Abstracts

Feasibility of noninvasive measurement of deep brain temperature in newborn infants by multifrequency microwave radiometry

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Clinical studies of hypothermal neural rescue therapy for newborn infants who have suffered hypoxia-ischaemia are currently hindered by the difficulty in measuring deep brain temperature. This paper addresses: the specific requirements for this measurement problem, the design of a proposed radiometer system, a method for retrieving the temperature profile within the cooled head, and an estimation of the precision of the measurement of deep brain temperature using the technique. A five-frequency-band radiometer with a contact-type antenna operating within the range 1-4 GHz is proposed to obtain brightness temperatures corresponding to temperature profiles predicted by a realistic thermal model of the cooled baby head. The problems of retrieving the temperature profile from this set of brightness temperatures, and the estimation of its precision, are solved using a combination of model fitting and Monte Carlo techniques. The results of this paper show that the proposed technique is feasible, that it is expected to provide a good estimate of the temperature profile within the cooled baby-head, and that the estimated precision (2/spl sigma/) of the temperature measured in the deep brain structures is better than 0.8 K, depending upon the estimation procedure used.

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