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Clinical Applications of Amide Proton Transfer Magnetic Resonance Imaging: Detection of Brain Tumor Proliferative Activity

Authors : Fumihiro Imai, Shinichi Watanabe, Shingo Maeda, Haruna Imai, Hiroki Niimi

Abstract : It is important to know the growth rate of brain tumors before surgery because it influences treatment planning, including not only surgical resection strategy but also adjuvant therapy after surgery. Amide proton transfer (APT) imaging is an emerging molecular magnetic resonance imaging (MRI) technique based on chemical exchange saturation transfer without the administration of a contrast medium. The underlying assumption in APT imaging of tumors is that there is a close relationship between the proliferative activity of the tumor and mobile protein synthesis. We aimed to evaluate the diagnostic performance of APT imaging of pre-and post-treatment brain tumors. Ten patients with brain tumor underwent conventional and APT-weighted sequences on a 3.0 Tesla MRI before clinical intervention. The maximum and the minimum APT-weighted signals (APTWmax and APTWmin) in each solid tumor region were obtained and compared before and after a clinical intervention. All surgical specimens were examined for histopathological diagnosis. Eight of ten patients underwent adjuvant therapy after surgery. Histopathological diagnosis was glioma in 7 patients (WHO grade 2 in 2 patients, WHO grade 3 in 3 patients, and WHO grade 4 in 2 patients), meningioma WHO grade 1 in 2 patients, and primary lymphoma of the brain in 1 patient. High-grade gliomas showed significantly higher APTW signals than that low-grade gliomas. APTWmax in one huge parasagittal meningioma infiltrating into the skull bone was higher than that in glioma WHO grade 4. On the other hand, APTWmax in another convexity meningioma was the same as that in glioma WHO grade 3. Diagnosis of primary lymphoma of the brain was possible with APT imaging before pathological confirmation. APTW signals in residual tumors decreased dramatically within one year after adjuvant therapy in all patients. APT imaging demonstrated excellent diagnostic performance for the planning of surgery and adjuvant therapy of brain tumors.

Keywords : amides, magnetic resonance imaging, brain tumors, cell proliferation
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