

Summary

Diffusion magnetic resonance imaging includes : diffusion weighted imaging that shows possible areas of increased or decreased signal, reflecting restricted and facilitated diffusion, respectively, and the apparent diffusion coefficient in which the T2-weighting of the diffusion sequence is cancelled out, and produces numerical evaluation of regions of interest.

Diffusion weighted MR imaging characterized by markedly decreased imaging time and increased sensitivity to signal changes due to molecular motion. But having the disadvantages of decreased spatial resolution of the images and magnetic field inhomogeneities which is particularly prominent in anatomic regions with air-tissue interfaces, such as the base of the skull and

The widest application of diffusion-weighted imaging has been in evaluation of cerebral ischemia .

In cerebral neoplasms, ADC values have been correlated with the degree of tumor cellularity. Thus, the lowest ADC value should indicate the region of greatest cellularity which is helpful in selecting biopsy targets. DWI helps distinguish low grade gliomas (low ADC values) from cerebral infarcts (high ADC values). Tumor cellularity is inversely correlated with tumor ADC value in various grades of astrocytomas

DWI is a useful technique to distinguish areas of predominantly nonenhancing tumor (low ADC) from areas of predominantly peritumoral edema (high ADC) when the abnormality was located in the white matter aligned in the direction of the diffusion –weighted gradient.

It is suggested that mean ADC ratio of enhancing tissues (ratio between ADC of the enhancing lesion and the ADC of the areas of T2 prolongation) can be used to distinguish recurrent neoplasm from treatment-related changes.

Preoperative determination of the ADC of fourth ventricular tumors makes possible the differential diagnosis between ependymomas and medulloblastomas. ADC of ependymomas is higher than that of medulloblastomas with no overlap.

The ADC of DNET was higher than that of other WHO grade I and grade II gliomas. In addition, the ADC of DNETs was higher than that of any other glioneuronal tumors, and there was no overlapping of ADC values. The preoperative identification of DNETs and the distinction of DNETs from other gliomas have important treatment implications. During long-term follow-up, patients who had undergone surgical removal of DNETs did not manifest clinical or radiologic evidence of tumor recurrence.

DWI is useful, with few reported exceptions, in distinguishing a brain abscess from a necrotic or cystic tumor (high signal intensity on DWI and low ADC value in brain abscesses, in contrast to low signal intensity on DWI and high ADC value in the tumors).

DW imaging can distinguish the arachnoid cysts (hypointense on DWI with decreased ADC) from epidermoid tumor which the ADC has been reported to be lower than that of cerebrospinal fluid and equal to or higher than that of brain parenchyma.

DWI could be useful in the assessment of response to therapy, because the inverse relationship between ADC and cellular density

suggests that the temporal evolution from viable tumour to treatment-induced necrotic tumour may be measurable by diffusion. Early increases in ADC values during therapy are hypothesized to relate to therapy-induced cellular necrosis, whereas a drop in ADC values within the tumour compared with pre-treatment levels is thought to be an indicator of tumour regrowth. Tumour heterogeneity is a major confounding factor in assigning a single indicator to tumour response; however DWI may be able to assist in the differentiation of recurrent tumour from radiation injury. Newly enhancing lesions that arise on routine follow-up brain MRI at the site of a previously treated primary brain neoplasm present a diagnostic dilemma. Recurrent tumour and treatment-related changes typically demonstrate enhancement with gadolinium and are commonly surrounded by an area of increased T2 signal.