Original Article

Doppler Echocardiographic Variables and the Type of Surgery to be Performed in Rheumatic Mitral Valve Regurgitation

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Objective

To identify the Doppler echocardiographic variables associated with the type of surgery performed in rheumatic mitral valve regurgitation and to determine the relation between those variables and the medium-term results of valvuloplasty.

Methods

Doppler echocardiographic variables were assessed in 68 patients with severe rheumatic mitral valve regurgitation on the day preceding surgery. The patients were divided, according to the surgery performed, into 2 groups: 1) valvuloplasty group; and 2) valve replacement group. The valvuloplasty group also underwent Doppler echocardiography before hospital discharge and 6 months after that. The Doppler echocardiographic variables of the preoperative period were assessed considering the type of surgery performed and the degree of regurgitation detected 6 months later.

Results

The groups did not differ in regard to their demographic characteristics and ventricular function. The valve replacement group had a smaller mitral area (P=0.001). In univariate analysis, the variables related to valve replacement were as follows: restricted mobility of the anterior (P=0.01) and posterior (P=0.01) leaflets; calcification of the anterior leaflet (P=0.01); and fusion of the chordae tendineae (P=0.018). Restricted mobility of the anterior leaflet and area remained as independent determining factors of the prosthetic implantation after multivariate analysis. Of the 7 patients with mitral regurgitation greater than mild detected 6 months after valvuloplasty, 6 had, before surgery, restricted mobility of the anterior leaflet and 4 had fusion of the chordae tendineae.

Conclusion

The chance of valve replacement is 3.8 times greater when restricted mobility of the mitral valve anterior leaflet exists and 2.2 times greater for each 0.5 cm^2 reduction in the mitral valve area. Restricted mobility of the anterior leaflet and fusion of the chordae tendineae are associated with regurgitation greater than mild, observed 6 months after valvuloplasty.

Keywords

Doppler echocardiography, surgery, rheumatic mitral valve regurgitation

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In our country, rheumatic disease is still one of the most prevalent causes of mitral valve regurgitation. Unlike mitral valve regurgitation caused by myxomatous degeneration or ischemic disease, that caused by rheumatic disease may have restriction and thickening of the leaflets, and marked abnormalities in the subvalvular region [1], which are also commonly associated with valvular stenosis. Rheumatic mitral valve regurgitation usually affects young individuals and should be assessed in a differentiated way in its clinical and surgical approaches. Some studies have reported the superiority of mitral valvuloplasty (conservative surgery) over valvular replacement (prosthesis implantation), when surgical treatment is required. The former has a smaller incidence of infective endocarditis and complications secondary to anticoagulation, and has also been associated with a better preservation of left ventricular systolic function after surgery [2-6].

Currently, Doppler echocardiography plays an important role in the early determination of the type of surgery that may be performed for correcting mitral valve regurgitation [7-9]. Morphological and functional aspects obtained on Doppler transthoracic and transesophageal echocardiography usually allow estimating at 85% the possibility of performing mitral valvuloplasty and its success in patients with myxomatous degeneration, particularly when the posterior leaflet is the most impaired one [10-12]. However, the studies that try to validate Doppler echocardiography as a powerful instrument for predicting the type of surgery to be performed in patients with rheumatic disease lack an expressive number of patients. In fact, the unique characteristics of rheumatic disease decrease the probability of performing mitral valvuloplasty, with rates estimated at 50% [13]. So far, the variables obtained on Doppler echocardiography for predicting the surgery to be performed in mitral valve regurgitation of different etiologies are not applicable to patients with the disease of rheumatic etiology.

Previous knowledge of the surgery to be performed, determined by the identification of Doppler echocardiographic variables, may help the cardiologist even in deciding the ideal moment for surgical treatment. The subgroups that will benefit most from that information are the patients with severe chronic regurgitation with normal left ventricular function and the following characteristics: a) asymptomatic patients referred for surgery with a high chance of valvuloplasty; b) young patients with a low socioeconomic condition, who have a low adherence to the anticoagulant therapy, if that treatment is mandatory due to metallic prosthetic implanta-

tion; and c) young females with a relative contraindication to the use of anticoagulants during pregnancy. In the latter 2 subgroups, previous knowledge about the impossibility of valvuloplasty may sometimes result in a delay in surgical treatment, because implantation of biological prostheses in young patients may often be accompanied by rapid degeneration of the prosthetic tissue. Another group that could benefit from the previous knowledge about the surgery to be performed is formed by patients with severe chronic mitral regurgitation and New York Heart Association functional class III or IV, who have very reduced ejection fraction (< 0.30) [14]. In that situation, mitral valvuloplasty would be the most indicated surgery (if not the only surgery), because it preserves left ventricular function better than other surgeries do.

This study aimed at identifying the Doppler echocardiographic variables associated with the type of surgery to be performed (valvuloplasty or valve replacement) in patients with mitral valve regurgitation of rheumatic origin, and also at identifying the Doppler echocardiographic determining factors of success of mitral valvuloplasty 6 months after conservative surgery.

Methods

This study was approved by the Committee on Ethics and Research at the Instituto Dante Pazzanese de Cardiologia, and all patients signed the written consent. From 1999 to 2002, 87 patients were admitted to our institution for surgical treatment of a probable mitral valve regurgitation of rheumatic origin, and the indications for surgery were based on the guidelines of the American College of Cardiology/American Heart Association (ACC/AHA) [14]. The inclusion criteria were as follows: severe chronic mitral regurgitation of rheumatic origin, diagnosed based on clinical or Doppler echocardiographic criteria, isolated or associated with mild mitral valve stenosis, with an area ≥ 2.0 cm^2. The exclusion criteria were as follows: acute mitral valve regurgitation; active rheumatic fever; acute infective endocarditis; moderate or severe aortic valve regurgitation; and contraindication to transesophageal echocardiography.

All patients underwent transthoracic and multiplanar transesophageal Doppler echocardiography [15-18] one day before surgery, with commercially available ultrasonographic equipment. The examinations were performed according to the guidelines of the American Society of Echocardiography [15]. All studies were recorded on videotapes for later analysis, when necessary. The rheumatic etiology was established when, in association with the clinical history, the following characteristics were found on Doppler echocardiography: thickening and occasional calcification of the mitral valve components; occasional reduction in the mobility of the leaflets, or commissural fusion, or both [19]. Assessment of the severity of mitral valve regurgitation was obtained through the transthoracic and transesophageal techniques, by using the following: calculation of the effective regurgitant orifice area (ERO) [20]; the width of the vena contracta [21]; the flow pattern of the pulmonary vein [22]; the ratio between the areas of the regurgitant jet and the left atrium [23]; and the length of the regurgitant jet into the left atrium [24]. Mitral valve regurgitation was considered severe when at least 2 of the following findings were present: ERO > 0.4 cm^2; width of the vena contracta > 0.5cm; reverse systolic flow in the pulmonary vein(s); ratio between the areas of the regurgitant jet and the left atrium > 40%; and length of the regurgitant jet into the left atrium > 4.5 cm. Mitral valve regurgitation was considered mild in the presence of the following: ERO < 0.2 cm^2; width of the vena contracta < 0.2cm; absence of reverse systolic flow in any pulmonary vein; ratio between the areas of the regurgitant jet and left atrium < 20%; and length of the regurgitant jet < 1.5 cm. Mitral valve regurgitation was considered moderate when greater than mild, but smaller than severe regurgitation.

The Doppler echocardiographic variables obtained through the transesophageal technique and used for mitral valve assessment were as follows: mobility of the leaflets; presence of calcification in the leaflets; thickening of the leaflets; area and presence of mitral ring calcification; and characteristics of the chordae tendineae. The latter were as follows: thickening (in the absence of fusion and calcification); fusion (in the absence of calcification); calcification; and stretching [25]. The area of the mitral valve ring was calculated by using the formula: pi x r_1 x r_2, where r_1 and r_2 were the radii obtained at 0° and 90°, respectively. Transthoracic Doppler echocardiography was used to calculate the mitral valve area, obtained by measuring the atrioventricular pressure half time [26], and to determine the left ventricular ejection fraction, using the Simpson method [27]. The mitral valve area was estimated by using the mean of 5 consecutive measurements.

Five surgeons took part in the study. They decided the type of surgery to be performed based on the degree of distortion of the mitral valve observed during surgery. All patients underwent intraoperative transesophageal Doppler echocardiography. According to the surgery performed, the patients were divided into the 2 following groups: valvuloplasty group and valve replacement group.

The patients treated with valvuloplasty underwent 2 other Doppler echocardiographic studies: on the day of hospital discharge (exam II) and 6 months after surgery (exam III). These examinations aimed at detecting and quantifying the severity of the possible mitral valve regurgitation, and the results were compared with those of the Doppler echocardiographic studies performed before surgery.

The continuous variables were expressed as mean ± standard deviation or median, when appropriate, and the categorical variables were described as percentages. The SPSS 8.0 computer program was used for statistical calculation. For comparing the valvuloplasty and valve replacement groups, the Student *t* test and ANOVA were used for the continuous variables, and the chi-square test or the Fisher exact test was used for the categorical variables, when appropriate. Logistic regression was used to establish the association between the Doppler echocardiographic variables and the type of surgery performed. The value of P < 0.05 was adopted as the significance level.

Results

Of the 87 patients, 19 were excluded from the study due to the following findings on Doppler echocardiography: 11 due to a mitral valve area smaller than 2.0 cm^2; 6 due to lack of rheumatic characteristics in the mitral valve; and 2 due to mitral valve regurgitation degree less than severe. The 68 patients included in this study had a mean age of 31.5 ± 13.2 years, and 38 (55.9%) were women. The comparison of the clinical characteristics of the 2 groups is shown in table I.

The left ventricular ejection fraction, calculated according to the Simpson method, was estimated in both groups at 62.2% ± 1.6%.

The surgical findings confirmed the rheumatic etiology and the severe mitral valve regurgitation in all patients. Twenty-nine patients underwent conservative surgery (valvuloplasty) and 39 underwent valve replacement. The most used techniques in the 29 patients undergoing valvuloplasty were as follows: annuloplasty with implantation of a prosthetic ring in 21 (72.4%) patients and with bovine pericardium strips in 7 (24.1%) patients; quadrangular resection of the posterior leaflet in 7 (24.1%) patients; shortening of the chordae tendineae in 14 (48.2%); commissurotomy in 11 (37.9%); resection of secondary chordae in 6 (20.7%); and immobilization of the posterior leaflet in one (3.5%). None of these patients died. Of the 39 patients undergoing valve replacement, 27 (69.2%) received a biological prosthesis implantation, and 12 (30.8%) received a metallic prosthesis implantation. In this latter group, 3 patients died, all of them during the in-hospital phase as follows: 2 due to multisystem organ failure, and one due to stroke.

Table II shows the Doppler echocardiographic findings. The patients undergoing prosthetic implantation had a smaller mitral valve area, and, more often, restriction on mobility of the leaflets, calcification of the anterior leaflet, and fusion of the chordae tendineae. Measurements of the thickness of the leaflets, the thickening and stretching of the chordae tendineae, as well as the characteristics of the mitral valve ring were not associated with the type of surgery performed.

Table I – Clinical characteristics

	Mitral valvuloplasty n=29	Valvular replacement n=39	p
Female sex	19 (65.5%)	19 (48.7%)	0.17
Age (years)	29.0±2.7	33.4±1.9	0.18
BS (m^2)	1.54±0.06	1.59±0.02	0.45
Sinus rhythm	24 (82.8%)	28 (71.8%)	0.29
NYHA Functional class III/IV	18 (62.1%)	18 (46.2%)	0.19

BS- body surface; n- number; NYHA- New York Heart Association.

Table II – Characteristics of the mitral valve

	Mitral valvuloplasty n=29	Valvular replacement n=39	p
Valvular area (cm^2)	3.32±0.13	2.81± 0.08	0.001
Restriction on mobility of the leaflets			
Absent (n=21)	13 (61.9%)	8 (38.1%)	0.275
Anterior* (n=26)	6 (23.1%)	20 (76.9%)	0.01
Posterior* (n=46)	15 (32.6%)	31 (67.4%)	0.01
Thickness of the leaflets (mm)			
Anterior	4.34±0.16	4.50± 0.15	0.462
Posterior	4.49±0.16	4.56± 0.13	0.733
Calcification of the leaflets			
Absent (n=48)	21 (43.7%)	27 (56.3%)	0.386
Both (n=10)	2 (20.0%)	8 (80.0%)	0.058
Isolated posterior (n=9)	6 (66.6%)	3 (33.3%)	0.317
Ilsolated anterior (n=1)	0	1 (100%)	-
Ring area (cm^2)	15.55±0.85	15.32±0.70	0.830
Calcification of the mitral ring (n=20)	8 (20.0%)	12 (80.0%)	0.776
Alterations in chordae tendineae			
Thickening (n=38)	20 (52.6%)	18 (47.4%)	0.75
Fusion (n=18)	4 (22.2%)	14 (77.8%)	0.018
Calcification (n=6)	0	6 (100%)	-
Stretching (n=17)	10 (58.8%)	7 (41.2%)	0.617

*isolated or associated with the other leaflet.

Logistic regression identified the smaller valvular areas and the restricted mobility of the anterior leaflet (fig. 1) as the only independent determinants for mitral valve replacement (tab. III).

All patients treated with mitral valvuloplasty underwent the second Doppler echocardiographic examination before hospital discharge (7.97±3.16 days after surgery), and 26 patients underwent another examination 157.43±47.34 days after surgery. Doppler echocardiography showed that none of the 29 patients studied before hospital discharge had a mitral valve regurgitation degree greater than mild. Seven (24.13%) had no regurgitation, 10 (34.48%) had minimum regurgitation, and 12 (41.37%) had mild regurgitation.

However, 7 (26.9%) of the 26 patients undergoing the last examination showed regurgitation greater than mild, all of which were moderate. Of those, 6 (85.71%) had restricted mobility of the anterior leaflet ($P < 0.001$), and 4 (57.14%) had fusion of the chordae tendineae ($P = 0.002$) on the Doppler echocardiography performed before surgery. These data represent 100% of the patients with restricted mobility of the anterior leaflet and fusion of chordae tendineae (fig. 2) referred for reparative surgery (tab. IV).

The interobserver concordance of the categorical Doppler echocardiographic variables was established using the Kappa statistic, whose results showed the values of 0.74, 0.86, and 0.69 for thickening, calcification, and stretching of the chordae tendineae, respectively. The remaining variables showed Kappa values equal to one.

Discussion

The advantages of valvuloplasty over valvular prosthesis implantation include smaller mortality, a low risk of thromboembolism,

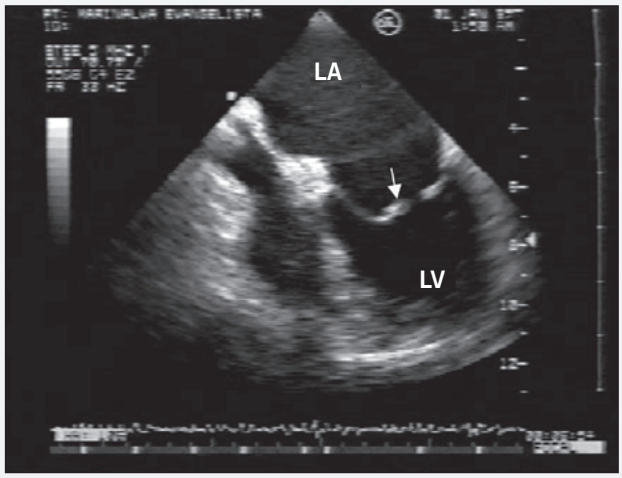

Fig. 1 – Transesophageal echocardiogram showing restricted mobility of the mitral valve leaflets; impairment of the anterior leaflet (arrow) is more evident. LA – left atrial; LV – left ventricle.

Table III – Logistic regression

Variables	Coefficient	Standard deviation	p value	Odds Ratio	95% confidence interval
Age	0.025	0.02	0.257	1.03	[0.98; 1.07]
MVA	-0.787*	0.26*	0.002*	2.20*	[1.32; 3.65]*
RMAL	1.325	1.65	0.03	3.76	[1.11; 12.7]

MVA- mitral valve area; RMAL- restriction on mobility of the anterior leaflet; * for each 0.5 cm^2.

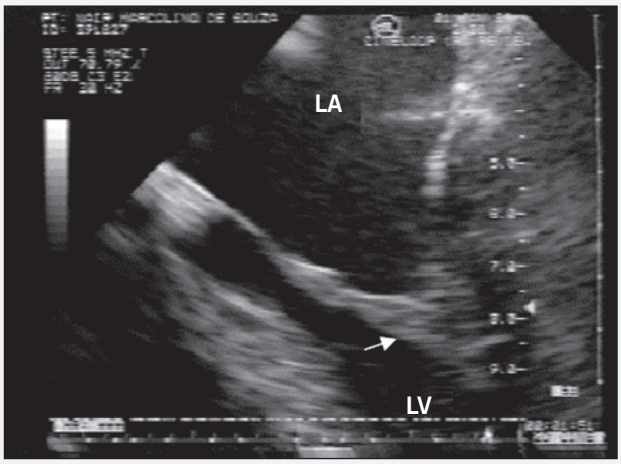

Fig. 2 - Magnified image ("zoom") of a transverse view of transesophageal echocardiography, showing fusion of the chordae tendineae (arrow). LA – left atrial; LV – left ventricle.

Table IV – Degree of mitral valve regurgitation 6 months after valvuloplasty

Variables	Absent or mild n=19	Greater than mild n=7	p
Restriction on mobility of the anterior leaflet			
Absent	19	1	
Present*	0	6	<0.001
Fusion of the chordae tendineae			
Absent	19	3	
Present**	0	4	0.002

* all patients with this alteration who underwent valvuloplasty.
** all patients with this alteration who underwent valvuloplasty.

no need for anticoagulation, and better preservation of the left ventricular function after surgery. These advantages make mitral valve reconstruction not only an alternative for valve replacement, but also the ideal choice of treatment in the cases where it is feasible. In addition, the recent questions related to the possibility and durability of the repairs were satisfactorily answered, and excellent results were demonstrated in patients with mitral valve regurgitation due to degenerative and ischemic processes. On the other hand, in lesions with a rheumatic etiology, merely acceptable results are a reflex of the high index of significant residual regurgitation with a subsequent elevated incidence of reoperations.

The results of the present study have shown that Doppler echocardiography plays an important role in predicting the type of surgery to be performed in patients with mitral valve regurgitation of rheumatic etiology. Our number of patients is the greatest reported in the publications comparing the Doppler echocardiographic findings obtained before surgery with the type of surgery effectively performed for correcting mitral valve regurgitation of rheumatic origin. Therefore, the usefulness of Doppler echocardiography is confirmed for the management of patients with that type of disease.

The population studied was representative of patients with rheumatic disease, the majority of whom were young women, and the results were comparable to those of the study by Sand et al [28].

Chauvaud et al [29] also assessed rheumatic patients with severe mitral valve regurgitation undergoing conservative surgery. The population of their study had characteristics similar to those of the population of the present study, as follows: mean age, 26 years and 29 years, respectively; prevalence of sinus rhythm, 63% and 82%, respectively; and prevalence of restricted mobility of the leaflets, 60% and 55%, respectively. In addition, the percentage of individuals undergoing the techniques of annuloplasty was almost identical, approximately 95% of the patients in both studies.

Valvuloplasty could be performed in only 43% of our patients, a finding similar to that reported by Chavez et al [30], who also assessed patients with mitral valve regurgitation exclusively of rheumatic etiology.

The analysis of the Doppler echocardiographic features of mitral valves showed important variables, which certainly correlated with the type of surgery performed. The mitral valve area was smaller in individuals undergoing valve replacement. The logistic regression showed that 0.5-cm^2 decreases in valvular area were associated with a 2.2-fold greater probability of the patients being treated with prosthetic implantation. Usually this is related to the fact that the smaller the mitral valve area, the more intense the anatomic impairment of the different regions of the valvular apparatus. This means that the greater the degree of thickening and calcification of the leaflets and chordae tendineae, as well as the fusion of the latter structure and the region of the commissures, the smaller the opening degree of the leaflets.

The direct and inversely proportional relation between valvular opening and the final result of anatomic impairment, ie, restricted mobility of the leaflets, is as important as the association of anatomic abnormalities and valvular opening. Therefore, the greater the restricted mobility of the leaflets, the smaller the opening area of the mitral valve. Thus, a significant and direct association between the presence of restricted mobility of the leaflets and valvular replacement should be expected. The presence of restricted mobility of the anterior leaflet reduced the chance of mitral valvuloplasty by 3.8 times. This result reflects the difficulty of the surgeons in repairing the valves in patients whose major pathogenetic factor for mitral valve regurgitation is the anterior leaflet alteration. This difficulty may be partially explained by the dimensions and shape of that leaflet, which do not favor the performance of resections, both triangular and quadrangular. Another motive of this difficulty is the fact that part of the ring related to the anterior leaflet is located between the fibrous trigones of the heart (left and right). This area is difficult to access, and, therefore, difficult to manage surgically. It is also an extremely important region, because it is related to valve support. In the present study, all patients with restricted mobility of the anterior leaflet who underwent valvuloplasty had mitral valve regurgitation greater than mild 6 months after surgery, despite the satisfactory results in the operating room and on hospital discharge. According to Carpentier et al [13], the fusion of chordae tendineae is the most important cause determining the restricted mobility of the leaflets.

The findings in this study are in accordance with those reported by Turner et al [31], who consider mitral reparative surgery formally contraindicated in individuals with restricted mobility of the anterior leaflet. In our study, which assessed the morphological and functional aspects of patients who required reoperation, none of the 51 patients with severe mitral regurgitation exclusively of rheumatic etiology and undergoing initial reparative surgery had that type of functional alteration. However, 49% of the patients had restricted mobility of the posterior leaflet at that moment (before the first surgery). Lessana et al [32] have suggested extreme caution when performing mitral valvuloplasty in patients with restricted mobility of the leaflets, but they did not distinguish between the impaired leaflets.

Of the 26 patients in our study with restricted mobility of the anterior leaflet, only one did not show on Doppler echocardiography the concomitant restricted mobility of the posterior leaflet. On the other hand, 21 patients were identified as having isolated restricted mobility of the posterior leaflet of the mitral valve, data that suggest that rheumatic impairment in the mitral valve may begin in the posterior region of the valve.

Our study is the first report in the literature about the quantitative analysis of thickening in the valvular leaflets in patients with severe chronic mitral valve regurgitation. Both leaflets had similar and only mild thickening (approximately 4.5 mm), being characterized as degree I when using the valvular score proposed by Wilkins et al [25], which is largely used in the Doppler echocardiographic studies performed in patients with mitral stenosis. Such a mild leaflet thickening observed in the patients did not seem to be the cause of the restricted leaflet mobility, which would explain the lack of a significant relation to the surgery of valvular prosthesis implantation. However, calcification of the anterior leaflet did relate to valvular replacement, although the statistical analysis was not performed due to the reduced number of patients with that alteration. On the other hand, the presence of calcification in the posterior leaflet did not interfere with the surgeon's decision in regard to the type of surgery to be performed.

The area of the mitral valve ring in the patients was 2.5-fold greater than that observed in healthy individuals [33], but did not influence the type of surgery performed. The increase in the diameters of the mitral valve ring is usually consequent to the marked left ventricular dilation observed in patients with dilated cardiomyopathy or volume overload of that cavity, such as aortic or mitral valve regurgitation. Thus, once installed, ring dilation may not only cause mitral valve regurgitation, but may even exacerbate the degree of the regurgitation already present, which can dilate even more the left ventricle and the valvular ring itself, typical aspects of a vicious circle. Turner et al [31] have also reported a high prevalence of dilation of the valvular ring in patients with mitral valve regurgitation of rheumatic etiology undergoing reparative surgery. The prevalence, determined by surgeons during surgery, was 92.1%. In a multicenter study performed in the Netherlands [8,9], the prevalence of that alteration was 62%, and the patients with severe mitral valve regurgitation of different etiologies were diagnosed with dilation of the ring by use of Doppler echocardiography performed just before surgical correction. Using the surgeon's assessment as the "reference pattern," 81% sensitivity was obtained for the mentioned examination.

Abnormalities in the chordae tendineae were frequently observed and diagnosed in more than half of the patients in the present study. One of the motives of this high prevalence was the inclusion only of patients with mitral valve regurgitant lesion of the rheumatic etiology. Another motive was the subjectivity of Doppler echocardiography for diagnosing those abnormalities. Subjectivity may account for diagnostic divergences among echocardiographers, mainly in cases of less severe impairments. It is worth noting that, during the Doppler echocardiographic assessment of the subvalvular region, one of the authors of this study (or at least strong evidence existed) already knew the etiology of the disease, a fact that may have induced false-positive diagnoses. Thickening of the chordae tendineae is considered by Carpentier [13] the major cause of restricted mobility of the leaflets. In our study, thickening of the chordae tendineae showed no type of association with the surgical treatment used. This lack of association may have been partially due to the fact that only the presence or absence of that abnormality was considered. Although thickening limited to the juxtavalvular region was not considered (which corresponded to degree I of the Wilkins et al [25] score), several other degrees of impairment that could have different repercussions on the mobility of the valvular leaflets were only considered as present. Thus, patients with more discrete thickening may have undergone reparative surgery, while those with severe thickening (and probably with more marked restricted mobility of the leaflets) may have undergone prosthetic implantation.

More advanced forms of thickening may result in fusion of the chordae tendineae. The prevalence of that abnormality in a study analyzing patients with mitral valve regurgitation of different etiologies was 13% [9], ie, two times smaller than that observed in the present study (27.9%). Extensive fusions that cause restricted mobility of the leaflets may be considered one of the indications for prosthesis implantation. In this study, univariate analysis showed the existence of a relation between the presence of fusion of the chordae and prosthesis implantation. It is worth emphasizing that 14 of 18 patients with that type of anatomic abnormality underwent valve replacement. However, an unfavorable postoperative evolution was observed in the 4 patients undergoing valvuloplasty and who had fusion of the chordae tendineae before surgery. All patients with that type of alteration undergoing conservative surgery had mitral valve regurgitation greater than mild on the Doppler echocardiographic study performed 6 months after surgery. According to Duran et al, [34] the major causes of the unsatisfactory results after valvuloplasty are as follows: a) use of inadequate technique in regard to the degree of valvular distortion; 2) valvular reconstruction performed in an inadequate manner; 3) the techniques of valvuloplasty are unstable and the results may deteriorate over time; and 4) progression of the underlying disease.

Carpentier et al [13] reported that 40% of the patients undergoing surgical correction of severe mitral valve regurgitation of any etiology had stretching of the chordae tendineae, and that was the major cause of mitral valve regurgitation observed in patients undergoing conservative surgery. In the present study, that alteration was not associated with the type of surgery performed.

That Doppler echocardiographic study exclusively directed to patients with severe mitral valve regurgitation of rheumatic etiology is extremely useful due to the high prevalence of the disease among us. In our cardiology practice, we have frequently observed that that disease accounts for the great number of young patients with severe mitral valve regurgitation, affecting mainly the low-income population. These aspects hinder the management of such patients, because the implantation of valvular prostheses in patients with those characteristics is frequently accompanied by complications.

The present study has shown that the isolated determining factors of valvular prosthesis implantation were the restriction on anterior leaflet mobility and the mitral valvular area, and this has relevant practical implications. Both variables are easily analyzed in echocardiographic laboratories through the transthoracic access due to the high rates of sensitivity and specificity of that technique in assessing those variables, despite the better quality of the image obtained through the transesophageal access. One may suppose that the exclusive use of transthoracic Doppler echocardiography

may identify patients with severe mitral valve regurgitation of rheumatic etiology who will receive valvular prosthesis implantation. The advantages of that technique over the transesophageal one are as follows: not invasive; lower cost; greater availability; easier to perform; no need for previous preparations; better tolerated by patients; and performed by a greater number of echocardiographers.

Of the variables subjectively assessed in this study, the following stand out: restricted mobility of the leaflets, calcification of the components of the mitral valve, and thickening and stretching of the chordae tendineae. Such subjectivity may have caused different assessments, both performed by a single observer at different times and between different echocardiographers. However, it is worth emphasizing that even the assessment of anatomic and functional abnormalities of the mitral valve performed by surgeons and pathologists is performed in a subjective manner. Although quantitative methods of analysis are desired, acceptable objective ways of measuring certain variables are still lacking, such as the mobility of the posterior leaflet of the mitral valve and stretching of the chordae tendineae. Another limitation of this study was the fact that several surgeons with different skills for performing reparative surgery took part in this research. It is worth emphasizing that the relation between the echocardiographic variables and the type of surgery performed also depends on the individual skill of each surgeon, and this may have influenced our results. The percentage of valvuloplasties performed in this study should not be extrapolated to other institutions, the possibility of performing reparative surgery being inherent to each institution. Finally, the absence of 3 patients in the medium-term Doppler echocardiographic assessment may have affected the percentage of patients with mitral valve regurgitation observed 6 months after surgery. However, the loss of only 10% of the patients of this case series may not have significantly altered the result.

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