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Epidemiological study of intracranial meningiomas in a tertiary care hospital

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ABSTRACT

Meningiomas are tumours that arise from the meningothelial cells. Most of these tumours are intracranial; some are intraspinal and few extra cranial. There are many histological variants classified into three grades depending on clinical behaviour. Classification is important for determining the modality of treatment. Objectives: To study the incidence, location, sex and age predilection, histological variants and grading of meningiomas based on WHO 2007 classification and recurrence if present. Materials and methods: All 200 cases of meningiomas. Based on Histological features, typing and grading of meningiomas was done as per the WHO 2007 classification of Meningiomas. Age, Sex incidence, Location of meningiomas were studied. Results: Meningiomas comprised 26.17% of all CNS tumours during the study period. Of 764 CNS tumours, 200 were meningiomas. Most of them were intracranial, predominantly involving the convexities of brain, females and the 41 – 50 age group. Of these, 180 were benign grade I tumours, 12 were grade II and 8 were grade III. The most common histological variant was fibroblastic and meningothelial. Grade II and Grade III tumours commonly recurred. Conclusion: Meningiomas are slow growing tumours arising from the meningothelial cells accounting for 26.17% of all CNS neoplasms showing a variety of histological patterns, more common in women, predominantly Grade I tumours. Recurrence of tumours depends on histological grade and extent of surgery.

Keywords
intracranial meningioma, epidemiological study, tertiary care hospital

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INTRODUCTION

A meningioma is a tumour that develops from the specialized meningothelial cell called as arachnoidal cap cells, the membrane that surrounds the brain and spinal cord, and located along the parasagittal sinus, over the cerebral convexity, sphenoid wing, around the pontocerebellar angle and along region of the spinal cord (1). Meningiomas constitute approximately a quarter of central nervous system (CNS) neoplasms. Most meningiomas (90%) are categorized as benign tumours, with the remaining 10% being atypical or malignant.

Harvey Cushing in 1922 coined the name "meningioma" for the most common dural based tumour, accounting for 15-30% of all primary intracranial tumours (2). These tumours can occur in any age, but commonly present in middle age and has a female preponderance,

with a female/male ratio of approximately 2:1 intracranial and 10:1 on the spine. Genetic factors also play a role in meningioma development and predisposition. Type 2 neurofibromatosis (NF2) is an autosomal dominant condition related to a mutation on chromosome 22q12 and is a common condition related to increased risk for developing meningiomas, among other neoplasms (3). Ninety percent of meningiomas are benign, 6% are atypical, and 2% are malignant tumours (4).

Meningiomas vary in their symptoms, cranial meningiomas may cause seizures, headaches, and focal neurological deficits. Diagnosis is made by a contrast enhanced CT and/or contrast MRI (magnetic resonance imaging) scan. While MRIs are in some ways superior, the CT-scan can be helpful in determining if the tumour invades the bone, cause hyperostosis of bone.

Most patients with meningioma undergo resection to relieve neurological symptoms. Complete resection is often curative. For incompletely resected or recurrent tumors not previously irradiated, radiotherapy is administered. Two of the most important factors that determine the prognosis in patients with meningiomas are the extent of the resection and the tumor's histological grade (5). Although as a group they are considered to be benign, symptoms, variability in recurrence frequency, life expectancy, histological appearance and prognosis exist.

Material and Methods

This study is a retrospective study conducted in the Department of Neurosurgery, G. R. Medical College and Jay Arogya Hospital, Gwalior, M.P. India, over a period of 5 years. Of all CNS tumours, only cases of meningiomas during the study period were included. Meningiomas in all age groups and both sexes were included in the study. Other CNS tumours were excluded. These cases were analysed for age, sex incidence, location and histopathological diagnosis. Statistical analysis was done by calculating the numbers and percentage for computing the incidence in various age groups, in sexes, location and HPE diagnosis.

Study design: A meta-analysis
Ethical approval: The study was undertaken after consent and clearance by the ethical committee of G.R. Medical College Gwalior
Inclusion criteria: Of all CNS tumours, only cases of meningiomas during the period 2012 – 2017 were included. Meningiomas in all age groups and both the sexes were included in the study.
Exclusion criteria: Other CNS tumours were excluded.
Sample size: Two hundred cases of meningiomas
Methodology: Based on Histological features, typing and grading of meningiomas was done as per the WHO 2007 classification of Meningiomas. Age, Sex incidence, Location of meningiomas were studied.
Statistical analysis: It was done by calculating number and percentage for computing the incidence in various age groups, in sexes, location and also comparison with other studies.

Observation and Results

Table 1: Age wise distribution of patients

S.No.	Age (yrs)	No. of patients	Percentage
1.	< 20	9	4.5%
2.	20-40	75	37.5%
3.	41-60	96	48%
4.	> 60	20	10%

Table 3: Presenting complaints

S.No.	Clinical presentation	No. of patients	Percentage
1.	Headache	178	89%
2.	Seizure	96	48%
3.	Raised ICP	80	40%
4.	Ptosis	20	10%
5.	Hemiparesis	69	34.5%
6.	Behaviour problem	15	7.5%
7.	Memory difficulties	40	20%
8.	Visual problem	27	13.5%

TABLE 2. Gender wise distribution of patients

S.No.	Gender	No. of patients	Percentage
1.	Male	92	46%
2.	Female	108	54%

TABLE 4: Distribution of patients according to location of tumour

S.No.	Location of tumour	No. of patients	Percentage
1.	Falx or parasagital	40	20%
2.	Convexity	80	40%
3.	Sphenoid wing	20	10%
4.	Olfactory groove	13	6.5%
5.	Petroclival	3	1.5%
6.	Posterior fossa & CP angle	22	11%
7.	Tentorial	9	4.5%
8.	Pterional	2	1%
9..	Tuberulam sellae	2	1%
10	Intraventricular	5	2.5%
11	Diploic	2	1%
12	Foramen magnum	2	1%

TABLE 5. Type of Craniotomy

Location of tumour	No. of patients	Percentage
Fronto-Temporo-Parietal craniotomy	20	10%
Fronto- Parietal craniotomy	62	31%
Frontal	33	16.5%
Temporo-parietal	19	9.5%
Tempro-parieto-occipital	9	4.5%
Bifrontal	15	7.5%
Parietal	5	2.5%
Sub-occipital	24	12%
Parieto-occipital	13	6.5%

TABLE 6. Distribution of patients according to according to surgical excision

S.No.	Simpson grade	No. of patients	Percentage
1.	I	30	15%
2.	II	135	67.5%
3.	III	17	8.5%
4.	IV	16	8%
5.	V	2	1%

TABLE 7. Distribution of patients according to size of the tumour

S.N.	Size of tumour	No. of patients	Percentage
1	1-3 cm	0	0
2	3-4 cm	138	69
3	4-5 cm	42	21
4	>5 cm	20	10

TABLE 8. Distribution of patients according to grade

S.No.	Grade	No. of patients	Percentage
1.	I	180	90%
2.	II	12	6%
3.	III	8	4%

TABLE 9. Post op complications

S.No.	Post op complications	No. of patients
1.	Infection	38
2.	Seizure	23
3.	Hemiparasis	86
4.	Visual loss	1
5.	Behavior change	28
6.	Memory deficit	43
7.	Raised (ICP)	13

TABLE 10. Patient follow up data given as frequency

S.No.	Follow up	No. of patients with recurrence	%
1.	< 2 year	5	2.5%
2.	2-5 years	12	6%

FIGURE 1. Pre op and post op CT of tuberculum sellae meningioma.

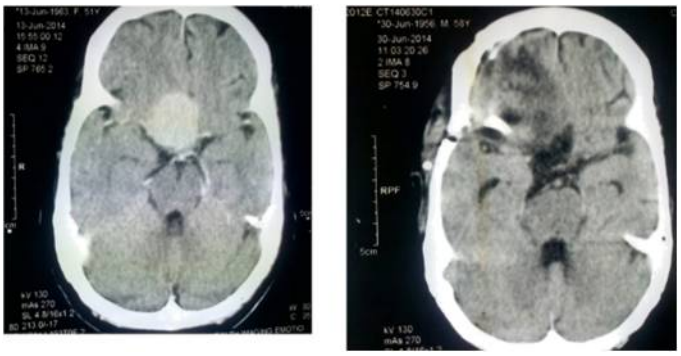


FIGURE 2. Pre op and post op CT of olfactory groove

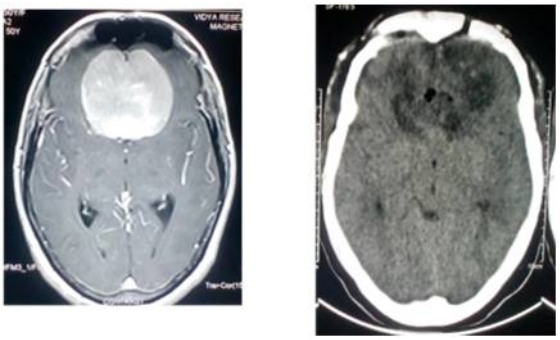


FIGURE 3. Pre op and post op CT of posterior fossa meningioma

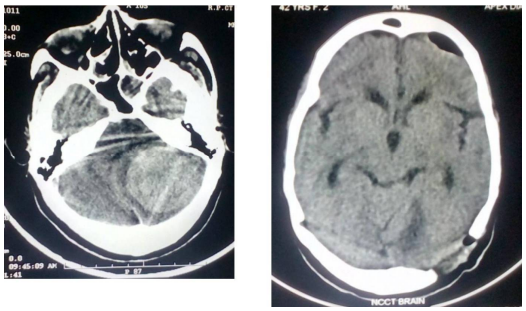


FIGURE 4. Pre op and post op CT of sphenoid wing meningioma

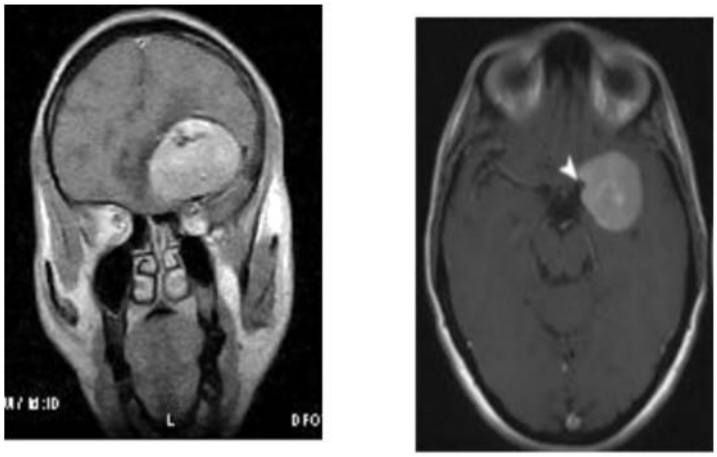


FIGURE 5. Pre op and post op CT of frontal convexity meningioma

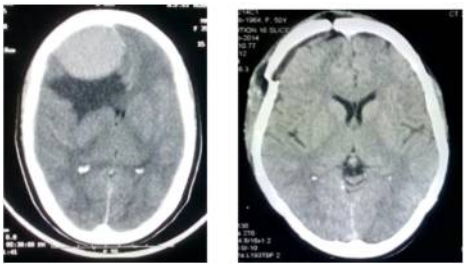
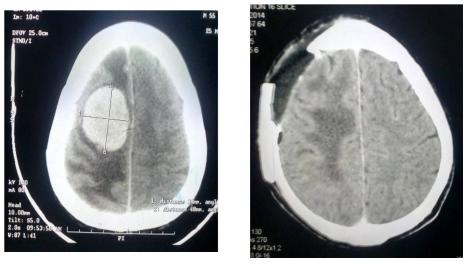


FIGURE 6. Pre op and post op CT of para saggital meningioma



Discussion

Meningiomas constitute 25 - 30% of all CNS tumours and are the most common tumour arising from the meninges (6). In our centre out of 764 cases of CNS tumours, Meningiomas constituted 200 (26.17 %), similar to studies by AB, Shah et al (7), Ruberti R F (8), Intisar SH Patty et al (9), Shrilakshmi 25.25% and Ejaz Butt et al (10). Women are more likely to develop a meningioma, (5) as in our study, females were more commonly affected 108 cases (54%) compared to males 92 (46%). A female preponderance for meningioma correlates with an endogenous hormone level and exogenous hormone replacement in postmenopausal women (in whom an increased incidence of meningioma is seen) as compared with postmenopausal women who have not taken exogenous hormone replacement therapy.

The present study revealed that the incidence of meningioma was common in the age group 41-60 years 48% of patients. The mean age was 48.54 years. In the studies done by A B Shah et al (7), Shrilakshmi (2), the most common age group involved were also 40-50 years.

Meningiomas in children are less common (11), and in our study, there were only 9 cases of meningiomas in children of age group 11-20 years. The intracranial location of meningiomas were distributed as to be the convexities were commonly involved 40%, in which frontal was more common, 45.45%, followed by the parasagittal and falcine meningioma were 20%, 10% were in sphenoid wing, 11% in CP angle and posterior fossa. In a study by shrilakshmi et al, 61.11% of tumours were located in convexity. The clinical presentation of meningiomas, depends on tumour location (12). The symptoms at presentation are rarely precipitous, but often insidious. Onset of slowly evolving headache is common and usually not associated with other symptoms suggestive of raised intracranial pressure, reflecting the slow growth of these tumours. A history of partial seizures is common for convexity meningiomas and an insidious personality change that is confused with dementia or depression is common in patients with large inferior frontal meningiomas (4). In our study, the most common clinical symptoms were headache, seizures and vomiting. The common radiological findings were mass lesions with pressure effect on adjacent structures and peritumoral edema.

Meningiomas divided in wide variety of histological patterns. Our present study revealed that the most common histologic type was meningothelial (38.89%), similar to studies by Nasrin Samadi et al (13) Sangamithra et al (14), Thomas Backer et al (15), followed by atypical meningiomas (16.67%). The other variants were fibroblastic (11.11%), transitional (11.11%), psammomatous variant, angiomatous, lympho-plasmacytic and fibrous (5.56%) each. According to WHO (5) atypical meningiomas have more than three of the following features – increased cellularity, smaller cells with high N/C ratio, greater than 4 mitotic figures/ 10HPF, prominent nucleoli and geographic necrosis. In our study (16.67%) of atypical meningiomas were reported. Singh Avninder et al (16) reported that papillary meningiomas and anaplastic meningiomas are rare and constitute 1 – 2.5% of all meningiomas. In the studies done by S Hoon et al (17) and Gottfried et al. (18) Histological analysis reveals that 80–90% of meningiomas are benign [World Health Organization (WHO) Grade I], 5–15% are atypical (WHO Grade II) and associated with a marked increase in recurrence. Only 1–3% of the cases become anaplasic or malignant (WHOGrade III), developing a high tendency to invade brain structures, metastasize, and recur. In our study, 16.67% of atypical meningioma was observed. Though meningiomas are considered to be benign tumours, recurrence is frequently observed (19). Benign meningiomas can recur following incomplete resection, if large and associated with monosomy14 and del (1p36). The extent of surgical resection depends on the size of the tumour, site, and its relation to vital structures. The best accepted system for prediction of recurrence is the Simpson grading system for completeness of resection (20), which evaluates the invasion of the venous sinuses, tumour nodules in adjacent dura, and infiltration of unresected bone by meningothelial cells. The recurrence rates that Simpson refers to 9% for grade I, 16% for grade II, 29% for grade III, 39% for grade IV, and 100% for grade V, respectively.

Simpson's scale of grading divides the extent of resection into 5 grades:

Grade I: Complete removal

Grade II: Complete removal with coagulation of dural attachment

Grade III: Complete removal, without coagulation of dural attachment or resection of involved sinus or hyperostotic bone
Grade IV: Subtotal resection
Grade V: Decompression biopsy.

For patients with resection grades IV and V, endpoint for recurrence was enlargement of the remaining tumour, shown on MRI or CT. In addition, histological characteristics of malignancy such as peritumoral brain edema, cellular pleomorphism, nuclear atypia, presence of macronuclei, atypical mitoses, increase of neovascularization, brain invasion and necrosis, favour recurrence rate of meningiomas (20).

The treatment in grade I meningioma is total resection. In grade II and grade III meningiomas (2), surgery and adjuvant radiotherapy are the treatment of choice. Extent of surgical resection is one of the most important factors in predicting recurrence along with histological grading.

Bone flap removal was done for 2 cases due to intraoperative brain swelling. Immediate complication was haematoma in 2 cases (3.84%), for which reexploration was done. Major post-operative complications in our study were convulsions 21.1%, wound infection 17.3%, CSF leak in 9.62%, meningitis in 11.53%, of cases. All the patients before surgery were adequately treated with anti-convulsive therapy. Postoperatively 15% of cases developed convulsions within 48 hrs after surgery. They were controlled with increase in the dose of anti-epileptics or addition of another antiepileptic drug. The major morbidity in our series was post-operative infection, in the form of wound infection, CSF leak, and meningitis.

Follow-up period was 6 months to 5 years. Cases were followed up with CT brain in symptomatic patients. Twelve cases of recurrence are noted on follow-up for which incomplete resection was done. Anyhow follow-up period was not enough to assess the recurrence as meningiomas are slow growing tumours.

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