

CASE REPORT

Ablation of Left Ventricular Posterior Superior Process Premature Beats via Right Atrial Approach

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Summary

In this case report, we present the successful catheter ablation of a 77-year-old patient with symptomatic ventricular premature beats (VPBs) originating from the posterior superior process of the left ventricle. Despite initial challenges in localizing the arrhythmic focus, detailed mapping revealed an ectopic origin within a structurally complex region of the left ventricle. A novel right atrial approach was utilized to access the target site, allowing for precise ablation without requiring transeptal puncture or left ventricular catheterization. The ablation was effective, with complete resolution of VPBs confirmed during follow-up, demonstrating the feasibility and safety of this approach for ectopy originating from difficult-to-reach left ventricular structures.

Keywords: catheter ablation; posterior superior process; right atrial approach

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Introduction

Ventricular arrhythmias arising from the posterior superior process (PSP) of the left ventricle are exceptionally rare and pose unique challenges in terms of diagnosis and treatment. The PSP is an anatomically complex and less commonly involved site, making localization and catheter access difficult. Ventricular premature beats (VPBs) originating from this region can often be symptomatic, leading to palpitations, reduced quality of life, and, in some cases, progression to more serious arrhythmias or cardiomyopathy.

Traditional ablation strategies typically involve a left-sided approach, often requiring transeptal puncture or retrograde aortic access to reach left ventricular arrhythmogenic foci. However, these methods carry additional risks, especially in elderly patients or those with structural heart disease. Alternative access routes, such as a right atrial approach, may offer a safer and more efficient pathway, especially when the arrhythmogenic focus is located in close proximity to the atrial myocardium.

In this report, we describe a successful ablation of VPBs originating from the PSP of the left ventricle, achieved through a novel right atrial approach. This case highlights the importance of individualized mapping and innovative access strategies for complex ventricular arrhythmias, particularly when conventional techniques may be associated with higher procedural risks.

Case Report

A 77-year-old male patient presented with complaints of palpitations and reduced exercise tolerance, which had been progressively worsening over the past few months. The patient reported experiencing symptoms for approximately two years. His medical history was notable only for hypertension, managed with bisoprolol (5 mg daily) and perindopril (5 mg daily) for the past two years. He had no history of ischemic heart disease, diabetes, or other major cardiovascular risk factors.

On physical examination, the patient had an irregular pulse, consistent with frequent premature beats. The baseline electrocardiogram (ECG) revealed bigeminal ventricular premature beats (VPBs) (Figure 1), suggesting a significant arrhythmic burden. Transthoracic echocardiography demonstrated mild left ventricular dilation with an ejection fraction of approximately 40%, and mild mitral regurgitation. Given the reduced ejection fraction and persistence of symptoms, a decision was made to proceed with catheter ablation, as medical management alone was deemed insufficient.

Initial mapping and ablation were performed using the Intellanav Mifi Open Irrigated catheter with local impedance measurement, in conjunction with the Rhythmia HDx high-density mapping system (Boston Scientific, Marlborough, MA, USA). Mapping of the left ventricle was conducted first due to the ECG findings, which pointed to an arrhythmic focus originating from the posterior superior process (PSP) of the left ventricle. During mapping, early activation signals were identified, with the local electrograms showing a 42 ms pre-QRS interval (Figure 2), confirming the site of origin.

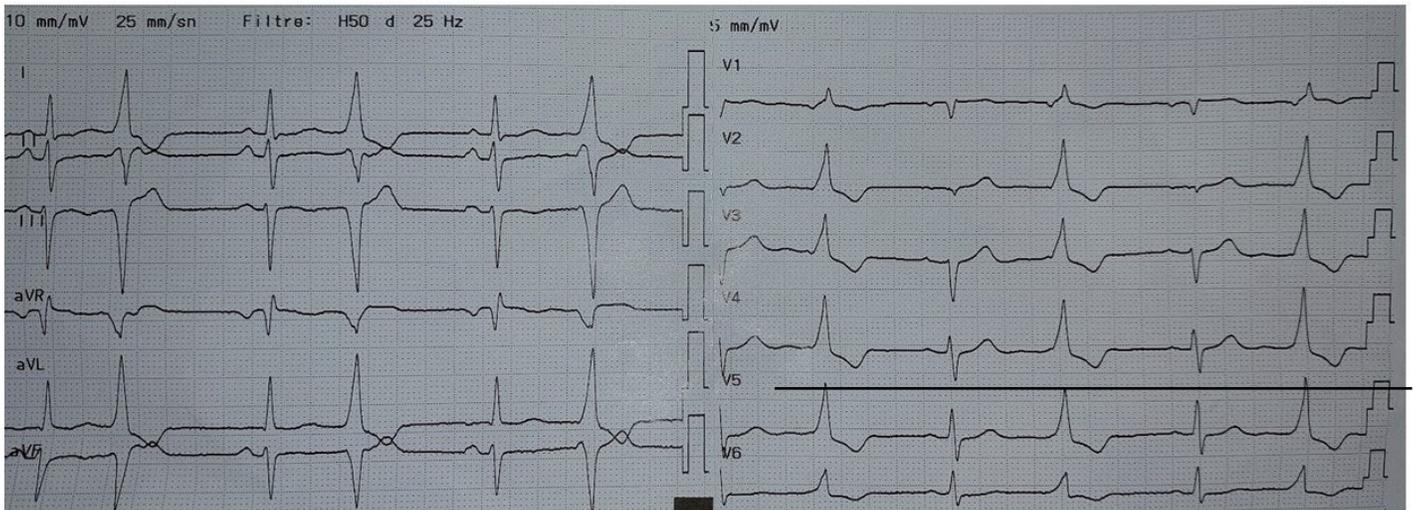


Figure 1. The patient’s surface electrocardiogram showing bigeminy ventricular premature beats. The right bundle branch block pattern, monophasic R wave in lead DI, and an r wave in lead II DII greater than in lead III DIII suggest an origin from the posterior superior process.

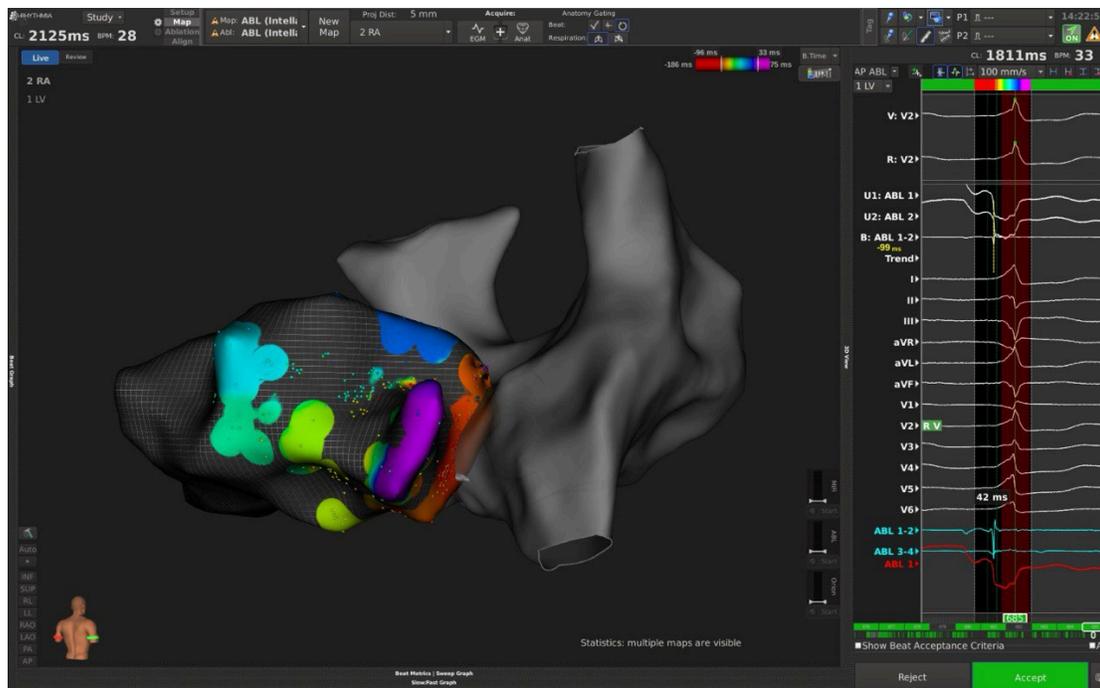


Figure 2. Activation map of the left ventricle during ventricular ectopy and the anatomical map of the right atrium showing the proximity of the earliest activation point to the right atrium. The earliest ventricular electrogram was recorded 42 ms before the onset of the QRS complex.

Radiofrequency ablation was initiated at the identified site within the left ventricle using 50 watts of energy per lesion for 15 seconds. Although the VPBs initially subsided after the application of energy, the arrhythmia recurred shortly afterward. Given the anatomical proximity of the PSP to the right atrial myocardium, we decided to attempt ablation from the right atrial side as an alternative approach.

Energy was delivered to the corresponding anatomical region from the right atrial side, utilizing the same power settings (50 watts per lesion for 15 seconds) (Figure 3). This resulted in immediate suppression of the VPBs, which did not reappear during the remainder of the procedure or during the post-ablation observation period. Notably, the reduction in local impedance was more pronounced when energy was applied from the right atrial site, with a drop of -33 ohms, compared to a reduction of -12 ohms from the left ventricular approach. The impedance measured from the generator was similar for both sites (-8 ohms for the left ventricle and -10 ohms for the right atrium).

The patient remained free of symptoms following the procedure, and follow-up ECG monitoring showed no recurrence of VPBs.

Discussion

The posterior superior process (PSP) is an anatomically complex region located at the most inferior and posterior segment of the left ventricular base. It extends behind the plane of the tricuspid valve¹, making it one of the most challenging locations for mapping and ablation of ventricular arrhythmias. The approximately 1 cm difference in the planes of the mitral and tricuspid annuli, the basal segment of the left ventricle is in close proximity to both the epicardium and the medial portion of the right atrium.^{2,3} This relationship creates a substrate where ventricular premature beats (VPBs) can originate from an epicardial focus adjacent to the inferior and medial right atrium. However, VPBs arising from the PSP are exceedingly rare, with an estimated prevalence of only 1.5% among all ventricular ectopies reported in the literature.⁴

The close anatomical relationship between the PSP, the epicardial surface, and the right atrium presents a challenge for conventional ablation strategies. Due to its location, the PSP is not easily accessible via traditional endocardial approaches, and ablation carries a higher risk of complications, including atrioventricular block, because of the adjacent septal and nodal arteries. There have been limited case reports describing successful ablation of VPBs originating from this region using various approaches, including the coronary sinus,⁵ the left ventricular endocardial⁴ and the right atrial surface.⁶

In our case, we achieved successful elimination of a sequential approach, first from the left ventricular endocardium and then from the right atrial side. Although initial ablation from the left ventricle suppressed the arrhythmia temporarily, it recurred, suggesting incomplete lesion formation. This prompted us to explore the possibility of a more effective ablation from the adjacent right atrial site. The anatomical proximity of the PSP to the right atrium allowed us to place deeper, more effective lesions using a right atrial approach.

A key observation in this case was the difference in local impedance reduction between the left ventricular and right atrial ablation sites. The catheter used in our procedure allowed for local impedance measurement, which evaluates the impedance change within a small, localized area between the microelectrodes at the catheter tip and the proximal ring. This is in contrast to conventional quadripolar catheters, which measure impedance across a broader field between the distal electrode and the grounding patch. The greater reduction in local impedance observed during right atrial ablation (-33 ohms) compared to left ventricular ablation (-12 ohms) suggested a more effective and deeper lesion when applied from the right atrial side. This finding aligns with previous studies that have shown local impedance measurement to be a reliable indicator of lesion depth and effectiveness.

The successful outcome of our case highlights several important points. First, it underscores the need for individualized mapping and ablation strategies for VPBs originating from complex anatomo-

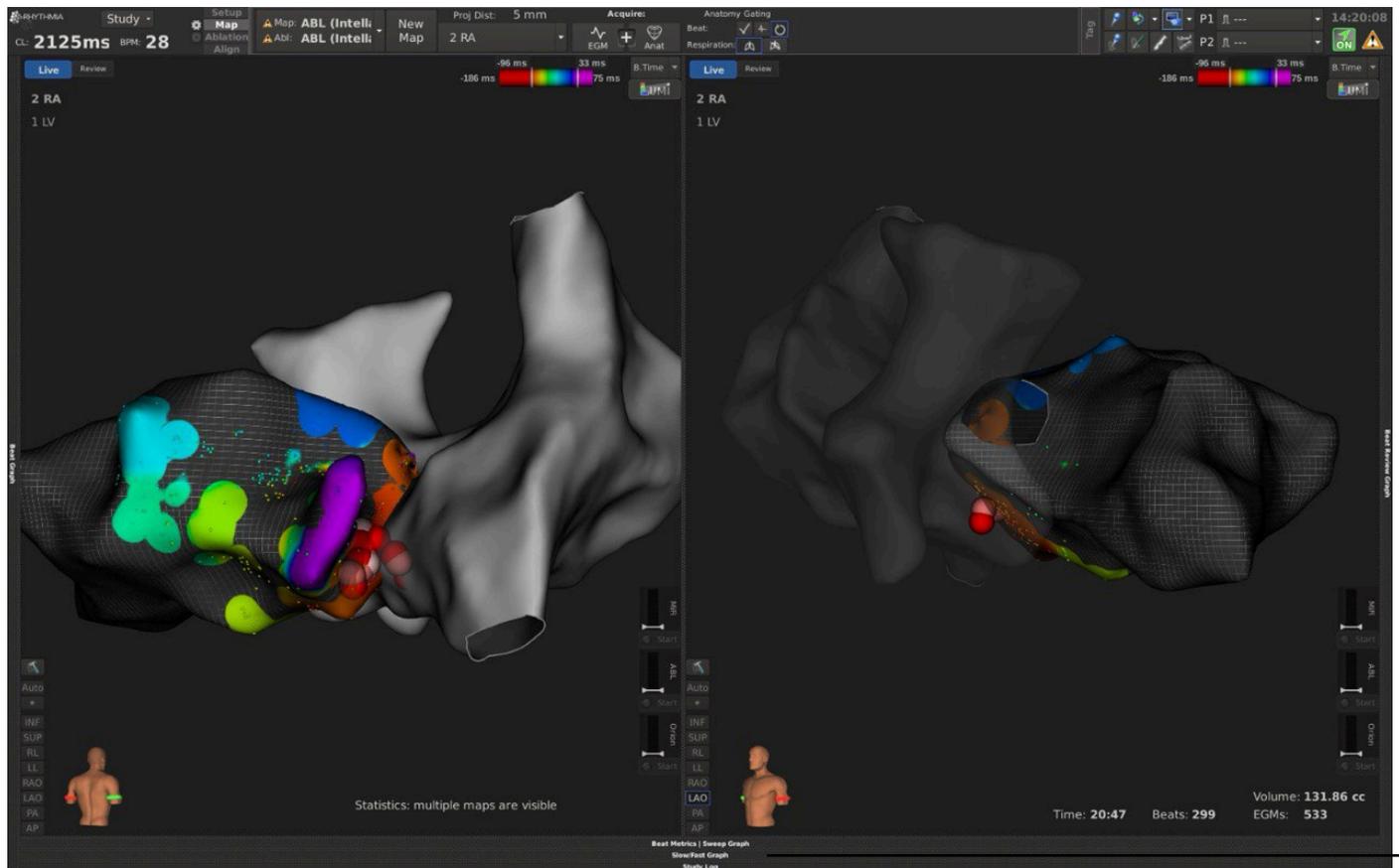


Figure 3. Ablation sites from both the left ventricle and the right atrium, along with their close anatomical proximity, are shown.

mical regions like the PSP. Second, it demonstrates the utility of a right atrial approach, which may be more effective due to the close epicardial proximity of the arrhythmic focus to the right atrial endocardium. Finally, it emphasizes the importance of utilizing advanced technologies, such as local impedance measurement, to guide ablation and assess lesion formation in real-time.

In conclusion, this case illustrates that VPBs originating from the posterior superior process of the left ventricle can be effectively and safely ablated using a right atrial approach. This strategy provides a viable alternative to conventional left-sided techniques, particularly when initial endocardial ablation is insufficient or carries higher procedural risks. Further studies are warranted to validate this approach and explore its application in a broader cohort of patients with similar arrhythmias.

References

1. Ba T. Operative Anatomy of the Heart. New York: Springer; 2011.
2. Sealy WC, Mikat EM. Anatomical problems with identification and interruption of posterior septal Kent bundles. *Ann Thorac Surg.* 1983;36(5):584-595.
3. Menasche P. Anatomic bases of the surgical division of Kent bundles in the posterior septal area of the heart. *Surg Radiol Anat.* 1986;8(2):109-114.
4. Li A, Zuberi Z, Bradfield JS, et al. Endocardial ablation of ventricular ectopic beats arising from the basal inferoseptal process of the left ventricle. *Heart Rhythm.* 2018;15(9):1356-1362.
5. Tavares L, Dave A, Valderrabano M. Successful ablation of premature ventricular contractions originating from the inferoseptal process of the left ventricle using a coronary sinus approach. *HeartRhythm Case Rep.* 2018;4(8):371-374.

6. Santangeli P, Hutchinson MD, Supple GE, Callans DJ, Marchlinski FE, Garcia FC. Right Atrial Approach for Ablation of Ventricular Arrhythmias Arising From the Left Posterior-Superior Process of the Left Ventricle. *Circ Arrhythm Electrophysiol.* 2016;9(7).

Informed consent

Written informed consent was obtained from the patient for the publication of the manuscript.

Conflict of Interests

None

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