

INTRACRANIAL MENINGIOMAS - MR IMAGING FINDINGS IN 30 CASES

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ABSTRACT**OBJECTIVE**

To present the magnetic resonance imaging findings of 30 cases of intracranial meningiomas diagnosed in a single institute. Magnetic resonance imaging (MRI) with contrast is the modality of choice for diagnosis of meningiomas. Objective of this study was to describe typical and atypical locations and findings of intracranial meningiomas on magnetic resonance imaging.

MATERIALS AND METHODS

This study was conducted at Department of Radiology, Government General Hospital, Kakinada from January 2013 to August 2014 over a period of 20 months. 30 patients of intracranial meningiomas of 15-75 years' age group were studied.

RESULTS

A higher incidence noted in females. Most of the tumours are solitary. The most common sites of occurrence are the cerebral convexities, parasagittal location/falx, posterior fossa, sphenoid ridge, olfactory groove. Majority were typical (WHO grade 1) in 96.6%, only 3.4% were atypical (WHO grade 2). Most of the tumours showed low signal on T1- (60%) and high signal on T2- (68%) and FLAIR (69%) weighted images. Also, the lesions showed heterogeneous signal on T1 (60%), T2 (68%) and FLAIR (64%) sequences. After contrast administration, 67% of the tumours presented intense and 33% showed moderate and heterogenous enhancement. The most common sites of occurrence are the cerebral convexities, parasagittal location/falx, posterior fossa, sphenoid ridge, olfactory groove and others accounting for 33.3%, 20%, 20%, 10%, 6.7%, 10% respectively. Areas of vasogenic oedema around the tumours were seen in 33% of the cases. Twenty percent of the cases showed bone infiltration, and the dural tail sign was seen in 56% of the tumours.

CONCLUSION

The diagnosis of meningioma is usually straightforward except when it presents in unusual locations and with atypical imaging characteristics. MRI is the modality of choice for diagnosis as well as for predicting the success of its complete removal.

KEYWORDS

Atypical meningiomas, Meningioma, MRI.

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INTRODUCTION: Meningiomas are the most common non-glial extraaxial primary tumours of the central nervous system (CNS), accounting for between 16 to 20 % of all intracranial tumours. Meningiomas originate from arachnoid cap cells of the arachnoid villi which are usually located along dural venous sinuses. The majority of meningiomas are spontaneous and of unknown aetiology, although recognised risk factors include previous exposure to radiation, trauma, genetic disorders such as neurofibromatosis type 2, in which the tumours may be multiple.¹

- They are more common in women, mostly benign and usually have distinct appearance on histology and imaging but rarely may be atypical or malignant.²
- Magnetic resonance imaging (MRI) with contrast is the modality of choice for diagnosis of meningiomas providing superior contrast differentiation and usually the ability to differentiate between intra- and extra-axial lesions.

MATERIALS AND METHODS:

- The protocol was approved by Ethics Committee and written informed consent was obtained from each patient. This study was conducted at Department of Radiology, Government General Hospital, Kakinada from January 2013 to August 2014 over a period of 20 months. 30 patients of 15-75 years' age group were studied and the MRI findings were correlated with intraoperative findings and histopathological

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diagnosis in operated cases. All MR imaging examinations were performed with WIPRO G.E 1.5-Tesla Bravo MR imaging unit with standard protocol.

- Thirty patients of age group 15-75 years diagnosed as meningiomas were included in this study.

RESULTS:

- Out of thirty patients, 60% were females and 40% were males.
- Most of them were solitary except one where multiple (two) meningiomas noted in a patient with neurofibromatosis.
- The most common sites of occurrence are the cerebral convexities, parasagittal location/falx, posterior fossa, sphenoid ridge, olfactory groove and others accounting for 33.3%, 20%, 20%, 10%, 6.7%, 10% respectively.
- Most common presenting symptom was headache followed by symptoms related to brain compression like hemiparesis, cranial nerve palsies and visual field defects due to compression effect of meningiomas based on their location. Majority were typical (WHO grade 1) in 96.6%, only 3.4% were atypical (WHO grade 2).



Fig. 1

Fig. 2

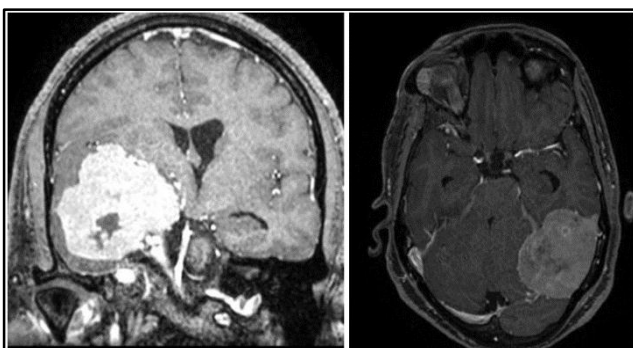


Fig. 3

Fig. 4

Fig. 1, 2, 3, 4: MRI T1 contrast images showing various locations of meningioma in falx, olfactory groove, sphenoid wing and posterior fossa respectively.

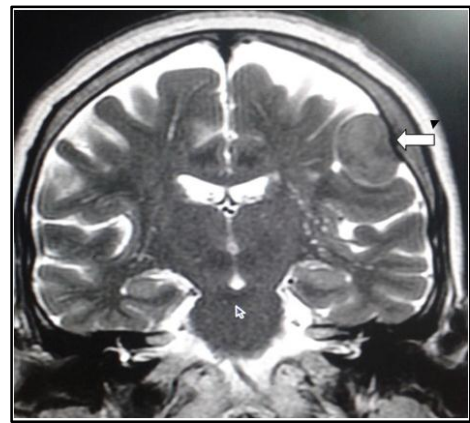


Fig. 5: (Coronal T2): Showing hyperostosis adjacent to meningioma

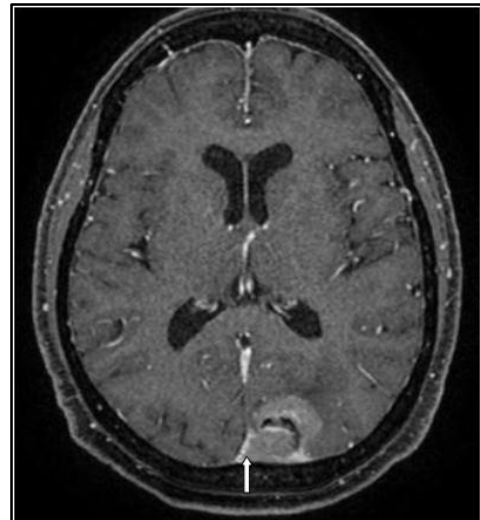


Fig. 6: (Axial T1 contrast): Showing superior sagittal sinus involvement

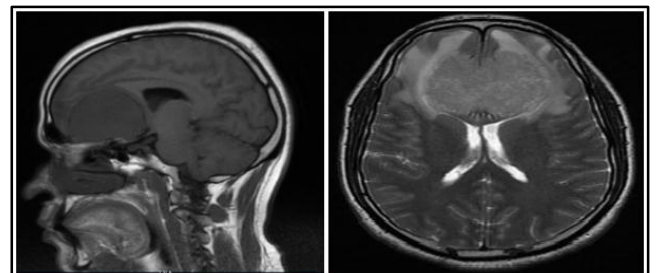


Fig. 7

Fig. 8

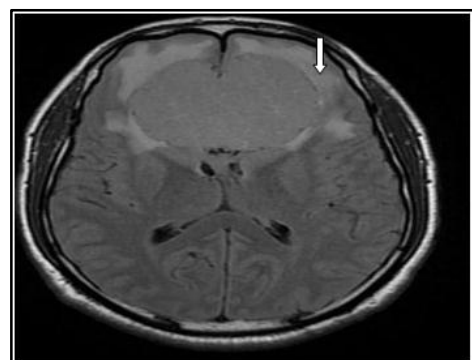


Fig. 9

Fig. 7: (sag T1) Fig. 8 (Axial T2) Fig. 9 (Axial FLAIR) Showing well circumscribed lobulated extraaxial dural based mass at the floor of the anterior cranial fossa in the midline overlying cribriform plate of ethmoid. T2 hyperintense perilesional oedema in adjacent brain parenchyma best depicted on FLAIR (Fig. 9).

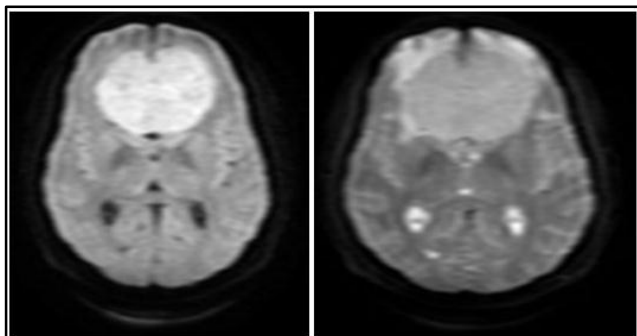


Fig. 10, 11: Showing high signal on diffusion attributed to atypical nature of meningioma

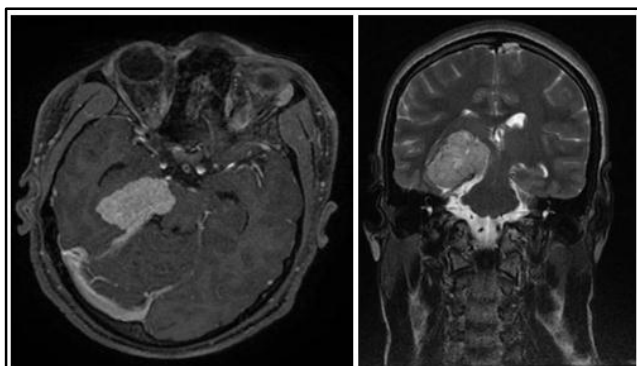


Fig. 12

Fig. 13

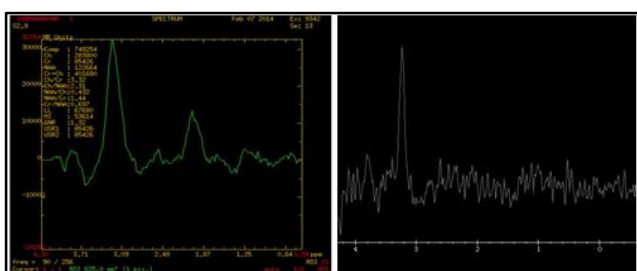


Fig. 14

Fig. 15

Fig. 12, 13, 14, 15: Showing MRI Spectroscopy from a typical meningioma showing increased choline peak with significant reduction in the NAA and creatine levels, small alanine peak.

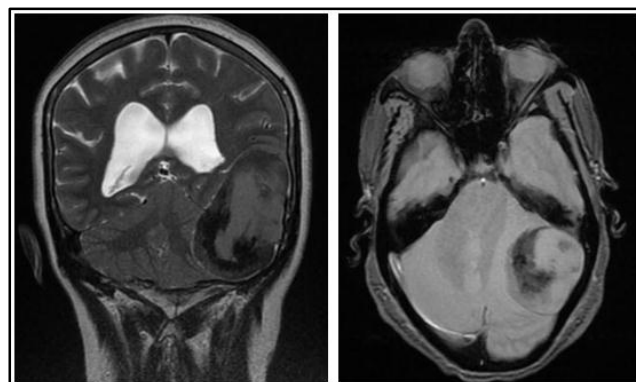


Fig. 16: (Coronal T2W), Fig. 17: (Axial T*): Images showing different types of calcified meningiomas

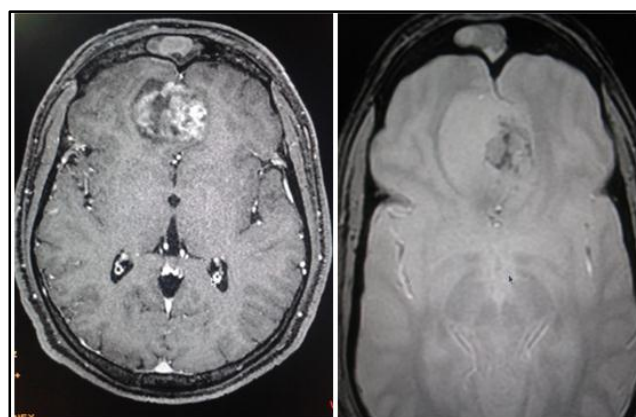


Fig. 18: (Axial T1 contrast) showing heterogeneously enhancing meningioma with non-enhancing cystic areas and Fig. 19: (Axial T*) showing calcifications

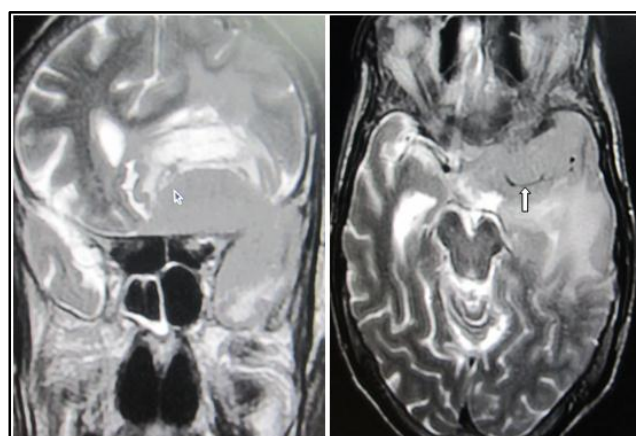


Fig. 20: (Coronal T2), Fig. 21 (Axial T2) Showing sphenoid wing meningioma encasing left MCA branches



Fig. 22: (Axial T1 contrast): Showing sphenoid wing meningioma with central non enhancing foci



Fig. 23: Axial T1 contrast image shows dural tail sign - enhancement of the dura infiltrating away from the lesion

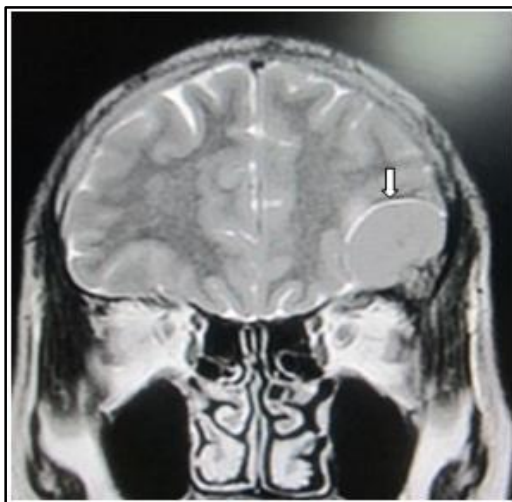


Fig. 24: Coronal T2 showing CSF Cleft sign showing hyperintense line in between the mass and surrounding brain

DISCUSSION:

- Meningiomas are well-circumscribed globular or lobulated dural-based tumours clearly demarcated from the brain.
- The typical MRI signal intensity characteristics consist of iso to slight hypointensity relative to grey matter on the T1-weighted sequence and iso to slight hyperintensity relative to grey matter on the T2 sequence.³ After contrast administration on T1 contrast sequence meningiomas typically show avid, homogeneous enhancement found in 67% cases.⁴ Rest of the 33% of cases showed peripheral, heterogenous enhancement due to calcifications, nonenhancing cystic and necrotic areas.
- Adjacent bony changes, hyperostosis noted in 20% of cases, as though better demonstrated in CT than MRI.⁵
- On spectroscopy - meningiomas shows increased choline peak with significant reduction in the NAA and creatine levels, small alanine peak.
- The typical radiological signs of extraaxial location are better identified on MRI, although not specific, more frequently observed in meningiomas than in other extra-axial lesions. These signs are the following.⁶
- White matter buckling of the underlying brain parenchyma.
- Dural tail sign - enhancement of the dura infiltrating away from the lesion. Other differential diagnoses to consider for dural tail sign are extra-axial metastases (leptomeningeal metastases), tuberculosis and sarcoid.
- Cerebrospinal fluid cleft sign – T1 low signal intensity(SI), T2 high SI line in between mass and brain parenchyma.
- Pial vascular structures interposed between the tumour and the brain surface.
- Differential diagnosis of extraaxial lesions are: Dural metastases, granuloma (T. B, Sarcoid), idiopathic hypertrophic pachymeningitis, extramedullary haematopoiesis, etc.

Atypical or less frequent radiological features:

- Large amount of oedema uncommon, both mild and severe oedema noted in ten cases (33.3%).⁷
- Calcifications noted in 30% of cases, it may be peripheral or central, small punctate or large conglomerate.
- Cystic or nonenhancing areas noted in two cases.
- Areas of haemorrhage noted in one case.
- Diffusion restriction noted in one case.
- Meningiomas associated with complications such as dural sinus invasion noted in four cases, significant mass effect on surrounding arteries, cranial nerves, ventricular system and brainstem noted in twelve cases.

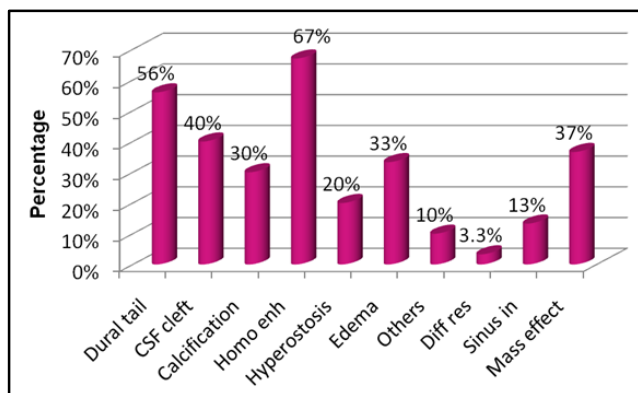


Fig. 25: Graph showing meningeoma imaging features

CONCLUSION: The diagnosis of meningeoma is usually straightforward except when it presents in unusual locations and with atypical imaging characteristics.

- MRI is the modality of choice for diagnosis as well as for predicting the success of its complete removal by providing information about their location, dural attachment site, severity of oedema and displacement of critical neurovascular structures; which is useful for planning operative approach and affects outcome
- Imaging features reported to suggest atypical or malignant nature of meningeomas are haemorrhage, cystic change and restricted diffusion on DWI.

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