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Case Report

Utility of 3D mapping in Electrophysiology-Less Time with Greater Success in Difficult Accessory Pathway Ablation

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Key Words : *Wolff–Parkinson–White, accessory pathway, atrioventricular reentrant tachycardia, 3D mapping system.*

Abstract:

This is a challenging case of Wolff–Parkinson–White syndrome which was located in the right posteroseptum region. Patient had a previous unsuccessful attempt at ablation. It is often difficult to precisely locate this type of accessory pathway. A repeat procedure using 3D electroanatomic mapping, the electroanatomic geometry of the heart was created. The accessory pathway potential was identified and the accessory pathway was successfully ablated in minimum amount of time. In this case report showed that the advanced three-dimensional cardiac mapping system plays a very important role in guiding clinicians in order to precisely locate and safely ablate this type of challenging accessory pathway.

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Introduction:

Definitive and first line of treatment for symptomatic WPW syndrome is radiofrequency ablation (RFA). Most of the time RFA is done by conventional mapping using fluoroscopy and standard electrophysiological techniques. However, it requires significant fluoroscopy exposure and skill, and can be tremendously difficult in some cases especially accessory pathway with an oblique course.

Three-dimensional (3D) electro anatomical mapping systems were first coming into light in the 1990s and promoted a new era of new exciting investigations for atrial and ventricular tachycardia, which has increased dramatically in recent years. 3D mapping systems can demonstrate the position of catheters in real time and reconstruct the detailed 3D surface anatomy of chambers of the heart by activation time, unipolar or bipolar voltage and the presence of fractionated electrocardiograms or late potentials.[1]

WPW syndrome is effectively treated by ablating the culprit accessory pathway (AP). Although the acute success rate of AP ablation is generally high, the APs that are located in the posteroseptal area sometimes remain challenging. The posteroseptal space is an anatomically complex region comprised of several structures, including atrioventricular valves, the ostium of the coronary sinus (CS) and the middle cardiac vein. Rarely, posteroseptal APs are located in CS anomalies such as diverticula which makes them even more challenging to ablate effectively and safely. There are other reasons for unsuccessful ablation also, including the correct positioning of the ablation catheter at target site, oblique course of the AP and an epicardial location.[2]

Here we have discussed a case where ablation was applied for a prolonged time but met with an

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unsuccessful endpoint. After utilizing 3D mapping, it guided us to locate and ablate the AP within minimum periods of time.

Case Report

A 35-year-old man was referred for management of palpitation for the last 15 days. He was known case of Left ventricular noncompaction with reduced ejection fraction (LVEF 40%). Medical therapy with beta-blocker was ineffective at controlling his symptoms. His surface electrocardiogram showed preexcitation which was located in right posteroseptum [Fig 1]. Coronary angiogram was done to exclude any presence of coronary sinus diverticulum [Fig 2]. An electrophysiologic study was performed to evaluate the exact location of accessory pathway and possible ablation. The baseline AH and HV intervals were 70 and 33 msec, respectively. Antegrade earliest activation signal found in CS proximal. Atrial activation in proximal coronary sinus catheter appeared the earliest site of activation during ventricular overdrive pacing. Ventricular extra- stimulus pacing also showed concentric retrograde conduction without decremental properties. Atrial extra-stimulus and burst pacing with and without isoprenaline produced orthodromic AVRT tachycardia [Fig 3].

Meticulous mapping of right sided annulus, para-Hisian and whole length of coronary sinus areas during ventricular pacing revealed the earliest retrograde atrial activation in the proximal coronary sinus just in between 5 to 6 o'clock position. Accessory pathway was resistant to ablation. After some time, through RF application with irrigated catheter and 40W power in the right posteroseptal, VA was separated on CS proximal and VA blocked at 370 msec ventricular pacing [Fig 4]. However regretfully the ECG next day showed preexcitation. Hence planned for 3D carto mapping guided RFA.

Interestingly during 3D mapping, there was no preexcitation, so AP was retrogradely mapped during right ventricular pacing. Retrograde activation pattern was concentric and earliest atrial signal was in CS proximal though it was modified than before [Fig 5]. The AP location was identified in 5 o'clock position preceding the ventricular insertion. Within first 10s of RFA application, subtle change of activation pattern occurred where earliest activation shifted from CS proximal to His region [Fig 6]. To make sure of abolition of AP, two ampoule of Adenosine was

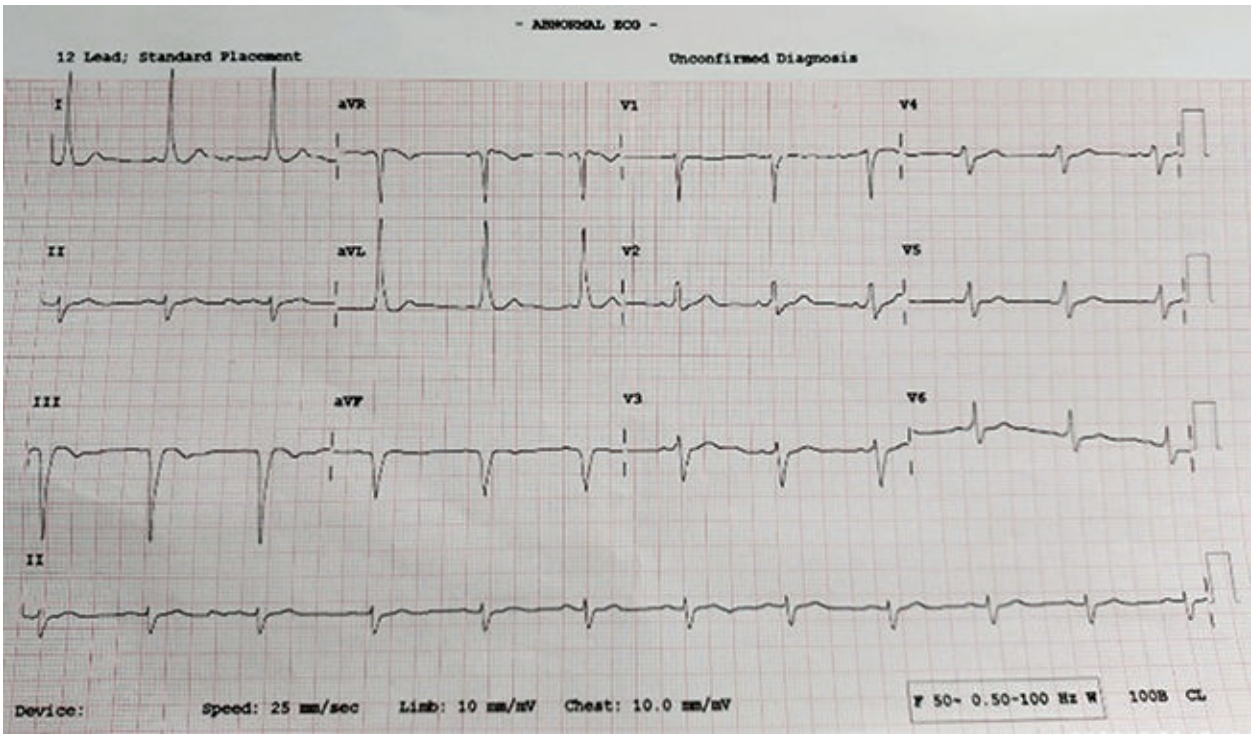

Fig.-1: *Base line ECG shows WPW pattern.*

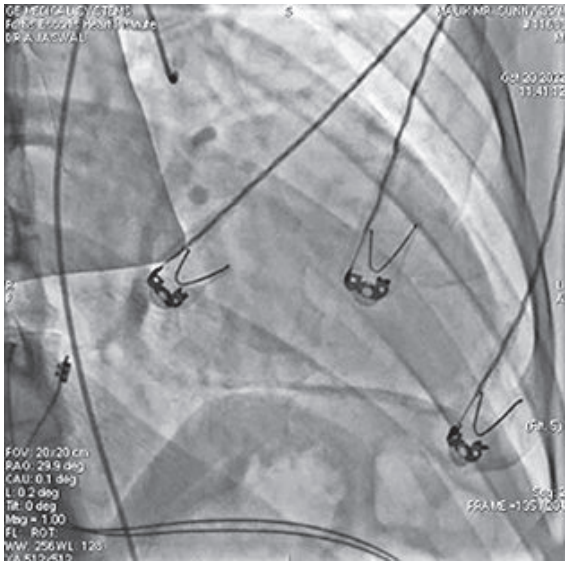

Fig.-2: *Absence of coronary sinus diverticulum.*

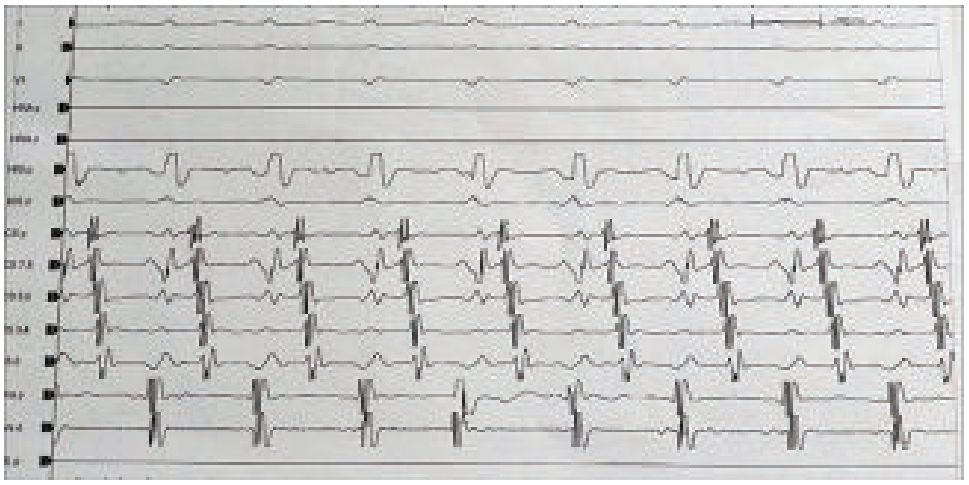

Fig.-3: *Intracardiac EKG during tachycardia.*

Fig.-4: *Marked star showed separation of A & V.*

given twice five minutes interval, but no evidence of retrograde VA block. So, activation mapping by 3D was done [Fig.7], where earliest point was in His region. So, ablation was successful with minimal amount of time with the help of 3D. Next day the patient remained clinically asymptomatic and had no further palpitations.

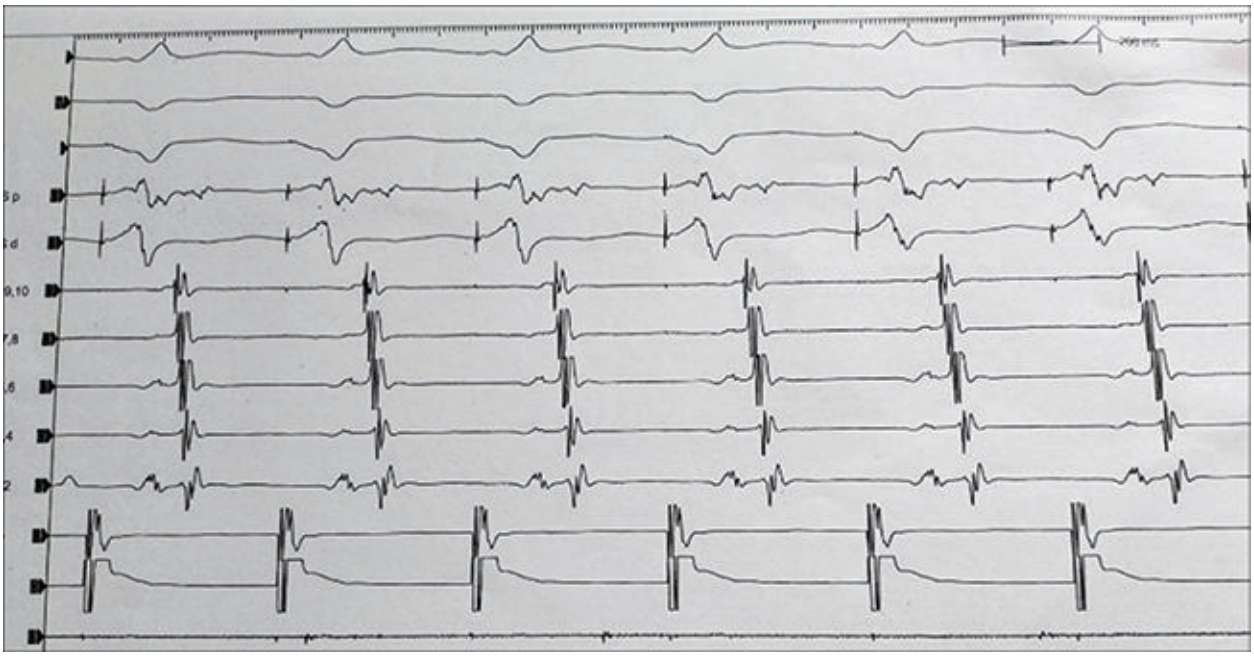

Fig.-5: *Earliest atrial signal in CS proximal during V pace.*

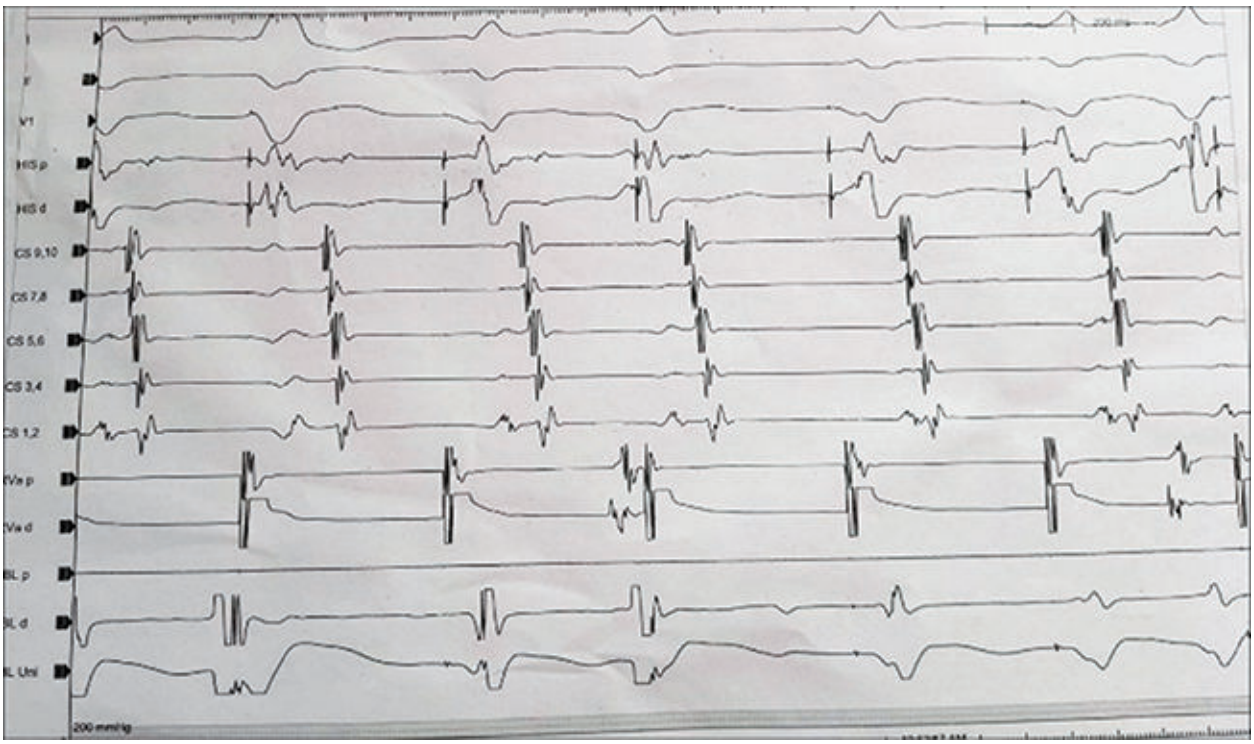

Fig.-6: *After successful ablation.*

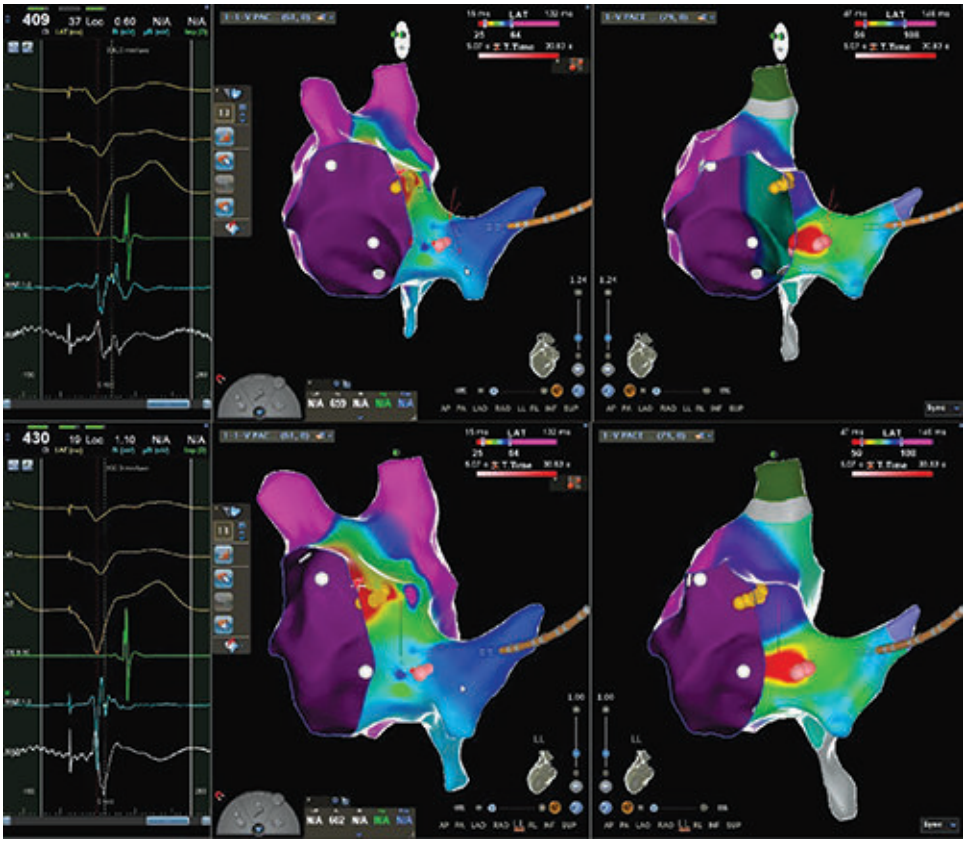

Fig.-7: *3D mapping during Ventricular pacing in LAO and left lateral view showing activation pattern changes from posteroseptum to His bundle area.*

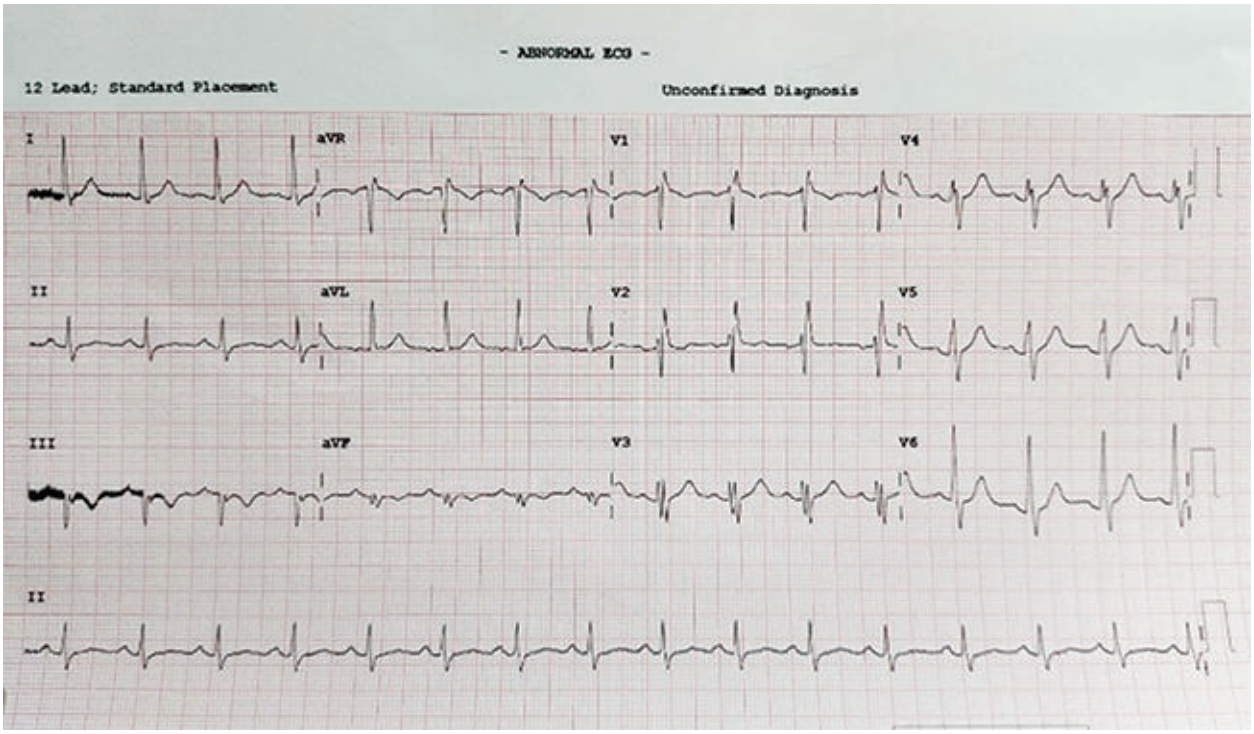

Fig.-8: *Post RFA ECG.*

Discussion:

In some studies, the ablation of right posteroseptal APs can be challenging, and associated with a lower success rate than others.[3,4] Posteroseptal APs were usually have "right atrio–left ventricular" fibers and demonstrated that a right atrial approach would suffice.[5] In order to face these issues, it is important to precisely locate AP insertion sites by patiently mapping it antegradely during either sinus rhythm or atrial pacing, retrogradely during right ventricular pacing as well as trying to identify the AP potential if possible. Schluter et al. reported that more radiofrequency pulses, longer procedure time and longer radiation exposure were needed to achieve successful results.[6] This case report demonstrated that an advanced three-dimensional cardiac mapping system could be very useful and could facilitate the process of locating the AP and ablating it. Using color-coded recording capability, the mapping system helped to identify the AP insertion sites accurately during pacing maneuvers. The mapping system also minimized the total fluoroscopy time.

Though still in current time we are hesitant to use 3D mapping system, it comes out as saving grace for some patients' and as well as for electrophysiologist. As we know most of the SVT cases are young even some belongs to pediatric group. It is more critical to reduce radiation exposure in this group. In pregnant patients with SVTs, if urgent ablation is needed, the use of a 3D mapping system is recommended to minimize or even eliminate radiation exposure which is class 1 indication. For localizations of APs with lower success and higher recurrence rates, such as right-sided APs, it is reasonable to use a 3D mapping system to reduce procedure and fluoroscopy time.[7]

3D mapping systems add an extra layer of safety by continuous visualization of the ablation catheter specially when the target is close to the normal conducting system and may reduce the risk of complete AV block. Furthermore, particularly in patients with complex congenital heart diseases and post cardiac surgery, this system gives us the better understanding about geometry of the heart. This also can be particularly useful in redo procedures.

Only disadvantages of 3D mapping system for SVT ablation are high cost, learning curve more, and procedure preparation time.

Conclusion:

In the recent era 3D mapping is increasingly accepted as first option for complex arrhythmia and viable best one for SVTs specially redo cases. This technique is useful for improving both the safety and efficacy of ablation therapy. So, we need to be more liberal about utilizing 3D mapping system and further understand the principles of cardiac electrophysiology.

Conflict of Interest - None.

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