

Influence of combined fMRI and MR Tractography on operative planning of brain tumors: Initial experience in a histopathologically variable subset of tumors

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Background and Purpose: Conventional MR imaging permits sub categorization of brain tumors by location and focality; however, assessment of the relation of the tumor to eloquent cortical centres and white matter tracts is limited (1). Functional MRI (fMRI) and Diffusion tensor imaging (DTI) are promising methods for identifying eloquent cortical brain centres and white matter tracts for proper planning of treatment strategy (2, 3). In this study, we investigated the role of fMRI and DTI in assessment of brain tumors prior to therapy.

Material and Methods: Using 1.5T Philips Scanner, conventional, functional and DTI (echo-planar) MRI scans were read in a conference by two experienced radiologists in 17 patients with histopathologically variable subset of brain tumors. The decision for treatment strategy for each case was determined twice by an experienced neurosurgeon: once when providing the conventional MRI readings and images alone, and another time when providing the conventional, functional MRI and DTI images and readings.

Results: Accurate localization of eloquent cortical centres and white matter tracts as well as detailed assessment of their relation and possible affection by the brain tumor was feasible in the majority of the examined patients (Figures 1, 2). The data provided by these new techniques modified the treatment strategy in 5 out of the 17 cases in a positive way aiding in avoiding damage of eloquent brain regions and tracts.

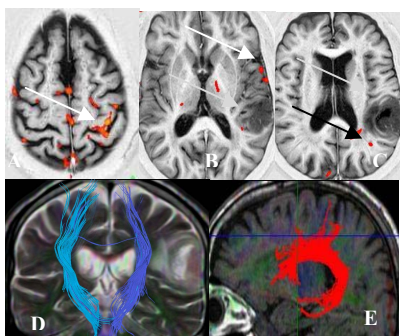


Figure 1: A 74 years old male with left parietal high grade glioma presented by convulsions.

- Axial (A) view of the motor paradigm for the right hand showing the representation of the right hand on the left side (white arrow) is more than 2 than 1 cm from the tumor.
- Axial (B and C) views of the language paradigm showing that Broca's area (white arrow) is more than 2 cm from the tumor, while the Wernick's area (black arrow) is less than 1 cm from it (grey arrow).
- Coronal view of both pyramidal tracts (D) over laid on T2WI showing medially displaced left pyramidal tract by the tumor and surrounding oedema.
- Sagittal view of the left superior longitudinal fasciculus (SLF) (E) showing no affection.

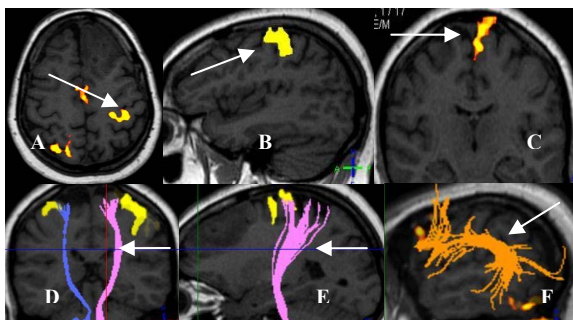


Figure 2: A 45 years old female with left frontal low grade glioma presented by convulsions.

- Axial (A) and sagittal (B) views of the motor paradigm for right hand showing the representation of the right hand on the left side (white arrow) is more than 2cm from the tumor (black arrow).
- Coronal (C) view of the motor paradigm for right foot showing the representation of the right foot on the left side (white arrow) is more than 2 cm from the tumor (not shown).
- Coronal view of both pyramidal tracts (D) and sagittal view of left pyramidal tract (E) showing medially and posteriorly displaced left pyramidal tract. (White arrow)
- Sagittal view of the left superior longitudinal fasciculus (SLF) (F) showing no affection (white arrow).

Conclusion: Compared with information provided by conventional MR imaging alone, the addition of fMRI and DTI provided essential information about the relation between eloquent cortical areas and the white matter tracts in relation to the tumor, therefore helping in pre operative planning and avoiding possible post operative neurological deficits.

References:

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