

## Radiofrequency Ablation of the Incisional Tachycardia and Atrial Fibrillation in Patients after Heart Valve Replacement

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### Abstract

Mitral valve disease, including dysfunction of the mitral valve, is often accompanied by atrial fibrillation. Among the patients with prosthetic mitral valves, atrial fibrillation occurs in 30 - 50% cases. Development of atrial arrhythmias and incisional tachycardia in the early and late postoperative periods can significantly influence patients' rehabilitation and prognosis. Our clinical case describes a patient with a mechanical mitral valve and incisional tachycardia, which led to progression of heart failure and reduced left ventricular systolic function. The patient underwent a catheter ablation with non-invasive myocardium mapping. The case reveals the potentials of treatment of incisional tachycardia and atrial fibrillation, which do not respond to drug therapy. Modern methods of visualization enable the cardiac surgeons to reduce possible intraoperative risks and development of complications in this group of patients.

**Keywords:** Catheter Ablation; Chronic Rheumatic Heart Disease; Case Report; Atrial Fibrillation; Incisional Tachycardia; Atrial Flutter; Mitral Valve Replacement, Cardioverter-Defibrillator

### Introduction

Pathology of the valvular apparatus is one of the most common diseases of the cardiovascular system. According to the Framingham study, the frequency of occurrence of this defect is 19 - 21% in the population. The failure of the mitral valve (MK) is of the particular interest due to increased prevalence.

Disturbances in the valve lead to electrophysiological and structural changes in the myocardium. Reduction of the refractory period, as well as the appearance of fibrosis can contribute to the development of cardiac arrhythmias. Thus, in natural course of the disease, atrial fibrillation (AF) develops in 30 - 84% of patients with mitral valve pathology [1].

The only method that improves the prognosis of such patients is surgical correction of valvular disease, which includes plastic or prosthetic repair of the mitral valve. Surgery can also contribute to increased myocardial trauma. The risk of AF or incisional tachycardia in the postoperative period is not excluded, further worsening the clinical picture and prognosis of patients.

### Materials and Methods

According to the results of a study of 48 patients after mitral valve replacement, patients with a combined mitral valve lesion and sinus rhythm, compared with patients with AF, showed lower diastolic and systolic myocardial stress, which persisted even in a remote period

of observation. At the background of sinus rhythm, the processes of reverse myocardial remodeling in patients with prosthetic mitral valve had more favorable course, which is probably due to the recurrent mitral regurgitation [2]. It is also known that the effectiveness of the rehabilitation of patients undergoing plastic surgery or prosthetic repair of the mitral valve is significantly higher in restoring and maintaining sinus rhythm [3].

In case of resistance to drug therapy the radiofrequency ablation is considered to be the possible strategy, which is the most effective treatment for atrial fibrillation.

In recent years, there have been carried out many studies showing the advantage of the surgical approach versus drug therapy. Numerous studies have shown that radiofrequency ablation is much more effective than antiarrhythmic drugs, and the recently completed CASTLE AF study has only confirmed the need to maintain sinus rhythm, showing not only high efficiency, but also improved prognosis in patients with heart failure and reduced systolic left ventricular function. According to the results of the analysis of 363 (n = 179/n = 184) patients, the achievement of a combined end point (death or hospitalization for decompensated heart failure) was recorded in 51 patients (28.5%) of the catheter ablation group versus 82 patients (44.6%) of the group of drug treatment for AF (p = 0.006) [4].

The "Labyrinth-4" procedure in combination with simultaneous correction of mitral valve pathology is indicated as a basic method of treatment in simultaneous diagnosis of mitral valve pathology and AF, however the frequency of using of this technique is small, especially in Kazakhstan [5].

At the same time, there are not so many clinical cases of surgical treatment of AF that occurred in the postoperative period in patients with prosthetic mitral valve [6]. Until recently, such patients were considered to be inoperable: many patients were denied a surgical treatment due to the technical complexity of the procedure and the high risk of complications. While performing the procedure, there is a likelihood of valve lesion, which may require further surgery on the "open" heart. Surgical operations on the "open" heart in the history contribute to the appearance of delayed arrhythmogenic zones that occur most frequently in the cannulation area. Concomitant structural heart disease only contributes to the disruption of rhythm and conduction with changes in the frequency and architectonics of contractions [7].

In our opinion, additional imaging methods are of fundamental importance in the surgical treatment of arrhythmias in patients with mechanical prosthetic mitral valve: intracardiac echocardiography, computer tomography with the possibility of invasive mapping of arrhythmia localization.

The most dangerous complication during the operation is the sticking of the catheter in the mechanical valve, which can lead to adverse and sometimes fatal consequences. In most cases, the probability of this risk is the main reason for the refusal of surgical manipulation.

The purpose of this clinical case is to show the effectiveness of radiofrequency ablation in the treatment of a developed arrhythmia in a patient with a prosthetic mitral valve.

### Clinical Case

Patient I, 65 years old. In 2010, chronic rheumatic heart disease and mitral valve disease were diagnosed. In 2011, in connection with the development of critical stenosis of mitral valve, he underwent a mitral valve replacement. According to coronary angiography in the same year, the coronary vessels are intact. At the same time, the patient had a gradual decrease in the left ventricular ejection fraction (up to 34%) and dilatation of the cardiac cavities.

In 2016, the patient felt a palpitation and heaviness in the heart area, dyspnea appeared in moderate exertion, edema in the lower extremities. According to ECG, there were atrial flutter, atrial fibrillation, tachysystole. According to EchoCG, the left atrium is 5.6 cm in size, the volume of the left atrium is 134 ml, the ejection fraction is 30%. The average daily heart rate, according to the daily ECG

monitoring, is 100 beats/min. Antiarrhythmic therapy had no effect (amiodarone 600 mg/day, further the dose is reduced to 200 mg according to the scheme without any effect; beta-blockers, cardiac glycoside, potassium-sparing and loop diuretics were also added). In connection with the increase of the heart failure, the patient was hospitalized to the hospital and underwent a cardioverter-defibrillator implantation for primary prevention of fatal complications. After implantation, the patient was prepared in a planned order for the next stage of treatment.

Taking into account the signs of decompensation of heart failure that occurred at the background of arrhythmia, and the ineffectiveness of drug treatment, we decided to perform a radiofrequency ablation. Because of sustained episodes of atypical flutter at the background of atrial fibrillation in the first stage, the patient underwent invasive mapping using the “Carto 3” system [8,9]. There were identified foci of focal activity in the area of the pulmonary veins and right atrium (Figure 1).

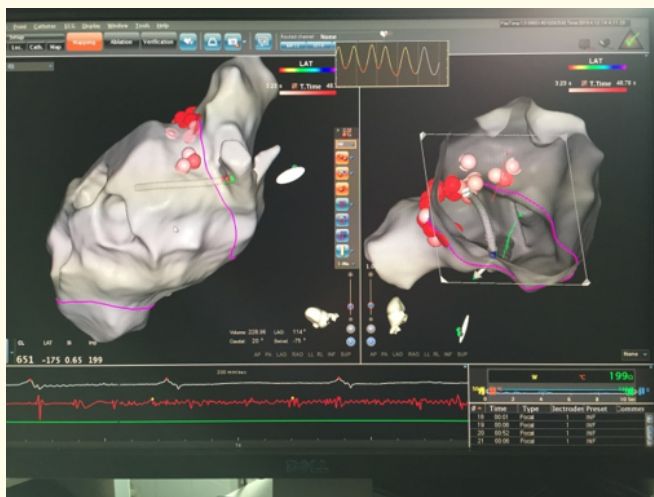
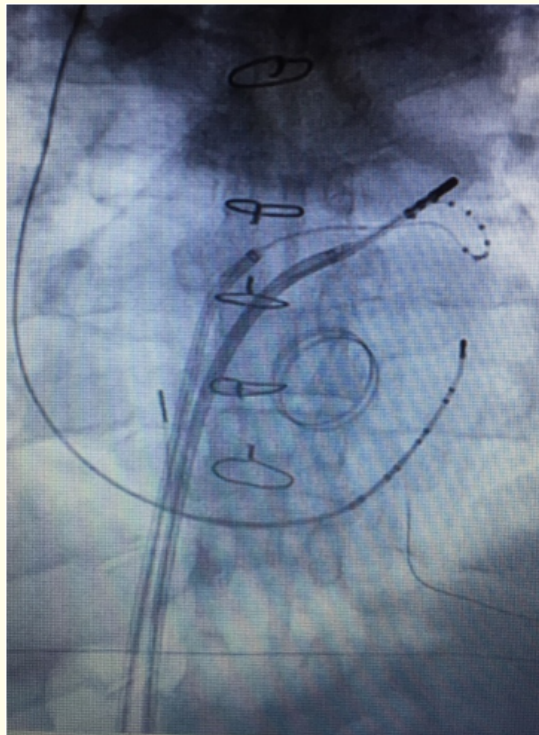


Figure 1: Ectopic foci according to invasive mapping using the “Carto 3” system.

The next step was the isolation of the pulmonary veins, mapping and radiofrequency ablation of atrial flutter. It should be noted that the operation was performed at the background of the target level of the international normalized attitude (INR) of 3.2 at the background of the AVC intake.

After installing a diagnostic electrode in the coronary sinus, an endogram showed the episodes of atrial fibrillation and atrial flutter with the earliest activation point at the distal end of the electrode with a cycle of 365 ms. Under the control of fluoroscopy, the puncture of the interatrial septum was performed; 2 intracardiac introducers were installed into the cavity of the left atrium (Figure 2). An electropotential map of the left atrium was constructed. A circular 10-pole diagnostic catheter is installed on the pulmonary veins; antral isolation of the pulmonary veins is performed. The next step was the construction of activation maps of the right and left atria. The earliest activation point was detected along the side wall of the right atrium, in the area of the intended cannulation of the superior vena cava. A line through the indicated area is made between the cava veins - a short-term restoration of the sinus rhythm with an instantaneous launch of isthmus-dependent atrial flutter with a cycle of 380 ms. Ablation in the area of the cava-tricuspid isthmus - restoration of sinus rhythm on the impact. This procedure is completed.

The postoperative period was uneventful: the sinus rhythm was maintained, with repeated echocardiography without significant dynamics. The patient was discharged in satisfactory condition. Amiodarone was recommended for 6 months at a dose of 200 mg/day (according to the scheme 5 and 2). At a control visit after 3 months the patient's condition is satisfactory, sinus rhythm, left ventricular ejection fraction of 36%.



**Figure 2:** Circular diagnostic 10-pole electrode and ablation electrode at the antrum of the left superior pulmonary vein.

During a visit after 6 months, according to ICD and standard ECG, there were atrial fibrillation and blockade of the left leg of the bundle of His. In this connection, the left ventricular electrode was routinely implanted into the patient, the cardioverter-defibrillator was replaced with a cardiac resynchronization device for correcting the heart chronological dyssynchrony. According to transthoracic echocardiography, the left ventricular ejection fraction is 37 - 38%, and heart failure does not progress.

### Discussion and Conclusion

Early diagnosis of AF in mitral valve pathology requiring surgical correction is an important advantage for the patient. According to the literature, intraoperative restoration of sinus rhythm with prosthetic mitral valve demonstrates significant results and the operation "Labyrinth-4" more and more consolidates its position when choosing the appropriate technique [8-10]. Nevertheless, in some cases, atrial fibrillation and incisional tachycardias occur in the postoperative period. The presence of the mechanical mitral valve is the reason for refusing of interventional treatment. Modern possibilities of visual control of invasive operations, such as intracardiac echocardiography, reduce intraoperative risks and the likelihood of complications. In maximum control, this technique is most effective. In turn, it should be taken into account that such operations should be carried out in medical institutions, whose specialists perform a large number of catheter interventions per year. The equipment of the operating room and the corresponding experience of the operating team is of equal importance for possible emergency correction in case of development of complications.

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