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## Case Report

## Atrioventricular reentrant tachycardia with a 2:1 right bundle branch block

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## ABSTRACT

The phenomenon of a 2:1 bundle branch block is reported during atrioventricular (AV) nodal reentrant tachycardia, sinus tachycardia, atrial fibrillation, and atrial flutter. A 2:1 bundle branch block is attributed to first- and second-degree bundle branch block, linking, electrical alternans, aberrancy, or supernormal conduction. However, the same phenomenon has not been reported in AV reentrant tachycardia. Herein, we report the case of a 52-year-old man presenting with orthodromic atrioventricular reentrant tachycardia with a 2:1 right bundle branch block.

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## 1. Introduction

The occurrence of bundle branch block during supraventricular tachycardia may aid in the differential diagnosis of the mechanism of supraventricular tachycardia. The phenomenon of a 2:1 bundle branch block is reported during atrioventricular (AV) nodal reentrant tachycardia, sinus tachycardia, atrial fibrillation, and atrial flutter [1–5]. A 2:1 bundle branch block is attributed to first- and second-degree bundle branch block, linking, electrical alternans, aberrancy, or supernormal conduction. However, the same phenomenon has not been reported in AV reentrant tachycardia. In this report, we present the case of AV reentrant tachycardia with a 2:1 right bundle branch block.

## 2. Case report

A 52-year-old man was admitted to Pusan National University Yangsan Hospital because of paroxysmal palpitations and was scheduled to undergo a cardiac electrophysiologic study. The results of his physical examination were unremarkable. A 12-lead electrocardiogram showed sinus rhythm without ventricular pre-excitation or bundle branch block, and the results of echocardiography were normal. Furthermore, 24-h Holter monitoring showed no supraventricular or ventricular tachycardia.

The cardiac electrophysiologic study was performed after obtaining informed consent from the patient; the findings were

as follows: sinus cycle length, 1100 ms; atrial-His (AH) interval, 95 ms; and His-ventricular (HV) interval, 50 ms. Tachycardia with a cycle length of 450 ms was reproducibly induced by atrial extrastimulus or decremental pacing (Fig. 1). A 2:1 right bundle branch block (RBBB) pattern and a 1:1 ventriculoatrial (VA) relationship were observed. The P wave was positive in the inferior leads and negative in V1, suggesting an anteroseptal or a right anterior accessory pathway. Intracardiac tracing (Fig. 2) showed (1) tachycardia with an alternating RBBB; (2) a normal HV interval; (3) the earliest retrograde atrial activation recorded in the His bundle catheter; (4) prolongation of the VA interval from 105 to 130 ms with RBBB development; and (5) no change in R-R interval secondary to reciprocal shortening of the AH interval immediately after VA prolongation.

Catheter ablation of a concealed right anteroseptal AV bypass tract was successfully performed in our patient. Catheter ablation of the anteroseptal accessory pathway did not affect normal AV conduction. The effective refractory period of the fast AV node was 380 ms at a pacing cycle length of 700 ms, and there was no AH jump after catheter ablation of the bypass tract. The patient developed a 2:1 RBBB when the atrium was paced at a cycle length of 450 ms, which was the same length as the tachycardia cycle.

## 3. Discussion

We report 2:1 RBBB during orthodromic AV reentrant tachycardia in a patient with a concealed anteroseptal accessory pathway.

Because the ventricle is part of the AV reentrant circuit, development of a bundle branch block ipsilateral to the free wall bypass prolongs the tachycardia cycle secondary to prolongation

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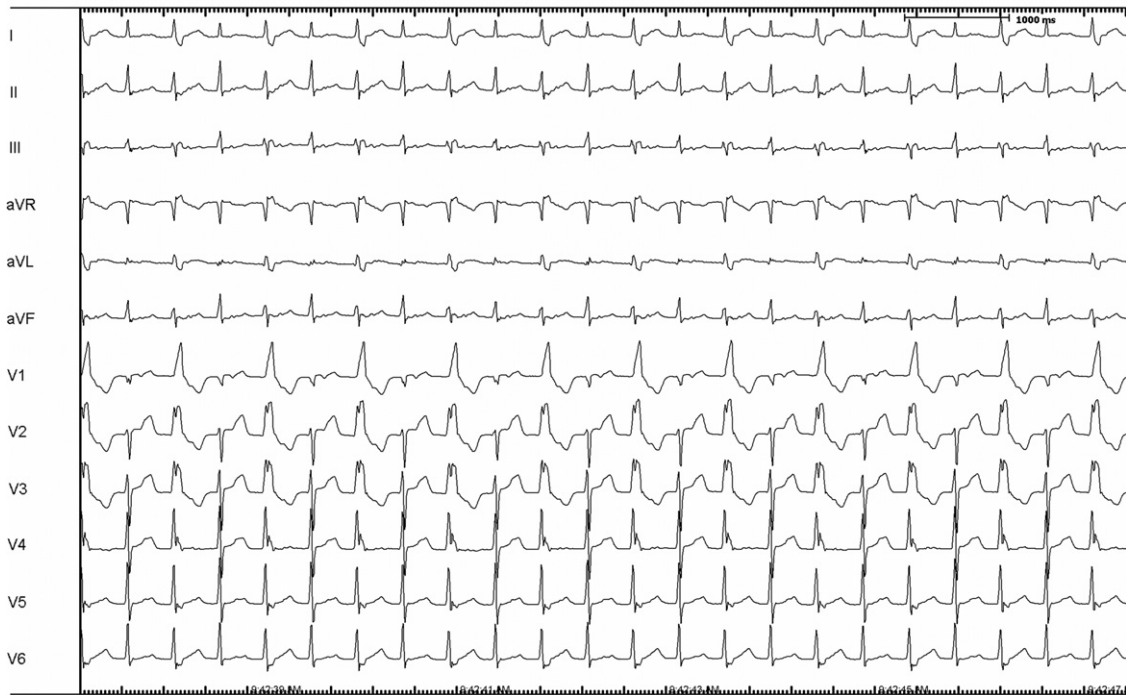


Fig. 1. A 12-lead electrocardiogram of induced supraventricular tachycardia with a 2:1 right bundle branch block.

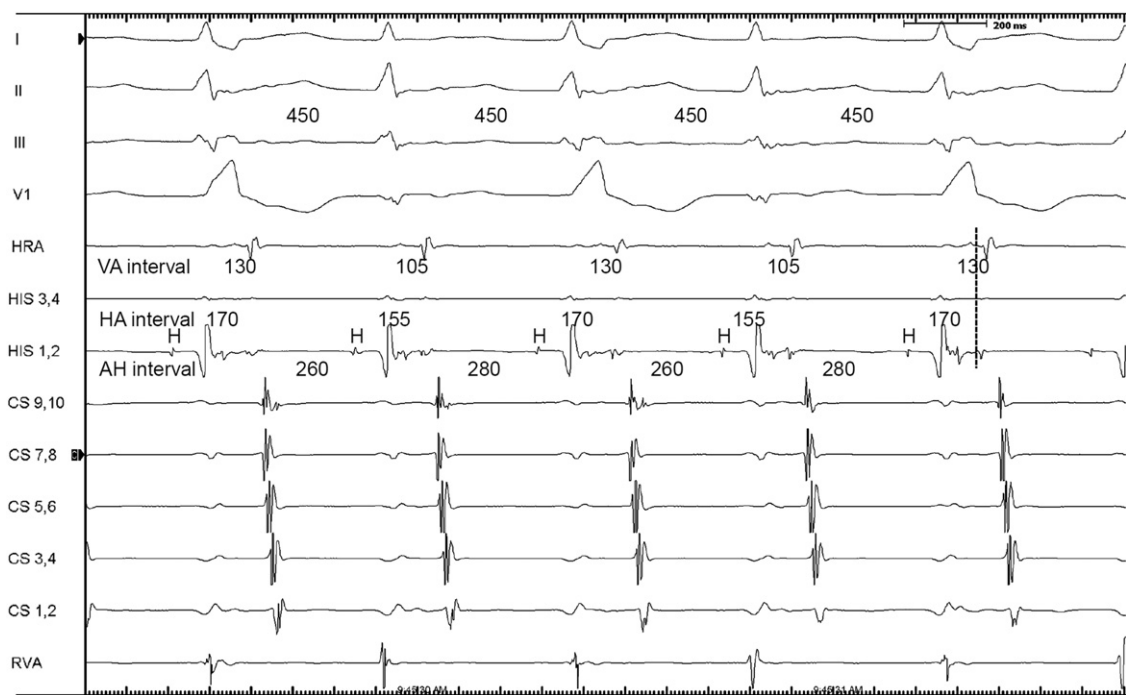


Fig. 2. Intracardiac tracing of induced supraventricular tachycardia.

of the VA conduction time if AV conduction time is unchanged. However, development of a bundle branch block in AV reentrant tachycardia by using a septal bypass tract does not increase the VA interval by less than 25 ms [6]. As observed in our case, reciprocal shortening of the AV interval can lead to no change or decrease of the tachycardia cycle length after bundle branch block development ipsilateral to the bypass tract.

A 2:1 bundle branch block is reported in patients with AV nodal reentrant tachycardia, sinus tachycardia, atrial flutter, atrial fibrillation, and pulmonary embolism [1–5]. This phenomenon

can be attributed to multiple mechanisms including first- and second-degree bundle branch blocks (prolonged refractory period of bundle branch block), aberrancy, or supernormal conduction [7–10].

A 2:1 (or an alternating) RBBB can be attributed to the long refractory period of the right bundle branch (RBB), which is greater than the tachycardia cycle length. In cases of supraventricular tachycardia, the reentrant atrial impulse is blocked in the RBB anterogradely, and RBBB is noted during the beat. The block in the RBB provides sufficient time for refractoriness to recover so

that the next echo beat could be conducted normally along the right bundle branch.

Based on constant heart rate during tachycardia, rate-related aberrancy of every other beat can be excluded.

A 2:1 bundle branch block can be also attributed to phase-3 (or tachycardia-dependent) antegrade block associated with supernormal conduction in the affected bundle branch. If the prolonged refractory period of an impaired bundle branch includes an early short phase of supernormal conduction (improved responsiveness), at a defined rate, the supraventricular impulses fall alternately within this period (producing normal QRS complexes) and outside it (resulting in a bundle branch block). This phenomenon only occurs if the antegradely blocked bundle branch is penetrated in a retrograde direction by the impulse coming from the contralateral bundle branch [8,9]. However, supernormal conduction should be considered only after failing to explain the phenomenon by a known physiologic mechanism [10]. Considering that the first-mentioned physiologic mechanism can explain the 2:1 RBBB, supernormal conduction would be less likely.

Phase-4 (or bradycardia-dependent) antegrade block of bundle branch can be excluded by the existence of bundle branch block only during tachycardia [11].

In conclusion, we report rare electrocardiographic manifestation of supraventricular tachycardia with a 2:1 RBBB in a patient with a concealed right anteroseptal accessory pathway. The most probable mechanism of this phenomenon is the long refractory period of the RBB, which is greater than the tachycardia cycle length.

## Conflict of interest

All authors have no conflicts of interest to declare.

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