Comparison of MRS and DWI defferentiation between high and low grade gliomas

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Key words:

Brain high grade glioma
Brain low grade glioma
Magnetic Resonance Spectroscopy
Diffusion Weighted Imaging
Apparent Diffusion coefficient

Abstract: Glioma is one of the most lethal, neuro-epithelial cell tumors. Prognosis depends on the grade of glioma. To evaluate the sensitivity and specificity of the MRS, DWI and ADC value in grading gliomas before treatment. We retrospectively analyzed 47 patients. The 28 patients were diagnosed with high-grade glioma, 19 patients were diagnosed by low-grade gliomas evaluated by 3.0 Tesla Siemens machines. The sensitivity and specificity of the Cho/Cr ratio was 75.9%, 77.8 %, cut off value was 2.0650 and the AUC 0.833. In Cho/Naa sensitivity 67.9%, specificity 73.7%, cut off value was 2.5000 and the AUC was 0.754. In intra-tumoral NAA sensitivity 78.9%, specificity 73.2%, Cut off value was 1.4500, AUC 0.791. On ADC map the LGG patients had a higher ADC value than HGG patients (P= .000). The sensitivity and specificity were 84.2%, 82.1% specific, cut off value was $1.419x10^{-3}mm^2/s$ and the AUC were 0.882. MRI has a high advantage in identification of location, qualitative and morphological manifestations of the gliomas and, different grade of the gliomas have different imaging characteristics. MRS and DWI have high value in the identification of high-grade gliomas and low-grade gliomas. The MRS and DWI sequences are the effective addition of conventional sequences, to make the imaging physicians to be more confident in the identification of the high-grade and low grade of the gliomas.

Background and purpose: Glioma is one of the most lethal, neuro-epithelial cell tumors. Originating from the glial cell of the brain. Prognosis depends on the grade of glioma. However, managements of the high grade glioma (HGG) and low grade glioma (LGG) are different, symptoms and appearances are can be similar signal intensity in the conventional MRI. Magnetic resonance imaging has revolutionized the diagnosis and post-treatment evaluation of gliomas. Magnetic resonance spectroscopy (MRS) detects the metabolic and histological markers of the brain tissue. Magnetic Resonance Diffusion Weighted Imaging (DWI) detects the microstructure and cellular structure of water protons in brain tissue. The purposes of this study assess the MRS, DWI techniques in differentiating between low and high-grade gliomas. To evaluate the sensitivity and specificity of the MRS, DWI and Apparent diffusion coefficient (ADC) value in grading gliomas before treatment.

Method and materials: We retrospectively analyzed 47 patients. The 28 patients were diagnosed with high-grade glioma, 19 patients were diagnosed by low-grade gliomas evaluated by 3.0 Tesla Siemens machines. All lesions were pathologically proven by biopsy and surgery. All patients underwent MRI dynamic contrast study, MRS and DWI scans before surgery, followed by measurement of Naa (N-acetyl aspartate), choline-containing compounds (Cho), creatine-phosphocreatine complex (Cr), Naa/Cr, Cho /Cr, Cho/Naa, and ADC value on the solid region of the tumor mass and contralateral region. Analysed by ROC curve, P values less than 0.05 were considered statistically significant. The SPSS statistical software 21.0 was used in this study.

Results: In MR dynamic contrast study, the most of the HGGs were demonstrated highly heterogeneous enhancement (P=.006), and rim pattern enhancement (P=.039). On MRS analysis HGG intratumoral area were generally had a low level of Naa (P=.0014), high level of Cho/Cr (P=.000), high level of the Cho/Naa (P=.003) than LGG patients.

The sensitivity and specificity of the Cho/Cr ratio

was 75.9%, 77.8 %, cut off value was 2.0650 and the AUC 0.833 Figure 1, In Cho/Naa sensitivity 67.9%, specificity 73.7%, cut off value was 2.5000 and the AUC was 0.754 Figure 2. In intra-tumoral NAA sensitivity 78.9%, specificity 73.2%, Cut off value was 1.4500, AUC 0.791 Figure 3. On ADC map the LGG patients had a higher ADC value than HGG patients (P= .000). The sensitivity and specificity were 84.2%, 82.1% specific, cut off value was 1.419x10^{-3}mm^2/s and the AUC were 0.882 Figure 4.

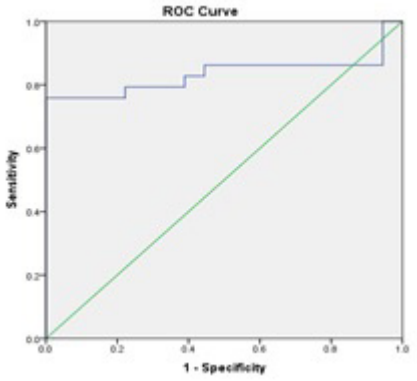


Figure 1 ROC curve of the Cho/Cr ratio in the intratumoral area

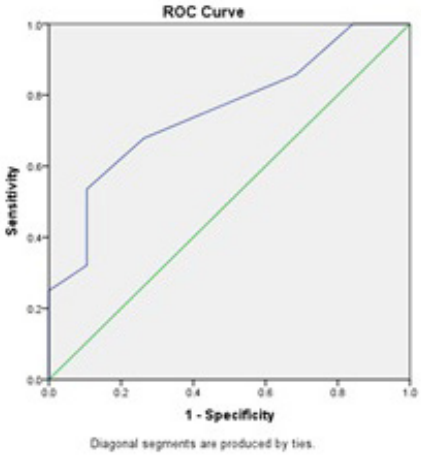


Figure 2 ROC curve of the Cho/Naa ratio in the intratumoral area

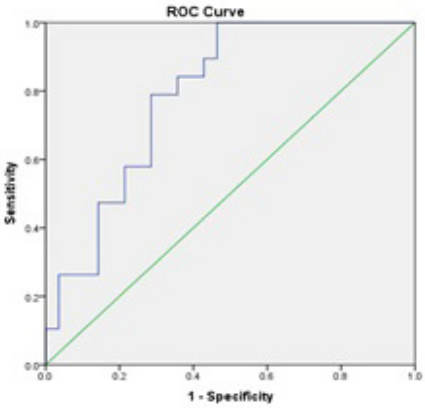


Figure 3 ROC curve of the Naa in the intratumoral area

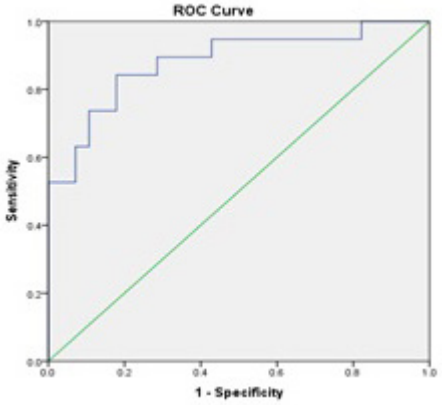


Figure 4 ROC curve of the ADC value in intra-tumoral area

Conclusion:

1. MRI has a high advantage in identification of location, qualitative and morphological manifestations of the gliomas and, different grade of the gliomas have different imaging characteristics.
2. MRS and DWI have high value in the identification of HGG and LGG.
3. The MRS and DWI sequences are the effective addition of conventional sequences, to make the imaging physicians to be more confident in the identification of the HGG and LGG.

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