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Histomorphological Spectrum of Meningioma at Tertiary Care Center

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Abstract

Background: Meningiomas are the most common slow growing benign, non-glial tumours of the brain arising from meningothelial cells. Histopathological examination and grading of meningiomas carries a paramount importance in treatment and prognosis.

Material & Method: It is a retrospective study in 36 cases of meningioma received in the Department of Neuropathology at tertiary care centre, Mumbai. The aim of the study was to investigate the incidence of meningiomas during a period of January 2019 to December 2019. All the cases of meningioma were studied by histopathological examination using H and E Staining and findings were recorded according to WHO classification 2016 criteria, bearing in mind the clinical and radiological findings.

Results: Out of 456 samples received in neuropathology sections, 36 (7.89%) were meningioma, with the commonest age group affected were 31-40 years (22.22%), with female preponderance 25(69.44%). Correlating the clinical, radiological findings the commonest location were intracranial 31(86.11%) among which cerebral convexity constitutes 14(38.88%) and commonest histopathological subtype was transitional meningioma 16(44.44%) followed by meningothelial meningioma 9 (25.00%). WHO grade I constitutes 32 (88.89%) cases, WHO Grade II 1(2.78%), WHO III 3(8.33%).

Conclusion: Our study concludes that the commonest age group affected by meningioma is 31-40 years with female preponderance, intracranial localization is most common compared to spine. In histomorphology transitional meningioma is the most common subtype followed by meningothelial meningioma. Most common WHO grade is Grade I meningioma.

Keywords: Meningioma, WHO, Transitional, prognosis.

Introduction

Meningioma was first discovered by Cushing in 1922 as dural-based tumors that arise from arachnoid cap or meningothelial cells.[1,2]

They are the most common adult primary intracranial tumor with female preponderance.[2,3]

The vast majority of meningiomas arise in intracranial, intraspinal, or orbital locations.[4]

Meningiomas produce neurological signs and symptoms due to compression of adjacent structures; the specific deficits depend on tumour location.[3]

WHO 2016 Classified meningioma into WHO grade I, WHO Grade II, WHO Grade III meningioma & criteria considered for grade I meningioma shows mitotic count of less than 4 per 10/HPF, absence of brain invasion, 9 histological subtypes: meningothelial, fibrous, transitional, psammomatous, microcystic, angiomatous, secretory, lymphoplasmacytic-rich, metaplastic meningioma.

Criteria for Grade II considered were mitotic count of 4 to 19 per 10/ HPF, presence of brain invasion, or 3 of 5 specific histological features: spontaneous necrosis, sheeting, prominent nucleoli, high cellularity and small cells, 3 histological subtypes: atypical, clear cells, chordoid. Grade III meningioma showed mitotic count of 20 or more per 10/ HPF or specific histologies: rhabdoid or papillary meningioma

Generally, the majority (81.3%) of meningiomas diagnosed are WHO grade I, 16.9% WHO grade II, and 1.7% are WHO grade III.[4]

Most of the subtypes behave in a benign fashion, but four distinct variants, which are categorized as WHO grade II and III, are more likely to recur and to follow a more aggressive clinical course.[4]

The WHO grade II and III meningiomas are more aggressive, with higher rates of mitosis, and are more likely to recur after surgery and require adjuvant treatment with radiotherapy. Therefore, determining the tumor grade can provide useful information for both neurosurgeons and patients.[5]

Methods

It was a retrospective study on 36 specimens of meningioma cases received in the department of Neuropathology for a period of 1 year from January 2019 to December 2019. The study included all the clinically and radiological suspected cases of meningioma irrespective of age & sex. Clinical data i.e. age, gender, clinical presentation and imaging findings like location, brain infiltration was obtained from patient's records available in the Medical Records Department for the retrospective study. Received specimens in 10 % Neutral buffered formalin were examined grossly, findings were noted. Section from representative area taken and routine processing, paraffin embedding, block was prepared. All the histological sections were stained with H&E and mounted. Special stains were done whenever required. The histological sections were examined microscopically and findings were noted and all the tumours were subtyped and graded according to WHO classification 2016 criteria.

Result

In our study out of 456 neoplastic lesions received in neuropathology section 36 cases were histopathologically proven meningioma which was graded as WHO grade I to III. The most common age group affected were 30-40 years. (Table 1) showing the age and sex specific incidence of meningioma cases. Among the 36 cases, females outnumbered male population and male to female ratio were 1: 2.3. (Figure 1)

Table 1: Age and sex specific Incidence of meningioma (n= 36)

Age	Male	Female	Total	%(n=36)
0-10	0	0	0	0.00
11-20	0	2	2	5.56
21-30	2	2	4	11.11
31-40	4	4	8	22.22
41-50	2	4	6	16.67
51-60	2	5	7	19.44
61-70	1	4	5	13.89
71-80	0	4	4	11.11
Total	11	25	36	

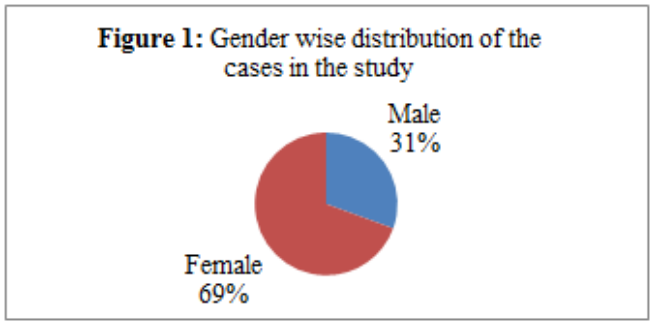

Figure 1: Gender wise distribution of the cases in the study

Table 2: Localization of meningioma in the present study (n= 36)

Localization		No	%
Intracranial region			
Cerebral convexity	Frontal (4)	14	38.89
	Fronto-parietal(3)		
	Parietal (4)		
	Parieto-temporal (0)		
	Temporal (1)		
	Parieto-occipital (2)		
	Occipital (0)		
Tentorium cerebelli		1	2.78
Parasagittal/Falx		7	19.44
Sellar, suprasellar, para-sellar		1	2.78
Posterior cranial foci		1	2.78
Cerebello –pontine angle		3	8.33
Cavernous sinus		1	2.78
Ethmoid sinus		1	2.78
Intraventricular		2	5.56
Spinal region			
Cervico thoracic		2	5.56
Thoracic		3	8.33
Lumbar		0	0
Total		36	100

Table 2: Showing localization of meningioma which indicates the most common location was intracranial 31 cases (86.11 %), among this cerebral convexity constitute 14(38.89%) and spinal 5(13.89%).

Among 36 cases of meningioma most common histological subtype noted were Transitional (mixed) meningioma, WHO grade I 44.44%(n=16) and other types are shown in (Table 3).

According to WHO classification 2016 grading, our study constitutes WHO grade I, 32 cases (88.89%) which was the commonest, followed by WHO Grade III (8.33%) which includes Rhabdoid meningioma 2 cases(5.56%) and Anaplastic meningioma 1(2.78%),

WHO Grade II constitutes atypical meningioma 1 case(2.78%). (Table 4)

Table 3: Histological variants of meningioma (According to WHO 2016)

Variants of meningioma	No	Percentage (%)
Meningioma with low risk of recurrence and aggressive behaviour		
Meningothelial meningioma WHO grade I	9	25.00
Fibrous (fibroblastic) meningioma WHO grade I	3	8.33
Transitional (mixed) meningioma WHO grade I	16	44.44
Psammomatous meningioma WHO grade I	0	00
Angiomatous meningioma WHO grade I	3	8.33
Microcystic meningioma WHO grade I	00	0.00
Secretory meningioma WHO grade I	00	0.00
Lymphoplasmacyte-rich meningioma WHO grade I	1	2.78
Metaplastic meningioma WHO grade II	00	00
Meningiomas with greater likelihood of recurrence and aggressive behaviour		
Chordoid meningioma WHO grade II	00	00
Clear cell meningioma WHO grade II	00	00
Atypical meningioma WHO grade II	1	2.78
Papillary meningioma WHO grade III	00	0.00
Rhabdoid meningioma WHO grade III	2	5.56
Anaplastic meningioma WHO grade III	1	2.78
Total	36	100

Table 4: WHO grading of Cases (n-36)

WHO	No	Percentage (%)
I	32	88.89
II	1	2.78
III	3	8.33
Total	(n=36)	100

Discussion

The WHO classification 2016 grouped meningioma as meningioma with law risk of recurrence (WHO grade I) and meningioma with greater likelihood of recurrence (WHO grade II & Grade III), bearing in mind variants of meningioma and their biological behaviour.

In accordance with 2016 WHO classification, we reviewed 36 cases of meningioma received in the Neuropathology section during the time period of

January 2019 to December 2019, which were classified as WHO grade I, WHO grade II, WHO grade III.

Among the total 456 samples received in the neuropathology section during the span of January 2019 to December 2019, meningioma accounts for 36(7.89%) cases. After evaluating the clinical presentation and radiological findings of all meningioma cases we found that presenting signs and symptoms predominantly depends on the location as well as size of the tumour. In present study the common presentation was headache followed by convulsions, hearing loss, ringing in ear, muscle weakness, change in personality or behaviour, visual disturbances.

Table 5: Comparison of percentage of age in various studies

Present study	Shenoy A et al [6]	Patil P et al [7]	Niranjan J et al [3]	Bhalla S et al [8]	Gadgil N et al [9]
31-40 years (22.22%)	31-40 year (26.98%)	31-40years (32.19%)	41-50 years (36.84%)	41-50years (29.3 %)	41-60years (44.1%)

Table 6: Comparison of Variants of meningioma with various studies

Study	Meningothelial	Transitional	Fibroblastic	Psammomatous
Shah S et al [1]	37%	-	16%	19%
Backer T et al[10]	17%	40%	7%	-
Wanjeri J et al [13]	22.5%	25.4%	22.5%	-
Bhalla S et al [8]	47.6%	23.2%	9.8%	9.7%
Shenoy A et al [6]	28.57%	28.57%	3.17%	15.87%
Patil P et al [7]	43.67%	24.14%	5.74%	10.34%
Niranjan J et al [3]	33.33%	28.07%	8.77%	8.77%
Present study	25%	44.44%	8.33%	-

The most common age group involved was 31-40 years accounting for 22.22% cases followed by 51-60 years i.e. 19.44% which is compatible with study done by Shenoy A et al[6] and Patil P et al[7], however study by Niranjan J et al [3], Bhalla S et al [8] and Gadgil N et al [9] showed most common age group affected were 41-50 years constitute 36.84%, 29.3%, 44.1% respectively. (Table 5)

In the present study female outnumbers male comprised of 25(69.44%) of total cases and male comprised of

11(30.66%) cases, which is concordance with the study conducted by Niranjan J et al [3], Shinoy A et al[6], Bhalla S et al[8], Patil P et al [7] and Gadgil N et al[9]. and hence confirmed the higher frequency of benign meningiomas in females compared to males. In our study Male: female ratio was 1:2.3. 31(86.11%) of total cases were intracranial in location and only 5(13.88%) cases were localized to the spinal region .Within the cranial cavity, commonest site include the cerebral convexities 14(38.88%) cases, followed by parasagittal/falx location 7(19.44%) cases, Cerebello –pontine angle 3(8.33%), Intraventricular 2(5.56%), Tentorium cerebelli 1(2.78%), Suprasellar 1(2.78%), Cavernous sinus1(2.78%), Ethmoid sinus 1(2.78%). These results were similar to those found by Patil P et al (37.93%) [7], Shinoy A et al(49.20%) [6], Smita et al (51%) [1], Thomas Backer et al (39.3%) [10.]

Among the 5 cases of intraspinal meningioma, the thoracic spine constitutes 3(8.33%) cases, cervico-thoracic spine 2 (5.56%) cases. Various studies like Traul et al[11] & Chamberlain et al[12] had similar observations as thoracic spine as a common site.

In present study in accordance with WHO classification 2016 (Table 6) , we found WHO grade I 32 (88.89%) cases, followed by WHO grade III 3(8.33%), least common was WHO grade II(2.78%). In Shenoy et al[6] study, grade I constitutes (88.89%), grade II constitutes (11.11%) and Grade III nil. Gadgil N et al[9] in his study on meningioma noted 85.6% grade I, 11.5% grade II and 2.9% grade III. Our results were consistent with the above studies except for Grade III meningioma which shows higher incidence in our study. In all these studies, the most common type was benign WHO grade I meningioma.

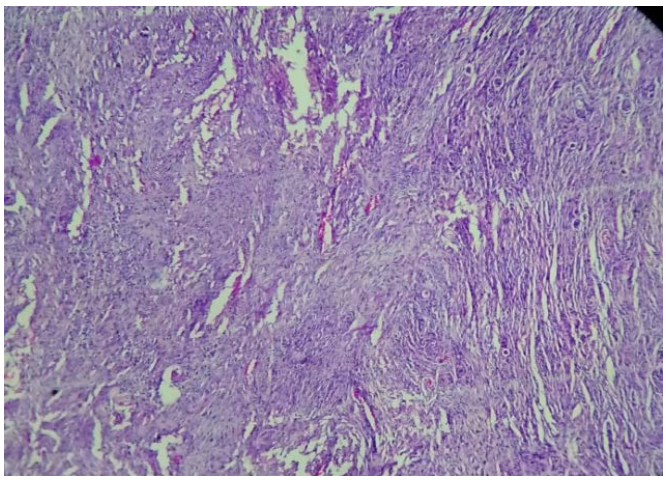

Fig 2: Histomorphology of Transitional meningioma

Among the WHO grade I cases in our study most common histomorphological subtype seen were transitional meningioma 16 (44.44%) (Fig-1), meningothelial meningioma9(25.00%), fibrous meningioma 3(8.33%), angiomatous meningioma 3(8.33%) (Fig-2), lymphoplasmacyte rich meningioma 1(2.78%). Similar findings were seen in study done by Wanjeri J et al [13].

However study done by Patil P et al [7] observed most common pattern seen were meningothelial meningioma 43.67% , followed by transitional meningioma 24.14%, Psammomatous meningioma 10.3% , fibrous meningioma 45.74 %. and Shenoy A et al [6] most common subtype seen were meningothelial meningioma 28.57%, followed by transitional meningioma 28.57%, Psammomatous meningioma15.87% , fibrous meningioma 3.17%. While study done by Niranjan J et al [3] most common pattern seen were meningothelial meningioma 33.33%, followed by transitional meningioma 28.07%, Psammomatous meningioma 8.77%, fibrous meningioma 8.77%

Benign meningiomas have recurrence rates of about 7-25%, whereas atypical meningiomas recur in 29-52%

of cases, and anaplastic meningiomas at rates of 50-94% [4].

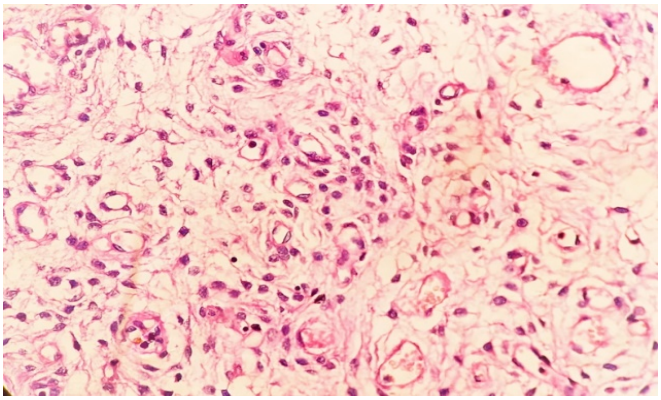

Fig 3: Histomorphology of Angiomatous Meningioma

We found single case (2.78%) of atypical meningioma (WHO grade II) which was located at parieto-occipital region with mitotic count of > 4 /10 HPF with increased cellularity and area of spontaneous necrosis which fulfill the criteria of WHO Grade II . Incidence of atypical meningioma in our study was compatible with Patil P et al [7] 2(2.30%), however Shinoy A et al[6] and Bhalla S et al [8] showed higher incidence 5(7.93%) & 4(4.9%) respectively.

In present study 3(8.33%) cases of Grade III meningioma were diagnosed, out of which 2(5.56%) cases were rhabdoid meningioma and 1(2.78 %)case of anaplastic meningioma all of were having epicentre at parieto-occipital region. Rhabdoid meningioma is an uncommon variant of meningioma having aggressive clinical course showing predominant rhabdoid cells with typical rhabdoid morphology or papillary architecture with rhabdoid cytomorphology. Study by Patil P et al[7] showed an incidence of 3(3.45%), Gadgil N et al[9] 2(0.6%), Niranjan J et al [3](1.75%) Shri Lakshmi S. et al [14](0.78%). Our study had the higher incidence of grade III meningiomas as compared to the above studies.

Conclusion

Meningiomas are the most common slow growing benign, non-glial tumours of the brain arising from management and patient's prognosis. meningothelial cells with a wide variety of histological patterns. Commonest age group affected by meningioma is 31-40 years with female preponderance, intracranial localization is most common compared to spine. The histological subtype of meningioma and grading determines.

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