Pulsed Field Ablation for VT/PVCs: The safer path, or just a new frontier?

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Ventricular arrhythmias, including ventricular tachycardia (VT) and premature ventricular complexes (PVCs), present a significant clinical challenge, often leading to debilitating symptoms, reduced quality of life, and increased risk of sudden cardiac death. Current treatment strategies, from antiarrhythmic drugs to conventional radiofrequency or cryoablation, carry limitations in efficacy, safety, or procedural complexity. The emergence of pulsed field ablation (PFA), a non-thermal modality already making inroads in atrial fibrillation, offers a potential new avenue for these complex ventricular conditions.

KEY TAKEAWAYS

- The Pivot: Pulsed field ablation, traditionally applied to atrial fibrillation, demonstrates feasibility for ventricular arrhythmias.
- The Data: Systematic reviews indicate PFA's potential for VT and PVCs, though specific efficacy numbers are still emerging from dedicated trials.
- The Action: Clinicians should monitor ongoing PFA trials for ventricular arrhythmias, particularly for patients refractory to conventional ablation.

Ventricular arrhythmias, encompassing both sustained ventricular tachycardia (VT) and frequent premature ventricular complexes (PVCs), represent a substantial burden on patients and healthcare systems. These arrhythmias can severely impair cardiac function, trigger symptoms ranging from palpitations to syncope, and critically, elevate the risk of sudden cardiac death. While antiarrhythmic medications offer some control, their long-term efficacy is often limited by side effects and incomplete suppression. Catheter ablation, using either radiofrequency (RF) energy or cryoablation, has become a cornerstone of treatment, but these thermal modalities carry inherent risks, including collateral damage to adjacent structures like coronary arteries or nerves, and can be technically challenging in the complex anatomy of the ventricles.1,3

The field has long sought a safer, more efficient ablation method. Pulsed field ablation (PFA) emerged as a non-thermal alternative, initially gaining traction for atrial fibrillation due to its tissue-selective properties, which spare surrounding non-myocardial tissues. This selectivity, based on irreversible electroporation, suggests a theoretical advantage for ventricular applications where critical structures are often in close proximity to the arrhythmogenic substrate. The question for cardiologists has been whether this technology, proven in the atria, could translate effectively and safely to the ventricles.1,2

Exploring PFA's Feasibility in Ventricular Arrhythmias

A systematic review by Irnizarifka, Tristan, and Budiono, published in Future Cardiology in 2026, investigated the feasibility of PFA for ventricular tachycardia and premature ventricular complexes.1 This review synthesized existing literature, primarily focusing on early-phase clinical studies and preclinical data, to assess PFA's potential beyond its established role in atrial fibrillation. The authors specifically sought to determine if PFA could offer a viable and safe alternative for these challenging ventricular conditions, given its distinct mechanism of action.1

The review included studies that explored PFA's application in both animal models and initial human cases of VT and PVCs. Researchers examined various PFA systems, including those utilizing both focal and multi-electrode catheter designs, and assessed parameters such as lesion formation, procedural success, and acute safety endpoints. The primary objective was to establish whether PFA could create effective, durable lesions in ventricular myocardial tissue without causing significant collateral damage to adjacent structures, a common concern with thermal ablation in the ventricles.1

Irnizarifka and colleagues reported that PFA demonstrated promising feasibility for ventricular arrhythmia ablation.1 Preclinical studies consistently showed that PFA created transmural lesions in ventricular tissue with minimal damage to adjacent structures such as the phrenic nerve, esophagus, and coronary arteries. This tissue selectivity is a key advantage, especially in areas like the epicardium or near the interventricular septum, where conventional thermal ablation carries higher risks. Early human case series, though limited in patient numbers, supported these preclinical observations, showing successful acute elimination of VT and PVCs with a favorable safety profile.1

The review highlighted several advantages of PFA for ventricular applications. Its non-thermal nature mitigates the risk of steam pops and char formation, which can complicate RF ablation. The rapid energy delivery of PFA also reduces procedural time, potentially improving patient comfort and reducing fluoroscopy exposure. The ability to create consistent, transmural lesions quickly and safely in the thick, heterogeneous ventricular myocardium is a significant step forward. But the authors cautioned that these were early findings, primarily from feasibility studies, and larger, randomized controlled trials are necessary to confirm long-term efficacy and safety.1

The Broader Context of Ventricular Arrhythmia Treatment

Elattar, Hodhod, and Basha provided a comprehensive overview of treatment options for premature ventricular contractions in their 2026 review in Cardiology Reviews.3 This paper contextualized PFA within the existing therapeutic landscape, which includes medical therapy and conventional catheter ablation. The authors underscored the limitations of current approaches, such as the side effect burden of antiarrhythmic drugs and the procedural risks and recurrence rates associated with thermal ablation.3

Medical therapy for PVCs often involves beta-blockers or calcium channel blockers, which can reduce symptom burden but rarely eliminate PVCs entirely. Antiarrhythmic drugs, while more potent, are associated with significant proarrhythmic risks and extracardiac side effects, limiting their long-term utility, particularly in patients with structural heart disease. Catheter ablation, therefore, remains a preferred option for symptomatic, refractory PVCs or those causing PVC-induced cardiomyopathy.3

But conventional ablation for PVCs can be challenging. The origin of PVCs can be diverse, arising from the right ventricular outflow tract, left ventricular outflow tract, papillary muscles, or epicardial sites. Each location presents unique anatomical challenges and risks. For instance, ablating near the aortic cusps or within the coronary venous system requires extreme precision to avoid damaging critical structures. The review by Elattar and colleagues noted that PFA's tissue selectivity could be particularly beneficial in these anatomically sensitive areas, offering a safer alternative where thermal ablation carries higher risks of complications.3

The authors also discussed the emerging role of PFA as a novel treatment modality. They emphasized that while PFA is still in its early stages for ventricular arrhythmias, its potential to overcome some of the inherent limitations of thermal ablation makes it a compelling area of research. The ability to create precise, durable lesions with reduced risk of collateral damage could improve both the safety and efficacy of PVC ablation, potentially expanding the indications for catheter intervention in patients who might otherwise be deemed too high-risk for conventional procedures.3

Lessons from Atrial Fibrillation and Future Directions

While the primary focus of the Irnizarifka review was ventricular arrhythmias, the success of PFA in atrial fibrillation (AF) provides a valuable precedent. Sindone, Brienesse, and Virk's study, published in Heart Rhythm in 2026, examined the impact of adjunctive posterior left atrial ablation using PFA on healthcare utilization in patients receiving first-time catheter ablation for AF.2 Although this study did not directly address ventricular arrhythmias, it highlighted PFA's operational efficiency and safety profile in a different cardiac chamber, which has implications for its broader adoption.2

The SENTINEL registry, a multicenter study, demonstrated that PFA, when used for adjunctive posterior left atrial ablation in AF, was associated with favorable outcomes.2 While specific numbers on healthcare utilization were not detailed in the abstract, the implication is that PFA's efficacy and safety in AF contribute to reduced rehospitalizations and repeat procedures. This operational efficiency and predictable lesion formation in AF suggest that similar benefits might be realized in ventricular applications, assuming comparable efficacy can be achieved. The rapid energy delivery and reduced need for extensive temperature monitoring, characteristic of PFA, could translate into shorter procedure times and potentially lower complication rates in the ventricles as well.2

The open-label design of many early PFA studies for ventricular arrhythmias is an obvious caveat. The lack of blinding, while common in device trials, means that operator experience and selection bias could influence reported outcomes. Furthermore, the systematic review by Irnizarifka and colleagues, while comprehensive, relied on a relatively small number of human studies, many of which were single-center experiences or case series.1 The long-term durability of PFA lesions in the dynamic, high-pressure environment of the ventricles also remains to be fully elucidated. Recurrence rates beyond the acute phase are critical for assessing true clinical benefit, and these data are still maturing. Clinicians looking for a concise guide to modern cardiological practice might find the Oxford Handbook of Cardiology a useful resource for current standards.

The trials were not powered to detect differences in specific ventricular arrhythmia subtypes or in patients with advanced structural heart disease, and that gap matters. Ventricular arrhythmias in patients with ischemic cardiomyopathy, for example, often involve complex scar-related reentrant circuits that may respond differently to PFA compared to focal PVCs in structurally normal hearts. Future research must stratify patients more rigorously and evaluate PFA in these high-risk populations. The current evidence, while encouraging, primarily establishes feasibility rather than definitive superiority or non-inferiority to existing thermal ablation techniques. The next step will require larger, randomized controlled trials comparing PFA directly against conventional ablation for specific ventricular arrhythmia indications, with long-term follow-up on recurrence and safety endpoints.

CLINICAL IMPLICATIONS

> The emerging data on pulsed field ablation for ventricular arrhythmias, while preliminary, offers a compelling glimpse into the future of electrophysiology. Clinicians currently grappling with refractory VT or symptomatic PVCs, especially in anatomically challenging locations, should view PFA as a technology to watch. Its tissue-selective, non-thermal mechanism addresses some of the most persistent safety concerns associated with conventional thermal ablation in the ventricles.
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> For patients, this could mean safer procedures with potentially fewer complications, particularly for those whose arrhythmogenic foci are near critical structures like coronary arteries or nerves. A reduced risk of collateral damage might expand the pool of patients eligible for catheter ablation, offering an effective treatment where risks previously outweighed benefits. The prospect of shorter procedure times and potentially less discomfort is also a tangible patient advantage.
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> But the enthusiasm must be tempered with a dose of clinical realism. The current evidence, largely from feasibility studies and systematic reviews, does not yet provide the robust, long-term efficacy and safety data required for widespread adoption. Device manufacturers will need to invest in large-scale, randomized trials that directly compare PFA to established ablation techniques, particularly in diverse patient populations with varying degrees of structural heart disease. Until then, PFA for ventricular arrhythmias remains an investigational tool, albeit a highly promising one.

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