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## Clinical fMRI: Pushing the limits

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Functional magnetic resonance imaging (fMRI) allows non-invasive assessment of human brain function in vivo by detecting blood flow differences. From a powerful research tool actively utilized in cognitive neuroscience, clinical fMRI has evolved and matured into a robust clinical tool, implemented with a wide spectrum of patients. In this study, we further push the limits of this unique tool with pediatric patients. The purpose of this study is to present the experience of a large teaching hospital centre in the utility of clinical fMRI in a pediatric cohort and in particular focusing on the typical problems, pitfalls, solutions and benefits. Twenty (20) children (5-16 years of age) underwent fMRI, over a period of 2 years, as part of the regional epilepsy pre-surgical evaluation program. fMRI was performed on a 3T Philips scanner. Some of the children additionally underwent DTI (tractography). Pediatric dedicated fMRI paradigms consisted of motor, sensorimotor, visual, auditory, memory and speech tasks. In some cases we also compared pre- and postoperative fMRI. MRI image analysis was performed using SPM12. In all cases, fMRI successfully revealed activation of the desired eloquent cortical territories. Speech and memory fMRI was challenging for some of the younger children in our cohort. Numerous cases successfully revealed evidence of neuroplasticity. fMRI can be successfully applied in children and holds significant promise for both research and clinical purposes. Using dedicated pediatric protocols and paradigms can result in a more effective and successful clinical fMRI investigation. fMRI allows more accurate assessment of cortical resection margins and can determine if surgery is best performed with the patient awake or asleep. Clinical fMRI has significant potential to replace Wada for this challenging age group. Fusion of fMRI and DTI yields further useful clinical information in relevant cases.

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