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# ROLE OF MR PERFUSION IN DIAGNOSIS OF BRAIN TUMORS

Radiology

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## ABSTRACT

Conventional magnetic resonance imaging (MRI) is widely used in the diagnosis and follow-up of brain tumor patients, owing to its high sensitivity and exquisite delineation of anatomic relationships. Nonetheless, conventional MR techniques are often nonspecific and provide limited information on tumor physiology. Thus, conventional MRI, which provides a “snapshot” in the time course of contrast enhancement, is sometimes inadequate to guide treatment of brain tumors. In our study, out of 21 patients, 13 were male and 8 were female.The subjects ranged in age 2-80 years. The commonest symptoms was headache (6/21) followed by seizure (5/21).The commonest tumour in this study was meningioma (8) followed by high grade glioma.Intra-axial tumors were more than extra-axial tumors. Among the intra-axial tumors, high grade gliomas were seen in largest numbers.In meningioma the rCBV ratio was 3.33 as compared to normal parenchyma.In high grade glioma the rCBV ratio was 1.7 as compared to normal parenchyma. In low grade glioma the rCBV ratio was 0.76 as compared to normal parenchyma. This parameter can be reflected in the rCBVmeasured within the lesion. Hence the rCBV of low grade glioma are lower than that of high grade gliomas .Neoplastic lesions in the brain are accompanied by a parallel increase in neoangiogenesis and the degree of this vascular hyperplasia corresponds to a great extent with the grade of malignancy.

## KEYWORDS

Volume of blood, Perfusion, Tumor, Branched, Microscopic tissue

## INTRODUCTION

It is defined as the volume of blood that flows into one gram of tissues. Perfusion is the measure of the quality of vascular supply to a tissue. Since vascular supply and metabolism are usually related, perfusion can also be used to measure tissue activity. When the tumor reaches a critical size of approximately 1-4mm diameter, the resultant ischemia leads to the secretion of antigenic factors, which in turn leads to proliferation of new vessels. These factors, such as vascular endothelial growth factor (VEGF), recruit and maintain tumor vessels, which are characterized by a tortuous and branched structure

MR perfusion imaging detects blood flow in microscopic tissue level.

Perfusion imaging utilizes a bolus injection of gadolinium administrated intravenously during ultrafast T2 or T2* acquisition. The contrast agent causes transient decreases in T2 and T1 in and around the microvasculature per fused with contrast.

Perfusion images can be acquired with fast scanning acquisitions before ,during and after a bolus injection of intravenous contrast.

After data acquisition, a signal decay curve can be used to ascertain blood volume, transient force and measurement of perfusion. This curve is known as time intensity curve.

Time intensity curve for multiple images acquired during and after injection are combined to generate a cerebral blood volume (CBV) map.

Mean transient time (MTT) of contrast through an organ or tissue can also be calculated.

In general, high-grade brain tumors have greater rCBV than low-grade lesions. MR perfusion can be more sensitive in defining the true extent of gliomas than can anatomic MR imaging. Better delineation of tumor borders can help in radiation and surgical planning.

In the future, MR perfusion imaging will probably play a role in better defining tumor margins for radiation and surgical planning.

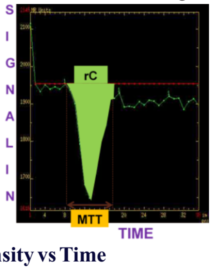



**Figure 1: Signal intensity vs Time**

### MRI Technique
### SELECTION OF PROTOCOL

After entering the patients details,such as Name, UHID, Weight and history the brain routine protocol is selected from the protocol library.

### PROTOCOL
**Plain study**

3 plane localizer
Calibration
Axial T2 propeller
Axial DWI 1000b ASSET
Coronal T2 Flair
Sagittal Flair
Axial gradient

**Contrast study**

**Axial dynamic EPI sequences**

Axial T1 Flair with Fat suppression
Coronal 3DSPGR
SagittalT1 Flair
spectroscopy
PROTOCOL AXIAL DYNAMIC EPI SEQUENCE

Sequence : Axial Dynamic EPI Gradient
TR :925 milli sec
TE :40 milli seconds
Flip angle :90 Degree
Slice thickness :7mm
Spacing :0.0
Matrix:128x128
NEX : 1.00
Scan time : 1.07 sec
Phase Per Location :35
Delay After Acquisition : 0.02sec

### POST PROCESSING
**Software: FuncTool**

**FuncTOOL:-** It is software package that allows the analysis of MR data sets for post processing.

The algorithms of the MR PWI post-processing includes: down MR PWI raw data to workstation; calculate perfusion maps with FuncTool software; save perfusion maps and push to PACS. Results are in the form of graphs and functional maps that can be saved and documented.

**MR PWI Process**

Load PWI images data
⇩
Select PWI series in the workstation
⇩
Click functool
⇩

Select MR Standard
⇩
Decrease lower threshold (around 100)
⇩
Draw a ROI; move to normal get the signal time curve
⇩
Pre enhancement images, post enhancement images
Click compute
⇩
Change image colour

**Table1: shows the age wise distribution of patients with brain tumors.**

| Age | No. of patients | Percentage (%) |
|---|---|---|
| 1-10 | 1 | 4.7 |
| 11-20 | 2 | 9.5 |
| 21-30 | 2 | 9.5 |
| 31-40 | 4 | 14.2 |
| 41-50 | 6 | 28.5 |
| 51 -60 | 4 | 19.0 |
| 61-70 | 1 | 4.7 |
| 71-80 | 1 | 4.7 |

## DISCUSSION

In day to day clinical practice, the diagnosis of intracranial mass lesions may not be always straight forward. The clinical history and neurological findings may sometimes be ambiguous. The morphological appearance of the lesions on the routine pre and post contrast MR images is not always characteristic. But differentiation of the lesions and narrowing of the differential diagnosis in the radiological report may be an infallible tool to guide the patient's further management. In this context the addition of advanced MR imaging tools like MR Perfusion to the routine conventional MRI may serve as formidable problem solving tools.

In our study, out of 21 patients, 13 were male and 8 were female.The subjects ranged in age 2-80 years. The commonest symptoms was headache (6/21) followed by seizure (5/21).

The commonest tumour in this study was meningioma (8) followed by high grade glioma.Intra-axial tumors were more than extra-axial tumors. Among the intra-axial tumors, high grade gliomas were seen in largest numbers.In meningioma the rCBV ratio was 3.33 as compared to normal parenchyma.\In high grade glioma the rCBV ratio was 1.7 as compared to normal parenchyma. In low grade glioma the rCBV ratio was 0.76 as compared to normal parenchyma.This parameter can be reflected in the rCBVmeasured within the lesion. Hence the rCBV of low grade glioma are lower than that of high grade gliomas .Neoplastic lesions in the brain are accompanied by a parallel increase in neoangiogenesis and the degree of this vascular hyperplasia corresponds to a great extent with the grade of malignancy.

## MATERIALS AND METHODS

Data were collected Patients who had brain tumors were retrospectively analyzed by MRI perfusion mapping.21 patients were included in the study to the Department of Radiology and imaging sciences, Sri Ramachandra medical college, The GE Signa HDx MRI system is a whole body magnetic resonance scanner designed to support high resolution, high signal to noise ratio, and short scan times. It includes a thirty two independent receive channels, and allow for future expansion in 16 channel increments. The overall system has been improved with multichannel surface coil connectivity, and an improved image reconstruction architecture known as the Volume Recon Engine (VRE).

## LITERATURE REVIEW

Rosen BR, BelliveauJW,VeveaJM,Brady TJ Perfusion imaging with NMR contrast agents. MagnReson Med 1990;14:249-265. 52 consecutive patients with different, newly diagnosed brain tumors were included in the study (25 glioblastoma, 12 meningioma, 12 metastasis, 3 lymphoma patients). For 21 patients, MRI examination was performed twice with a time interval of 1 to 4 days. 18 patients received preoperatively dexamethasone (10 glioblastoma, 2 meningeoma, 5 metastasis, 1 lymphoma patients). We excluded five patients who received an MRI examination twice and eight patients with single-time MRI examinations from further analysis due to non-plausible vascular input functions or movement artifacts.

Villringer A. Rosen BR, Belliveau JW, et al. Dynamic imagingwith Lanthanide Chelates in normal brain: contrast due to magnetic susceptibility effects. MagnReson Med 1988:6:164-174.Fifty-seven patients with pathologically proven brain tumors (21 high-grade gliomas, 8 low-grade gliomas, 8 lymphomas, 6 hemangioblastomas, 7 metastases, and 7 various other tumors) were included in this study. Relative cerebral blood volume (rCBV) and time-to-peak (TTP) ratios were quantitatively analyzed and the rCBV grade of each tumor was also visually assessed on an rCBV map.

## RESULTS

In our study, out of 21 patients, 13 were male and 8 were female.The subjects ranged in age 2-80 years. The commonest symptoms was headache (6/21) followed by seizure (5/21).

The commonest tumour in this study was meningioma (8) followed by high grade glioma.Intra-axial tumors were more than extra-axial tumors. Among the intra-axial tumors, high grade gliomas were seen in largest numbers.

In meningioma the rCBV ratio was 3.33 as compared to normal parenchyma.

In high grade glioma the rCBV ratio was 1.7 as compared to normal parenchyma.

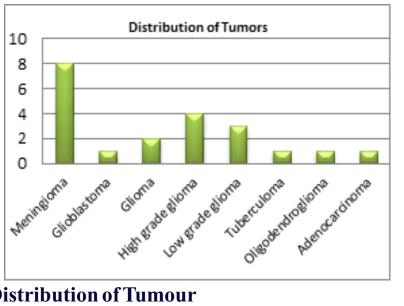
In low grade glioma the rCBV ratio was 0.76 as compared to normal parenchyma.

This parameter can be reflected in the rCBVmeasured within the lesion. Hence the rCBV of low grade glioma are lower than that of high grade gliomas .

Neoplastic lesions in the brain are accompanied by a parallel increase in neoangiogenesis and the degree of this vascular hyperplasia corresponds to a great extent with the grade of malignancy.

**Table no. 1: Distribution of Tumor**

| S.N0. | NAME OF THE TUMORS | N0. OF CASES |
|---|---|---|
| 1 | Meningioma | 8 |
| 2 | Glioblastoma | 1 |
| 3 | Glioma | 2 |
| 4 | High grade glioma | 4 |
| 5 | Low grade glioma | 3 |
| 6 | Tuberculoma | 1 |
| 7 | Oligodendroglioma | 1 |
| 8 | Adenocarcinoma | 1 |




**Graph 1: Distribution of Tumour**

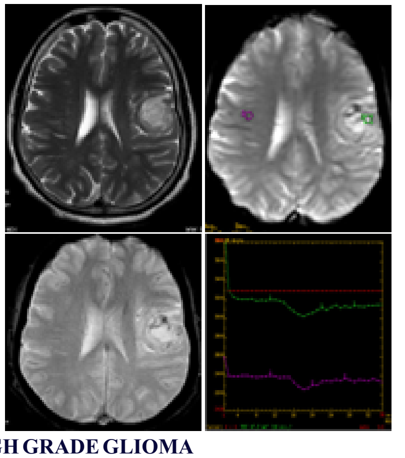


**Fig. 1. HIGH GRADE GLIOMA**

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## CONCLUSION

MR Perfusion is an extremely useful adjunctive imaging tool in characterization and accurate diagnosis of various intracranial masses.

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