Identification of Sensorimotor Cortex by means of Functional Magnetic Resonane Imagin

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بسم الله الرحمن الرحيم

و ما توفيقي الا بالله

عليه توكلت و اليه أنيب.

صدق الله العظيم


To my family

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Abstract

***Purpose*:** blood oxygenation level dependant (BOLD) fMRI is a well known non invasive functional imaging modality. In the present study, a trial has been made to evaluate the ability of BOLD fMRI of detecting sensorimotor centers in normal control subjects as well as in neurosurgical patients having tumors in the vicinity of the central sulcus. The use of BOLD fMRI in presurgical planning has been also tested aiming to spare the patients invasive preoperative investigations as well as helping the surgeons to save as much as possible of the eloquent cortices present nearby the tumors.

Subjects and patients : in the present study 40 normal control subjects as well as 20 neurosurgical patients having tumors in the vicinity of the central sulcus have been examined by BOLD fMRI .

Results: - of the 40 normal control subjects 33 subjects demonstrated activation of the motor hand area at the precentral gyrus with concomitant activation of sensory areas in 21 of them activation of the premotor areas has been noted in 16 subjects , activation of the supplementary motor areas has been noted in 15 subjects .

- Of the 20 neurosurgical patients, 18 revealed activation of the primary motor hand area (mostly at the crown of precentral gyrus), concomitant activation of the sensory area has been noted in 6 patients. In 12 patients the primary motor area was displaced by the mass effect of the tumor. Two patients showed activation of the premotor areas and two patients showed activation of the supplementary motor areas. The displacement of the primary motor areas and decreased signal of activation is mostly evident in patients having glioma.

Conclusion: the BOLD fMRI has proved sensitive ability in detecting the eloquent cortices (sensorimotor centers) in normal control subjects as well as in neurosurgical patients having tumors at the vicinity of the central sulcus. Several subjects and two patients didn't show valuable activation of the sensorimotor cortices, the most important causes of failure to obtain sufficient activation is the motion artifacts in subjects and severe paresis in patients. Activation of premotor areas and supplementary motor areas has been shown as well in those having their motor centers activated and in those who didn't show valuable activation. This is explained by their motor imagery as well as motor inhibitory roles. Increase amount of activation in these areas have been also noted in neurosurgical patients and was attributed to reorganization of the cortical motor system

Key Words :

BOLD fMRI , motor hand area , motor cortex .

List of abbreviations

fMRI : functional magnetic resonance imaging .

BOLD : Blood oxygenation level dependant .

PCG : precentral gyrus .

SMC : supplementary motor area .

MsI : primary motor area .

MsII : secondary motor area

SmI : primary sensory area .

SmII : secondary sensory area .

SMA : supplementary motor area .

PM : premotor area .

cPM : caudal premotor area .

dPM : dorsal premotor area .

ASL: arterial spin labeling .

CBF: cerebral blood flow .

CBV: cerebral blood volume .

CMRGLc : cerebral metabolic rate of glucose .

CMRO2 : cerebral metabolic rate of oxygen .

RF : radiofrequency pulse .

FA: flip angle .

FOV: field of view .

S/N : signal to noise ratio .

GRE : gradient recalled echo .

SE :spin echo

EPI : ecchoplanar imaging .

SSEPI : single shot echoplanar imaging .

IVIM : intravoxel incoherent motion

MEG : magentoencephalography .

TMS : transcranial magnetic stimulation .

PET : positron emission tomography .

EEG : electroencephalography .

DECS : direct electrical cortical stimulation .

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