INNV-11

Delivery of TTFields to the infratentorial brain using HFE arrays

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Introduction

- Tumor Treating Fields (TTFields) is a noninvasive locoregional treatment delivered to the tumor site via two pairs of skin-placed arrays (**Figure 1**)[1–7]
- The electric fields physically disrupt cancer cell viability through a multimodal mechanism that includes antimitotic and antitumor immune effects[1–4]

Figure 1. NovoTTF-100A system for use in glioblastoma[5–7]

- TTFields therapy is US Food and Drug Administration-approved and Conformité Européenne (CE)-marked for glioblastoma (World Health Organization grade 4 glioma in Europe) based on results from the randomized, controlled, pivotal phase 3 EF-14 (NCT00916409) and EF-11 (NCT00379470) studies[5–7]
- To increase patient comfort, Novocure developed HFE arrays that are thinner and lighter than INE arrays; these thinner arrays are CE marked in Europe[8]
- While clinically approved array layouts for GBM target supratentorial tumors, distribution of TTFields depends on the arrays' locations and dedicated layouts are needed to target infratentorial tumors[9]

Study rationale

- To evaluate innovative HFE array layouts for TTFields delivery to infratentorial tumors at therapeutic intensities (~1 V/cm)

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Author disclosures
Oshrit Ze'evi, Ariel Naveh, Doron Manzur, and Nadav Shapira are employees of Novocure and may hold stock.

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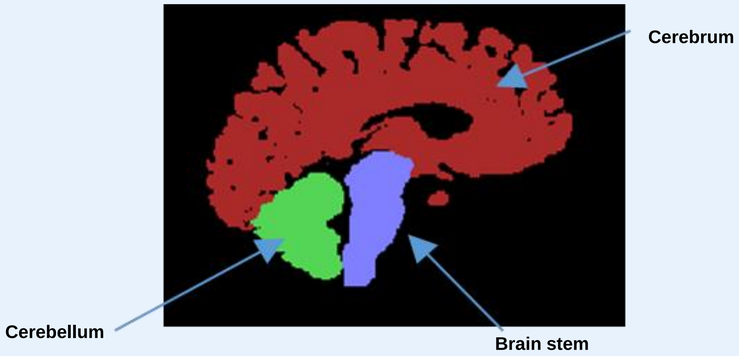
Methods

- Delivery of TTFields was simulated using Sim4Life v6.2 in a male computational model. Thirty-two layouts of HFE arrays were placed on the model's scalp, neck, and scapulae, including a standard array layout for a cerebral tumor
- Local average field intensity (LAFI) and local minimum power density (LMiPD) were calculated in the cerebrum, cerebellum and brainstem (**Figure 2**)

Figure 2. Regions of interest



Results

- Four layout patterns were applied to each of the three regions of interest (ROIs) (**Figure 3**)
- Standard cerebral layout provided differing LAFI (**Table 1**) and LMiPD (**Table 2**) to the cerebrum, cerebellum and brainstem
- Layouts with arrays on the scapulae paired in cross configuration with arrays on the temples or forehead provided higher LAFI and LMiPD to the cerebellum and brainstem; LAFI and LMiPD in the cerebrum were above therapeutic intensities (**Table 1 and 2**)

Conclusions

- **Compared to the standard cerebral layout, placing one array (for each pair) on the scapula increases LAFI and LMiPD in both the cerebellum and brain stem; moving the corresponding upper arrays towards the back of the head increases the field delivered to the cerebellum**
- **This simulation-based study suggests feasibility of delivering therapeutic TTFields intensities to infratentorial tumors using dedicated HFE array layouts**

Figure 3. Layout of HFE arrays: A, 1, 2 and 3

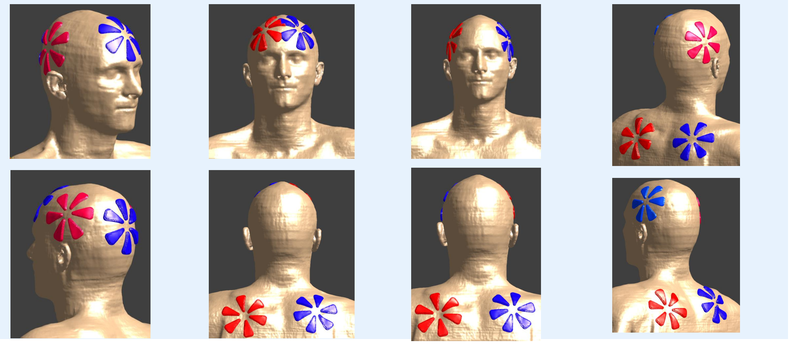


Table 1. Local average field intensity (V/cm)

ROI	Standard cerebral layout	Cross front shoulder	Cross ear–eye shoulder	Cross above–ear shoulder
Cerebrum	2.47	2.17	1.87	2.00
Cerebellum	1.50	1.64	1.67	2.13
Brainstem	1.10	1.89	1.74	1.80

Table 2. Local minimum power density (mW/cm^3)

ROI	Standard cerebral layout	Cross front shoulder	Cross ear–eye shoulder	Cross above–ear shoulder
Cerebrum	2.22	2.20	1.05	1.16
Cerebellum	1.34	2.09	1.77	2.26
Brainstem	0.64	2.89	2.28	2.41

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