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Bimodal histogram analysis of wash-in-E_{max} ratio derived from dynamic contrast-enhanced perfusion MR imaging for differentiating primary central nervous system lymphoma from glioblastoma

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PURPOSE: To investigate the diagnostic value of bimodal histogram annalysis of Wash-in-Emax ratio (WER) derived from dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) in differentiating treatment-naive primary central nervous system lymphoma (PCNSL) and glioblastoma.

MATERIALS AND METHODS: Thirty-one glioblastoma and eleven PCNSL patients were respectively recruited in this study. All of them were histologically confirmed and treatment-naive. Normalized model-free DCE maps were calculated by dividing wash-in value by E_{max} value on a voxel by voxel basis. Whole enhancing tumor WER histogramswere calculated from normalized DCE maps with a two-component normal distribution mixture fitting curve. Histogram parameters of WER, including mean WER at higher curve ($mWER_H$), skewness, kurtosis, standard deviation (SD), and three cumulative histogram parameters (WER_{50}, WER_{75}, and WER_{90}), were generated and compared. The classifiers were selected by t-test and receiver operating characteristic (ROC) curves.

RESULTS: Significant differences between PCNSL and glioblastomas were found in skewness ($p < 0.001$), SD ($p < 0.05$) and WER_{90} ($p < 0.05$). Bimodal histogram of 90% ($n = 28/31$) glioma patients demonstrated positive skew while that of 64% ($n = 7/11$) PCNSL patients was negative skew. SD and WER_{90} of glioblastoma were higher than that of PCNSL patients. The $mWER_H$ of glioblastoma was higher than PCNSL patients but without significant difference ($p > 0.05$). ROC curve analyses showed skewness was the best classifier for differentiating PCNSL from glioblastoma, with a sensitivity of 77%, a specificity of 100% and area under curve (AUC) of 0.918.

CONCLUSION: Bimodal histogram analysis of WER derived from DCE-MRI is effective for differentiation of treatment-naive PCNSL and glioblastoma. Skewness is the best predictor.