

An Integrated Numerical Model to Analyze Thermal Ablation by High-Intensity Focused Ultrasound

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The aim of this study is to develop an integrated numerical method for modeling thermal ablation during high-intensity focused ultrasound surgery. The acoustic field of the focused ultrasound transducer was modeled using O'Neill's equation. Then the corresponding temperature field was obtained by solving the thermal conductive and diffusion equations with consideration of the cooling effects of large blood vessels through the finite element method. Finally, the proposed model incorporated with an algorithm for calculating the thermal dose as a way to predict the lesion size, shape, and location. Numerical results coincide with in-vitro phantom experiments. The proposed model could help to quantify the effects of presence of a large blood vessel during HIFU ablation, and find the optimal location of the HIFU focal point to obtain the largest lesion size during HIFU heating.

Keywords: HIFU, Blood vessel, Finite element analysis, Lesion