Diffusion-weighted magnetic resonance imaging

- Beyond the Middle Ear: A Thorough Review of Cholesteatoma in the Nasal Cavity and Paranasal Sinuses
- High angular resolution diffusion-weighted imaging and higher order tractography of the white matter tracts in the anterior thalamic area: Insights into deep brain stimulation targeting
- Brain Microstructure Interrogation by Diffusion Tensor and Kurtosis Imaging in Progressive Supranuclear Palsy Subtypes
- Unilateral Hearing Loss as the Sole Presentation of Extensive Intracranial Epidermoid Cyst: A Case Report
- Role of Magnetic Resonance Venography in the Evaluation of Cerebral Veins and Sinuses Occlusion
- Inflammatory, White Matter, and Neurodegenerative Mechanisms in Fluid Ability Decrements in Chronic Mild-to-Moderate Traumatic Brain Injury
- Current Update on DWI-MRI and Its Radiomics in Liver Fibrosis-A Review of the Literature
- Unilateral involuntary movements of the limbs with caudate nucleus restricted diffusion on magnetic resonance imaging: A case report

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Diffusion-weighted magnetic resonance imaging (DWI or DW-MRI) is the use of specific MRI sequences as well as software that generates images from the resulting data, that uses the diffusion of water molecules to generate contrast in MR images.

It allows the mapping of the diffusion process of molecules, mainly water, in biological tissues, in vivo and non-invasively. Molecular diffusion in tissues is not free but reflects interactions with many obstacles, such as macromolecules, fibers, and membranes. Water molecule diffusion patterns can therefore reveal microscopic details about tissue architecture, either normal or in a diseased state. A special kind of DWI, diffusion tensor imaging (DTI), has been used extensively to map white matter tractography in the brain.

DWI exploits the random motion of water molecules. The extent of tissue cellularity and the presence of intact cell membrane help determine the impedance of water molecule diffusion. This impedance of water molecules diffusion can be quantitatively assessed using the apparent diffusion coefficient (ADC) value.

Indications

Diffusion-weighted magnetic resonance imaging indications.

Hyperintense lesions

Hyperintense lesions around the resection cavity on magnetic resonance diffusion-weighted imaging

(MR-DWI) frequently appear after brain tumor surgery due to the damage of surrounding brain. The putative connection between the lesion and the prognosis for patients with glioblastoma (Glioblastoma) was explored in sixty-one patients with newly diagnosed Glioblastoma. Postoperative MRI was performed within 2 weeks after the initial surgery.

The cases into two groups depending on whether DWI hyperintense lesions were observed or not [DWI(+) group and DWI(-) group]. Progression-free survival (PFS) and overall survival (OS) were compared between the two groups. Forty-two patients were identified. The various extents of hyperintense lesions around the resection cavity were observed in 28/42 (66.7 %) cases. In the DWI(+) and DWI(-) groups, median PFS was 10.0 [95 % confidence interval (CI) 8.4-11.5] and 6.7 (95 % CI 4.9-8.5) months, respectively (p = 0.042), and median OS was 18.0 (95 % CI 12.2-23.8) and 17.0 (95 % CI 15.7-18.3) months, respectively (p = 0.254). On multivariate analysis, the presence of DWI hyperintense lesion was more likely to be an independent predictor for 6-month PFS (p = 0.019; HR, 0.038; 95 % CI 0.002-0.582). Tumor recurrence appeared outside the former DWI hyperintense lesion. Hyperintense lesions surrounding the resected Glioblastoma on MR-DWI might be a favorable prognostic factor in patients with Glioblastoma [1)].

Diffusion-weighted imaging in stimulated echo acquisition mode

Diffusion-weighted imaging in stimulated echo acquisition mode.

Diffusion-weighted magnetic resonance imaging for acute ischemic stroke diagnosis

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Furuta T, Nakada M, Ueda F, Watanabe T, Arakawa Y, Higashi R, Hashimoto M, Nitta H, Hayashi Y, Hamada JI. Prognostic paradox: brain damage around the glioblastoma resection cavity. J Neurooncol. 2014 Mar 7. [Epub ahead of print] PubMed PMID: 24604751.