

# An Isoproterenol Dependent Broad QRS Tachycardia: What is the Mechanism?

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## An Isoproterenol Dependent Broad QRS Tachycardia: What is the Mechanism?

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A 27-year-old female presenting with recurrent palpitation during exercise was referred for electrophysiology study. Electrocardiogram (ECG) during symptom was not documented. Her baseline ECG was sinus rhythm with normal PR interval. Ventricular pacing and programmed extrastimulus showed retrograde conduction via AV node. A-H interval was progressively prolonged during atrial extrastimuli without preexcitation (Figure 1). No tachycardia was inducible until isoproterenol infusion, after which a wide QRS tachycardia was initiated by ventricular burst pacing. Figure 2 showed 2 intracardiac recordings during tachycardia. What can be learned from the tracings?

Figure 2A showed a wide QRS complex tachycardia with left bundle branch block morphology, left-inferior frontal axis and 1:1 VA relationship, the cycle length of which was about 365ms. There was no His electrogram preceding each QRS, instead, a putative retrograde His could be observed after local ventricular electrogram on His catheter with an H-A interval around 100ms. Differential diagnosis included ventricular tachycardia (VT) from right ventricular outflow tract and different types of preexcited tachycardia. A sensed atrial extrastimulus was delivered when AV node was refractory, indicated by the unchanged timing of atrial signal on His catheter, which advanced the next QRS with identical morphology to tachycardia. This phenomenon suggested the presence of an anterograde conducting accessory pathway. Measurement of A-A interval indicated the tachycardia was reset, providing the evidence that the AP was participating in the reentry [1]. VT can be ruled out by the unchanged QRS morphology during sensed atrial extrastimulus and entrainment from atrium, while preexcited AV nodal reentry and nodoventricular tachycardia was precluded by the resetting of tachycardia with AV-nodal-refractory atrial extrastimulus. The fact that atrial extrastimulus

with earlier prematurity terminated the tachycardia without conduction to the ventricle (Supplemental Figure) also argued against AVNRT with innocent bypass tract, which in this setting would require the timing of the extrastimulus to exactly encounter the refractory period of the pathway when terminating AV nodal reentry. Furthermore, the tachycardia could also terminate spontaneously with an atrial signal, making preexcited atrial tachycardia highly unlikely (Figure 2B). Therefore, the diagnosis of antidromic atrioventricular reentrant tachycardia (AVRT) was made based on all the evidence above.

But how could the patient have antidromic AVRT whose preexcitation was absent at baseline, during atrial extrastimuli, and pacing from both atria (not shown)? If we look into the sinus QRS configuration after tachycardia cessation in Figure 2B, prominent delta waves could be observed, which emerged only during isoproterenol infusion in this case. In Wolff-Parkinson-White syndrome, intermittent anterograde pathway conduction dependent on isoproterenol, although not common, has been reported [2]. The pathway conduction was unsustainable when isoproterenol was discontinued, proving the unidirectional conducting accessory pathway was highly isoproterenol-sensitive, which served as the anterograde limb of the antidromic AVRT. On the other hand, isoproterenol also facilitated the retrograde conduction of AV node, which played the role of the retrograde limb. The pathway was then ablated near 12 o'clock site of tricuspid annulus, after which no delta wave was present with isoproterenol infusion, and the tachycardia was therefore not inducible.

### Conflicts of interest

The authors declare no conflicts of interest.

### References

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### Figure legends

Figure 1 12-lead ECG and intracardiac electrogram showed normal P-R/H-V interval during sinus rhythm and constant H-V during atrial extrastimulus. CS=coronary sinus; ECG=electrocardiogram; RV=right ventricle.

Figure 2 A: A sensed atrial extrastimulus delivered from CS5-6 during the wide QRS tachycardia, advanced the subsequent ventricular activation and reset the tachycardia, with unchanged QRS configuration. B: Termination of the tachycardia with an atrial signal. The 3 sinus beats after tachycardia showed prominent delta wave during isoproterenol infusion. See text for discussion. CS=coronary sinus; RV=right ventricle.

Supplementary Figure 1 An early-coupled atrial extrastimulus encountered the anterograde refractory period of the accessory pathway and terminated the tachycardia. See text for discussion. CS=coronary sinus; RV=right ventricle.

