EDITORIAL COMMENTARY

Pulsed field ablation can be a source of electromagnetic interference with cardiac implantable electronic devices

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Introduction

Pulsed field ablation (PFA) has recently been approved by the Food and Drug Administration in the United States for atrial fibrillation ablation and has since gained rapid adoption because of its tissue selectivity, shortened procedure time, and potentially improved safety.[1]

The presence of a cardiac implantable electronic device (CIED) including permanent pacemaker and implantable cardioverter-defibrillator (ICD) is not uncommon in patients who undergo atrial fibrillation ablation. Because PFA involves applying high-amplitude pulsed electrical fields to myocardial cells, leading to subsequent cell death through irreversible electroporation,[1] it has the potential to generate electromagnetic interference (EMI) with CIEDs. An initial small study by Chen et al[2] in 20 patients with CIEDs who underwent atrial fibrillation ablation with PFA did not identify any evidence of significant EMI.

More recently, Lennerz et al[3] published a comprehensive in vitro study to evaluate the safety of PFA in patients with CIEDs.[3] In this study, 44 CIEDs (16 pacemakers, 21 ICDs, and 7 CRT devices) were tested using 1980 PFA applications delivered by the Farapulse system (Boston Scientific, Marlborough, MA). The CIED was connected to leads that were positioned in the saline bath, and the PFA catheter was positioned <5 cm from the lead tip and <15 cm from the generator. No evidence of damage to the generator or the leads was observed, and there were no incidences of triggering ICD therapy, mode switching, or noise detection alerts. However, oversensing and pacing inhibition were observed in the 2 cases in which continuous telemetry monitoring was performed, suggesting that the true prevalence of EMI may have been underestimated.[3]

In the current issue of *HeartRhythm Case Reports,* Lampert et al[4] reported a case of EMI triggering both atrial automatic mode switch and ventricular noise reversion alerts in a patient who had an ICD and underwent PFA ablation using the Farapulse system.[4] This is a very important observation that warrants additional investigation in the future as we accumulate more experience in patients with CIEDs going through PFA procedures. Only 2 automatic mode switch events and 4 noise reversion alerts were recorded in the case, whereas a typical PFA case using the Farawave ablation system would require 8 applications per pulmonary vein, suggesting that not all PFA applications resulted in EMI. The factors that contributed to the EMI from PFA application remain unclear. Possibly the relative distance from the PFA catheter to the ICD sensing electrodes may have contributed. Compared with the left-sided veins, the right-sided veins are closer to the atrial lead and the ICD coil (if included in the sensing configuration). It is therefore plausible that PFA ablation in the right-sided veins may be more prone to triggering EMI.

The case reported here confirms the in vitro findings from Lennerz et al.[3] Although it is reassuring that all the in vitro and in vivo studies so far have not demonstrated any detrimental effect of PFA on the mechanical as well electrical properties of CIEDs, there is evidence that EMI interfering with CIED function can occur during PFA. Until further studies shed more light into the mechanism and a "safe" distance can be determined, from which PFA would unlikely cause any EMI, it may be reasonable to consider programming changes to ensure ventricular pacing for patients who are pacing dependent and to avoid inappropriate ICD therapy during PFA application.

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