

Three-tesla functional MR language mapping: comparison with direct cortical stimulation in gliomas.

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Abstract

OBJECTIVE:

To evaluate the accuracy of functional MRI (fMRI) at 3T, as currently used in the preoperative mapping of language areas, compared with direct cortical stimulation (DCS) during awake surgery, in patients with supratentorial gliomas; and to identify clinical, histopathologic, and radiologic factors associated with fMRI/DCS discrepancies.

METHODS:

Language mapping with fMRI and DCS of 40 consecutive patients with gliomas (24 low-grade, 16 high-grade) in functional areas were retrospectively analyzed. Three block designed tasks were performed during fMRI (letter word generation, category word generation, semantic association). During awake surgery, eloquent areas were mapped using DCS, blinded to fMRI. A site-by-site comparison of the 2 techniques was performed using a cortical grid. fMRI sensitivity and specificity were calculated using DCS as the reference. Associations of clinical, histopathologic, and radiologic features (including relative cerebral blood volume [rCBV] measured with dynamic susceptibility contrast MRI) with fMRI false-positive and false-negative occurrence were assessed using hierarchical logistic regressions.

RESULTS:

Of 2,114 stimulated cortical sites, 103 were positive for language during DCS. Sensitivity and specificity of language fMRI combining the 3 tasks reached 37.1% (95% confidence interval [CI] 20.7–57.2) and 83.4% (95% CI 77.1–88.3), respectively. Astrocytoma subtype (odds ratio [OR] 2.50 [1.32–4.76]; $p = 0.007$), tumor rCBV, 1.5 (OR 2.17 [1.08–4.35]; $p = 0.03$), higher cortical rCBV (OR 2.22 [1.15–4.17]; $p = 0.02$), and distance to tumor .1 cm (OR 2.46 [1.82–3.32]; $p = 0.001$) were independently associated with fMRI false-positive occurrence.

CONCLUSIONS:

There are pitfalls in preoperative fMRI as currently used in preoperative language mapping in glioma patients, made more complicated when high-grade and hyperperfused tumors are evaluated.

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