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Original Research Paper

Radiodiagnosis

A CLINICO-RADIOLOGICAL EVALUATION OF INTRACRANIAL SUPRATENTORIAL MENINGIOMAS IN PATIENTS ATTENDING THE DEPARTMENT OF RADIO-DIAGNOSIS AT BANKURA SAMMILANI MEDICAL COLLEGE AND HOSPITAL,BANKURA.

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KEYWORDS : intracranial, supratentorial, meningiomas, female, CT Scan, MRI

INTRODUCTION

The tumor originating from the meninges was termed as meningioma by Cushing in 1922. Meningiomas originate from the arachnoidal cap cell, a meningothelial cell in the arachnoidal membrane. It accounts for 15% of all intracranial tumors. They commonly occur in the fourth to sixth decades of life, with a mean age of 45 years at diagnosis. Females suffer more often than males .[1] Among intracranial meningiomas, 90% are supratentorial. According to site ,they are located at parasaggital convexity, sphenoid ridge, suprasellar, olfactory groove, middle fossa, tentorial, peritorcular, lateral ventricle, orbit or optic nerve sheath.[1] The clinical presentation of supratentorial meningiomas varies depending on location of the tumour and its size .Most of them are slowly growing with variety of etiological factors. Intraoperatively these tumours are usually capsulated and the consistency varies from extremely soft to firm and calcified. Surgical removal of the tumour shows excellent prognosis. [1]

AIMS AND OBJECTIVES-

1. To find out the occurrence of Supratentorial meningiomas as per the age group and sex ratio.
2. To find out the different clinical presentations of Supratentorial meningiomas in different areas of brain .

MATERIALS AND METHODS- Inclusion Criteria

All patients with Supratentorial meningiomas

Exclusion Criteria

i. Infratentorial Meningiomas
ii. Meningiomas associated with other intracranial lesions

1.Study Area:
Department of Radio-Diagnosis
Bankura Sammilani Medical College and Hospital,Bankura

2.Study Population:
All patients who had supratentorial meningiomas on imaging studies namely CT Scan(Computed Tomography) and MRI(Magnetic Resonance Imaging)

3.Study Period:
18 months from January 2017- June 2018. .Study design:
4.study Design- A Prospective, Observational study

5.Parameters to be studied:
a. Occurrence:
I. Different age groups
ii. Male:Female distribution
b. Location
c. Number
d. Clinical symptoms and signs
e. Investigations

6.Study Tool
1. Imaging: CT Scan Brain(Plain & Contrast), MRI Brain with contrast with or without MR venography CT Scan was done in 16- slice CT Scanner and MRI was done in 1.5 T GE machine

All analysis was done using standard statistical methods

BACKGROUND-

Interpreting the symptomatology of meningiomas according to their location was one of the most fascinating topics that have exploited the full potential of the clinical neurologic examination. However, the availability of modern imaging techniques has facilitated the diagnosis of meningiomas at an earlier stage, so that the full burden of symptoms associated with the different locations is rarely seen.[75]

As the anatomical distribution of meningiomas is paralleled by the location of arachnoid villi, meningiomas are found in all parts of the cranium, most frequently in the parasagittal area, followed by the falx, the sinus cavernosus, tuberculum sellae (5–10%), lamina cribrosa, foramen magnum and torcular zones.

Focal changes (hyperostosis/erosion) of the bone close to the tumour is a not uncommon and characteristic finding in meningiomas and is almost invariably the sign of bone invasion by meningioma cells. This may result in focal bulging of involved bones and in localized pain. [10]

Parasagittal meningiomas make up the largest subgroup of meningiomas (17–20%) and occur most often in the frontal lobe. They can grow to considerable size before symptoms, mostly Jacksonian seizures of the lower limbs or headache, become apparent. Papilloedema and homonymous hemianopia were characteristic features of advanced anterior parasagittal meningiomas. [10]

In falcine meningiomas the clinical signs vary according to the area from which they arise. Meningiomas of the anterior falx often cause a long history of headache and optic atrophy as well as gradual personality changes with apathy and dementia.

Patients with meningiomas of the frontal skull base most often complain about impaired vision (54%), headache (48%), anosmia (40%), mental changes (34%) and seizures (20%).

The most prominent finding in tuberculum sellae meningiomas is an insiduous visual loss in one eye, followed by scotomaous defects in the other eye. Transient visual loss during pregnancy with recovery after delivery has been repeatedly documented.

Lateral sphenoid wing meningiomas often cause a painless unilateral exophthalmos, followed by unilateral loss of vision and

hearing loss. Tumours distorting the temporal lobe frequently cause seizures.

In most patients with suprasellar meningiomas, only minor hormonal abnormalities are found.

Clinoidal meningiomas cause a wide variety of visual impairment, cranial nerve palsies and exophthalmos.

Peritorcular meningiomas present with neurologic symptoms due to compression of the occipital lobe or the cerebellum, such as headache with occipitally localized pain, papilledema and homonymous field deficits as well as ataxia, dysmetria, hypotonia and nystagmus.[10]

Epileptic seizures as the first symptom are reported to occur in 20–50% of meningioma patients.[9]

In a recent survey on 222 consecutive, surgically treated meningioma patients, 26.6% of patients presented with epilepsy as their initial symptom.

The incidence of preoperative epilepsy in the temporal lobe was eightfold higher than in the occipital lobe and twofold higher than in the frontal and parietal lobes. A strong correlation was also found with peritumoral oedema ($p < 0.001$), but no correlation with histological subtype).

Surgical removal of the meningioma resulted in cessation of the epilepsy in 62.7% of patients with preoperative epileptic seizures. Approximately 20% of the patients without history of preoperative seizures developed postoperative epilepsy, which could be controlled successfully in 70% of this cohort.

Rarely, spontaneous bleeding occurs in meningiomas.

Imaging

Plain skull x ray may show hyperostosis, erosion of bone, engorged vascular channels, tumour calcification and dilatation of air sinuses (Pneumosinus dilatans).[83]

On non–contrast-enhanced CT, meningiomas are typically isodense to slightly hyperdense(70-75%) compared with contiguous brain parenchyma.[10]

Calcification is seen in 20-25% of tumours. Meningiomas usually enhance homogeneously and intensely. The tumor is sharply marginated and is usually broadly based against a bony structure or dural margin. About 15% of benign meningiomas have a noncharacteristic appearance, including the presence of central lucency denoting necrosis or the presence of a cystic cavity (cystic meningioma). Hemorrhage is rare. The amount of edema surrounding a meningioma is variable. The dura mater adjacent to the attachment of a meningioma may enhance on CT or MRI after the administration of a contrast agent. These so-called dural tails were studied histologically. Although only connective tissue and vascular tissue proliferation were seen in some cases, meningioma cell nests were identified in other cases.

Signs of extra axial lesion like buckling of surrounding brain parenchyma, CSF cleft are seen usually.

Hyperostosis is a characteristic finding in meningiomas, especially in en plaque meningiomas. In most cases, histologic studies of hyperostotic bone reveal tumor cells in the diploë and haversian canals.

On T1-weighted MRI, 60% of meningiomas are isointense and 30% are mildly hypointense compared with gray matter. On T2-weighted images, the tumors are isointense (50%) or mildly to moderately hyperintense (40%). Hyperintensity on T2-weighted images suggests a higher water content, denoting a meningothelial meningioma, a vascular meningioma, or an aggressive meningioma. However, it is suggestive of an easily suckable tumor during surgery.Flow voids signals may be seen. Meningiomas usually enhance intensely and uniformly after the injection of gadolinium, with typical dural tail enhancement.[10]

On MR spectroscopy, the most characteristic features were the presence of alanine, high relative concentrations of choline and glutamine/glutamate and low concentrations of creatine containing compounds, N-acetyl-containing compounds and lipids.

Angiography may be an adjunct in the preoperative assessment of some meningiomas. It enables the surgeon to assess the vascularity and vascular supply of the tumor, the feasibility of embolization, and the presence of tumor encroachment on vascular structures. Meningiomas parasitize the adjacent blood supply ; knowledge of the vascular supply pattern allows the surgeon to gain early control of arterial feeders during surgery.

The evaluation of sinus patency,invasion and development of collateral venous pathways are performed with contrast enhanced MR Venography.The sensitivity and specificity for these findings on MR Venography is similar to Digital subtraction angiography with reduction in risk and patient discomfort.

Typical Angiographic Features of Meningioma[10]

1. Meningioma is supplied by normal meningeal arterial supply to the meninges of the tumour site.
2. Prolonged homogenous vascular blush is seen beginning in the late arterial phase and continuing into the late venous phase;this so called mother in law blush comes early and leaves late.
3. Prolonged venous drainage is frequently seen.
4. After tumour penetration , the primary feeding vessels branch in a sunburst or radial pattern.
5. Partial tumour blush may arise from the injection of each major feefing vessel; overlapping the blush ,images from selective injections often create a complete,homogenous image of tumour.
6. En-plaque meningiomas especially those associated with planum sphenoidal,clinoidal and anterior cranial fossa floor are poorly vascularised.
7. Arterial blush,neo vascularization,cork screw vessels are indicative of high vascularity of tumour specially of Angiomatous variety.

8. RESULTS

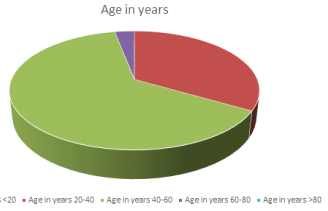
In our study ,we had included 40 patients with supratentorial meningiomas.We studied their clinical features and imaging features of these patients.However 4 patients could not be followed up for MRI,post CT Scan. 2 had meningiomas as apart of the neurofibromatosis syndrome, and 1 case meningioma was diagnosed along with posterior reversible encephalopathy syndrome, so these 7 cases were excluded.

Age

The mean age group of the patients was 44.51 years

Table no 1 –Age group of the patients

Age in years	<20	20-40	40-60	60-80	>80
No of patients	0	11	21	1	0



The most common age group encountered was 40 to 60 years .21

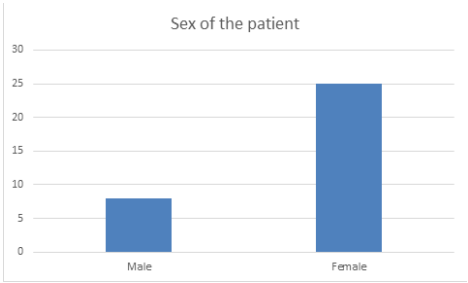
patients (63.63%) were in this age group.11 patients (33.33%) were in age group of 20-40 years and 1 patient(3.03%) in age group of 60 - 80 years.

Sex

Out of 33 patients , 25 patients were female and rest 8 patients were male.

Table no 2- Sex of the patient

Gender	Male	Female
No of patients	8	25



Out of 33 patients, 25 patients were female(75.76%) and 8 patients were male(24.24%).

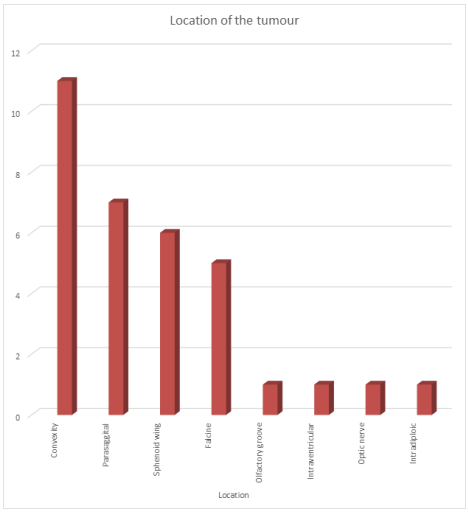
Location

Depending on location of meningioma

Table no 3 –Location of the tumour

Location	No of patients
Convexity	11
Parasagittal	7
Sphenoid wing	6
Falcine	5
Olfatory groove	1
Intraventricular	1
Optic nerve	1
Intradiploic	1
Total no of patients	33

Out of 33 patients, 11 patients had meningioma in convexity (33.33%), 7 patients in Parasagittal (21.2%), 6 patients in sphenoid wing (18.2%) , 5 Patients in Falcine (15.16%) ,1 each in Olfactory groove, Intraventricular, Optic nerve and Intradiploic (3.03% each) .



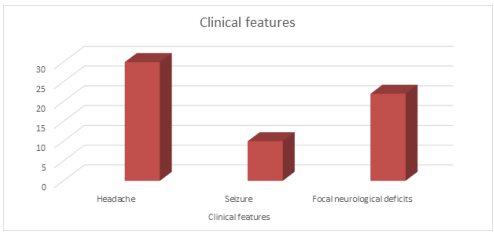
Clinical Features

Table no 3- Clinical features

Clinical features	No of patients
Headache	30
Seizure	10
Focal neurological deficits	22

Out of 33 patients,30 patients complained of headache (91%),10 patients had an episode of seizure(30.3%) and 22 patients had focal neurological deficits(66.67%).

Focal neurological deficits included motor weakness,sensory abnormalities and cranial nerve involvement depending on the location of meningioma.



Imaging

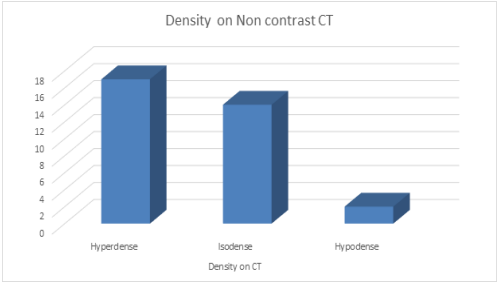
CT Brain

All Patients underwent CT scan Brain during evaluation.

Table no 4 – Density on Non contrast CT

Density on CT	No of Patients
Hyperdense	17
Isodense	14
Hypodense	2
Total no of patients	33

Out of 33 patients, 17 patients had hyperdense lesion (51.51% ,14 patients had isodense lesion(42.42%) and rest 2 patients had hypodense lesion(6.06%) on CT Brain.



MRI Brain

All patients underwent MRI Brain during evaluation

Table no 5 – MRI findings

Intensity on MRI T1w	No of Patients
Isointense	23
Hypointense	10
Hyperintense	0
Intensity on MRI T2w	**No of Patients**
Isointense	7
Hypointense	13
Hyperintense	13
MRI T1w+ Contrast	
Enhancing	33
MR Venography (Occlusion of Superior Sagittal Sinus)	**No of Patients**
No occlusion	3
Partial Occlusion	4
Complete occlusion	0
MR Angiography	6

Out of 33 patients on T1 Weighted Images , 23 patients had isointense lesion (69.69%) and rest 10 patients had hypointense lesion(30.3%) . No patients had hyperintense lesion on MRI T1 Image.

Out of 33 patients on T2 Weighted Images, 7 patients had isointense lesion(21.21%) , 13 patients had hypointense lesion (39.39%) and rest 13 patients had hyperintense lesion(39.39%) on MRI T2w Image.

MRI T1 + contrast Image

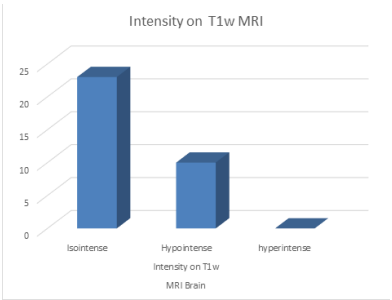
All 33 patients had Homogenous contrast enhancement on administration of IV contrast.

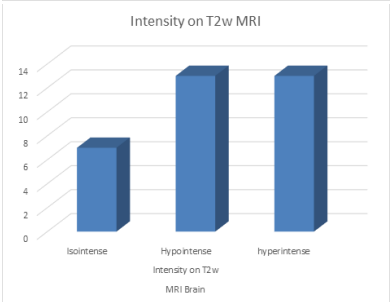
MR Venography and Angiography

MR Venography was done in parasagittal meningiomas only. Out of 33 Patients 7 patients had parasagittal meningiomas.

Out of 7 patients ,on MR Venography 3 patients had no occlusion of superior sagittal sinus and rest 4 patients had partial occlusion of superior sagittal sinus(57.14%).

MR Angiography was done in sphenoid wing meningiomas to look for displacement of middle cerebral arteries and external carotid artery feeders .





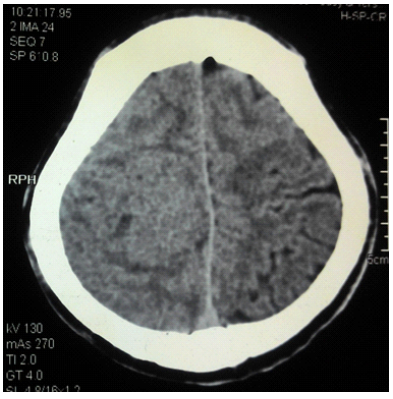


Figure 1 – CT plain axial image of parasagittal meningioma

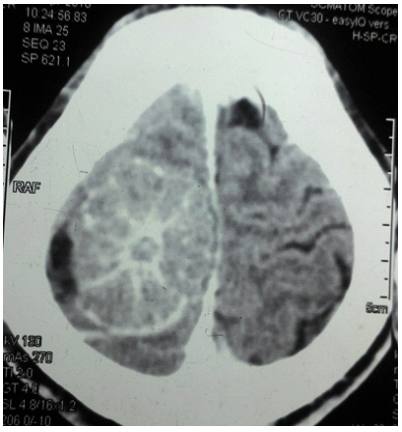


Figure 2– CT contrast axial image of parasagittal meningioma

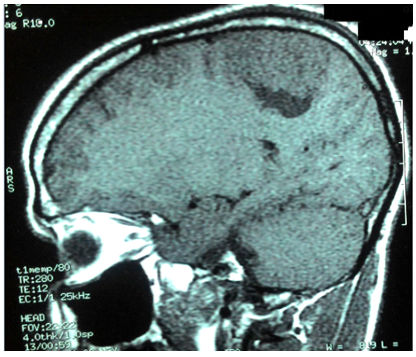


Figure 3– MRI T1 w Sagittal image of parasagittal meningioma

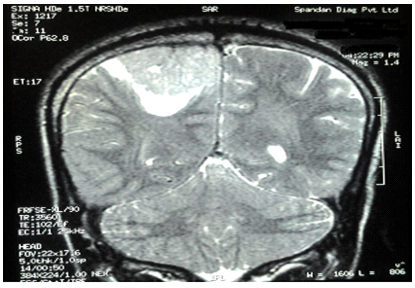


Figure 4– MRI T2 w coronal image of parasagittal meningioma

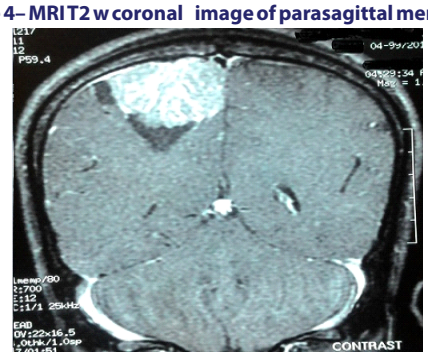


Figure 5– MRI T1 w + contrast Coronal image of parasagittal meningioma

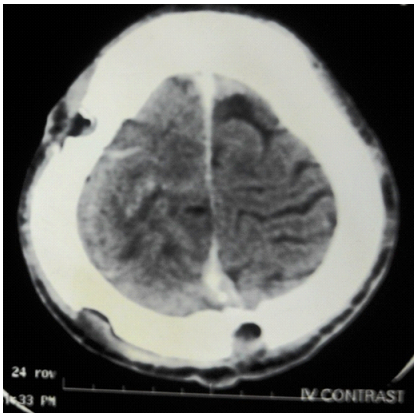


Figure 6– Post operative CT contrast Axial image of parasagittal meningioma

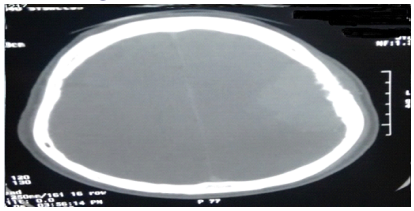


Figure 7– CT scan bony window axial image showing hyperostosis of left Parietal bone

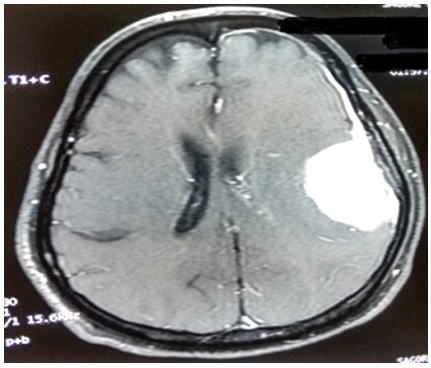


Figure 8– MRI Contrast axial image showing Left sided convexity meningioma.

DISCUSSION-

In our study ,we included 33 patients of supratentorial meningioma. The most common age group encountered in our study was 40 to 60 years .21 patients (63.63%) were in this age group.11 patients(33.33%) were in age group of 20-40 years and 1 patient(3.03%) in age group of 60 -80 years. The mean age group of the patients was 44.51 years In present study, 25 patients were Female(75.76%) and 8 patients were Male(24.24%).

In Gabriel Zada et al study, The mean patient age was 52 years. Out of total 50 patients ,there were 11 men(22%) and 39 women(78%).

In Smita shah et al study, meningiomas were most common in the age group of 40-59 years (59%), followed by in the age group of 20-39 years (21%). Meningiomas were least common in the age group of <20 years (06%). Out of 51 cases 34 (67%) were female and 17 (33%) were male.

In Haradhan deb nath et al study of 25 cases of supratentorial meningioma ,most common age group was 40-59 years(60%) and most commonly affected women (52%).

Our study is consistent with above studies.

In our study, 11 patients had meningioma in convexity(33.33%), 7 patients in Parasagittal (21.2%), 6 patients in sphenoid wing(18.2%) , 5 patients in Falcine(15.16%) ,1 each in Olfactory groove ,Intraventricular ,Optic nerve and Intradiploic (3.03% each) .

In Gabriel Zada et al study, [2] out of 50 Patients with intracranial meningioma ,41 were supratentorial, 5 were infratentorial and rest 4 were tentorial .Of Supratentorial meningiomas 22 were convexity and parafalcine meningiomas,5 were sphenoid wing meningiomas,5 were olfactory groove ,3 tuberculum sella,2 clinoidal ,1 middle fossa ,1 palnum sphenoidal and 2 were from atrium of lateral ventricle.

In Smita shah et al study, [1]most common location of tumor was convexity of brain in 26 (51%) of cases.

In Haradhan deb nath et al study ,most common location was convexity of brain.(80%)

Our study shows that most common site of supratentorial meningiomas were convexity followed by parasagittal meningiomas.

In present study, 30 patients complained of headache (91%),10 patients had an episode of seizure(30.3%) and 22 patients had focal neurological deficits(66.67%).

In Smita shah et al study, [1]Out of 51 patients ,most common clinical feature was headache, seen in 38 (75%).

In Haradhan deb nath et al study of 25 cases of supratentorial meningioma, most common clinical feature was headache (72%).

In present study, 17 patients had hyperdense lesion (51.51% ,14 patients had isodense lesion(42.42%) and rest 2 patients had hypodense lesion(6.06%) on CT Brain.

Al Mefty et al [10] quotes that on non contrast CT , meningiomas are usually isodense to slightly hyperdense as compared to brain parenchyma.

Out of 33 patients in our study on T1 Weighted Images , 23 patients had isointense lesion (69.69%) and rest 10 patients had hypointense lesion(30.3%) . No patients had hyperintense lesion on MRI T1w Image .

Al Mefty et al [10] quotes that on T1 Weighted MRI ,60% of meningiomas are isointense and 30 % are hypointense.

Out of 33 patients on T2 Weighted Images, 7 patients had isointense lesion(21.21%) , 13 patients had hypointense lesion (39.39%) and rest 13 patients had hyperintense lesion(39.39%) on MRI T2 Image.

Al Mefty et al[10] quotes that on T2 Weighted MRI ,50% of meningiomas are isointense and 40 % are hyperintense.

Our study is consistent with CT and MRI T1 Weighted images ,however we found 39.39 % of lesions which are hypointense on MRI T2 weighted images.

All 33 patients had homogenous contrast enhancement on administration of IV contrast

SUMMARY AND CONCLUSION

Supratentorial meningiomas occurred more frequently in females than in males.The most common age group is 40-60 yrs and most commonly seen in convexity followed by Parasagittal meningiomas.The most common presenting complaint is headache.

They most commonly presented as a hyperdense lesion on Non contrast CT Brain, isointense on T1w MRI and hyperintense and hypointense on T2W MRI.All meningiomas take up contrast homogenously with or without dural tail sign.

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