Resolution of the functional retrograde right bundle branch block during antidromic atrioventricular reciprocating tachycardia

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Introduction

Although gradual development and/or resolution of anterograde right bundle branch block (RBBB), suggesting decremental RBB conduction, is well known, gradual resolution of retrograde RBBB is rare. We encountered a case, however, in which a phenomenon suggested that gradual resolution of the functional retrograde RBBB occurred.

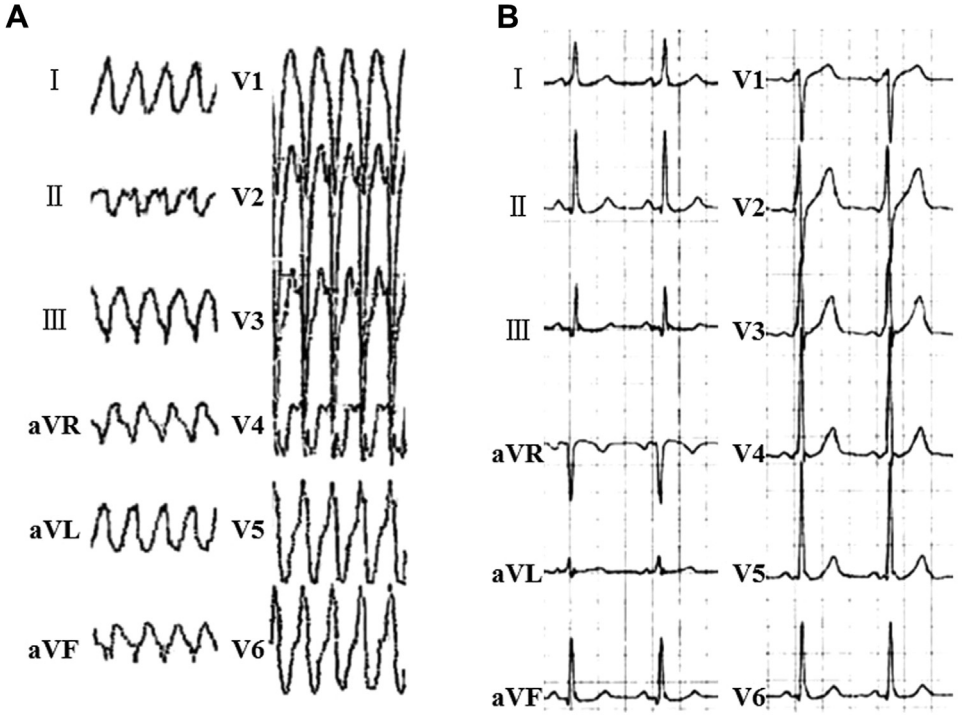

Figure 1 Twelve-lead electrocardiograms obtained during (**A**) clinical supraventricular tachycardia (SVT1) and (**B**) sinus rhythm. SVT1 was shown to be a wide QRS complex tachycardia (200 beats/min) with left bundle branch block morphology (panel A). Ventricular preexcitation was seen during sinus rhythm, suggestive of the presence of a right lateral accessory pathway (panel B).

KEYWORDS Retrograde right bundle branch block; Antidromic atrioventricular reciprocating tachycardia; Decremental conduction; Atrioventricular nodal reentrant tachycardia; Catheter ablation
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Case report

A 41-year-old man was referred to our institution for electrophysiology study and catheter ablation (Figure 1A) of wide QRS tachycardia (200 beats/min) with left bundle branch block morphology. The tachycardia was terminated by intravenous bolus administration of 20 mg of adenosine triphosphate, and 12-lead electrocardiography performed during

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KEY TEACHING POINTS

- Antidromic atrioventricular reciprocating tachycardia is uncommon and seen in only 4%–5% of patients with manifest ventricular preexcitation during sinus rhythm.
- Gradual ventricular-His interval shortening resulting in a decreased cycle length without a change in the QRS morphology or atrial sequence during antidromic atrioventricular reciprocating tachycardia suggests gradual resolution of the retrograde right bundle branch block.
- The phenomenon can be explained by the decremental property of functional retrograde right bundle branch block.

sinus rhythm (SR) revealed manifest ventricular preexcitation, suggesting the presence of a right lateral accessory pathway (RLAP) (Figure 1B).[1]

We positioned multipolar catheters in the patient's high right atrium, His bundle region, and right ventricular apex via the right femoral vein and in the coronary sinus via the right internal jugular vein. During SR, the cycle length (CL), atrial-His interval, and His-ventricular interval were 942, 64, and 0 ms, respectively. A decrease in the atrial extrastimulus coupling interval from 350 to 340 ms at a basic pacing CL of 600 ms revealed a jump in the atrial-His interval of 70 ms, suggesting the presence of dual atrioventricular nodal pathways; an atrial extrastimulus delivered at a coupling interval of 300 ms revealed an anterograde accessory pathway (AP) effective refractory period (ERP), and an atrial extrastimulus delivered at a coupling interval of 250 ms revealed an atrioventricular nodal ERP. RV extrastimuli delivered at coupling intervals from 400 to 350 ms at a basic pacing CL of 600 ms showed earliest activation at the His bundle region, but those delivered between 340 and 300 ms revealed a left posterolateral accessory pathway (LPLAP). With further shortening of the coupling interval between 290 and 220 ms, earliest atrial activation shifted back to the His bundle region, with an increased ventricular-His (VH) interval.

Clinical preexcited tachycardia with left bundle branch block morphology and a CL of 350 ms (clinical supraventricular tachycardia [SVT1]) was induced by delivery of a ventricular extrastimulus at a coupling interval of 300 ms. A His bundle electrogram was recorded after septal ventricular activation, and the earliest atrial electrogram was recorded from the His bundle region (Figure 2). Antidromic atrioventricular reciprocating tachycardia (AVRT) that used an RLAP was diagnosed on the basis of advancement of ventricular activation induced by a single premature atrial beat, with timing adjusted decrementally to that of the atrial septal refractory period.

During SVT1, the tachycardia had shortening CLs with the same morphology and atrial activation sequence. The CL

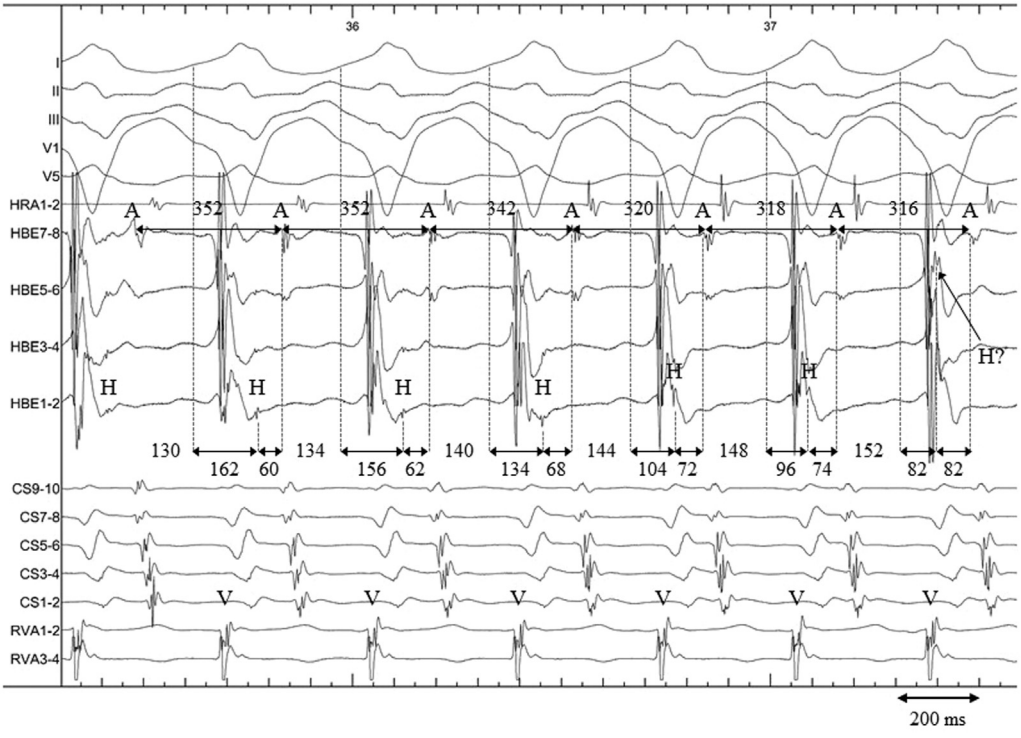

Figure 2 Intracardiac electrograms obtained during clinical supraventricular tachycardia (SVT1), antidromic atrioventricular reciprocating tachycardia that used a right lateral accessory pathway with shortening cycle lengths. The cycle length of the tachycardia decreased gradually along with the shortening of the ventricular-His interval and a slight prolongation of the His-atrial interval, suggesting resolution of the functional retrograde right bundle branch block. CS = coronary sinus; HBE = His bundle electrogram; HRA = high right atrium; RVA = right ventricular apex.

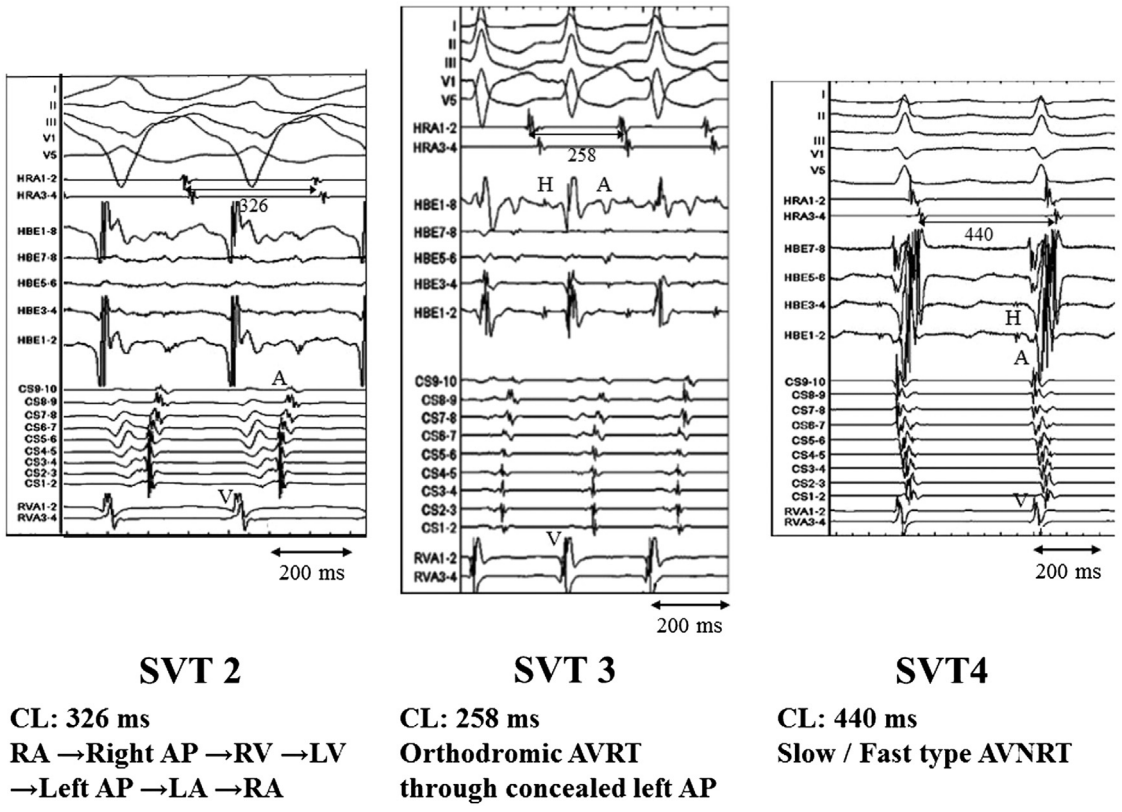

Figure 3 Intracardiac electrograms of the 3 additional supraventricular tachycardias (SVTs). Atrioventricular reciprocating tachycardia (AVRT) that used a right lateral accessory pathway as the anterograde limb and left posterolateral accessory pathway (LPLAP) as the retrograde limb at a tachycardia cycle length (CL) of 326 ms (SVT2), orthodromic AVRT that used an LPLAP at a tachycardia CL of 258 ms (SVT3), and common atrioventricular nodal reentrant tachycardia at a CL of 440 ms (SVT4) were induced. AP = accessory pathway; AVNRT = atrioventricular nodal reentrant tachycardia; CS = coronary sinus; HBE = His bundle electrogram; HRA = high right atrium; LA = left atrium; LV = left ventricle; RA = right atrium; RV = right ventricle; RVA = right ventricular apex.

decreased gradually along with the shortening of the VH interval and a slight prolongation of the His-atrial interval (Figure 2). Shortening of the cycle appeared to be due to the fact that the increase in the His-atrial interval was smaller than the decrease in the VH interval. As the VH interval decreased, the septal ventricular electrogram obscured the His bundle electrogram. This phenomenon was reproducibly observed.

Antidromic AVRT with an RLAP used as the anterograde limb and LPLAP used as the retrograde limb (SVT2; tachycardia CL 326 ms), orthodromic AVRT that used an LPLAP at a tachycardia CL of 258 ms (SVT3), and common atrioventricular nodal reentrant tachycardia at a CL of 440 ms (SVT4) were also induced (Figure 3). The RLAP, LPLAP, and atrioventricular nodal slow pathway were eliminated by radiofrequency ablation, and no SVT was induced by subsequent programmed stimulation with or without isoproterenol administration. The patient has been followed up for 1 year, and the arrhythmia has not recurred.

Discussion

Antidromic AVRT is uncommon and seen in only 4%–5% of patients with manifest ventricular preexcitation during SR.[2] During our patient's antidromic AVRT that used an RLAP, we observed gradual VH interval shortening that resulted in CL shortening without a change in the QRS morphology or atrial sequence. The most plausible explanation for this phenomenon is resolution of the functional retrograde RBBB or intramyocardial conduction delay. Tchou et al[3] showed that resolution of functional retrograde RBBB can occur gradually as a result of migration of the site of block from the distal to the proximal RBB with shortening of the tachycardia CL. The VH interval shortening was consistent with this reported phenomenon, although no definitive proof was provided in our case. RBB recording might have clarified the hypothesis. In contrast, gradual delay of intramyocardial conduction was unusual. Furthermore, the interval from the QRS onset to the ventricular potential in the His bundle region or right ventricular apex was unchanged during this phenomenon. These observations suggested that intramyocardial conduction delay was less possible. Decremental retrograde RBB conduction is another possible mechanism. Such anterograde decremental conduction has been shown in several reported studies,[4–6] and Kuck et al[7] reported that retrograde BBB developed abruptly during antidromic AVRT. However, there has been no report of decremental retrograde RBB conduction.

Four types of SVT were uncovered in our patient, and these SVTs used 2 APs and a dual atrioventricular nodal pathway. Multiple APs have been reported at a prevalence of 4%–15%.[8,9] The similar ERPs of the pathways allow SVTs to transition easily to other SVTs.

Conclusion

We encountered a rare case of multiple SVTs that used 2 APs and a dual atrioventricular nodal pathway. Spontaneous but gradual resolution of functional retrograde RBBB likely occurred during the antidromic AVRT that used the RLAP.

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