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Histopathological Study of Meningioma in a Tertiary Care Centre

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Abstract: ***Background*: Meningioma is a neoplasm arising from the arachnoidal cap cells in the meningeal coverings of the spinal cord and brain. These are the most common benign intracranial tumours and account for about 13-26% of all primary brain neoplasms. These are generally benign neoplasms, but about 10% are atypical or malignant. *Objective*: To study the variants and histopathological spectrum of meningioma. *Material & Methods*: This study includes cases of Meningioma diagnosed over a period of one year. *Result*: Most common variant was noted to be Meningothelial meningioma followed by Atypical meningioma. Out of the 67 cases reported, cases with Grade 1 were 74.6 % whereas those with Grade 2 were 22.3 %. *Conclusion*: From our study, we conclude that Meningothelial meningioma is the most common variant. Benign meningiomas are the most common type.***

Keywords: Meningioma, WHO grading, WHO classification, Meningothelial meningioma

1. Introduction

The term 'Meningioma' was coined by Harvey Cushing in the year 1922. Meningiomas are the most common primary intracranial neoplasms arising from the leptomeninges. These account for about 13-26% of all primary brain neoplasms [1]. These are predominantly located in the cerebral hemisphere, but occurrence at other sites has also been noted. Most of the meningiomas are benign and are categorized as WHO grade I. Atypical meningiomas account for about 4.77.2% of meningiomas; whereas anaplastic meningiomas comprise between 1.0-2.8% of meningiomas [2, 3].

The origin of meningioma is thought to be from the arachnoidal cap cells in the meningeal coverings of the brain and spinal cord [4]. Meningiomas have dural attachment and are well-demarcated rounded or lobular masses. Parafalcinemeningiomas are usually irregular, dumbbell shaped [5]. En plaque meningioma is a specific clinicopathological entity, which is locally invasive, but usually is histologically benign. These are usually located in sphenoidal region, calvarium and spinal region and grow in a sheet like pattern [6]. A small number of meningiomas tend to lack circumscription and involve the adjacent brain parenchyma indicating aggressive nature of tumour. Cut surface of meningioma may vary depending upon the histological features. These are usually light tan to brown in colour. Angiomatous meningioma has a haemorrhagic appearance due to prominence of vascular channels. Microcystic meningiomas usually have a soft and spongy texture due to presence of numerous small cystic spaces [7].

Histological grading of meningioma is known to have prognostic and therapeutic implications. Histologically, meningiomas show considerable heterogeneity. Several histological features are associated with either benign or aggressive behaviour. Various histological features that are included for diagnosis and classifying meningioma include tissue pattern, cellular morphology, mitotic activity, necrosis, presence of psammoma bodies, and infiltration of underlying brain parenchyma. Features taken into consideration for higher grading of meningioma include mitotic rate, high cellularity, small cell change (high nuclear to cytoplasm ratio), macronucleoli, patternless growth, foci of necrosis and brain invasion [4]. Mitotic count is assessed in the areas of highest mitotic count, calculating number of mitotic figures in ten consecutive non-overlapping high power fields. Sheeting is defined as lack of typical meningioma growth patterns, and is noted when this covers more than half of the field at 10X magnification. Macronucleoli are said to be present when they are recognized at 10 X power.

Small cell formation is characterized by high nuclear to cytoplasm ratio. Many other studies correlated several histological features like fibrosis, hyper vascularization, nuclear pleomorphism, apoptosis, vesicular nuclei, presence of lymphocytes, lipidization, etc. [4].

The 2016 WHO classification of tumours of the central nervous system [2] determines 15 separate histopathological variants of meningiomas that correspond with 3 grades of malignancy: benign meningiomas (grade I), atypical meningiomas (grade II) and malignant meningiomas (grade III) [2, 8].

An update of the 2007 WHO classification was introduced in 2016. In which brain invasion was introduced as a criterion for the diagnosis of atypical meningiomas, WHO grade II, which can alone suffice for diagnosing an atypical meningioma [9]. The aim of this study is to classify meningioma and its variants based on histology.

Aims & Objectives

1) To study the histomorphological variants of meningiomas.

2) To study the incidence of meningioma in different ages and gender
3) To grade meningiomas according to WHO grading system 2016.
4) To compare the findings of our study with similar peer studies.

2. Materials and Methods

Study design: A hospital based retrospective study was undertaken which included diagnosed cases of meningioma. This study has been carried out in a tertiary care hospital in Amdavad over a period of 1 year. (January 2021 to December 2021)

Sample collection & method: The hematoxylin and eosin stained sections were studied. Special stains were taken into consideration wherever needed. Microscopic features were studied and criteria outlined in the WHO Classification of Tumours of CNS 2016 were used for diagnosis and categorization of meningioma.

Inclusion criteria: Patients diagnosed as Meningioma during the study period in the Department of Pathology were included.

Exclusion criteria: Patients with inadequate biopsy specimen and the specimens with diagnosis other than Meningioma.

Statistical analysis: Data was analysed in the form of tables and percentage.

3. Observation and Result

During the study period, 67 cases of meningioma were studied histologically. The most common variant was found to be Meningothelial meningioma (46.3%) followed by Atypical (22.3%).

One case each out of 67 cases reported were of variants like metaplastic, rhabdoid and anaplastic meningioma where as cases of angiomatous, secretory, lymphoplasmacyte-rich, chordoid, clear cell and papillary were not reported. The other variants found were transitional meningioma (14.9%), fibrous meningioma (6%), microcystic (3%) and psammomatous (3%). Most of the variants belonged to WHO grade 1 (74.6%). There were 50 cases of grade 1 meningioma during the study period (74.6%) (Table 1).

We noted Meningothelial and Atypical meningioma as the most common subtypes.

4. Discussion

Meningiomas have heterogenous histological picture and are divided into three grades according to WHO classification of tumours of the central nervous system. This grading system is of prognostic importance.

Most of the meningiomas are benign, but few have atypical and malignant features. Higher grade of meningioma are associated with increased chances of recurrence and biologically aggressive behaviour. Histology is an important tool for categorizing meningioma into various subtypes and WHO grading.

In the present study, 67 cases of meningioma were studied with the aim to study the histopathological features of meningioma and to classify meningioma based on histology according to the WHO Classification 2016.

Out of 67 cases in our study, 50 cases belonged to WHO grade 1 (74.6%) whereas there were 15 cases of WHO grade 2 (22.3%). We found 2 cases of WHO grade 3 in our study.

In a study by Vijaya Gattu et al., 2017 (10), grade 1 meningioma were 94.7 %, grade 2 were 5.3% and no grade 3 cases were found [10].

Gadgil et al 94, in his study on meningioma noted 85.6% grade 1, 11.5% grade 2 and 2.9% grade 3 [11]. The results in both these studies were similar to our study (Table 1).

Many other studies in literature found grade 1 to be the most common type of meningioma [12]. Meningothelial, Transitional and fibrous meningioma constitute the most common variants in many studies [10, 11, 13]

Table 1: Comparison of percentage of Grades of meningioma reported in our study with peer studies

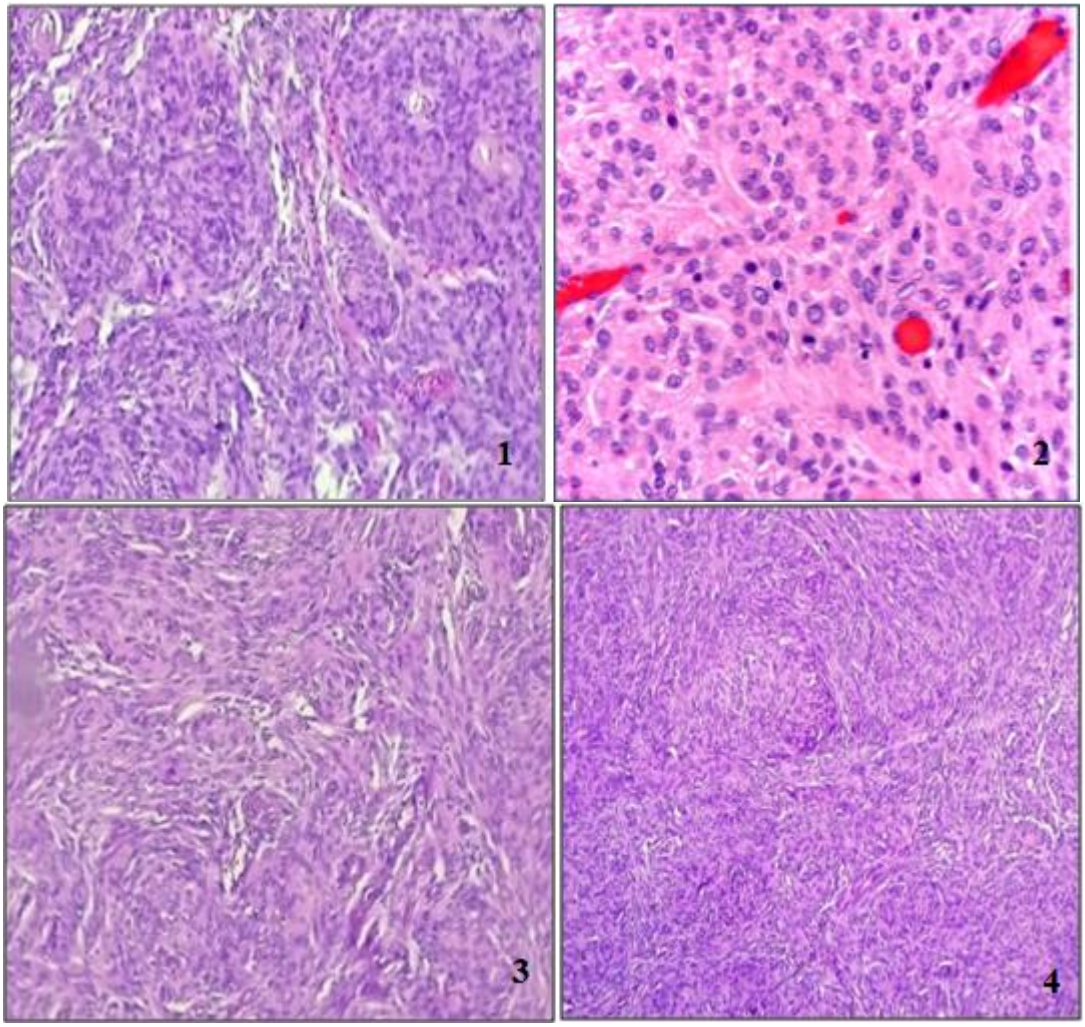
Studies	Grade 1	Grade 2	Grade 3
Vijaya Gattu et al.,	94.7%	5.3%	0%
Gadgil et al	85.6%	11.5%	2.9%
Present study	74.6%	22.3%	2.9%

The study conducted by Reddy et al [12] demonstrated Meningothelial meningioma to be 42.1%, while transitional meningioma were 10.5%. These lobules were separated by thin collagenous septae. Most of these cases showed oval nuclei with delicate nuclear chromatin. Some cases showed rounded eosinophilic, cytoplasmic invaginations, and some cases demonstrated central nuclear clearing. Transitional meningioma constituted tumour cells arranged in syncytial pattern at places as well as interlacing fascicles and bundles. This formed both meningothelial and fibrous pattern which were 10.5%. In meningothelial meningioma, the meningothelial cells were arranged in syncytium and lobules. These lobules were separated by thin collagenous septae. Most of these cases showed oval nuclei with delicate nuclear chromatin. Some cases showed rounded eosinophilic cytoplasmic invaginations, and some cases demonstrated central nuclear clearing. Transitional meningioma constituted tumour cells arranged in syncytial pattern at places as well as interlacing fascicles and bundles. This formed both meningothelial and fibrous pattern.

In the study by Gadgil et al 94 [11], Among Grade I meningiomas, the most common variants were transitional (24.2%), meningothelial (22.6%), while psammomatous meningioma was seen in 12.7%. There were 2 cases each of lymphoplasmacyte cell rich and microcystic meningioma. Also were seen 4 cases each of Angiomatous meningioma and Metaplastic meningioma. Out of 4 cases of metaplastic meningioma, there was a case of Xanthomatous meningioma

with multiple multinucleated giant cells, which was an uncommon finding. The Grade 2 meningioma comprised of 31 cases of atypical meningioma along with 3 cases of Clear cell and 2 cases of Chordoid meningioma. There were 9 cases of Grade 3 Meningioma, which included 5 cases of anaplastic type exhibiting high mitotic figures (20 or more/10 HPF) along with necrosis and prominent nucleoli. Two cases (0.6%) each of Papillary & Rhabdoid meningioma were seen.

In Our study most common variants were Meningothelial (46.3%) similar to peer studies (Table 2) followed by Atypical (22.3%), Transitional (14.9%), Fibrous (6%), Psammomatous (3%) and Microcystic (3%). One case each out of 67 total cases was of variants like metaplastic, rhabdoid and anaplastic meningiomas where as cases of angiomatous, secretory, lymphoplasmacyte-rich, chordoid, clear cell and papillary were not reported.



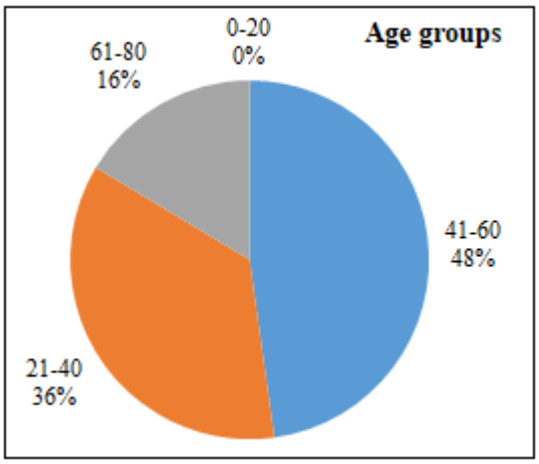
1) Meningothelial Meningioma: Figure shows meningothelial cells arranged in lobules
2) Atypical Meningioma: Figure shows mitotic figures and sheeting architecture
3) Transitional Meningioma: Figure shows cells in vague fasicular and lobular arrangements
4) Fibrous meningioma: Figure shows cells arranged in fasicles and bundles

Table 2: Comparison of percentage of types of meningioma reported in our study with peer studies

Types of Meningioma	Gadgil et al	Reddy et al	Present Study
Meningothelial meningioma	22.7%	42.1%	46.3%
Fibrous meningioma	22.0%	5.2%	6%
Transitional meningioma	24.2%	10.5%	14.9%
Psammomatous meningioma	12.7%	26.3%	3%
Angiomatous meningioma	1.27%	5.2%	0%
Microcystic meningioma	0.6%	0%	3%
Secretory meningioma	0%	0%	0%
Lymphoplasmacyte-rich meningioma	0.6%	0%	0%
Metaplasticmeningioma	1.27%	0%	1.5%
Chordoid meningioma	0.6%	0%	0%
Clear cell meningioma	9.6%	0%	0%
Rhabdoid meningioma	0.6%	0%	1.5%
Papillary meningioma	0.6%	5.2%	0%
Atypical meningioma	9.9%	5.2%	22.3%
Anaplastic (malignant) meningioma	1.6%		1.5%
Total	100%	100%	100%

In our study, age groups between 41-60 were predominantly affected (48%) followed by age groups 21-40 (36%), 61-80 (16%) and no cases were reported in age group between 0-20 years. The above findings of the most common age group affected were similar to that of found in study by

Gadgil et al [11]. Females [48 cases (71.6%)] were most commonly affected compared to males. Male: female ratio was 1: 2.5. Thus, female predominance was noted.



5. Conclusion

Meningiomas are predominantly benign neoplasms of the central nervous system. Histopathological examination is an imperative tool for confirmatory diagnosis due to the diverse histological variants. Also, the prognosis of the disease depends on histopathological grading of the lesion.

From our study, we conclude that Meningothelial meningioma is the most common variant. Benign meningiomas are the most common type.

The accuracy of histopathological diagnosis and grading of meningioma requires a continuous revision of histopathology. Continual revision of grading systems is essential to improve the diagnostic accuracy. Our distribution of histomorphologic spectrum of meningioma is similar to most of the other studies worldwide as stated in discussion. Genetic profiling and Immunohistochemistry in prospective study may provide more details and elaborate the facts.

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Conflict of Interest: None

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