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Arrhythmia recurrence in patients following cardiac surgery with concomitant therapy of atrial fibrillation – Experience of our cardiac center

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ABSTRACT

Introduction: Surgical treatment of atrial fibrillation (AF) is a common and time-proven treatment method for this type of arrhythmias both as a separate procedure and as a procedure related to cardiac surgery for another indication (concomitant procedure). Patients experience arrhythmia recurrence despite highly efficient surgical treatment. These arrhythmias are often resistant to pharmacological treatment (due to an extensive fibrous substrate); therefore, electroanatomical mapping accompanying catheter ablation is significantly more effective. The arrhythmogenic fibrous substrate is a result of both a primary cardiac disease (an underlying disease causing atrial dilation) and surgical intervention (incision, cannula insertion sites, MAZE lines with a renewed spread of electrical signal in these blocks).

Method and patients: Electroanatomical mapping and ablation were performed in 92 patients with arrhythmia recurrence following concomitant surgical treatment for AF between January 2010 and November 2015. The Cox maze procedure was performed using a disposable cryoablation catheter. The heart rhythm in patients following radiofrequency ablation procedure was monitored in half-year intervals (24-h Holter ECG, 7-day loop recorder, in some patients also by means of implanted pacemakers or implantable loop recorders). The average left atrial size (PLAX) was 50 mm, 59% of patients underwent mitral valve surgery, 54% of patients had tricuspid valve surgery, 16% were operated for congenital developmental disorders, in 17% of patients, repeated cardiac surgery was performed. The above-mentioned facts show that these are patients with an extensive arrhythmogenic substrate.

Results: The Cox maze procedure resulted in an extensive fibrous arrhythmogenic substrate in the atrium (arrhythmia recurrence following the maze procedure is more often regular atrial tachycardias while AF is predominant among arrhythmias for which the maze procedure was indicated). All patients had a follow-up visit after 12 months, 80% of patients presented for a follow-up visit after 24 months. Early recurrence after ablation (within

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3 months following the procedure) was found in 21% of patients. Early recurrence after ablation was statistically significantly related to arrhythmia recurrence within 12 months ($p = 0.003$) and arrhythmia recurrence within 24 months ($p = 0.003$). 73% of patients had no recurrent AF or atrial tachycardia (AT) after 12 months and 53% after 24 months. A total of 146 arrhythmias were ablated, i.e. 1/3 of patients had more than 1 arrhythmia. These were persistent AF found in 24% of patients, paroxysmal AF seen in 13% of patients and regular AT detected in 53% of patients. More than one half of regular AT originated in LA (as perimitral atrial flutter in most cases). Remaining arrhythmias originated from the right atrium (as typical atrial flutter in half of the cases). 57% of patients had a renewed spread of signal in the mitral isthmus (ablation of the coronary sinus was necessary in 1/3 of patients). No domination in the number of reconnections was found for any of the pulmonary veins. The finding of a significantly reduced signal amplitude in the entire LA was associated with a higher risk of acute ablation failure ($p = 0.001$). Acute ablation failure was associated with a higher risk of arrhythmia recurrence after 12 months ($p = 0.07$). There was a trend of a higher AT incidence originating from the RA in patients who underwent surgery for a congenital heart defect ($p = 0.06$). The diagnosis of arterial hypertension was associated with a higher risk of arrhythmia recurrence ($p = 0.13$). The finding of persistent AF on ECG (compared to other findings, i.e. paroxysmal AF and regular AT) before ablation did not increase the risk of recurrence after ablation.

Conclusion: In patients after cardiac surgery, catheterization performed to treat arrhythmia recurrence is a effective method of subsequent treatment, despite an extensive arrhythmogenic substrate. A rather large number of AT cases originate from the right atrium, in particular in patients after surgery for congenital heart defects. Patients with a significantly reduced signal in the larger part of the atrium due to an extensive arrhythmogenic substrate present the most complicated cases.

Introduction

Surgical treatment of atrial fibrillation (AF) is an established treatment method both as a separated procedure and as part of a complex cardiac surgery intervention [1]. In patients with AF, enhancing cardiac surgery with (concomitant) MAZE procedure leads to a twofold reduction of recurrent AF and atrial tachycardia (AT) without anti-arrhythmic therapy, compared to procedures without surgical intervention for AF (sinus rhythm after 12 month, 63.2% vs. 29.4%, $p < 0.001$), the procedure being accompanied by an insignificant prolongation of extracorporeal circulation (15 min) and the need of permanent pacemaking (some works did not confirm the increase need of permanent pacemaking). Other works, not differentiating whether the patient used antiarrhythmic drugs or not, report an even greater – more than threefold – reduction of recurrent AF and AT [2]. At the same time, the addition of MAZE procedure does not increase the incidence of post-operative complications, length of hospitalization and repeated hospitalization due to surgical complications or the post-surgical incidence of cardiac and cerebrovascular events and overall mortality [3,4]. It is, therefore, desirable to enhance the surgical procedure with a targeted intervention for AF (recommended IIa level for symptomatic AF and recommended IIb for asymptomatic AF) [1].

It has been reported in patients with paroxysmal AF that catheterization ablation (unless otherwise stated term ablation refers to catheterization ablation) leads to a significant decrease in the number of AF episodes, compared to antiarrhythmic drugs. In patients with paroxysmal AF, it is sufficient to isolate pulmonary veins during surgical procedure [5] (however, it is not electrophysiologically verified in the majority of surgical patients). For persistent AF, when mere pulmonary vein isolation is not sufficiently efficient, it is necessary to perform enhanced lesions in the left atrium (LA), i.e. box lesions, mitral isthmus lesions and lesions toward the amputated left atrial appendage (LAA) (the addition of these lines produces a threefold reduction of AF recurrence after 24 months compared to simple pulmonary vein isolation) and, if possible, lesions in the right atrium (RA) leading to an increased effectiveness of the procedure (the risk of arrhythmia is reduced by a further 20–25% in the 1st and 2nd year [1,6,7,24,26]). The addition of right-sided lines reduces the number of hospitalizations for all causes, increases stress tolerance and reduces the need of antiarrhythmic drugs [6] according to Italian authors (who used radiofrequency energy). Due to the muscular architecture and thickness of the mitral isthmus [8], bilateral energy application is advisable (from the endocardial and epicardial side through the coronary sinus) to ensure lesion transmurality. This has been confirmed by studies where repeated applications of radiofrequency energy in individual lines lead to an increased reduction of recurrent