



Case Report

Successful elimination of double accessory pathways: a rare case of co-existence between right inferoseptal WPW and left lateral AVRT

Ardi Yudha^{1*}, Pipin Ardhianto¹

¹Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Diponegoro, Semarang-Indonesia.

ARTICLE INFO

Keyword :
Atrioventricular Reentrant Tachycardia;
Double Accessory Pathway;
Radiofrequency Ablation;
Wolf-Parkinson-White Syndrome.

ABSTRACT

Background: Managing double accessory pathways (APs) in the clinical setting presents significant challenges, primarily due to the rarity of this condition and the complexities involved in both diagnosis and treatment.

Case Presentation: A 51-year-old male presented with recurrent episodes of palpitation. Electrocardiography (ECG) revealed a sinus rhythm with a pre-excitation pattern that was characterized by a delta wave morphology. This pattern showed a negative deflection in V1, a transitional zone in V2, and negativity in lead III and aVF, which indicated an accessory pathway through the right infero-septal pathway. Further evaluation with electrophysiology study (EPS) confirmed the presence of accessory pathways, with the right infero-septal pathway exhibiting pre-excitation during sinus rhythm. Radiofrequency ablation (RFA) successfully eliminated the right infero-septal accessory pathway. Subsequently, coronary sinus propagation shifted from a concentric to an eccentric pattern, indicating another accessory pathway from the left lateral region. Another mapping was performed retrogradely at the mitral annulus, revealing ventriculoatrial (VA) fusion at the left lateral area and demonstrating inducible atrioventricular reentrant tachycardia (AVRT). RFA successfully eliminated the left lateral accessory pathway, resulting retrograde block.

Conclusion: This case highlights the importance of thorough diagnostics and tailored treatment strategies in managing dual APs, emphasizing the effectiveness of EPS-guided RFA for complex arrhythmias.

1. Introduction

Ventricular pre-excitation continues to pose a significant challenge. A critical complication associated with this condition is the heightened risk of sudden cardiac death due to rapid antegrade conduction via the accessory pathway (AP) during atrial fibrillation (AF). This scenario increases the propensity for ventricular fibrillation (VF) and consequent death.¹ The predominant manifestation of ventricular pre-excitation, known as Wolff-Parkinson-White (WPW) syndrome, is characterized by the presence of an additional pathway linking the atria and ventricle, offering an alternative route for ventricular activation.² Although double APs are only identified in a minority of patients, approximately 5-10%,³ their presence is associated with an augmented mortality risk compared to the general population, with sudden death rates ranging from 0.1-0.3%.⁴ Double APs are associated with increased susceptibilities to supraventricular tachycardia,⁵ elevated occurrences of antidromic reentry, heightened conduction velocities during AF, and ultimately, VF.⁶

Managing double APs presents significant challenges, primarily arising from diagnostic complexities. The diagnosis of double APs can be complex due to several factors, including variations in anatomic locations, diverse conduction properties, potential coexistence with other arrhythmias, mapping intricacies, and the associated risks of procedural complications.^{7,8} Furthermore, the

treatment of double APs involves inherent difficulties, such as prolonged procedure durations, heightened risks of recurrence, and the intricacies involved in mapping and ablation procedures.⁸ Consequently, investigating such cases becomes imperative. However, the rarity of these cases poses challenges for conducting large-scale studies. Thus, the exposition of case reports becomes crucial for in-depth discussion, particularly concerning the complexities of diagnosis and treatment. In this article, we presented a rare case involving a patient with double APs. One of these pathways exhibited WPW syndrome utilizing the right inferoseptal pathway, while the other manifested atrioventricular reentrant tachycardia (AVRT) via the left lateral pathway.

2. Case Presentation

A 51-year-old male presented with recurrent episodes of palpitations and intermittent dizziness. A 12-lead electrocardiography (ECG) showed sinus rhythm with a short PR interval of 0.10 s, normal QRS duration of 0.12 s, and a delta wave, indicating a pre-excitation pattern consistent with WPW syndrome (Figure 1). The delta wave morphology had negative deflections in V1, a transitional zone in V2, and negativity in leads III and aVF suggesting an AP through the right infero-septal pathway. Subsequently, the patient was scheduled for an electrophysiology study (EPS) and radiofrequency ablation of the accessory pathway as a form of treatment.

* Corresponding author at: Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Diponegoro, Semarang-Indonesia.
E-mail address: pipinardhianto@fk.undip.ac.id (P. Ardhianto).

<https://doi.org/10.21776/ub.hsj.2024.005.04.18>

Received 18 April 2024; Received in revised form 30 May 2024; Accepted 14 July 2024.
Available online 28 October 2024

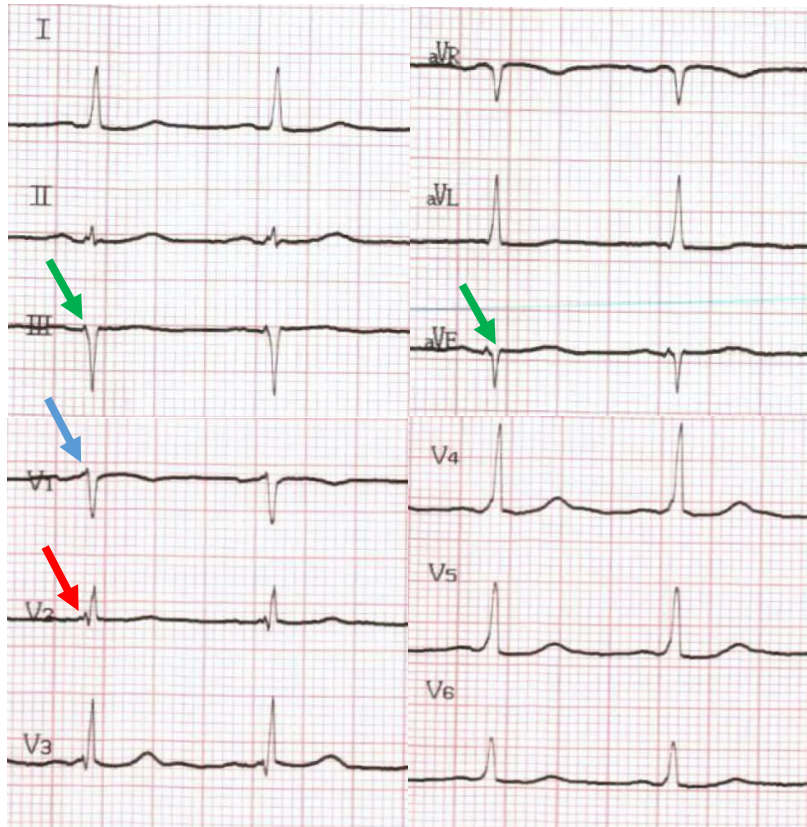


Figure 1. The electrocardiography (ECG) revealed a pre-excitation pattern. The delta wave morphology showed a negative deflection in V1 (blue arrow), a transitional zone at V2 (red arrow), and negativity in leads III and aVF (green arrow), suggesting a right inferior-septal accessory pathway.



Figure 2. The initial V was detected at CS 9-10 (indicated by an orange arrow), preceding the QRS complex and other catheters. This observation indicates a septal origin for the earliest V, implying the existence of an accessory pathway (AP) within the septum.

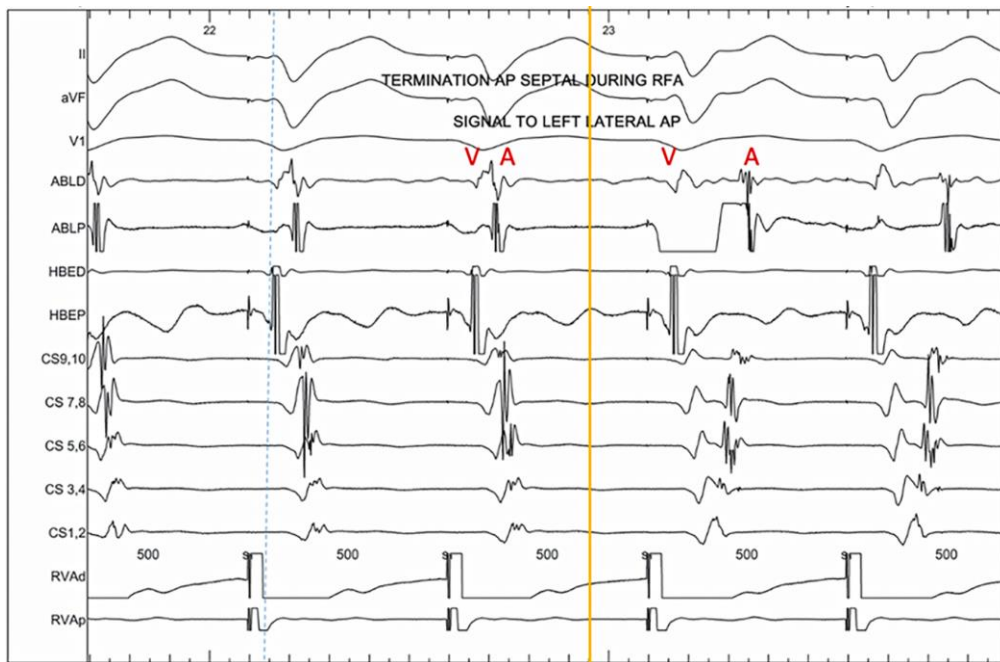


Figure 3. During radiofrequency ablation (RFA), sequential changes were observed in the coronary sinus (CS). VA fusion initially occurred at CS 9-10, then shifted to CS 1-2, indicating the presence of another accessory pathway (AP) in the left lateral region. The yellow line indicates the VA propagation changes from the right infero-septal to the left lateral during right ventricular (RV) pacing, recorded during the delivery of RFA.

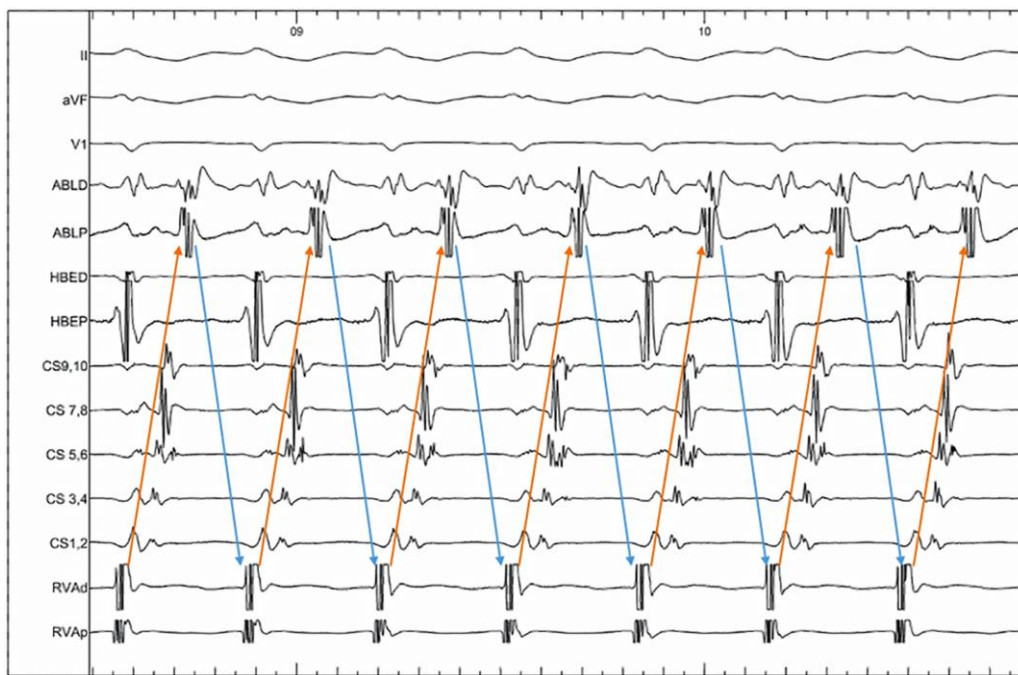


Figure 4. Supraventricular tachycardia was induced after the first RFA. Coronary sinus propagation showed the earliest A recorded at CS 1-2, indicating the presence of an accessory pathway in the left lateral region.

During sinus rhythm, the coronary sinus (CS) propagation showed the earliest V at CS 9-10, preceding the QRS complex and other catheters, indicating an AP in the septum (Figure 2). A 7F non-irrigating catheter was used to map the tricuspid annulus during right ventricular (RV) pacing. The most ventriculoatrial (VA) fusion was observed at the infero-septal region near the ostium of the coronary sinus, following which radiofrequency ablation (RFA) was delivered. Within the first 5 seconds of ablation, sequential changes were noted in the coronary sinus, with VA fusion initially recorded at CS 9-10, shifting to CS 1-2, indicating the presence of another AP in the left lateral region (Figure 3). Subsequently, programmable atrial pacing was performed, which easily induced tachycardia. The diagnosis of orthodromic AV re-entrant tachycardia (AVRT) was confirmed by CS catheter propagation, which showed VA fusion at CS 1-2. This demonstrated the use of left lateral

AP (LLAP) as AVRT's retrograde limb (Figure 4). An arterial puncture was done to retrogradely access the left lateral mitral annulus. RFA was then delivered during RV pacing on LLAP until the V wave was no longer followed by the A wave, confirming successful ablation of the LLAP (Figure 5).

3. Discussion

In this case report, RFA successfully treated both APs for right inferoseptal WPW syndrome and left lateral AVRT. EPS in WPW syndrome is critical for confirming the diagnosis, elucidating the mechanisms underlying tachycardias initiation, precisely localizing the accessory pathway, evaluating its refractoriness, and assessing its implications for the risk of life-threatening arrhythmias. Furthermore,

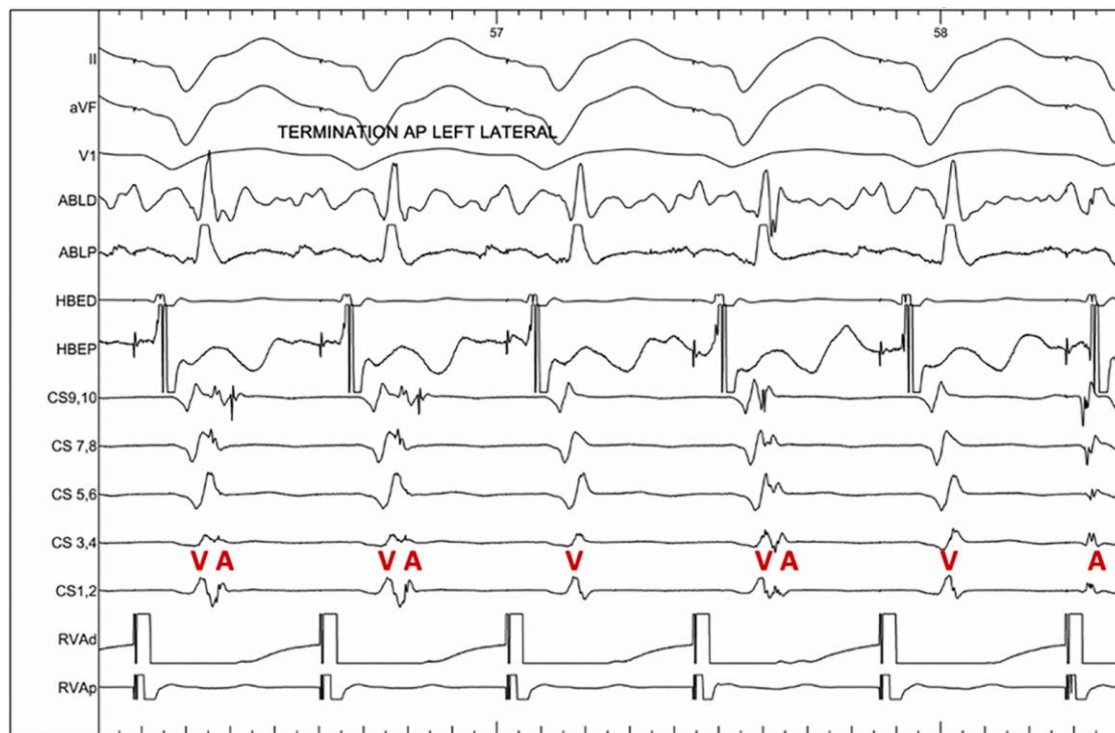


Figure 5. Ablation was performed on the left lateral accessory pathway (LLAP) until the V wave was no longer followed by the A wave (retrograde block), indicating successful ablation of the LLAP.

EPS serves as a pivotal tool in terminating tachycardia and facilitating the development of tailored therapeutic strategies, whether pharmacologic, pacing-based, or ablative, for managing arrhythmias associated with WPW syndrome.⁹

In our case, the patient presented with a rare occurrence of double APs. According to existing literature, the distribution of APs typically includes 46% to 60% within the left free wall space, 25% within the postero-septal space, 13% to 21% within the right free wall space, and 2% within the right supero-paraseptal space. Double APs, found in 5% to 10% of patients, are defined when they are separated by more than 1 to 3 cm. The most common combination of widely spaced double APs is postero-septal and right free wall APs. Incidence rates of double APs are notably elevated in patients with antidromic AVRT (50% to 75%), those where AF pre-excitation leads to VF, and in patients with Ebstein's anomaly.³ Characterized by two abnormal conduction pathways in the heart, double APs are exceptionally rare. This configuration is estimated to be identifiable in 3-13% of patients undergoing EPS for the evaluation of tachycardias mediated by accessory pathways.¹⁰ The presence of double APs is associated with increased risks of supraventricular tachycardia,⁵ heightened occurrence of antidromic reentry, elevated incidence of rapid conduction during AF, and VF.⁶

In our case, RFA successfully eliminated the right infero-septal accessory pathway. Following this, the propagation pattern in the coronary sinus shifted from concentric to eccentric, indicating the presence of another AP originating from the left lateral region, by which the AVRT was easily induced using programmed atrial pacing. Further mapping was performed retrogradely at the mitral annulus which revealed VA fusion in the left lateral area. Subsequently, RFA was successfully eliminating the LLAP. Ablation of APs stands as the primary therapeutic intervention for individuals experiencing episodes of supraventricular tachycardias, including those with WPW syndrome on ECG. It is also recommended for asymptomatic individuals with WPW pattern on ECG, particularly when electrophysiology studies reveal a relatively short antegrade refractory period of the AP.¹¹ Encouragingly, success rates ranging from 95% to 99% have been documented for AP ablation, although with a modest recurrence rate of 5% to 10%.

The procedure is generally considered safe, with a low incidence of complications. However, one notable concern is the potential induction of complete atrioventricular block, necessitating the implantation of a permanent pacemaker.^{2,11-14}

This case report emphasized several key aspects of managing patients with double APs. It is also provided an enhanced understanding of the clinical and electrophysiological characteristics of individuals with multiple APs, which informed treatment strategies and patient outcomes. Additionally, our study underscored the importance of mapping and identifying specific pathway potentials to guide targeted ablation approaches, and potentially improving treatment success rates. Furthermore, the successful elimination of double APs through RFA was also highlighted.

Our case report had several limitations. First, the study did not provide information on the long-term follow-up of the patient, which would have been crucial for assessing the durability of the ablation procedure and the potential for recurrence of arrhythmias. Second, it did not discuss the potential risks and complications of RFA, such as the risk of heart block or damage to surrounding tissues. Third, the study did not address the potential impact of patient-specific factors, such as age, comorbidities, or genetic predisposition, on the success and safety of ablation procedures. Fourth, the study only presented a single case report, which may not have been representative of the larger population of patients with multiple accessory pathways.

4. Conclusion

This case underscores the importance of a comprehensive diagnostic approach in patients with dual accessory pathways. Successful ablation of both the right infero-septal WPW and left lateral AVRT pathways was accomplished, resulting in the resolution of symptoms and prevention of potential arrhythmic complications. This report highlights the effectiveness of EPS-guided RFA in managing complex arrhythmias and emphasizes the significance of thorough evaluation and individualized treatment strategies for patients with rare AP configurations.

5. Declaration

5.1 Ethics Approval and Consent to participate

Patient has provided written informed consent prior to involvement 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: PA, AY. Design: AY. Control/supervision: PA. Data collection/processing: AY. Analysis/interpretation: PA. Literature review: PA, AY. Writing the article: AY. Critical review: PA, AY. All authors have critically reviewed and approved the final draft and are possible for the content and similarity index of the manuscript.

5.7 Acknowledgements

We thank to Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Diponegoro, Semarang.

References

- Antiperovitch P, Skanes A, Klein G, Tang A. Approach to a patient with asymptomatic pre-excitation. *Heart* 2023;109(16):1254-1259.doi: 10.1136/heartjnl-2022-321639.
- Jackman WM, Wang XZ, Friday KJ, Roman CA, Moulton KP, Beckman KJ, et al. Catheter ablation of accessory atrioventricular pathways (Wolff-Parkinson-White syndrome) by radiofrequency current. *N Engl J Med* 1991;324(23):1605-1611.doi: 10.1056/NEJM199106063242301.
- Issa ZF, Miller JM, Zipes DP. *Clinical arrhythmology and electrophysiology: A companion to Braunwald's heart disease*. Elsevier: Elsevier; 2019.
- Page RL, Joglar JA, Caldwell MA, Calkins H, Conti JB, Deal BJ, et al. 2015 ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia: executive summary: a report of the American College of Cardiology/American Heart Association task force on clinical practice guidelines and the Heart Rhythm Society. *Circulation* 2016;133(14):e471-e505.doi: 10.1161/CIR.0000000000000310.
- Pappone C, Manguso F, Santinelli R, Vicedomini G, Sala S, Paglino G, et al. Radiofrequency ablation in children with asymptomatic Wolff-Parkinson-White syndrome. *N Engl J Med* 2004;351(12):1197-1205.doi: 10.1056/NEJMoa040625.
- Klein GJ, Bashore TM, Sellers TD, Pritchett EL, Smith WM, Gallagher JJ. Ventricular fibrillation in the Wolff-Parkinson-White syndrome. *N Engl J Med* 1979;301(20):1080-1085.doi: 10.1056/NEJM197911153012003.
- Vătăşescu RG, Paja CS, Şuş I, Cainap S, Moisa ŞM, Cintează EE. Wolf-Parkinson-White syndrome: Diagnosis, risk assessment, and therapy—an update. *Diagnostics* 2024;14(3):296.doi: 10.3390/diagnostics14030296.
- Vemulapalli HS, Iyengar SK, Ko NLK, Iyengar S, Saranathan S, Srivathsan K. Navigating the diagnostic challenges of the accessory pathway: Participant or bystander? *HeartRhythm Case Reports* 2024;7(1):In-press.doi: 10.1016/j.hrcr.2024.02.011.
- Leitch JW, Klein GJ, Yee R, Leather RA, Kim YH. Syncope associated with supraventricular tachycardia. An expression of tachycardia rate or vasomotor response? *Circulation* 1992;85(3):1064-1071.doi: 10.1161/01.cir.85.3.1064.
- Zachariah JP, Walsh EP, Triedman JK, Berul CI, Cecchin F, Alexander ME, et al. Multiple accessory pathways in the young: the impact of structural heart disease. *Am Heart J* 2013;165(1):87-92.doi: 10.1016/j.ahj.2012.10.025.
- Calkins H, Yong P, Miller JM, Olshansky B, Carlson M, Saul JP, et al. Catheter ablation of accessory pathways, atrioventricular nodal reentrant tachycardia, and the atrioventricular junction: final results of a prospective, multicenter clinical trial. The Atakr Multicenter Investigators Group. *Circulation* 1999;99(2):262-270.doi: 10.1161/01.cir.99.2.262.
- Calkins H, Prystowsky E, Berger RD, Saul JP, Klein LS, Liem LB, et al. Recurrence of conduction following radiofrequency catheter ablation procedures: relationship to ablation target and electrode temperature. The Atakr Multicenter Investigators Group. *J Cardiovasc Electrophysiol* 1996;7(8):704-712.doi: 10.1111/j.1540-8167.1996.tb00578.x.
- Kay GN, Epstein AE, Dailey SM, Plumb VJ. Role of radiofrequency ablation in the management of supraventricular arrhythmias: experience in 760 consecutive patients. *J Cardiovasc Electrophysiol* 1993;4(4):371-389.doi: 10.1111/j.1540-8167.1993.tb01277.x.
- Dagres N, Clague JR, Kottkamp H, Hindricks G, Breithardt G, Borggrefe M. Radiofrequency catheter ablation of accessory pathways. Outcome and use of antiarrhythmic drugs during follow-up. *Eur Heart J* 1999;20(24):1826-1832.doi: 10.1053/euhj.1999.1749.