



Case Report

Occurrence of atrioventricular block during supraventricular tachycardia: What is its possible mechanism?

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Abstract

A female patient was admitted to our hospital for catheter ablation arising from paroxysmal supraventricular tachycardia (PSVT). In the laboratory, PSVT (the earliest retrograde atrial activation at the coronary sinus ostium) with intermittent atrioventricular (AV) block could be induced repeatedly. The tachycardia could be terminated during ventricular pacing without retrograde conduction to the atria. Therefore, orthodromic AV reciprocating tachycardia (AVRT) and atrial tachycardia (AT) could be ruled out and AV nodal re-entrant tachycardia (AVNRT) was subsequently considered. Initial attempts using slow or intermediate AV nodal ablation failed to cure the tachycardia. We considered the possibility of orthodromic AV reciprocating tachycardia (AVRT) with AV block occurring during the tachycardia. The tachycardia was successfully terminated during the ablation of the right posteroseptal pathway at the coronary sinus ostium. We hypothesized about the possible explanation that might help to clarify the phenomenon of AV block during SVT in order to provide some guidance to other clinicians confronted with similar patient challenges in the future.

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1. Introduction

When atrioventricular (AV) block occurs during paroxysmal supraventricular tachycardia (PSVT) without termination of the tachycardia, AV reciprocating tachycardia (AVRT) using an accessory pathway can be completely ruled out because both atrium and ventricle are required to sustain the AVRT. However, is this commonly accepted rule of thumb 100% reliable, without exception? Here we report a case with PSVT for catheter ablation. Intermittent AV block was noted during the PSVT. After the electrophysiological (EP) study, the diagnosis of AVRT was considered. In addition, the tachycardia terminated after burning the right posteroseptal

pathway. We raised the possible mechanism to explain the AV block during sustained AVRT.

2. Case report

A 54-year-old female was sent to the emergency department the day before her admission due to a sudden onset of palpitations. Examination using a 12-lead electrocardiogram (ECG; Fig. 1) revealed a paroxysmal supraventricular tachycardia (PSVT). The tachycardia was terminated twice transiently by an intravenous bolus of adenosine, of 6 mg and 12 mg respectively, and converted to sinus rhythm after an intravenous bolus of 5 mg of verapamil. She was admitted for an electrophysiological (EP) study plus a catheter ablation on the next day. In the EP laboratory, a PSVT (with the earliest retrograde atrial activation at the coronary sinus ostium) with intermittent atrioventricular (AV) block could be induced repeatedly by an atrial single extrastimulus (Fig. 2A). The tachycardia could be terminated during ventricular pacing with a shorter cycle length (Fig. 2B). In addition, the tachycardia could be also terminated

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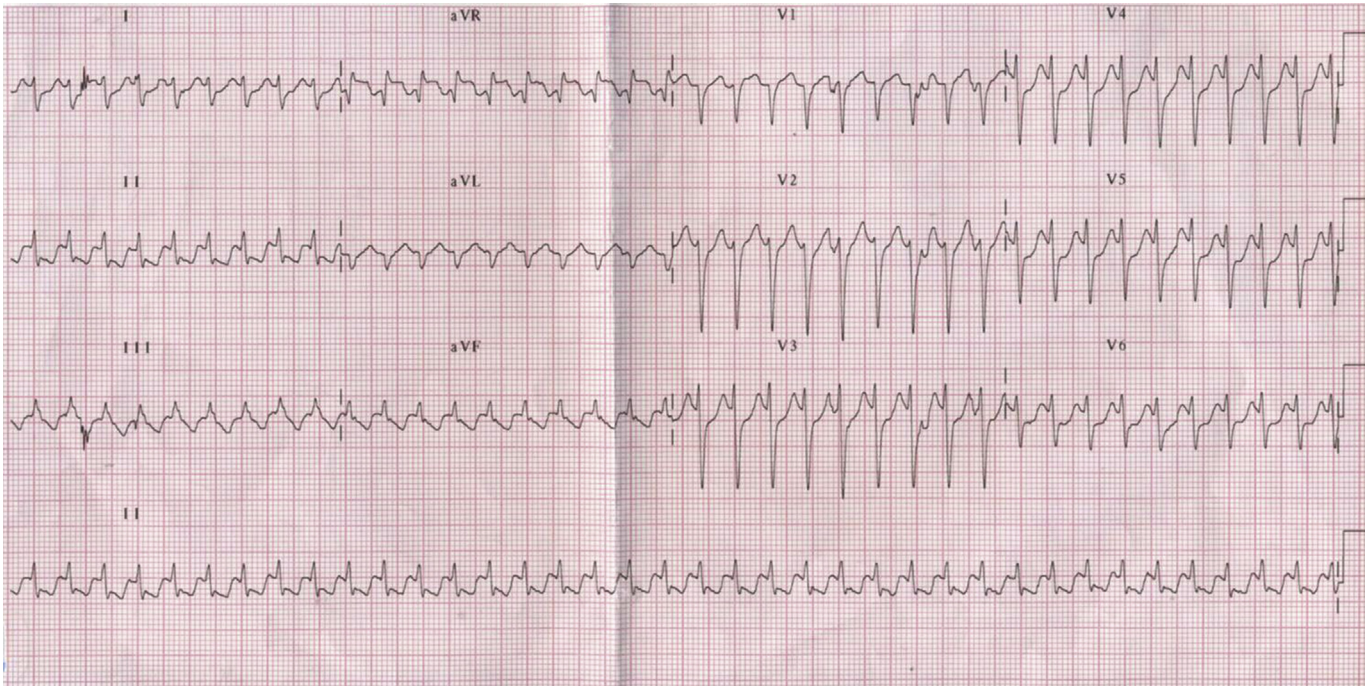


Fig. 1. A 12-lead ECG showing a paroxysmal supraventricular tachycardia.

during ventricular premature beats without retrograde conduction to the atria. With this information, we wanted to determine the possible mechanism of the PSVT.

3. Discussion

Use of the 12-lead ECG (Fig. 1) revealed a PSVT. Due to an AV block that occurred during the PSVT without termination of the tachycardia (Fig. 2A), orthodromic AV reciprocating tachycardia (AVRT) was not likely the etiology of the PSVT.¹ In addition, because the tachycardia could be terminated during ventricular premature beats without retrograde conduction to the atria, atrial tachycardia (AT) could be ruled out.^{2,3} Therefore, AV nodal re-entrant tachycardia (AVNRT) with retrograde conduction through the slow or intermediate AV node (the earliest retrograde atrial conduction during the PSVT was at the coronary sinus ostium) provided the most likely etiology of the PSVT.

However, no antegrade or retrograde dual AV nodal electrophysiology could be demonstrated during atrial and ventricular pacing, or with extrastimuli. In addition, no retrograde decremental conduction properties could be found during ventricular pacing or extrastimuli, and no lower common pathway could be demonstrated in the course of ventricular pacing during the PSVT (Fig. 2B). The initial attempts of slow or intermediate AV nodal ablation failed to cure the tachycardia. We considered the possibility of orthodromic AVRT (with AV block occurring during the tachycardia), mediated by a posterior septal accessory pathway. We delivered some premature ventricular beats during the refractory period, but always terminated the tachycardia without retrograde conduction to the atria, as in Fig. 2B. Tachycardia was successfully terminated during the ablation of the right posteroseptal

pathway at the coronary sinus ostium (Fig. 3A). The complete ventriculoatrial (VA) dissociation observed after the successful ablation of the pathway further supported an accessory pathway mediated tachycardia. Of course, VA dissociation is not an uncommon finding after successful modification of the slow pathway.

We wondered why the AVRT was sustained without immediate termination when the AV block occurred. In our case, the AV block occurred every time after premature atrial depolarizations at the coronary sinus ostium (the atrial electrogram appeared earlier than in the previous tachycardia beats) (Fig. 2A, arrow) and resulted in VA fusion or even the atrial electrogram being earlier than the ventricular electrogram (which originally also did not favor an orthodromic AVRT). We hypothesized two possibilities that might explain why AV block occurred during sustained AVRT. First, the patient may not be experiencing a genuine AVRT with AV block during SVT. During three atrial premature beats shown in Fig. 2A, the first one reset the tachycardia (Fig. 2A, red 1), the second one terminated it (Fig. 2A, red 2) and the third one reinitiated it (Fig. 2A, red 3). Second, we concluded that in fact it was a real AVRT with AV block during tachycardia. The AVRT had double-wave re-entry circuits (Fig. 3B): one had a longer, standard circuit (Circuit 1) conducting from the right atrium through the AV node and down to the right ventricle, then through the right posteroseptal accessory pathway and up to the right atrium; the other circuit was shorter (Circuit 2), with the wavefront moving from the right atrium, conducting into the coronary sinus ostium and then directly through the right posteroseptal accessory pathway and up to the right atrium. The shorter tachycardia circuit resulted in atrial premature depolarizations and subsequent AV block, but the tachycardia still was sustained because the AV node was not in the shorter re-entrant circuit.

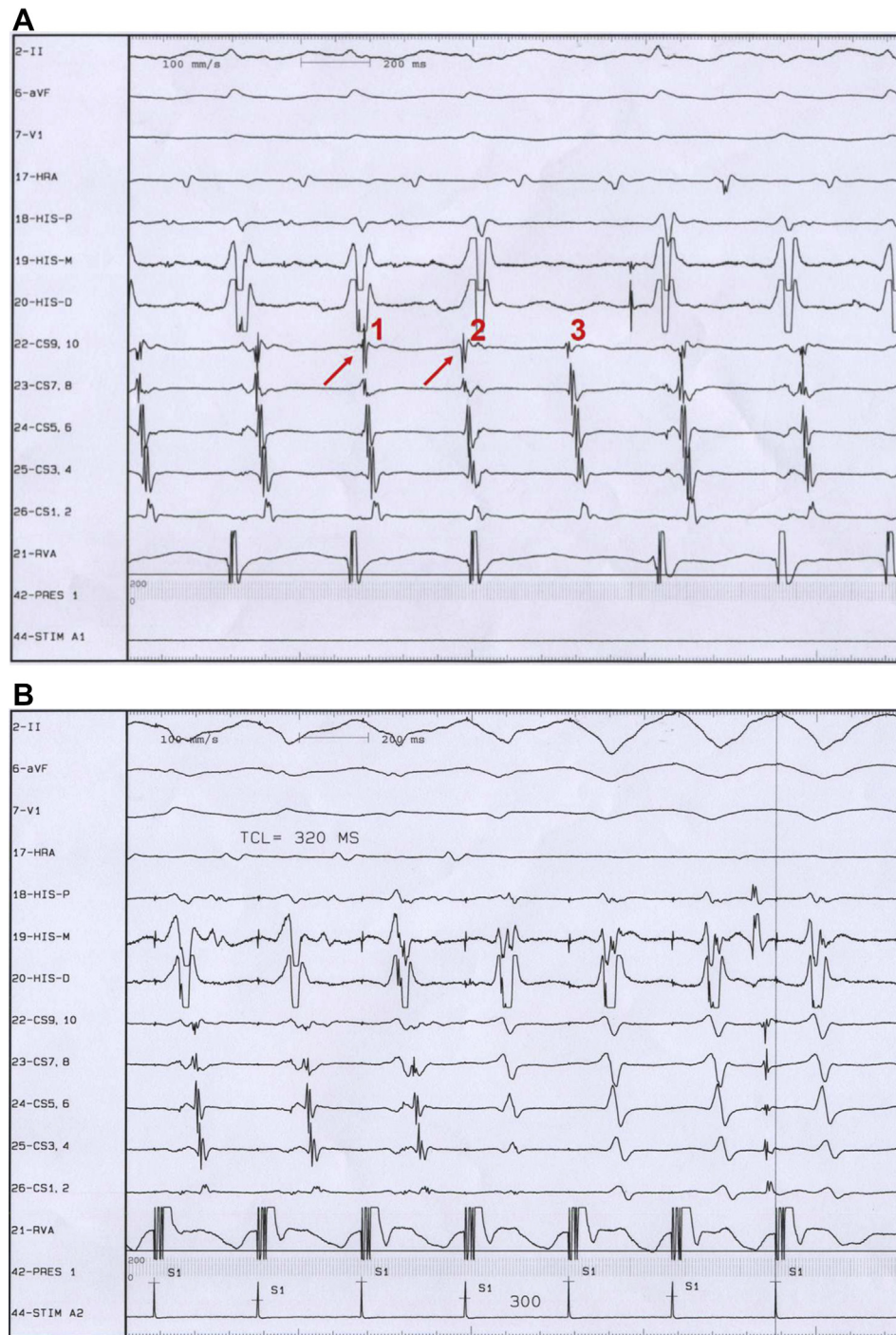


Fig. 2. (A) The intracardiac electrograms show atrioventricular (AV) block occurring during a paroxysmal supraventricular tachycardia (PSVT). For other detailed descriptions please see the text. (B) The intracardiac electrograms show that a shorter (300 milliseconds) pacing cycle length at the RV apex terminates the tachycardia (cycle length 320 milliseconds).

Of course, we could not completely rule out the possibility of a fast-intermediate AVNRT (we successfully ablated the retrograde intermediate AV nodal pathway at the coronary sinus ostium), or an atypical fast-slow AVNRT with the slow AVN located at the coronary sinus ostium, even though no retrograde decremental conduction or slow pathway properties could be demonstrated, and a shorter HA

interval then AH interval was found (Fig. 2A).^{4,5} We also could not completely rule out the possibility of a right posteroseptal atrial tachycardia (we successfully ablated the retrograde AV node and atrial tachycardia focus simultaneously at the coronary sinus ostium) even though the electrophysiological characteristics suggested it was not likely.

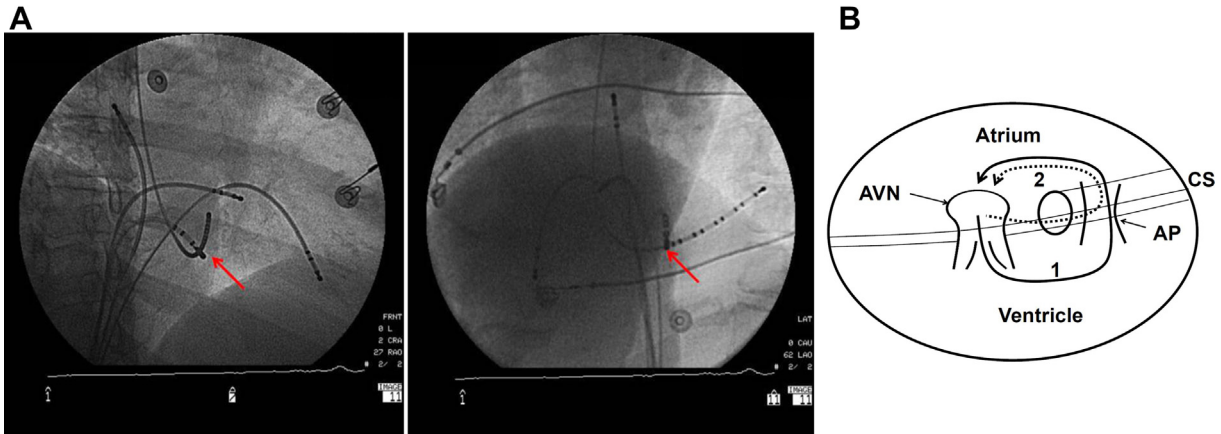


Fig. 3. (A) Right anterior oblique (RAO) 30 degree (left panel) and left anterior oblique (LAO) 60 degree (right panel) fluoroscopic views showing the successful ablation site (arrow) at the coronary sinus ostium. (B) The postulated mechanism of the orthodromic atrioventricular re-entrant tachycardia (AVRT) with AV block. A double-wave re-entry circuit is shown, including a longer standard circuit (Circuit 1) and a shorter circuit (Circuit 2). AP = accessory pathway; AVN = atrioventricular node; CS = coronary sinus.

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