Abstracts

A Finite Element Model of a Microwave Catheter for Cardiac Ablation

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To investigate the delivery of microwave energy by a catheter located inside the heart for the purpose of ablating small abnormal regions producing cardiac arrhythmias, a numerical model was developed. This model is based on the finite element method and can solve both the electromagnetic field and the temperature distribution resulting from the radiated power for axisymmetrical geometries. The antenna, which is fed by a coaxial cable with a 2.4 mm diameter, is constituted by a monopole which is terminated by a metallic cylindrical cap. The heart model can be either homogeneous or constituted of coaxial cylindrical shells with different electrical and thermal conductivities representing the intracavitary blood masses, the heart, and the torso. Experimental measurements obtained in an homogeneous tissue equivalent medium, such as the reflection coefficient of the antenna at different frequencies and for different monopole lengths, the radial and axial steady-state temperature profiles, and the time course of the temperature rise, were all in close agreement with the values computed with the model. Accurate modeling is a useful prerequisite for the design of antennas, and these results confirm the validity of the catheter-heart model for the investigation and the development of microwave catheters.

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