What are the trends in local hyperthermia?

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Introduction

Hyperthermia was one of the very first medical approaches. It was based on various religions and had deep philosophical roots in most of the ancient cultures. The discovery of electromagnetism gave new hopes for oncological applications a century ago, however up to now it suffers from lack of wide acceptance.

Medical challenges

The main problematic points of the extended applications are connected with the control of the process, the adequate dose and protocol of the method and the reproducibility of the results. Hyperthermia in oncology has similar status that other medicaments, the difference between the medicine and poison is only the dose. The other medical challenge is the systemic, non-local effect of the malignancy, which is curatively approached by a local method. This is of course a (apparent) contradiction, which has to be solved for further developments.

Biological challenges

Hyperthermia struggles the dose problem above, and sometimes it hinders the biological factors. However, the applied heating has definite consequences: the physiologic control of the human body tries to compensate the active deviation from the homeostatic equilibrium. The compensation is the higher blood-flow in the heated volume, which delivers nutrients (mainly glucose) to the tumor as well as increases the risk of metastases.

Technical challenges

There are numerous electromagnetic hyperthermia methods applied. These are distinguished by the kind of the fields, frequencies, heated volume, and conjunction with other methods, etc. The main problem with the various technical solutions is the loss of the basic control over the processes in depth of the body. The methods became increasingly sophisticated to keep the deep-heating controlled.

Answers on the challenges

A proper technical and physiological solution is necessary to be harmonized with the overall and local feedbacks of the complex living system. Clues for the success of the proper hyperthermia treatment are: (1) accurately select the tumor; (2) do not excite the homeostatic correction feedbacks (like blood-flow); (3) select properly the malignant cells; (4) use effective cell-killing for the malignant cells; (4) act on innate and adaptive immune system completing the job. The solution of making selected concentration of the electromagnetic energy on the sensitive points of malignant cells is the nanoscopic heating. This method is popularly called oncothermia. Solving the non-locality problem of the malignancy is in the center of the nowadays research. Oncothermia is devoted to solve this point, having multiple laboratory and clinical results providing answer. The clue is the immune supportive treatment, which is realized in abscopal (bystander) effect. Synergy with the well-known systemic approaches like traditional Chinese medicine (TCM) is naturally offered, and the results on this line are very promising.

Conclusion

Oncothermia is a selective and effective method. It is a vivid way solving the old-problems in hyperthermic oncology: it is a controlled, reproducible and reliable treatment. Its abscopal effect and wide synergy possibilities with TCM opens a new renewal of hyperthermic oncology.