Magnetic Fluid Hyperthermia (MFH): Description and rationale of a new option in clinical hyperthermia

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Magnetic Fluid Hyperthermia, which can be controlled particularly well[1], involves the local deposition of tumor cell specific iron oxide nanoparticles and an external AC magnetic field applicator system. The method falls under the regional hyperthermia category as regions of the body can be selected freely to be heated even for tumors that are positioned deeper inside. Only the nanoferrite particles are easily applied interstitially for minimal invasive application. MFH is based on a defined transfer of power onto magnetic nanoparticles in an alternate magnetic field that is determined by the type of particles, frequency and magnetic field strength and which results in local generation of heat. Depending on the equilibrium temperature set in the tumor tissue, this heat may either destroy the tumor cells directly (thermoablation) or result in a synergic reinforcement of radiation efficacy (hyperthermia).

The survival benefit of a combined thermoradiotherapy has been shown for glioblastomas in a randomized phase II/III study by another research team in the U.S.[2] a few years ago. However, this combination did not make a clinical breakthrough due to the extremely expensive, complicated and high-risk method of conventional interstitial hyperthermia techniques. Since hyperthermia proved clinical effectivity with glioblastomas, the technical bottleneck of tumor specific heating inside the brain can be solved by magnetic fluid hyperthermia, if a homogeneous particle load of the target volume is achieved.

Here we present the new clinical MFH therapy unit MFH®-300F, the concept of MFH stereotactic brain tumor thermoradiotherapy and new survival data with glioblastomas of the rat.

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[1] Jordan et al., Int. J. Hyperthermia 13 (6), 587-605, 1997
[2] Sneed et al., Int. J. Radiat. Oncol. Phys. 40 (2), 287-295, 1998