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Discriminant analysis to classify glioma grading using dynamic contrast-enhanced MRI and immunohistochemical markers.

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Abstract

INTRODUCTION: The purpose of the present study was to look for the possible predictors which might discriminate between high- and low-grade gliomas by pooling dynamic contrast-enhanced (DCE)-perfusion derived indices and immunohistochemical markers.

METHODS: DCE-MRI was performed in 76 patients with different grades of gliomas. Perfusion indices, i.e., relative cerebral blood volume (rCBV), relative cerebral blood flow (rCBF), permeability (k (trans) and k (ep)), and leakage (v (e)) were quantified. MMP-9-, PRL-3-, HIF-1 α -, and VEGF-expressing cells were quantified from the excised tumor tissues. Discriminant function analysis using these markers was used to identify discriminatory variables using a stepwise procedure. To look for correlations between immunohistochemical parameters and DCE metrics, Pearson's correlation coefficient was also used.

RESULTS: A discriminant function for differentiating between high- and low-grade tumors was constructed using DCE-MRI-derived rCBV, k (ep), and v (e). The form of the functions estimated are "D (1) = 0.642 \times rCBV + 0.591 \times k (ep) - 1.501 \times v (e) - 1.550" and "D (2) = 1.608 \times rCBV + 3.033 \times k (ep) + 5.508 \times v (e) - 8.784" for low- and high-grade tumors, respectively. This function classified overall 92.1% of the cases correctly (89.1% high-grade tumors and 100% low-grade tumors). In addition, VEGF expression correlated with rCBV and rCBF, whereas MMP-9 expression correlated with k (ep). A significant positive correlation of HIF-1 α with rCBV and VEGF expression was also found.

CONCLUSION: DCE-MRI may be used to differentiate between high-grade and low-grade brain tumors non-invasively, which may be helpful in appropriate treatment planning and management of these patients. The correlation of its indices with immunohistochemical markers suggests that this imaging technique is useful in tissue characterization of gliomas.

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