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Original Article

Effect of balloon mitral valvotomy on left ventricular function in rheumatic mitral stenosis

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ABSTRACT

Aim: Mitral stenosis (MS) is found to produce left ventricular (LV) dysfunction in some studies. We sought to study the left ventricular function in patients with rheumatic MS undergoing balloon mitral valvotomy (BMV). Ours is the first study to analyze effect of BMV on mitral annular plane systolic excursion (MAPSE), and to quantify prevalence of longitudinal left ventricular dysfunction in rheumatic MS.

Methods: In this prospective cohort study, we included 43 patients with severe rheumatic mitral stenosis undergoing BMV. They were compared to twenty controls whose distribution of age and gender were similar to that of patients. The parameters compared were LV ejection fraction (EF) by modified Simpson's method, mitral annular systolic velocity (MASV), MAPSE, mitral annular early diastolic velocity (E′), and myocardial performance index (MPI). These parameters were reassessed immediately following BMV and after 3 months of procedure.

Results: MASV, MAPSE, E′, and EF were significantly lower and MPI was higher in mitral stenosis group compared to controls. Impaired longitudinal LV function was present in 77% of study group. MAPSE and EF did not show significant change after BMV while MPI, MASV, and E′ improved significantly. MASV and E′ showed improvement immediately after BMV, while MPI decreased only at 3 months follow-up.

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Abbreviations: MS, mitral stenosis; BMV, balloon mitral valvotomy; LV, left ventricle; EF, ejection fraction; MAPSE, mitral annular plane systolic excursion; MASV, mitral annular systolic velocity; E′, early diastolic mitral annular velocity; MPI, myocardial performance index; TDE, tissue Doppler echocardiography; RHD, rheumatic heart disease; AF, atrial fibrillation; ROC, receiver–operating characteristics; IVCT, isovolumic contraction time; IVRT, isovolumic relaxation time.

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Conclusions: There were significantly lower mitral annular motion parameters including MAPSE in patients with rheumatic mitral stenosis. Those with atrial fibrillation had higher MPI. Immediately after BMV, there was improvement in LV long axis function with a gradual improvement in global LV function. There was no significant change of MAPSE after BMV.

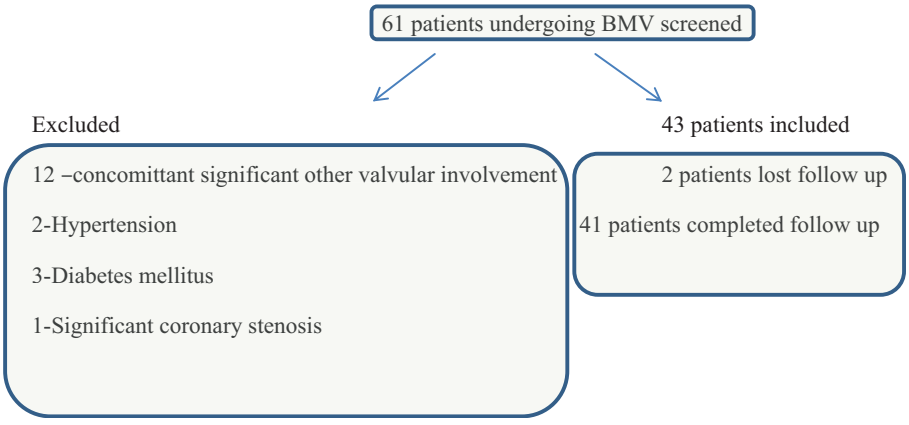
1. Introduction

Left ventricular (LV) dysfunction has been described in mitral stenosis (MS),[1–4] which may be a due to change in interaction between right and left ventricles, myocardial fibrosis or a chronic decrease in preload.[5] Even with normal ejection fraction (EF) (indicating preserved global left ventricular function), there can be impairment in long-axis function (measured by tissue Doppler echocardiography).[6,7] Altered LV long-axis movement has been shown to be a sensitive indicator of early myocardial dysfunction. Atrial fibrillation has shown to cause impairment of LV function. Pulsed-wave Doppler tissue velocities have been proven to be a good tool for assessment of long-axis ventricular shortening and lengthening. There are no previous studies on mitral annular plane systolic excursion (MAPSE) in mitral stenosis and the effect of balloon mitral valvotomy (BMV) on it. The previous studies have utilized myocardial performance index (MPI), mitral annular systolic velocity (MASV), and early mitral annular diastolic velocity (E′). Previous studies have not quantified the prevalence of longitudinal LV dysfunction in rheumatic MS. We sought to study the various echo parameters of LV function in rheumatic mitral stenosis and effect of BMV on these indices.

2. Methods

2.1. Study population

In a prospective cohort study conducted at a tertiary care hospital in Kerala, the southernmost state of India, patients of severe MS undergoing BMV from August 2013 to March 2014 were screened. Patients with more than mild stenosis or regurgitation of other valves, evidence of coronary artery disease (symptomatic, electrocardiographic or angiographic), hypertension and diabetes mellitus were excluded. Of a total of 61 patients screened, 2 had hypertension, 3 had diabetes mellitus, 1 had significant coronary artery disease (underwent PTCA to LAD), and 12 patients were excluded due to more than mild concomitant valve involvement. 20 controls, whose distribution of age and gender was similar to that of patients, were chosen from healthy controls with no cardiac symptoms, good effort tolerance, normal ECG and no structural heart disease undergoing echocardiography. Data were collected after getting informed consent from the patients and institutional ethics committee approval. Study conforms to widely accepted ethical principles guiding human research.



2.2. Echocardiography

Echocardiography was done by Philips HD11 XE system, using probe frequency range of 2–4 MHz. A single investigator did all the echocardiographic evaluation (except for assessing inter-observer variability, where 2 investigators were involved). All echocardiographic measurements were taken as mean of 3 consecutive cycles in those in sinus rhythm and 5 consecutive cycles in AF. Modified Simpson's method was used to assess ejection fraction (after measuring end diastolic and end systolic volumes). Mitral valve area was calculated by planimetry (measurement obtained by direct tracing of the mitral orifice at the leaflet tip, on a parasternal short-axis

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