Correlation between the impedance drop, force time index, ablation index, and lesion formation: Which is the most preferable parameter to evaluate the lesion formation?

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Introduction: For eliminating the arrhythmogenic substrate or creating transmural lesions, the evaluation of the lesion size is an important aspect of catheter ablation. The impedance drop, force-time integral (FTI), and ablation index (AI) have been reported to be useful for a lesion confirmation. However, it has not been well clarified which one is the most preferable parameter to evaluate the lesion formation.

Methods: Excised swine hearts were perfused in saline with a circulating pump and thermometer. Using a CARTO3 system, the experiment was performed with a combination of various powers (20W, 30W, 40W, and 50W) and contact forces (CFs) (10g, 30g, and 50g). To evaluate the maximum lesion creation, the ablation energy was delivered until the occurrence of a steam pop. The correlation between the lesion formation and ablation parameters was evaluated.

Result: The lesion volume and lesion depth had a positive correlation with the FTI and AI, however, the impedance drop had a negative correlation with those (lesion volume; AI, $r=0.5506$, $p<0.0001$; FTI, $r=0.4488$, $p<0.0001$; $\Delta \Omega$, $r=-0.2495$, $p=0.0002$; lesion depth; AI, $r=0.5049$, $p<0.0001$; FTI, $r=0.3717$, $p<0.0001$; $\Delta \Omega$, $r=-0.2229$, $p=0.0011$). The coefficient of the correlation was the highest for the AI in terms of the lesion volume and lesion depth. When the steam pop was set as an endpoint, the maximal lesion-size was obtained by the following settings: lesion volume, 20W-10g (120.0±0 sec); lesion depth, 20W-10g (120.0±0 sec) and 30W-10g (88.1±34.6 sec); lesion surface area, 40W-10g (31.0±27.7 sec).

Conclusion: The AI was the most accurate marker to predict the lesion formation. Wide shallow lesions were created by a high power short duration ablation, while small deep lesions were created by a low power long duration ablation. The ablation settings should be arranged while considering the location of the ablation target.