Preoperative Grading of Glioma Using Dynamic Susceptibility-Contrast MRI: relative Cerebral Blood Volume Analysis of Intra-tumoral and Peri-tumoral Tissue

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Abstract:

Methods: 21 patients with histopathological confirmed glioma were included. Imaging was achieved on a 1.5T MRI scanner. Dynamic susceptibility contrast (DSC) MRI was performed using T2* weighted gradient echo-planner imaging (EPI). A series of 50 dynamic scans were acquired at 1.9 seconds intervals after intravenous bolus injection of 10 mmol/kg Gd-DTPA. Multiple ROIs have been drawn in the hot spots of both intra-tumoral and peri-tumoral regions, corresponding the colour maps. The highest ROI has been selected to represent the rCBV of each intra-tumoral and peri-tumoral regions. Tumors were subdivided into low grades and high grade on the basis of histopathology. Receiver operating characteristic analysis of rCBV, of both intra-tumoral and peri-tumoral regions, was performed to find cutoff values between high and low grade tumors. The resulting sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated. Results: Based on the histopathology, high grade glioma (HGG) represented 71.4% whereas low grade glioma (LGG) represented 28.8%. Both intra-tumoral and peri-tumoral rCBV of HGG were significantly higher than those of LGG. The cut-off value = 2.9 for intratumoral rCBV provided sensitivity, specificity, positive predictive values, negative predictive values, and accuracy of 80%, 100%, 100%, 66.7% and 85.7% respectively to differentiate between HGG and LGG. Additionally, the cut-off value = 0.7 for peri-tumoral rCBV provided sensitivity, specificity, positive predictive values, negative predictive values, and accuracy of 100%, 66.6%, 88.2%, 100%, and 90.5% respectively to differentiate between HGG and LGG. Conclusion: ROI of the highest rCBV is significantly reliable for the preoperative distinction between HGG and LGG. Combined intra-tumoral and peri-tumoral rCBV provides overall better diagnostic accuracy and helps to decrease the invasive intervention for non-surgical candidates.

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