Int Cardiovasc Res J.2016;**10**(2):95-98 doi: 10.17795/icrj-10(2)95

International Cardiovascular Research Journal
www.ircrj.com

Interesting ECG Pattern in Accessory Pathway of Crux

Mohammad Hossein Nikoo [1,*], Mohammad Vahid Jorat [1], Seied Amir Aslani [1]

[1] Cardiovascular Research Center, Shiraz University of Medical Sciences, Shiraz, IR Iran

ARTICLE INFO

Article Type:
Case Report

Article History:
Received: 19 Jun 2015
Accepted: 20 Sep 2015

Keywords:
Accessory Pathway
Wolf Parkinson White Syndrome
Coronary Sinus
Electrocardiography

ABSTRACT

Using Electrocardiographic criteria is usual for determining the best site for ablating accessory pathways. Many algorithms are present in this regard, but there are still many facts to be found. The present study aimed to reduce fluoroscopic time by using a special electrocardiographic sign. This study was performed on a young lady with palpitation, negative delta wave in V1 and V3, and positive delta wave in V2. Positive delta in V2 intervened with negative delta in V1 and V3 localized in the crux area for accessory pathway. This might help reduce the procedure time and increase the success rate. This exceptional electrocardiography could be used to locate the site of ablation, increase the rate of success, and reduce radiation exposure.

►*Implication for health policy/practice/research/medical education:*
Using ECG is simple, inexpensive, and practical to reduce the procedure time and increase success when handling arrhythmia.

1. Introduction

Crux of the heart is where coronary sulcus meets the posterior inter-ventricular sulcus (1). This epicardial area causes an interesting focal Ventricular Tachycardia (VT) reported by Doppalapuid (2). This VT ablated in proximal coronary sinus, ostium of the middle cardiac vein, or near Patent Ductus Arteriosus (PDA) after pericardiocenthesis (2). This VT has characteristic Electrocardiography (ECG) with superior axis and early precordial transition or R wave among precordial leads with dominant negative QRS (2). This crux is also on Atrioventricular (AV) ring; therefore, some accessory pathways may show similar ECG patterns. Crux area is around the poster septal area. Using ECG algorithm, the large posteroseptal area should be mapped (3-5). However, using this ECG, mapping can be started in the crux.

Accessory AV bypass tracts cause bothering paroxysmal tachycardia, especially in young population (6). In rare reports, these pathways have even caused sudden cardiac death, chiefly when atrial fibrillation with rapid ventricular rate degenerated to ventricular fibrillation (6). These accessory tracts are mostly located around the AV rings of mitral valve and tricuspid valve apparatus. These electrical connections can ablate from within heart or sometimes from epicardium. Epicardial access is dominantly from the coronary sinus and sometimes with pericardiocenthesis (6). Ablation of these accessory pathways with intracardiac mapping is the final treatment (6).

The present study aims to use ECG algorithm to pinpoint pathway before going to intracardiac recording to reduce fluoroscopic time and radiation hazard.

2. Case Presentation

A 35-year-old woman came to our clinic for repeated episodes of palpitation. These episodes were terminated by adenosine at admission and did not respond to intravenous verapamil and propranolol. On surface ECG, short PR and negative delta wave in inferior leads predicted posteroseptal area (5). Precordial leads also had early transition from V1 to V2, a confirmation to the previous site (5). Electrophysiology study and ablation were planned for the patient and she was transferred to catheterization laboratory in fasting state.

After prep and drape, both femoral veins were punctured

*Corresponding author: Mohammad Hossein Nikoo, Cardiovascular Research Center, Mohammad Rasoul-Allah Research Tower, Khalili Ave., Mollasadra St, Shiraz, Iran, Tel: 0098-7136281561,
E-mail: mhnmp@yahoo.com

and using Slazenger technique, two (7) French sheaths were placed in the right femoral vein and three (6) French sheaths in the left side. In addition, diagnostic quadripolar catheters were placed in the high right atrium, right ventricular apex, and His area. Another decapolar lead was also introduced to the coronary sinus to record electrical signal from the mitral ring. Short HV (about ten ms) confirmed accessory pathway presentation. Thus, atrial pacing was started with cycle length of 500 msec to obtain fully preexcited ECG (Figure 1). As can be seen, mapping the posteroseptal area was begun from the right atrium due to negative delta in inferior leads and early transition in V2. Since fused AV signal was not found from the right side, we started mapping in the left side by retrograde aortic approach. Unfortunately, there were no signals to satisfy Radiofrequency (RF) energy delivery. Finally, the proximal coronary sinus was mapped and RF energy was delivered to the best signal, but the accessory pathway did not disappear. Due to this astonishing dilemma, the ECG was studied for the missing data. Interestingly, the R in V2 disappeared in V3. This simulation of ECG to crux VT provoked us to find the map of proximal coronary sinus and middle cardiac vein (2). Thus, venography of the coronary sinus was done to find crux (Figure 2). In crux, we found fused atrial and ventricular signals and about 29-msec earlier ventricular activation compared to the surface electrogram (Figure 3). Application of RF to this area with an 8-mm catheter led to disappearance of the delta wave (Figure 4).

3. Discussion

ECG localization for successful accessory pathway ablation was time saving although intracardiac mapping is the final gold standard mapping for ablation (5). Up to now, many algorithms have been invented and validated for this purpose (3-5). All these algorithms have their own sensitivity and specificity (6). This explains the fact that one should rely on one's intracardiac mapping as the final determinant (3). In fact, what you can find from most algorithms is rough estimation; for example, posteroseptal area. However, posteroseptal area by itself is a large area where thousand targets can be selected for ablation (6). Overall, posteroseptal area has three major

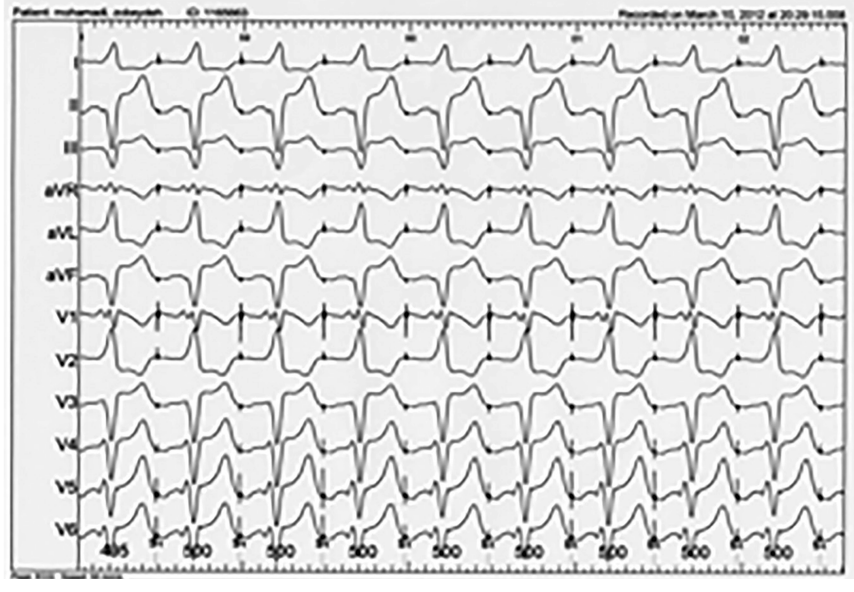

Figure 1. Fully Manifested ECG during Atrial Pacing

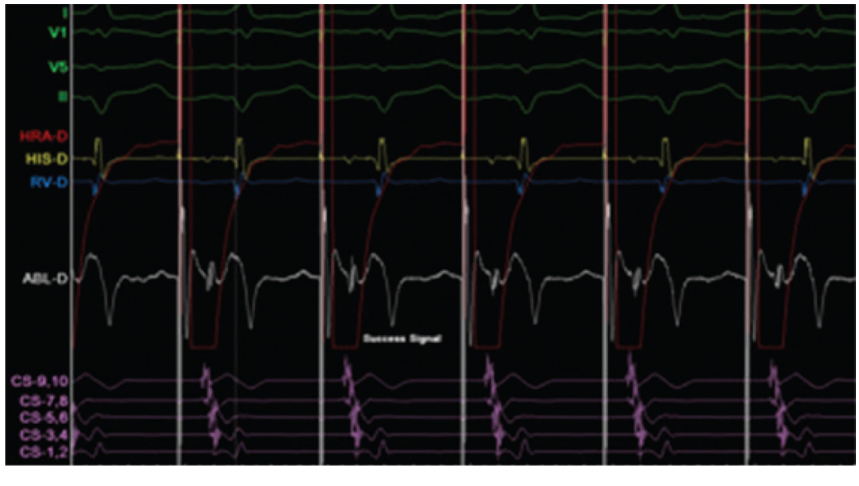

Figure 2. Intracardiac Recording of the Success Signal

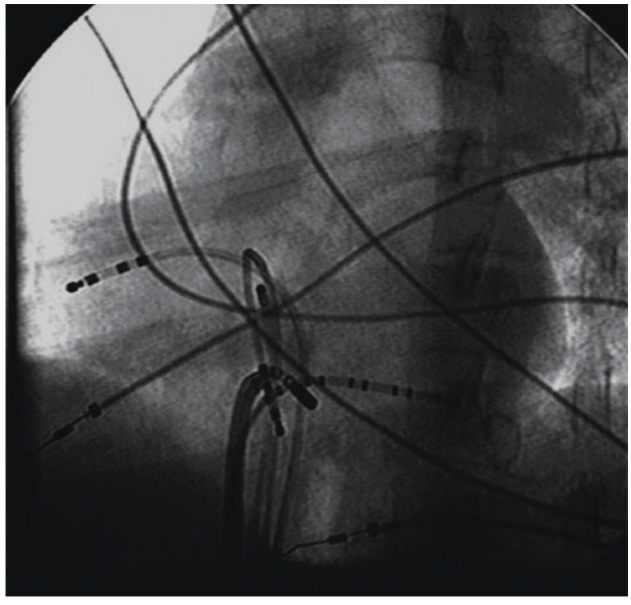

Figure 3. Fluoroscopic View of the Crux during Ablation

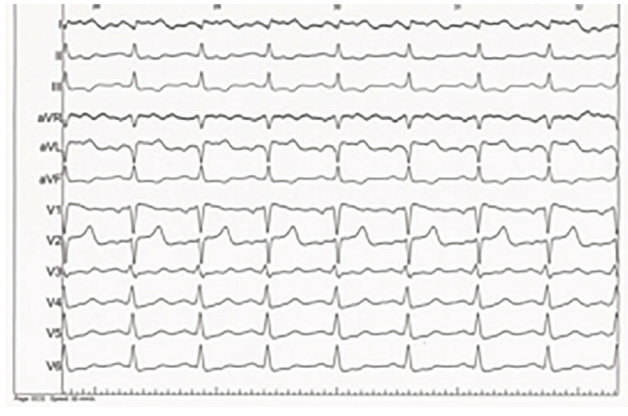

Figure 4. ECG after Ablation

areas to be mapped. These areas include right posteroseptal endocardium, left posteroseptal endocardium, and epicardium. Epicardium can be accessed through the coronary sinus in many situations and rarely by direct access after pericardiocenthesis. In rare cases, diverticulum from the coronary sinus or the related veins is the site of accessory pathways (6). Accordingly, there looks to be space for more exact data and location to be extracted from ECG. Haghjoo et al. showed that negative delta in lead II and positive delta in aVr were highly suggestive of epicardial site for a posteroseptal accessory pathway (7).

Furthermore, our study revealed that ECG could be used for pinpointing especial accessory pathways. In this study, we found an unusual site for accessory pathways and described an electrocardiographic pattern for it. To the best of our knowledge, this is the first report of crux accessory pathway and its exceptional ECG pattern.

ECG is a vectorial parameter in reality (8). This means that direction, quantity, and course all make one vector. Electrical activation of the septum is started in the left mid part in normal individuals. This vector shows the first part of ventricular activation in ECG. The vector directs towards right, anterior, and upward directions. This can be seen as initial positivity in V1 and small Q wave in lateral leads and occasionally inferior ones. After depolarization of septum, electrical activity occurs in other parts of the left ventricle. This can be seen as a large R wave in limb leads, except for aVr. Besides, electrical activity of the main parts of the ventricle is seen as negative S wave in the right precordial leads and positive R wave in the left precordial leads (8). Depolarization of the base occurs in the end. This directs towards posterior, left, and upward paths and overlaps with the left ventricle's major vector in most leads. Nevertheless, it is occasionally seen in aVr and lead III.8 In contrast to this normal activation, septal force has another direction if it is activated from the crux. Precordial leads showed these vectors in horizontal plane dominantly. However, V3 - V6, in contrast to V1 and V2, had an inferior direction. In patients with accessory pathway of crux, vector of septal activation has a leftward, upward, and anterior direction. This is due to the position of the crux in posterior and inferior parts and base of the heart.

Vector of septal activation from the crux had a leftward direction, thus creating a negative component in V1 and a positive component in V2. This vector also had an upward direction and created a negative component with an inferior direction in V3 – V6. This positive depolarization in V2 between negative ones in V1 and V3 is interesting and practical in ablation.

Acknowledgements

We would like to appreciate Mohammad Shirvani, our especial nurse, for his participation in this ablation.

Authors' Contribution

Original idea was developed by MH. Nikoo, literature was reviewed by MV. Jorat, data gathering and writing the manuscript were done by A. Aslani, and submission and edition of the manuscript were supervised by MH. Nikoo

Financial disclosure

The authors have no financial interests to declare for this article.

Funding/Support

This study was supported by Cardiology Department and Cardiovascular Research Center affiliated to Shiraz University of Medical Sciences.

References

1. Stedman TL. *Stedman's Medical Dictionary for the Dental Professions*. Lippincott Williams & Wilkins; 2006.
2. Doppalapudi H, Ramaswamy K, Ahn J, Yamada T, Kay GN. Idiopathic Catecholamine-sensitive Epicardial Ventricular Tachycardia At The Crux Of The Heart. *Circulation*. 2008;**118**(18 Supplement):S_985.
3. Boersma L, Garcia-Moran E, Mont L, Brugada J. Accessory pathway localization by QRS polarity in children with Wolff-Parkinson-White syndrome. *J Cardiovasc Electrophysiol*. 2002;**13**(12):1222-6.
4. Dar MA, Sheikh SH, Abid AR, Mallick NH. Localization of Accessory Pathways According to AP Fitzpatrick Ecg Criteria in Patents with Wolff-Parkinson-White Syndrome in Our Population. *Pakistan Heart Journal*. 2012;**41**(3-4).
5. Fitzpatrick AP, Gonzales RP, Lesh MD, Modin GW, Lee RJ, Scheinman MM. New algorithm for the localization of accessory atrioventricular connections using a baseline electrocardiogram. *J Am Coll Cardiol*. 1994;**23**(1):107-16.

6. Cain ME, Luke RA, Lindsay BD. Diagnosis and localization of accessory pathways. *Pacing Clin Electrophysiol*. 1992;**15**(5):801-24.
7. Haghjoo M, Mahmoodi E, Fazelifar AF, Alizadeh A, Hashemi MJ, Emkanjoo Z, *et al*. Electrocardiographic and electrophysiologic predictors of successful ablation site in patients with manifest posteroseptal accessory pathway. *Pacing Clin Electrophysiol*. 2008;**31**(1):103-11.
8. Mann DL, Zipes DP, Libby P, Bonow RO. *Braunwald's heart disease: a textbook of cardiovascular medicine*. Elsevier Health Sciences; 2014.