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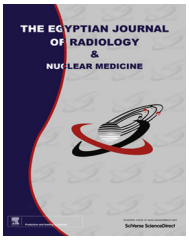

CASE REPORT

The puzzle of choline and lipid peak on spectroscopy

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KEYWORDS

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Choline peak;
Lipid lactate peak

Abstract Choline and lipid lactate peaks elevated in a number of intracranial space occupying lesions, in endemic area tuberculosis should be considered. Choline peak along with lipid lactate elevation is non-specific and can be seen in a number of other conditions like high-grade gliomas, Metastases, lymphomas and demyelinating disorders. We present a case of 45 year old gentle man known case chest tuberculosis on treatment default presenting with multiple intracranial lesions showing lipid–choline elevation.

1. Introduction

In MR spectroscopy (MRS), neuro metabolite NAA is considered as a good metabolite (as it represents neuronal health), choline is considered as a bad metabolite (as it is seen in tumors) and lipid lactate doublet as an ugly metabolite (as it is seen in necrotic tumors), however this is not always true as numerous exceptions exist (1–3). In an endemic area, cerebral tuberculomas have to be considered as one of the differential diagnosis when elevated choline–lipid lactate peak is detected (1). We describe a case of multiple intracranial lesions which showed lipid–choline peaks. The patient was a defaulter on ATT and because of it we made initial diagnosis of multiple tuberculomas. There were a number of factors that were confusing which lead to the bias and MRS left us puzzling without giving us further lead in this case. (Elevated choline and lipid peaks with NAA/choline ratio less than 2.)

2. Case report

A 45 year gentleman, presented with the history of headache, vomiting and low grade fever of 15 days duration. He was dull for the last 5 days. He received treatment for pulmonary tuberculosis 1 year back but did not complete it. On examination, he had altered sensorium, however was obeying commands.

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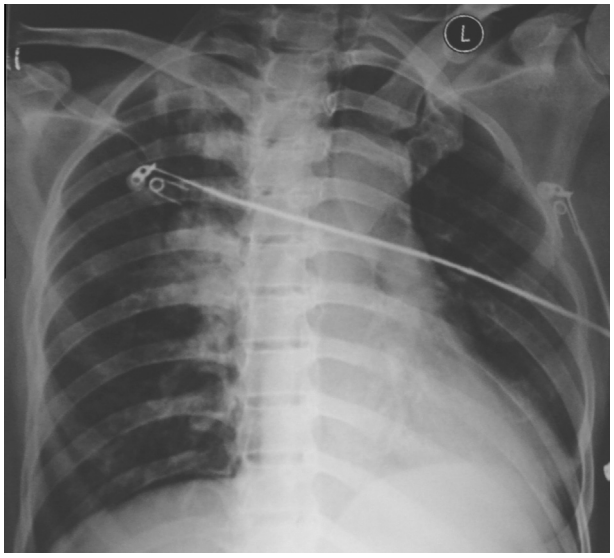

Fig. 1 Chest X ray is showing the right upper lobe fibrosis and right hilar lesion.

Motor power was normal in all four limbs. He was not co-operative for sensory examination. Fundus showed bilateral papilledema, EOM full, pupils were bilateral equal and reacting to light. Facial nerves were normal. All deep tendon reflexes were normal. Plantars were extensor on the left side and flexor on the right side. Blood investigations were normal except for a moderately raised erythrocyte sedimentation rate (ESR-36 mm in the first hour). Mantoux test was positive. Chest radiograph showed hilar shadow on right and fibrotic changes in the right upper zone (Fig. 1). CT was performed on emergency which showed multiple isodense opacities with perilesional edema in cerebrum and cerebellum, the largest one was in the right frontal lobe (Fig. 2). MRI was performed on 3T GE HDXT 750W MR machine and it showed multiple ring lesions in supratentorial and infratentorial location, the largest lesion in the right frontal lobe was hypointense on T1 and was showing mixed signal intensity with extensive perilesional edema on T2 (Fig. 3). MRS was performed. MR spectroscopy was performed using multiple voxel technique and intermediate TE (144 ms) spectral sampling in the center of the lesion showed high lipid lactate and choline, at the periphery choline peaks were more pronounced than lipid peaks (Figs. 4 and 5). The choline/NAA ratio in the center was 1.34 and at periphery it was 1.9. Lumbar puncture was deferred because of poor compliance of the patient. In view of clinical and past history a provisional diagnosis of tuberculosis was made and for establishing diagnosis biopsy was performed and sent for histopathological evaluation (Fig. 6) which confirmed the larger lesion to be metastatic adenocarcinoma (see Fig. 7).

3. Discussion

Magnetic resonance spectroscopy (MRS) detects biochemical metabolites of tissue in vivo. (3) MRS is a useful adjunct to routine conventional MR imaging. It is operator and interpreter dependent up to some extent, positioning of voxel is a very important step in performing MRS, which if not accurate will obtain contaminated or sub optimal spectra. Interpreter requires an overall knowledge of the biochemical metabolites and the possible differential diagnosis. It is difficult to perform MRS on smaller lesions as partial volume averaging will contaminate the spectra. Many disorders have overlapping MRS features. Choline peak in brain MRS is a cell membrane marker and its elevation indicates high cellularity or cell destruction as seen in most neoplastic lesions, however can be seen in infections (Tubercular and fungal infections) and inflammatory disorders (demyelination) (1,3–5). Lipid lactate peak is consistently seen with necrotic tumors, lymphomas and tuberculomas (1,3–9). Gupta et al have described that increased choline along with the presence of lipid/lactate is a nonspecific finding and may not be useful in the differentiation of tumors from infective/inflammatory intracranial lesions (1). In our case conventional MR imaging with T1 and T2 spin echo, FLAIR, GRE sequences were equivocal as they could not

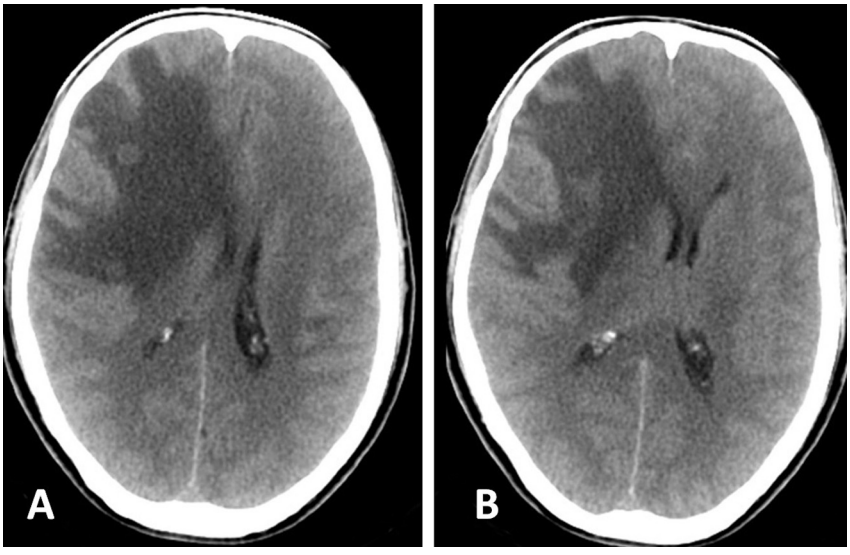

Fig. 2 Plain CT scan showing heterogeneous iso-hyderdense lesion in the right parietal region showing extensive vasogenic edema.

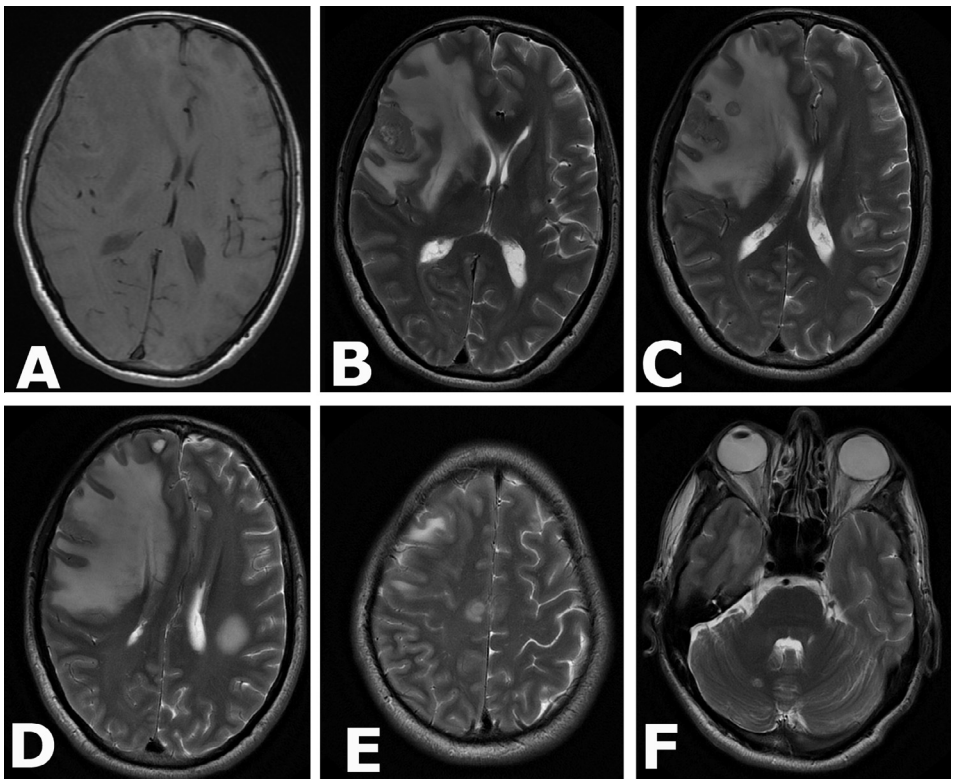

Fig. 3 (A) T1W sequence showing isointense lesion in the right frontal lobe with hypointense vasogenic edema and (B–F) T2W multiple hyperintense lesions are seen in both frontal lobes and in cerebellum largest lesion is the right frontal lobe showing extensive vasogenic edema and hyperintense T2 sequence showing heterogeneous signal intensity.

differentiate between TB, High grade glioma and metastasis. Multivoxel MR Spectroscopy showed lipid–choline peak. MRS in brain metastases shows prominent lipid lactate and choline peaks with reduced NAA and creatinine peaks (10). However this spectral formation is not finger print of metastases and there exists considerable overlap with other conditions. Tuberculomas can be differentiated from metastases based on T2W images (black lesion), however it is not fool proof as different stages of tuberculomas look different on T2 (11). As high grade glioma shows adjacent parenchymal invasion choline elevation is seen in surrounding edema but not in metastases (12). Lymphomas show homogenous enhancement, lack of necrosis and show lactate elevation on MRS along with lipid–choline peaks. Demyelinating diseases can be differentiated from other causes of lipid–choline elevation by classical acute history and presentation. Recent literature suggests that metabolite ratios are more specific in distinguishing neoplastic lesions from non-neoplastic pathologies and high grade neoplasms from low grade neoplasms (12,13). A high Cho/NAA ratio (>2.5) is an indicator of a high-grade neoplasm, low Cho/NAA ratio is attributed to low-grade neoplasm or nonneoplastic processes (13). Choline/creatinine ratio above 2.0 is

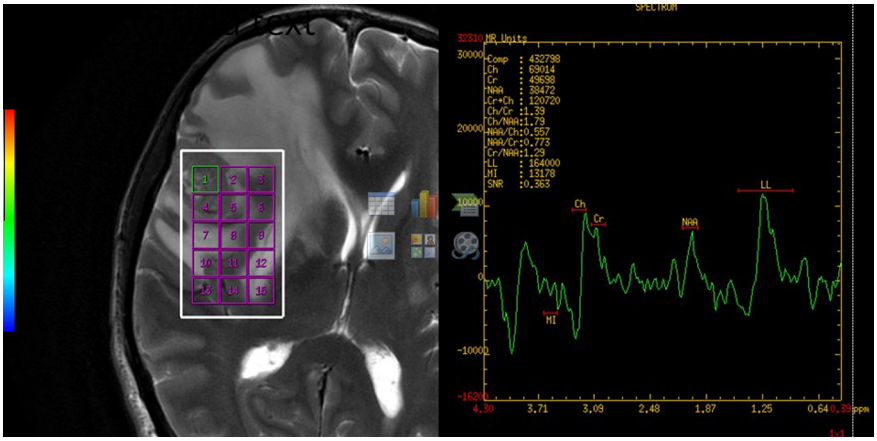

Fig. 4 Centre of lesion showing lipid lactate peak at 0.9 and 1.3 ppm and choline peak at 3.25 ppm, also note decreased NAA at 2.0 ppm.

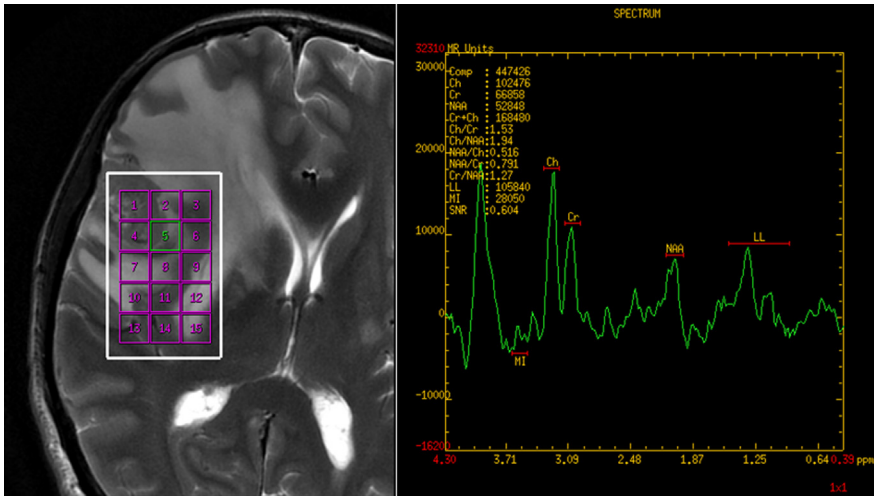

Fig. 5 Periphery of the lesion showing lipid lactate peak at 0.9 and 1.3 ppm and choline peak at 3.25 ppm, also note decreased NAA at 2.0 ppm. (choline peak is more pronounced at the periphery than in center).

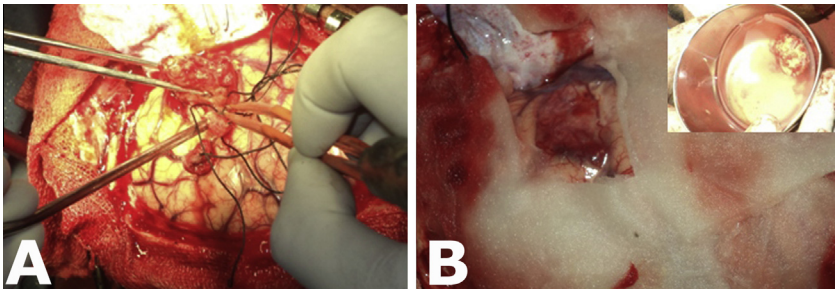

Fig. 6 Right frontal lobe lesion – post surgical excision.

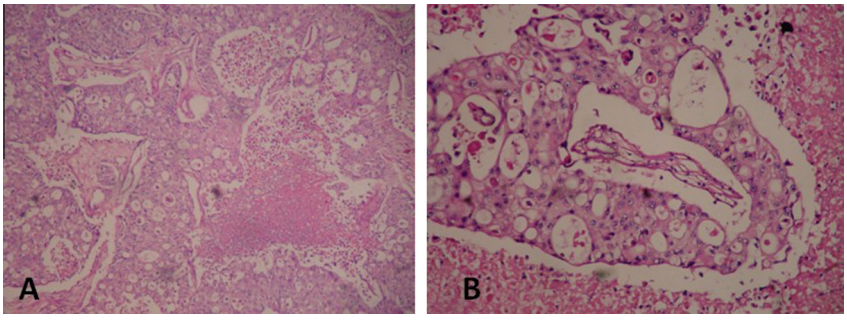

Fig. 7 (A) Sheets of tumor cells arranged in glandular and cribriform pattern, foci of necrosis also seen (H&E-100) and (B) tumor cells arranged in glandular pattern and having vesicular nuclei with prominent nucleoli (H&E-400).

strong indicators of high grade neoplasm (12). In our case choline/NAA and choline/creatinine ratios were in low cellular neoplastic/non-neoplastic range.

4. Conclusion

Attempt to comprehend MRS on the basis of summary points (Good, bad and Ugly concept of metabolites) lacking eagle eye vision while interpreting can lead to erroneous diagnosis and thereby affecting the final outcome. Choline peak along with lipid lactate elevation is a puzzle in MRS as it is found in a number of conditions like high-grade gliomas, Metastases, lymphomas tuberculomas, demyelinating disorders etc. To solve this puzzle, one should read spectra under the light of conventional MR imaging and clinical history and if any doubt should not hesitate to perform biopsy.

Conflict of interest

We have no conflict of interest to declare.

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