Iranian Heart Journal; 2023; 24 (4)

Case Report

Subacute Transient First-Degree AV Block After the Catheter Ablation of a Focal Atrial Tachycardia Originating From the Left Atrium

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ABSTRACT

Atrioventricular (AV) block is a rare but severe complication of the catheter ablation of cardiac arrhythmias. It usually occurs during ablation in the right atrium close to the His bundle and the peri-AV nodal area or the left ventricle in the septal basal area. AV block occurring during the deployment of radiofrequency (RF) energy in the left atrium is much rarer and has only exceptionally been described. We present the case of a subacute transient first-degree AV block occurring late (24 h) after the catheter ablation of a symptomatic incessant focal atrial tachycardia originating from the left atrium. Spontaneous resolution of the AV block with the recovery of normal AV conduction was observed 7 days after the procedure. This case report highlights the fact that care must be exercised while performing RF ablation on the left atrial septum since AV block can occur during the ablation of areas close to the AV node. ***(Iranian Heart Journal 2023; 24(4): 79-84)***

KEYWORDS: Atrioventricular block, Left atrial tachycardia, Catheter ablation

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Received: January 15, 2023 **Accepted:** March 23, 2023

Atrioventricular (AV) block is a rare but severe complication of the catheter ablation of cardiac arrhythmias. It usually occurs during ablation in the right atrium close to the His bundle and the peri-AV nodal area or the left ventricle in the septal basal area. AV block occurring during the deployment of radiofrequency (RF) energy in the left atrium is much rarer and has only exceptionally been described. Awareness regarding its possible occurrence during RF energy deployment in the left atrium is crucial since it can have significant negative consequences for the patient, leading to complete AV block and permanent pacemaker implantation.

Data from the literature on this subject are scarce. Zoppo et al [1] presented a case of a complete permanent AV block occurring in a 69-year-old male patient with perimitral atrial flutter in whom an RF ablation line was created between the mitral annulus and the right superior pulmonary vein. The patient received a dual-chamber pacemaker.

Kim et al [2] presented a case of a sub-acute AV block occurring in a 60-year-old female patient undergoing the RF catheter ablation of atrial fibrillation and counter-clockwise perimitral atrial flutter. The patient also underwent the creation of a septal RF ablation line, connecting the septal mitral annulus to the right superior pulmonary vein. The patient presented no AV conduction disturbances during the procedure but was found to have a complete AV block the morning after the procedure. The mechanism was likely lesion progression at the level of the interatrial septum late after the end of the RF application. [3] This patient also underwent a dual-chamber pacemaker implantation since AV conduction did not recover 72 hours after the procedure.

Apart from these case reports, data are scarce in the literature describing the occurrence of AV block during the catheter ablation of left atrial arrhythmias. Further, no information is available concerning the ablation of focal atrial tachycardia originating from the left atrium. This case report describes such an event.

Case Report

A 33-year-old female patient with no significant past medical history was addressed by her treating cardiologist for an electrophysiological study due to a drug-refractory symptomatic narrow QRS complex tachycardia (Fig. 1). The patient had presented incessant palpitations for the preceding 3 months, accompanied by anxiety. She had experienced no syncope, and there was no notion of sudden cardiac death in her family. Her single cardiovascular risk factor was represented by overweight (body mass index = 27.3 kg/m^2). She was on bisoprolol (2.5 mg, OD), amiodarone (100 mg, OD), and potassium supplements. Her clinical examination revealed rapid and regular heart sounds but no overt signs of decompensated heart failure. Biological workup showed no anemia, no inflammatory syndrome, normal electrolyte levels, and normal thyroid function, with an increased level of NT-pro BNP of 363 pg/mL. The 12-lead electrocardiogram (ECG) showed a narrow QRS complex tachycardia with a heart rate of 101 bpm. Additionally, the morphology of the P wave was negative in leads II, III, and aVF and positive in lead V1, in favor of atrial tachycardia (Fig. 1).

Figure 1: The 12-lead electrocardiogram shows a narrow QRS complex tachycardia with a heart rate of 101 bpm, normal QRS axis, negative P waves in lead II, III, and aVF and a positive P wave in V1, suggesting a diagnosis of atrial tachycardia.

Transthoracic echocardiography revealed a non-dilated left ventricle (43/28 mm), with a left ventricular ejection fraction of 64%. Moreover, it showed no global or regional motion abnormality, normal diastolic function, no significant valve disease, a non-dilated left atrium, no pulmonary hypertension, and no pericardial effusion.

Given the persistence of the palpitations under antiarrhythmic drug therapy and the patient's preference, an electrophysiological study was scheduled and subsequently performed 5 weeks after the discontinuation of bisoprolol and amiodarone. The procedure was performed using the CARTO 3 (Biosense-Webster) electro-anatomical mapping system. A quadripolar deflectable diagnostic catheter (Xtrem, Microport) was placed at the level of the His bundle. The AH and HV intervals at the beginning of the procedure were 135 ms and 35 ms, respectively (Fig. 2, the left upper panel). A decapolar deflectable diagnostic catheter (Inquiry, Abbot) was inserted via the femoral vein into the coronary sinus. The depolarization sequence was proximal to distal. The A:V relationship of 2:1 or 3:1 with variable AV and VA intervals confirmed the diagnosis of atrial tachycardia (Fig. 2, the right upper panel). With the aid of a 3.5 mm irrigated tip Navistar ThermoCool (Biosense Webster) catheter, an activation map of the right atrium was created, which showed an area of early depolarization at the level of the interatrial septum. However, the rS aspect of the local unipolar electrogram recorded by the ablation catheter raised suspicion of a left atrial origin.

A single transseptal puncture was then performed, and an activation map of the left atrium during tachycardia was created with a Pentaray catheter. This step confirmed the origin at the level of the anterior-septal wall of the left atrium (Fig. 2, the left lower panel). RF energy was applied at the earliest activation site, with a maximum power of 30 W, which promptly terminated the tachycardia. Non-accelerated junctional beats were observed during RF application

(Fig. 2, the right lower panel), which determined the prompt interruption of RF application. No prolonged PR intervals or blocked P waves were noted during sinus rhythm. The tachycardia was non-inducible afterward.

The PR interval recorded on the ECG after the ablation procedure was 172 ms. Twenty hours after the procedure, the PR interval increased to 228 ms, and it continued to rise to 300 ms at 48 hours after the procedure. Telemetry recordings did not document any second- or third-degree AV block. After a surveillance period of 7 days, the PR interval regressed spontaneously to 168 ms (Fig. 3).

Seven months after the procedure, the patient was in sinus rhythm, had a normal PR interval, and was asymptomatic.

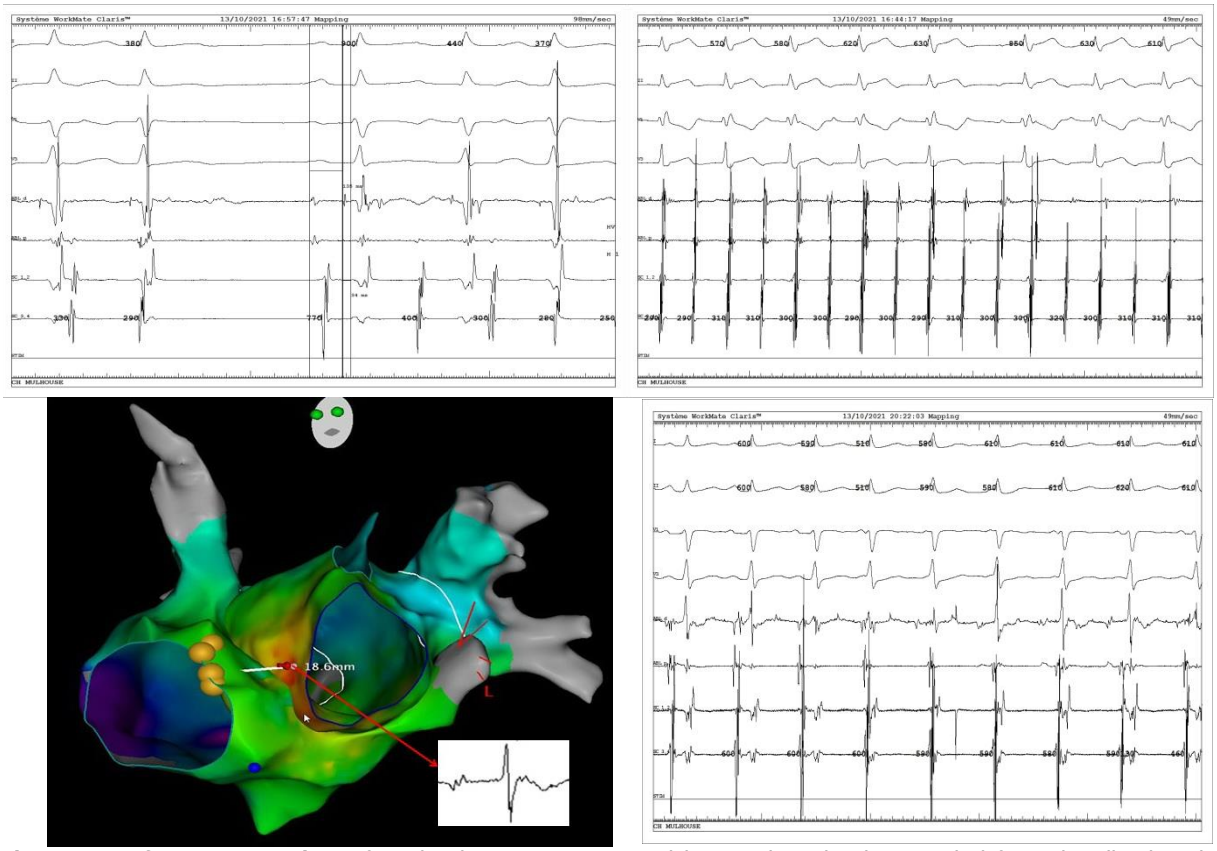

Figure 2: Left upper panel: Surface leads I, II, V1, V5, and intracavitary leads recorded from the distal and the proximal bipolar electrodes of the His bundle catheter (His d and His p) and of the first 4 electrodes of the coronary sinus catheter (SC 1-2 and SC 3-4) are presented herein. The AH and the HV intervals measured at the beginning of the ablation procedure are 135 ms and 35 ms, respectively. **Right upper panel:** Surface ECG leads I, II, V1, and V6, together with the intracavitary leads, recorded from the 10 electrodes of the coronary sinus catheter show the depolarization sequence during atrial tachycardia, a tachycardia cycle length of 300 ms, and a variable A:V relationship, confirming the diagnosis of atrial tachycardia. **Left lower panel:** The CARTO image of the right and left atria in the left anterior oblique (47°) shows the activation map of the right and left atria during atrial tachycardia, confirming its focal nature and its origin at the level of the anterior and septal left atrial wall (the red dot in the red area). Note the anatomical relationship between the successful radiofrequency ablation site in the left atrium and the interatrial septum. The distance between the successful ablation site and the His bundle region (the yellow tags) is 18 mm. The red arrow indicates the local bipolar electrogram recorded by the ablation catheter. **Right lower panel:** Surface leads I, II, V1, and V5 and the intracavitary leads recorded from the distal and the proximal bipolar electrodes of the ablation catheter (Abl d and Abl p) and of the first 4 electrodes of the coronary sinus catheter (SC 1-2 and SC 3-4) are presented herein. Junctional beats are recorded during radiofrequency energy application at the level of the tachycardia origin.

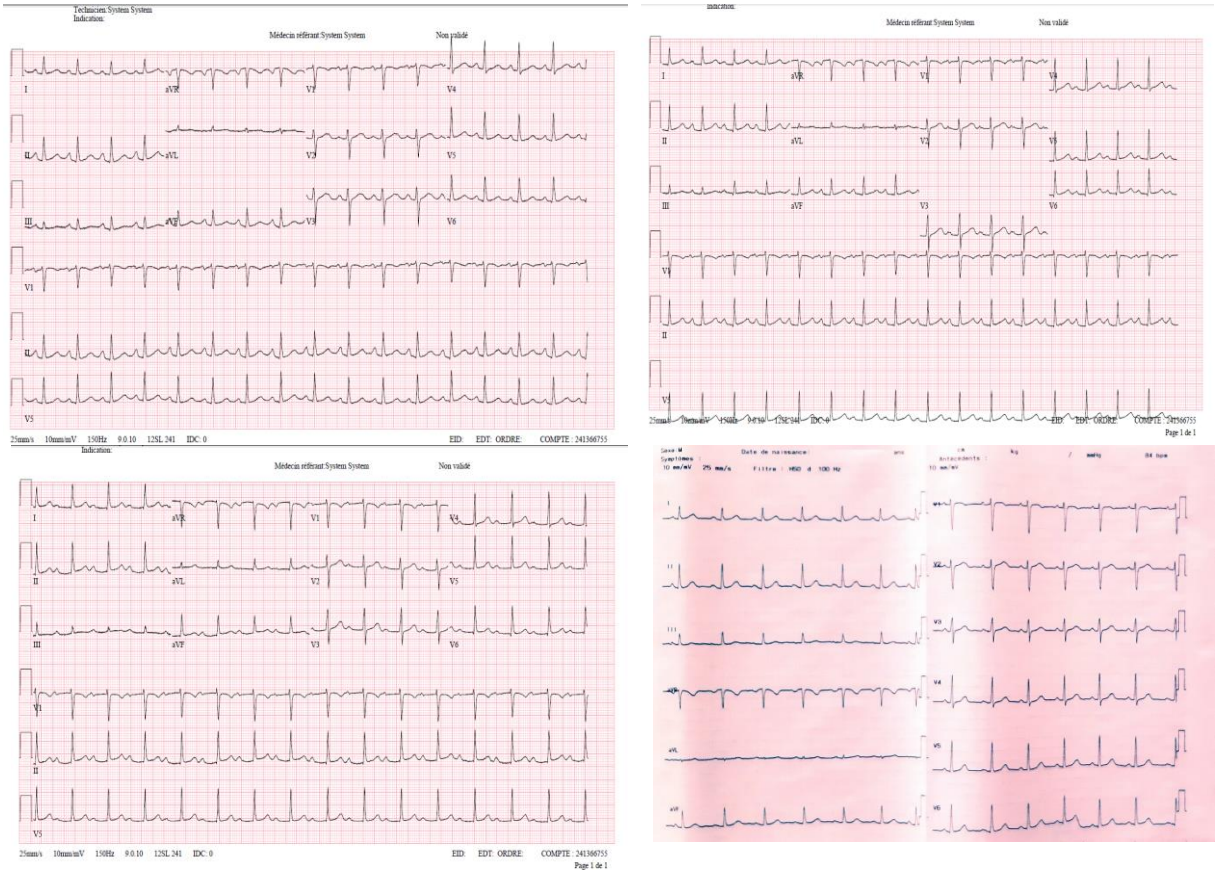

Figure 3: The images present the evolution of the PR interval from 176 ms in the **left upper panel** on the ECG recorded just after the ablation procedure to 226 ms in the **right upper panel** on the ECG recorded 24 hours after the ablation procedure to 300 ms in the **left lower panel** and the normalization of the atrioventricular conduction on the ECG recorded 7 days after the ablation procedure in the **right lower panel**.

DISCUSSION

We present a rare case of subacute transient first-degree AV block occurring late (24 h) after the catheter ablation of a symptomatic incessant focal atrial tachycardia originating from the left atrium in a young female patient with no structural heart disease. The sub-acute occurrence of the AV block could be explained by progressive myocardial edema created by RF lesions. The transient nature of the AV block could be explained by the fact that the maximum power used was 30 W, and RF applications were immediately stopped when junctional beats were observed. The normalization of the AV conduction could be explained by edema resorption.

Interestingly, the ablated site where the AV block occurred in this patient is very similar to the site where RF energy was applied in a patient described by Zoppo et al. [1] As can be seen in Figure 3, this area is in proximity to the His bundle and the AV node. The occurrence of junctional beats during RF ablation in our patient also proves the proximity to the conduction system. [2]

This case report underlines 4 significant ideas, as follows:

1) AV block can occur during the deployment of RF lesions not only in the right atrium and the left ventricle but also in the left atrium. Care must be exercised while performing the RF ablation of the left atrial septum since AV block can occur when ablating areas close to the AV node.

2) High-power RF applications should be avoided, and power should be limited while deploying RF energy at the left atrial septum in order not to damage the cardiac conduction system.
3) AV block can occur even after 24 hours post-catheter ablation and even in the absence of intraprocedural AV conduction disorders. Telemetry and ECG recordings for more than 24 hours after the ablation procedure should be performed so as to identify such complications early.
4) When present, watchful waiting is a good option in selected cases since the unnecessary implantation of a pacemaker can sometimes be avoided using such a strategy. Some authors suggest administering high doses of cortisone, theophylline, or atropine in the acute phase, [4,5] but clinical trials demonstrating their efficacy in such a setting are lacking.

Conflict of Interest: None

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