

Atrioventricular nodal reentrant tachycardia in a nonagenarian—Triple traps of AV block



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Introduction

Atrioventricular nodal reentrant tachycardia (AVNRT) is a common arrhythmia encountered in clinical practice. Catheter ablation reduces duration of hospitalization and improves quality of life in patients with this arrhythmia.¹ AVNRT is occasionally seen in patients at an old age; however, ablation therapy has not been fully investigated in nonagenarians.

In patients with a long PR interval at baseline, antegrade fast pathway conduction may be absent and slow pathway ablation for AVNRT can lead to atrioventricular (AV) block.^{2,3} Bifascicular block at baseline was also recognized as a risk factor for AV block during ablation therapy; however, there are few reports that discuss the combination of both conduction disorders.

Here, we report a case of a nonagenarian with AVNRT and trifascicular block including prolonged PR interval treated with cryoablation.

Case report

A 91-year-old male patient with a history of right coronary artery percutaneous coronary intervention presented with recurrent episodes of symptomatic wide complex tachycardia and a short RP interval. A baseline electrocardiogram showed first-degree AV block with a 233 ms PR interval, right bundle branch block, and left axis deviation (Figure 1). Since the tachycardia was resistant to medication, an electrophysiological study was performed after written informed consent, which confirmed the diagnosis of slow-fast AVNRT by diagnostic pacing maneuvers. An intracardiac electrocardiogram

KEY TEACHING POINTS

- Patients with trifascicular block have a high risk of atrioventricular block following slow pathway ablation.
- The slow and fast pathways may be located close together in elderly patients.
- Cryoablation is feasible in elderly patients with atrioventricular nodal reentrant tachycardia and trifascicular block.

shows that a para-Hisian region is the earliest atrial activation site and the His-atrium interval is shorter than the atrio-His (AH) interval during tachycardia. The difference between postpacing interval after entrainment of the tachycardia by ventricular apical pacing and tachycardia cycle length was 158 ms (Figure 2). The differential atrial overdrive pacing indicated ventriculoatrial linking. Para-Hisian pacing revealed retrograde conduction over the AV node. Because the presence of an AH jump of more than 50 ms during decremental atrial extrastimulus confirmed the presence of dual antegrade AV nodal pathways, catheter ablation targeting the antegrade slow pathway was performed. We assessed the His bundle (HB) region and the ostium of the coronary sinus by utilizing the 3D mapping system of EnSite Precision (Abbott, St. Paul, MN), and recognized that the site of the HB was displaced inferiorly. Moreover, in order to locate the site of the antegrade fast pathway, pacing was performed at various sites of the right atrial septum and the interval between the stimulus and HB potential onset was measured. The site of the shortest stimulus-His interval was considered as the antegrade fast pathway input, which was located near the ostium of the coronary sinus (Figure 3A and 3B). HB potentials were recorded at the relatively inferior aspect of the right atrial septum. The target region of antegrade slow pathway was thought to be very close to both HB and the antegrade fast pathway, and we selected cryocatheter

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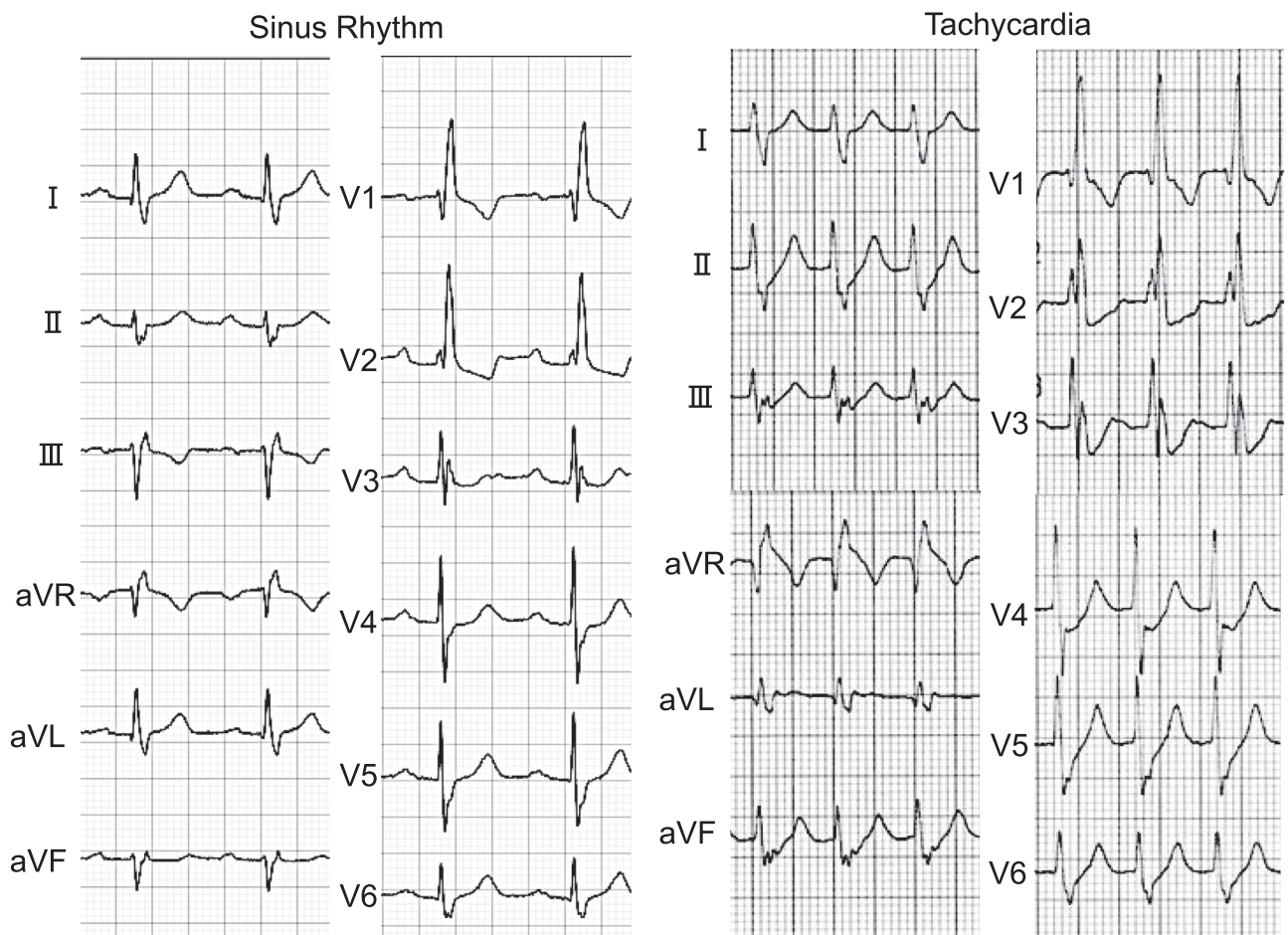


Figure 1 Electrocardiograms during sinus rhythm and tachycardia. Trifascicular block with a 233 ms PR interval was seen during sinus rhythm. Tachycardia episodes (150 beats/min) were associated with the same morphology of QRS at baseline and short RP interval.

because the risk of AV block was considered to be prohibitive.

Since the posteroseptal aspect of the tricuspid annulus was near the area of HB potential recordings and the antegrade fast pathway input (5 and 4 mm, respectively), the first cryoapplication was delivered near the coronary sinus ostium (7 mm from the HB and 4 mm from the antegrade fast pathway input) (Figure 3C and 3D). The AH interval became gradually prolonged during mapping mode and cryoapplication was ineffective at the site. Therefore, the cryocatheter was moved to the posteroseptal aspect of the tricuspid annulus. At that point, the AH interval remained unchanged and antegrade slow pathway was eliminated during cryomapping. Cryoablation was performed for a total of 8 minutes using a freeze-thaw-freeze cycle (Figure 3E). The AH interval was carefully monitored during cryoapplication. After cryoapplication, slow pathway conduction was

interrupted and no induction of AVNRT was confirmed using isoproterenol. No tachycardia events were documented during 3 months of follow-up.

Discussion

Currently, catheter ablation of the slow pathway has become first-line therapy in patients with AVNRT. Although several studies have noted its efficacy,^{2,4,5} few reports have studied the ablation in patients older than 90 years old. The distance between the proximal HB and coronary sinus ostium negatively correlates with patient age⁶ and aortic elongation can cause inferior displacement of the HB and fast pathway.⁷ As a result, the slow and fast pathways may be located close together in elderly patients. Our patient was over 90 years old; therefore, the fast pathway and HB could have been dislocated inferiorly owing to aortic elongation. To assess

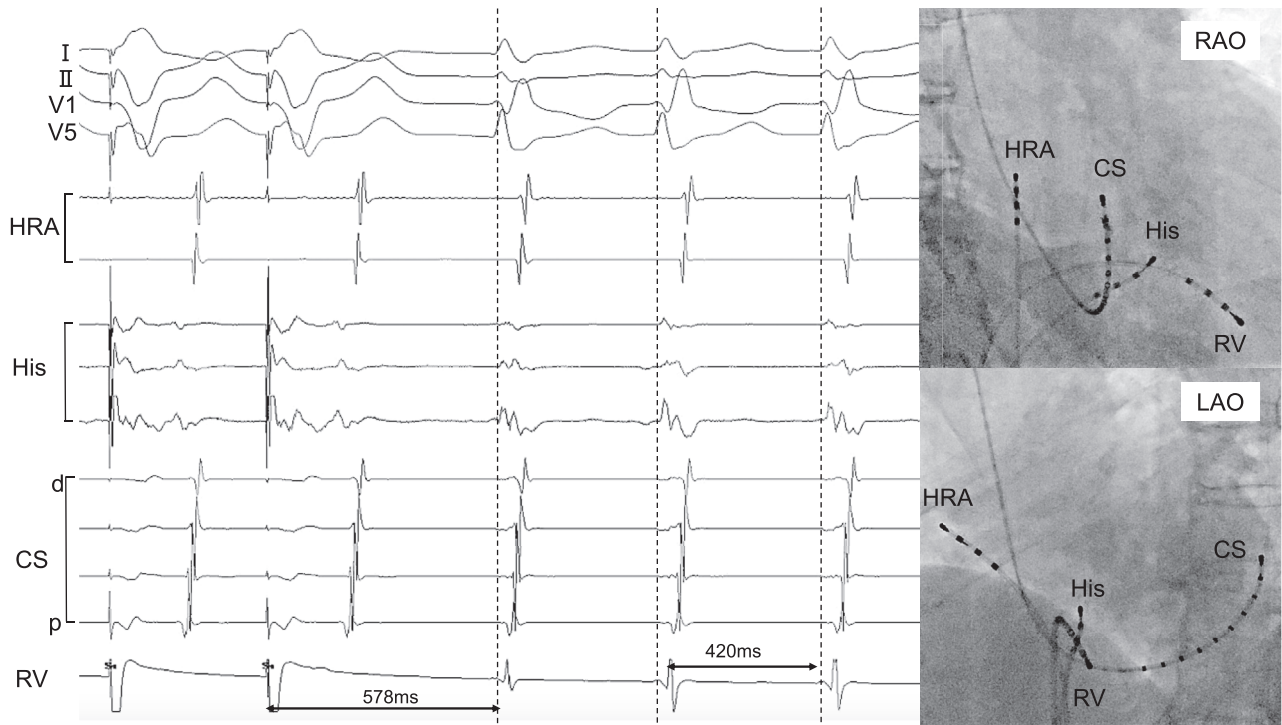


Figure 2 Entrainment of tachycardia by right ventricular apical pacing and catheter positions. An intracardiac electrocardiogram shows that a para-Hisian region is the earliest atrial activation site and the His-atrium interval is shorter than the atrio-His interval during tachycardia. The difference between postpacing interval after entrainment of the tachycardia by ventricular apical pacing and tachycardia cycle length was 158 ms. The ventriculoatrial interval during entrainment pacing was much longer than that during tachycardia (178 ms vs 52 ms, respectively). CS = coronary sinus; d = distal; HRA = high right atrium; LAO = left anterior oblique; p = proximal; RAO = right anterior oblique; RV = right ventricle.

the location of the antegrade fast pathway and HB, we sought to visualize the anatomy of the triangle of Koch using 3D mapping and pacing together.⁸

The main complication of slow pathway ablation for AVNRT is AV block. Previous studies reported that the risk of third-degree AV block is in the range of 0.8%–2.0%.^{9,10} Risk factors for such an immediate complication have been suggested to be related to total elimination of the slow pathway and occur in patients with a prolonged PR interval.^{2,5,11,12} A previous study reported that 6 of 18 patients (33%) with first-degree AV block had late second-degree AV block after slow pathway ablation, although only 1 patient was implanted with a permanent pacemaker.⁵ In addition, patients with both prolonged AH interval and bundle branch block have a high incidence of complete AV block following slow pathway ablation. In our patient, prolonged PR interval and bifascicular block were recognized on the preprocedural electrocardiogram, and the risk of AV block seemed to be prohibitive.

In cryoablation, the risk of AV conduction impairment can be reduced via cryomapping and cryoadhesion of the catheter tip to the myocardial tissue; moreover, adverse effects are likely to be reversible if cryoapplication is ceased early.¹³ Since a high degree of conduction system disorder was observed on our patient's preoperative electrocardiogram, we elected to perform cryoablation instead of radiofrequency ablation to avoid AV block. It may be difficult to determine a safe and effective treatment site in patients with displacement of the conduction system and in nonagenarians. In such cases with triple traps (the baseline prolonged PR, the underlying bifascicular block, and the displacement of the AV node), the diagnostic pacing maneuver to locate antegrade fast pathway input and the use of cryoablation should be considered to avoid serious complication of AV block.

Conclusion

Detailed evaluation and using cryocatheter avoided triple traps of AV block in a nonagenarian with AVNRT.

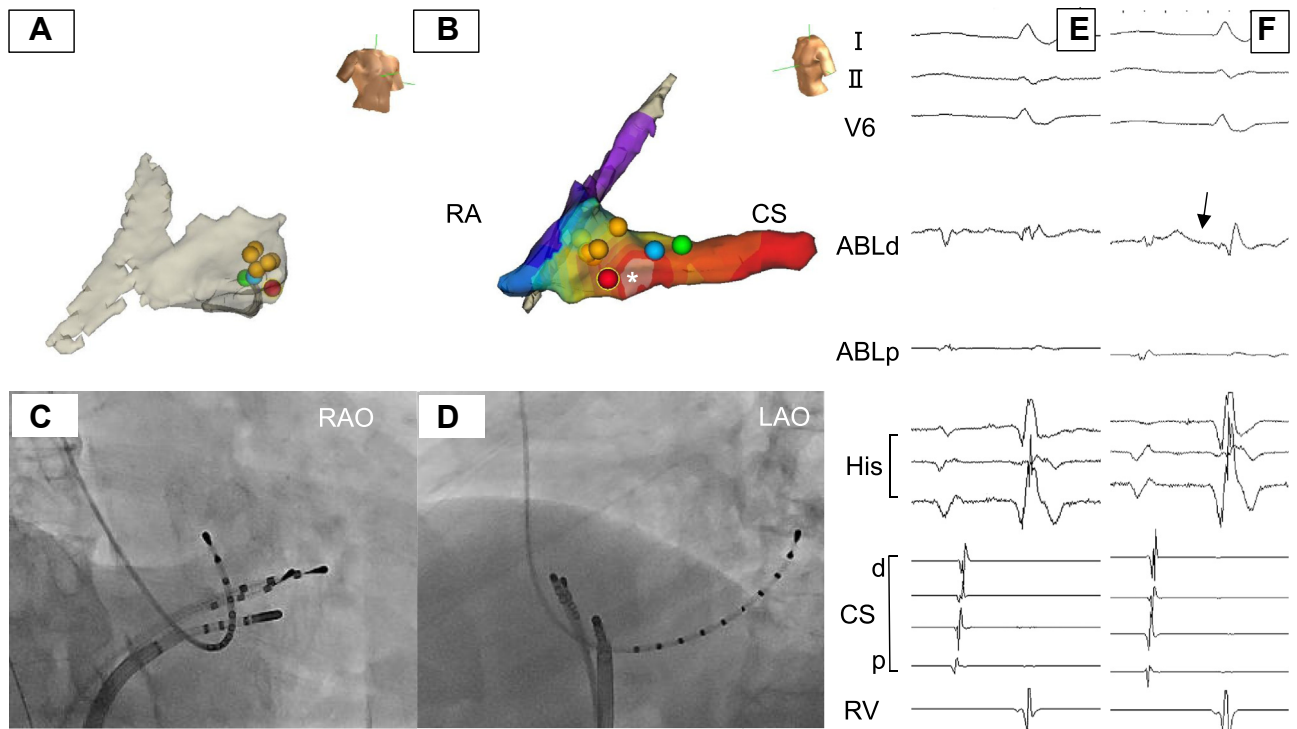


Figure 3 The sites of His bundle, antegrade fast pathway input, and cryoapplications. **A:** A right anterior oblique (RAO) view of 3D map shows the locations of His bundle (yellow tags) and the cryoablation site (blue and red tags). **B:** Left anterior oblique (LAO) view of 3D map indicates the sites of His potential recordings (yellow tags). The antegrade conduction input site was located near the ostium of the coronary sinus (CS; white asterisk). The site of the first cryoapplication is indicated by the blue tag, which induced atrioventricular (AV) block during cryomapping. Cryoapplication at the red tag point interrupted slow pathway conduction. Green tag point indicates the roof of the CS. **C, D:** Fluoroscopic view of the successful cryoablation point without AV block (**C:** RAO, **D:** LAO). **E:** The intracardiac electrocardiogram at the unsuccessful cryoapplication site near the CS ostium. **F:** The intracardiac electrocardiogram at the successful cryoablation site. There is a tiny far-field His potential detected by the distal bipolar electrode of cryoablation catheter (ABLd; arrow). ABL = ablation catheter; d = distal; p = proximal; RA = right atrium; RV = right ventricle.

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