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Heat Delivery Session: Summary of Discussion

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Discussion of interstitial and intracavitary methods of producing hyperthermia concerned differences in the distribution of power density in tissues produced by microwave antennae, localized current fields, and thermoseeds. J. W. Strohbehn emphasized that there are also differences arising from considerations of equipment cost and complexity, as well as the density of energy sources that is required in tissue. It is premature to conclude that one of these approaches is clearly advantageous to the others.

Several discussants raised questions about F. A. Gibbs' comparison of thermometric and patient tolerance end points achieved with magnetic induction *versus* the annular phased array system. The possibility of bias resulting from the order in which the 2 methods were used seemed slight in view of the close reproducibility of temperature distributions from day to day achieved in a given patient with each device. F. K. Storm argued that systematic differences could result from differences in thermometric approaches, but Dr. Gibbs pointed out that the same catheters were used for temperature monitoring with each device and that the mean duration of treatment with both devices was similar.

The potential for injury with regional hyperthermia devices was recognized by many discussants to be significant if devices were used without understanding of physical characteristics of the device, measurement of temperatures, and attention to patient discomforts. Regional hyperthermia, particularly with microwave devices producing significant power deposition in deep sites, was felt at this time to be unsafe to administer to patients under general anesthesia.

In view of increasing evidence that treatment efficacy with hyperthermia is related to minimum intratumoral temperature and in view of the difficulty in achieving and measuring such minimum temperatures near 42° with external devices, the use of whole-body hyperthermia appeared to several discussants to have advantages over local and regional hyperthermia. This issue was to be considered further in the session on whole-body hyperthermia.

A number of discussions invariably led to consideration of what end points are appropriate for assessing treatment efficacy. Complete clinical response or disappearance of a treated tumor does not necessarily correlate with complete histological clearing, as M. A. Bagshaw emphasized. M. W. Dewhirst pointed out that the histological type of tumor does not predict complete response, but it does correlate with duration of response in his animal studies. In few human studies has duration of response been analyzed. Attaining a local complete response in a patient who subsequently succumbs to metastatic disease was of questionable value, in Dr. Bagshaw's opinion. J. R. Oleson emphasized that our ability to improve local control rates of bulky tumors could be particularly important in curing patients when more effective systemic adjuvant agents are available but, in the meantime, there is much to be done to improve local treatment efficacy. In performing clinical trials, it is also important to be aware of what can be achieved with optimized conventional therapy in given disease sites. Interstitial radiation, for instance, currently yields high control rates in some locally advanced diseases that thus would be inappropriate to consider for combined hyperthermia and radiation.

Other limitations exist in assessing efficacy with regional treatment of large tumor masses. The difficulty in sampling temperatures along more than one or 2 directions yields uncertainty in knowing the extent to which desired temperatures are achieved. The lack of volume reduction of bulky tumors, moreover, does not rule out the possibility that there has been significant cytotoxicity within the tumor.

Finally, consideration of theoretical and clinical aspects of local and regional hyperthermia approaches leads one to conclude that temperature distributions achieved clinically are never better with particular devices than would have been predicted theoretically. The theoretical limitations of devices thus must be taken seriously. In the case of most regional hyperthermia approaches being tested currently, broad or unfocused specific absorption rate distributions rely upon lower perfusion in tumors than in normal tissues to achieve advantageous temperature gradients. Such hypoperfusion may not always be present, so that there is a compelling reason to continue development of devices for regional hyperthermia, producing at least a partially focused and steerable specific absorption rate distribution.

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