Intracranial tuberculomas: atypical MRI and MRS findings

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Intracranial tuberculosis is still a major cause of mortality and morbidity in the developing countries and its incidence is on rise in developed nations too with the emergence of AIDS. The role of MR with and without Gd-DTPA is well established in its diagnosis and treatment. However in day to day clinical practice a large number of intracranial lesions are encountered, where in-vivo characterisation cannot be made by non contrast/contrast enhanced imaging pattern alone. Single voxel/ CSI MR spectroscopy may play important role in further characterisation of intracranial tuberculomas from other lesions especially in the indeterminate stage, when it mimics to a variety of other lesions. In the present study, the variegated imaging patterns of intracranial tuberculomas along with SVS/CSI spectroscopic findings in 25 cases is discussed.

Materials And Methods:
25 cases of proved tuberculomas based on stereotactic biopsy ( n=15), excisional biopsy (n = 05) and follow up after ATT (n=05) were selected for the present study, out of 220 cases of suspicious ICSOLs mimicking as variegated infective lesions. The MRI/MRS studies were performed in subjects in the age group 16-56yrs (15 Males&10 Females) during Oct, 1997-Oct, 1999.

MR/MRS studies were performed on a 1.5 T MR equipment (Siemens Magnetom Vision) with a quadraxial polarised head coil using SE & TSE pulse sequences (pre contrast) SE T1 WI in axial &coronal planes (post-contrast). The MRS studies were performed 03 days after contrast enhanced MRI using TR=1500ms, TA=6.31 min, AC =256 and TE of 135 & 270 ms and STEAM with TE = 20ms. A volume of 3.4 cc (1.5x1.5x1.5cc) was selected either from enhancing area or a combination of enhancing/cystic area. The lesion adjacent to periventricular/ calvarial regions were avoided to avoid signal contamination from CSF or calvarial bone marrow. Prior to MRS measurement the magnetic field in the area of interest was adequately shimmed as judged by FWHM of water peak in the target voxel, which was 4-6 Hz in the majority of 1H-MRS studies. This was followed by selective water suppression. The reproducibility of spectral pattern was established by carrying out measurement on the same volume on two different occasions in the six patients. Spectral assignment was done as per literature. CSI and metabolite imaging was also performed in 10 cases of large tuberculomas.

Results:
A variety of imaging patterns were seen in our study as already reported in MR literature. However in 07 cases, the imaging pattern was atypical, i.e. large, irregular, heterogeneous intensity pattern mass lesion in both T1 & T2 WI. On contrast enhancement MRI study, it revealed conglomerated ring enhancing/ dense focal enhancing mass lesions which mimicked like glioma/ other neoplastic lesions. Spectral analysis from tuberculoma showed large lipid peak at 1.28 ppm in 20 patients (Fig.1). 09 cases revealed marked increase in choline integral value i.e. 83.98±2.5 along with marked increase in Cho/Cr ratio (3.44±0.03) and decrease in NAA/Cho ratio (0.1±0.02). In the spectra using STEAM (20) sequence, lipid peak showed an increasing trend with low NAA and Cho content and associated tubercular vasculitis may lead to anaerobic type of glycolysis leading to increased lactate formation. Thus this type of spectral findings may be misleading and lesion can be confused with tumour. This atypical findings are not reported in the literature. It is concluded that presence of lipid peak is no specific or definite metabolic marker to characterise the tuberculoma. Atypical MRS findings simulating to neoplastic lesions may also be encountered. In such a scenario, a holistic approach need to be adopted to review the MEG/MRS findings in totality and if need be histopathological diagnosis must be obtained by stereotactic/guided biopsy.

Discussion:
An adequate imaging/pathological explanation has already been given in reference to characteristic tuberculomas. Atypical morphological presentation may be due to successive addition of layers of granulation tissue infection or possibly due to multidrug resistant \\textit{Bacillus} strain. Aging tuberculomas may show irregular necrotic foci with in the granulation tissue, which attains a large size, thus they can be confused with glioma/ metastasize as seen in our study. The lipid peak seen at 1.28 ppm is due to saturated fatty acids mainly found in tubercular bacillus. The increased choline concentration and Cho/Cr ratio, which has not been earlier reported in literature is difficult to explain. It may be due to increased cellular multiplication in tubercular granuloma and formation of excessive epitheloid and giant cells, there is increased choline content and associated tubercular vasculitis may lead to anaerobic type of glycolysis leading to increased lactate formation. Thus this type of spectral findings may be misleading and lesion can be confused with tumour. This atypical findings are not reported in the literature. It is concluded that presence of lipid peak is no specific or definite metabolic marker to characterise the tuberculoma. Atypical MRS findings simulating to neoplastic lesions may also be encountered. In such a scenario, a holistic approach need to be adopted to review the MEG/MRS findings in totality and if need be histopathological diagnosis must be obtained by stereotactic/guided biopsy.

References:

Abbreviations used:
SE - spin echo; TE - echo time; SVS - single voxel spectroscopy, CSI - chemical shift imaging; T1WI - T1 weighted imaging; T2WI - T2 weighted imaging; NAA - N-acetyl aspartate, Cho - choline; Cr - creatine; ATT - anti tuberculosis treatment; ICSOL - IntraCranial Space Occupying Lesions.

Fig. 1 Atypical SVS spectra (a) before treatment, (b) after treatment