MTR-20. INCREASING TUMOR TREATING FIELDS (TTFIELDS) EFFICACY IN GBM PATIENTS THROUGH OPTIMIZATION OF TRANSDUCER ARRAY CONFIGURATION
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BACKGROUND: In 2011 Tumor Treating Fields (TTFields) were approved by the US FDA to treat recurrent glioblastoma multiforme (GBM). Recently the EF-14 Phase III clinical trial of TTFields in combination with temozolomide in patients with newly diagnosed GBM was terminated due to early success. TTFields are low-intensity (1-3 V/cm) alternating electric fields of intermediate frequencies (100-300 kHz) applied noninvasively via transducer arrays placed on the scalp. The magnitude and direction of the electric field in the tumor are crucial in determining treatment efficacy and maximizing TTFields’s anti-mitotic effect. METHODS: A realistic human head model was developed by segmenting MRIs into different tissue types. Virtual cystic tumors of different size and shape were placed in the brain parenchyma at different locations. The model of the commercial device used for TTFields delivery possessed an accurate current configuration and placement of the transducer arrays. The electric field was calculated using the finite element method with dielectric properties specific to 200 kHz for different tissues. RESULTS: Although the electric field distribution is highly non-uniform within the brain, the average field strength within the tumor shell exceeds 1 V/cm in all tumors for all array layouts, which is sufficiently high to inhibit cell proliferation. Comparing different array configurations shows that the induced field strength at the tumor location can always be optimized, leading to increases in average field strength of up to 184%. For optimized layouts the average field strength values can exceed 2 V/cm within the active tumor shell. CONCLUSIONS: The results of this modeling study suggest that personalized treatment planning is beneficial for optimal TTFields delivery. Adapting array layouts to individual tumor locations increases electric field strength and is predicted to improve treatment efficacy. Differences in the field distribution might also explain some of the observed variability in response among GBM patients.