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Thoracoscopic radiofrequency ablation for lone atrial fibrillation: Box-lesion technique

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ABSTRACT

Background: We report the feasibility and outcomes of box-lesion ablation technique to treat stand-alone atrial fibrillation (AF).

Methods: There were 31 patients with a mean age of 63.3 ± 8.4 years who underwent bilateral totally thoracoscopic ablation of symptomatic paroxysmal AF (n = 8; 25.8%) and long-standing perzistent AF (n = 23; 75.2%). The box-lesion procedure included bilateral pulmonary vein and left atrial posterior wall ablation using irrigated bipolar radiofrequency with documentation of conduction block.

Results: There were no intra- or perioperative ablation-related complications. There was no operative mortality, no myocardial infarction, and no stroke. Skin-to-skin procedure time was 152.1 ± 36.7 min and the postoperative average length of stay was 6.26 ± 1.24 days. At discharge, 29 patients (93.5%) were in sinus rhythm. Median follow-up time was 20.4 ± 8.3 months. At three months postsurgery, 20 patients of 30 (66.6%) were free from AF without the need of antiarrhythmic drugs. Six patients (20%) underwent catheter reablation. Twenty-three patients (76.6%) were in sinus rhythm at one year after the last performed ablation (surgical ablation or catheter reablation).

Conclusion: The thoracoscopic box-lesion ablation procedure is a safe, effective, and minimally invasive method for the treatment of isolated (lone) AF. This procedure provided excellent short-term freedom from AF.

Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia with a lifetime risk of 25% for people aged above 40 years. Due to an ageing population, the incidence is increasing even further [1]. Secondary to negative haemodynamic effects, AF carries significant morbidity and mortality; stroke is the most feared complication with a fivefold increased risk [2]. Therefore, treatment of AF is crucial and worthwhile. Initially,

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Abbreviations: AADs, antiarrhythmic drugs; AF, atrial fibrillation; LA, left atrial; SD, standard deviation; LVEF, left ventricular ejection fiction; LAF, stand alone atrial fibrillation; CA, catheter ablation; PV, pulmory vein; PVI, pulmonary vein isolation; AFL, atrial flutter; AT, atrial tachycardia; TEE, transoesophageal echocardiografy; HM, Holter monitoring; SR, sinus rythm.

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rhythm control treatment of AF was limited to a direct current shock or taking quinidine, and digitalis was recommended for rate control [3,4]. In 1982, the first catheter ablation (CA) aimed at achieving rate control by ablation of the atrioventricular junction [5,6]. The first successful cut and sew surgical treatment (cut and sew Maze procedure) was performed in 1987 by Dr. Cox [7]. As a result of increased knowledge on AF, these procedures have changed extensively over the years. Haissaguerre et al. recognized pulmonary vein (PV) foci as initiators of AF, which currently forms the cornerstone of most interventional treatments for AF [8]. According to current guidelines, pharmacological treatment is still considered as the first step in the approach of AF treatment. However, invasive strategies are gaining more attention. In selected cases, CA [9], or even surgical ablation [10,11], could be considered as first-line therapy [12]. Although pulmonary vein isolation (PVI) is the cornerstone of AF treatment, no uniform invasive treatment concept in the setting of the nonparoxysmal AF forms exists. Due to suboptimal results of both CA [13] and minimal invasive surgical strategies in this difficult to treat group [14], surgeons and electrophysiologists have combined strengths in the form of a hybrid AF ablation (combination of endocardial catheter and surgical epicardial ablation) to maximize success rates and minimize procedural morbidities. Some ablation lesions associated with the Cox-Maze procedure, for example, cannot be performed epicardially, though can be easily performed endocardially. This hybrid approach, first described by Pak et al. [15] in 2007, has already proved to be safe and effective and showed good results in patients suffering from all types of AF [16]. Available data however is still scarce. Hybrid ablation has now been carried out since a few years and is applied more and more across the world. Absence of guidelines on this procedure leads to the use of different approaches and different insights with respect to patient management.

Methods

The Institutional Review Board approved the study and individual consents were obtained from the patients. Patients requiring nonpharmacologic treatment of AF and patients with a preference for minimaxy invasive surgery and/or earlier failure of catheter pulmonary vein isolation were eligible for the study. According to the guidelines, only patients who had failed to maintain sinus rhythm when using at least one AAD for symptomatic AF were included. Definition of paroxysmal AF, persistent AF, and long-standing persistent AF (LSPAF), success and failure of ablation, and follow-up monitoring were based on the HRS/EHRA consensus statement for catheter and surgical ablation of AF [7]. Before surgery, all patients underwent clinical examination, 12-lead electrocardiogram (ECG), chest radiography, and coronary angiography if agend 40 years or older. The possibility of underlying heart disease was excluded by transthoracic or esophageal echocardiography. No patients had undergone a previous cardiac operation. Exclusion criteria were previous cardiac surgery, previous catheter ablation for AF treatment, and left atrial–anteroposterior diameter greater than 60 mm. A detailed data of patient characteristics is outlined in Table 1.

Table 1 – Preoperative characteristics.

Age, y (mean ± SD)	63.3 ± 8.4
Female gender, *n* (%)	14 (45.2%)
Diabetes mellitus, *n* (%)	4 (11.4%)
Hypertension, *n* (%)	19 (54.3%)
AF type	
Paroxysmal, *n* (%)	8 (25.8%)
Long-standing perzistent, *n* (%)	23 (75.2%)
LA size, mm (mean ± SD)	43.6 ± 8.4
LVEF, % (mean ± SD)	51 ± 11.5

Preoperative management

Oral anticoagulant therapy was discontinued free days before surgery and replaced by low-molecular weight heparin when the international normalized ratio value was less than 2.0. AAD were continued during hospital admission. Before surgery transesophageal echocardiogram was performed to exclude thrombus in the left atrial appendage (LAA) and structural cardiac patology.

Patients underwent first a thoracoscopic, epicardial surgical ablation. In case of reccurence the patient underwent other procedure. Therefore at six patients the surgical ablation was followed by catheter endocardial ablation between 30 and 90 days postoperatively in a sequential, staged fashion.

All patients were followed up at 3, 6 and 12 months after surgery. Success was defined as no episode of AF, atrial flutter (AFL) or any atrial tachycardia (AT) lasting more than 30 s and patient off antiarrhythmic drugs (AAD). At the first 16 patients were the data obtained via the implantable monitoring device (CareLink Network, Medtronic, Inc), which allows online storage and retrieval of data without the need for an outpatient visit. Because of high price of this device we were forced to stop to use it for monitoring. Therefore 24 h Holter monitoring (HM) was performed at 3 months, 6 months and 1 year at other 15 patients. All ECGs and Holters were checker by arrhythmologist. For analysis, occurence of three rhythms was considered as procedure failure: AF, AFL or AT lasting more than 30 s.

30 patients reached 1-year follow-up (one patient died 4 months after surgery). Median follow-up was 20.5 months [range 12–34]. AADs were given postoperatively to all patients, and although we recommended discontinuation three months after ablation if the patient appeared to be AF free, their continued use was at the discretion of referring cardiologists. Anticoagulation was started with administration of LMWH on first postoperative day and warfarin was administered on 3 postoperative day 2 with INR target of 2.5 and stopped after three months if the Holter recording or CareLink data showed a sinus rhythm (SR) and patients had a low thromboembolic risk (CHADS2 score <2).

Our technique

First step – thoracoscopic pericardial pulmonary vein isolation

- The procedure was performed under the general anaesthesia by using a double lumen tube for unilateral lung ventilation. The patient was placed in a supine position.

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