Abstracts

A Predictive-Adaptive, Multipoint Feedback Controller for Local Heat Therapy of Solid Tumors

C.F. Babbs, V.A. Vaguine and J.T. Jones. "A Predictive-Adaptive, Multipoint Feedback Controller for Local Heat Therapy of Solid Tumors." 1986 Transactions on Microwave Theory and Techniques 34.5 (May 1986 [T-MTT] (Special Issue on Phased Arrays for Hyperthermia Treatment of Cancer)): 604-611.

Uniform heating of tumor tissue to therapeutic temperatures without damaging surrounding normal tissue is required for optimal local heat therapy of cancer. This paper describes an algorithm for on-line computer control that will allow the therapist to minimize the standard deviation of measured intratumoral temperatures. The method is applicable to systems incorporating multiple surface and/or interstitial applicators delivering microwave, radiofrequency, or ultrasonic power and operating under control of a small computer. The essential element is a novel predictive-adaptive control algorithm that infers relevant thermal parameters from the responses of multiple temperature sensors as each of the power applicators is briefly turned off. Applied power and effective perfusion are estimated from transient slope changes of the temperature-time curves for each sensor. By substituting these values into a system of linear equations derived from the bio-heat transfer equation, the small computer can calculate the optimal allocation of power among the various applicators ("knob settings") to generate most uniform intratumoral temperature distribution with the desired mean, or minimum, tumor temperature.

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