Radiofrequency catheter ablation of newly diagnosed paroxysmal atrial fibrillation in a patient with mitral and aortic mechanical valves: A case study

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ABSTRACT

Background: Radiofrequency catheter ablation (RFCA) of atrial fibrillation (AF) in patients with prosthetic valve is still a challenge because of the higher recurrence rate and difficult manipulation of catheters in the left atrium which may lead to higher risk of complications. We presented the first AF ablation in Vietnam of a patient who had mitral and aortic mechanical valves.

Case summary:

A 54-year-old man who had two mechanical heart valves (mitral and aortic) implanted 16 years ago was newly diagnosed with symptomatic paroxysmal AF for the past 4 months at a province general hospital. The patient was treated with amiodarone but still symptomatic and could not tolerate the medication. A referral to our centre was made for consideration of radiofrequency catheter ablation. Sinus rhythm was successfully restored after pulmonary vein isolation, cavo-tricuspid isthmus ablation, and tailor-ablation. At the last follow-up at 9-months post-ablation, the patient was still in sinus rhythm and asymptomatic.

Discussion:

Catheter ablation of AF in patients with mechanical heart valve(s) is challenging due to increased difficulty in accessing the left atrium as well as catheter manipulation and ablation inside the atrium. Nevertheless, this procedure could be safely performed in high experience centres.

Keywords: Radiofrequency catheter ablation; paroxysmall artrial fibrillation; mechanical heart valve.

Learning points:

1. Radiofrequency catheter ablation of atrial fibrillation in patients with mechanical heart valves is challenging due to higher risk or arrhythmia recurrence, increased risk of complications due to more difficult left atrium access and catheter manipulation.

2. Nevertheless, this procedure is effective and safe for patients who have failed or could not tolerate anti-arrhythmic drugs.

INTRODUCTION

Atrial fibrillation (AF) is the most common arrhythmia after valvular heart surgery[1] and associated with particularly high risk of thromboembolism[2]. The occurrence of new-onset

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AF in patients after mitral valve surgery confers a worse prognosis and poorer survival[3,4]. Therefore, restoring and maintaining sinus rhythm are preferred, either with the pharmacological or catheter ablation therapy[5]. And while radiofrequency catheter ablation (RFCA) has been widely performed for nonvalvular AF, especially symptomatic drug-refractory paroxysmal AF, the utilization of this procedure in patient with AF and prosthetic heart valves is still limited. We described the first case of successful RFCA of recently diagnosed AF in a 54-year-old man who had two mechanical valves (mitral and aortic).

Case summary

A 54-year-old patient who had mitral (MV) and aortic (AV) replacement surgery 16 years ago was recently diagnosed with paroxysmal AF in the past 4 months before the current presentation. The initial symptoms were intermittent dyspnoea and palpitation, he was diagnosed paroxysmal at a province general hospital with the ventricular response rate of 140 beats per minute (bpm) and the baseline sinus rate of 60 bpm. His medications included amiodarone (200 mg daily), beta blocker (100 mg daily) and oral antivitamin K agent (target international normalised ratio [INR] 2.5-3.5). Echocardiography showed an enlarged left atrium (LA) with a diameter of 43 mm. The patient was prescribed oral amiodarone (200 mg twice daily) but could not tolerate the medication and remained highly symptomatic, due to which he was referred to our hospital for catheter ablation.

Electro-anatomy mapping and catheter ablation

The planned ablation strategy included pulmonary vein isolation and LA voltage mapping. Cessation of acenocoumarol drug three days before the procedure and bridging therapy with low-molecular-weight heparin (1mg/kg/24 hours BID) was used. The transseptal double punctures with two SL0 sheaths was performed under fluoroscopy guidance *(Figure 1)*.

Intravenous heparin was administered, and an activated clotting time of 250 to 300 seconds was maintained throughout the procedure. The three-dimensional (3D) geometry of the left atrium was reconstructed using NavX mapping system (St. Jude Medical, Minneapolis, MN, USA). The patient underwent isolation of all pulmonary veins (PVI) using an open irrigated ablation catheter (Flexibility catheter, St. Jude Medical, Minneapolis, MN, USA) and intracardiac electrogram was obtained by a spiral mapping catheter (Afocus catheter, St. Jude Medical, Minneapolis, MN, USA). The RF energy output was delivered to a maximum of 35 W, 25 W, 45W along the anterior, posterior segments, and cavo-tricuspid isthmus (CTI) respectively. Initially, organised signals were recorded by the spiral mapping catheter in PVs, contrast to the disorganised signals recorded in the left atrium noted by the CS catheter *(Figure 2A)*. During circumferential antral ablation of final PVs, AF converted to typical atrial flutter (AFL) with a cycle length of 220 ms *(Figure 2B)*. CTI ablation was then successfully performed after PVI, identified by entrainment pacing and confirmed bidirectional block.

After CTI ablation, sinus rhythm was restored *(Figure 2C and 2D)*, the 3D voltage remapping of whole left atrium and PVs illustrated mostly scar tissue *(Figure 3)*. Several small areas of healthy tissue located in left superior pulmonary vein (LSPV) were tailor ablated. Before finishing the procedure, programmed atrial stimulation was performed but no tachycardia was inducible. Warfarin was restarted early aiming at an early optimal INR but the patient developed haemorrhagic complication that required prolonged compression. The patient was discharged on day 5 post-procedure on sinus rhythm and daily oral amiodarone (200 mg b.i.d). Nine months after the procedure, the patient remained in sinus rhythm *(Figure 4)* and asymptomatic.

DISCUSSION

Rheumatic valvular disease remained prevalently in Vietnam and was diagnosed with dilated LA[6]. Furthermore, atrial enlargement as a consequence of atrial fibrillation[7]. The non-PV triggers due to atrial remodelling are assumed to play a crucial role in valvular AF mechanism. In addition, several factors from open heart surgery, such as mechanical trauma, ischemia or necrosis, or incisional scar, may also contribute significantly to the presence and maintenance a new AF after valvular surgery[8].

In some patients who could not tolerate anti-arrhythmic drugs (AAD) and especially in Vietnam where not many pharmacologic options are available, RFCA becomes an alternative option that has been shown to be superior to AAD for long-term maintenance of sinus rhythm[9,10]. RFCA of AF in patients with mechanical prosthetic valves is being viewed as a relative contraindication or even should be avoided[9] due to the higher recurrence rate and risk of mitral mechanical valve dysfunction, entrapment of mapping and ablation catheters, as well as challenge with LA access and catheter manipulation. These are major concerns not only in Vietnamese cardiovascular centres but also other experienced institutions. The efficacy and safety of RFCA of AF in patients with isolated MPV have been evaluated by some authors[11-13], but reports of AF ablation in those with both mitral and aortic MPVs are rare.

Although the circumferential PVI remains the cornerstone of AF ablation[13], there have been some reports of AF not provoked by PV triggers in patients with rheumatic heart disease[14] due to atrial remodelling leading to abnormal atrial substrate and scar formation. Therefore, extending CPVI and elimination of non-PV triggers are usually performed in additional to PVI in these patients with higher success compared with isolated PVI[13,15,16]. In our centre, voltage mapping is often used to find gaps and verify atrial substrate after completing antral PVI during sinus rhythm. In the presented case, the huge scar in atrial wall and several small areas of healthy tissue were noted in left superior pulmonary vein, and complete CPVI by tailor-ablation facilitated the achievement of acute success and maintenance of sinus rhythm.

Atrial macro re-entrant tachycardia or atrial flutter is common in patients after MV replacement surgery, whose mechanism is associated with atrial incisions in open heart surgery and the risk of arrhythmia occurrence

depends on the surgical approach[17,18]. Moreover, these types of arrhythmias also occur concomitantly with non-PV triggered valvular AF and related to fibrosis scar burden[16]. In our case, the sustained AF shifted to a typical atrial flutter (AFL) with CL of 220 ms during circumferential antral ablation of final PVs, AF was terminated by CPVI and linear ablation.

The periprocedural anticoagulant control is still a challenge in AF ablation in patients with mechanical valves due to the requirement of an INR at a higher therapeutic range compared with non-valvular AF. The most common non-fatal complication is groin bleeding[11] which usually requires prolonged local compression for 24 hours. Our procedure time and radiation time were 240 minutes and 35 minutes, respectively, consistent with what reported in Lakkireddy's study[11]. The recurrence rate of AF patients with MPVs undergoing RFCA can reach to 50% at a mean follow up of 26 months[11]. Our patient has remained in sinus rhythm nine-month post-ablation, however that further follow-up to evaluate a long-term outcome is warranted.

Conclusions: RFCA of new-onset AF in patients with both mitral and aortic MPVs remains challenging, particularly with the limited experience with the implementation of 3D mapping in these patients in Vietnam. However, AF ablation in these patients is feasible and relatively safe when performed carefully.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient.

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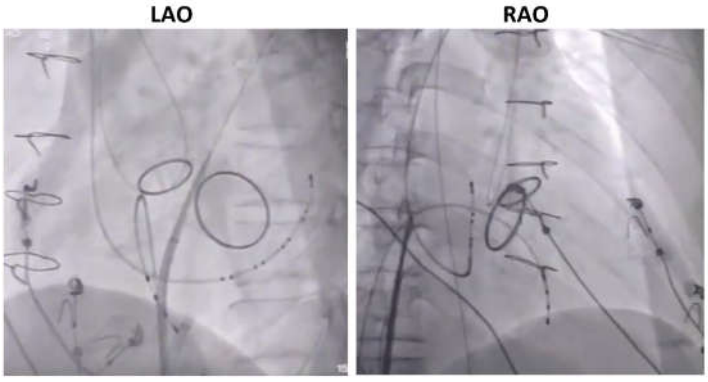
FIGURE LEGENDS

Figure 1: The transseptal double punctures with two SL0 sheaths was performed under fluoroscopy guidance (left: LAO 60º and right: RAO 30º). Abbreviation: LAO = Left anterior oblique, RAO = Right anterior oblique.

Figure 2: Intracardiac and surface electrocardiography (ECG). A: baseline rhythm before ablation. B: termination of AF during ablation of CTI. C: AF converted to atrial flutter (AFL) with CL of 220 ms. D: sinus rhythm before ending procedure. Abbreviation: AF=Atrial fibrillation, CTI=cavo-tricuspid isthmus, CL=Cycle length, ECG=electrocardiography.

Figure 3: Voltage mapping. Left, the illustration of CPVI ablation, CTI ablation and tailored ablation in LSPV. Right, the LA voltage mapping after PVI. Abbreviation: CPVI=circumferential pulmonary veins isolation, CTI=cavo-tricuspid isthmus, LSPV=left superior pulmonary vein, LA=left atrium, PVI=pulmonary veins isolation.

Figure 4: ECG at nine-month post-procedural follow up.



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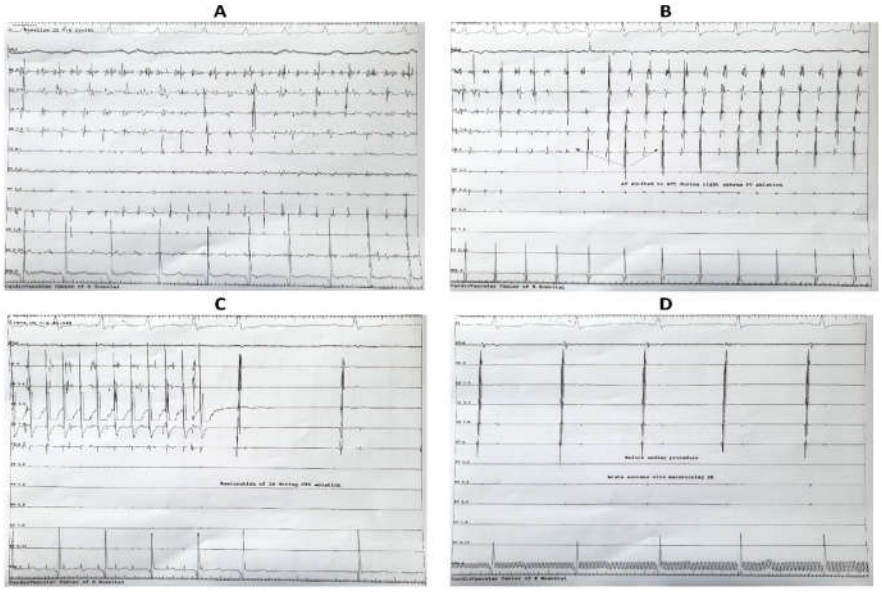

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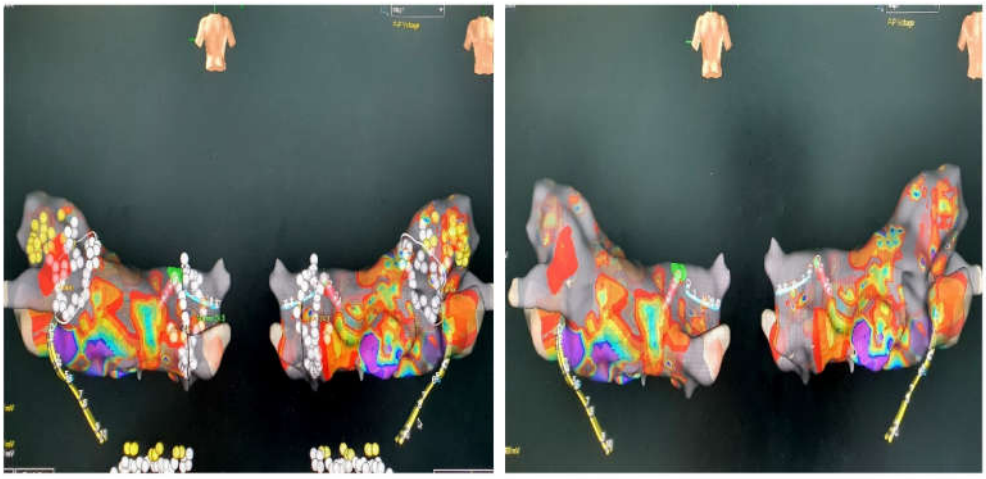

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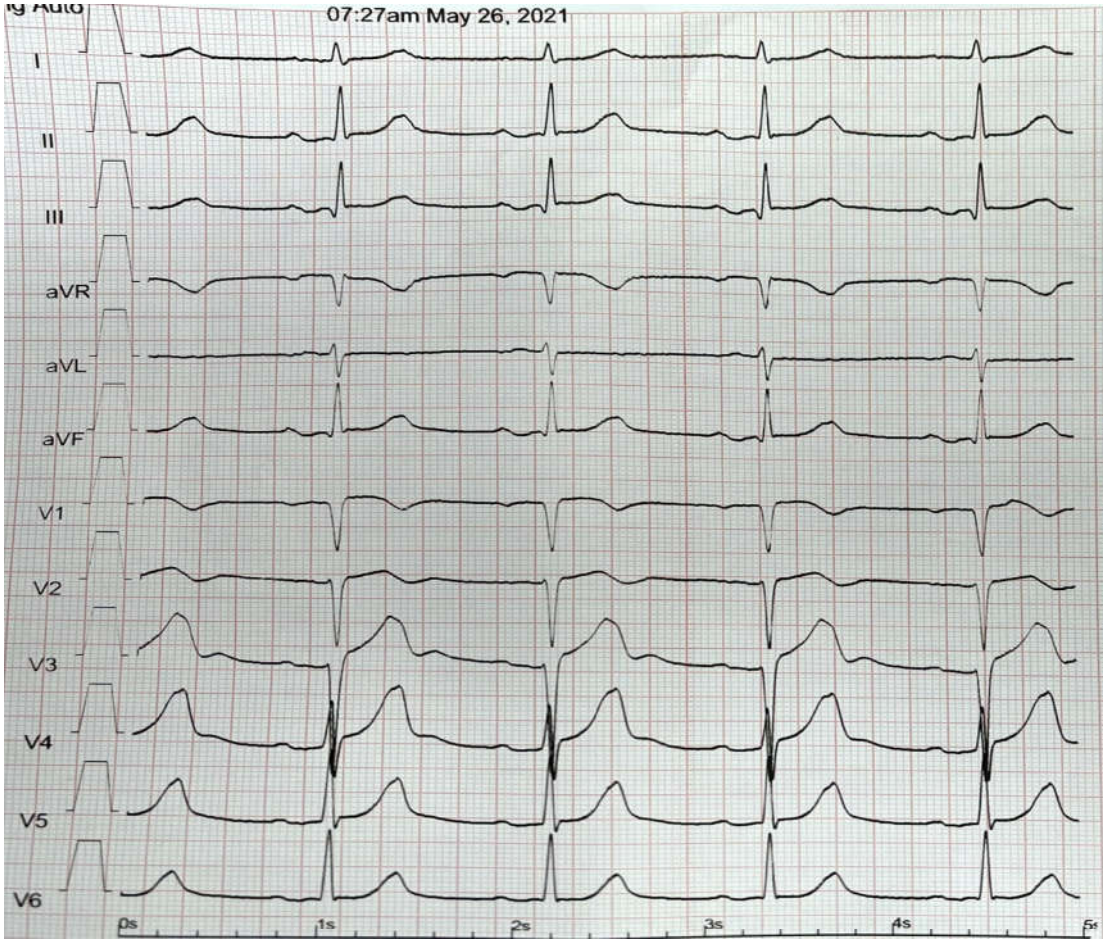

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