Marco Timmer[1], Roland Goldbrunner[1]. [1] *University Hospital Cologne, Cologne, Germany;* [2] *University of Cologne, Cologne, Germany*

Oral e-Poster Presentations - Booth 2: Neuro-Oncology C (Imaging&Monitoring), September 27, 2023, 1:00 PM - 2:30 PM

Background: For brain tumour surgery, the need of maximized resection has to be balanced against the risk of functional damage. Lesion to important white matter connections is critical with regard to permanent deficits of sensorimotor and communication deficits. We here present the clinical experience of using multi-task fMRI-informed tractography to plan the resection of brain tumours adjacent to the sensorimotor, language or attention network.

Methods: A consecutive series of 25 patients with intrinsic brain tumours in eloquent location were investigated preoperatively by 3T fMRI and diffusion imaging (DTI). Depending on the tumour location, patients underwent an alternating movement task, and/or two language tasks: overt picture naming (PN) and forced choice (i.e., selection of a semantically related object) via left-handed button press based on the auditive presentation of a sentence. The BOLD activations were analysed in SPM 12 to calculate the laterality indices whenever clinically relevant, and to define the starting/ending regions of interest (ROIs) for DTI-based tractography using FSL and MRTrix.

Results: The exams were well tolerated and could be performed adequately by all patients. The results pointed towards a relatively robust identification of language laterality using the combined clusters of the inferior frontal gyrus (IFG) and the angular gyrus (ANG) based on the forced choice (semantic decision) task. Moreover, we observed an overall excellent agreement between our preoperative results and the intraoperative findings during awake surgery, using cortical and subcortical direct electrical stimulation.

Conclusions: Based on our preliminary experience, multi-task fMRI-informed tractography could represent a powerful tool to optimize surgical decision making and intraoperative guidance, even in cases where the complexity of the function at risk pushes towards the limits of intraoperative monitoring. The affiliation of structure to function is particularly helpful to enable a dynamic adjustment of language and cognition tasks during awake surgery.

956

BRAIN AND SPINE 3 (2023) 101794 102168

ULTRA-SHORT TRAIN TMS FOR MORE SPECIFIC MAPPING OF CORTICAL LANGUAGE AREAS

Charlotte Nettekoven[1,2], Julia Pieczewski[1,2], Kristina Jonas[2], Volker Neuschmelting[1,2], Christian Grefkes[1,2,3], Roland Goldbrunner[1,2], Carolin Weiß Lucas[1,2]. [1] *University Hospital Cologne, Cologne, Germany;* [2] *University of Cologne, Cologne, Germany;* [3] *University Hospital Frankfurt, Frankfurt, Germany*

Oral e-Poster Presentations - Booth 2: Neuro-Oncology C (Imaging&Monitoring), September 27, 2023, 1:00 PM - 2:30 PM

Background: Repetitive TMS (rTMS) can be used to non-invasively map cortical language areas. Commonly, frequencies of 5-10 Hz are used to induce speech errors. We could recently show that frequencies of 30 and 50 Hz are advantageous to achieve higher reliability. However, high-frequent rTMS applied over perisylvian regions still suffer from limited tolerability. Using short-train or paired-pulse TMS (pp-TMS) might offer a good alternative to rTMS to interfere with speech production. In this study, we, therefore, compared 30 Hz rTMS to pp-TMS aiming at improved language mapping.

Methods: 13 healthy, right-handed subjects (f=6, 25-41 years) were investigated using two different rTMS protocols: (i) 30 Hz rTMS and (ii) pp-TMS. TMS protocols were applied in a pseudo-randomized order during a picture naming task (picture-to-trigger interval: 0 ms) over cortical language areas. In a subsequent study, we compared pp-TMS also to short trains of three TMS pulses and repetitive paired pulse TMS. Language errors were post-hoc analysed by two independent raters and were assigned to eight different error categories. The level of pain was assessed on a subjective 0-10 numeric rating scale (NRS). Moreover, language error distribution was analysed using a cortical parcellation system.

Results: 30 Hz rTMS evoked a significantly higher number of errors than the pp-protocol, i.e., 18 $\pm$ 12 % vs. 10 $\pm$ 7 % ($p<0.05$). However, pp-TMS was significantly better tolerated with a mean NRS of 2.3 $\pm$ 1.6 vs. 3.4 $\pm$ 1.5 ($p<0.05$, FDR-corrected). Of note, pp-TMS could induce a higher number of anomias (15 $\pm$ 15 %) than repetitive TMS protocols (4 $\pm$ 7 %; $p<0.1$, FDR-corrected), but less dysarthria. The cortical distribution of errors differed between the two protocols. The results of train-of-three TMS were similar to the pp-TMS protocol.

Conclusions: Due to its better tolerability, pp-TMS might offer the possibility to stimulate regions which are particularly prone to direct facial / trigeminal nerve stimulation, e.g., the inferior frontal gyrus. Moreover, pp-TMS seems advantageous for mapping patients who are comparatively susceptible to rTMS side effects and with regard to safety in general.

964

BRAIN AND SPINE 3 (2023) 101794 102169

SURGICAL ACCESS THROUGH S1 FOR GLIOMA RESECTION: INTERPRETING M1 MOTOR RESPONSES WHILE STIMULATING THE POSTERIOR PORTION OF THE CST.

Lorenzo Gabriel Gay[1], Luca Vigano[3], Marco Rossi[2], Marco Conti Nibali[1], Tommaso Sciortino[1], Marta Lampert[1], Vincenzo Callipo[1], Gabriella Cerri[3], Lorenzo Bello[2]. [1] *Neurosurgical Oncology Unit, IRCCS Ospedale Galeazzi Sant'ambrogio, Milano, Italy;* [2] *Neurosurgical Oncology Unit, Dept. of Oncology and Hemato-oncology, Università degli Studi di Milano, Milano, Italy;* [3] *Laboratory of Motor Control, Dept. of Medical Biotechnology and Traslational Medicine, Università degli Studi di Milano, Milano, Italia*

Oral e-Poster Presentations - Booth 2: Neuro-Oncology C (Imaging&Monitoring), September 27, 2023, 1:00 PM - 2:30 PM

Background: Intraoperative MEPs mapping with HFs represents the most efficient tool to identify and preserve the CST during surgery of tumors infiltrating M1. Regarding S1, few data are available on motor responses at the cortico-subcortical level.

Methods: Patients harboring gliomas extending to S1, surgically treated with a cortical access through S1, were analyzed. CST was continuously monitored throughout the procedure by a 4-to-6-contact cortical strip over the hand-knob region of M1 (To5). Motor mapping was performed with HFs, combining the 5-shocks-mode (HF-To5) and the bistim-mode (HF-To2), at cortical and subcortical level. Progressing through S1, at each site eliciting MEPs the sMT was obtained with HF-To5 and HF-To2. All positive sites were registered with the neuronavigation system. In a subset of 5 patients with HARDI-optimized-acquisitions, whole brain DTI and spherical deconvolution were computed. Local cortico-cortical connections and the CSTs were dissected with a region-of-interest approach. EOR was calculated and MRC-score assessed 5-days and 1-month post-op.

Results: Eleven patients were analyzed. HFs cortically discriminated M1 posterior area from M1 anterior area and S1. When HFs was applied subcortically to S1, MEPs were evoked with similar sMTs to those obtained by stimulation of CST posterior portion. Anatomical reconstructions and DTI analysis demonstrated the overlap between these sites and S1-M1 U-shaped fibers at the level of the hand-knob region. Progressing subcortically, a higher current intensity was required to elicit reliable MEPs; these sites were localized below the S1-M1 U-shaped fibers. Tractographic dissection confirmed a distance between these sites and the CST $\leq$ 5mm. No permanent motor deficits were reported 1-month post-op and GTR was achieved in 72.7% of the cases.

Conclusions: U-shaped fibers connecting S1 to M1 might mediate low-threshold HFs responses when stimulation is delivered in white matter below S1. Surgical access through S1 with MEPs mapping with HFs is safe and feasible.

970

BRAIN AND SPINE 3 (2023) 101794 102170

LANGUAGE HEMISPHERIC DOMINANCE IN BRAIN TUMOUR PATIENTS INFORMED BY TRACTOMETRY

Maura Luisa Becker[1], Ricardo Loução[1], Ms. Sophia Kochs[1], Ms. Carla Tampier[1], Christoph Kabbasch[2], Roland Goldbrunner[1], Carolin Weiß Lucas[1]. [1] *Centre of Neurosurgery, University Hospital Cologne, Cologne, Germany;* [2] *Institute for Diagnostic and Interventional Radiology, University Hospital Cologne, Cologne, Germany*

Oral e-Poster Presentations - Booth 2: Neuro-Oncology C (Imaging&Monitoring), September 27, 2023, 1:00 PM - 2:30 PM

Background: Identifying language hemispheric dominance prior to surgery is of great interest for neurooncological and epilepsy surgery. Due to the invasive nature of the Wada test, efforts have been made do establish reliable non-invasive alternatives, primarily using functional MRI. Recently, it was shown that the white matter tracts also reflect hemispheric dominance, in particular the arcuate fascicle. In this study, we assessed to which extent tractometry of the language network, i.e., the study of microstructural characteristics along the tracts, can inform on hemispheric dominance in brain tumour patients.