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PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIAS AND PRE-EXCITATION SYNDROMES: COMPREHENSIVE NARRATIVE REVIEW

Camilo Andres Neisa Morales MD. Universidad de Boyacá

ABSTRACT This comprehensive review explores the management of supraventricular paroxysmal tachycardias (SVTs) and preexcitation syndromes, providing a synthesis of 15 selected studies. A meticulous literature search in prominent databases guided our review, yielding 15 relevant articles. Etiology and pathogenesis, clinical manifestations, diagnostic strategies, and treatment modalities are extensively discussed. The etiology of SVTs and preexcitation involves accessory pathways, and their manifestation varies from asymptomatic cases to life-threatening arrhythmias. Diagnosis relies on electrocardiography, electrophysiological studies, and imaging. Ablation is the preferred treatment for symptomatic cases, with catheter-based procedures demonstrating efficacy. Prognosis is generally favorable, with low recurrence rates post-ablation. In conclusion, this narrative review emphasizes the significance of tailored therapeutic approaches and the need for vigilant follow-up in SVTs and preexcitation syndromes. The wealth of evidence presented underscores the role of catheter ablation as a pivotal intervention, ensuring improved patient outcomes and highlighting the nuanced nature of these arrhythmias.

KEYWORDS : Arrhythmia, Electrophysiology, Catheter Ablation, Wolff-Parkinson-White, Atrioventricular Nodal Reentry.

INTRODUCTION

Supraventricular paroxysmal tachycardias (SVTs) and pre-excitation syndromes represent distinct cardiac conditions. SVTs involve rapid heartbeats originating above the heart's ventricles, often triggered by abnormal electrical pathways. Ablation with catheters, boasting a success rate exceeding 90%, emerges as a primary intervention for symptomatic cases. Conversely, asymptomatic pre-excitation, linked with ventricular pre-excited fibrillation, sparks debate regarding intervention necessity due to the rarity of sudden death. While catheter ablation mitigates risks, weighing the procedure's mortality against the low sudden death risk complicates decision-making. Current clinical guidelines lean towards catheter ablation for symptomatic pre-excitation, emphasizing its effectiveness and low complication rates. In cases of asymptomatic pre-excitation, a cautious approach considering patient preference aligns with recommendations, emphasizing informed decisions based on individualized risk-benefit assessments. Understanding these conditions aids tailored treatment strategies for optimal patient outcomes (1).

METHODS

In this narrative review on supraventricular tachycardia (SVT) and pre-excitation syndromes, two authors systematically identified relevant literature. A comprehensive search was conducted across PubMed, Embase, and Scopus using keywords such as "supraventricular tachycardia," "pre-excitation syndromes," and "catheter ablation." The inclusion criteria encompassed articles published between 2010 and 2023, written in English, and focusing on clinical interventions and outcomes. Screening titles and abstracts initially, the authors selected 15 articles for full-text review based on relevance and methodological rigor. Data extraction involved key findings related to SVT mechanisms, catheter ablation outcomes, and long-term management. The synthesis of these articles informs a cohesive overview of current knowledge in SVT and pre-excitation syndromes.

Etiology and pathways

The etiology and pathogenesis of paroxysmal supraventricular tachycardias (PSVT) and pre-excitation syndromes are multifaceted, involving various anatomical and electrophysiological factors. PSVT often arises from reentrant circuits within the atrioventricular node or accessory pathways. These pathways can be congenital or acquired due to underlying heart conditions. Atrioventricular nodal reentrant tachycardia (AVNRT) typically involves dual pathways within the AV node, fostering reentry loops (2).

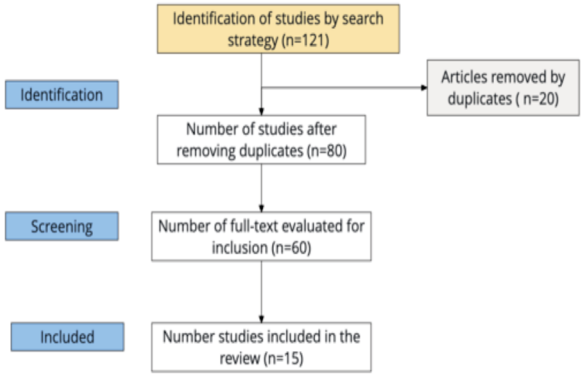

Figure 1. PRISMA.

Accessory pathways, present in pre-excitation syndromes like Wolff-Parkinson-White (WPW) syndrome, create abnormal connections between the atria and ventricles. These pathways bypass the AV node, allowing for premature ventricular excitation and contributing to tachyarrhythmias. The accessory pathways are congenital, arising during cardiac development. Additionally, genetic factors play a role in the predisposition to both PSVT and pre-excitation syndromes. Specific ion channel mutations, such as those affecting sodium and potassium channels, can influence cardiac excitability and contribute to arrhythmogenic substrates (3).

Triggers for PSVT episodes include stress, stimulants, or structural heart abnormalities. In WPW syndrome, the accessory pathway's location and properties determine the risk of arrhythmia initiation. Understanding the interplay of these factors is crucial for tailoring therapeutic approaches, including catheter ablation. Further research is needed to unravel the intricate genetic and molecular underpinnings, providing insights into targeted interventions for these arrhythmias (4).

Clinical manifestations

Clinical manifestations and signs of paroxysmal supraventricular tachycardias (PSVT) and pre-excitation syndromes encompass a spectrum of symptoms reflecting the rapid and irregular heart rhythms characterizing these conditions. Patients often experience sudden-onset

palpitations, chest discomfort, and anxiety during PSVT episodes. These arrhythmias may be associated with dizziness, lightheadedness, or syncope, particularly in cases of compromised cardiac output. The duration and frequency of episodes can vary, ranging from brief, self-terminating events to prolonged and recurrent occurrences (5).

In pre-excitation syndromes like Wolff-Parkinson-White (WPW) syndrome, the clinical presentation can be more diverse. Patients may remain asymptomatic, with the condition incidentally discovered during routine electrocardiography or clinical assessments. However, those with symptomatic WPW may encounter episodes of rapid, irregular heartbeat, often accompanied by palpitations, chest pain, and in some cases, syncope (6).

Electrocardiography plays a pivotal role in diagnosing these conditions, capturing characteristic findings such as premature atrial contractions, narrow QRS complexes during tachycardia, and delta waves indicative of accessory pathway conduction in WPW syndrome. Effective management involves not only addressing acute episodes but also assessing the overall clinical impact on the patient's quality of life. Tailored therapeutic strategies, including medications and catheter ablation, aim to alleviate symptoms and prevent future arrhythmia occurrences. Regular follow-up and monitoring are crucial to ensuring the effectiveness of the chosen interventions (7).

Diagnosis

The diagnosis of paroxysmal supraventricular tachycardias (PSVT) and pre-excitation syndromes involves a comprehensive approach, integrating clinical evaluation, electrocardiography (ECG), and additional diagnostic modalities. During acute episodes, a 12-lead ECG is crucial for capturing the characteristic features of PSVT, such as narrow QRS complexes and atrioventricular nodal reentrant tachycardia (AVNRT) or atrioventricular reentrant tachycardia (AVRT) patterns. Holter monitoring or event recorders may be employed for capturing intermittent arrhythmias, aiding in diagnosis when symptoms are less frequent (8).

In pre-excitation syndromes like Wolff-Parkinson-White (WPW) syndrome, the hallmark delta waves on the ECG are indicative of accessory pathway conduction. Exercise stress testing can be employed to induce and unmask arrhythmias, aiding in risk stratification and management decisions. Advanced imaging techniques, such as electrophysiological studies (EPS), may be utilized to pinpoint the location of accessory pathways and guide therapeutic interventions. During EPS, catheters are strategically placed to assess conduction properties and provoke arrhythmias for precise diagnosis (9).

Importantly, a thorough clinical history is imperative, exploring the frequency, duration, and triggers of symptoms, as well as any family history of sudden cardiac death or related conditions. Given the potential life-threatening complications, distinguishing between various PSVTs and identifying high-risk features, especially in WPW syndrome, is crucial. The multidisciplinary diagnostic approach enables tailored and effective management strategies, ranging from pharmacological therapies to catheter ablation, aiming to alleviate symptoms and reduce the risk of adverse events associated with these arrhythmias. Regular follow-up assessments contribute to the ongoing evaluation of treatment success and adjustment if needed (9).

Management

The management of paroxysmal supraventricular tachycardias (PSVT) and pre-excitation syndromes, such as Wolff-Parkinson-White (WPW) syndrome, encompasses both acute interventions during symptomatic episodes and long-term strategies to prevent recurrences and potential complications (10).

Acute Interventions

During acute episodes of PSVT, vagal maneuvers, such as the Valsalva maneuver or carotid sinus massage, can be attempted to terminate the tachycardia. Adenosine, a rapid-acting antiarrhythmic, is often administered intravenously, aiming to transiently block atrioventricular nodal conduction and reset the cardiac rhythm. Verapamil or diltiazem may be used in hemodynamically stable patients if adenosine proves ineffective. In the case of WPW syndrome, caution is exercised with the use of adenosine, as it can paradoxically enhance conduction through the accessory pathway, potentially precipitating ventricular fibrillation. Procainamide is considered a safer option in this scenario (11).

Long-Term Management

Catheter ablation is the cornerstone of long-term management for both PSVT and WPW syndrome. This minimally invasive procedure involves the targeted destruction of abnormal conduction pathways using radiofrequency or cryoenergy. The success rates for catheter ablation are high, exceeding 90%, with a low risk of complications (12).

For asymptomatic individuals with WPW pattern on ECG, the decision to pursue ablation is individualized, weighing the risks and benefits. However, in the presence of symptoms or high-risk features, early intervention is often recommended to prevent potentially life-threatening arrhythmias. Pharmacological options are reserved for those who are not suitable candidates for or decline catheter ablation. Antiarrhythmic medications like beta-blockers, calcium channel blockers, or class IC agents may be considered, although their efficacy can vary, and long-term use may be associated with side effects (13).

In individuals with WPW syndrome and atrial fibrillation (AF), the risk of rapid ventricular response mandates careful management. AV nodal-blocking agents, such as beta-blockers or non-dihydropyridine calcium channel blockers, are preferred, while the use of digoxin and certain antiarrhythmics is generally avoided due to their potential to enhance conduction through the accessory pathway. Risk stratification is crucial in determining the appropriate course of action. Patients with multiple or high-risk accessory pathways, those with recurrent and poorly tolerated arrhythmias, or those with a history of sudden cardiac arrest are often considered for early ablation. Regular follow-up evaluations are essential to monitor treatment efficacy, assess for potential complications, and adjust management strategies as needed. Patient education regarding triggers, symptoms, and the importance of timely medical attention is paramount to enhance overall care and mitigate the impact of these arrhythmias on quality of life (13,14).

REFERENCES

1. Blomstro¨m-Lundqvist C, Scheinman MM, Aliot EM, Alpert JS, Calkins H, Camm AJ, et al. ACC/AHA/ESC guidelines for the management of patients with supraventricular arrhythmias—executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Supraventricular Arrhythmias). Circulation. 2003;108:1871–909.
2. Otomo K, Nagata Y, Uno K, Fujiwara H, Iesaka Y. Atypical atrioventricular nodal reentrant tachycardia with eccentric coronary sinus activation: electrophysiological characteristics and essential effects of left-sided ablation inside the coronary sinus. Heart Rhythm. 2007;4:421–32.
3. Jackman WM, Beckman KJ, McClelland JH, Wang X, Friday KJ, Roman CA, et al. Treatment of supraventricular tachycardia due to atrioventricular nodal reentry by radiofrequency catheter ablation of slow-pathway conduction. N Engl J Med. 1992;327:313–8.
4. Haissaguerre M, Gaita F, Fischer B, Commenges D, Montserrat P, D'Ivernois C, et al. Elimination of atrioventricular nodal reentrant tachycardia using

discrete slow potentials to guide application of radiofrequency energy. Circulation. 1992;85:2162–75.
5. Hummel JD, Strickberger SA, Williamson BD, Man KC, Daoud E, Niebauer M, et al. Effect of residual slow pathway function on the time course of recurrences of atrioventricular nodal reentrant tachycardia after radiofrequency ablation of the slow pathway. Am J Cardiol. 1995;75:628–30.
6. Morady F. Catheter ablation of supraventricular arrhythmias. Pacing Clin Electrophysiol. 2004;27:125–42.
7. Skanes AC, Dubuc M, Klein GJ, Thibault B, Krahn AD, Yee R, et al. Cryothermal ablation of the slow pathway for the elimination of atrioventricular nodal reentrant tachycardia. Circulation. 2000;102:2856–60.
8. Chanani NK, Chiesa NA, Dubin AM, Avasarala K, Van Hare GF, Collins KK. Cryoablation for atrioventricular nodal reentrant tachycardia in young patients: predictors of recurrence. Pacing Clinl Electrophysiol. 2008;31:1152–9.
9. Santinelli V, Radinovic A, Manguso F, Vicedomini G, Gulletta S, Paglino G, et al. The natural history of asymptomatic ventricular pre-excitation a long-term prospective follow-up study of 184 asymptomatic children. J Am Coll Cardiol. 2009;53:275–80.
10. 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;23:107–16.
11. Dı´az-Infante E, Maci´as-Gallego A, Garcı´a-Bolao I. Registro Espan˜ol de Ablacio´ n con Cate´ter. IX Informe Oficial de la Seccio´n de Electrofisiologı´a y Arritmias de la Sociedad Espan˜ola de Cardiologı´a (2009). Rev Esp Cardiol. 2010;63:1329–39
12. Klein GJ, Gula LJ, Krahn AD, Skanes AC, Yee R. WPW pattern in the asymptomatic individual: Has anything changed? Circ Arrhythm Electrophysiol. 2009; 2:97–9.
13. Almendral Garrote J, Gonza´lez Torrecilla E,Atienza Ferna´ndez F,Vigil EscribanoD, Arenal Maiz A. Tratamiento de los pacientes con preexcitacio´n ventricular. Rev Esp Cardiol. 2004;57:859–68.
14. Soria R, Guize L, Chretien JM, Le Heuzey JY, Lavergne T, Desnos M, et al. [The natural history of 270 cases of Wolff-Parkinson-White syndrome in a survey of the general population]. Arch Mal Coeur Vaiss. 1989;82:331–6.
15. Leitch JW, Klein GJ, Yee R, Murdock C. Prognostic value of electrophysiology testing in asymptomatic patients with Wolff-Parkinson-White pattern. Circulation. 1990;82:1718–23.