Correspondence

Letter by Haines Regarding Article, “Direct Measurement of the Lethal Isotherm for Radiofrequency Ablation of Myocardial Tissue”

To the Editor:

Myocardial injury with hyperthermic catheter ablation technologies (radiofrequency electric current, microwave radiation, laser irradiation, or ultrasound) is both time and temperature dependent. The isotherm of irreversible injury is defined as the temperature at the border zone transition between viable and nonviable tissue. Ultimately, there is necrosis of that tissue and replacement by collagen scar, rendering that area electrically silent. Previous investigations have calculated the lesion isotherm indirectly or have measured the temperature at which physiological changes consistent with tissue death occur, including cellular depolarization, loss of excitability, contracture, or loss of conduction. In these studies, it has been estimated that the critical temperature for lesion formation after a 60-second hyperthermic exposure is ~50°C to 56°C.

Wood et al described a model that uses a thermographic camera and radiofrequency ablation in vitro. In this study, they determined that the lethal isotherm was ~60°C. The temperature measurements with thermography from this study were likely very accurate, but the methodology for defining the edge of the pathological lesion was not. The authors used triphenyltetrazolium vital staining to define the area of acute necrosis. This stain has been validated in infarct models, and tetrazolium stains have been used in other studies to assess the extent of lesion formation with catheter ablation. The mechanism by which triphenyltetrazolium differentiates viable from nonviable tissue is by the action of intracellular dehydrogenase enzymes. As the myocytes die, the dehydrogenase activity dissipates. However, that time-dependent process would not be apparent immediately after hyperthermic exposure. Thus, a rim of nonviable myocardium would be anticipated to have ongoing dehydrogenase activity hours after the acute injury. The area of the acute lesion with pale triphenyltetrazolium staining corresponds to the area of thermal inactivation of dehydrogenase, with an anticipated isotherm of 62°C but would underestimate the extent of irreversible tissue injury. In conclusion, the isotherm of irreversible myocardial injury with hyperthermic ablation is likely to be 50°C to 56°C.

Disclosures

None.

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References

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