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Assessing the safety of Pulsed Field Ablation in the presence of implantable medical devices

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Pulsed field ablation (PFA) is an effective treatment for atrial fibrillation but uses high voltages that may cause heating near metallic cardiac devices. This study developed a finite-element numerical model in COMSOL to investigate interactions between PFA and atrial appendage occlusion devices, focusing on catheter device spacing and safety risks related to potential excessive heating. The model included a tissue block, a nitinol disk representing the device, and a bipolar platinum catheter and spacing was varied from 1–10 mm (z-axis) and 1–20 mm (x-axis). Simulations used 1800 V, a duty factor of 0.01, and 0.2 s duration. Results showed strong electric fields (>550 V/cm) extending widely around the catheter, with an electroperated tissue volume of 1570.2 mm³, while significant heating was localized near the catheter and device. Temperatures approached 100 °C only when spacing was 2 mm. At larger distances, ablation was predominantly non-thermal, suggesting PFA is safe near devices unless in very close proximity.