Magnetic resonance spectroscopy findings in non-enhancing desmoplastic medulloblastoma

Puneet Mittal

Department of Radiodiagnosis, Punjab Institute of Medical sciences, Jalandhar, India

Abstract

Medulloblasoma is a common posterior fossa tumor seen in children and presents with some typical features like midline vermian location and fairly homogeneous enhancment. Desmoplastic variety of medulloblastoma is usually seen in the adults and is known to show some atypical features like lateral cerebellar location, variable enhancement, and early meningeal infilteration. Therefore medulloblastoma should always be considered in differential diagnosis of posterior fossa mass in adults even when typical imaging findings are not that of medulloblastoma. Enhancement pattern can be variable in these tumors varying from mild to striking. Occasionally, totally non-enhancing tumors are encountered, which can cause further diagnostic confusion. We describe the magnetic resonance (MR) and MR spectroscopy findings in a case of midline vermian mass, which did not show any enhancement on post-contrast images, and was subsequently proven to be desmoplastic medulloblastoma. On MR spectroscopy, the mass showed elevated choline peak consistent with mitotic lesion. No significant lipid lactate leak was seen, which is also consistent with the ususally homogeneous nature of these tumors. Moreover, it displayed taurine peak at 3.4 ppm which is considered fairly specific for medulloblastoma. Therefore, MR spectroscopy findings can be helpful in the diagnosis of medulloblastoma in adults when MR imaging findings can be nonspecific.

Key Words

Desmoplastic, medulloblastoma, MR spectroscopy

For correspondence:
Dr. Puneet Mittal, 448, Opp. Singla Memorial Hospital, Prem Basti, Sangrur, Punjab - 148 001, India.
E-mail: drpuneetmittal@gmail.com

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Introduction

Desmoplastic variety of medulloblastoma is predominantly seen in adults. It is characterized by atypical features like less intense enhancement, early meningeal infiltration, lateral location, and heterogeneous appearance. Non-enhancing tumors are uncommon and pose a diagnostic dilemma. We describe magnetic resonance (MR) and MR spectroscopy findings in a non-enhancing tumor. MR spectroscopy proved useful in the differential diagnosis.

Case Report

A 20-year-old male patient presented for MRI for suspected posterior fossa mass due to hydrocephalus on an outside CT. Contrast-enhanced MR study with MR spectroscopy was performed on Siemens Avanto 1.5T scanner. A midline vermian mass was seen which was hyperintense on T2W [Figure 1a] and fluid attenuation inversion recovery (FLAIR) images [Figure 1b]. It was projecting into the fourth ventricle and causing upward displacement of superior medullary velum. [Figure 1c] No enhancement was seen on post-contrast images [Figures 2a and b]. Based on the MR findings, differential diagnosis included medulloblastoma or astrocytoma. Then 2D proton MR spectroscopy was performed using chemical shift imaging with intermediate TE (time to echo) of 135 ms and TR (time of repetition) of 1500 ms. MR spectroscopy showed increased choline peak with reduced N acetyl aspartate (NAA). No significant lipid/lactate peak was seen. Taurine peak was identified at 3.4 ppm [Figure 3]. A provisional diagnosis of medulloblastoma was made. At surgery, midline vermian mass was resected, which on subsequent histopathology was proved to be desmoplastic medulloblastoma.

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Discussion

There are four principle histological subtypes of medulloblastoma: Classic, desmoplastic, extensively nodular with advanced neuronal differentiation, and large cell type.[1] Although medulloblastoma is predominantly a tumor of children, desmoplastic

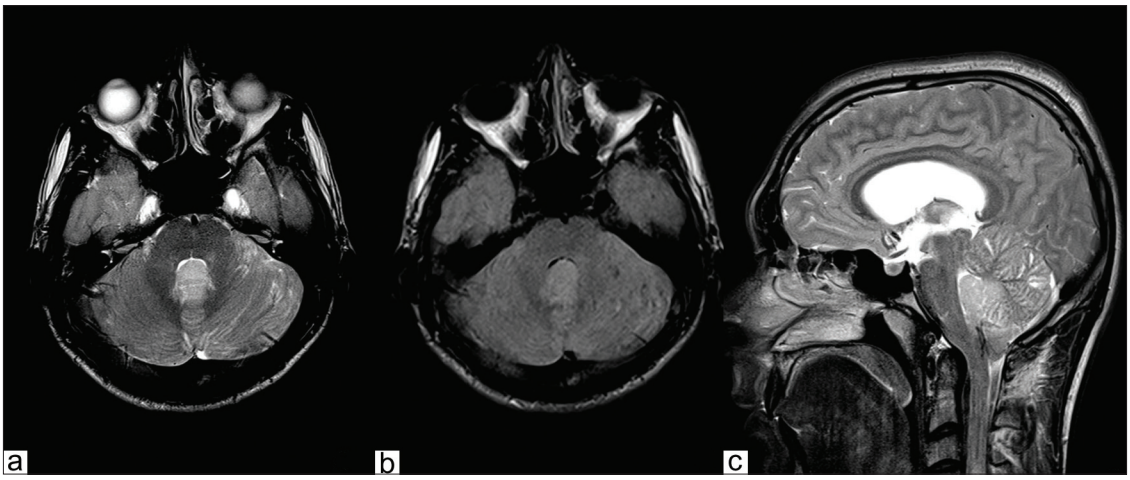

Figure 1: Axial T2W (a) and FLAIR (b) images show homogeneously hyperintense midline vermian mass. Sagittal T2W (c) images show mild upward displacement of superior medullary velum by the mass

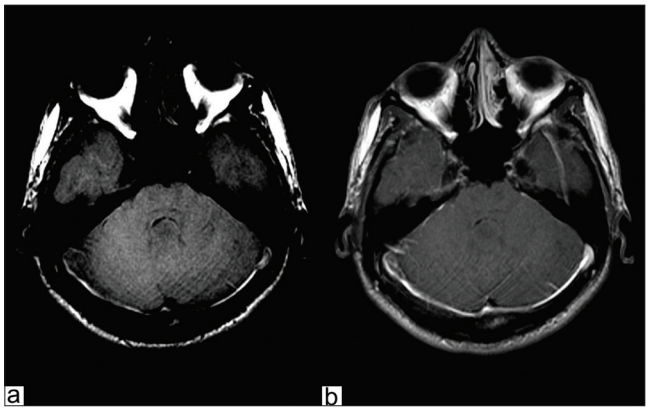

Figure 2: Axial pre contrast (a) and axial (b) post-contrast images show no enhancement in the mass

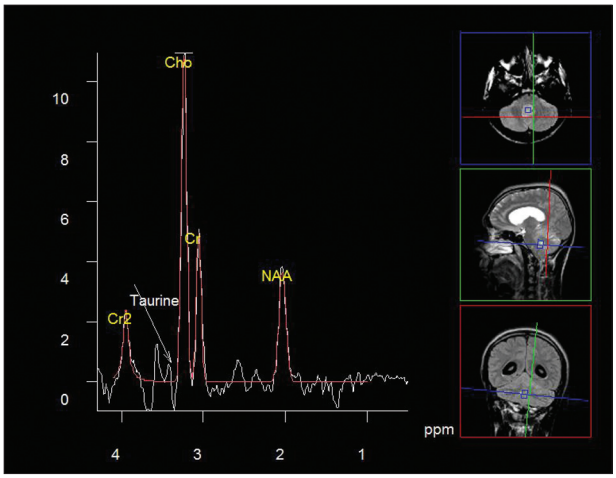

Figure 3: Proton MR spectroscopy image showing prominent choline peak. Taurine peak is seen at 3.4 ppm

subtype is predominantly seen in adults. While the classical appearance of medulloblastoma is that of a midline fairly homogeneously vermian mass, which shows intense homogeneous enhancement, desmoplastic subtype is characterised by many atypical imaging features like lateral cerebellar location, variable enhancement, more heterogeneous appearance, and early meningeal infiltration.[2,3] Variable and heterogeneous enhancement is commonly seen, which is usually less intense as compared to the classical subtype.[1,2] Occasionally, non-enhancing medulloblastomas are reported.[4,5] Therefore, it is important to consider the diagnosis of medulloblastoma is all adult posterior fossa tumors since it has important surgical and prognostic implications.

In our index case, a midline homogeneous vermian mass was seen, which did not show any enhancement of post-contrast images. No evidence of diffusion restriction, calcification, or hemorrhage was seen in it. Primary differential considerations included medulloblastoma or astrocytoma. Meningioma and metastasis were excluded due to lack of enhancement. Mass was causing upward displacement of superior medullary velum, which has been previously reported to favour medulloblastoma.[6]

MR spectroscopy findings in medulloblastoma have been described in literature.[7] Medulloblastomas are characterised by high choline peak, which is explained by the hypercellular nature of these tumors. Absent or low lipid peak has also been described in these tumors. This is likely due to relatively homogeneous nature of these tumors with little necrosis and is said to be useful in differential diagnosis from metastasis or astrocytomas. Taurine peak has been described and is thought to be relatively specific for medulloblastoma.[7,8] Moreno-Torres *et al*.[9] reported usefulness of taurine peak to discriminate medulloblastoma from astrocytoma. They reported taurine peak in all medulloblasoma patients while it was seen in none with astrocytomas. Taurine peak has been reported in gliomas in *in vitro* analysis of biopsy material and is said to correlate with presence of apoptotic cells.[10] However, apoptosis is usually related to hypoxia and there was no spectroscopic evidence of lactate peak in the lesion. Furthermore, lesion was homogeneous with no areas of necrosis. Also, the lesion had a high choline peak, which would be unusual for low grade non-enhancing glioma. Furthermore, the location of the lesion did not favour the diagnosis of glioma. Similarly, although taurine peak has been reported in *in vitro* analysis

in meningiomas,[11] it is not usually demonstrable on *in vivo* MR spectroscopy. NAA is usually undetectable or shows very minimal peak in meningiomas because of their non-glial origin. Also, non-enhancing tumor is unlikely to be a meningioma. All these features point against the diagnosis of meningioma. One of the recent report[12] also demonstrated MRS demonstration of taurine peak to be useful in differentiating adult medulloblastoma from meningioma.

Similar MR spectroscopy findings were seen in our index case. We observed high choline peak without any significant lipid/lactate peak. Taurine peak was identified at 3.4 ppm. No alanine peak was seen. Based on these findings, diagnosis was medulloblastoma was considered, which was subsequently proved on surgical pathology.

In conclusion, imaging findings of medulloblastoma in adults tend to be atypical causing diagnostic difficulties. Therefore, it always remains in the differential diagnosis of posterior fossa mass in this age group. The combination of imaging findings can usually help to reach the correct diagnosis. MR spectroscopy can be useful in some cases by demonstrating taurine peak.

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