Ablation of atrioventricular-nodal-reentrant-tachycardia in a patient with left-sided superior vena cava and dilated coronary sinus

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ABSTRACT
Atrioventricular (AV)-nodal-reentrant-tachycardia is a rare association in a patient with persistent left-sided superior vena cava and dilated coronary sinus. There are a few inherent difficulties in ablation in this condition, viz., difficulty in localization of good site for ablation and difficulty in stabilization of the ablation catheter at the designated site, making it difficult to produce transmural lesions and increasing risk of producing AV block. We hereby present a case highlighting the difficulties and possible solutions for them.

KEY WORDS: Atrioventricular block, atrioventricular-nodal-reentrant-tachycardia ablation, catheter stability, ideal ablation site, persistent left superior vena cava

Introduction
Atrioventricular-nodal-reentrant-tachycardia (AVNRT) associated with persistent left superior vena cava (PLSVC) and its ablation has been found challenging due to distortion of the triangle of Koch’s. The problems faced in most of these cases were related to catheter stability due to large coronary sinus (CS) ostium (use of transseptal approach or long sheaths), identification of ideal site for ablation for localizing the slow pathway region (need for multiple sessions of ablation or use of novel 3D reconstruction techniques for mapping), and risk of AV block due to stability issues with ablation catheter. We highlight the possible difficulties in one such case.

Case Report
A 45-year-old female was admitted for recurrent paroxysmal palpitations for the last few years. The tachycardia electrocardiogram (ECG) was suggestive of AVNRT, without any e/o preexcitation of sinus rhythm ECG. She had recurrent symptoms while on medications. Hence, she was taken up for electrophysiological study and ablation. Preoperative echocardiographic evaluation did not reveal any structural heart disease.

She was taken up for the procedure after overnight fast and stoppage of all medications for more than five half-lives. Venous access was taken via two right femoral veins (6F and 7F) and one left femoral vein (6F). A decapolar catheter was introduced through one of the sheaths. It could be easily maneuvered inside the CS. Based on the movement of catheter inside CS, dilatation of CS ostium (Video 1), which showed bell-shaped CS with severe dilatation of CS ostium [Figure 1], was performed with a pigtail passed in the PLSVC. A retrograde venogram was then performed with a pigtail passed in the PLSVC [Figure 1], which showed bell-shaped CS with severe dilatation of CS ostium [Video 1]. Even after the detection of the anomaly, conventional catheter positions were maintained, with decapolar in CS and quadripolar at the bundle of His.

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Basal parameters were recorded which revealed normal AV node function and dual AV nodal physiology.

Tachycardia was easily inducible [Figure 2a] with a single extraneous stimulus protocol without the use of isoprenaline. A significant atrio-His jump was documented at the initiation of tachycardia [Figure 2b]. The tachycardia showed simultaneous V and A stimulation, which is congruent with concentric activation with earliest A in Hisd (tachycardia cycle length = 320 ms). The differential diagnoses at this point were atrial tachycardia or typical slow-fast AVNRT. Diagnostic maneuvers were performed to confirm AVNRT with a cycle length of 320 ms.

Ablation was then undertaken, after due consent from the relatives of the patient. A 7F 4-mm tip nonirrigated D curve (medium) of Cordis® (Johnson n Johnson, Fremont, California, USA) catheter was taken for the ablation. An anatomical approach was considered for slow pathway ablation. The ablation was done in the lower part of the triangle of Koch’s [Figure 3a], in the anterior border of CS ostium, with electrograms showing A:V ≅ 1:4 [Figure 3b] with 50W power at 60° for 60 s. The ablation catheter was stable with good contact. Only one or two runs of ablation were performed to get a stable slow junctional rhythm [Figure 3c], indicating successful ablation. Postablation pacing was carried out to induce the tachycardia, but it could not be done even with the use of isoprenaline. No slow pathway conduction was seen postablation.

Patient is asymptomatic after a follow-up of 3 years off all of the medications.

Discussion

There have been a few studies to evaluate supraventricular tachycardia in PLSVC. Weiss et al.[3] studied 204 consecutive patients, to find five cases of PLSVC, of which one had AVNRT. In a recent study done in Korea, out of 6662 patients with supraventricular arrhythmias referred for electrophysiological study, 18 had PLSVC, among which seven had AVNRT.[4] Uhm et al. had 37 patients with supraventricular arrhythmias and PLSVC in their study. In these 37 patients, 40 tachycardias were induced which included 19 AVNRT, 17 AVRTs, and four focal atrial tachycardias.[5]

In cases of PLSVC, there is significant dilatation of CS ostium, which makes the treatment with ablation even more difficult. The successful ablation site has been conventionally detected with the use of X-ray fluoroscopy at the area of CS ostium.[1] A study done with the help of 3D reconstruction and angiography detected more precise location of successful ablation site at 1 cm from CS ostium in the anterior wall.[6] Slow pathway potential (A:V ≅ 1:4) was detected at conventional site in two out of eight patients, whereas fractionated atrial deflection followed by large ventricular deflection (A:V > 1:3) was found in six out of eight patients in the anterior wall of CS, in the study by Liang et al.[6] In our case, we used the usual site of ablation based on anatomical approach using fluoroscopic positioning with an A:V ≅ 1:4. We had to give two burns to get good slow junctional rhythm after which no AVNRT could be induced.

The risk of AV block and incomplete burns is higher in the case of dilated ostium due to the dilated CS ostium and
thus difficulty in achieving a stable position for the ablation catheter. In addition, the actual location of the slow pathway is severely dilated CS may be difficult to decipher. A systemic approach to look for good A: V signals and concentrating on fragmented atrial signals will help in choosing the appropriate site of ablation. Despite these considerations, Uhm et al. found that the outcomes of ablation for AVNRT were not poor in patients with PLSVC compared with those in patients without PLSVC. They also found that procedure-related AV block rate in radiofrequency ablation for the slow pathway was very low in these patients. A similar case report of successful ablation of the slow pathway using the anatomical approach was described by Siliste et al. A left-sided approach targeting the leftward extension of the slow pathway via a transeptal approach may be required in some cases as described by Chokr et al.

Conclusion

In patients with PLSVC referred for AVNRT ablation: (1) There will be difficulty in localizing the slow pathway region in patients with a very dilated CS ostium. Successful site of ablation may be closer to the His bundle region due to the dilated CS ostium (since the base of the Koch’s triangle is moved superiorly). This can be troubleshooted by meticulous mapping of the slow pathway region along the anterior border of the CS ostium. (2) There is a risk of an incomplete burn or possible injury to the bundle of His due to movement of the ablation catheter due to the dilated CS ostium. This can be minimized by the use of a long sheath to achieve a stable position.

Declaration of patient consent

The authors certify that appropriate patient consent was obtained.

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Conflicts of interest

There are no conflicts of interest.

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