Loss of subcortical language pathways correlate with surgery-related aphasia in brain tumor patients: an investigation via nTMS-based DTI fiber tracking

Chiara Negwer; Jan Kirschke; Florian Ringel MD; Bernhard Meyer MD; Sandro M. Krieg MD
Department of Neurosurgery; Klinikum rechts der Isar, Technische Universität München, Munich, Germany

Introduction

Diffusion tensor imaging fiber tracking is well established to visualize subcortical fiber tracts. Yet, a new and more standardized way is to use cortical regions mapped via (nTMS) as seed regions for DTI fiber tracking. This study investigates if preoperatively acquired nTMS language areas are useful for pre- and postoperative nTMS-based DTI FT to track language pathways and whether postoperative fiber changes correlate with clinical status.
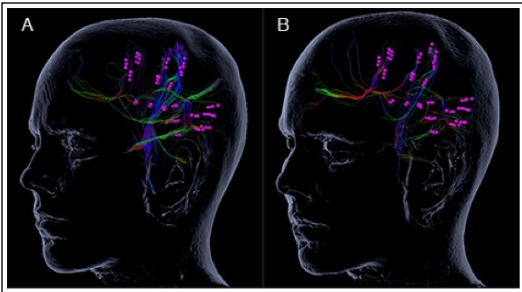

Figure 1 shows an example of preoperative nTMS-based DTI FT (A) compared to postoperative DTI FT (B) in the same patient.

Methods

nTMS-based DTI fiber tracking was performed pre- and postoperatively in 24 patients with left-hemispheric perisylvian tumors. nTMS-based DTI fiber tracking was performed and pre- and postoperative language pathways were analyzed individually (corticonuclear tract, arcuate fascicle (AF), uncinate fascicle, superior longitudinal fascicle inferior, longitudinal fascicle, arcuate fibers, commissural fibers, corticothalamic fibers, and frontooccipital fascicle). Transient aphasia was defined as up to three months. Since postoperative aphasia does not allow nTMS language mapping, we used preoperative nTMS data throughout.

Results

The transient aphasia group had a significant reduction in fiber count due to surgery (pre: 489 ± 339; post: 156 ± 130 fibers; p=0.027) compared to patients without deficit (pre: 337 ± 317; post: 249 ± 206 fibers; p=0.145). In the 'transient aphasia' group, the AF was lost in 60% compared to the 'no new' group where it was only 29% (p=0.124).
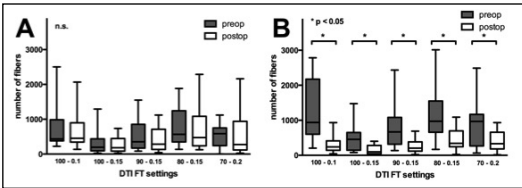

Figure 3 shows the mean percentage of lost fiber tracts (mean of all settings) after surgery compared to the preoperative state. This is shown for every individual fiber tract.
ArF=arcuate fibers, CF=commissural fibers, AF=arcuate fascicle, CNT=corticonuclear tract, CtF=corticothalamic fibers, SLF=superior longitudinal fascicle, ILF=inferior longitudinal fascicle, UF=uncinate fascicle, FoF=fronto-occipital fascicle
ND=no deficit, TD transient deficit.
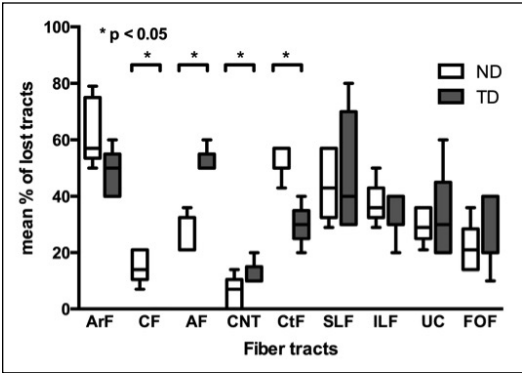
Learning Objectives

By the conclusion of this session, participants should be able to recognize that nTMS-based DTI FT of language tracts corresponds with the clinical status

Conclusions

This study proves preoperative nTMS language mapping to be useful for pre- and postoperative nTMS-based DTI fiber tracking of language pathways. Moreover, changes in pre- vs. postoperative fibers correlate with clinical status and impairment of the AF can be compensated well.