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SIMULTANEOUS PULMONARY VEIN ISOLATION AND ABLATION OF THE SUBSTRATE OF BIATRIAL FLUTTER IN A PATIENT WITH A MECHANICAL MITRAL VALVE PROSTHESIS: A CASE REPORT

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Catheter radiofrequency ablation of the atrial fibrillation substrate may be difficult in patients after open heart surgery. Difficulties may arise in the presence of a mitral valve prosthesis, atrial arrhythmias of several morphologies (more often left atrial atypical flutter), including incisional ones. These cases require a thorough and scrupulous approach to achieve complete isolation of all available arrhythmia substrates. A distinctive feature of this observation is the successful simultaneous pulmonary vein isolation and two atrial arrhythmias in a patient with a mechanical mitral prosthesis.

Key words: radiofrequency ablation; atrial fibrillation; mitral prosthesis; navigation mapping; incisional arrhythmia

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Atrial fibrillation (AF) is the most common atrial tachyarrhythmia in patients after open heart surgery. Radiofrequency catheter ablation to isolate the pulmonary veins (PV) is a proven and effective treatment for AF [1]. However, the presence of a mechanical mitral valve prosthesis and the presence of other atrial arrhythmias, including incisional arrhythmias, may limit the use of radiofrequency catheter techniques. Technical difficulties in accessing the left atrium (LA) are also common.

In reviewing the literature, we were able to find individual clinical reports of successful catheter ablation in patients with a mechanical mitral valve prosthesis. These reports also support the efficacy of the procedure and call for the ablation to be performed carefully and meticulously until the arrhythmia substrate is completely ablated [2].

The peculiarity of this observation is the elimination of the substrate of AF and two atrial tachycardias simultaneously in a patient with a mechanical mitral prosthesis.

A 72-year-old patient was admitted for AF radiofrequency ablation. Primary diagnosis:. Mitral valve replacement with mechanical prosthesis in 2015. Arterial hypertension III stage, very high risk of cardiovascular complications. Complications: Tachysystole persistent atrial fibrillation, CHA_2DS_2-VASc score 3. Heart failure NYHA functional class II.

The patient had frequent atrial extrasystoles for 7 years, but after mitral valve replacement in 2015, frequent symptomatic paroxysms of atrial fibrillation with heart failure phenomena were also observed. The following antiarrhythmic therapy was prescribed in anamnesis: Allapinin, Sotalol, Propafenone, Amiodarone. Sinus rhythm control was not achieved. In view of the ineffectiveness of drug therapy, the frequent symptomatic paroxysms of AF and the progression of heart failure, the indication for catheter ablation of the arrhythmia substrate was therefore given. For preoperative preparation, coronary angiography (without evidence of coronary atherosclerosis) and transoesopha-

geal echocardiography (TE ECHO) were performed the day before surgery. No thrombus seen in the LA cavity or in the auricle.

An initial sinus rhythm of 65 bpm was observed. The right femoral vein was punctured three times under local anaesthesia. An electrode was placed in the coronary sinus (CS) via an inferior approach. Under X-ray guidance, a standard puncture of the atrial septum was attempted, but due to the altered anatomy, the needle was difficult to position. It was decided to perform the puncture under the additional TE ECHO monitoring (a functional diagnostician was invited to the operating room). A navigation electrode and a 20-pole Lasso diagnostic catheter were inserted into the LA through two transseptal intraductions. Anatomical mapping of the LA was performed with mapping of the PV. Electrical activity was detected in the right and left PV, and radiofrequency exposure with a wide antral ablation (power 40 W - along the posterior wall, 45 W - along the anterior wall of the LA, each for 10-15 seconds) was performed until they were isolated. A sustained atrial flutter attack with a cycle duration of 240-260 ms and early electrical activity in the proximal CS 9-10 was induced during the programmed atrial pacing protocol (Fig. 1). Stimulation of the region of the cavatricuspid isthmus (CTI) in 'entrainment' mode occurred during tachycardia with an acceptable so-called 'post-pacing interval' (PPI) that differed from the tachycardia cycle by 10 ms, indicating the involvement of the CTI in the re-entry chain of flutter. Three linear ablations were performed in the CTI region, whereupon a transition to sustained atrial tachycardia with a cycle length of 290 ms and a shift of the earliest atrial activity to the region CS 7-8 was noted (Fig. 2). Activation mapping of the right atrium (RA) during arrhythmia along the posterior wall of the RA near the inferior vena cava revealed a region where the earliest and latest atrial signals are adjacent, the so-called 'head-to-tail' re-entry pattern. When this region was stimulated during an 'entrainment' arrhythmia, an unacceptable PPI of 70 ms greater than the tachycardia cycle was observed. Bi-atrial amplitude mapping revealed localisation of scar zones along the posterior RA wall with a transition through the interatrial wall to the anterior LA wall in the region of the right inferior PV. These low-amplitude zones were most likely the cause of an 'incisional' biatrial flutter (Fig. 3). The anterior LA wall was stimulated in 'entrainment' mode and a PPI of 20 ms was obtained, confirming the involvement of this zone in the re-entry circuit. Dual potentials were also recorded at the ablation electrode (Fig. 4). Radiofrequency exposure was performed in this area with restoration of sinus rhythm at the 4th second (Fig. 5). Conduction through the CTI zone was monitored and a bidirectional conduction block (180-200 ms) was confirmed. No tachycardia induction was observed after ablation with programmed repetitive and overdrive atrial pacing. Electrical activity in the PV was monitored and its isolation confirmed. The

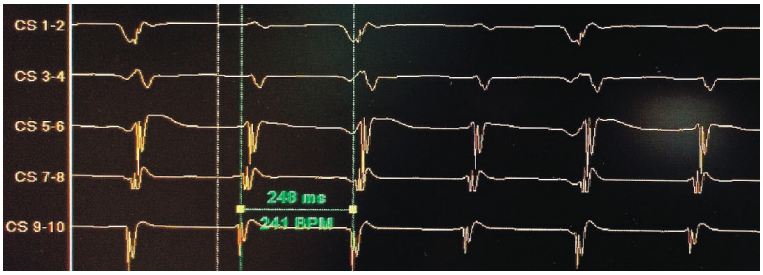

Fig. 1. Induced attack of atrial flutter with 240-260 ms cycle and early CS 9-10.

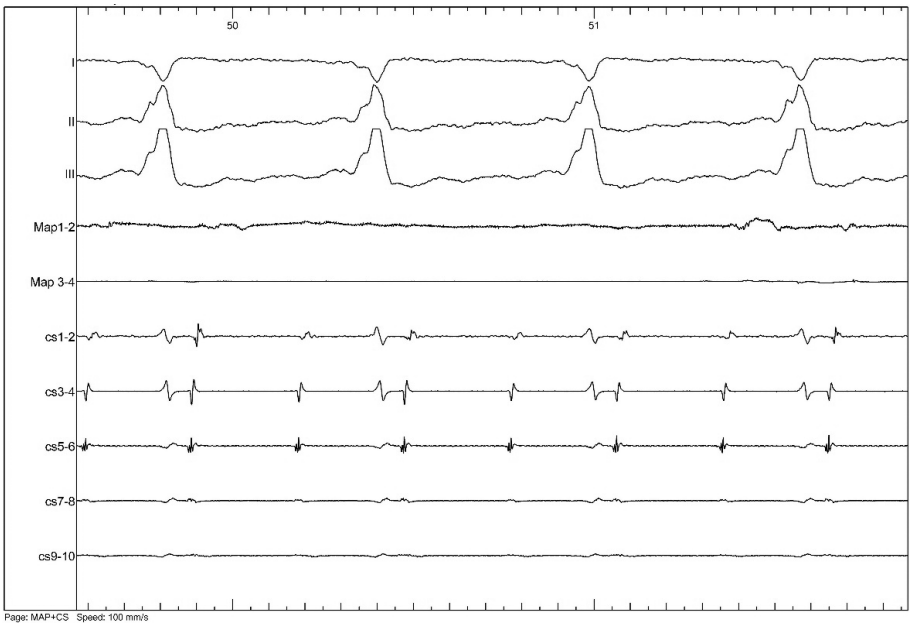

Fig. 2. Atrial flutter with 290 ms cycle and early CS 7-8.

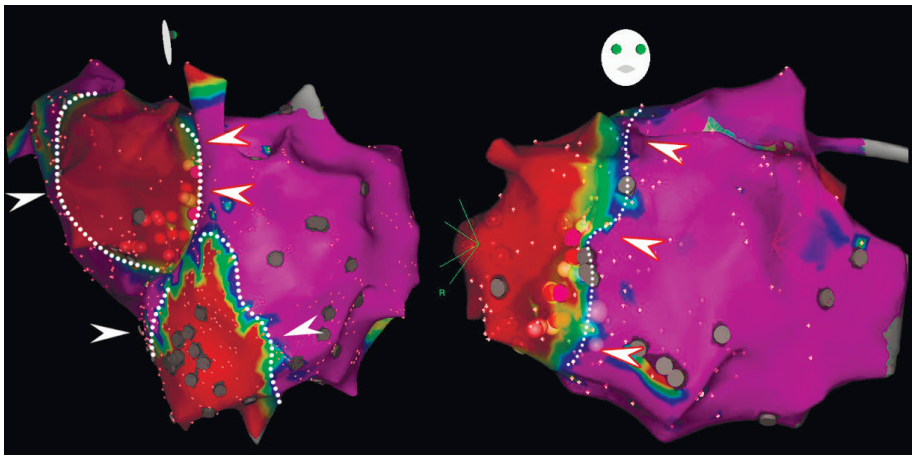

Fig. 3. Activation and bipolar biatrial mapping.

duration of the procedure was 157 minutes (from the time the patient was placed on the table to the time he was removed from the operating table). At the end of the operation, haemodynamics were stable, the patient was transferred to the intensive care unit under observation.

Follow-up after 3 months showed no clinical evidence of AF and atrial flutter with persistent single atrial extrasystoles in sinus rhythm.

DISCUSSION

Catheter isolation of the PV in a patient with a mechanical mitral prosthesis is a major challenge for the surgeon. This is due to the high complexity of the transseptal approach and catheter manipulation in the LA associated with the altered anatomy and scarring changes at the atrium [3]. The use of additional imaging techniques (intracardiac ultrasound or TE ECHO, as in our case) can facilitate the transseptal approach and reduce the risk of complications [4]. One of the most threatening complications is mechanical dysfunction of the prosthesis due to catheter manipulation, as well as entrapment of the catheter between the prosthetic elements [5]. Such conditions require special care in catheter manipulation and sufficient experience on the part of the surgeon. Classical techniques of catheter manipulation cannot always be used due to the large low-amplitude fields in the area of the scar and the mitral valve prosthesis. It is also important to note that arrhythmia mechanism detection and subsequent substrate ablation is now quite effective using activation high-density mapping (subject to inducible tachycardia).

Several studies have shown lower recurrence-free survival with a higher incidence of atrial flutter after PV isolation in patients undergoing cardiac surgery [3, 6]. This requires a more careful approach to surgery. The method of navigated mapping has proven successful in the treatment of complex atrial tachyarrhythmias in patients after cardiac surgery. Among other things, this method makes it possible to localize and eliminate incurrent and ectopic tachyarrhythmias with high accuracy, which ultimately significantly improves surgical efficiency [7]. Therefore, the use of navigated mapping is recommended for more precise detection and ablation of all available arrhythmogenic substrates in the right and left atrium. In complex cases, the surgeon often needs to combine several techniques. Alternatively, electrophysiological techniques can be used with detection of fractionated and low-amplitude signals as well as electrically 'silent' zones in critical areas of re-entry into the atria, including analysis of unipolar signals from the ablation catheter.

An equally important aspect before surgery is to clarify the method and access for valve replacement. There is a possibility of arrhythmias occurring at the site of interatrial septal access or in the area of cannulation of the RA or vena cava [8, 9]. The data obtained allows planning of the operation, preparation of instruments and additional equipment in advance.

CONCLUSION

Radiofrequency ablation of atrial fibrillation in patients with a mitral valve prosthesis is a complex proce-

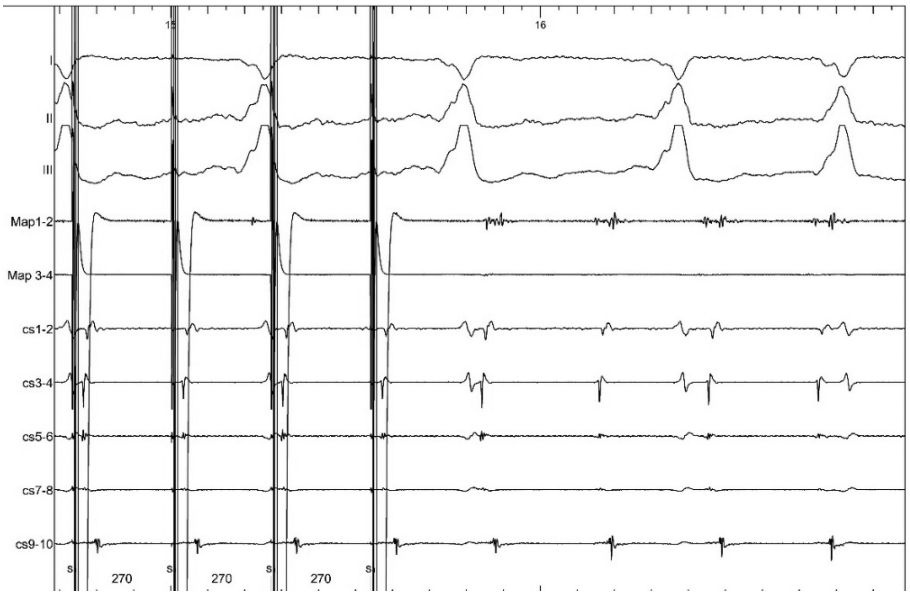

Fig. 4. Entrainment stimulation from the anterior wall of the left atrium in the region of the right inferior pulmonary vein, double potential on the ablation electrode.

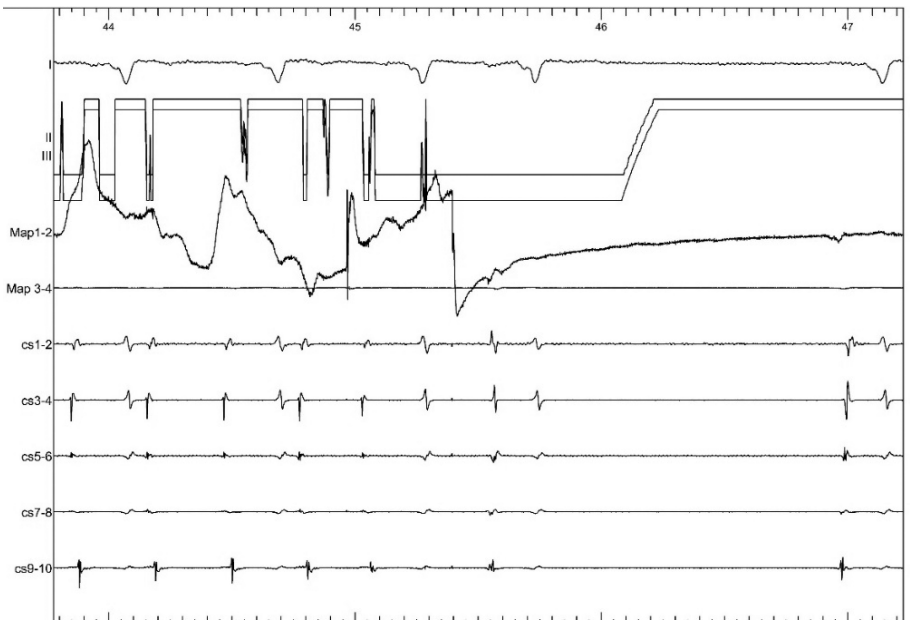

Fig. 5. Restoration of sinus rhythm during radiofrequency ablation.

dure that requires the use of navigation mapping, electrophysiological diagnostic maneuvers and sufficient experience of the surgeon. Such procedures should be performed in modern hospitals that have all the necessary electrophysiological and anaesthesiological equipment, including the ability to perform transoesophageal or intracardiac echocardiography on the patient. This is the key to effective and safe catheterization of cardiac arrhythmias. An important prerequisite for the long-term antiarrhythmic effect of catheter ablation against atrial fibrillation in patients with a mitral valve prosthesis is the simultaneous elimination of all inducible atrial arrhythmias, including the so-called 'incisional' atrial flutter.

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