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Short Communication

# Fasciculoventricular accessory pathway unmasked by a pseudo gap phenomenon

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ABSTRACT

A 28 year old female with manifest preexcitation underwent electrophysiology study for intermittent palpitation. During progressively premature atrial extrastimuli, bypass tract was blocked before relative refractory period of AV node, making it unfeasible to observe the change of H-V interval and QRS morphology during decremental nodal conduction. However, dual AV node physiology, presented as a marked increase of A-H interval, occurred when a short-coupled extrastimulus was delivered, followed by a preexcited QRS with an H-V interval identical to that in sinus rhythm. This was an example of gap phenomenon involving accessory pathway and AV node. Diagnosis of fasciculoventricular bypass tract was made and ablation was therefore not performed.



## Introduction

Fasciculoventricular bypass tracts(FVBTs) are a rare form of preexcitation characterized by the fixed H-V interval with decremental conduction over atrioventricular node(AVN) [1–3]. Since FVBTs are not associated with supraventricular tachycardia (SVT) or preexcited atrial fibrillation, considering their close anatomical relationship with conduction system, ablation is not recommended [3–5]. Therefore it is always important to differentiate FVBTs from atrioventricular bypass tracts (AVBTs). Here we report an FVBT with long refractory period, which was diagnosed with the help of a "pseudo gap phenomenon".

## Case presentation

A 28 year old female underwent electrophysiology study (EPS) for multiple episodes of palpitation which had not ever been documented. Her baseline electrocardiogram (ECG) at admission showed manifest preexcitation. Her delta wave had a left inferior axis with a highest amplitude of 1.7 mm in lead 2, and was almost isoelectric in lead V1-V3 (Fig. 1A). No structural cardiac disease was found with preprocedural cardiac imaging. Family history was negative.

During EPS, her preexcitation was found to be intermittent. H-V interval was 14 ms with delta wave and 33 ms without preexcitation (Fig. 1B). V potential on His recording was earlier than coronary sinus (CS) and right ventricular apex (RVa, not shown) when preexcitation presented. There was no ventriculo-atrial conduction during pacing at 600 ms from RVa.

Programmed atrial extrastimuli (AES) were delivered from high right atrium(HRA). An A1-A2 of 350 ms was associated with loss of delta wave and normalization of H-V interval, indicating the refractoriness of the accessory pathway (Fig. 2). Then A-H interval remained constant until A1-A2 was below 330 ms, after which gradual prolongation of A-H was observed, consistent with relative refractory period of AV node (RRP-AVN).

When A1-A2 was decreased to 280 ms, an A-H interval jump from 173 ms to 390 ms was observed. Simultaneously, the delta wave appeared again with an H-V interval identical to that during sinus rhythm (Fig. 3). Therefore, the diagnosis of FVBT could be made based on the same H-V interval before the pathway was blocked and after it recovered (Fig. 4).

A-V conduction was completely blocked with an A1-A2 no longer than 270 ms. No atrial or ventricular tachyarrhythmia was induced. Ablation was not performed based on the results above. ECG monitoring showed that she had sinus tachycardia which was presumably related to her symptoms.

## Discussion

FVBTs are rarely reported preexcitation. The diagnosis relies on the fixed preexcitation with decremental AVN conduction and/or preexcitation during a His extrasystole. The prevalence of FVBT is believed to be underestimated due to lack of attention on ECG/EP characteristics of such patients [1–4].

Several surface ECG characteristics may be utilized for differentiation of FVBTs from AVBTs before invasive diagnostic procedures, including preexcitation pattern, QRS width, PR interval and delta wave amplitude [2,3,5]. In a recent study, a higher delta wave amplitude (DWA) measured from the most preexcited frontal limb lead was the only

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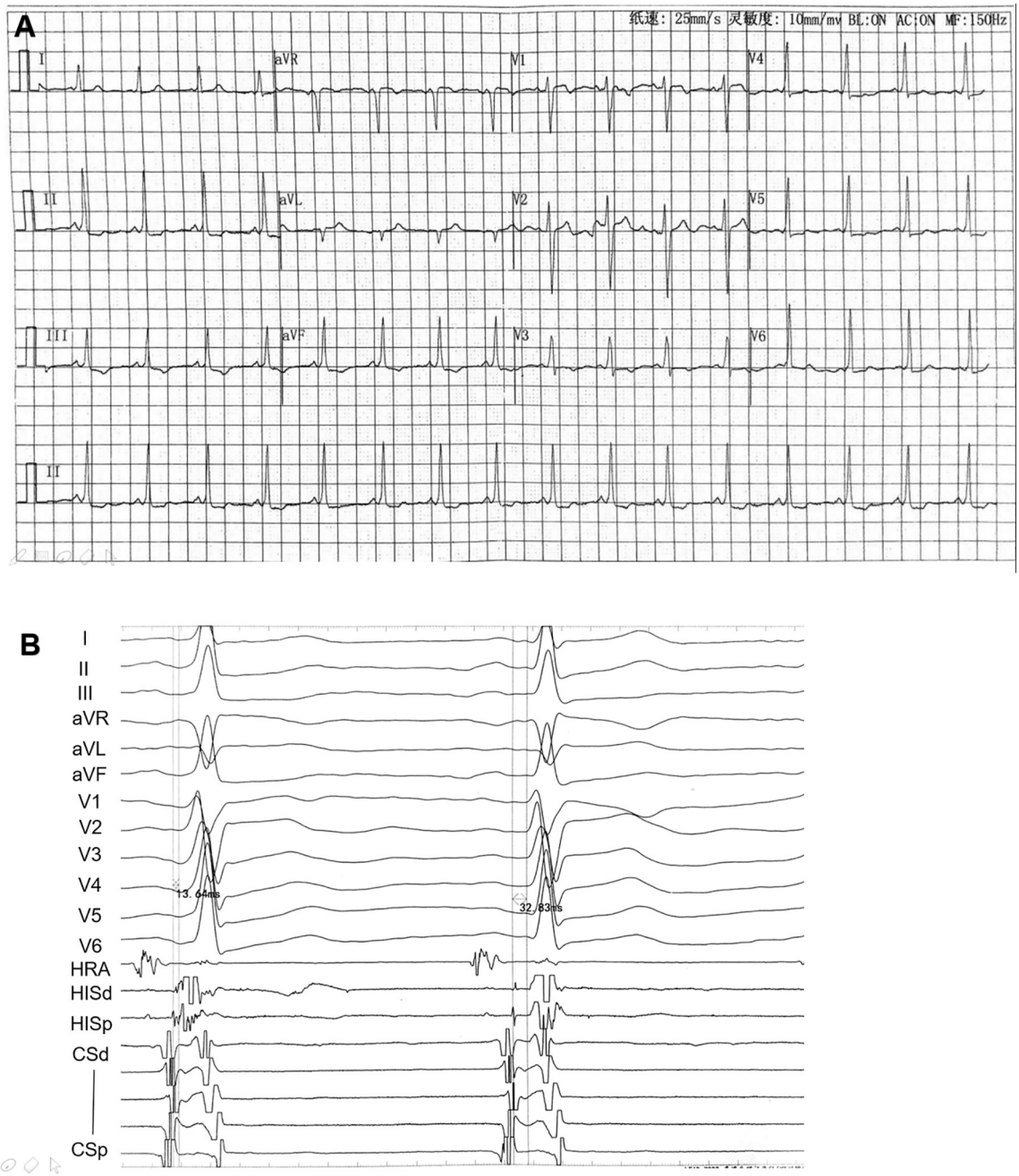


**Fig. 1.** A. 12-lead ECG during sinus rhythm showed manifest preexcitation. B. Baseline HV with and without preexcitation.

independent predictor for distinguishing AVBT from FVBT. DWA of our patient was 1.7 mm, which was below the cutoff (<2 mm) for FVBT in this study [5].

Fig. 4 summarizes the A-H and H-V interval with all coupling intervals of AES in this patient. During decremental A-H conduction, AES was blocked in the fast pathway and conducted down the slow pathway of AVN, which provided an enormous increase of nodal conduction time to restore conduction over FVBT. This was clearly an example of gap phenomenon, defined as a certain zone in cardiac cycle during which AES fails to evoke ventricular responses while atrial stimuli with greater and lesser prematurity are able to conduct to ventricle. Initial block occurs at a distal site with a long refractory period, then conduction at proximal site is delayed with more premature extrastimuli, which consequently allows the distal site to recover excitability and make A-V conduction feasible [6]. According to the different involved structures in the conduction system, antegrade gap phenomena can be classified into 6 types [7]. Although this case matched none of them, it could still be regarded as a "pseudo gap phenomenon" using fasciculoventricular pathway for initial block(distal), while AVN played the role of proximal site, where the conduction was delayed and thus sufficient time was given for recovery of FVBT.

The reappearance of delta wave with identical H-V interval was the only proof of FVBT in this patient and AVBT was excluded because slow nodal conduction would result in full preexcitation under this circumstance. An alternative explanation for this tracing can be junctional escape following AV block, which is however unlikely because it was reproducible and could not be observed with even shorter-coupled AES.

Adenosine challenge could also be useful in distinguishing FVBTs from AVBTs [2,3]. However, some AVBTs may also be blocked by

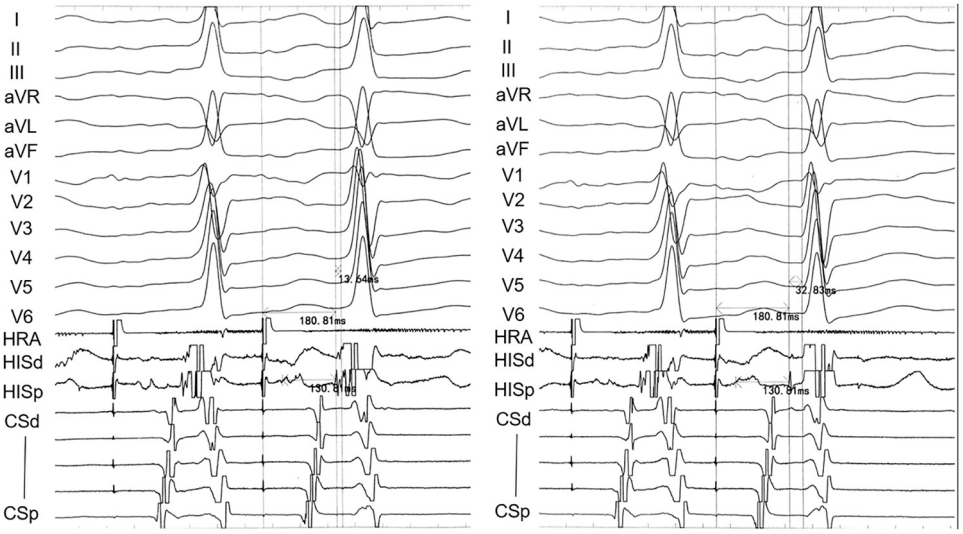


**Fig. 2.** Left panel: Programmed atrial extrastimulus from HRA, A1-A1 550 ms, A1-A2 360 ms, A-H interval was 131 ms, HV was 14 ms with preexcitation. Right panel: A1-A1 550 ms, A1-A2 350 ms, A-H was still 131 ms, HV was 33 ms with loss of delta wave.

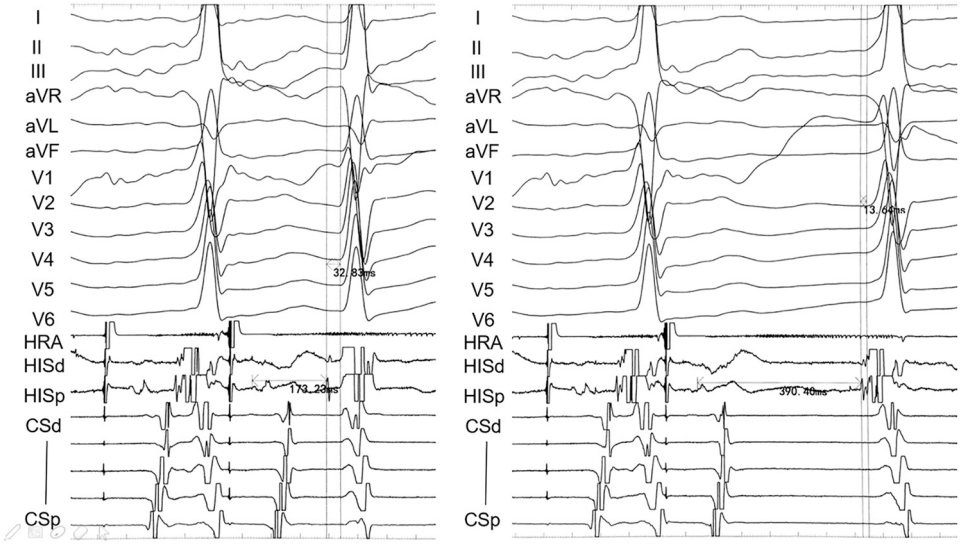


**Fig. 3.** Left panel: Programmed atrial extrastimulus from HRA, A1-A1 550 ms, A1-A2 290 ms, A-H interval was 173 ms, HV was 33 ms without preexcitation. Right panel: A1-A1 550 ms, A1-A2 280 ms, A-H jumped to 390 ms, HV was 14 ms and delta wave reappeared.

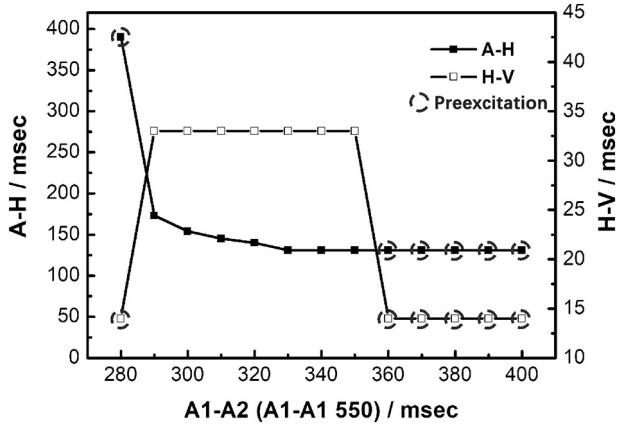


**Fig. 4.** Demonstration of A-H and H-V interval during progressively premature atrial extrastimuli. Preexcitation occurred only when A1-A2 was 280 ms, or higher than 350 ms, with a fixed H-V interval, which was consistent with "gap phenomenon". See text for discussion.

adenosine, thus misdiagnosis can happen [8]. Occasionally a spontaneous His extrasystole can result in preexcitation [4], which did not occur in our case. Ablation in this patient was not performed due to the extremely low probability of SVT or atrial fibrillation with rapid ventricular response, and in contrast, a high risk for AV block. But she might require long-term follow-up based on the evidence that some patients with FVBT developed arrhythmias such as AV block or atrial flutter/fibrillation [9].

Informed consent was obtained from the patient.

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## Declarations of interest

None.

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