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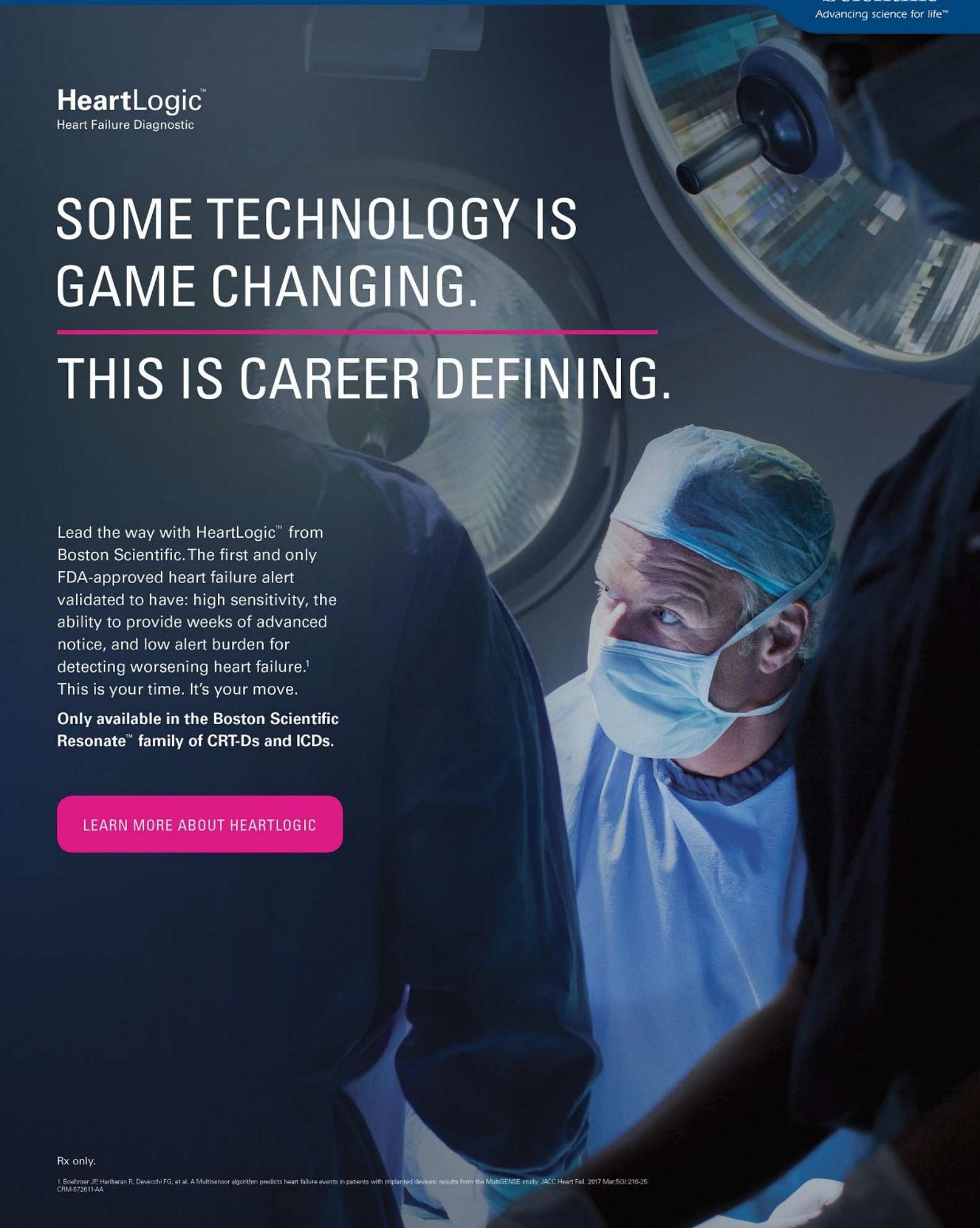

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Comparison of Surgical Cut and Sew versus Radiofrequency Pulmonary Veins Isolation for Chronic Permanent Atrial Fibrillation: A Randomized Study

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Background: *Surgical pulmonary veins isolation (PVI) is done to restore sinus rhythm (SR) in patients with chronic permanent atrial fibrillation (CPAF) and mitral valve disease. Here we compare the efficacy of electrical block lines performed with radiofrequency (RF) compared with conventional surgery.*

Methods: *Randomized trial of 22 patients with CPAF and indication for mitral valve surgery. Ten patients underwent conventional surgery (SURG) and 12 RF. To prove the efficacy of the blockage lines, epicardial pacemaker wires were placed in the isolated pulmonary veins region (IPVR) and right atria (RA).*

Results: *There were no differences in the baseline data among the groups. All patients remained in SR during the immediate postoperative period. Block lines were tested in patients who remained in SR during the following days (eight in SURG and nine in RF). The median value of thresholds to conduct the stimulus of IPVR for the RA was 18 mA in SURG and 3 mA in RF ($P < 0.022$). Eight SURG patients and seven RF patients ($P < 0.38$) remained in SR at hospital discharge. Eleven RF patients and one SURG required amiodarone to maintain SR ($P < 0.001$). The incidence of recurrent atrial fibrillation (AF) in the follow-up was 10.7/100 patients/year in the SURG group versus 73.1/100 patients/year in the RF group ($P = 0.009$).*

Conclusions: *PVI by SURG formed more effective block lines than RF. SR at hospital discharge was similar among the groups, but more amiodarone was used in RF. During follow-up, incidence of recurrent AF was higher in the RF group. (PACE 2010; 33:1249–1257)*

atrial fibrillation, pulmonary veins, heart surgery, radiofrequency, surgery for arrhythmias

Introduction

Atrial fibrillation (AF) is the most frequent supraventricular arrhythmia. Individuals with AF are at higher risk for thromboembolic events, heart failure, and adverse effects secondary to the use of antiarrhythmics, a greater number of hospital admissions, and development of tachycardiomyopathy.[1] Mitral valve disease increases the chances of developing this arrhythmia due to structural changes and atrial remodeling.[2]

Treatment with antiarrhythmics is not satisfactory since the reversion to sinus rhythm (SR) is not very effective, side effects often occur, and the risk of pro-arrhythmia is high.[1] Thus, nonpharmacological treatment appears to be an interesting option, especially in the group of patients who have associated structural cardiac disease requiring surgical correction. The advent of the Maze Procedure made it possible to cure this arrhythmia, both in the cases of isolated AF and in those with concomitant heart disease.[3] In this surgical technique, cut and sew at predetermined sites in both atria are performed, thus blocking reentrant wavefronts responsible for maintaining AF. Despite good clinical results presented, few centers adopted this procedure as a usual option in treating AF due to its complexity.

More recently, Haïssaguerre et al.[4] showed the importance of ectopic foci originating in the pulmonary veins in the genesis and maintenance of AF. This finding was associated with the fact that reentrant waves, depending on the refractory period, mass, and conduction velocity in different portions of the atria (*multiple-wavelet hypothesis*), would jointly provide a substrate for the beginning and perpetuation of AF.[5]

For these reasons, together with the need to simplify a complex procedure such as the Maze Procedure, several authors began to use modified forms of this procedure, emphasizing the posterior

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region of the left atrium and pulmonary veins.[6] At our institution, surgical pulmonary vein isolation (PVI) in patients with AF and mitral valve disease proved to be as effective as the Maze Procedure in maintaining SR in patients submitted to mitral valve surgery.[7]

New sources of energy used for linear ablation instead of incision and suture during surgery could reproduce the block lines and simplify the procedure. In search of new technologies intended to facilitate the procedure, ablation using energy in the radiofrequency (RF) range is one of those.[8] A recent study showed that block lines in Maze Procedure can be reproduced using this energy source, with clinical results similar to those of the original procedure.[9,10]

In this study, we compare the efficacy of block lines created by energy in the RF range to cut and sew lines in surgical PVI in patients with chronic permanent atrial fibrillation (CPAF) submitted to mitral valve surgery.

Methods

Patients

Twenty-two consecutive patients with CPAF and mitral valve disease referred to the Cardiac Surgery Service at the Instituto de Cardiologia do Rio Grande do Sul – Fundação Universitária de Cardiologia (IC-FUC) with an indication for corrective surgery (valvuloplasty or valve replacement with mechanical or biological prosthesis) were selected. The inclusion criteria were age between 18 and 75 years, ventricular ejection fraction (EF) greater than 20%, AF lasting more than 6 months, and agreeing to participate in the study. Those who had undergone previous surgery and had pericardial adhesions during the intraoperative period were not included. The research protocol was approved by the Ethics Committee of the Institution and all the participants in the study agreed to participate, signing a Free and Informed Consent. A preoperative evaluation was performed in all patients, which included clinical history and physical examination, electrocardiogram, laboratory tests, echocardiogram, chest x-ray, and cardiac catheterization.

Randomization

The patients were randomized into two groups: a group with surgical cut and sew PVI – SURG TECHNIQUE (10 patients) – and a group in which the PVI technique was done by RF – RF TECHNIQUE (12 patients). Randomization was performed by drawing lots.

Surgical Procedures Performed

In patients randomized to SURG TECHNIQUE, immediately after clamping the aorta a left atriotomy was performed, with an incision line running parallel to the interatrial sulcus. This incision was extended to surround the four pulmonary veins. At that time, the mitral valve was examined and treated accordingly to the lesion found. After this, the incision that surrounded the pulmonary veins was completed, isolating this area from the rest of the heart. Then a perpendicular incision was made beginning at the lower margin of the incision that isolates the pulmonary veins until the mitral valve annulus. Here one must be careful not to injure the coronary sinus or the circumflex coronary artery. When the valve repair and all the incisions had been done, these were sutured with polypropylene monofilament 3–0, continuously in a single layer (Fig. 1A). Then the aortic clamp was removed, and during myocardial reperfusion, the left atrial appendix was sectioned and sutured externally. Differently from the Maze Procedure, no incision was performed between the suture line of the left atrial appendix and the circular suture line surrounding the pulmonary veins. At no time were cryoablation or RF performed while doing this technique. No incision was made in the right atrium or atrial septum.

In the patients randomized to the RF TECHNIQUE, the procedure was performed simulating the same lines as the SURG TECHNIQUE. However, the lines created to isolate the pulmonary veins of the remaining atrial myocardium, except the atrial incision for access to the mitral valve, were performed using the technique of ablation by energy in the RF range, using an unipolar irrigated surgical ablation pen, Cardioblate™ Surgical ablation pen (Medtronic Inc., Minneapolis, MN, USA), instead of a surgical incision, from the endocardial aspect (Fig. 1B). This ablation pen was irrigated with 0.9% saline solution, with a 1,000 mL/h infusion and 30-watt ablation energy. To perform this line, we used a "drag-and-burn" technique with continuous RF delivery. The formation of an edema halo, surrounding the PV, indicated the appropriate application of RF. Fourteen Cardioblate™ (Medtronic Inc.) surgical ablation pens funded by National Research Council (CNPq) and State Foundation for Research (FAPERGS) were purchased in order to perform the RF TECHNIQUE. Medtronic provided a Cardioblate™ Surgical Ablation System, a dispersive electrode cable, and a remote control foot switch. The other resources were from our Institution.

In order to analyze the amount of current necessary to test the block lines created by the PVI techniques, two temporary epicardial electrodes were implanted intraoperatively (separated 15-mm apart), in each of the three areas described:

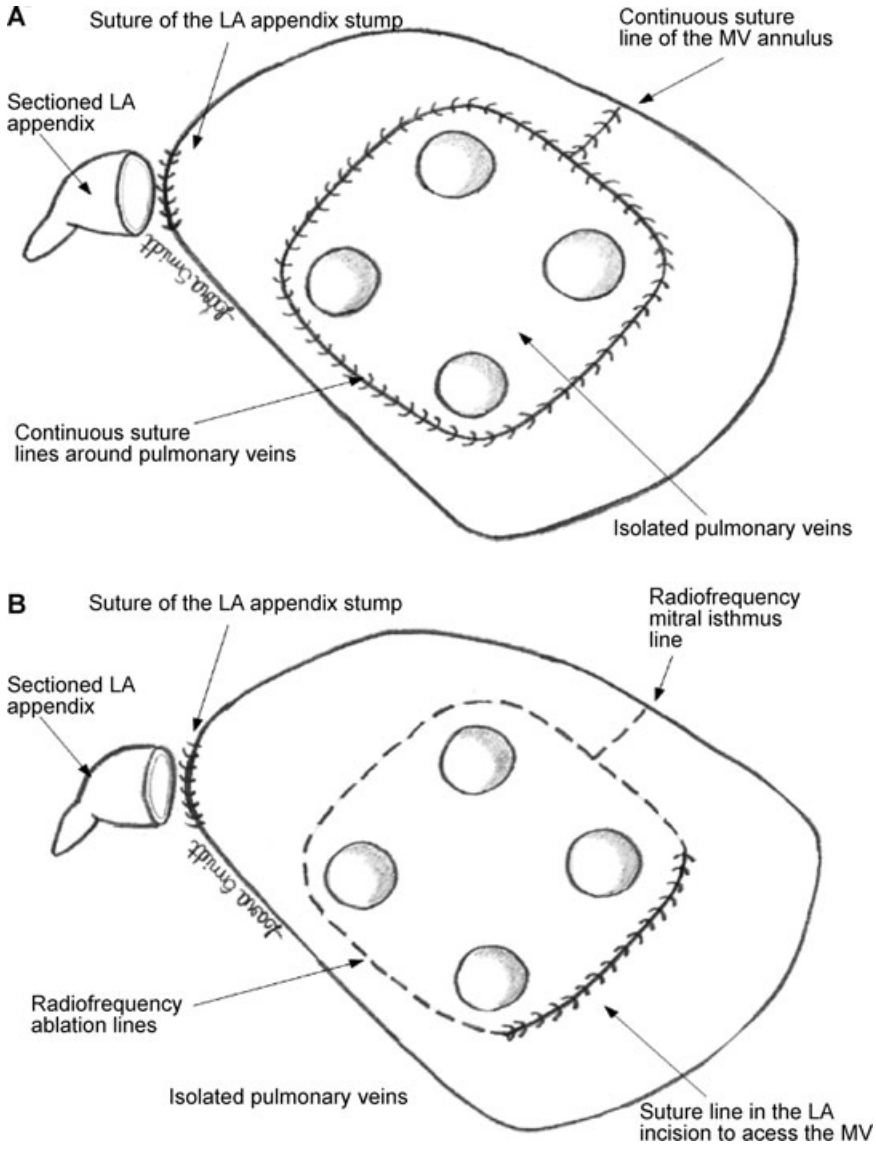

Figure 1. *(A) View of the endocardial aspect of the left atrium after the pulmonary veins were isolated using the SURG TECHNIQUE. (B) View of the endocardial aspect of the left atrium after isolating the pulmonary veins using the RF TECHNIQUE using a continuous line "drag-and-burn." LA = left atrium; MV = mitral valve.*

(1) right ventricle (RV); (2) right atrium (RA); (3) isolated pulmonary veins region (IPVR).

Evaluation during the Postoperative Period

During the early postoperative period (after discharge from the Postoperative Care Unit), the epicardial electrograms (EGMs) of the RV, the RA, and the IPVR were recorded in SR using the epicardial temporary wires. This procedure was performed in the Electrophysiology Laboratory at IC-FUC using a Cardiolab™ polygraph (Prucka Engineering Inc., Houston, TX, USA). The efficacy of the PVI was tested by the stimulation in the IPVR, through the electrodes implanted in the posterior wall of the LA, and looking for capture in the RA and RV (defined as near-field EGMs recorded in the epicardial wires placed in those two chambers). Isolation was considered complete if there was a block of stimulus conduction between the IPVR and the rest of the myocardium. This was defined as the inability of the LA pacing, at the IPVR, to capture the other two chambers. If capture occurred, after the LA pacing spike, a near-field EGM potentials should be recorded in the IPVR wire (representing LA capture) followed by a near-field EGM recorded in the RA and the RV

wires subsequently (representing captures of this chamber by pacing the isolated LA region). To ensure capture of the atrial tissue was not simultaneously in both LA and RA, a minimum conduction delay between LA EGM and RA EGM of at least 40 ms was necessary. Pacing was performed using a pacing rate 20% higher than the basal heart rate, up to the amplitude of 28 mA (maximum value of the stimulator) keeping a steady pulse width of 2.5 ms. For pacing these structures, we used programmable Stimulator Model 5328 (Medtronic Inc.). If conduction occurred between the IPVR, during stimulation, over the other two chambers using amplitude under 28 mA, isolation was considered incomplete. The researcher who performed the test was not blinded. Once the procedure was ended, the temporary pacemaker leads were removed.

The patients were followed during their hospital stay. All interventions and complications were recorded from the postoperative period until discharge from hospital. Those who had AF at some time during the postoperative period were submitted to the reversion protocol for SR with amiodarone IV or PO (600 mg/day) and/or electric cardioversion (200–360 J) followed by anticoagulation with heparin IV and, later, oral anticoagulant. In order to perform the block lines test, it was necessary that the patient was in SR. Otherwise, the test would not be performed.

After hospital discharge, patients were followed by 1, 2, 6, and 12 consecutive months in schedule visits. At that moment, history, physical examination, medications in use, and electrocardiogram were registered.

Outcomes

The primary outcome to be evaluated in this study is the efficacy of block lines created by SURG TECHNIQUE procedure against those of RF TECHNIQUE in the surgical PVI in patients with CPAF, with indication for mitral valve surgery. This was measured by the amount of energy required to capture the contralateral chamber during the test of the block lines. The secondary outcomes are the postoperative incidence of AF and the need of amiodarone to maintain SR between the two techniques during follow-up.

Statistical Analysis

The database was stored in a Microsoft Excel 2000 program. The size of the sample was calculated, estimating a difference of 2 mA in stimulation threshold to capture the nonisolated atrium (RA), in seven patients for each group, with a power of 80% and confidence interval of 95%. A value of $P < 0.05$ was considered significant. The analysis performed was by intention to treat. We decided to include up to 14 patients in each group to compensate possible losses (noncapturing electrode, AF during the postoperative period). The continuous data were analyzed using the Student's *t*-test for repeated measures and comparisons of the two samples. The χ^2 (Fisher) test was used to analyze the difference between the categorical variables. For asymmetrical variables, the Mann–Whitney test and analysis of covariance (ANCOVA) were used for repeat measures. Cumulative late AF recurrence was analyzed individually and altogether with the Cox proportional hazard regression model. The amount of current necessary to test the block lines measured during the postoperative period were adjusted for the effects of variables gender, age, day when block lines were tested, base excess, and colloid and crystalloid balances. The statistical analysis was performed in SPSS v.12 (SPSS Inc., Chicago, IL, USA).

Results

From November 2005 to February 2007, 10 patients were randomized to the SURG TECHNIQUE procedure and 12 to the RF TECHNIQUE. The characteristics of the patients are in Table I. There was no difference between the groups as to these preoperative demographic data. Also, there was no difference in type of mitral repair done. In both groups, patients with other valvular, congenital, and ischemic heart disease were surgically treated as noted in the same table.

There was a statistically significant difference between the procedures as to total procedure length, which was greater in the SURG TECHNIQUE (258 ± 47 min) compared with RF TECHNIQUE group (218 ± 35) ($P < 0.039$). In the RF TECHNIQUE group, the lines performed during the "drag-and-burn" continuous RF delivery were homogeneous with no visible gaps during the procedures. The presence of an edema halo immediately after the contact of the pen was considered an evidence for suitable lesion. The mean time to apply RF using the Cardioblate™ pen was 8.2 min (± 2.3 min).

All the patients in the two techniques were in SR in the first 24 hours postoperatively. A female patient in RF TECHNIQUE group presented cardiac tamponade requiring surgical intervention. No patients died or were lost during the study. In SURG TECHNIQUE group, two of the 10 patients presented episodes of AF during the postoperative period, while in the RF TECHNIQUE group, 11 of the 12 patients had AF during the same period ($P < 0.02$).

The patients who presented AF during the postoperative period were submitted to a reversion protocol for SR. In the SURG TECHNIQUE

Table I.

Demographic Data of the Sample Comparing the Treated Groups

Characteristics	SURG TECHNIQUE n = 10	RF TECHNIQUE n = 12	P
Age (years)	62.1 ± 8.3	56.5 ± 11.5	0.22
Male sex	4	7	0.67
NYHA			
I	2	1	0.86
II	5	5	0.97
II	3	4	0.76
IV	0	2	0.54
Medication			
Anticoagulant	5	3	0.44
Aspirin	3	1	0.44
Diuretic	8	9	0.81
Espironolactone	3	3	0.82
Digoxin	4	9	0.96
ACEI	7	4	0.19
ABR	0	2	0.54
Amiodarone	2	1	0.86
Beta block	5	7	0.96
Comorbidities			
Hypertension	6	7	0.72
DM	0	1	0.92
Tobacco	1	1	0.54
Stroke	1	0	0.92
LA (mm)	58.7 ± 10.2	60.3 ± 313.1	0.75
EF (%)	62.8 ± 10.8	59.3 ± 15.3	0.55
Mitral lesion			0.16
MI	3	6	0.60
MS	4	3	0.76
DML	3	3	0.82
Etiology			1.0
Rheumatic	7	9	0.82
Degenerative	3	3	0.82
Repair type			
Mechanical PR	2	0	0.1
Biological PR	3	3	0.1
Valvuloplasty	5	9	0.1
Other heart diseases			
TI	1	0	0.92
AoI	1	1	0.54
AoS	0	1	0.92
IHD	1	1	0.54
FO	0	1	0.92

NYHA = New York Heart Association; ACEI = angiotensin-converting enzyme inhibitor; DM = diabetes mellitus; LA = left atrium; EF = ventricular ejection fraction; MI = mitral insufficiency; MS = mitral stenosis; DML = double mitral lesion; PR = prosthesis; TI = tricuspid insufficiency; AoI = aortic insufficiency; AoS = aortic stenosis; IHD = ischemic heart disease; FO = foramen ovale.

group, one of the two patients with AF reverted to SR, while in the RF TECHNIQUE, nine of the 11 patients reverted to SR after the protocol was applied ($P < 0.02$).

In order to perform block lines test, the patients had to be in SR. Those who presented AF during the postoperative period at the time of the test were considered complete failure of block lines created by the surgical technique employed in that case, and the median minimum value was used to compare the groups. This artifice was used to analyze the intention to treat. For this, on the sixth day postoperatively (median value), eight patients in the SURG TECHNIQUE group and nine in the RF TECHNIQUE group (ns) were tested. The amount of current necessary during pacing of the IPVR that ensures capture of the RA and RV in the SURG TECHNIQUE group was 18 mA, while in the RF TECHNIQUE group it was 3 mA ($P < 0.022$). This difference among the groups was significant after the adjustment for gender, age, day when block lines were tested, base excess, and colloid and crystalloid balances during the postoperative period (Table II, Fig. 2). The electric record acquired from IPVR did not show AF or any other tachyarrhythmia during block lines test. The difference of those who were actually tested, not adjusting for confounding factors, was also statistically significant (median 28 mA SURG TECHNIQUE vs 5 mA SURG TECHNIQUE, $P = 0.0056$).

At the time of discharge from hospital, there was no difference in the number of patients who remained in SR among the groups. However, more patients needed amiodarone to remain in SR in the RF TECHNIQUE group than in the SURG TECHNIQUE group ($P < 0.001$). There was no

Table II.

Values of Median Stimulus Conduction Thresholds between the Groups

	SURG TECHNIQUE n = 10	RF TECHNIQUE n = 12	P*
Conduction threshold (mA)	18 (2 to 28)	3 (2 to 12)	$P < 0.022$

The data are presented as median and minimum and maximum values. mA = milliampere.

*Statistical significance obtained in ANCOVA applied to the ranks of the measures of conduction thresholds, adjusting for the effects of gender, age, day when block lines were tested, base excess, and colloid and crystalloid balances during the postoperative period.

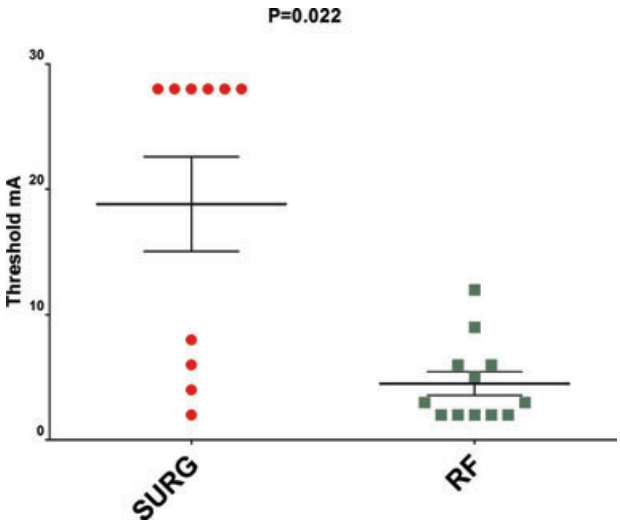

Figure 2. *Graph of the values of median thresholds of stimulus conduction between the SURG TECHNIQUE and RF TECHNIQUE groups. Dots and squares represent the stimulus in mA in each subject. The box plot shows the median and 95% CI. Data were adjusted for gender, age, postoperative day for block line test, blood PH, colloid, and crystalloid balances during the postoperative period.*

difference in the length of stay in the hospital (Table III). All the patients in the study were still anticoagulated on hospital discharge.

The incidence of recurrent AF was higher in the RF group as compared with the patients treated by the conventional technique (Table III). Survival free of recurrent AF was also significantly higher among the SURG group; Figure 3 shows the survival function in a proportional hazards model.

Discussion

Surgical PVI is based on two principles of AF physiopathology: the need to have foci of origin and a susceptible substrate. The PVI attempts to isolate these foci and alter the substrate.[1] The arrhythmogenic foci would not contaminate the rest of the atrial myocardium due to block lines created and the atrial mass to sustain the reentrant waves would be diminished. In this study, a comparison was done between the efficacy of block lines created by two surgical PVI techniques: incision and suture (SURG TECHNIQUE), and ablation by energy in the RF range (RF TECHNIQUE). In the SURG TECHNIQUE group, block lines created were more effective than in the RF TECHNIQUE group. The need for a greater range of energy of pacing stimulus was shown during the electric stimulation of the epicardial electrodes placed in IPVR.

Table III.

Length of Stay in Hospital, Rhythm and Use of Amiodarone at Discharge from Hospital, and Incidence of Recurrent AF During Follow-Up

Characteristics	SURG TECHNIQUE N = 10	RF TECHNIQUE n = 12	P
Sinus rhythm	8	7	0.38
Use of amiodarone	1	11	<0.001
Days in hospital	8.9	9.7	0.62
Incidence of recurrent AF/100 patients/year	10.75	73.1	0.009

Energy in the RF range is characterized by the passage of alternating current from an RF generator, through an appropriate catheter, causing later tissue lesions by heat.[10,11] The higher the resistance between the tissue and the ablation catheter, the greater will be the lesion produced. The temperature developed responsible for permanent tissue lesions is estimated as 50°C or more. The lesion is predominantly thermal, with coagulation necrosis, and late onset of fibrosis. However, possibly the tissue lesion caused by RF might not be sufficiently deep or transmural. There is a great difference in resistance between the tip of the catheter and the myocardium, which produces the heat that causes the lesion. If it is necessary to extend the lesion, more power must be applied to raise the temperatures, which coagulates the proteins present on the catheter–myocardium interface. Clot formation increases the impedance, cutting the current and ending the RF application. The Cardioblate™ (Medtronic Inc.) surgical unipolar ablation pen with a tip irrigated with 0.9% saline solution used in the RF TECHNIQUE group, attempted to reduce this difference in impedance with the myocardium and to deepen the lesion. With the diminished resistance between the catheter–myocardium interface, more energy could be applied, deepening the volume of heat and increasing the lesion in the same proportion.[12] There was no clot formation in the patients submitted to PVI with an irrigated pen. Despite this, the left atrial myocardium does not present a regular thickness in its posterior anatomy, which could change the impedance, not ensuring a full thickness lesion.[13,14]

Although the atrial wall was completely sectioned and sutured, some patients in SURG TECHNIQUE group presented low stimulation thresholds with conduction between the isolated

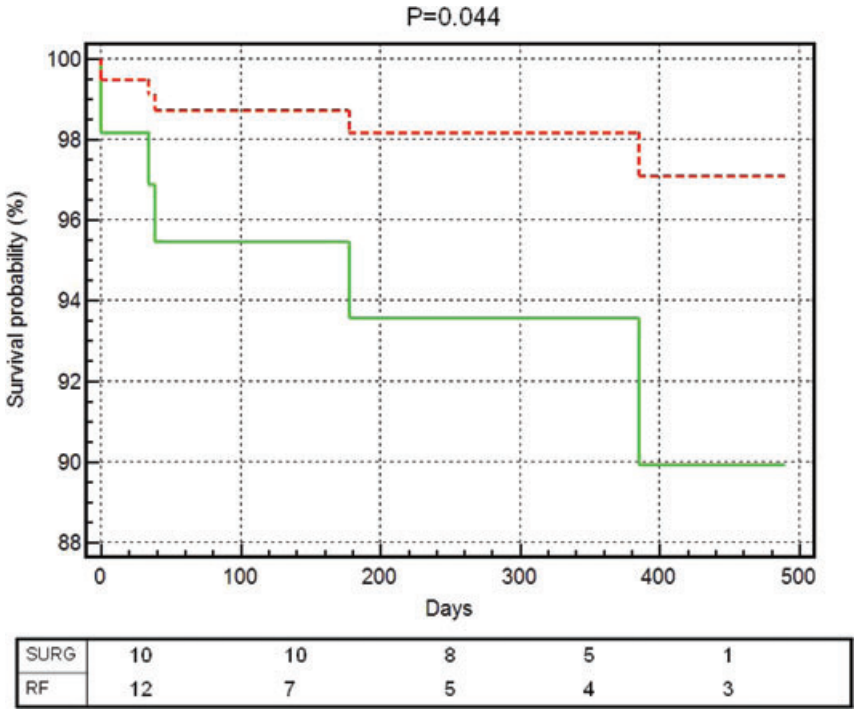

Figure 3. *Survival probability free of recurrent atrial fibrillation using a proportional hazards model adjusted by intervention type and threshold (mA) in the postoperative test for block. Red line = SURG, green line = RF.*

area and the remaining myocardium. The presence of fluid retained locally in the pericardium or edema of the sutures during the postoperative period in these areas may have made conduction easier, "crossing" the block line in these patients. Temporary pacemaker leads are used routinely in cardiac surgery to treat cardiac rhythm disturbances in the early postoperative period. After a few days, during the postoperative period, the stimulation thresholds rise due to the inflammatory reaction of the myocardium, especially on the fourth day after implantation.[15] Changes in pH, such as alkalosis or acidosis, expressed by base excess, also change the capture threshold.[16] Despite the presence of such variables, statistical analysis showed no interference in the final result.

The autonomic nervous system (ANS) is involved in the formation of AF. Electrical stimulation of the ganglia or autonomic nerve endings in the posterior region of the left atrium may trigger AF.[17] A study demonstrated that RF applied by percutaneous catheter in patients with paroxysmal AF close to the pulmonary veins induces bradycardia and asystole, and this is evidence of a parasympathetic response. A lower incidence of AF occurred in the patients when this response was completely abolished.[18] In the case of the SURG TECHNIQUE group, the damage caused by transmural incisions may have damaged more tissue of the local ANS than the RF TECHNIQUE group, thus diminishing the possibility of AF recurrence.

Postoperative AF is a common complication in cardiac surgery and usually occurs within 5 days after the procedure. The predictor factors included age, chronic obstructive lung disease, valvular heart disease, atrial enlargement, withdrawal of either β-blocker or angiotensin-converting enzyme inhibitor per operative period.[1] In our study, a higher incidence of AF was also observed during the postoperative period in the RF TECHNIQUE group and pharmacological reversion with amiodarone was used in this group to achieve SR. Possibly the less effective block line in this group is responsible for this result.

It should be understood that these results refer to an early postoperative period. It is known that patients submitted to RF catheter ablation may present the "late cure" phenomenon. In such cases, the lesion created may "progress," forming a larger lesion.[11] If this phenomenon occurs in the RF TECHNIQUE group, a more effective block line might result with late SR recovery. However, the incidence of AF during the follow-up was higher in the RF TECHNIQUE as shown by the Cox regression. This phenomenon is not entirely understood,

but it could possibly be related to an incomplete isolation of the posterior LA region.

No tachyarrhythmia was identified in the IPVR while monitoring the electrical activity through the epicardial electrodes implanted. In a study using surgical PVI with cryoablation in 14 patients, Todd et al. demonstrated AF sustained in IPVR in four cases.[19] The absence of AF in this study may be the result of the high number of patients who used amiodarone. Creating effective block lines in both groups may also have helped stabilize the substrate in that region, making it impossible for AF to form and perpetuate itself when being monitored.

The pulmonary veins are known to be AF trigger foci. However, they are not the only ones. Areas such as the coronary sinus, the superior vena cava, and the RA also produce focal AF.[4,9] The occurrence of AF during the postoperative period may also be explained by the existence of these foci not involved in the surgical procedures of the study. The success rate of AF freedom can also be related to the type of monitoring used during follow-up. We considered failure the presence of an electrocardiogram showing AF during the schedule visits at the clinic or during a symptomatic crisis of palpitation, although even with this potential bias the recurrence was clearly higher in the RF group.

The study has some other limitations: A blanking period was not used during the follow-up, as occurred in other studies using surgery for AF.[3] This study was powered to assess differences in amount of energy required to capture a contralateral chamber during the test of the block lines, not recurrence of AF.

The use of energy in the RF range to create block lines during CPAF surgery has already been reported in recent articles, with promising results.[10] However, the impossibility of guaranteeing a transmural lesion using this technique may negatively affect its result, as shown in this study. One potential drawback of our study is the fact that only unipolar RF instruments were approved for use in our country by the time of the trial design. Other methods to apply RF have already been tested and can solve the problem of lesion depth. The use of bipolar electrodes involving the endocardium and epicardium would ensure a lesion throughout the thickness of the atrial wall, thus avoiding gaps in the lines created.[20] The PVI performed in the SURG TECHNIQUE group is already large at our Institution. In patients who have CPAF and mitral valve disease, it proved to be as effective as the Maze Procedure in maintaining SR, as we have reported previously.[7,21] This procedure can be applicable, because it uses the whole length of the incision of the left atriotomy to approach the mitral valve, encircling the pulmonary veins.[22] It is not necessary to use any further technology, except for stitch suture. These results also may provide information to understand the AF mechanisms and to choose the methods of treatment in clinical practice.

We were able to demonstrate that in this population of patients with CPAF, surgical PVI using the cut and sew technique led to more effective block lines at stimulation than the technique using and irrigated unipolar RF pen set at 30 W with a "*drag-and-burn*" technique. The RF TECHNIQUE group presented a higher incidence of AF during hospital stay and in the long-term follow-up, and also need more electrical cardioversion to SR during the postoperative period, as well as more use of amiodarone to maintain this rhythm. These findings may indicate that the block lines created in the SURG TECHNIQUE group produce a blockage that isolates the pulmonary veins and restores SR more effectively than those created by ablation using and irrigated unipolar RF pen set at 30 W with a "*drag-and-burn*" technique. On the other hand, they also indicate that complete isolation, in the acute postoperative period, may not be necessary to restore the SR, as long as it is associated to the administration of antiarrhythmic medication and that maybe scarring and remodeling in the line created by RF can lead to a conduction block during follow-up. A randomized trial using hard endpoints is needed to better understand these pending questions.

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