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Original article:

Study of Evaluation of brain SOL by MR Imaging

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Abstract:

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.

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

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 31 patients 27 shows Cho/Cr ratio more then 1.5. Out of these 27 patients; 12 have lipid peak & 8 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.

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 used to detect the metabolic and biochemical profile of brain areas. MRS is an analytical method used in chemistry that enables the identification and quantification of metabolites in samples. It differs from conventional MRI in that spectra provide physiological and chemical information instead of anatomy.[2] MRS and MRI have their origin in Nuclear Magnetic Resonance (NMR). NMR was first described in 1946 simultaneously by the Nobel Prize winners Edward Purcell, and Felix Bloch. At that time, NMR was used only by physicists for purposes of determining the nuclear magnetic moments of nuclei. It was only in the mid 1970's that NMR started to be used in vivo, after Lauterbur, Mansfield and Grannell introduced gradient into the magnetic field enabling them to determinate the location of the emitted signal and to reproduce it in an image. In vivo NMR was renamed MRI because the term "nuclear" was constantly and erroneously associated with nuclear medicine.

Materials and methods

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

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 SOL on MRI.
- Location of SOL.
- Enhancement pattern if CEMRI done.
- Biochemical metabolites & their ratios are evaluated on single or multi-voxel spectroscopy.

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- Differential diagnosis was narrowed down based on the above parameters and according to the biochemical changes.

Results

Table 1: Sex wise distribution of brain SOL

Sex	Frequency	Percent
F	16	35.5
M	29	65.5
Total	45	100.0

Table 2: Age wise distribution of brain SOL

Age	Frequency	Percent
<10	06	13.33
10-20	6	13.33
20-30	5	11.11
30-40	8	17.77
40-50	10	22.22
>50	10	22.22
Total	45	100.0

Table 3: Cho/NAA ratio in non neoplastic lesions

Cho/NAA ratio	Frequency
0.5-1.0	5
1.1-1.5	6
1.5-2.0	1
>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	3
3.0-3.5	2
>3.5	7

Table 5:

Lipid Peak	Frequency	Percent
Absent	19	61.3
Present	12	38.7
Total	31	100.0

Table 6: Lactate peak in neoplastic lesions

Lactate Peak	Frequency	Percent
Absent	23	74.2
Present	08	25.8
Total	31	100.0

Table 7: Infective granulomas / abscesses

Choline/ Creatine ratio	No of patients
0.6 -0.9	2
0.9-1.2	7
1.2-1.5	2
>1.5	1

Discussion

Two cases of acute cerebral infarction were studied. The MR spectra were obtained from the areas of restriction with TE 135. In parallel to the studies by Dawn E Saunders et al[3] and Jonathan H. Gillard et al[4];

findings of acute cerebral infarction on Multivoxel MR Spectroscopy at TE 135 were reduced NAA and creatine (Cr) peak and elevated choline (Cho) peak with the pathognomic inverted lactate peak at 133ppm.
An inverted bifid lactate peak was noted at 1.3 ppm. The purpose of doing spectroscopy at TE 135 in this scenario is to help differentiate lipid from lactate as only the lactate portion of the lipid- lactate peak is expected to be inverted at intermediate TE of 135.
The raised lactate however is not limited to the area of infarction (area of restricted diffusion) probably due to diffusion into the adjacent brain parenchyma and hence raised level are also seen in the parenchyma adjacent to the areas of T2W hyperintensity.
There was significant reduction in the level of creatine (Cr) and NAA consistent with loss of viable neurons in infarction. We studied a total of 45 patients out of which 31 patients were reported as neoplastic etiologies. In our study there were 31 patients with brain SOL that was other than infective or ischemic lesion. Out of these 31 patients 26 patients have Cho/NAA ratio >1 which is in parallel to the studies by R. Hourani et al[5.] Meng Law et al demonstrated that a threshold value of 1.56 of Cho/Cr ratio with minimum C1 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. High-grade neoplasms tend to have elevated lipid signal, which is often absent in low-grade neoplasms.[6,7]
H. Poptani et al demonstated that all 37 patients of high grade gliomas have high choline, low or absent NAA and creatine along with lipid and/or lactate, whereas 23 patients of low-grade gliomas were characterized by low NAA and creatine and high choline and presence of only lactate. 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 31 patients 27 shows Cho/Cr ratio more then 1.5. Out of these 27 patients; 12 have lipid peak & 8 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.

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