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Personalization of oncothermia

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Objective: Dosing of oncothermia is based on the energy delivery to the targeted tumor [1]. This energy is well focused on cellular level [2], and makes the dose of energy optimal for cell destruction [3]. The personal feedback of the patient is the important control of the process; the patient became the primary sensor of the treatment protocol. This gives good safety records and low toxicity and side effects for the patients, however the objective dose is not equal for them. We know it well, that the dose is an important factor, the too low is ineffective, the too high is toxic. Our objective is investigating the personalized feedback in point of view of the objectivity of the dose.

Discussion: The objectivity of the treatment is definitely depends on the radiofrequency current and its gained voltage on the given impedance on the tumor. This current is well regulated by the skin-conductance and by the connected physiological changes. The inconvenient feeling of RF-heating defines a pain-limit, which depends on many objective and individual factors. A good approach is regarding the nerve-cell sensitivity objective (the cellular processes are well unified), and regarding the personal differences as influence of physiological factors. The main factor for heat-sensitivity is the blood-perfusion and blood-flow in the subcutaneous layers where the heat-sensing nerves are located. The high blood-flow is an effective heat-exchanger, cools the given volume, and the nerves tolerate higher energy-flow through the layer. The high blood cooling is not only the facility to have higher energy-flow, but also getting more current through the volume. The higher current density excites the nerve-sensing, and the feeling again an overheating, requests down-regulation. In the case of low blood-perfusion the current is small, so the nerves can tolerate more intensities than anyway. The crucial point is the surface heat-regulation, which has to be carefully done by the electrode systems. When the surface temperature kept constant, the nerves mainly regulate the current density, which is the clue of the objective regulation. A detailed mathematical model is worked out for this regulation mechanism, and applied in oncothermia treatment. Furthermore the step-up heating is important not only avoid the inconveniences, but regulate the adaptation mechanisms. Healthy cells can be adapted to the electric/heat-stress, while this adaptation is much less in the malignant lesions. The step-up heating supports the physiological selection and makes the contrast of the reaction definite.
Other factor is connected to the psychological interaction with the treatment process also. In any protocols, when the temperature is described as a dose, when the required temperature can not be achieved than of course it is forced by the power, so the incident energy is not limited in this case. Oppositely, if the patients can not tolerate the prescribed power (and required temperature), than a lower one is applied in their cases. The pain in the body depth is independent from the temperature sensing nerves, the pain there has other mechanisms, which are not part of the prevention of damage (like the temperature sensing), but sensing the actual damage itself. Consequently blocking the surface heat sensors is a high risk factor, which is never made in oncothermia therapies.

Conclusion: Oncothermia with its surface stabilized sensing (patented action) uses the personal sensing in objectivity of the actual energy-dose. The synergy of the technical and psychological regulations makes objective dose control for oncothermia processes, keeping the energy dose in the curative range.

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