Intraoperative magnetic resonance imaging in pediatric neurosurgery: safety and utility.

Giordano M¹, Samii A², Lawesson McLean AC¹, Bertalanffy H¹, Fahlbusch R¹, Samii M¹, Di Rocco C¹.

Abstract

OBJECTIVE The use of high-field intraoperative MRI has been largely studied for the treatment of intracranial tumors in adult patients. In this study, the authors investigated the safety, advantages, and limitations of high-field iMRI for cranial neurosurgical procedures in pediatric patients, with particular attention to craniopharyngiomas and gliomas.

METHODS The authors performed 82 surgical procedures in patients under 16 years of age (range 0.8-15 years) over an 8-year period (2007-2014) using iMRI. The population was divided into 3 groups based on the condition treated: sellar region tumors (Group 1), gliomas (Group 2), and other pathological entities (Group 3). The patients' pre- and postoperative neurological status, the presence of residual tumor, the number of intraoperative scans, and complications were evaluated.

RESULTS In Group 1, gross-total resection (GTR) was performed in 22 (88%) of the procedures and subtotal resection (STR) in 3 (12%). In Group 2, GTR, STR, and partial resection (PR) were performed, respectively, in 15 (56%), 7 (26%), and 5 (18%) of the procedures. In Group 3, GTR was performed in 28 (93%) and STR in 2 (7%) of the procedures. In cases of craniopharyngioma (Group 1) and glioma (Group 2) in which a complete removal was planned, iMRI allowed localization of residual lesions and attainment of the surgical goal through further resection, respectively, in 18% and 27% of the procedures. Moreover, in gliomas the resection could be extended from partial to subtotal in 50% of the cases. In 17% of the patients in Group 3, iMRI enabled the identification and further removal of tumor remnants. There was no intra- or postoperative complication related to the use of iMRI despite special technical difficulties in smaller children.

CONCLUSIONS In this study, the use of iMRI in children proved to be safe. It was most effective in increasing the extent of tumor resection, especially in patients with low-grade gliomas and craniopharyngiomas. The most prominent disadvantage of high-field iMRI was the limitation with respect to operative positioning due to the configuration of the surgical table.

KEYWORDS: DTI = diffusion tensor imaging; GTR = gross-total resection; MPRAGE = magnetization prepared rapid acquisition gradient echo; PR = partial resection; STR = subtotal resection; craniopharyngioma; glioma; iMRI = intraoperative MRI; intraoperative magnetic resonance imaging; oncology; pediatric