**"Decoding Tumour Dynamics: The Pivotal Role of Perfusion MRI in Unravelling the Vascular Tapestry of Brain Tumours"**

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**Abstract**

**Background**

Brain tumours, whether primary or metastatic, are commonly encountered, and their prognosis is strongly related with their grade. Gliomas are the most common primary brain tumour in adults.

Magnetic resonance imaging (MRI) is the current primary method to identify the anatomic details of the central nervous system (CNS). However, it is not so successful in showing physiological and metabolic changes. Advanced MRI techniques are the solution for this problem. Of these techniques, perfusion MRI is most commonly used.

Perfusion MRI provides information about tissue vascularization, in vivo tumour angioneogenesis, and microcirculation. Perfusion MRI offers information about tissue blood volume, blood flow, and oxygenation of tissues. This non-invasive imaging technique offers insights into tumour angiogenesis, microvascular density, and hemodynamic parameters, aiding in both diagnosis and treatment planning.

The signal changes in arteries/veins, which occur with the passage of paramagnetic contrast agent are used to create relative cerebral blood volume (rCBV), mean transit time (MTT), and cerebral blood flow (rCBF) parameters.

These parameters help in differentiating between tumour types, grading tumours based on their vascularity, and assessing treatment response.

Furthermore, perfusion MRI can contribute to surgical planning by identifying regions of increased blood flow within and around tumours, helping surgeons to navigate and delineate tumour boundaries more accurately. This information is crucial for maximizing tumour resection while minimizing damage to surrounding healthy brain tissue.

The aim of this study was to evaluate the performance and success of perfusion MRI methods in grading gliomas and discriminating high- and low-grade tumours.

**Method:** The study is a tertiary care hospital based prospective diagnostic study which was conducted in the Department of Radiodiagnosis, Indira Gandhi Govt. Medical College and Hospital, Nagpur. This study was conducted over 25 patients who were referred from various referral centres. The diagnostic success of the perfusion MRI methods was evaluated for the high-grade and low-grade groups. A gadolinium (Gd)-based contrast agent (Gadovist, Bayer) was administered, boluses at a standard dose of 0.1 mmol/kg for perfusion MRI. Regions of interest (ROIs) were placed in tumour portions with maximum perfusion on rCBF and rCBV maps, with contralateral normal appearing white matter and cerebellum as reference regions. Larger ROIs were drawn for histogram analyses.

**Inclusion criteria**: Twenty-three patients who were diagnosed to have intra-axial brain tumours either by CT or MRI were included in study.

**Exclusion criteria:** Patients with imaging features of extra axial lesion or intra-axial infective lesions were excluded.

**Result:** Twenty-five patients were included in this study. Female preponderance was observed with 14 (56%) patients being female (F). Out of 25 patients 12(48%) patients were given high grade glioma as provisional diagnosis. Mean rCBV and rCBF among these tumours was more than contralateral white matter. On applying unpaired t-test for comparison of two groups, this difference was statistically significant. (p<0.001).

**Interpretation And Conclusion:**

Gliomas are the most common brain tumours. Differentiating between low grade glioma and high-grade glioma at times becomes difficult because of significant overlap of the two.

In the context of brain tumours, perfusion MRI is particularly valuable for distinguishing between high-grade and low-grade tumours, as high-grade tumours typically exhibit increased vascularity and perfusion compared to their low-grade counterparts. Additionally, perfusion MRI aids in identifying areas of tumour recurrence, assessing treatment efficacy, and monitoring changes in vascularization during the course of therapy.

In summary, perfusion MRI plays a pivotal role in the comprehensive evaluation of brain tumours by providing quantitative and qualitative information about tumour vascularity and perfusion characteristics. This enhances the understanding of tumour biology, aids in differential diagnosis, guides treatment decisions, and improves surgical precision, ultimately contributing to better patient outcomes.

**References**

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