

Surgical Treatment of Atrial Fibrillation Through Isolation of the Left Atrial Posterior Wall in Patients with Chronic Rheumatic Mitral Valve Disease. A Randomized Study with Control Group

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Objective

To determine the effectiveness of surgical isolation of the left atrial posterior wall encompassing the ostia of the pulmonary veins for the treatment of atrial fibrillation of rheumatic etiology.

Methods

Prospective and randomized study of patients with rheumatic mitral valve disease, persistent atrial fibrillation for 6 months or longer, age ≤ 60 years, and left atrial diameter ≤ 65 mm. The patients were randomly distributed into 2 groups as follows: surgical valvular treatment (control group) and surgical valvular treatment associated with isolation of the left atrial posterior wall according to the "cut-and-sew" technique (treated group).

Results

Twenty-nine individuals were operated upon, 27 of whom (13 in the control group and 14 in the treated group) were regularly followed up. The patients of both groups did not differ in regard to their basal characteristics. The mean follow-up time was 11.5 months in the control group and 10.3 months in the treated group. The cumulative frequencies of the patients without atrial fibrillation were significantly greater in the treated group both in the perioperative ($P=0.0035$) and late ($P=0.0430$) phases.

Conclusion

Surgical isolation of the left atrial posterior wall encompassing the ostia of the pulmonary veins is an effective form of treating atrial fibrillation in rheumatic mitral valve disease.

Key words

surgical treatment, atrial fibrillation, isolation of the left atrial posterior wall, rheumatic mitral valve disease

Atrial fibrillation is an important clinical problem. It is the most frequent disorder of cardiac rhythm that requires therapeutic intervention and may cause disabling symptoms. It is a frequent cause of hospital admission, may clinically and hemodynamically worsen heart failure, is associated with an increase in mortality, and consistently is implicated in systemic thromboembolic accidents¹⁻¹⁰.

Currently, in some countries, hypertensive heart disease and heart failure are the major cardiac abnormalities associated with atrial fibrillation¹¹. In our country, however, rheumatic heart disease is still highly prevalent. Its structural sequelae correspond to 1 of the major causes of surgical valvular treatment¹²⁻¹⁶, and in this context, atrial fibrillation of a rheumatic nature continues to be an extremely important clinical problem.

In patients with mitral valve disease and atrial fibrillation, surgical correction of valvular dysfunction does not usually result in a solution for arrhythmia, because the indices of recurrence are elevated, reaching up to 80% in 6 months¹⁷⁻²⁰.

The Maze surgical technique, developed by Cox et al^{21,22} more than 10 years ago, is still considered the reference method for the surgical treatment of atrial fibrillation²³⁻²⁶. However, the routine use of this surgery is limited to a few centers, due to its complexity. In addition, the impact of that technique on the dynamics of atrial contraction is still being discussed, because of the multiple incisions required²⁷. Therefore, new surgical techniques have been proposed in recent years, ranging from the replacement of the classical "cut-and-sew" technique by simpler alternatives of ablation, such as radiofrequency, to the directing of the intervention to specific areas of the atrial myocardium considered critical for triggering or perpetuation of atrial fibrillation, or both^{20,28-35}.

The left atrium has been the target of the new interventions, more specifically, its posterior wall. Several studies have shown that, for controlling atrial fibrillation, the mere creation of lines by using the "cut-and-sew" technique or ablation by radiofrequency, contouring or uniting the ostia of the pulmonary veins, determines clinical results similar to those obtained with the Maze procedure^{20,28,29,32-35}. However, it is worth considering that the surgical studies supporting this approach are studies of case series with no control group and usually have heterogeneous samples.

This prospective randomized study with a control group aimed at determining the effectiveness and safety of surgical isolation of

the left atrial posterior wall encompassing the ostia of the pulmonary veins for the treatment of atrial fibrillation of rheumatic etiology.

Methods

A prospective randomized study was carried out in patients with chronic rheumatic heart disease, persistent atrial fibrillation, and also mitral valvular impairment indicating surgical treatment.

All patients previously recruited were carefully instructed in regard to the characteristics and objectives of the study and signed a written informed consent. The Committee on Ethics and Research at our institution approved the study protocol.

Based on the type of surgery adopted, the patients were randomly distributed into 2 groups according to a draw with sealed envelopes as follows: a) control group - correction of only the valvular dysfunction; b) treated group - correction of the valvular dysfunction and surgical isolation of the left atrial posterior wall encompassing the ostia of the pulmonary veins.

All patients should have the following characteristics: persistent atrial fibrillation for at least 6 months prior to the study; age \leq 60 years; and left atrial diameter determined on M-mode echocardiography \leq 65mm. Aiming at limiting the potential participation of the right atrium in the occasional recurrences of atrial fibrillation in the postoperative period, factors that directly or indirectly could be implicated in the significant impairment of that chamber led to the patients' exclusion from the study. Patients with other diseases concomitant with rheumatic disease that could have atrial fibrillation as 1 form of manifestation were also excluded from the study. Chart 1 shows the inclusion and exclusion criteria of the study.

The surgeries were performed by the same surgeon using median sternotomy and extracorporeal circulation, and the patients were maintained under moderate systemic hypothermia (32°C). The ascending aorta was clamped to interrupt coronary blood flow and cause cardiac arrest due to anoxia. Myocardial protection was provided through the injection of a hypothermal cardioplegic blood solution (4°C) in an antegrade and intermittent manner every 20 minutes.

The left atrium was approached through a right longitudinal lateral incision, beginning between the right pulmonary veins and the interatrial sulcus.

In the previously randomized patients for isolation of the left atrial posterior wall, the left atrial auricle was sectioned and sutured at its base.

Isolation of the left atrial posterior wall (fig. 1) was performed prior to the surgical treatment of the mitral valve. After resecting the left atrial auricle, isolation was performed through extension of the left atrial incision, surrounding the ostia of the 4 pulmonary veins. Two other atrial incisions were performed as follows: 1 between the orifice of the left inferior pulmonary vein and the posterior margin of the mitral valve ring, and the other from the margin of the orifice of the left superior pulmonary vein to the base of the sectioned left atrial auricle. Then, the atrial incisions were continuously sutured.

After interrupting extracorporeal circulation, cardiac rhythm was assessed. Whenever atrial fibrillation was detected, electric defibrillation was performed.

Chart 1 - Inclusion and exclusion criteria of the patients studied

Inclusion criteria

- Diagnosis of chronic rheumatic heart disease – established according to clinical and echocardiographic criteria
- Persistent atrial fibrillation – evolution = 6 months
- Important mitral valvular disease with indication of surgical treatment
- Left atrial diameter equal to or smaller than 65 mm – established on M-mode echocardiography
- Age = equal to or smaller than 60 years

Exclusion criteria

- Antecedents of acute myocardial infarction
- Atherosclerotic coronary lesions determining thinning of the lumen of any vessel greater than 50%
- Important tricuspid insufficiency – established according to clinical, echocardiographic, and hemodynamic criteria
- Tricuspid stenosis
- Important pulmonary hypertension – established according to hemodynamic or echocardiographic criteria, defined as systolic pressure of the pulmonary artery equal to or greater than 60 mmHg
- Significant functional impairment of the left ventricle – left ventricular ejection fraction determined on echocardiography equal to or lower than 30% and/or left ventricular diameter equal to or greater than 70 mm
- Idiopathic dilated cardiomyopathy
- Hypertrophic cardiomyopathy
- Chagasic cardiomyopathy
- Collagenoses
- Chronic obstructive pulmonary disease
- Chronic renal insufficiency requiring dialytic treatment
- Primary thyroid disease
- Contraindications to the use of amiodarone

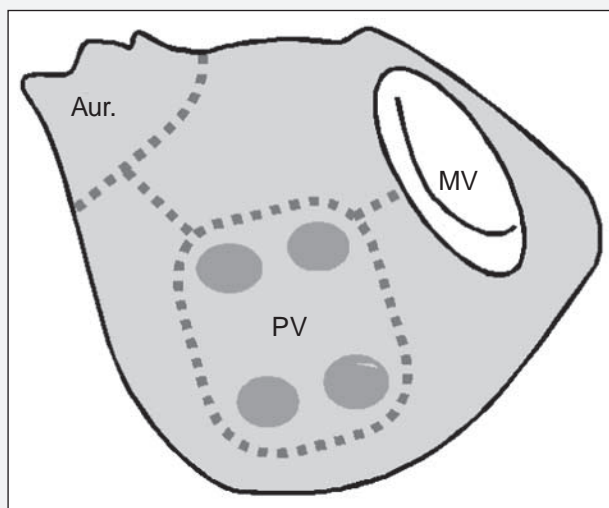


Fig. 1 - Technique used for the surgical isolation of the left atrial posterior wall encompassing the ostia of the pulmonary veins. The left atrial posterior wall is represented in an endocardial view. PV - pulmonary veins; Aur - auricle; MV - mitral valve. The dotted line corresponds to the incisions performed. Through the technique of "cut-and-sew", a flap encompassing the ostia of the pulmonary veins was created, isolating these structures from the rest of the left atrium and the left auricle sectioned and sutured at its base. Two additional incisions were performed, uniting the isolated area to the mitral ring and to the base of the left auricle section.

The postoperative follow-up was divided into 2 phases as follows: a) perioperative phase – corresponding to the 10 days following surgery, or the entire period of hospitalization, should the latter be longer than 10 days; b) late phase – corresponding to the period subsequent to the perioperative phase.

Follow-up during hospitalization was carried out by a single observer using daily electrocardiography or cardiac monitoring with a portable device.



The occurrence of atrial fibrillation in the perioperative phase was interpreted as resulting from factors directly linked to the surgical procedure. In these cases, oral therapy with amiodarone hydrochloride was instituted for 5 to 10 days at the dosage of 600 to 800 mg/day, and transthoracic electric defibrillation with direct current was performed. After effective defibrillation, the drug was maintained for 10 days at the dosage of 600 mg/day orally, or, should discharge happen after 10 days, until discharge from the hospital, after which, the drug was suspended. If atrial fibrillation occurred in the presence of significant postoperative complications, such as infections, conditions with bronchial hypersecretion, and renal or heart failure, amiodarone was administered and electric defibrillation was performed only after effective control of the clinical situation. The same management was adopted for the occurrence of other atrial tachycardias, such as flutter, in this postoperative phase.

After discharge from the hospital, the patients were followed up monthly by the same observer with clinical and electrocardiographic assessment. Two-dimensional echocardiography with Doppler was performed after the second postoperative month in patients undergoing surgery for isolation of the left atrial posterior wall who maintained sinus rhythm, aiming mainly at assessing the impact of the surgery on the left atrial transport function. This was achieved by assessing the presence or absence of the A wave on the Doppler echocardiography of the mitral valve, which represents the presence of atrial systole.

Due to safety reasons, all patients, independently of the group or type of surgery, received oral anticoagulation with warfarin aiming at maintaining the International Normalized Ratio (INR) between 2 and 3. In case of late recurrence of atrial fibrillation, amiodarone was used at the dosage of 600 mg/day for 14 to 21 days. In case spontaneous conversion to sinus rhythm did not occur, transthoracic electric defibrillation with direct current was used and amiodarone was continuously administered at the maintenance dosage of 200 mg/day. If defibrillation was ineffective, or if atrial fibrillation recurred after the effective procedure, regardless of the continuous use of the drug, the case was considered refractory, and the therapy was exclusively directed to heart rate control by use of digitalis and a beta-blocker or calcium channel blocker, or both.

Over a period of 28 months (September 2000 to December 2002), 29 patients were recruited and operated on as follows: 15 underwent isolation of the left atrial posterior wall and valvular surgery (treated group), and 14 underwent valvular surgery exclusively (control group). Nineteen patients were females, 10 were males, and their ages ranged from 28 to 60 (median, 53; mean, 50 ± 9.75) years.

All patients had significant mitral valve dysfunction as follows: 12 had stenosis; 7 had insufficiency; and 10 had the combined type. Fifteen patients had associated tricuspid or aortic valve impairment, or both. Tricuspid insufficiency was observed in 11 cases, aortic insufficiency in 3, and aortic stenosis in 2. Eleven (38%) patients had antecedents of surgical treatment of the mitral valve.

Persistence of atrial fibrillation ranged from 6 to 84 (median, 19; mean, 28.46 ± 24.38) months.

Considering the entire sample, the left atrial diameter ranged from 45 to 63 (median, 55 mm; mean, 55.55 ± 4.8) mm. The

left ventricular diastolic diameter ranged from 42 to 72 (median, 52 mm; mean, 54 ± 8.1) mm, and left ventricular ejection fraction ranged from 42% to 77% (median, 70%; mean, $67.24 \pm 9.6\%$). The systolic pressure of the pulmonary artery ranged from 25 to 60 (median, 39 mmHg; mean, 40.72 ± 10.57) mmHg.

The classificatory variables were organized in contingency tables containing absolute (n) and relative (%) values. The association of these variables and the groups was performed using the chi-square or Fisher exact test. The quantitative variables are descriptively presented in tables containing means and standard deviations. The distribution in the groups was compared using the nonparametric Wilcoxon rank sum test. Curves with the perioperative and late atrial fibrillation events were constructed according to the Kaplan-Meier method. The event-free curves were compared by using the log-rank test. P values < 0.05 were considered statistically significant.

Results

The major characteristics of the patients in both groups are shown in table I. The control and treated groups were similar in regard to the major variables considered.

Twenty patients underwent mitral valve replacement with a biological prosthesis (9 in the control group and 11 in the treated group) and 8 patients with a mechanical prosthesis (5 in the control group and 3 in the treated group). No statistically significant differences were observed in the proportions of biological and mechanical prostheses implanted in both groups ($P=0.6776$). One female patient in the treated group underwent mitral commissurotomy. Tricuspid valvuloplasty was performed in 7 patients, 4 in the control group and 3 in the treated group ($P=0.6817$). Aortic valve replacement was performed in 5 patients. No significant surgical complications occurred in the patients of the 2 groups studied.

The time of extracorporeal circulation in the patients in the treated group ranged from 60 to 124 (mean of 106 ± 17.3) minutes, which was longer ($P=0.0035$) than that observed in control group patients, which ranged from 35 to 120 (mean, 78.2 ± 24.4) minutes.

On admission to the postoperative recovery unit, 28 (96.6%) patients had a nonfibrillation rhythm, 24 (82.8%) of whom had sinus rhythm and 4 (13.8%) had junctional rhythm due to sinus

Table I - Characteristics of the patients in control and treated groups

	Control (N = 14)	Treated (N = 15)	P
Age	50.79 \pm 9.71	49.40 \pm 10.08	0.5113
Sex (M/F)	6 / 8	4 / 11	0.4497
Previous surgery	35.71%	40.00%	0.8121
Duration of AF (m)	33.85 \pm 28.52	23.80 \pm 19.98	0.3091
AoV disease	28.57%	6.67%	0.1686
Tricuspid ins.	35.71%	40.00%	0.8121
LA (mm)	55.86 \pm 4.74	55.27 \pm 5.02	0.8097
LV (mm)	55.86 \pm 8.22	52.27 \pm 7.85	0.2555
LVEF (%)	66.07 \pm 10.57	68.33 \pm 8.83	0.5848
PASP (mmHg)	37.36 \pm 11.25	44.43 \pm 12.11	0.0778

M - male; F - female; previous surgery = previous valvular heart surgery; AF - atrial fibrillation; m - months; AoV - Aortic valve; Ins. - insufficiency; LA - left atrial diameter; LV - left ventricular diastolic diameter; LVEF - left ventricular ejection fraction; PASP - pulmonary artery systolic pressure. Values expressed as mean \pm standard deviation.

bradycardia. Atrial fibrillation was observed in only 1 (3.5%) patient of the control group.

In control group patients, the intensive care unit length of stay (ICULOS) ranged from 37 to 182 hours (mean, 62.9 ± 42.5 h), which did not statistically differ ($P=0.7182$) from the ICULOS observed in the treated group, which ranged from 37 to 288 hours (mean, 66.3 ± 70.6 h).

The hospital length of stay (HLOS) in control group patients ranged from 7 to 92 (mean of 23 ± 24.2) days, which also did not statistically differ from ($P=0.8356$) the HLOS in treated group patients, which ranged from 7 to 42 (mean of 17.8 ± 10.2) days.

During hospitalization, significant clinical events occurred in 6 (42.8%) control group patients and in 4 (26.7%) treated group patients. Considering the control group, 4 patients developed hemopericardium, which was conservatively and successfully treated. One patient evolved with important sinus bradycardia and required definitive pacemaker implantation. One patient developed fever of an unknown origin and evolved favorably with conservative management. One of the patients who developed hemopericardium had infectious endocarditis in the mitral bioprosthesis and required reoperation. In the postoperative period, the patient had low output, pneumonia, and bronchial hypersecretion, but recovered gradually and satisfactorily, remaining hospitalized for 92 days.

In the treated group, 1 patient had sternal bleeding and required surgical revision, which was successful; a female patient had asystolic cardiac arrest of an unknown origin on the first postoperative day, was successfully resuscitated, and evolved favorably with no sequelae. Another female patient died suddenly on the second postoperative day due to cardiac tamponade. An autopsy was performed, and a perforation was detected in the anterobasal region of the left ventricle, approximately 2cm below the plane of the mitral valve. Abnormalities were detected neither in the mitral bioprosthesis nor in the isolated area of the left atrial posterior wall. Another female patient evolved with fever of unknown origin, and, on the 19th postoperative day, she experienced an episode of ischemic stroke, possibly embolic. Infectious endocarditis was not confirmed on serial blood cultures, and conclusive alterations that could justify the event were not identified on transesophageal echocardiography. The patient evolved satisfactorily, being discharged from the hospital with minimum motor sequelae.

The statistical comparison of the incidence of complications in both groups showed no significant difference ($P=0.4497$).

Persistent atrial fibrillation occurred in 15 (53.6%) of 28 patients in the perioperative period (1 female patient was excluded because she died), 11 of whom were in the control group and 4 of whom were in the treated group. The moment of arrhythmia onset ranged from 0 to 13 days after surgery, and, in 13 of the 15 (86.6%) patients, arrhythmia began in the first 5 days (mean day of occurrence, 3.5 ± 3.5 ; median, third day). In comparison with the control group, the incidence of atrial fibrillation was significantly lower in the patients undergoing isolation of the left atrial posterior wall. The cumulative frequencies of patients free from atrial fibrillation in this phase of the study in the control and treated groups were, respectively, as follows: 0.78 vs 0.92 on the first day; 0.35 vs 0.85 on the third day; 0.28 vs 0.78 on the fifth day; 0.21 vs 0.78 on the 10th day; and 0.21 vs 0.67 on the 15th day ($P=0.0035$) (fig. 2).

Of the 11 cases of atrial fibrillation recurrence in the control

group, electric defibrillation with direct transthoracic current was performed in 10, with conversion to sinus rhythm in all. One female patient, however, had recurrence 3 days after the procedure. In another patient the best choice was the performance of defibrillation after hospital discharge due to mediastinal bleeding; at that moment the anticoagulant therapy was contraindicated.

In the 4 patients with atrial fibrillation in the treated group, spontaneous conversion to sinus rhythm without antiarrhythmic drugs occurred in 1 case and pharmacological conversion with amiodarone occurred in another. In the other 2 patients, electric defibrillation with direct transthoracic current was performed, being successful in both.

Eight (28.6%) patients developed atrial flutter in the postoperative phase as follows: 1 in the control group and 7 in the treated group. On electrocardiographic analysis, the 7 cases in the treated group were considered atypical. The control group patient was treated with transthoracic external electric cardioversion, and it did not recur later. Of the 7 patients in the treated group, 4 had pharmacological conversion to sinus rhythm with amiodarone and 3 required electric cardioversion. One patient undergoing electric cardioversion developed recurrence after 3 days, being discharged from the hospital with a flutter.

Twenty-eight patients were discharged from the hospital, 25 (89.3%) of whom had sinus rhythm, 2 in the control group had atrial fibrillation, and 1 in the treated group had atrial flutter.

Twenty-seven patients, 13 in the control group and 14 in the treated group were regularly followed up. The patient who had atrial fibrillation recurrence at the perioperative phase who had not undergone electric defibrillation, was excluded from the study due to lost of contact.

Except for 4 cases, late clinical follow-up of patients was initiated in the absence of antiarrhythmic drugs, because their use was not necessary in the perioperative phase (8 patients) or their use was interrupted, according to the protocol established (15 patients). The patient in the treated group discharged from the hospital with atrial flutter had pharmacological reversion of the arrhythmia with amiodarone, and the drug was suspended from the 49th postoperative day onward. Two patients, 1 in the control group and another in the treated group, were discharged from the hospital with sinus rhythm and using amiodarone, which was introduced due to atrial fibrillation, which occurred in the perioperative phase and was reverted with electric defibrillation. During the first visit after discharge, the occasion on which the drug would be suspended, both patients had persistent atrial

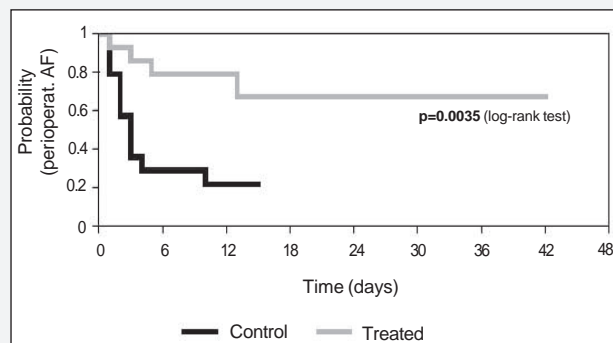


Fig. 2 - Probability of nonoccurrence of atrial fibrillation in the perioperative phase in the control and treated groups. AF - atrial fibrillation.

fibrillation, despite the regular use of the drug. One female patient already cited was discharged from the hospital with atrial fibrillation due to recurrence of the arrhythmia after effective electric defibrillation; amiodarone was maintained aiming at performing another electric defibrillation procedure later.

Follow-up of the control group patients ranged from 4 to 25 (mean, 11.5 ± 7.3) months, and that of the treated group patients ranged from 3 to 26 (mean, 10.3 ± 7.2) months ($P = 0.5595$).

Ten patients had recurrence of atrial fibrillation during follow-up, 7 from the control group and 3 from the treated group.

Of the 7 control group patients with recurrence of atrial fibrillation, 5 experienced arrhythmia in the first month of follow-up and 2 had it after the sixth month. Therapy with amiodarone was used in these 7 patients, aiming at performing secondary electric defibrillation. In 1 female patient, pharmacological conversion to sinus rhythm was obtained, but persistent atrial fibrillation recurred on the day following conversion. Five patients underwent electric defibrillation, which was effective with recurrence of arrhythmia in the first week in 3 patients, and effective with maintenance of stable sinus rhythm in 2 patients. Another patient developed recurrence of atrial fibrillation in the sixth postoperative month; pharmacological therapy with amiodarone was then instituted, but before electric defibrillation was performed, the patient experienced a hemorrhagic stroke and died.

In addition to these 7 cases with recurrence of atrial fibrillation, there is that female patient, who was discharged from the hospital with atrial fibrillation. The transthoracic external defibrillation procedure, repeated in this phase, was ineffective. Thus, of the 8 control group patients who evolved with atrial fibrillation in the late phase, 5 were refractory to the therapeutic strategy adopted.

In regard to the treated group, the arrhythmia recurred in 3 patients in the first month. Pharmacological therapy with amiodarone and external electric defibrillation were used in the 3 cases. Defibrillation was ineffective in 2 patients, and, although conversion to sinus rhythm was obtained, fibrillation recurred approximately 6 hours after defibrillation in 1 patient. Thus, the 3 cases of atrial fibrillation recurrence in the treated group were refractory to therapy with amiodarone and transthoracic electric defibrillation.

The cumulative frequencies of patients free from atrial fibrillation in the control and treated groups were, respectively, 0.53 vs 0.78 at 1 month, 0.53 vs 0.78 at 3 months, 0.44 vs 0.78 at 6 months, 0.35 vs 0.78 at 9 months, and 0.35 vs 0.78 at 12 months ($P=0.043$) (fig. 3).

Six patients developed atrial flutter during follow-up, 1 in the control group and 5 in the treated group. The time elapsed between surgery and the first manifestation of arrhythmia ranged from 1 to 6 (mean of 2.5) months. The only case of flutter in the control group was an atypical and persistent flutter. External cardioversion with direct current was performed, but the arrhythmia recurred 3 days after the procedure, despite the use of amiodarone. This patient maintained incessant flutter with satisfactory ventricular response, using a beta-blocker (carvedilol), and refused catheter ablation therapy. Of the cases of flutter in the treated group, 1 patient had persistent counterclockwise typical atrial flutter. Percutaneous ablation with radiofrequency of the cavo-tricuspid isthmus was successfully performed, and the patient evolved without recurrences in the absence of antiarrhythmic drug use during a 12.5-month follow-up. Three patients developed atypical paroxysmal atrial flutter, which

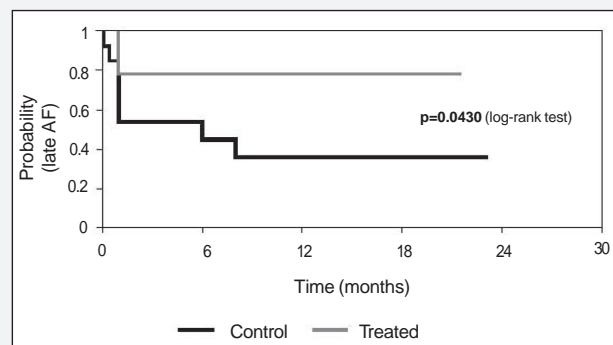


Fig. 3 - Probability of nonoccurrence of atrial fibrillation in the late phase in the control and treated groups. AF - atrial fibrillation.

was self-limited, well tolerated, and had few crises, not requiring antiarrhythmic therapy, except for a beta-blocker (atenolol), aiming at reducing the ventricular response in occasional episodes. In 1 of these cases, however, in the ninth postoperative month, the arrhythmia acquired a persistent character with important symptomatology and was successfully controlled with amiodarone. One female patient had atypical persistent atrial flutter on the 30th postoperative day with elevated ventricular response, which required external cardioversion with direct current. This patient was maintained with propafenone and had no recurrences. It is worth noting that the 4 cases of atypical atrial flutter documented in the treated group were patients who had atypical atrial flutter in the perioperative period.

The relevant atrial arrhythmic events occurring in the late follow-up phase in the control and treated groups were compared, considering atrial fibrillation and flutter. The 2 patients who evolved with paroxysmal atrial flutter during the entire follow-up were not included in this assessment, due to the fact that the tachycardias were not clinically important, because of their self-limited character and lack of need for using specific antiarrhythmic therapy. Nine events were identified among the 13 control group patients, and 6 events were identified among the 14 treated group patients, but no significant statistical difference was observed in the groups ($P=0.1650$) (fig. 4).

Two-dimensional echocardiography with Doppler was performed in 11 treated group patients after the second postoperative month, directed to evaluation of the left atrial transport function. The presence of atrial systole, determined by the presence of A wave on Doppler echocardiography of the mitral valve, was shown in 10 patients. This evaluation was impossible in 1 case due to the presence of aortic insufficiency, whose regurgitation jet was directed to the mitral prosthesis.

Relevant clinical events occurred in 2 patients during long-term follow-up. One patient in the control group with a mechanical prosthesis in the mitral position had a hemorrhagic stroke in the sixth postoperative month and died. One female patient in the treated group with a bioprosthesis in the mitral position had 2 episodes of ischemic stroke in the second and third postoperative months, apparently thromboembolic, but she maintained stable sinus rhythm during the entire follow-up and used anticoagulation with warfarin, which, however, was inadequate on the occasion of the event (INR 1.4). The transesophageal echocardiogram showed the presence of pediculate and mobile images compatible with thrombi in the atrial face of the mitral prosthesis.

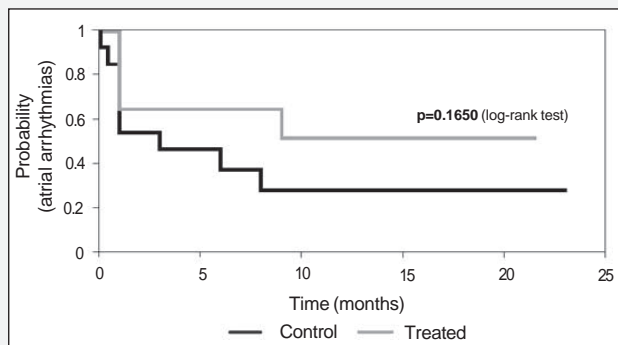


Fig. 4 - Probability of nonoccurrence of atrial arrhythmic events (atrial fibrillation or flutter) in the control and treated groups.

Discussion

The surgical approach exclusive to the left atrium has been used for recent years as an advantageous alternative to the Maze procedure for treating atrial fibrillation, because of its apparent efficacy with greater technical simplicity and smaller damage to atrial muscle. Different surgical techniques have been proposed, and the common point to them all is the focus of the interventions on the posterior wall of the chamber, more specifically on the region where the pulmonary veins merge^{20,28,29,32-35}. Despite the several reports of good results in controlling the arrhythmia, obtaining of clear conclusions about the effectiveness of these new forms of surgical treatment for atrial fibrillation based on the analysis of these results have not been possible. As already mentioned, these studies are limited to reporting experiences of case series, with a great diversity of surgical techniques and a striking heterogeneity of sample characteristics.

The present study was carried out to assess the efficacy of the surgical isolation of the left atrial posterior wall involving the ostia of the pulmonary veins for treating atrial fibrillation in patients with rheumatic mitral valvular disease. Four methodological peculiarities were important in designing the study, distinguishing our study from most studies about the surgical treatment of atrial fibrillation published so far: 1) ours is a prospective, randomized study with a control group; 2) only patients with chronic rheumatic heart disease were included in the study; 3) we sought uniformity in the sample in regard to several important characteristics, such as age and left atrial diameter, trying to exclude the association with other conditions that could potentially interfere with pathophysiological elements distinct from those in rheumatic disease, in occasional recurrences of atrial fibrillation; 4) the study was designed for comparing 2 surgical approaches in the absence of the interference of antiarrhythmic drugs. In fact, as shown in table I, the similarity of the characteristics of the patients in the control and treated groups is notable.

One of the major problems in assessing the effectiveness of a surgical technique for treating atrial fibrillation when used in association with the surgical treatment of a valvular disease is the difficulty in establishing whether the results obtained were consequent to the procedure directed at the treatment of arrhythmia, or simply a consequence of correcting the valvular dysfunction. In the present study, the inclusion of a control group allowed establishing that the isolation of the left atrial posterior wall encom-

passing the ostia of the pulmonary veins, used concomitantly with the valvular surgical treatment in patients with chronic rheumatic heart disease, is a safe and effective procedure for treating atrial fibrillation, leading to a reduction in the incidence of recurrence of the arrhythmia, both in the perioperative and late phases.

Although the presence of important tricuspid insufficiency was one of the exclusion criteria in the study, a significant number of patients underwent tricuspid valvuloplasty. In the clinical, echocardiographic and hemodynamic assessment performed prior to inclusion in the study, no evidence of significant tricuspid insufficiency was detected. However, in some cases, the surgeon decided to perform tricuspid valve exploration, and when, through direct visualization, the dysfunction was considered important, valvuloplasty was performed. As already shown, the incidence of tricuspid insufficiency, as well as the proportions of the tricuspid valvuloplasties performed, did not significantly differ between the 2 groups.

The surgical technique used was similar to that used by Sueda et al²⁰ and Kalil et al³⁵. The choice of the "cut-and-sew" technique was based on the objective to promote effective transmural lesions, which are not guaranteed with the use of other therapeutic modalities, such as radiofrequency. The addition of the surgery for arrhythmia caused an increase of approximately 28 minutes in the time of extracorporeal circulation. This increase in time, as well as the surgery itself, did not cause an increase in the incidence of trans- or perioperative complications. Yet, the surgery apparently did not cause significant damage to the transport function of the left atrium, because the presence of effective atrial systole, characterized by the presence of A wave on Doppler echocardiography of the mitral valve, was observed in all patients in whom its assessment through that method was possible.

The incidence of atrial flutter, both in the perioperative follow-up phase and in the late phase, was elevated in patients undergoing surgical isolation of the left atrial posterior wall. Its incidence in both groups studied could not be compared, because this assessment would be biased, considering the great proportion of individuals in the control group who evolved with atrial fibrillation. However, it is reasonable to infer the existence of a greater probability of occurrence of incisional atrial flutter in patients undergoing surgery for arrhythmia, obviously due to characteristics of the intervention. Occasional discontinuities in the isolation line may have created substrates for reentry phenomena. The use of the "cut-and-sew" technique may have played a relevant role in the creation of discontinuities, because the healing process with recovery of conduction in effectively isolated areas has been reported³⁶⁻³⁸. It is worth noting that, due to the surgical technique used, a union incision between the isolated area and the mitral ring may not have avoided the formation of a conduction isthmus in this region, because no complementation of the lesion through electrocauterization or cryoablation was used, according to the techniques proposed by some authors^{20,35}. The presence of residual conduction through remaining muscle fibers may have created a propitiating medium for the occurrence of reentry of the electric impulse.

On the other hand, it is worth emphasizing that these statements are only conjectures. An elevated incidence of atypical atrial flutter has also been reported in other studies^{28,32,33} about treatment of atrial fibrillation for approaching the left atrial posterior wall. The correlation of arrhythmogenic substrates and the area of intervention and the mechanisms of these tachycardias have not



been well established. Studies designed for their electrophysiological investigation are required and may eventually cause modifications in the surgical techniques adopted.

The sample size was small, which hindered a comparison of the rates of occurrence of atrial flutter between the groups.

A controversial point in designing this study was how the occurrence of atrial fibrillation in the perioperative and late phases was defined. In general, atrial fibrillation was considered perioperative when occurring in the first 10 days subsequent to surgery, or during the period of hospitalization, when longer than 10 days. Atrial fibrillation was considered late, when occurring after the tenth postoperative day, or after hospital discharge. Some studies^{22,39} have postulated that the process of surgical recovery may be prolonged and recurrence of atrial fibrillation up to 3 months after surgery may yet be related to operative factors or the process of atrial electrical remodeling, or both. In fact, in the present study, of the 11 patients with atrial fibrillation, 9 had recurrence in the first month after surgery. However, it is worth emphasizing that this was a prospective, randomized study in which follow-up, assessment, and management were similar in both groups. Thus, the time until recurrence of arrhythmia does not contradict the results obtained. Yet, of the 9 patients with recurrence of atrial fibrillation within the first month, 8 were refractory to the strategy of pharmacological therapy with amiodarone combined with transthoracic electric defibrillation. In only 1 patient was reversion of the arrhythmia obtained, with maintenance of stable sinus rhythm, suggesting that almost all these patients actually had irreversible findings.

The primary objective of this study was to assess the efficacy of isolation of the left atrial posterior wall encompassing the ostia

of the pulmonary veins for reducing the indices of late recurrence of atrial fibrillation. In this regard, the benefit of the treatment was evident, which makes it an effective and recommendable therapeutic option. However, when clinically relevant atrial tachycardias were considered (including atrial fibrillation and flutter) and their occurrence was assessed, no significant differences in the incidence were identified between the 2 groups studied. The frequent manifestation of atrial flutter in the treated group patients was the determinant factor of this finding. And considering the hypothesis that the left atrial incisions were the cause, the benefits of the treatment could not be clearly defined in a perspective of global clinical advantages. The size of the sample studied may have contributed to this type of result. On the other hand, it is worth noting that atrial flutter is a tachycardia depending on a well-defined substrate, even when depending on a scar, which may be eliminated by use of catheter ablation⁴⁰⁻⁴², a characteristic that provides a clinical significance different from that related to atrial fibrillation associated with structural heart disease.

In conclusion, in patients with rheumatic mitral valvular disease and persistent atrial fibrillation, isolation of the left atrial posterior wall involving the ostia of pulmonary veins and used in addition to the surgical valvular treatment reduces the incidence of atrial fibrillation recurrence, both in the perioperative period and late phase of postoperative follow-up.

The surgical technique of isolation of the left atrial posterior wall used in this study in association with surgical correction of valvular dysfunction increased neither surgical morbidity nor mortality, proving to be a safe procedure.

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