

Original Research Article

Echocardiography changes in pre and post-operative patients who under gone mitral valve replacement in concerned with left atrial size

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Abstract

Background: The most frequent cause of atrial fibrillation is atrial dilatation resulting from volume or pressure overload of the heart, which may occur in ischemic heart disease, valvular disease, dilated cardiomyopathy, chronic heart failure or, less frequently, due to degenerative, inflammatory or fibrous disease.

Aim of the study: Echocardiography changes in pre and post-operative patients who under gone mitral value replacement in concerned with left atrial size.

Materials and methods: Totally 76 patients were included in the study. The study was conducted in the department of cardiothoracic surgery, Government Mohan Kumaramangalam Medical College Hospital, from 2015-2018. 76 patients underwent isolated mitral two groups were identified based on left atrial size: Group 1 <60 mm ($n=44$) and Group 2 >60 mm ($n=32$). Clinical assessment, preoperative and last postoperative echocardiograms were considered for analysis.

Results: The left atrium decreased by 5.84 mm 10.5 in group 1 compared to 20.9 mm 10.64 in group 2 ($p=0.0001$). This correlated with preoperative mitral valve area ($p=0.009$), preoperative mitral regurgitation ($p=0.000$), and preoperative atrial fibrillation ($p=0.022$). Linear regression analysis revealed atrial fibrillation ($p=0.001$, $b1=6.006$), a high grade of mitral regurgitation ($p=0.001$, $b1=3.812$), and larger size of the left atrium ($p=0.000$, $b1=0.701$) predicted a greater reduction of left atrial size during follow-up. Left atrial size decreased by 28mm in patients with a preoperative left atrium >60 mm (75% sensitivity and 100% specificity).

Conclusion: The asymptomatic left atrium reduces in size considerably after mitral valve replacement, and the decrease is greater in patients with a left atrium >60 mm in size. Surgical treatment of mitral valve disease results in a significant reduction of left atrial size and, in some patients, also in the restoration of sinus rhythm.

Key words

Heart valve diseases, Heart valve prosthesis implantation, Mitral valve, Heart atria, Mitral valve insufficiency.

Introduction

Atrial fibrillation is the most common atrial arrhythmia, with a prevalence of 0.5 to 1% in the population. It arises from non-coordinated depolarization of the atrial myocardium; the atria are in a seemingly chaotic rapid rhythm produced by multiple interlacing wavelets of re-entrant activity [1]. Transmission of impulses to the ventricles through the atrioventricular (A-V) node is irregular and results in an irregular heart rate with a peripheral pulse deficit [2]. The atrium loses its contractile force and the ventricle is deprived of an atrial filling contribution [3]. In the atrium, and especially in its auricle, thrombus formation with a subsequent risk of systemic embolism may occur [4]. The most frequent cause of atrial fibrillation is atrial dilatation resulting from volume or pressure overload of the heart, which may occur in ischemic heart disease, valvular disease, dilated cardiomyopathy, chronic heart failure or, less frequently, due to degenerative, inflammatory or fibrous disease [5]. Excessive LA enlargement can lead to bronchial compression or hoarseness of voice due to compression of the recurrent laryngeal nerve [6]. While operating for correction of mitral valve disease, extremely enlarged LA are reduced surgically. Some surgical groups recommend routine. Mitral regurgitation (MR) has a variety of etiologies and is characterized by an insidious progression [7]. Primary (organic) MR is a disease of one or more components of the mitral valve apparatus, whereas secondary (functional) MR results from geometric disturbance of the left ventricle (LV) in the presence of a structurally normal valve [8]. Resting echocardiography is the most important tool for diagnosing valvular heart disease;

however, the decision for intervention is primarily based on exercise-induced symptoms. Therefore, functional testing is helpful to assess symptoms with exertion, especially in patients with discordance between symptoms and the severity of valve disease [9]. Moreover, mitral valve disease has a dynamic component, being load-dependent or increasing with exercise. Exercise echocardiography may provide the necessary clues in determining changes in cardiac hemodynamics [10].

Materials and methods

Totally 76 patients were included in the study. The study was conducted in the Department of Cardiothoracic Surgery, Government Mohan Kumaramangalam Medical College Hospital, From 2015-2018. 76 patients underwent isolated mitral valve replacement. Two groups were identified based on left atrial size: group 1 <60 mm ($n=44$) and group 2 >60 mm ($n=32$). Clinical assessment, preoperative and last postoperative echocardiograms were considered for analysis. The patients with a post-operative ventricular frequency higher than 90–100/min received amiodarone intravenously to prevent a rapid ventricular response or, when atrial fibrillation was present, to attempt sinus rhythm restoration by medication. The patients with an atrial size less than 50 mm, in whom atrial fibrillation failed to respond to medication, were treated by electrical cardioversion under short-time general anesthesia. After surgery all patients were treated with acenocoumarin; in patients with valve replacement this anticoagulation therapy remained permanent and those with valve repair received it for 3 months. In every patient, cardiac rhythm and left atrial size was evaluated on their

occasions: before surgery (A), on post-operative examination (B) and at one-year follow-up (C). The left arterial size was measured by echocardiography in the parasternal long axis.

Statistical analysis: The data were analyzed using the SPSS V.17. All quantitative data were expressed as mean±SD. The comparison of means was done using the Student t test and the χ^2 test was used to compare proportions. The one-way analysis of variance procedure was used to compute the differences in mean and CI for quantitative data.

Results

There were 2 immediate postoperative deaths, one in each group, thus follow-up of 76 patients was presented. Both of the patients who died had septicemia with multiorgan failure. Immediate post-operative events tended to be higher in group 2: 4(5%) in group 1 vs. 6(16%) in group 2, $p = 0.07$. At the last follow-up, 62 of 76 (79%) patients in group 1 were in AF compared to 28 of 36 (78%) in group 2 ($p =$

0.9). In group 1, 44 of 68 (76%) patients were in NYHA class I compared to 28 of 36 (78%) in group 2. Postoperatively, there was a reduction in LV size in both groups, but to a greater extent in group 2. LA size and right ventricular systolic pressure were significantly reduced in both groups LA size decreased by 5.84 T 10.5 mm in group 1 compared to 20.9 T 10.64 mm in group 2 ($p = 0.0001$). Preoperative LA size had a strong positive correlation with preoperative mitral regurgitation ($r = 0.296$, $p = 0.002$), a strong negative correlation with AF ($r = 0.0541$, $p = 0.000$), and very strong negative correlation with LA size on follow-up ($r = 0.724$, $p = 0.000$). No correlation was detected between LA size and pre-operative mitral valve gradient or right ventricular systolic pressure. The decrease in LA size postoperatively correlated with preoperative mitral valve area ($r = 0.26$, $p = 0.009$), preoperative mitral regurgitation ($r = 0.389$, $p = 0.000$), and preoperative AF ($r = 0.223$, $p = 0.022$) as per **Table - 1**.

Table – 1: Pre- and post-operative echocardiography parameters according to left atrial size.

Variable	Group 1		P value	Group 2		
	Pre-operative	Post-operative		Pre-operative	Post-operative	P value
LVEDD (mm)	46.68 ±9.9	44.60 ±5.40	0.05	56.83 ±11.43	45.90 ±5.80	0.0001
LVESD (mm)	29.54 ±7.40	28.7 ±5.40	0.3	37.86±10.52	29.50 ±4.30	0.0001
LVEF	60.45%±1.90%	59.0%±4.90%	0.03	59.86%±4.77%	60.60% ±2.70%	0.6
LA size (mm)	47.87 ±7.66	41.90 ±8.40	0.0001	67.46 ±6.84	48.20 ±8.80	0.0001

Discussion

The mitral valve (MV) is one of the most challenging structures of the heart with its complex saddle-shaped annulus and multi-scalloped and indented leaflets. Mitral valve regurgitation (MR) and its surgical correction is a Class I indication for two-dimensional (2D) and color Doppler echocardiography. The primary clinical tool for evaluation of the mechanism and severity of MR is echocardiography; however, many patients referred to surgical centers for severe MR by echocardiography have only mild or moderate MR on quantitative evaluation [11]. Because surgery is only indicated in patients with

severe MR, it is imperative to quantify MR severity accurately. In 2003, the American Society of Echocardiography (ASE) and the European Association of Echocardiography (EAE) jointly published recommendations for quantification of valvular regurgitation. In 2010, the EAE published an updated guideline document. The present review aims to summarize those recommendations and to incorporate new data regarding the use of 3-dimensional (3D) echocardiographic parameters to determine MR severity. First, a theoretical framework for understanding the quantitative determinants of MR severity will be presented.

Then, the practical application of various techniques for assessment of MR severity will be discussed, including their strengths and weaknesses [12]. New evidence regarding the use of 3D echocardiography to quantify MR severity will be presented. Although the patients remained in AF with an increase in the absolute number of patients in group 1 with AF, yet there was a decrease in LA size. In rheumatic disease, a giant left atrium is more common [13]. It is considered to be due to the weakness of the atrial wall. However, there is no evidence of Aschoff bodies in biopsies of LA fibrosis, and chronic inflammatory infiltrates are readily witnessed. It was also observed that although the gradient across the mitral valve reduced postoperatively, this did not affect recovery of normal sinus rhythm, but a correlation has been reported in other studies [14]. This difference can be attributed to the rheumatic etiology in all our patients.

LA size of 41.50 mm was associated with AF with 100% sensitivity and 75% specificity in our series. A decrease in LA size from the preoperative level was associated with preoperative mitral valve area, AF, and mitral valve regurgitation. LA size reduced by 28 mm after mitral valve replacement in patients with preoperative LA > 60 mm. Linear regression analysis revealed that AF, a higher grade of mitral regurgitation, and larger preoperative LA size predicted a better chance of reduction of LA size on post-operative follow-up. Our study found a decrease in LA size after 5 years of follow-up, while others have reported a reduction in LA size in the immediate postoperative period, but no further reduction during follow-up [15]. There were more postoperative events in the group with larger LA, but this was not significant. AF was similar in both groups during follow-up. Some reports have advocated a reduction in the size of the LA during mitral valve surgery, even in asymptomatic patients, to help regain normal sinus rhythm [17]. Others have found no significant reduction in LA size, regardless of whether or not plication was performed [16]. It

has been observed that LA enlargement is rarely evidenced in non-rheumatic mitral valve disease. Our study supports the observation that there is a significant reduction in LA size after mitral valve replacement [19]. Furthermore, we found that the reduction in LA size was more profound in patients with larger preoperative LA who were in AF and had high grades of mitral regurgitation [17]. This regression in LA size was observed in rheumatic valvular heart disease with asymptomatic LA enlargement. Atrial fibrillation was observed even in patients with smaller LA sizes and was persistent even with the reduction in LA size during follow-up. Therefore, the left atrium may not require reduction during mitral valve replacement in this group of patients [18, 19, 20].

Conclusion

In conclusion, there is substantial variation in the frequency of TTE assessment of MR among different physicians even after adjustment for patient factors. Ordering TTEs too frequently may reduce value in echocardiography, and not ordering TTEs often enough may lead to poor patient outcomes because of ventricular remodeling. We think these findings offer opportunities to improve both quality and value in echocardiography. In our study, provider-related variation is associated with specialization and provider experience, which are fortunately practical targets to minimize unwanted variation in patient care. These results may provide guidance for tactics to improve quality and value in the care of patients with MR and suggest the need for further investigation into the causes of practice variation.

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