Magnetic resonance perfusion imaging in glioblastoma

Indications

Magnetic resonance perfusion imaging, may:

Provide a noninvasive diagnostic tool for properly grading lesions.

Identifying the most malignant region of a tumor for guiding biopsy

Monitoring response to therapy that may precede conventionally assessed changes in tumor morphology and enhancement characteristics.

May help quantitatively predict recurrent glioblastoma/progression for glioblastomas. The active tumor histological fraction correlated with quantitative radiologic measurements including rCBV and rCBF.

The dominant predictors of OS are normalized perfusion parameters Normalized Relative Tumor Blood Volume (n_rTBV) and Normalized Relative Tumor Blood Flow (n_rTBF). Pre-operative perfusion imaging may be used as a surrogate to predict glioblastoma aggressiveness and survival independent of treatment [1].

For metastases, Perfusion MRI may not be as useful in predicting mean active tumor fraction (AT). Clinicians must be judicious with their use of MRP in predicting tumor recurrence and radiation necrosis [2].

While perfusion MRI is not the ideal diagnostic method for differentiating glioma recurrence from pseudoprogression, it could improve diagnostic accuracy. Therefore, further research on combining perfusion MRI with other imaging modalities is warranted [3].

Perfusion-weighted magnetic resonance imaging (PW-MRI) techniques, such as dynamic contrast-enhanced MRI (DCE-MRI) and dynamic susceptibility contrast-MRI (DSC-MRI), have demonstrated much potential as powerful imaging biomarkers for glioma management as they can provide information of vascular hemodynamics [4] [5] [6].

PW-MRI is now rapidly expanding its application spectrum by noninvasively exploring the relationship between imaging parameters and the molecular characteristics of gliomas [7].

Dynamic contrast enhanced magnetic resonance imaging and Dynamic susceptibility weighted contrast enhanced perfusion imaging represent a widely accepted method to assess glioblastoma (GBM) microvasculature.

The aim of Navone et al. from the Laboratory of Experimental Neurosurgery and Cell Therapy,

Neurosurgery Unit, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Postgraduate School in Radiodiagnostics Department of Neuroradiology, Milan, was to investigate the correlation between plasma von Willebrand Factor (VWF):Ag, permeability and perfusion MRI parameters, and examine their potential in predicting GBM patient prognosis.

They retrospectively analysed pre-operative DCE-, DSC-MRI, and VWF:Ag level of 26 GBM patients. They assessed the maximum values of relative cerebral blood flow (rCBF) and volume (rCBV), volume transfer constant Ktrans, plasma volume (Vp) and reflux rate constant between fractional volume of the extravascular space and blood plasma (Kep). Non-parametric Mann-Withney test and Kaplan-Meier survival analyses were conducted and a p-value<0.05 was considered statistically significant.

The median VWF:Ag value was 248 IU/dL and the median follow-up duration was about 13 months. They divided patients according to low- and high-VWF:Ag and found significant differences in the median follow-up duration (19 months vs 10 months, p=0.04) and in Ktrans (0.31 min-1 vs 0.53 min-1, p=0.02), and Kep (1.79 min-1 vs 3.89 min-1, p=0.005) values. The cumulative 1-year survival was significantly shorter in patients with high-VWF:Ag and high-Kep compared to patients with low-VWF:Ag and low-Kep (37.5% vs. 68%, p = 0.05).

These findings, in a small group of patients, suggest a role for VWF:Ag, similar to Ktrans, and Kep as a prognostic indicator of postoperative GBM patient survival [8].

References

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