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Commentary

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Role of Diffusion Magnetic Resonance Imaging in Assessment of Neoplastic and Inflammatory Brain Lesions

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Introduction

A traditional magnetic resonance imaging (MRI) examination allows us to see a mass lesion and gives us information on its location, homogeneity, and signal strength, as well as the existence of perilesional edema and the degree of contrast enhancement. Differentiating between low and high-grade tumors based on MRI is still problematic in the case of brain mass lesions. The presence of necrotic and/or hemorrhagic regions, substantial vascular edema, significant enhancement, and mass effect all contribute to the heterogeneity of traditional high-grade tumors. These indications, however, are not always present. Low-grade tumors can sometimes exhibit characteristics that are seen in more aggressive tumors. Diffusion-weighted imaging (DWI) is a well-known and commonly used technology that allows for the evaluation of normal brain tissue or lesions produced by ischemia, damage, proliferation, multiple sclerosis, or abscess [1]. It is included in a standard MRI protocol and also allowing for the assessment of normal brain tissue as well as lesions caused by ischemia, damage, proliferation, multiple sclerosis, or abscess DWIs and the apparent diffusion coefficient (ADC) of mass lesions could provide extra information in the differential diagnosis of patients with brain mass lesions and the distinguishing between intracerebral necrotic tumors and other types of tumors, and other cystic lesions. Water mobility in normal brain tissue, cerebral infarction, multiple sclerosis, gliomas, and brain abscesses has been studied using MR diffusion imaging, as well as to distinguish between arachnoid cysts and epidermoid cysts and other illnesses. Because of the various therapy modalities and prognoses, preoperative distinction of brain mass lesions is critical.

Differentiating mass lesions such as tumors with a typical MRI based on parameters such as the mass lesion's signal intensity, the presence of cysts, necrotic regions, peri-tumoral edema, and the degree of contrast enhancement or lack thereof is unreliable, if not impossible [2]. Malignant mass lesions did not always enhance following contrast injection, peri-tumoral edema was not always present, and cysts and/or necrotic zones were found in both malignant and benign tumors, according to the literature and our data. As a result, it is necessary to look for new, more sophisticated imaging technologies that can aid in the differentiating of the brain mass lesions [3]. Malignant gliomas are frequently enhanced following intravenous contrast injection and show peritumoral edema on imaging examinations, but low-grade gliomas, with the exception of pilocytic astrocytoma and giant-cell astrocytoma, usually show little to no aberrant enhancement or peritumoral edema. Low-grade gliomas, with the exception of pilocytic astrocytoma and giant-cell astrocytoma, usually show little to no abnormal enhancement or peritumoral edema on imaging studies. In fact, abnormal enhancement was noted in three of eight patients with low-grade astrocytoma in our study, and peritumoral edema was noted in three of eight patients with low-grade astrocytoma.

In T2-weighted images, astrocytes have higher signal intensity than the cerebrospinal fluid, but not as high as the cerebrospinal fluid. The signal intensity of pilocytic astrocytomas is often substantially higher than that of medulloblastomas. This applies to both the cystic and solid components of astrocytomas. The histological structure of the malignancies is directly related to differences in signal intensity [4]. The signal intensity of malignant tumors with significant mitotic activity is lower than that of benign tumors with a looser shape. The solid component of a typical medulloblastom is isointense in relation to the gray matter. This is linked to a larger ratio of nuclei to cytoplasm in tumor cells, implying a decrease in free water molecules in this area. On the other hand, the observed tumor heterogeneity is the result of the creation of tiny cysts and calcifications. The extracellular space, like the cerebrospinal fluid in the brain ventricles, is characterized by relative isotropy and a relatively high diffusion coefficient [5]. Depending on the number and density of cell membranes, the intracellular space exhibits varying degrees of anisotropy. On the basis of ADC evaluation in the presented group of patients, we showed a possibility of differentiation between high grade glioma and metastasis, pilocytic astrocytomas and medulloblastomas, as well as necrotic tumors and benign cystic lesions such as abscess, epidermoid cyst, and arachnoid cyst. Dissemination weighted MR imaging additionally was utilized in the conclusion of cerebral abscesses and separation between necrotic tumors and ulcer.

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