



Case Report

Accessory Pathway Ablation Located Just Below The Bundle of His: A Challenging Case

Puspa Lestari^{1*}, Ardian Rizal², Yoga Waranugraha²¹Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia.²Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia.

ARTICLE INFO

Keywords:

Wolff-Parkinson-White Syndrome;
Atrioventricular reciprocating tachycardia;
Anteroseptal accessory pathway;
Catheter ablation

ABSTRACT

We presented a case of Wolff-Parkinson-White (WPW) Syndrome. A 69-year-old man was admitted for evaluation of frequent episodes of palpitation. The diagnosis of WPW syndrome was established based on the 12-lead surface electrocardiogram (ECG) and electrophysiology (EP) study. We conducted the radiofrequency ablation (RFA) to the accessory pathway (AP). The challenging point of this case was the accessory pathway located just below to the bundle of His, which is related to the risk of complete atrioventricular (AV) block. In summary, we conclude that anatomical consideration, EP study, and the ablation strategy were important to improve the safety and success rate of RFA procedure.

1. Introduction

The Wolff-Parkinson-White (WPW) syndrome is a type of pre-excitation syndrome in which part of the ventricle is depolarized earlier by the accessory pathway (AP) that bypasses the atrioventricular (AV) node, establishing a direct connection between the atrium and the ventricle.¹ The abnormality of embryological development of the heart during the differentiation of the cardiac fibrous skeleton which splits the atria and ventricles results in the existence of AP. Atrioventricular re-entrant tachycardia (AVRT) could be the re-entrant tachyarrhythmia that occurs in Wolff-Parkinson-White (WPW) syndrome.² In AVRT, the existence of normal atrioventricular (AV) node and AP along with the atria and ventricles establishes the electrical circuit that permits impulse re-entry.³ The incidence of sudden cardiac death (SCD) in WPW syndrome is about 0.25% per year or 3% to 4% over a lifetime.⁴

In patients with WPW syndrome, the treatment of choice includes anti-arrhythmia drugs and radiofrequency ablation (RFA).⁵ RFA is a safe, effective, and curative method, given its high individual efficacy.¹ The RFA procedure is conducted based on the location of the AP, which could be predicted by 12-lead surface electrocardiogram (ECG).⁶ Prior information of the AP location permits better catheter ablation strategy such as (1) allowing the more appropriate choice of suitable energy sources and appropriate catheters; (2) more rapid and secure procedure; and (3) reduction of unnecessary vascular punctures and ionizing radiation exposure.¹ Catheter ablation of anteroseptal and

midseptal AP remains a challenging procedure because of the anatomic proximity to the normal cardiac conduction system. Moreover, the catheter ablation procedure of septal AP has a higher recurrence rate and the chance for AV block.⁷⁻⁹ In present study, we reported our first experience in performing RFA for the accessory pathway located just below the Bundle of His.

2. Case Presentation

A 69-year-old man was admitted for evaluation of frequent episodes of palpitation for three years before. He experienced palpitation at rest or mild activity. Episodes of palpitation were more frequent in the last two months. He consumed bisoprolol 5 mg once daily and diltiazem 200 mg once daily. He did not have a history of chest pain or syncope previously. He was an active smoker, but he denied for taking alcohol. On admission, blood pressure was 140/90 mmHg, and pulse rate was 86 beats per minute regularly. There were no murmurs on cardiac auscultation. A 12-lead ECG showed sinus rhythm with heart rate 100 beats per minute, left axis deviation (LAD), short PR interval, and the existence of delta wave. The QRS complex and delta wave morphologies were negative in lead V1 and III; positive in the lead I, II, aVL, as well as lead V4-V6, indicating the AP was located in the anteroseptal position of the Bundle of His. A cardiothoracic ratio (CTR) 55% was noted from the chest radiograph. Two-dimensional echocardiography showed concentric left ventricular hypertrophy (LVH), LVEF 64%, left ventricular (LV) diastolic dysfunction, and mild aortic regurgitation (AR).

*Corresponding author at: Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
E-mail address: pusparyath@gmail.com (P. Lestari).

<https://doi.org/10.21776/ub.hsj.2020.001.01.6>

Received 9 March 2020; Received in revised form 12 March 2020; Accepted 24 March 2020

Available online 1 April 2020

2721-9984/ ©Brawijaya Cardiovascular Research Center. All rights reserved.

The EP study was performed before the catheter ablation. We used three venous access at the femoral vein (6F and 7F introducer sheath) and one venous access at the jugular vein (6F introducer sheath). A decapolar catheter was advanced to the coronary sinus through jugular vein access. Through the femoral vein access, two quadripolar catheters were placed in the right ventricular apex (RVA) and Bundle of His, respectively, and one ablation catheter was placed in the high right atrium. We tried to induce the arrhythmia but failed after several attempts of aggressive pacing maneuver. Therefore, we decided to ablate the slow pathway. Resting ECG and electrogram

showed anteroseptal AP, with AV fusion was shown at His catheter. Pacing from RVA also showed that VA fusion was noted at the His catheter. During the EP study, we performed cardiac mapping to identify the arrhythmia origin or areas of critical conduction to allow ablation targets. We decided to conduct catheter ablation with multiple RFA with maximum power 30 watts and temperature 40 degrees that delivered to the anteroseptal accessories pathway. During 20 minute observation, no fusion was noted at the Hiss catheter, and no recurrent episode of supraventricular tachycardia (SVT) was observed. Following that catheter ablation procedure, he never experienced the recurrent palpitation episodes.

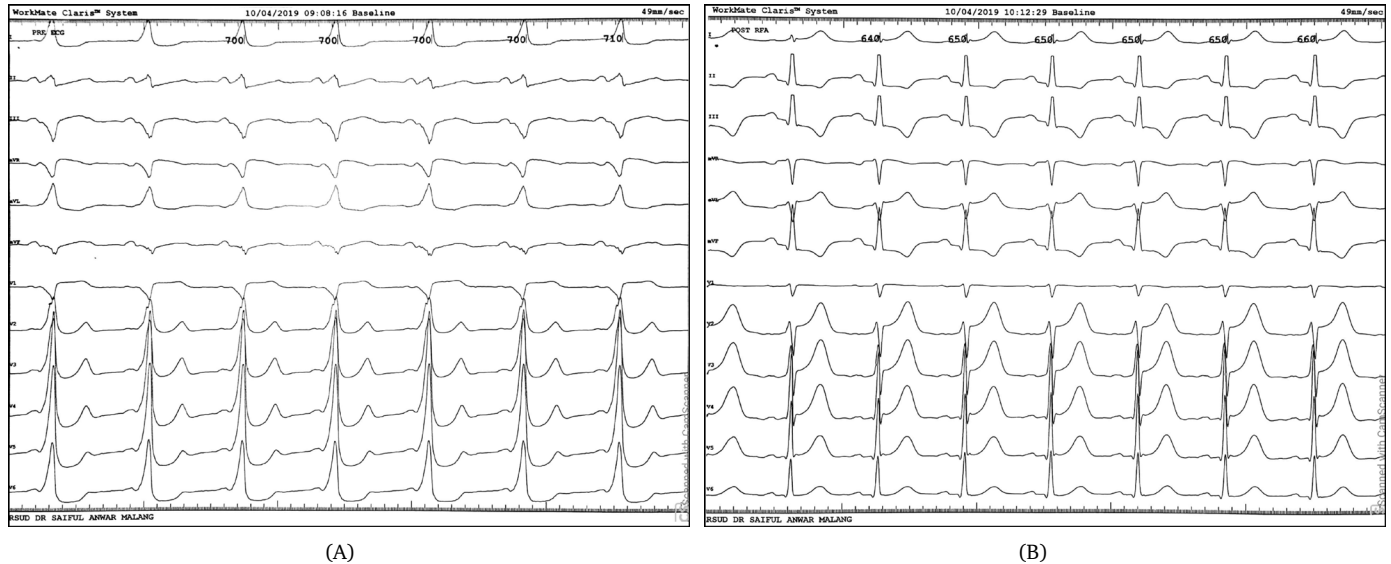


Figure 1. (A) ECG before ablation revealed a short PR interval and the existence of the delta wave; (B) after ablation, there was no delta wave anymore. ECG = electrocardiogram.

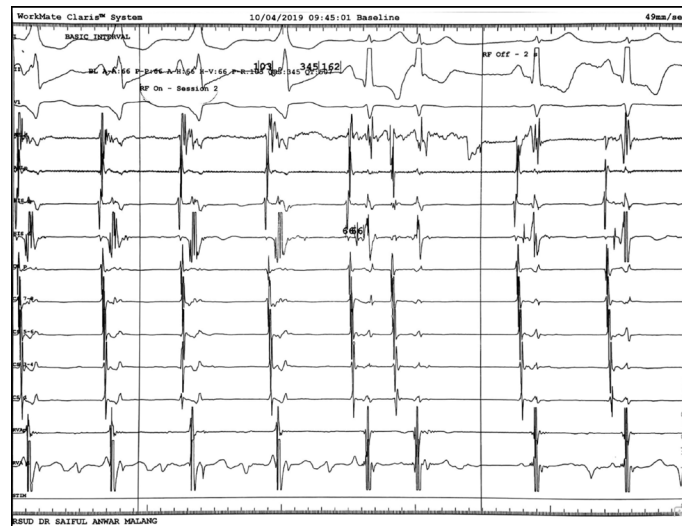


Figure 2. EGM showed A-V Fusion at His distal. Catheter ablation with multiple RFA that delivered to the anteroseptal AP. After RFA to the anteroseptal AP, there was no fusion anymore. AP = accessory pathway; EGM = electrogram; RFA = radiofrequency ablation.

3. Discussion

WPW syndrome is characterized by the existence of the ventricular pre-excitation on the ECG and the event of paroxysmal tachycardia. Even though the AP is inherent, its first appearance can be occasionally identified in adolescence. The predominance of the tachyarrhythmia has been detailed to diminish with age in WPW syndrome.¹⁰ Even though its component is uncertain, a few degenerative changes of the AP developing with age and guaranteeing prolonga-

tion of the effective refractory period (ERP) have been proposed. AVRT could be a re-entrant tachycardia that occurs in WPW syndrome. A normal AV node and an AP in conjunction with the atrium and ventricles form a circuit permits re-entry impulse in AVNRT.^{8,10,11}

AP in the classical WPW Syndrome is varied in anatomic locations and conduction properties.⁶ Several algorithms had been established to predict the AP location.^{6,12,13} The conduction properties of AP could be from atria to the ventricles (antegrade), from the ventricles

to the atria (retrograde), and also bidirectional.^{13,14}

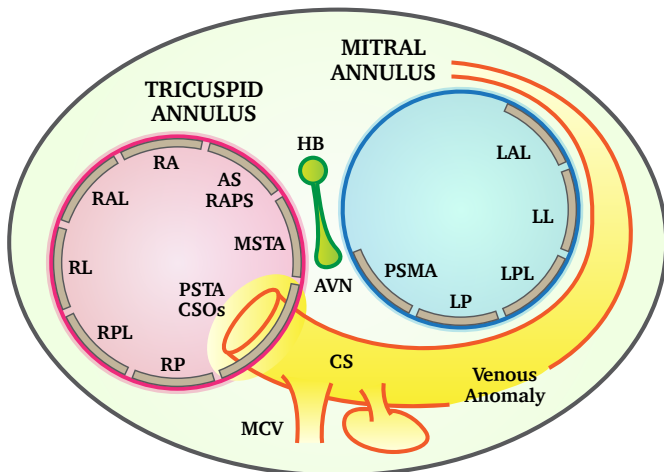


Figure 3. Schematic representation of the atrioventricular annuli, the atrioventricular node (AVN), and the His bundle (HB). RA = Right Anterior; RAL = Right Anterolateral; RL = Right Lateral; RPL = Right Posterolateral; RP = Right Posterior; PSTA = Posteroseptal Tricuspid Annulus; CSOs = Coronary Sinus Ostium; MSTA = Midseptal Tricuspid Annulus; AS RAPS = anteroseptal tricuspid annulus and right anterior paraseptal; HB = His Bundle; PSMA = posteroseptal mitral annulus; LP = Left Posterior; LPL = Left Posterolateral; LL = Left Lateral; LAL = Left Anterolateral; CS = Coronary Sinus; MCV = Middle Cardiac Vein. (Source: modification from Daubert JP et al., 2019).

The success rate of left-sided AP ablation is more than 90%. Technically, the catheter ablation procedure for right-sided AP is more challenging. Advancing the catheter to the proper position in the AV junction is difficult because of less stable catheter support. The utilization of long sheaths to stabilize the catheter may be supportive.¹⁵ Since their closeness to the normal AV conduction system that will be harmed with ablation, the catheter ablation of anteroseptal AP is still challenging.¹³ Catheter ablation of the anteroseptal AP is generally showing poor success rates, high recurrence rates, and critical hazard of the complete AV block. The other difficulties of catheter ablation of anteroseptal AP are they are frequently located superficial and amenable to catheter block during mapping. Those conditions can prolong the procedure time or lead to not successful results. The differences between anteroseptal AP need to be confirmed from right anterolateral or right anterior pathways, which can be ablated with low risk of AV node injury, and from the right mid-septal pathways, for which one should have an important concern with respect to compact AV node injury.^{16,17}

Traditionally, the catheter ablation of anteroseptal AP is performed through the inferior vena cava approach. Anteroseptal AP ablation may be unsuccessful because of conservative energy delivery at these locations or anatomical figures in some cases.¹⁸ An elective standard transfemoral approach with the catheter ablation position of anteroseptal AP through the cranial approach over the right internal jugular vein is frequently more stable with the approach through the superior vena cava. In most of anteroseptal AP, the ventricular end is located more lateral than the atrial end.¹⁹ We were optimistic that the catheter ablation procedure would be conducted successfully without any complications if the ablation catheter was placed at the save enough distance from the bundle of His.

The management for WPW syndrome consists of pharmacologic treatment and ablation. In our case, the AP was an anteroseptal pathway, and we decided to ablate it with multiple RFA. The challenge of this catheter ablation procedure was the risk of AV block because the

target AP was located just below the bundle of His. After the follow-up period, a significant improvement was observed. The patient never complained of palpitation or any symptoms after catheter ablation.

4. Conclusion

Radiofrequency catheter ablation therapy should be considered as the first-line treatment in the symptomatic patient, although there is a risk of AV block. In our case, we successfully ablate the accessory pathway without any complications.

5. Declarations

5.1. Ethics Approval and Consent to participate

Patient has provided informed consent prior to involve in the study.

5.2. Consent for publication

Not applicable.

5.3. Availability of data and materials

Data used in our study were presented in the main text.

5.4. Competing interests

Not applicable.

5.5. Funding source

Not applicable.

5.6. Authors contributions

Idea/concept: PL. Design: PL. Control/supervision: AR, YW. Data collection/processing: PL. Extraction/Analysis/interpretation: PL, AR, YW. Literature review: AR, YW. Writing the article: PL. Critical review: AR, YW. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

5.7. Acknowledgements

We thank to Brawijaya Cardiovascular Research Center.

References

- Teixeira CM, Pereira TA, Lebreiro AM, Carvalho SA. Accuracy of the Electrocardiogram in Localizing the Accessory Pathway in Patients with Wolff-Parkinson-White Pattern. *Arq Bras Cardiol.* 2016. doi:10.5935/abc.20160132
- Pappone C, Vicedomini G, Manguso F, et al. The natural history of WPW syndrome. *Eur Heart J Suppl.* 2015;17(suppl A):A8-A11. doi:10.1093/eurheartj/suv004
- Chee YC, Ang J-G. A Case of Supraventricular Tachycardia Associated With Wolff-Parkinson-White Syndrome. *J Med Cases.* 2018;9(2):54-57. doi:10.14740/jmc2693w
- Obeyesekere M, Gula LJ, Skanes AC, Leong-Sit P, Klein GJ. Risk of Sudden Death in Wolff-Parkinson-White Syndrome: How High Is the Risk? *Circulation.* 2012;125(5):659-660. doi:10.1161/CIRCULATIONAHA.111.085159
- Brugada J, Katritsis DG, Arbelo E, et al. 2019 ESC Guidelines for the management of patients with supraventricular tachycardia The Task Force for the management of patients with supraventricular tachycardia of the European Society of Cardiology (ESC). *Eur Heart J.* 2020;41(5):655-720. doi:10.1093/eurheartj/ehz467
- Taguchi N, Yoshida N, Inden Y, et al. A simple algorithm for localizing accessory pathways in patients with Wolff-Parkinson-White

- syndrome using only the R/S ratio. *J Arrhythmia*. 2014;30(6):439-443. doi:10.1016/j.joa.2013.10.006
7. Macedo PG, Patel SM, Bisco SE, Asirvatham SJ. The Chennai Pediatric Electrophysiology Symposium (TCPES 2010) Septal Accessory Pathway: Anatomy, Causes for Difficulty, and an Approach to Ablation. *Indian Pacing Electrophysiol J*. 2010:18.
 8. Kobayashi D, Arya SO, Singh HR. Successful Ablation of Antero-septal Accessory Pathway in the Non-Coronary Cusp in a Child. *Indian Pacing Electrophysiol J*. 2012;12(3):124-130. doi:10.1016/S0972-6292(16)30506-X
 9. Liu E, Shehata M, Swerdlow C, et al. Approach to the Difficult Septal Atrioventricular Accessory Pathway: The Importance of Regional Anatomy. *Circ Arrhythm Electrophysiol*. 2012;5(3). doi:10.1161/CIRCEP.112.971135
 10. Brembilla-Perrot B, Yangni N'Da O, Huttin O, et al. Wolff-Parkinson-White syndrome in the elderly: clinical and electrophysiological findings. *Arch Cardiovasc Dis*. 2008;101(1):18-22. doi:10.1016/S1875-2136(08)70250-X
 11. Jung HJ, Ju HY, Hyun MC, Lee SB, Kim YH. Wolff-Parkinson-White syndrome in young people, from childhood to young adulthood: relationships between age and clinical and electrophysiological findings. *Korean J Pediatr*. 2011;54(12):507. doi:10.3345/kjp.2011.54.12.507
 12. Chu SD, Pham KQ, Tran DV. Accuracy of the new electrocardiogram algorithm in predicting localization of accessory pathways in patients with typical Wolff-Parkinson-White syndrome. *Interv Cardiol*. 2017;09(06). doi:10.4172/Interventional-Cardiology.1000587
 13. Pambrun T, El Bouazzaoui R, Combes N, et al. Maximal Pre-Excitation Based Algorithm for Localization of Manifest Accessory Pathways in Adults. *JACC Clin Electrophysiol*. 2018;4(8):1052-1061. doi:10.1016/j.jacep.2018.03.018
 14. Tai C-T, Chen S-A, Chiang C-E, et al. Accessory atrioventricular pathways with only antegrade conduction in patients with symptomatic Wolff-Parkinson-White syndrome: Clinical features, electrophysiological characteristics and response to radiofrequency catheter ablation. *Eur Heart J*. 1997;18(1):132-139. doi:10.1093/oxfordjournals.eurheartj.a015095
 15. Stephenson EA, Davis AM. Electrophysiology, pacing, and devices. In: *Paediatric Cardiology*. 3rd ed. Philadelphia: Churchill Livingstone Elsevier; 2010:379-413.
 16. Huang H, Wang X, Ouyang F, Antz M. Catheter ablation of antero-septal accessory pathway in the non-coronary aortic sinus. *EP Eur*. 2006;8(12):1041-1044. doi:10.1093/europace/eul122
 17. Shenasa M, Hindricks G, Callans DJ, Miller JM, Josephson ME. *Cardiac Mapping*. 5th ed. New Jersey: John Wiley & Sons Ltd; 2019.
 18. Z Wenjuan, W Zulu, L Ming, Y Guitang, J Zhiqing, D Mingying. ASSA14-02-11 Catheter ablation of antero-septal accessory pathway: Implication for the strategies of mapping and ablation. *Heart*. 2015;101(Suppl 1):A1-A48. doi:10.1136/heart-jnl-2014-307109.17
 19. DiLorenzo MP, Pass RH, Nappo L, Ceresnak SR. Ablating the antero-septal accessory pathway—ablation via the right internal jugular vein may improve safety and efficacy. *J Interv Card Electrophysiol*. 2012;35(3):293-299. doi:10.1007/s10840-012-9699-9
 20. Daubert JP, Sze E. Mapping and Ablation of Typical and Atypical Accessory Pathways. *Cardiac Mapping*. 2019 Apr 12:689-716.