

Wolff–Parkinson–White Syndrome in a Heart Transplant Recipient

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Abstract

A 44-year-old woman underwent heart transplantation due to refractory angina and advanced heart failure. During the postoperative period, she developed episodes of supraventricular tachycardia and intermittent ventricular pre-excitation on the electrocardiogram. After an initial period of pharmacological management, she underwent successful radiofrequency ablation of a left posteroseptal accessory pathway. A review of the literature regarding Wolff–Parkinson–White syndrome in heart transplant recipients is also presented.

Introduction

Heart transplantation is an established therapeutic option for patients with advanced heart failure, offering the potential for substantial improvement in prognosis. Its prevalence has increased in recent years; in 2023, a total of 430 heart transplants were performed in Brazil, according to data from the Brazilian Ministry of Health.¹

Wolff–Parkinson–White (WPW) syndrome is characterized by ventricular pre-excitation on the electrocardiogram (ECG) and symptomatic arrhythmias involving an accessory pathway that enables premature conduction between the atria and ventricles.² Although most individuals with ventricular pre-excitation remain asymptomatic,² a small subset may develop life-threatening arrhythmias, such as atrioventricular reentrant tachycardia, atrial fibrillation, or even ventricular fibrillation and sudden cardiac death.² Catheter ablation is the guideline-recommended definitive therapy,³ with a high success rate.⁴ Although the occurrence of WPW syndrome after cardiac transplantation is rare, it can lead to severe arrhythmic events in this specific patient population.

Case Report

A 44-year-old Caucasian woman with ischemic cardiomyopathy secondary to an anterior ST-elevation

myocardial infarction (STEMI) due to thrombotic occlusion of the left anterior descending artery, complicated by failed primary angioplasty with a no-reflow phenomenon, progressed to severe LV dysfunction (left ventricular ejection fraction 26%) with formation of an LV aneurysm.

Despite optimized guideline-directed medical therapy and subsequent percutaneous revascularization of the right and left circumflex coronary arteries, she remained in NYHA class IV heart failure and Canadian Cardiovascular Society (CCS) class IV angina after 25 months of follow-up. Cardiopulmonary exercise testing (CPET) demonstrated severely reduced functional capacity (peak VO₂ 10.7 mL/kg/min), confirming treatment-refractory disease, and she was listed for heart transplantation.

After 30 days on the waiting list, the patient underwent heart transplantation using the bicaval technique. The donor was a 21-year-old male with no significant comorbidities, who had a history of tachyarrhythmia and an ECG showing ventricular pre-excitation. He died as a result of a traffic accident. Surgical parameters included a total cardiopulmonary bypass time of 130 minutes, an aortic cross-clamp time of 96 minutes, and a total ischemia time of 245 minutes. In the immediate postoperative period, the patient developed graft dysfunction, likely secondary to a right coronary artery air embolism, requiring temporary inotropic support with norepinephrine and dobutamine. Additionally, she experienced episodes of narrow-QRS supraventricular tachycardia (SVT) associated with hemodynamic instability (Figure 1), which were terminated via epicardial pacemaker overdrive pacing.

Postoperative ECG monitoring revealed intermittent ventricular pre-excitation. A formal 12-lead ECG (Figure 2) confirmed sinus rhythm with a posteroseptal accessory pathway, as determined by the Milstein algorithm.⁴ Amiodarone was initially prescribed but was discontinued due to limiting tremors and potential drug interactions. An endomyocardial biopsy performed 10 days after heart transplantation revealed grade 3R acute cellular rejection, characterized by marked perivascular and interstitial mononuclear inflammatory infiltrates. Immunosuppressive therapy was subsequently adjusted by the heart transplant team. The patient was discharged 46 days post-transplant without further SVT episodes.

Three months later, the patient presented to the emergency department with recurrent SVT, which was successfully terminated with 3 mg of adenosine. Catheter ablation was subsequently recommended. The procedure was performed under general anesthesia via triple right femoral vein puncture. Decapolar and quadripolar catheters were positioned in the coronary sinus and His bundle region, respectively. An HD Grid catheter was advanced into the left chambers via

Keywords

Heart Transplantation; Wolff–Parkinson–White Syndrome; Catheter Ablation

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Manuscript received May 14, 2026, revised manuscript July 17, 2026, accepted August 03, 2026

Editor responsible for the review: Germano Conceição-Souza

DOI: <https://doi.org/10.36660/abchf.20260017i>

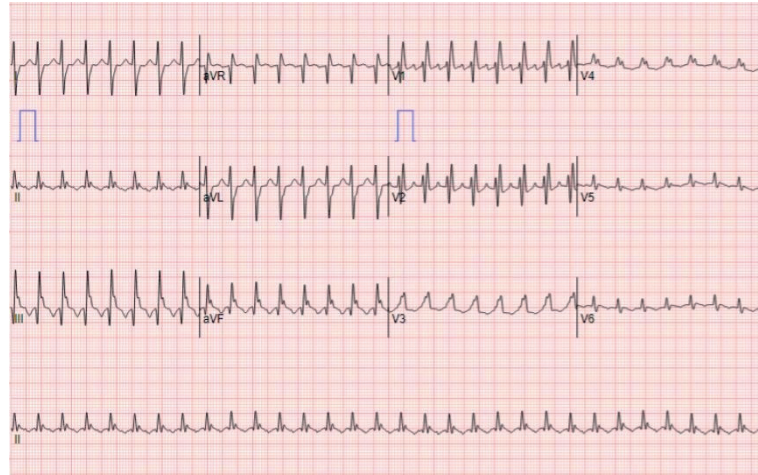


Figure 1 – Twelve-lead electrocardiogram obtained during the postoperative period. The tracing demonstrates a narrow-QRS complex tachycardia with a regular rhythm, consistent with orthodromic atrioventricular reentrant tachycardia (AVRT).

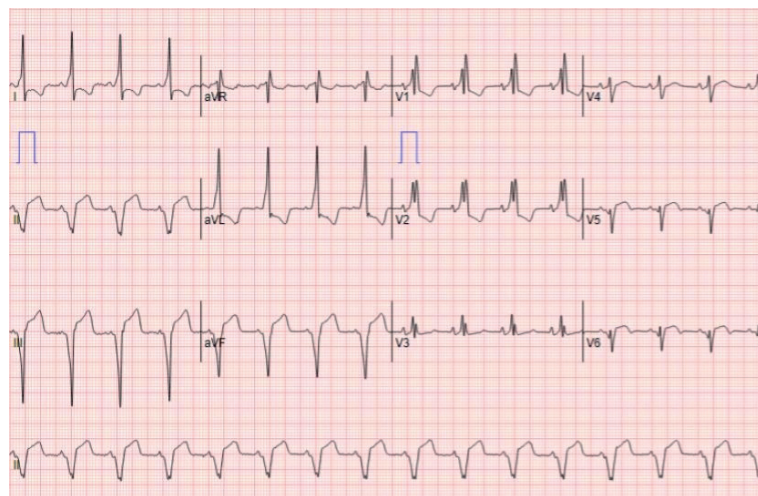


Figure 2 – Baseline twelve-lead electrocardiogram in sinus rhythm. The tracing shows a short PR interval and a prominent delta wave, characteristic of ventricular pre-excitation. The presence of positive delta waves in leads V1, I, and aVL, together with negative delta waves in the inferior leads (II, III, and aVF), is consistent with a left posteroseptal accessory pathway according to the Milstein algorithm.

transseptal puncture, and electroanatomical mapping was performed using the EnSite Precision system.

During mapping, orthodromic SVT (cycle length 384 ms) was spontaneously induced, mediated by a posteroseptal accessory pathway at the mitral annulus. Radiofrequency ablation via a transeptal approach successfully terminated the tachycardia. Post-ablation ventricular pacing maneuvers demonstrated decremental retrograde conduction with no evidence of residual accessory pathway activity. Final conduction intervals were PA 27 ms, AH 63 ms, and HV 54 ms. The patient has remained asymptomatic, with no further

clinically significant episodes of SVT and no evidence of pre-excitation on ECG (Figure 3) during a 2-year follow-up, without the use of antiarrhythmic medication.

Discussion

The electrocardiographic pattern of ventricular pre-excitation has an estimated prevalence ranging from 0.1% to 0.3% in the general population.⁵⁻⁷ In contrast, WPW syndrome – defined by the coexistence of pre-excitation and symptomatic arrhythmias – is significantly less common.

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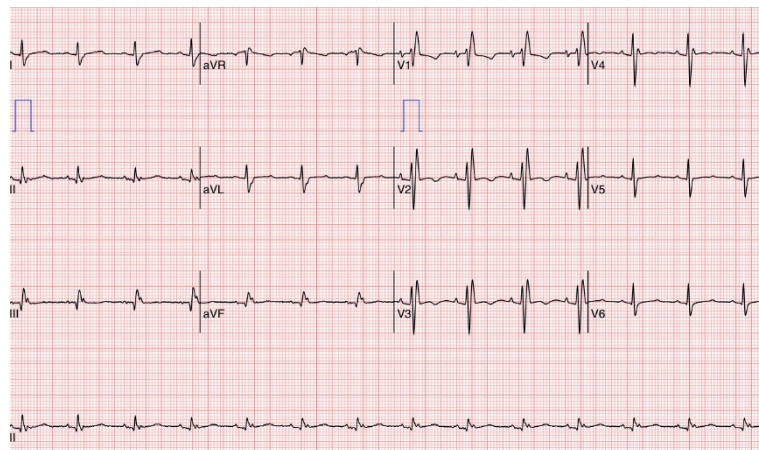


Figure 3 – Surface twelve-lead electrocardiogram obtained at the two-year follow-up, showing sinus rhythm without evidence of ventricular pre-excitation.

Notably, a surface ECG may appear normal in cases of intermittent pre-excitation or concealed accessory pathways. While many patients remain asymptomatic, others may experience life-threatening events, including sudden cardiac death. Accessory pathways are most frequently located in the left lateral region, accounting for approximately 50–60% of cases, followed by the posteroseptal, right free wall, and anteroseptal regions. Definitive treatment consists of catheter ablation, which yields a high success rate – up to 98% in some series⁸ – and a favorable safety profile, including a low incidence of nonfatal adverse events (1.5%) and procedure-related mortality (0.1%).³

Arrhythmias are common after orthotopic heart transplantation and arise from mechanisms largely specific to the allograft: autonomic denervation, surgical technique, acute and chronic rejection, and transplant vasculopathy. The bicaval technique and minimizing ischemic time are current standards to reduce this risk.^{9,10} Bradyarrhythmias occur in roughly 8–23% of recipients, with sinus node dysfunction being the leading indication for early pacemaker implantation, whereas atrioventricular block becomes more frequent with increasing time from transplantation.¹⁰ Among sustained atrial arrhythmias, atrial flutter predominates late after transplantation and is the arrhythmia most consistently associated with rejection, whereas atrial fibrillation clusters in the perioperative period and is uncommon in stable long-term recipients – its late appearance should prompt evaluation for rejection, vasculopathy, or sepsis. Reported incidences vary widely (atrial flutter approximately 3–30%; atrial fibrillation approximately 0.3–24%).¹⁰ SVTs in stable recipients are most often atrial flutter or scar-related atrial tachycardia, although atrioventricular nodal reentry and conduction between recipient and donor atria have also been described.⁹ Ventricular premature complexes are nearly universal, whereas sustained ventricular arrhythmias and sudden death are primarily associated with rejection and vasculopathy.¹⁰ Against this background, accessory-pathway-mediated tachycardia is rare and, because the recipient's native heart is explanted, is necessarily donor-derived.

In contrast to the present case – in which the donor had documented ventricular pre-excitation and a history of tachyarrhythmia – several reports describe donors in whom pre-excitation had not been recognized before transplantation. This may reflect the intermittent nature of pre-excitation, limited access to comprehensive donor data, or subtle delta waves associated with certain pathway locations.^{11–13}

In the transplant recipient, alterations in autonomic tone and the denervated state of the graft are considered likely triggers for arrhythmia initiation.¹⁰ Rejection may further unmask or facilitate pathway conduction; pre-excitation manifesting in the setting of antibody-mediated rejection has been reported¹³ – a relevant consideration in the present case, given the grade 3R acute cellular rejection identified on the day-10 endomyocardial biopsy, concurrent with the early SVT.

Electroanatomical mapping is a valuable adjunct in the transplanted heart, reducing fluoroscopic exposure and, when the biatrial technique is used, helping to distinguish donor from recipient atrial signals.⁹ In the present case, performed using the bicaval technique, the left posteroseptal pathway was localized at the mitral annulus and ablated via a transeptal approach, anatomically remote from the caval anastomoses. The optimal timing of intervention is not established; ablation has been reported from the early postoperative period through delayed, elective procedures.⁹ Here, given the early graft dysfunction and treated acute rejection, ablation was deferred for three months to allow graft stabilization and resolution of inflammation, and to confirm that pre-excitation persisted. The procedure was uncomplicated despite the altered surgical anatomy.

Fewer than fifteen cases have been reported since the first description in 1989,¹¹ and, because the recipient's native heart is explanted, every such pathway is donor-derived. The published experience includes manifest, concealed,^{14,15} and intermittent¹⁶ pathways in nearly all annular locations, including septal and other high-risk sites in the donor heart.¹⁷ Pre-excitation may be

recognized in the donor before procurement or may appear as a new finding only after transplantation,¹⁸ may declare itself immediately postoperatively or remain dormant for years,¹⁹ and has been managed with catheter ablation with uniformly favorable outcomes.^{12,14,19}

Within this experience, the present case is distinguished by several features. Whereas some reports describe a normal donor ECG with pre-excitation emerging only in the recipient, here the donor's pre-excitation and history of tachyarrhythmia were documented before procurement, yet the organ was accepted for a critically ill recipient (NYHA class IV, CCS class IV) – a deliberate use of a pathway-bearing allograft rather than an incidental post-transplant discovery. The pathway was manifest and clinically consequential: it produced hemodynamically unstable SVT in the early postoperative period and, subsequently, recurrent symptomatic orthodromic reentry. Ablation was therefore indicated on clinical grounds rather than on the basis of anterograde risk stratification. A transplant-specific consideration further informed management: rejection and altered autonomic tone may unmask or facilitate pathway-mediated tachycardia, as observed here in the context of the grade 3R rejection identified on the day-10 biopsy and as previously reported in antibody-mediated rejection.¹³ The durable result – two years free of pre-excitation and symptoms without antiarrhythmic therapy – is consistent with outcomes reported after ablation of donor-derived pathways.^{12,19}

Considering the persistent shortage of donor organs, the present case supports the position that ventricular pre-excitation or WPW syndrome in a donor should not, by itself, contraindicate transplantation. Even a donor with recognized pre-excitation and a history of tachyarrhythmia may be used successfully, with the pathway definitively managed by catheter ablation in the recipient, thereby expanding the donor pool without compromising outcomes.

Conclusion

We report a rare case of WPW syndrome following heart transplantation. Although uncommon, this condition can be definitively managed with catheter ablation, which offers a high success rate and a favorable safety profile, significantly improving the patient's prognosis. Current evidence

suggests that the presence of ventricular pre-excitation in a donor should not be considered a contraindication for heart transplantation. Utilizing such organs, followed by post-transplant intervention when necessary, is a viable strategy to expand the donor pool without compromising clinical outcomes.

Author Contributions

Writing of the manuscript: Schreiber Junior A, Spannemberger KP, Caberlon E; Critical revision of the manuscript for intellectual content: Faganello L, Magalhães AP, Zimmerman LI, Pimentel M.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Hospital das Clínicas de Porto Alegre under the protocol number 5.554.420. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Data Availability Statement

The underlying content of the research text is contained within the manuscript.

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