

Original article:

Study Of Role Of MRI In Evaluation Of Brain Space Occupying Lesion

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Abstract:

Introduction: Magnetic resonance imaging (MRI) is an best method for anatomical and structural diagnosis of the brain, but it does not provide functional or metabolic information.

Materials and methods : Present Cross sectional Study was conducted in the Department Of Radiodiagnosis , JJM Medical College , Davangere , Karnataka , India in a period of one & half year .Prior to the commencement of the study, the ethical clearance was obtained from the Ethics Committee, JJM Medical College , Davangere.

All the patients fulfilling the selection criteria were explained about the purpose of study and a written informed consent was obtained to participate in the study before enrolment.

Results: In our present study out of 50 patients 46 shows Cho/Cr ratio more than 1.5. Out of these 46 patients; 22 have lipid peak & 14 have lactate peak.

Conclusion: MR spectroscopy is a useful adjuvant to standard MRI during a wide selection of conditions, both neoplastic and non-neoplastic helping us reach a diagnosis.

Introduction:

Magnetic resonance imaging (MRI) is an excellent method for anatomical and structural diagnosis of the brain, but it does not provide functional or metabolic information.¹ Magnetic resonance spectroscopy (MRS) is a good tool to detect the metabolic and biochemical profile of brain areas. MRS is an analytical method utilized in chemistry that permits the identification and quantification of metabolites in samples. It differs from conventional MRI therein spectra provide physiological and chemical information rather than anatomy. MRS and MRI both have their origin in Nuclear Magnetic Resonance (NMR). In late 1945 independent teams led by Felix Bloch at Stanford and Edward Mills Purcell at the Massachusetts Institute of Technology, simultaneously demonstrated NMR in condensed matter (water and paraffin, respectively). Their discoveries were simultaneously published in the January, 1946 issue of Physical Review and simultaneously Bloch and Purcell jointly received the Nobel Prize for Physics in 1952. At that point, NMR was used only by physicists for purposes of determining the nuclear magnetic moments of nuclei. It had been only in the mid 1970's that NMR began to be utilized in vivo, after Lauterbur, Mansfield and Grannell introduced gradient into the magnetic field strength enabling them to determinate the situation of the emitted signal and to reproduce it in an picture. As the term "nuclear" was constantly and erroneously related to nuclear medicine in vivo NMR was renamed as MRI.

Materials and methods :

Present Cross sectional Study was conducted in the Department of Radiology, JJM Medical College , Davangere in a period of one & half year .Prior to the commencement of the study, the ethical clearance was obtained from the Ethics Committee, JJM Medical College , Davangere.

All the patients fulfilling the selection criteria were explained about the purpose of study and a written informed consent was obtained to participate in the study before enrolment.

Inclusion criteria:

1. All age groups.
2. Both males and females.
3. All subjects with space occupying lesions (SOL) of brain

Exclusion criteria:

1. Brain aneurysm clip
2. Implanted neural stimulator
3. Implanted cardiac pacemaker
4. Cochlear implant
5. Ocular foreign body
6. Metal shrapnel
7. Other implanted medical devices
8. Patients with surgery of uncertain type where the presence of metal clips or wires cannot be excluded.

Preparation:

- History and physical examination of all patients was performed.
- Patients were asked to remove all ornaments & metallic accessories.
- Patients were explained about the technique & instructed to not move during the scanning.

Technique:

- All the patients underwent MRI & MRS scanning at our department on Philips Achieva 1.5 Tesla.
- Patient was placed supine on the table and the area from the vertex to the skull base was included.
- MRI Brain was performed with T1, T2, FLAIR, T2* & Diffusion sequences.
- Single and Multi-voxel Spectroscopy was performed in addition to MRI Brain study of those patients who present with various intracranial lesions and as per requirement data analysis was done.

Parameters evaluated:

- Characterization of brain space occupying lesion on MRI.
- Location of space occupying lesion.
- Enhancement pattern after CEMRI is done.
- Biochemical metabolites & their ratios are evaluated on both single or multi-voxel spectroscopy.
- Differential diagnosis was narrowed down supported the above parameters and consistent with the biochemical changes.

Results:

Table 1: Sex wise distribution of brain SOL

Sex	Frequency	Percent
F	18	36
M	32	64
Total	50	100.0

Table 2: Age wise distribution of brain SOL

Age	Frequency	Percent
<10	7	14
10-20	7	14
20-30	6	12
30-40	10	20
40-50	10	20
>50	10	20
Total	50	100.0

Table 3: Cho/NAA ratio in non neoplastic lesions

Cho/NAA ratio	Frequency
0.5-1.0	6
1.1-1.5	7
1.5-2.0	2
>2.0	0

Table 4: Cho/NAA ratio in neoplastic lesions

Cho/NAA ratio	Frequency
0.5-1.0	5
1.1-1.5	4
1.5-2.0	8
2.1-2.5	2
2.6-3.0	4
3.0-3.5	3
>3.5	9

Table 5: Lipid peak in neoplastic lesions

Lipid Peak	Frequency	Percent
Absent	21	60
Present	14	40
Total	35	100.0

Table 6: Lactate peak in neoplastic lesions

Lactate Peak	Frequency	Percent
Absent	25	71.5
Present	10	28.5
Total	35	100.0

Table 7: Infective granulomas / abscesses

Choline/ Creatine ratio	No of patients
0.6 -0.9	3
0.9-1.2	8
1.2-1.5	3
>1.5	1

Discussion :

Fifteen cases of acute cerebral infarction were studied. In parallel to the studies by Jonathan H. Gillard, et al; findings of acute cerebral infarction on Multivoxel MR Spectroscopy were reduced NAA and creatine (Cr) peak and choline (Cho) peak. The NAA resonance is absent or depleted from lesions known to involve neuronal/axonal loss, such as infarcts.^{2,3}

The high lactate levels however is not limited to the area of infarction (area of restricted diffusion) . This might be because of diffusion into the adjacent brain parenchyma where reduced perfusion is noted . Hence raised level are also seen in the parenchyma adjacent to the areas of T2W hyperintensity. Lactate has also been reported to be elevated in subacute and chronic stages of human cerebral infarction.⁴ So lactate therefore, is not necessarily a specific indicator of acute cerebral ischemia.

There was significant reduction within the level of creatine (Cr) according to loss of viable neurons in infarction. We studied a total of 50 patients out of which 35 patients were reported as neoplastic etiologies. In our study there were 35 patients with brain SOL that was other than infective or ischemic lesion. Out of these 35 patients 30 patients have Cho/NAA ratio >1 which is in parallel to the studies by R O Kaddah, et al⁹.

Meng Law, et al. demonstrated that a threshold value of 1.56 of Cho/Cr ratio with minimum CI value error and 75.8%, 47.5%, 81.2%, and 39.6% for the sensitivity, specificity, PPV, and NPV for determination of a high-grade glioma. Cho/Cr values range from a low grade to high grade of 1.8-4.8. The second best discriminator between low grade glial tumours and malignant gliomas was amount of lipids.⁵ High-grade neoplasms tend to have elevated lipid signal, which is often absent in low-grade neoplasms.^{6,7}

H. Poptani, et al. demonstrated that all 37 patients of high grade gliomas have high choline, low or absent NAA and creatine. NAA and Creatine peaks were visible in only 12 of 37 cases and were undetectable in remaining 25 cases. Most of high grade gliomas showed presence of lipid and lactate , with only lactate in 10 and lipids in two cases. Whereas 23 patients of low-grade gliomas were characterized by low NAA and creatine and high choline and presence of only lactate in all low grade gliomas. NAA /Cho ratio was significantly lower and Cho/Cr ratio was significantly higher in high-grade gliomas than in low-grade gliomas. Presence of lipids suggested a higher grade of malignancy.⁸

In our present study out of 35 patients 21 shows Cho/Cr ratio more than 1.5. Out of these 31 patients; 14 have lipid peak & 10 have lactate peak.

Conclusion:

MR spectroscopy is a useful adjuvant to conventional MRI in a wide range of conditions, both neoplastic and non-neoplastic helping us reach a diagnosis. It's a non invasive tool which detects cancerous tissue in brain through its metabolic activity.

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