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Central Neurocytoma and its mimic- MR Spectroscopy to the rescue

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ABSTRACT:

The purpose of this study was to discriminate supratentorial intraventricular subependymoma from central neurocytoma using magnetic resonance spectroscopy (MRS).Multi-voxel proton MRS using a 3T MR scanner from two subependymomas and three CNCs were evaluated. Automatically calculated ratios comparing choline (Cho), N-acetylaspartate (NAA), myoinositol (MI), and glycine (Gly) to creatine (Cr) were determined. Evaluation of Cr to unsuppressed water (USW) was also performed. Mann-Whitney *U*test was carried out to test the significance of differences in the metabolite ratios. Detectability of lactate (Lac) and alanine (Ala) was evaluated.Histopathology was taken as gold standard.

Keywords: Central neurocytoma, Intraventricular tumor, MR Spectroscopy, Supratentorial intraventricular subependymoma .

1. Introduction

Central neurocytoma (CNC) has affinity for lateral ventricle, typically attached to the septum pellucidum, so do supratentorial intraventricular subependymoma.[1] Both present with similar symptoms of raised intracranial pressure subependymoma typically presents as a homogeneous and non-enhancing lesions as opposed to CNC which is generally a heterogeneous, calcified, enhancing tumor. However, when a rather large subependymoma is discovered it may be heterogeneous, cystic, and calcified and may demonstrate slight enhancement making it difficult to distinguish from CNC.[2] To avoid unnecessary surgery in incidental tumors, it is necessary to characterize them on imaging. Our aim in this study was to assess the role of magnetic resonance spectroscopy (MRS) in the characterization of CNC and differentiate it from its close differential Supratentorial intraventricular subependymoma .

2. Materials and Methods

Five cases of intraventricular tumors suspected to be CNC on conventional 3T MR Imaging sequences along with Gadolinium contrast and diffusion weighted imaging underwent MR Spectroscopy. Multivoxel MRS was performed with long TE of 144ms obtained from voxels located within the tumor. Voxel size was chosen to maximize the partial volume of tumor in each single-volume study. In all cases, sampling

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voxels were localized to avoid contamination by normal brain tissue or cerebrospinal fluid in the lateral ventricle. Imaging diagnosis was reassessed in viw of MRS findings and 2 of them were characterised as subependymomas. All the 5 cases underwent excision biopsy with histophysiological examination after informed consent. Hematoxylin and eosin staining and Ki-67 labeling indexes were evaluated in SIS. Hematoxylin and eosin staining and immunohistochemical examination for synaptophysin were performed in CNC. Histopathological findings were corroborated with MRS.

3. Results

Out of 5 cases previously suspected to be CNC on conventional MRI, 2 of them showed high Glycine and Myoinositol peak with raised cho/cr ratio and were reconsidered to be subependymoma. On histopathology, the Ki-67 labeling indices of subependymomas were all <1%. According to the microscopic findings, a histological diagnosis of subependymoma corresponding to World Health Organization (WHO) grade I was made in these cases, thus confirming our MRS findings. Strong staining for synaptophysin indicated a diagnosis of CNC in rest 3 cases.

Although a statistically significant difference ($P < 0.0001$) was observed in Cho/Cr among subependymoma and CNC, no statistical difference was noted between subependymoma and control spectra ($P = 0.11$). Statistically significant differences were observed in NAA/Cr between subependymoma and CNC ($P = 0.04$). Significant statistical differences were found between subependymoma and CNC ($P < 0.0083$) for Cr to USW. Lac inverted doublets were confirmed in two SIS. Both SIS and CNC showed small NAA peaks.

4. Discussion

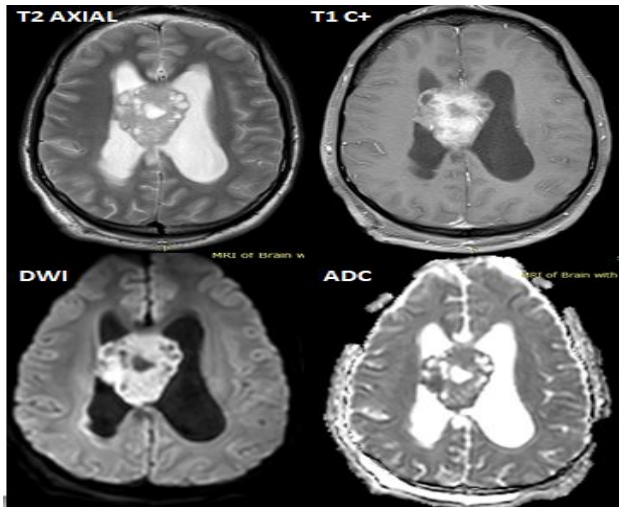

Fig.1a: Central neurocytoma (CNC). A 28-year-old male with a history of chronic headache. T2 axial image showing a heterogeneous hyperintense tumor with internal cystic areas withintense contrast enhancement and diffusion restriction with ADC fall originating from the septum pellucidum attached to both inner walls of the bilateral lateral ventricles.

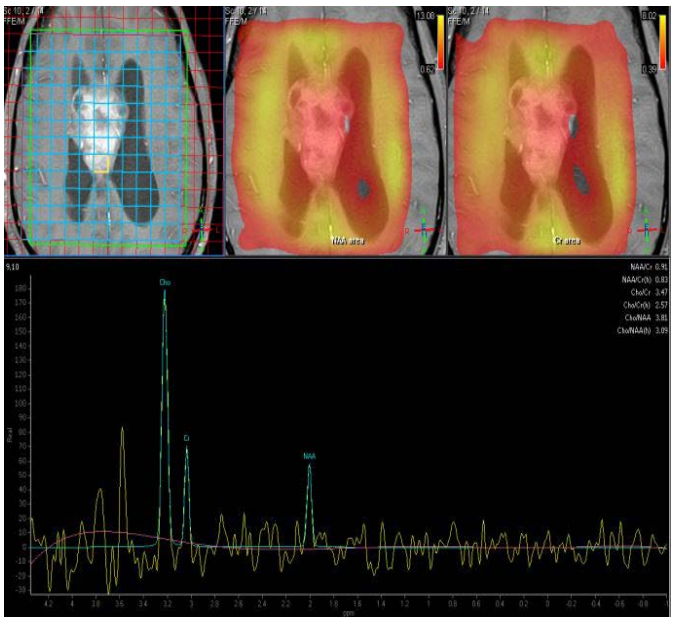

Fig.1b: Central neurocytoma (CNC). MRspectroscopy obtained at echo time of 144 ms showing a prominent peak of choline and a small NAA peak. The Cr peak is small. The glycine peak is seen equivalent to the Cr peak.

Subependymoma is defined as a WHO grade I tumor, which means low proliferative potential and potential curability with surgical resection alone.The tumor location of Supratentorial intraventricular subependymoma overlaps with that of CNC. CNC is defined as a WHO grade II tumor that can be derived from bipotential precursor cells of the periventricular germinal matrix capable of both neuronal and glial differentiation. CNC is thought to originate from rather neuronally committed stem cells.

The Cr concentration is high in mature astrocytes and oligodendrocytes and so the presence of Cr is considered as an astroglial rather than a neuronal marker. Neoplastic cells synthesize lower levels of Cr. The high Cho/Cr is thought to be a malignant feature, which increases in parallel with the histological grade. Although the histological grade of CNC is defined as WHO grade II, previous reports of in vivo MRS of CNC showed a prominent Cho peak with small Cr resonance.[3.4]

MRS of our Subependymomas showed a not so prominent Cho peak which is one of the marked differences from CNC.

In CNC, the peak at 3.56 ppm was assigned to Gly based on the results of high-resolution studies of surgically excised tumor tissues.[4] In our cases, CNC showed peaks of MI and/or Glycine whereas both metabolites were present in subependymoma. So the metabolite resonating at 3.56 ppm in subependymoma was thought to be composed of a massive amount of MI.

The presence of a large MI peak might contribute to the differential diagnosis of Supratentorial Intraventricular Subependymoma.

5. Conclusion

MRS is a useful noninvasive tool for discriminating of Supratentorial Intraventricular subependymoma from CNC. The present study adds data for clinicians in planning treatment.

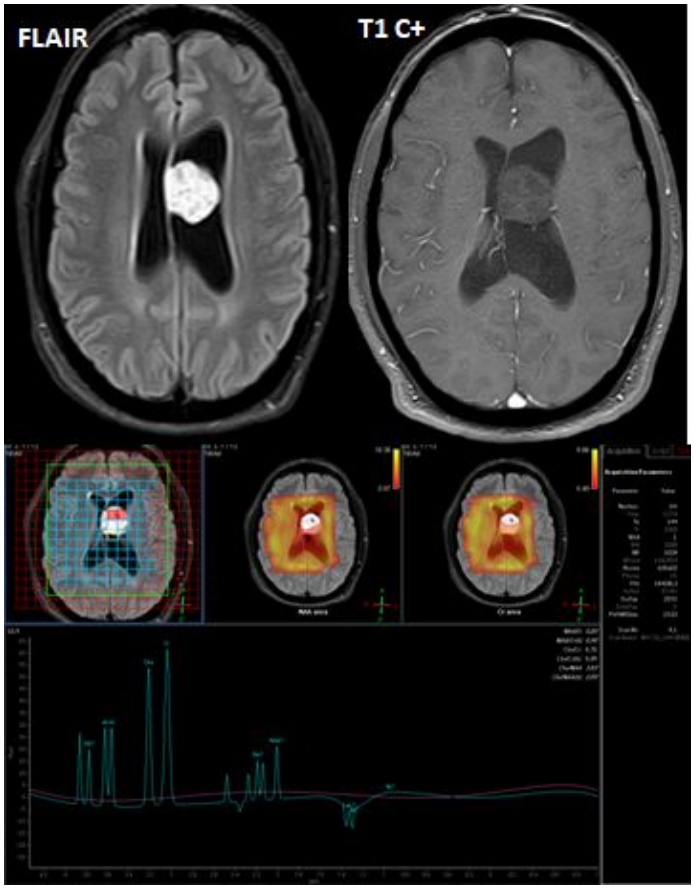

Fig.2: Supratentorial intraventricular subependymoma. A 30 year old male with history of chronic headache.FLAIR axial image showing a heterogeneous hyperintense tumor with internal cystic areas with low contrast enhancement originating from the septum pellucidum attached to inner wall of the left lateral ventricles.MRS spectroscopy obtained at echo time of 144 ms shows a prominent creatine (Cr) peak and a slightly smaller peak of choline (Cho). There is a large myoinositol (MI) and glycine (Gly) peak. Inverted doublet peaks of lactate (Lac) and a small N-acetylaspartate peak are seen.

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