

VARIOUS PRESENTATIONS OF INTRACRANIAL MENINGIOMAS

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ABSTRACT

Meningiomas are the most common non-glioma tumor of the central nervous system (CNS). There are a number of characteristic imaging features of meningiomas on magnetic resonance imaging (MRI) that allow an accurate diagnosis, however there are a number of atypical features that may be diagnostically challenging. Furthermore, a number of other neoplastic and non-neoplastic conditions may mimic meningiomas.

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INTRODUCTION:

Meningiomas are the most common all brain tumors accounting for over one-third of all primary intracranial neoplasms. Meningiomas are the most common non-glioma tumors of the central nervous system (CNS), accounting for between 16 and 20 % of all intracranial tumors [1]. The WHO subdivides meningiomas into meningioma and meningioma variants. Meningioma and meningioma variants. Meningioma is benign lesion with a non-aggressive growth and a low recurrence rate and corresponds histologically to WHO grade I. meningioma variants include benign histologic subtype such as meningothelial, fibrous, transitional, psammomatous, microcystic and angiomatous meningiomas. All these belongs to WHO grade I neoplasms. Atypical meningioma

corresponds to WHO grade II. Meningiomas have an annual incidence of 6 per 100,000 and are twice as common in the females as in the male population [2].

Meningioma arises from progenitor cells that give rise to arachnoid meningothelial cells positioned outside the thin arachnoid layer that covers the brain and spinal cord.

Most of the meningiomas are found incidentally at the time of imaging. Females are more common to have meningioma as compared to males, with female to male ratio being 2:1. Ionizing radiation is the established environmental risk factor for meningioma. People who are exposed to ionizing radiations in childhood are at high risk. NF2 meningiomas have genomic instability and are more likely to be atypical. The cytogenic alteration in meningioma is monosomy of

chromosome 22. The majority of meningiomas are spontaneous and of unknown etiology, although recognized risk factors include previous exposure to radiation, genetic disorders such as neurofibromatosis type 2, in which the tumors may be multiple [3] Meningioma are slow growing tumor and are benign. They are the most common primary intracranial tumor to harbor metastases, majority from lung or breast. Meningiomas usually form sessile or lentiform, well circumscribed, extra-axial mass lesions with broad-based dural attachment. They characteristically demonstrate hyper density on non-contrast CT, iso- to hypo intensity on T1-weighted, and iso- to hyperintensity on T2-weighted images [4]. Most of them will demonstrate no diffusion restriction or facilitation on diffusion weighted images, compared with the brain parenchyma [5].

Uniform and strong enhancement is typically seen after contrast administration. Dural tails [6],

They account for 27 % of all primary brain tumors in Japan, and middle-aged women are most commonly affected [7]

Meningiomas with WHO grade II or III are associated with high recurrence rates and mortality. Successful gross total resection significantly decreases the rate of recurrence, compared with subtotal resection [8].

In WHO grade I meningiomas, tumor consistency, associated with tumor histology, is an important factor in determining the extent of tumor resection and surgical outcome. Therefore, preoperative imaging information regarding histologic grade and subtype of meningioma is crucial [9]

SITES OF MENINGIOMAS:

General locations :

- Supratentorial 90% : parasagittal, convexities: 45%
 - sphenoid ridge: 15-20%
 - olfactory groove/planum sphenoidale: 10%
- Juxtaseilar: 5-10% can present with

- visual field defects
- cranial nerve deficits

- Infratentorial 8-10%
- Rarely intraventricular

CLINICAL FEATURES:

Most of the time meningiomas are diagnosed incidentally while imaging the patient less than 10 percent of the meningiomas are symptomatic in nature.

Symptomatic patients can have headaches, altered mental status and symptoms depending upon the site and mass effect caused by meningioma Olfactory groove meningioma can cause anosmia Juxtaseilar meningioma can cause visual field defect and cranial nerve deficits

IMAGING FEATURES OF MENINGIOMAS:

- Meningiomas typically appear as lobular, extra-axial masses with well-circumscribed margins
- They typically have a broad-based dural attachment and, if sufficiently large, cause inward displacement of the cortical grey matter [5].
- They may occasionally, however, exhibit a more infiltrating growth pattern over the dura, termed meningioma en plaque which most commonly occur along the sphenoid ridge or the convexity.
- The typical MRI signal intensity characteristics consist of isointensity to slight hypo intensity relative to grey matter on the T1-weighted sequence and isointensity to slight hyperintensity relative to grey matter on the T2 sequence.
- On FLAIR images it appears hyperintense.
- Diffusion and ADC maps are variable.
- After contrast administration, meningiomas typically demonstrate homogeneous enhancement however, they may occasionally have areas of central necrosis or calcification that do not enhance.

- Calcification is typically best demonstrated on CT, with variable reported rates of occurrence. On MRI, calcification is best identified on susceptibility-weighted images as areas of low signal intensity; however, calcification may also be appreciated on T2-weighted sequences as areas of low signal intensity. Contrast is especially useful in delineating plaque meningiomas [2] that are typically seen as asymmetric thickened sheets of enhancing dura.
- MR spectroscopy: shows elevated levels of alanine at short TE: Triplet-like spectral pattern at 1.3-1.5 ppm (overlapping of Ala, Lac) Elevated glutathione.
- NECT SCAN: Sharply circumscribed smooth mass abutting dura
Hyper dense (70-75%), isodense (25%)
Hypodense (1-5%), calcified (20-25%)

Hemorrhage is present in 8-23% cases.
CECT: 90 % enhance homogenously and intensely.

VARIOUS SIGNS IN MENINGIOMAS :

- **CSF cleft sign:** Helps establish the mass to be extra-axial loss of this can be seen, which may suggest brain parenchyma invasion
- **Dural tail** is seen in 60-72%² (note that a dural tail is also seen in other processes)
- **Sunburst or Spoke-wheel** appearance of the vessels
- White matter buckling sign
- Arterial narrowing
- typically seen in meningiomas which encase arteries
- useful sign in parasellar tumors, in distinguishing a meningioma from a pituitary macroadenoma; the latter typically does not narrow vessels

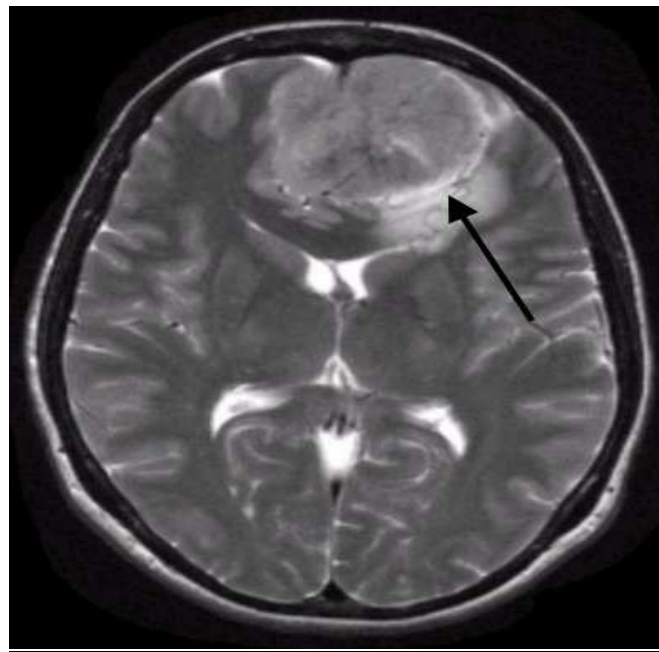


Fig 1: CSF Cleft Sign

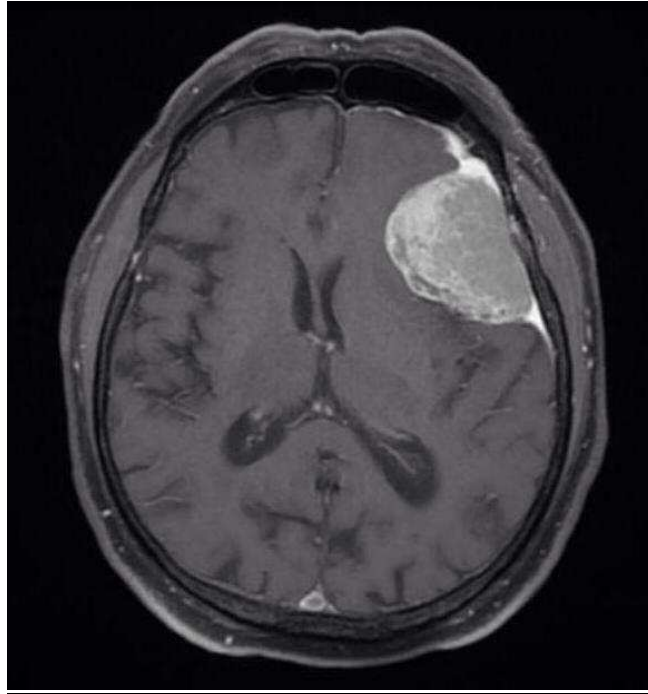


Fig 2: Dural Tail Sign

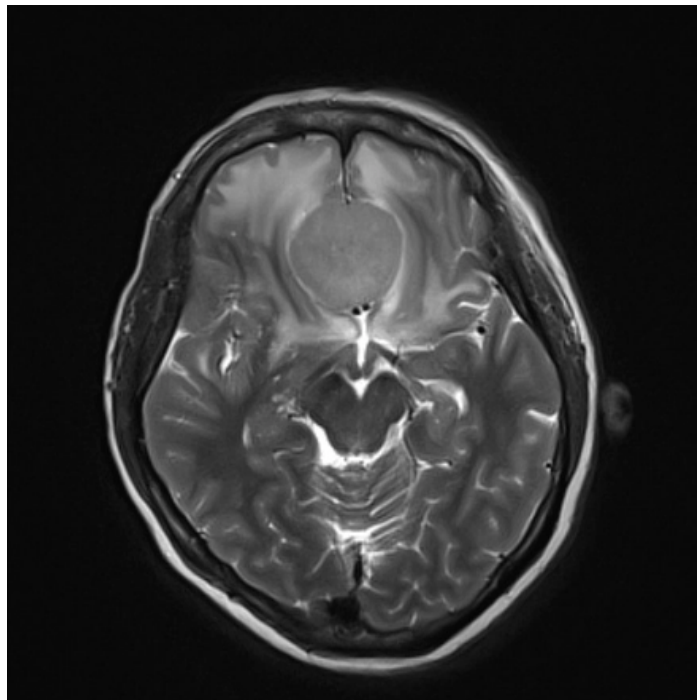


Fig 3: White Matter Buckling Sign

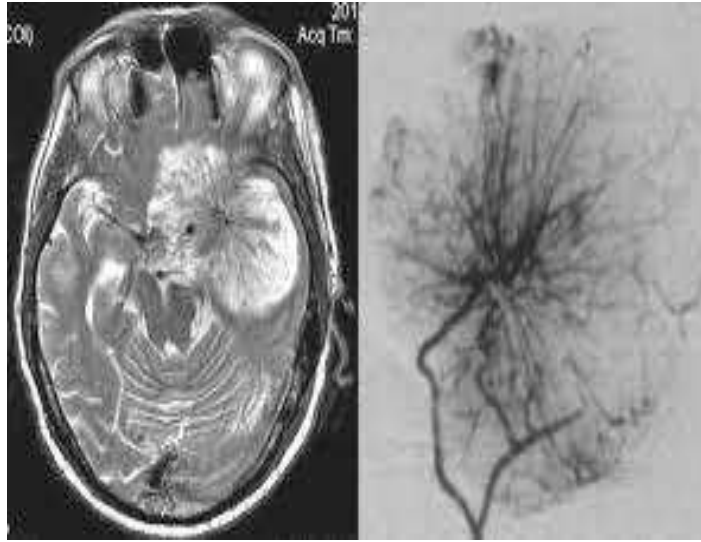


Fig 4: Spoke Wheel Sign

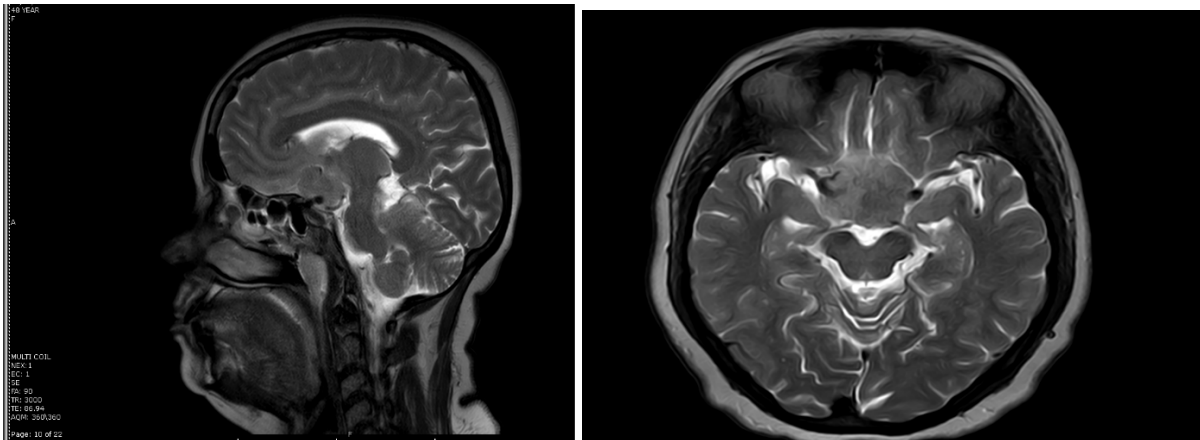


Fig 5: A case of 48 years' patient who presented with headache and difficulty in vision:
Suprasellar Meningioma with involvement of clinoid portion of ICA.



Fig 6: 36 years' patient presented with headache, MRI images demonstrates well defined oval extra axial mass in left parietal region which appears isointense to cortex on T1W images, hyperintense on T2W images with a positive cleft sign. On Post contrast study homogenous contrast enhancement is present

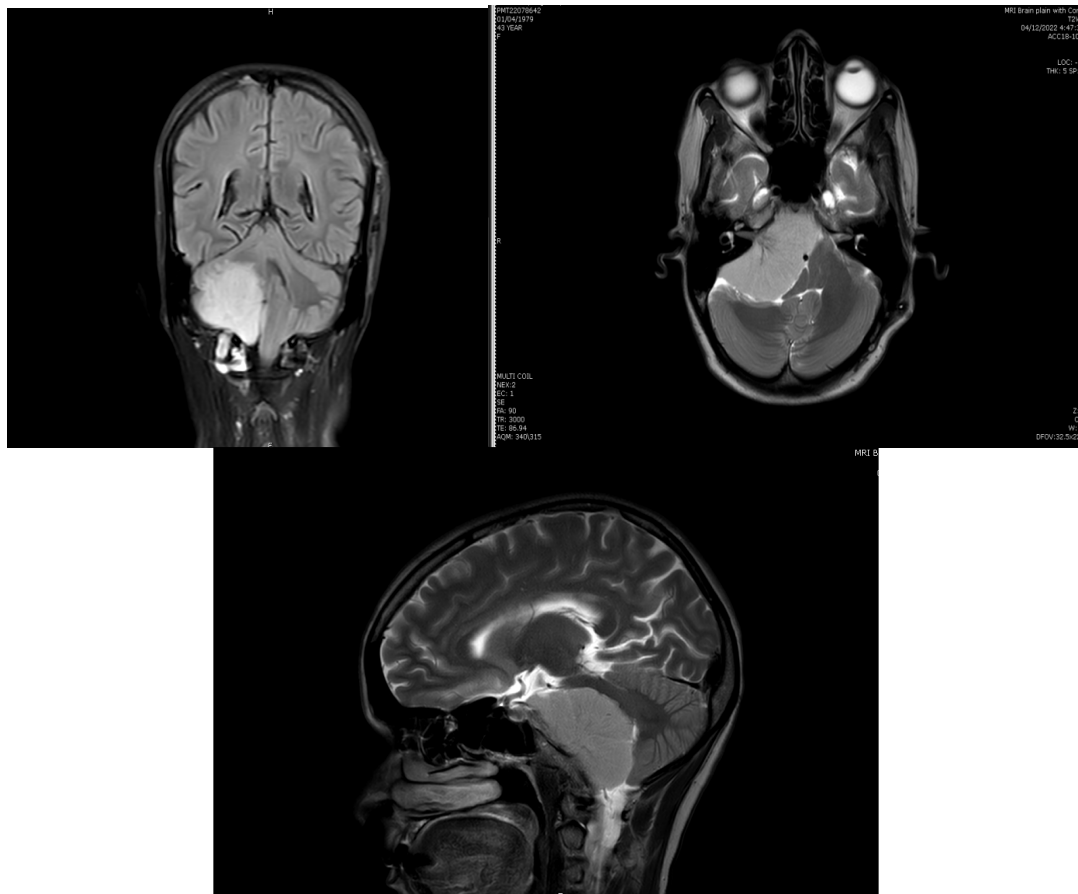


Fig 7: Right CP angle meningioma

- Meningioma extends to involve 5th, 6th, 7th 8th 9th cranial nerves on right side
 - It involves right vertebral artery and basilar artery

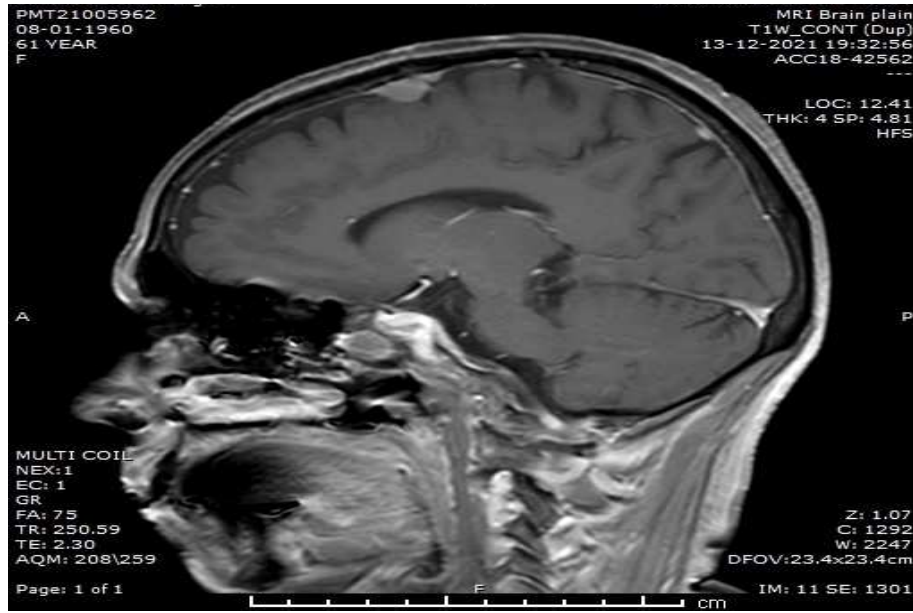
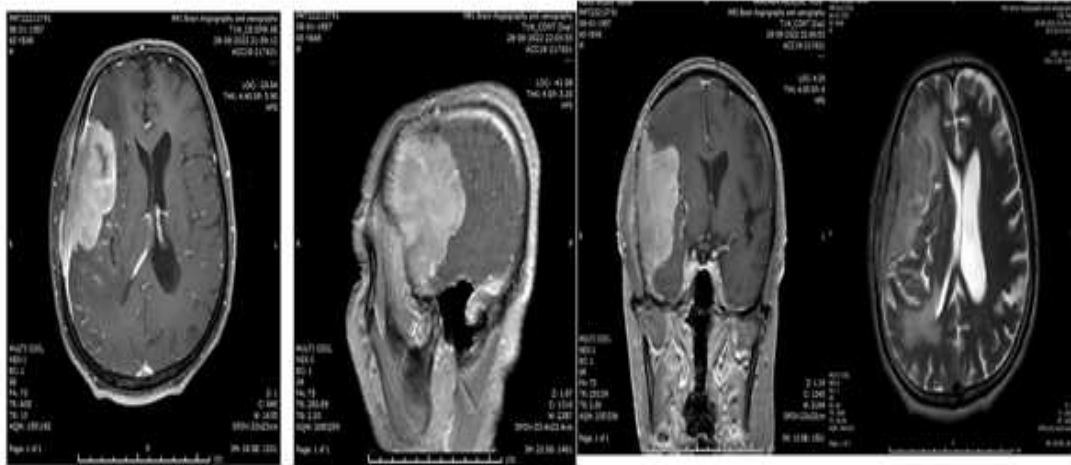


Fig 7: Meningioma in Frontal Region with Positive Dural Tail Sign



Fig 8: Left Temporal Region



Extra-axial, broad based meningioma along right fronto-parieto-temporal convexities likely arising from greater wing of sphenoid with adjacent calvarial thickening and grey-white matter buckling. Positive CSF cleft sign is noted on T2W axial images. Also edema and mass effect is noted in adjacent brain parenchyma.

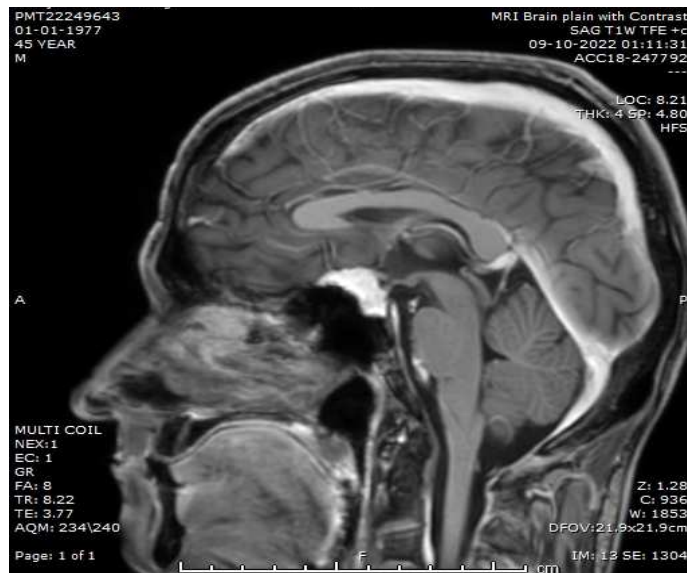


Fig 9: Suprasellar meningioma with a broad dural attachment to the planum sphenoidale giving "dural tail sign".

Superiorly, it is indenting the optic chiasma.

Anterolaterally at the orbital apex, it is compressing over posterior part of right optic nerve, causing its tortuosity.

Laterally, seen extending into cavernous sinus on right side with encasement of cavernous portion of right internal carotid artery.

Inferiorly, it is causing depression of diaphragm sellae.

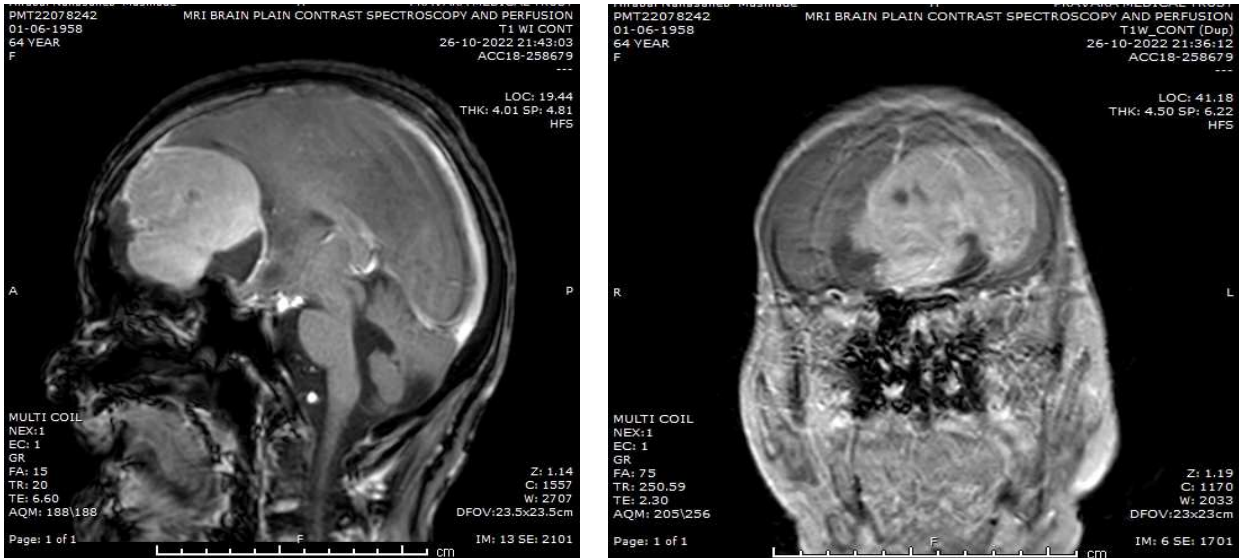
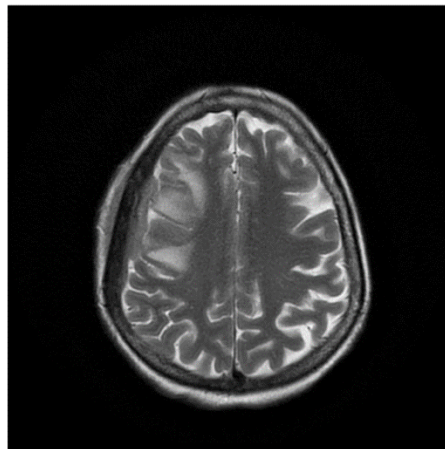


Fig 10: Olfactory groove meningioma showing dural reflection and homogenous contrast uptake with mass effect in the adjacent brain parenchyma

En plaque Meningioma

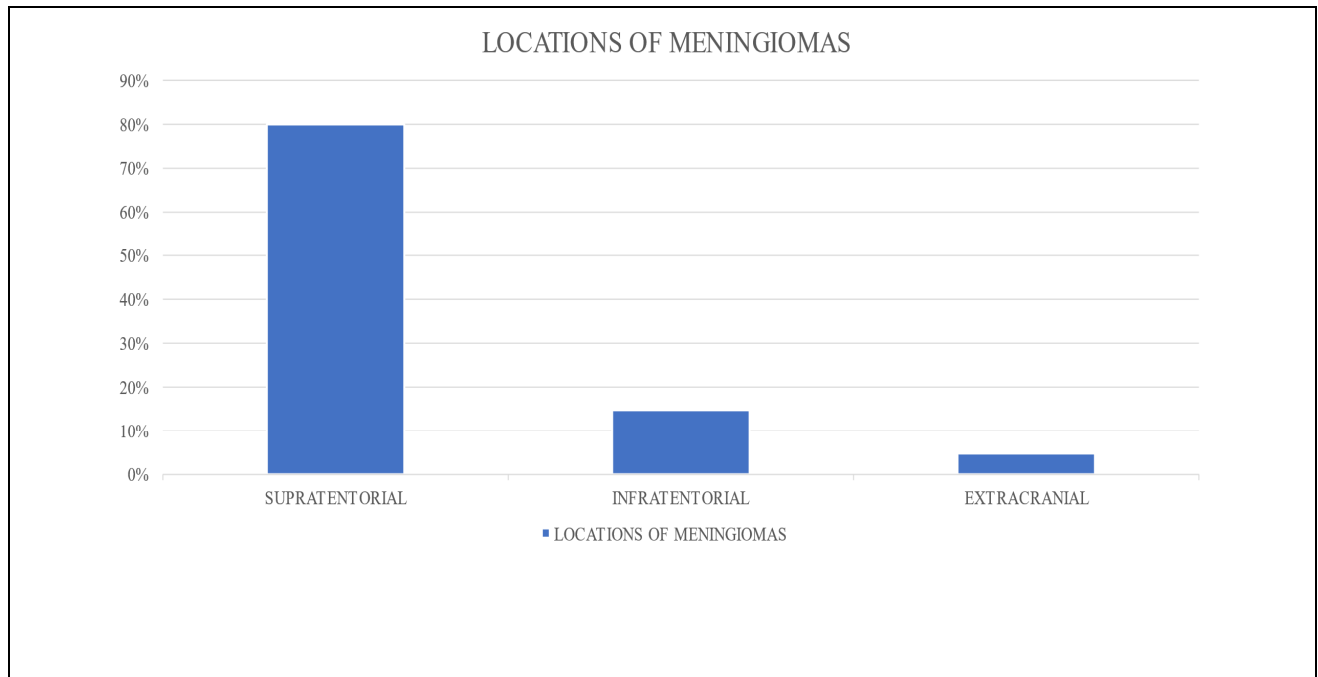


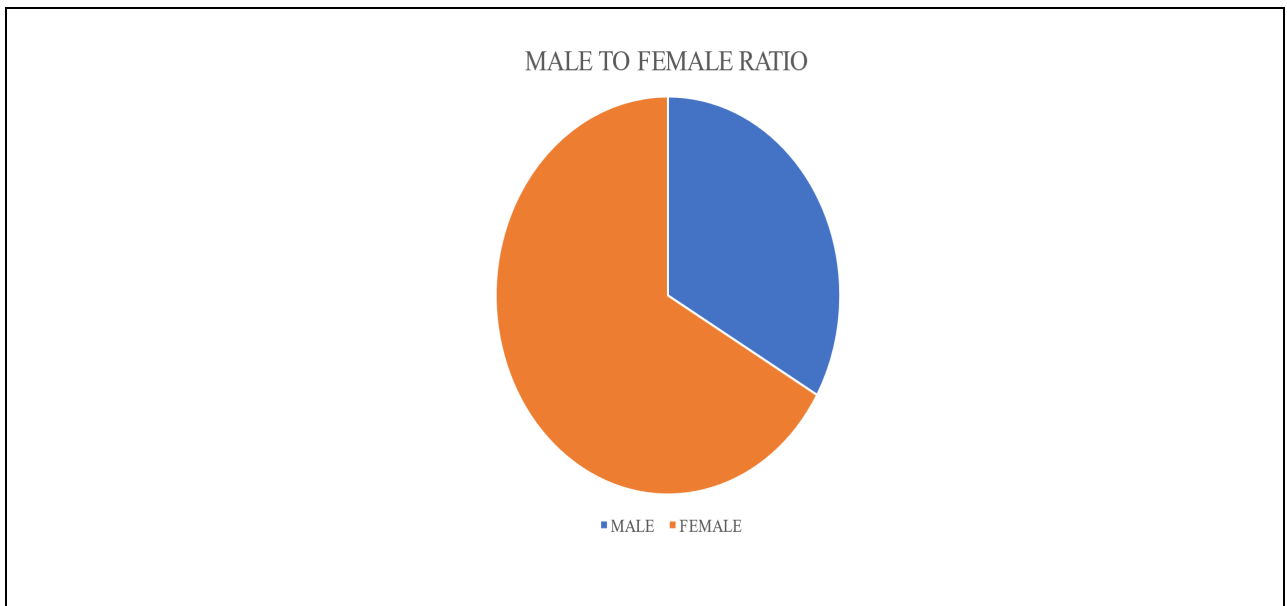
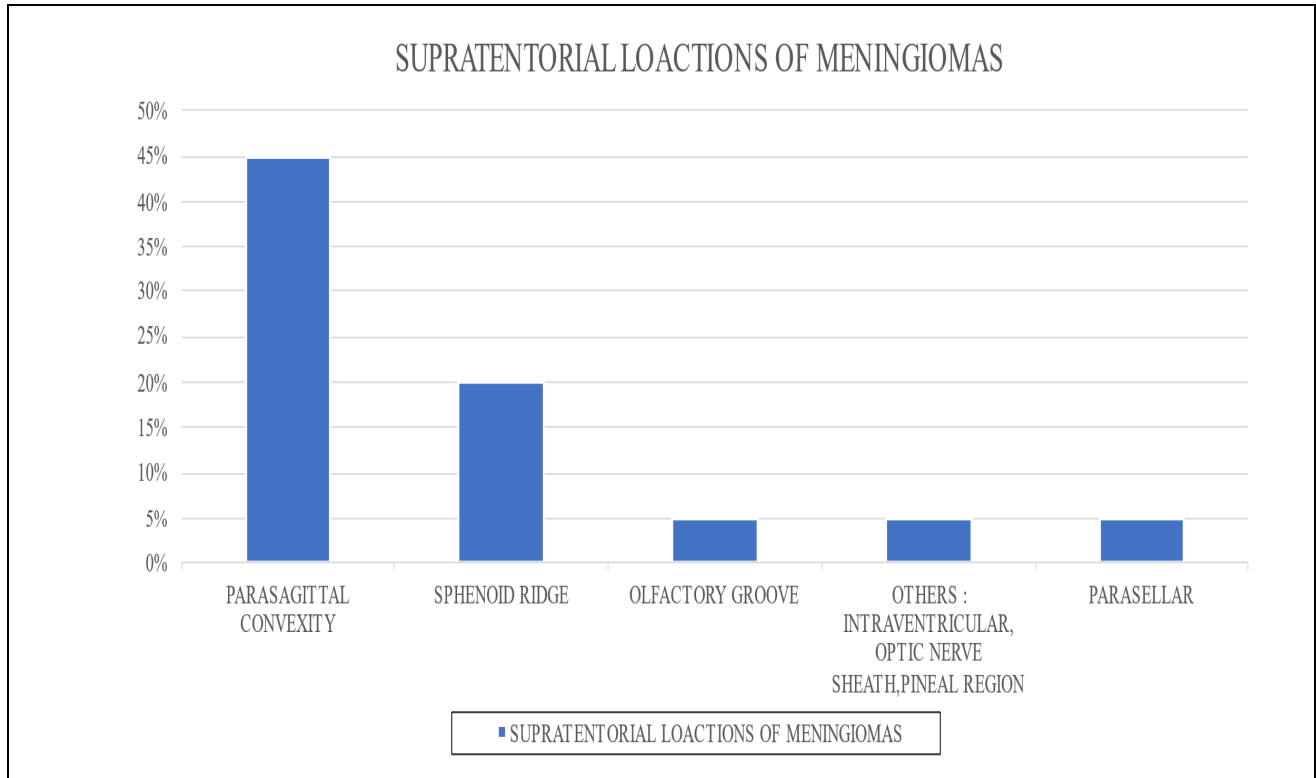
All the patients referred to department of radiodiagnosis were taken into consideration. A cross sectional study was performed on 40 patients who were referred to department of

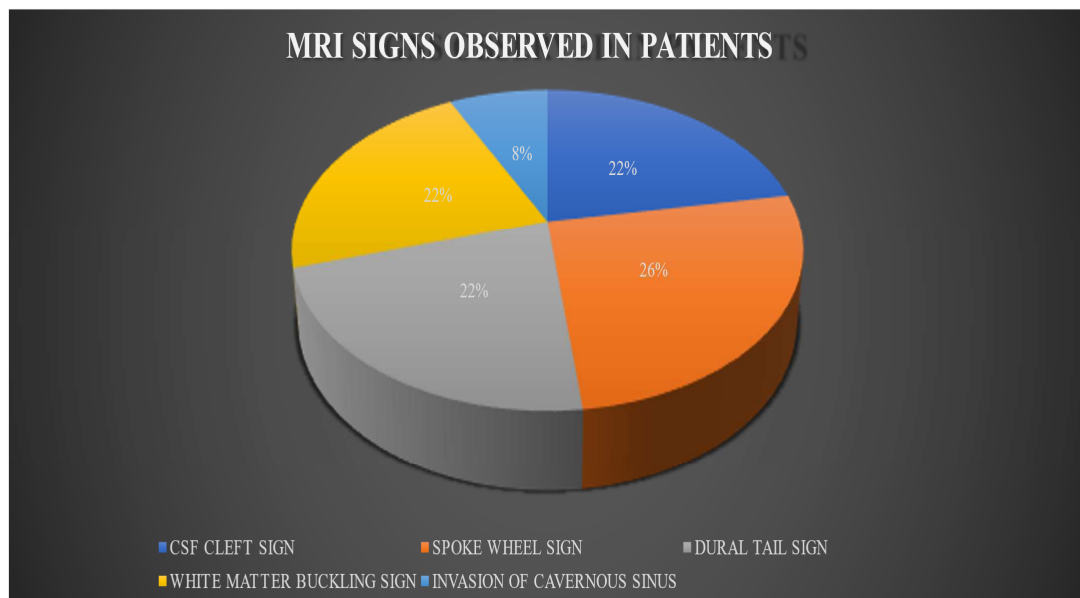
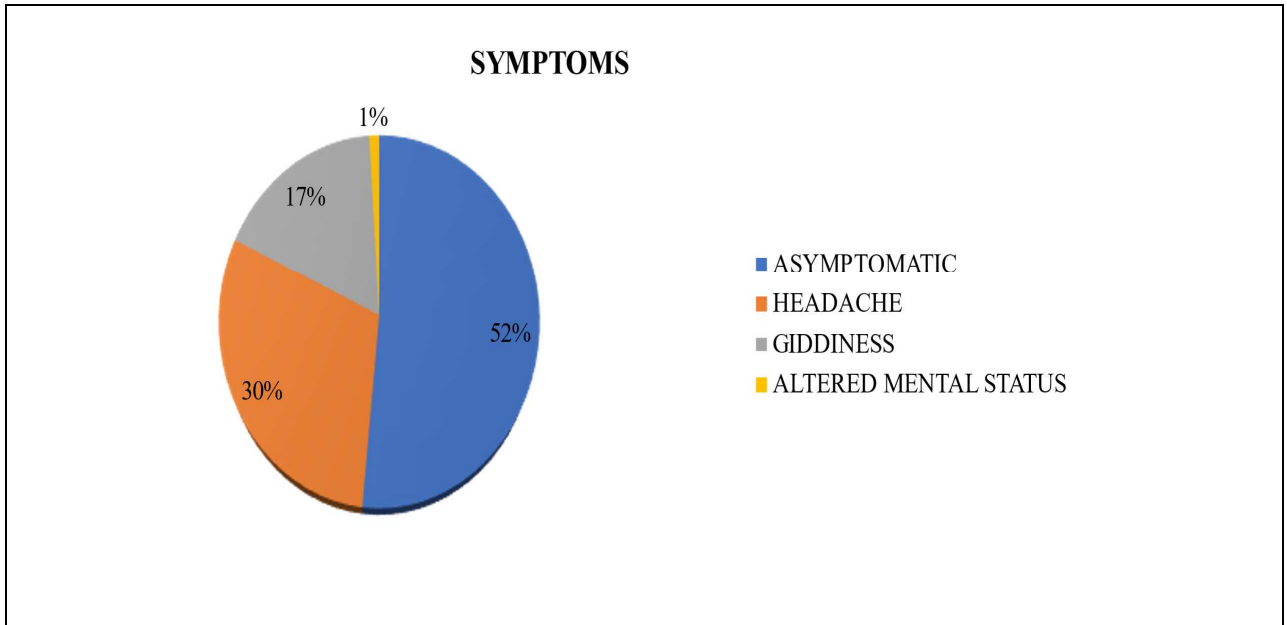
radiodiagnosis with complaints of headache, altered mental status and giddiness. Patients with contraindication of MRI were excluded from the study.

Following results were obtained.

- Meningioma was found in supratentorial location in most of the patients and also in supratentorial region it was more found along the parasagittal convexities
- Females were more prone to have meningioma as compared to males
- Most of the patients had history of headache
- Many MRI signs were observed, out of that CSF cleft sign was most commonly observed.







MANAGEMENT OF MENINGIOMAS:

The treatment option is usually surgical excision. If the incomplete excision is possible then external beam radiation therapy or even brachytherapy can be used. Radiation has been shown to improve local control and prolongs overall survival. No widespread chemotherapy/ systemic therapy has been proven to efficacious although some mTOR inhibitors and antiangiogenic treatment show promising outcomes.

CONCLUSION

Meningiomas are the most common non-glial tumor of the central nervous system (CNS). Meningiomas are the most common all brain tumors accounting for over one third of all primary intracranial neoplasm. Meningiomas are slow growing tumors. They are more common in female as compared to males. Most of the patients are asymptomatic or have complaints of headache. Very large meningioma can produce mass effect and symptoms depending upon the location of the mass. They are the most common primary intracranial tumor to harbor metastases, majority from lung or breast. Treatment option for meningioma is the surgical excision in symptomatic cases.

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