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Hippocampus avoidance whole brain radiation therapy: A practical IMRT planning and delivery approach to RTOG 0933

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The goal of this work was to develop a more practical technique to meet the requirements of the RTOG 0933 protocol for sparing the hippocampus while irradiating the whole brain. Whole brain radiation therapy (WBRT) has been linked to decrease in neurocognitive function (NCF) and increase in memory loss leading to lower quality of life for patients. Hippocampus avoidance WBRT (HA-WBRT) may help to mitigate these issues by delaying the decline in NCF. RTOG 0933 is a phase II clinical trial aimed at HA-WBRT for patients with metastatic brain lesions. Published results from this study showed significant benefit in preserving short term memory function for these patients. While the trial allows several methods of treatment, including tomotherapy, volumetric arc therapy and linac-based IMRT, treatment at many cancer centers is limited to linac-based step-and-shoot IMRT. The linac-based method suggested by RTOG involves nine gantry angles on a number of different planes. Our goal was to find a more practical solution for the planning and delivery of HA-WBRT according to the RTOG 0933 protocol. We were able to achieve our goal by developing a technique that requires only seven gantry angles and no couch movements. All of our plans met the protocol requirements and were accepted into the study. The method developed in our center is a practical technique for HA-WBRT. Our process gave reproducible results in the patients we accrued to RTOG 0933 and should allow many more centers to be able to deliver HA-WBRT.

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Magnetic nanoparticle hyperthermia for deep sitting cancer therapy

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Magnetic nano-particle hyperthermia (MNPH) is minimally invasive thermal technique for cancer therapy. One of main characteristics of MNPs for clinical hyperthermia is a high specific absorption rate (SAR), which depends on the applied magnetic field frequency, strength and MNP properties. During MNPH therapy a coil produces alternating electric and magnetic fields. The alternating magnetic field (AMF) penetrates inside tissue and activates MNPs in cancerous tissues, where else the alternating electric field produce undesirable eddy currents within normal tissue. Since, the AMF from a coil decays rapidly (as 1/R2); therefore, to use magnetic hyperthermia for deep tumors, such as pancreatic, prostate, rectum and etc. cancers, a high-magnitude transmitter current is required in the coil. High transmitter currents also produce high electric fields E and eddy currents J within normal tissue that cause non-specific heating (J.E), which limits the applicability of MNP hyperthermia for deep sitting cancers. To overcome this problem, recently we have develop next generation Dartmouth MNP, with high SAR at low AMF strength, and a new device for guiding and delivering transmitted magnetic fields to deep tumors and for minimizing undesirable eddy currents heating in normal tissues. In this presentation, first the system's AMF delivery and focusing performance will be described and illustrated using both modelled and measured data, then temperature distributions in a conducting phantom with and without the flexible magnetic device will be shown, and finally, applicability of the device for clinically MNPH therapy will be demonstrated in combination with the next generation MNP.

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