Case report

Ablation of left-deviated dual atrioventricular nodal pathway from coronary sinus

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Keywords: *tachycardia, AV nodal reentry; catheter ablation*

Atrioventricular nodal reentrant tachycardia (AVNRT) is one of the most common types of paroxysmal supraventricular tachycardia. The mechanism of AVNRT is reentry associated with dual or multiple atrioventricular nodal (AVN) pathways. Typical AVNRT pathways, including fast and slow pathways, are confined in the right atrium. Radiofrequency catheter ablation of the slow pathway, and occasionally the fast pathway, has become the definitive treatment of choice for most symptomatic patients. Besides typical AVNRT, there exists some atypical AVNRT with various manifestations. Several groups have reported successful ablation of the leftward dual AVN pathway from the left side of the heart.[1-3] We present one case of left-sided AVN as well as dual AVN pathway. The tachycardia was successfully eliminated by ablation of the slow pathway deep in the coronary sinus.

CASE REPORT

A 55-year old woman was admitted to Xiamen University Affiliated Zhongshan Hospital due to 30 years of palpitations. The symptoms had deteriorated in the last six months, with attacks occurring 2–5 times per week. The palpitations often started abruptly and terminated suddenly. She had no history of syncope.

Previous ECG from another clinic showed "paroxysmal supraventricualr tachycardia". Several antiarrhythmic drugs including propafenone and verepamil were used to prevent the tachycardia without long-term success. A radiofrequency ablation procedure was performed unsuccessfully 10 days previously in another hospital.

Previous medical history included radical surgery for breast cancer four years previous. She had no history of structural heart disease, hypertension, or mellitus diabetes.

Physical examination: BP 130/80 mmHg, the heart sound was normal and the lungs were clear. Blood and urine tests were unremarkable. Echocardiogram showed normal cardiac structure and function. ECG during palpitation showed supraventricular tachycardia.

After an informed consent form was obtained, an electrophysiological study was performed. Under local anesthesia, three 6-French, quaripolar electrode catheters were positioned in the right ventricular apex, His bundle and the high right atrium. A quaripolar electrode catheter was inserted into the coronary sinus via the left subclavian vein. No apparent His bundle potential was recorded in the right atrial septum. Programmed electrical stimuli at 400/300–400/290 ms in the right atrium revealed a jump of the AV interval.

There was no evidence of an AV accessory pathway or atrial tachycardia during the study. After intravenous infusion of isoproterenol, tachycardia was induced by atrial stimulus (S1S2). AVNRT (slow-fast type) using dual AVN pathway was diagnosed. Radiofrequency ablation was attempted in the right septum, tricuspid annulus, and the ostium of the coronary sinus but failed to eliminate AVNRT. Left-side deviation of the AVN pathway was suspected and another ablating catheter was advanced to the left ventricular posterior septum via a retrograde approach through the femoral artery.

A prominent His bundle potential was recorded at the left posterior septum (Figure 1). The right atrial ablating catheter was subsequently advanced deep into the coronary sinus with the tip near to the opposite catheter in the left ventricle, where a prominent His bundle electrogram was recorded (Figure 2). A target with atrial and ventricular electrogram ratio of 1/4 and without His bundle electrogram was mapped. Low energy ablation (from 5 W) was first attempted and it was titrated up to 20 W. The nodal response (junctional rhythm) was satisfying and the energy of 20W was continued for 120 seconds.

DOI: 10.3760/cma.j.issn.0366-6999.2009.05.021
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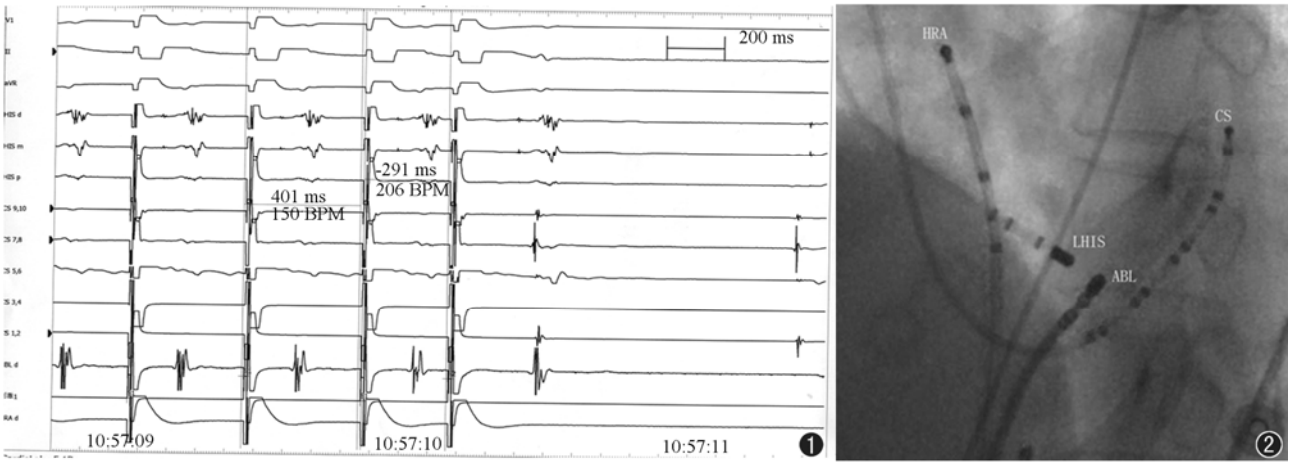

Figure 1. Surface and intracardiac electrocardiogram. His bundle potential was recorded at the left septum. Programmed electrical stimuli 400/300–400/290 ms in the right atrium revealed a jump of AV interval.
Figure 2. Left anterior oblique (45°) view of the ablation. ABL, CS, HRA and LHIS represent catheters for ablation, and for recording electrograms from coronary sinus, high right atrium, and left His bundle.

After the ablation, a repeated electrophysiological test was performed. The slow pathway was eliminated and tachycardia was no longer being induced. After 30 minutes, a repeated test was performed with the same results and the catheters were withdrawn. The patient was followed for 19 months showing no symptoms of palpitation or occurrence of the tachycardia.

DISCUSSION

Deviation of the dual AVN pathways from their normal location at the right side of the inter-atrial septum is one of the common reasons of misdiagnosis, failure of ablation, or reoccurrence of AVNRT. These variations may include variations in conduction characteristics, types of reentry, and sites of dual AVN pathways. Recently, leftward fibers of dual AVN pathways have been proposed. Inoue et al[1] reported anatomic features of posterior extensions of human compact AVN (where slow pathways were located). They dissected 21 human hearts and observed that rightward posterior extension was present in 20 of the 21 hearts, and leftward posterior extension in 14 hearts. The leftward posterior extension eventually disappeared within the central fibrous body at the site of the mitral valve annulus. But AVNRT had not been clinically documented in these hearts. Anselme et al[2] suggested that left atrionodal connection might be a bystander of AVNRT. They demonstrated that in 18 of 38 patients, earliest retrograde atrial activation in the coronary sinus distal to the ostium, suggesting a left-sided atrionodal connection, were present. But the mechanism of the tachycardia was confirmed by electrophysiological study as AVNRT by standard criteria. There was no correlation between the H to the earliest CS atrial electrogram interval and the AVNRT cycle length.

Tondo et al[3] reported 4 patients in whom AVNRT was eliminated by ablation at the mitral annulus (across an atrial septal defect in 1 patient, transseptal puncture in 2 patients, or retrograde transaortic approach in 1 patient) after ablation at the right posterior septum failed to eliminate AVNRT. The pattern of AVNRT was slow-fast type in 3 patients and fast-slow type in 1. They concluded that the atrial end of the slow pathway or fast pathway participating in AVNRT may be located along the mitral annulus in some cases.

Ma et al[4] also reported one case in whom successful ablation of the slow pathway from the posterior septum of the mitral annulus after a failed ablation attempt in another hospital. In one series of 587 cases with symptomatic typical AVNRT, Kilic et al[5] reported 9 patients (1.5%) in whom radiofrequency energy delivered to the right atrial septum with the integrated approach failed to ablate or modify the slow pathway. Slow pathway ablation was performed at the posteroseptal aspect of the mitral annulus in 6 and at the midseptal aspect in 2 patients, (although in 1 patient attempts at ablation on both the right and the left atrial septum failed).

The proposed characteristics of the leftward dual AVN pathway by the previous studies included: an atrial premature stimulus easily results in a double ventricular response or the HA interval may be very short (less than or equal to 15 ms) during AVNRT. In the present study, we attempted to ablate at multiple sites in the right septum but failed. We could not record an His bundle electrogram in the right septum. But a prominent His bundle electrogram was present in the left atrium, indicating a leftward His bundle. There are two distinguished features in the present patient that are different from the previous ones. First, previous reports only showed left deviation of the slow pathway while our study showed left deviation of the entire AVN based on electrophysiological features. Previous reports did not describe whether the His bundle electrogram could be recorded in the left atrium or not, but from the figures in

the literatures[2,4] we could find a marked His bundle electrogram in the right atrium. On the contrary, in our patient the His bundle potential could not be recorded in the right atrium.

Second, in the previous reports the ablation was attempted from the left atrium via a transseptal or transaortic approach.[2,4] We ablated successfully the slow pathway deep in the coronary sinus. Hence ablation from the coronary sinus might be a good choice for this unsual type of dual AVN pathway. Compared to a transseptal or transaortic approaches, ablation in the coronary sinus has the advantages of simplicity in procedure and a potentially shorter procedural times.

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(Received July 7, 2008)
Edited by WANG Mou-yue and LIU Huan