Effect of Contact Force on Pulsed Field Ablation Lesions in Porcine Cardiac Tissue

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Abstract

Background: Contact force has been used to titrate lesion formation for radiofrequency ablation. Pulsed Field Ablation (PFA) is a field-based ablation technology for which limited evidence on the impact of contact force on lesion size is available. **Methods**: Porcine hearts (n=6) were perfused using a modified Langendorff set-up. A prototype focal PFA catheter attached to a force gauge was held perpendicular to the epicardium and lowered until contact was made. Contact force was recorded during each PFA delivery. Matured lesions were cross-sectioned, stained, and the lesion dimensions were measured. Numerical modeling of the catheter-tissue interface under different contact forces was performed to aid in the interpretation of our results and isolate effects of biomechanical tissue displacement. **Results:** A total of 82 lesions were evaluated with contact forces between 1.3 g and 48.6 g. Mean lesion depth was 4.8 ± 0.9 mm (standard deviation), mean lesion width was 9.1 ± 1.3 mm and mean lesion volume was 217.0. ± 96.6 mm ^{3}. Linear regression curves showed an increase of only 0.01 mm in depth (Depth = 0.01*Contact Force + 4.37, R ^{2} = 0.06), 0.03 mm in width (Width = 0.03*Contact Force + 8.32, R ^{2} = 0.12) for each additional gram of contact force, and 2.20 mm ^{3} in volume (Volume = 2.20*Contact Force + 163, R ^{2} = 0.11). Numerical modeling found consistent trends with experimental mean values and shows tissue displacement alone is likely not a significant factor to formation of lesion depth. **Conclusions:** Increasing contact force using a bipolar, biphasic focal PFA system has minor effects on acute lesion dimensions in an isolated porcine heart model.

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