

Specialty area: Liver

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Highlights:

- DWI and apparent diffusion coefficient (ADC) are useful in the detection and characterization of benign and malignant hepatic lesions
- ADC measurement can be utilized in assessing treatment response to locoregional and systemic therapies
- Volumetric measurements of ADC are better predictors of overall survival compared with conventional response criteria.

Talk Title:

Diffusion-weighted imaging in body applications

Target Audience:

Abdominal radiologists, and radiologist practicing oncologic imaging

Outcome/Objectives:

Diffusion weighted MR imaging of liver has emerged as a useful MR pulse sequence for lesion detection and characterization. Participants will learn the basic principles, technique and current role of DWI of liver at 1.5 T and 3T with emphasis on lesion characterization, reproducibility of ADC, treatment response and value of ADC in assessing volumetric functional tumor burden.

Purpose:

Conventional MRI sequences are limited in the detection and characterization of liver lesions. Also, conventional criteria of tumor response assessment are limited to anatomic metrics and may not be sensitive to early cellular and molecular functional changes that occur after therapy.

Results:

In general cysts showed highest ADC values because of their mainly consist of water. Hemangiomas also tend to have high ADC values primarily because of their liquid content and large extracellular spaces. Most studies reported lower ADC values in metastatic liver lesions compared to normal liver tissue. Reduced ADC values have also been reported for hepatocellular carcinoma (HCC). These findings are thought to be the result of cellular membranes of the tumor which are impeding the mobility of water molecules. However, some authors found that metastatic liver lesions had lower ADC values than HCC while some others detected the opposite. The reason for this discrepancy may be the differences between these studies in respect to MR sequence, b values used, or tumor biology. While the ADC value for each type of hepatic neoplasm differed between studies, most articles determined that the difference between benign and malignant lesions was statistically significant and the ADC value was lower in malignant tumors.

Therapy induced increases in ADC values have been demonstrated in several studies. Conventionally, tumor response to therapy is assessed by comparing tumor size or viable tumor size (recognized as nonenhanced areas using dynamic imaging techniques) before and after

treatment. In theory, DWI would be an ideal method to monitor early treatment response because effective anticancer treatment results in tumor lysis, loss of cell membrane integrity, increased extracellular space, and, therefore, an increase in water diffusion, whereas viable tumor cells restrict the mobility of water and result in a decrease in water diffusion.

The most common loco-regional therapy of hepatic neoplasms is transarterial chemoembolization (TACE). While changes in tumor size after TACE are rare in patients with hepatic metastasis of leiomyosarcoma, neuroendocrine, islet cell, ocular melanoma and breast cancer, significant decrease in tumor enhancement and increase in tumor ADC value in the treated lesions can be observed. Several studies reported significantly increased ADC values after TACE in HCC, suggesting that DWI can be used to predict the degree of tumor necrosis HCC after TACE and to guide patient management. This results in better stratification of responders and non-responders, and prediction of patient survival.

Conclusion:

DWI shows promising potential for the detection and characterization of liver focal lesions. Combining DWI with routine MR imaging techniques as well as Magnetic Resonance Spectroscopy (MRS) can increase the accuracy of the characterization of benign and malignant lesions. In our experiences, the absolute ADC value of the lesions are less valuable for the diagnosis or prognosis assessment compare to the relative difference between neoplasm and normal hepatic tissue or the change in ADC value after therapy. ADC together with conventional imaging is a promising tool for prediction and monitoring of response to locoregional therapy in hepatic neoplasm. But it may not be the best tool for detection of recurrent HCC.

References:

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