

CASE REPORT

## Peculiar Electrocardiographic Feature Localizing Accurately an Unusual Case of Permanent Junctional Reciprocating Tachycardia

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ablation; accessory pathway;  
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### LIST OF ABBREVIATIONS

AP = accessory pathway  
AV = atrio-ventricular  
CS = coronary sinus  
ECG = electrocardiogram  
EPS = electrophysiology study  
LBBB = left bundle branch block  
PJRT = permanent junctional  
reciprocating tachycardia  
RF = radiofrequency  
VA = ventriculo-atrial

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### ABSTRACT

Permanent junctional reciprocating tachycardia (PJRT) is an uncommon form of atrioventricular reentrant tachycardia due to an accessory pathway with slow retrograde conduction that is mostly localized in the posteroseptal zone. The standard electrocardiogram (ECG) shows a long-RP tachycardia with negative P waves in the inferior leads and positive in leads I and aVL. We report a case of PJRT in a 31-year-old woman with incessant long-RP tachycardia displaying negative P waves not only in the inferior leads but also in leads I and aVL. The accessory pathway was localized in the left posterolateral region and managed successfully with radiofrequency catheter ablation.

### INTRODUCTION

Persistent or permanent junctional reciprocating tachycardia (PJRT) is an uncommon arrhythmia characterized by anterograde conduction over the atrioventricular node (AV) and retrograde conduction via an accessory pathway (AP) with slow conduction (decremental) properties.<sup>1</sup> The characteristic electrocardiographic feature is a long-RP tachycardia with inverted P waves in the inferior leads and positive in the lateral leads. In the vast majority of cases, the retrograde slowly conducting AP is located in the posteroseptal region. However, other locations of the AP have also been described.<sup>2</sup> We herein report a case of PJRT that was successfully ablated in the left posterolateral region. In this rare case, various electrophysiological manoeuvres are described that were used appropriately in order to achieve an accurate differential diagnosis. Of interest, the surface electrocardiogram (ECG) was indicative of the unusual position of the accessory pathway, underscoring the important role of the 12-lead ECG in planning appropriately an electrophysiological study.

## CASE PRESENTATION

A 31-year-old lady was referred to our center due to an incessant narrow-QRS tachycardia. On admission, she was found to be in persistent regular long-RP tachycardia at a rate of 125 beats per minute (bpm), with negative P waves in the inferior leads, as well as in leads I and aVL (Fig. 1). The echocardiogram demonstrated normal left ventricular dimensions and systolic function. A series of attempts aiming at tachycardia termination proved ineffective despite use of various antiarrhythmic agents. Interestingly, adenosine administration interrupted the tachycardia only for a few beats.

An electrophysiology study (EPS) in the drug-free state was performed after written informed consent was provided by the patient. Three hexapolar electro-catheters were placed in the high right atrium, the apex of the right ventricle, and the His bundle region (against the septal leaflet of the tricuspid valve), while a steerable decapolar catheter was positioned within the coronary sinus, all introduced via the right and left femoral veins. The patient was in stable long-RP tachycardia (142 bpm), with 1:1 AV association, VA interval of 193 ms, while the earliest retrograde atrial activation was registered from the posterolateral aspect of the mitral annulus at the second most distal electrode pair of the coronary sinus (CS<sub>3-4</sub>). Single ventricular extrastimulus delivered during the His refractoriness could reproducibly reset the tachycardia, while a ventricular ectopic beat terminated the tachycardia without atrial capture suggesting the participation of an accessory pathway in the tachycardia circuit. In favor of atrio-ventricular reentry tachycardia was also a V-A-V resumption of tachycardia after overdrive ventricular pacing termination (Fig. 2a).<sup>3</sup> A prolongation of the VA interval by 39 ms following spontaneous development of left bundle branch block (LBBB) also supported the presence of a left-sided accessory pathway (AP) (Fig. 2b). The findings from the electrophysiology study (EPS) were consistent with a left posterolateral pathway having slow conduction properties. The EPS conclusion, along with the earliest recording of retrograde atrial activation >1cm inside the coronary sinus (CS<sub>3-4</sub>), led to a left-sided approach as first choice for the ablation catheter insertion.

A 4-mm tip ablation catheter was advanced to the left

ventricle with use of a retrograde transaortic approach for detailed mapping of the mitral annulus during the tachycardia. An early atrial activation (45 ms before the P wave onset) was found in the posterolateral region. Radiofrequency (RF) application at this site (55°C, 40 Watts, 30 seconds) terminated the tachycardia with retrograde block over the AP, approximately 7 seconds from the onset of RF application (Fig. 3). A bonus energy application with the same setting for another 30 seconds was also applied. Five RF applications were delivered overall with a total duration of 180 seconds. Thirty minutes after the last RF application, the tachycardia was not inducible any longer, while the ventriculoatrial conduction was dissociated with ventricular pacing. No recurrence of arrhythmia occurred during a follow-up period of 3 months.

## DISCUSSION

The electrocardiographic and electrophysiologic characteristics of the tachycardia seen in this patient are suggestive but not typical of the incessant form of AV junctional reciprocating tachycardia. The electrocardiographic feature with negative polarity of the P wave in the inferior and lateral limb leads is different from the pattern obtained in typical PJRT due to septally located AP, where positive wave is expected in the lateral leads.<sup>4</sup> Our final successful ablation position in the left posterolateral area confirmed the observation reported by Gaita et al that a negative P wave in lead I is the pattern seen in most of the pathways ablated inside the coronary sinus or at the left endocardium.<sup>5</sup> In this large series of 33 patients with PJRT, a 3% incidence of left lateral pathway location (1 out of 33 cases) was reported, which could be located successfully using the P wave configuration. The authors concluded that the P wave polarity on the surface ECG may be useful in suggesting the approach to the site of ablation.

The differential diagnosis of long-RP tachycardias includes PJRT, atrial tachycardia and atypical AV nodal re-entrant tachycardia. The polarity of the P wave in the ECG made the atypical AV nodal re-entrant tachycardia less likely, while the tachycardia response to adenosine supported a pathway with decremental (node-like) properties, although an atrial

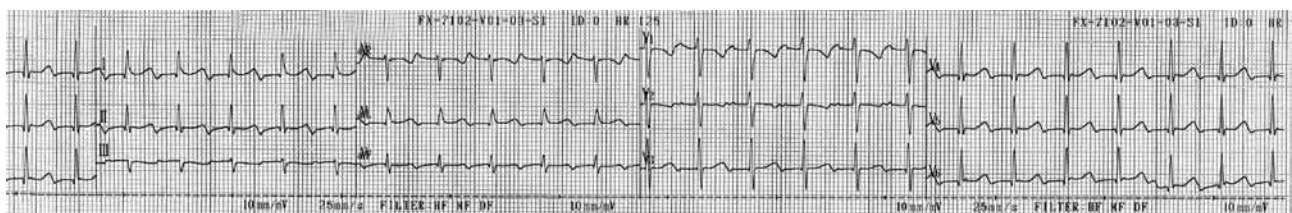
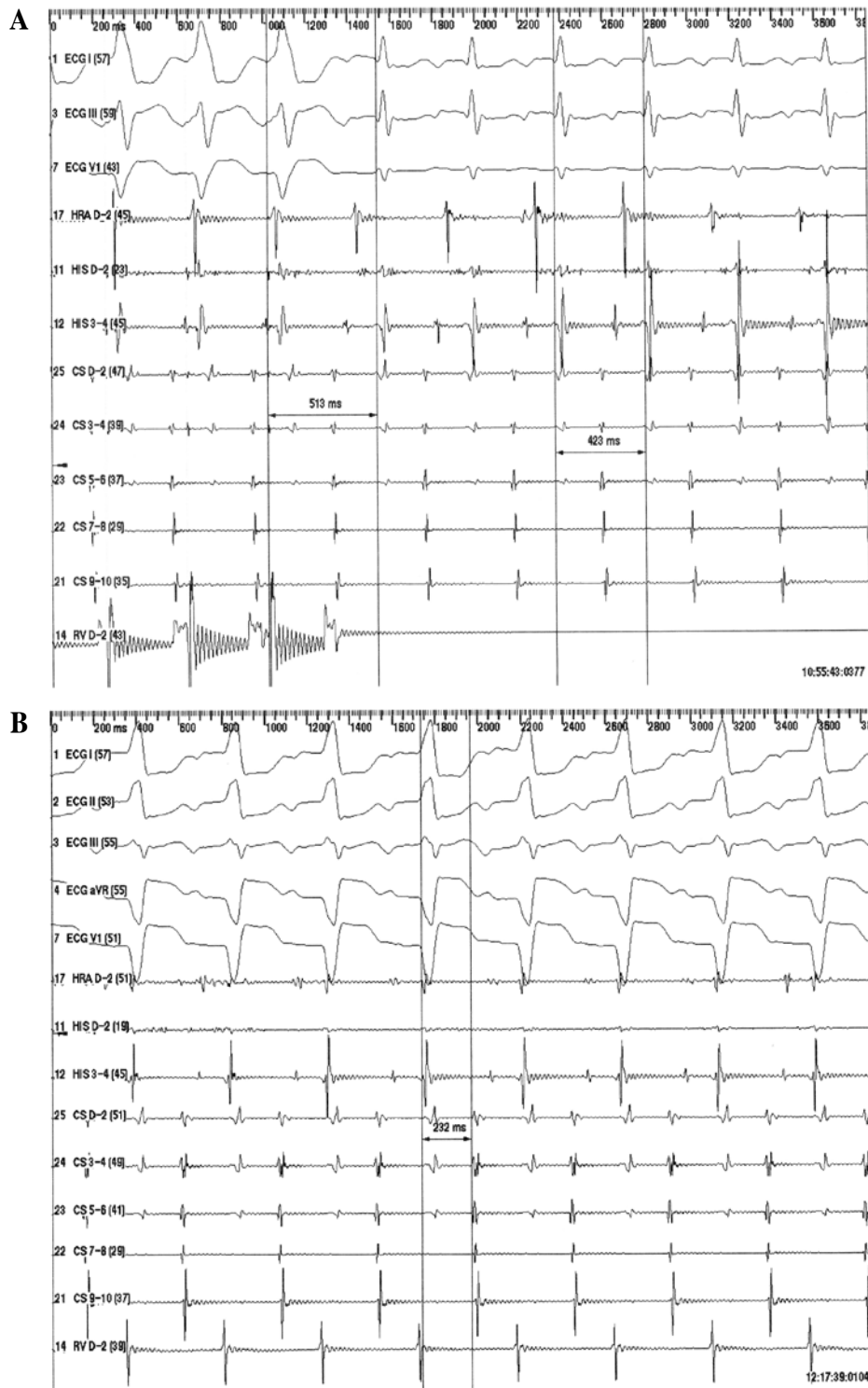


FIGURE 1. 12-lead ECG from the patient showing a narrow QRS complex tachycardia at a rate of 125 bpm, with long RP interval and negative P waves in leads II, III, aVF, I, aVL, V<sub>5</sub>, V<sub>6</sub> and a positive P wave in lead V<sub>1</sub>.



**FIGURE 2A.** The figure demonstrates the response of tachycardia to entrainment from the right ventricle with pacing at 400 ms. Note that the tachycardia resumes after pacing with a V-A-V pattern (excluding atrial tachycardia), while the post-pacing interval exceeds the tachycardia cycle length by less than 115 ms consistent with atrioventricular reentry tachycardia. **2B.** VA interval prolongation of 39 ms with spontaneous LBBB development. HRA D-2: distal high right atrium electrogram; HIS D-2: distal His bundle electrogram; HIS 3-4: proximal His bundle electrogram; CS D-2: distal coronary sinus electrogram; RV D-2: distal right ventricular apex electrogram. Paper speed 100 mm/sec.

## INCESSANT TACHYCARDIA

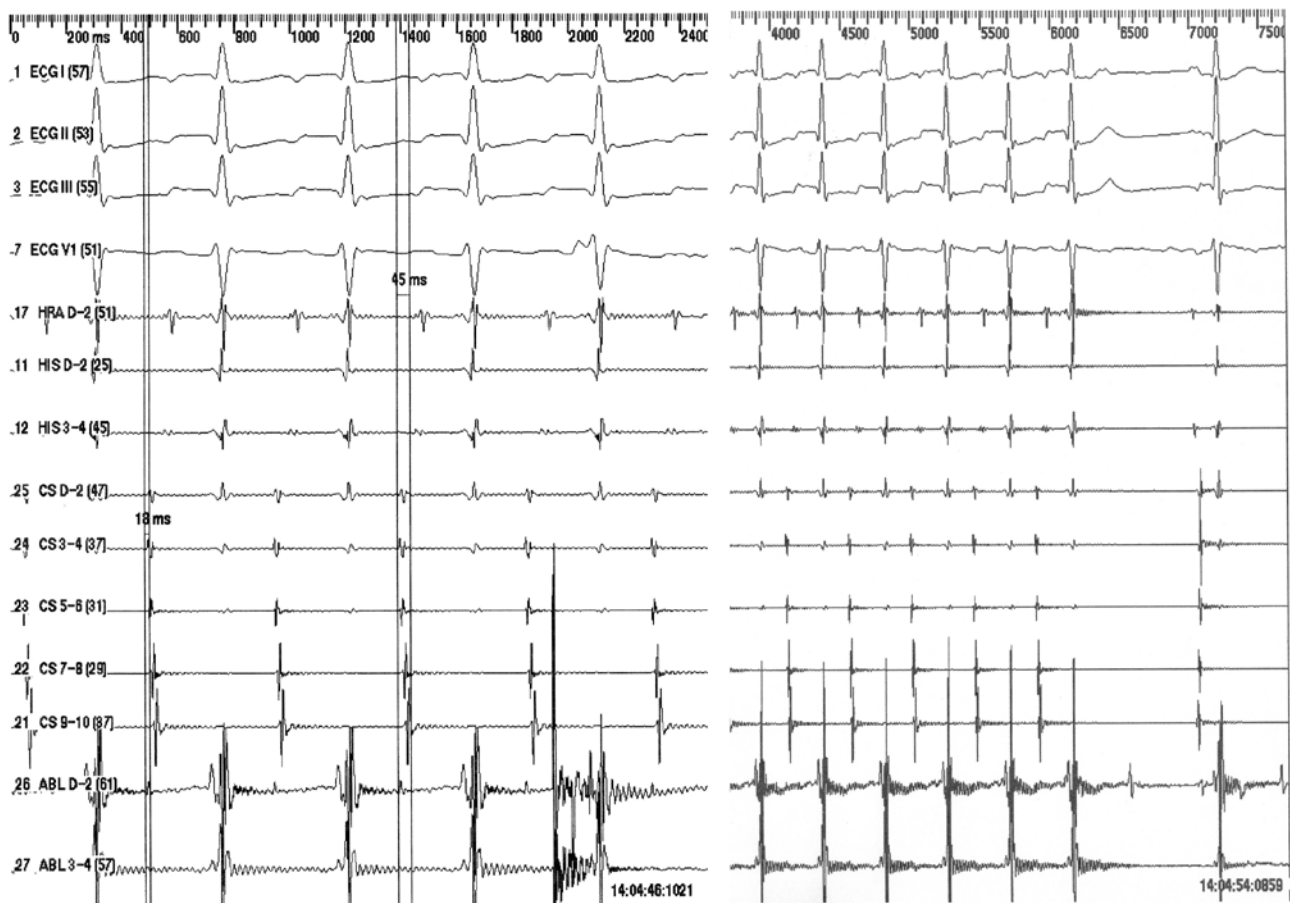


FIGURE 3. Successful ablation site. The ablation electrogram showed early atrial activation preceding the P wave onset by 45 ms and VA interval which was 18 ms earlier than CS<sub>3-4</sub>. Single radiofrequency energy application at this site resulted in termination of the tachycardia in the retrograde limb within 7 seconds.

tachycardia sensitive to adenosine still needed to be excluded. Several appropriate electrophysiologic manoeuvres confirmed the diagnosis of PJRT by excluding the other two arrhythmias (Fig. 2).

In conclusion, we reported a case of incessant PJRT, refractory to various attempts for cardioversion, where the AP was successfully ablated in the left posterolateral area. Negative P waves in ECG leads I and aVL during the tachycardia were proved of diagnostic value.

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