

SURGICAL ABLATION OF ATRIAL FIBRILLATION AND LEFT ATRIAL APPENDAGE OCCLUSION BY A TOTALLY VIDEOTHORACOSCOPIC APPROACH - NEW PARADIGM?

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Abstract

Introduction: Atrial fibrillation (AF) contributes to increased morbidity and mortality. Pharmacological and percutaneous catheter therapies are unsatisfactory, with potential serious adverse effects. Cox-Maze III/IV surgery, with higher rates of success, has not been widely adopted because of the associated complexity of the procedure.

Methods: We performed a retrospective analysis of the first patients submitted to surgical ablation of AF with occlusion of the left atrial appendage with a totally videothoracoscopic (VATS) approach in our institution. We describe the surgical technique and our results, including duration of surgery, hospital stay, complications and maintenance of sinus rhythm after surgery, at 6, 12 and 18 months of follow-up.

Results: We studied 15 patients (ages ranging from 39 to 75 years old; 54,5% female gender). Mean time since the diagnosis of AF was 5,75 years. All had been submitted to prior catheter ablation (mean of 2 attempts). Mean diameter and volume of the left atrium was 42 mm (M-mode) and 70 ml (43 ml/m²), respectively. Mean duration of surgery was 2 hours and 22 minutes. In one patient we had to convert the surgery to median sternotomy. Mean hospital stay was 4,8 days. Mean time of follow-up was 12 months. During follow-up, 91%, 90% and 80% of the patients were in sinus rhythm at 6, 12 and 18 months, respectively.

Conclusion: This surgical approach represents a real benefit for those patients with multiple attempts of catheter ablation without success. However, a larger sample of patients with a longer period of follow-up is necessary for further conclusions.

Keywords: atrial fibrillation, surgical ablation, videothoracoscopy

INTRODUCTION

Atrial fibrillation (AF) increases the risk of stroke by 5 times and accounts for 25% of strokes in patients over 80 years¹. It has been identified as an independent risk factor for mortality and dementia². The associated morbidity and mortality entail high costs for health systems. Anti-arrhythmic drugs have failure rates in the 1st year that reach 60%, being associated with significant adverse effects¹. On the other hand, catheter ablation has very variable success rates after a single procedure¹.

Regarding surgical ablation techniques, Cox-Maze III/IV procedures have become the gold standard in the surgical treatment of AF, with promising long-term results, obtaining, in some series, success rates of 93% in long term follow-up³.

Despite the success, they are technically demanding, complex, time-consuming surgeries associated with significant morbidity. It is in this context that several minimally invasive approaches for surgical ablation of AF have emerged.

METHODS

We performed a retrospective analysis of our initial experience in 15 patients who underwent surgical ablation of AF and concomitant occlusion of the left atrial appendage by VATS, between November 2017 and April 2019. It was not possible to proceed with this approach in one patient, due to extensive pleural adhesions, and he subsequently underwent open Cox-Maze surgery. We present a descriptive analysis of the characteristics of the population, describe the surgical technique used

and the results obtained, namely, duration of surgery and hospital stay, intra- and postoperative complications and conversion to sinus rhythm. In order to monitor the results of this technique, patients were evaluated by ECG at the time of discharge and at the first postoperative visit. At 6 months postoperatively they were evaluated by 24-hour Holter recording and at 12 and 18 months monitored by an external event recorder for 7 days.

RESULTS

Population

The characteristics of the population are shown in Table 1.

VATS surgical technique

The patients are placed in the supine position and intubated orotracheally through a double-lumen tube. External defibrillation paddles are used and a transeophageal echocardiogram probe is placed.

The procedure starts with the surgeon on the patient's right side, using 3 access ports. The first port is introduced into the fifth intercostal space, for video camera placement. Posteriorly, and under videothoracoscopy, the two working ports are introduced into the fourth and sixth intercostal space, approximately 45 degrees from the camera port (Figure 1).

The right phrenic nerve is identified and the pericardium incision made anteriorly and 2 centimetres parallel to it. Next, the dissection of the right pulmonary veins, oblique sinus and transverse sinus is done, allowing the insertion of the clamp for isolation of the right pulmonary veins (Figure 2) and then the upper (roof) (Figure 3) and lower lines (floor) of the box-lesion on the posterior wall of the left atrium. On the patient's left, the pericardium is opened posteriorly to the left phrenic nerve. The left pulmonary veins are isolated and the upper and lower lines of the box lesion are completed.

The bidirectional conduction block in the pulmonary veins and within the limits of the box lesion is tested (pacing with 10v output) and, finally, the left atrial appendage is excluded using a surgical clip (Figure 4) under echocardiographic control (Figure 5). The pericardium is closed. The incisions are infiltrated with ropivacaine to minimize postoperative pain.

Patients whose conversion to sinus rhythm did not occur during the procedure underwent electrical cardioversion at the end of surgery. The average duration of the intervention was 2 hours and 22 minutes.

It was necessary to convert to median sternotomy in one patient, due to hemorrhage originating in the inferior vena cava, and the procedure was completed through this approach after controlling the bleeding. 87% (n=13) of patients were extubated in the operating room and then transferred to the intensive care unit.

The average length of hospital stay was 4.8 days.

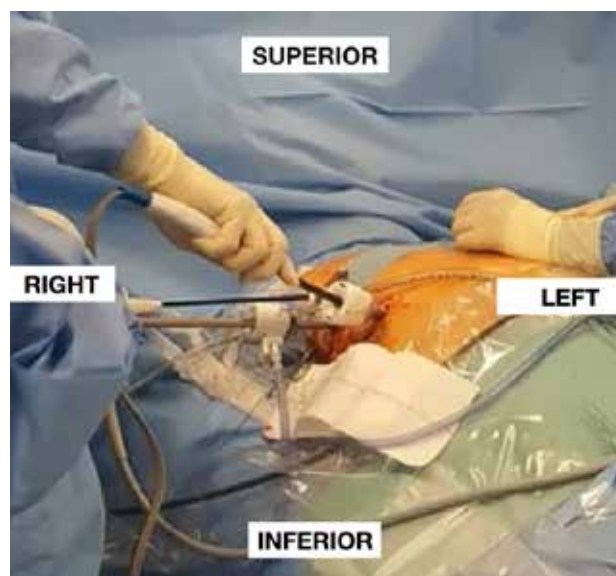


Figure 1

Positioning of right sided 3 ports.

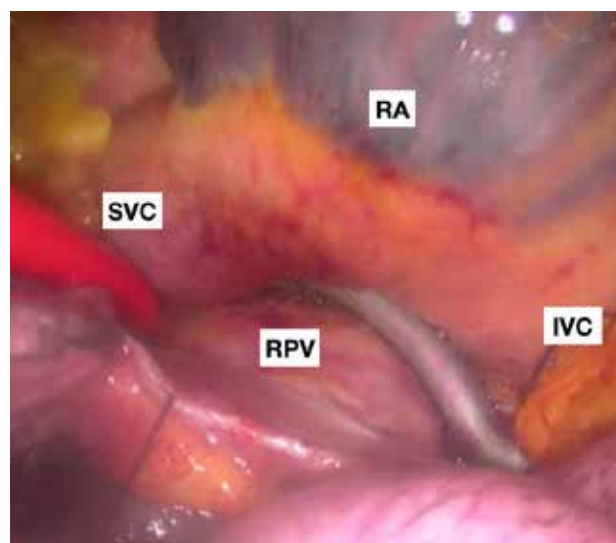


Figure 2

Isolation of right sided pulmonary veins: RA: right atrium, IVC: inferior vena cava, SVC: superior vena cava, RPV: right pulmonary veins.

Definitive pacemaker implantation was required in a patient with previous sinus node dysfunction.

One patient was reinterventined on the 3rd postoperative day for hemothorax. Two patients had a prolonged hospital stay due to respiratory infections. There were no cases of stroke or mortality.

Follow-up

All patients were discharged from the hospital in sinus rhythm and maintained their previous anticoagulant therapy. Three patients (20%) were discharged medicated with antiarrhythmic drugs, namely amiodarone

and flecainide, medication they were already taking pre-operatively.

The mean follow-up time was 12 months. The first outpatient evaluation was performed in the first postoperative consultation using ECG, with 91% of the patients in sinus rhythm. The first evaluation performed after the so-called blanking period (3 first months post-intervention) occurred at 6 months, using 24-hour Holter recording, with 91% of patients in sinus rhythm. At 12 and 18 months, patients were evaluated by an event recorder for 7 days, with 90% and 80% in sinus rhythm, respectively.

DISCUSSION

According to international, European and American recommendations, surgical ablation of AF alone can be considered in symptomatic patients in whom pharmacological and percutaneous ablation approaches have not been successful⁴. The results of these first-line therapies remain unsatisfactory and quite variable (influenced by the experience of the center and operator, clinical characteristics, cardiac structure and type of AF).

The effectiveness of anti-arrhythmic drugs in maintaining sinus rhythm is low, ranging between 19 and 60% in the 1st year, depending on the drug⁵. Equally or more important is the safety profile, which includes the proarrhythmic effects of this type of medication. Regarding catheter ablation, a meta-analysis including 19 studies and 6167 patients with AF followed for 28 to 71 months after multiple percutaneous ablation procedures, reports a success rate per single procedure of 65% at one year and 51% at 5 years old. After multiple procedures, the success rate increases to 86% in the first year and 78% at 5 years. The single-procedure success rate is significantly higher in patients with paroxysmal AF compared to those with persistent AF (67% versus 52%)⁵.

Despite the superior results of surgical ablation, it remains reserved for symptomatic patients, in whom previous therapies were not successful, probably because the Cox-Maze procedures, even with successive alterations, are still complex, time-consuming and invasive. Minimally invasive surgical ablation approaches aim to overcome these disadvantages.

In a systematic review, which included 14 studies with 1171 patients undergoing video-thoroscopic AF ablation, the success rate at one and two years, in patients without antiarrhythmic medication, was 78% and 77%, respectively⁶. In those who maintained the antiarrhythmic drug therapy, the success rate in the 1st year was 84%. When the results were analyzed by type of AF, patients with the paroxysmal form had better results than those with persistent AF (81% versus 63%; 95% CI)⁶. Considering that almost all patients in our series are without antiarrhythmic therapy, with 80% in sinus rhythm at 18 months, we can say that these are promising results, which are close to the published series.

Regarding complications, the same systematic re-

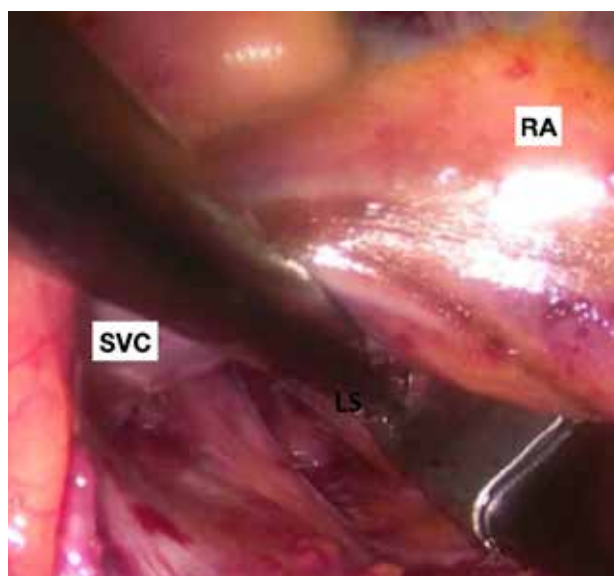


Figure 3

Creating the upper limit of the box lesion. AD: right atrium, SVC: superior vena cava, UP: box lesion upper limit

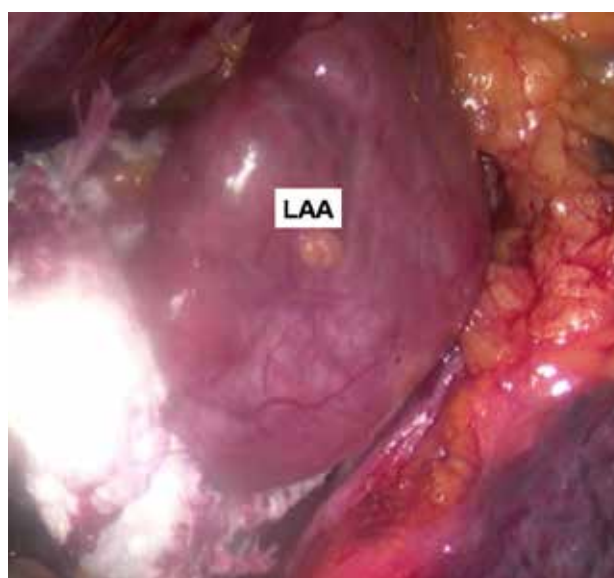


Figure 4

Occlusion of the left atrial appendage by clip. LAA: left atrial appendage.

view reports conversion rates to median sternotomy of 0.85%, stroke of 0.34%, pneumonia of 0.09%, mortality of 0.26% and pacemaker implantation of 0.77%, half of which had previous sinus node dysfunction.

In our series, it was necessary to convert the approach to sternotomy in two patients. A definitive pacemaker was implanted in a patient with previous sinus node dysfunction. The frequency of respiratory infections was 13% (n=2). When compared with the results of published studies, the incidence of complications in our series was higher, which we attribute to the fact that it represents the beginning of the learning curve inherent

Table 1 Population characteristics

Age (mean)	58,5 years (range 39 - 75 years)
Sex	54,5%(n=8) female
Average CHA2DS2VASc score	2
Average interval sine AF diagnosis	5,75 years
AF classification	66% paroxistic
Average LA diameter/volume	42 mm/70 ml (43 ml/m2)
Median number of previous percutaneous AF ablation	2



Figure 5 Echocardiographic aspect after LAA occlusion.

to any surgical procedure. We do not have any stroke nor mortality to report.

This is a population with a mean CHA2DS2VASc score of 2, which corresponds to a risk of stroke of 2.2% per year. All patients maintain anticoagulant therapy. The suspension of this and antiarrhythmic therapy will be discussed in a multidisciplinary team, and requires a longer follow-up period and longer continuous monitoring intervals, as well as the analysis of results regarding the reduction in the amount of AF (AF burden). This approach requires a multidisciplinary team, which brings together cardiologists, cardiac surgeons and anesthesiologists, dedicated to the treatment of this arrhythmia.

These are preliminary results, which represent the beginning of the learning curve, based on a small sample size and a short follow-up period. However, this is a very specific group of patients given the number of previous percutaneous interventions.

CONCLUSION

This type of surgical approach to AF represents a real benefit for patients undergoing multiple unsuccessful percutaneous ablation attempts. However, to validate its clinical impact, more follow-up time and longer periods of continuous monitoring will be needed.

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