Microwave Surfing

Battling Cancer: The Latest on Microwave Hyperthermia

■ **Rajeev Bansal, Associate Editor**

Hyperthermia is a procedure for treating cancer in which the tissue temperatures in the tumor are raised to the range of 42–45 °C [1]. Microwave hyperthermia was introduced several decades ago (see, for example, Paglione's U.S. patent [2] and the references cited therein). It has been used generally in combination with chemotherapy and/or radiotherapy because hyperthermia enhances the tumor's response to radio/chemotherapy. A recent example of experimental research on microwave hyperthermia is the work by Maccarini et al. [3], presented in the technical session "Biological Effects and Medical Applications" at IMS 2005. However, as Maccarini et al. [3] note,

> Microwave hyperthermia…survived mostly as academic research, because of the difficulties involved with commercially available heating equipment and clinicians' skepticism.

This treatment modality has seen more clinical usage in Europe and Asia [4], [5]. In the United States, microwave hyper-

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thermia in conjunction with radiation has received approval from the Food and Drug Administration (FDA), but [4] "few doctors are trained to use it." The publication [6] of the results of a new clinical trial may help change the U.S. scene.

The latest U.S. clinical study was carried out at Duke University by a team led by Dr. Ellen Jones. The team felt that earlier hyperthermia studies had generally lacked "rigorous thermal dose prescription and administration." In its clinical trial, the Duke team used

the number of cumulative equivalent minutes exceeded by 90% of monitored points within the tumor (CEM 43 °C T_{90}) as a measure of thermal dose.

The trial involved 109 patients with superficial ($\leq$ 3 cm depth) "heatable" tumors. Most of the patients were women with breast cancer that had recurred in the chest wall following surgery.

Based on prior preclinical as well as clinical data, the investigators' estimated that the minimum effective thermal dose was 10 CEM 43 °C T_{90}. The hyperthermia plan involved twice-a-week sessions of 1–2 hr duration for a maximum of ten treatments. It was delivered using externally located microwave spiral strip applicators operating at 433 MHz. Fiberoptic thermometers were used to monitor the temperature distribution in the tumor. The hyperthermia was combined with radiotherapy. It was a randomized trial, with some patients receiving only radiotherapy while others received the combination of hyperthermia and radiotherapy.

The dual therapy was found to be completely effective in destroying the tumor in 66% of the patients receiving radiotherapy and hyperthermia, while the success rate was only 42% for those receiving radiotherapy by itself. Patients who had received radiotherapy previously had the greatest incremental gain in complete response: 68% for the dual-therapy cases versus only 24% for those receiving no hyperthermia.
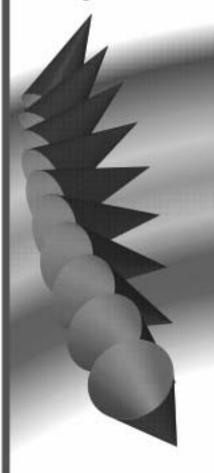
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Overall, the dual therapy did not extend survival for the patients, "primarily because so many patients had metastases elsewhere in the body." However, by controlling the tumor locally, the combined therapy was critical to enhancing the patient's quality of life. It also provided a strategy for getting more mileage out of a modest dose of radiation for previously treated patients, who cannot tolerate a full dose [6].

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