S Medical College, Mumbai 400012, India

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ABSTRACT

Background: Balloon mitral valvotomy (BMV) is a well-established therapeutic modality for rheumatic mitral stenosis (RMS). However, there are chances of procedural failure and the more ominous post-procedural severe mitral regurgitation. There are only a few prospective studies, which have evaluated the pathogenic mechanisms for these major complications of BMV, especially in relation to the subvalvular apparatus (SVA) pathology.
Methods: All symptomatic patients of RMS suitable for BMV by echocardiographic criteria in a span of 1 year were selected. In addition to the standard echocardiographic assessment of RMS (Wilkins score and score by Padial et al.), a separate grading and scoring system was assigned to evaluate the severity of the SVA pathology. The SVA score was 'I', when none of the two SVAs had severe disease, 'II' when one of the two SVAs has severe disease, and 'III' when both SVAs had severe disease. With these scoring systems, the outcomes of BMV (successful procedure, failure, and post-procedural mitral regurgitation) were analyzed. Emergency valve replacement was performed depending on clinical situation, and in cases of replacement, the pathology of the excised mitral valves were compared with echocardiographic findings.
Results: Of the 356 BMVs performed in a year, 43 patients had adverse outcomes in the form of failed procedure (14 patients) and mitral regurgitation (29 patients). Forty-one among these had a SVA score of III. The sensitivity and specificity of the MR score was lesser than the SVA score (sensitivity 0.34 vs. 1.00, specificity 0.92 vs. 0.99, respectively). The mitral valvular morphology in 39 patients who underwent post-procedural valve replacements correlated well with echocardiography findings.
Conclusion: It is important to assess the degree of SVA pathology in the conventional echocardiographic assessment for RMS, as BMV would have adverse events when both SVAs were severely diseased.

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1. Introduction

Balloon mitral valvotomy (BMV) is the preferred intervention for rheumatic mitral stenosis (RMS). However, a successful outcome is not seen in all the patients who undergo this procedure as some patients develop varying grades of mitral regurgitation, while some valves do not yield to balloon dilatation; both subsets sooner or later may require a surgical intervention. In this background, the morphology of the diseased mitral valve is the most important predictor of the immediate outcome. Two-dimensional echocardiography (2D-Echo) and color Doppler (CD) evaluation of the mitral valve with scoring methods have been developed for patient selection, so as to exclude those who are most likely to develop failure or severe mitral regurgitation (SMR).[1–12] Surprisingly, only a few studies have addressed the post-procedural problems in a prospective manner; furthermore, very few researchers have correlated the valvular pathology with 2D-Echo findings.[13–15] This study was undertaken to analyze the relationship of echocardiographic and/or pathological features of the mitral subvalvular apparatus (SVA) with reference to adverse outcomes of BMV.

2. Materials and methods

This was a 1-year prospective, observational study, conducted in a tertiary care hospital, and was approved by the hospital ethics committee. All symptomatic patients of RMS who fulfilled the standard clinical and echocardiographic criteria for BMV[11,15] were included. All these patients underwent detailed clinical evaluation, which also included chest X-ray and ECG. In all patients, four independent cardiologists (blinded for pre- and post-procedural recordings) analyzed the 2D-Echo and CD images and inter-observer variation was obtained. The variables assessed included mitral valve score (Wilkins score (WS) and mitral regurgitation score (MR score)[11,15]), mitral valve area (calculated by planimetry and pressure half-time in apical four-chamber view), and baseline and post-procedural mitral, aortic, and tricuspid pathologies (assessed as per European Association of Echocardiography guidelines[17]). Scoring was performed prospectively and outcomes were assessed by all observers. Intra-observer variation was assessed by evaluating the recorded image twice.

In addition to the aforementioned variables, a scoring system based on echocardiographic morphology of SVA pathology was devised. As mitral valve has two SVAs, each was assessed individually in the parasternal long axis, short axis, and apical views. Posteromedial SVA can be imaged in parasternal long-axis view by tilting the probe toward the left shoulder. The SVA pathology was graded as: 1. *Mild*, when multiple, thickened, discrete chordae were visible just below commissures (Fig. 1); 2. *Moderate*, when thickened and fused chordae form two identifiable thick chords below commissure (Fig. 2), and 3. *Severe*, when fused chordae appear as a single, thick chord below the commissure (Fig. 3). Further, SVA scoring was done as follows: Score I where both SVAs have mild to moderate disease, Score II where one SVA has severe disease and the other has mild to moderate disease, and Score III where both SVAs have severe disease.
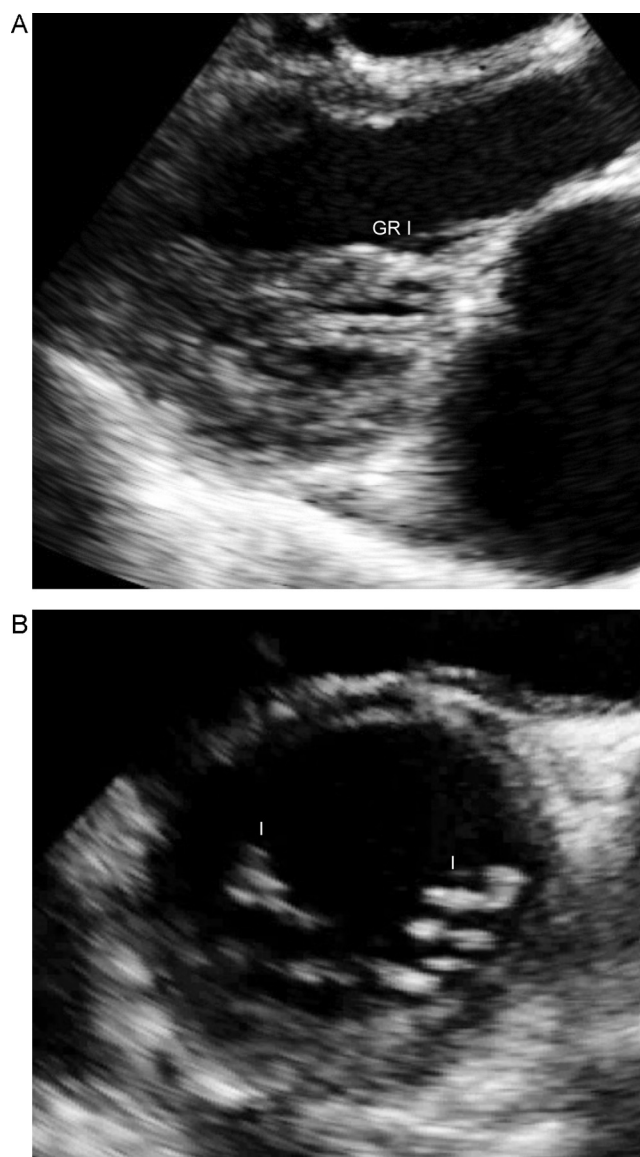

Fig. 1 – Parasternal long-axis (PLAX) (A) and short-axis (SAX) (B) view showing mild SVA pathology (Gr I).

The BMV was performed as per the conventional technique, using the Inoue balloon (Toray Corporation, Japan) (intended balloon diameter in mm = height in cm/10 + 10).[16] Successful BMV was defined when all of the following criteria were met: more than 50% gain in MVA or post-BMV MVA >1.5 cm^2, no more than grade 1 increase in MR or moderate MR, and complete splitting of at least one commissure.

Failure of BMV and SMR were adverse events. Failure of BMV was defined as (1) none of the above criteria were met and (2) there was absence of commissural splitting. SMR following BMV was defined as immediate post-procedural MR that was severe grade.[17] Patients with adverse events underwent valve replacement depending on the clinical status. Excised mitral valves were then compared with echocardiographic findings.

In the statistical analysis, mean and standard deviation was calculated for all continuous variables (age, mitral valve