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ABSTRACT SUBMISSION

Title: Electric fields for the treatment of Glioblastomas: a Modeling Study

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Abstract

Oscillating electric fields are being investigated as an adjunct and even an alternative to chemotherapy in the treatment of glioblastoma multiforme. According to in vitro studies, an electric field strength greater than 1 V/cm is necessary to achieve inhibition of tumor growth. Here we used a realistic head model constructed from MRI data to calculate the electric field distribution in the brain during the application of tumor treating fields (TTF).

A realistically shaped head model was created from MRIs with a voxel size of 1x1x1 mm³. Images were segmented into five different tissue types: scalp, skull, cerebrospinal fluid (CSF), gray matter (GM), and white matter (WM). The electrode arrays and the current intensity used in both models mimicked as closely as possible a commercial device specifically designed for the treatment of tumors (www.novocure.com).

The electric field was calculated for two electrode configurations using the finite element method (FEM). In both cases, the magnitude of the electric field exceeded 1 V/cm over large areas of the brain. The magnitude of the electric field is higher in the WM because its impedance is higher than that of GM. The low impedance of the CSF in the ventricles also affects the electric field in the nearby brain tissue.

These calculations indicate that the electric field magnitude in some parts of the brain may be sufficiently high to arrest cell proliferation. However, the electric field is not uniform as it is affected by the distribution of tissue types, the location and orientation of interfaces between them, and their individual electrical properties.

Patient specific FEM models based upon MRI data could provide a means to estimate the electric field in the tumor and to optimize its delivery. This new tool could be used in treatment planning, and for understanding outcomes of TTF therapy.

Permission Yes

Prior publication No

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Registration Confirm

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Contact us if you have a problem or wish to withdraw a submission: jan@soc-neuro-onc.org