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MENINGIOMAS: A CLINICOPATHOLOGICAL STUDY

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ABSTRACT

Introduction: Meningiomas are tumors that arise from the meningothelial cells. Most of these tumors are intracranial; some are intraspinal and few extra cranial. There are many histological variants classified into three grades depending on clinical behavior. 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:** All128 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 25.25% of all CNS tumors during the study period. Of 507 CNS tumors, 128 were meningiomas. Most of them were intracranial, predominantly involving the convexities of brain, females and the 41 – 50 age group. Of these, 116 were benign grade I tumors, 9 were grade II and 3 were grade III. The most common histological variant was fibroblastic and meningothelial. Intraspinal meningiomas were 16 (12.5%) cases with the psammomatous variant being more common. Grade II and Grade III tumors located in parafalcine or parasagittal area commonly recurred. **Conclusion:** Meningiomas are slow growing tumors arising from the meningothelial cells accounting for 25.25% of all CNS neoplasms showing a variety of histological patterns, more common in women, predominantly Grade I tumors. Recurrence of tumors depends on histological grade and extent of surgery.

INTRODUCTION

Harvey Cushing coined the name “MENINGIOMA”, in 1922 for the most common dural based tumor, accounting for 15-30% of all primary intracranial tumors.[1]Meningiomas are mostly benign tumors but few are malignant. The incidence of meningioma in India ranges from 9-15 per cent of all intracranial neoplasms according to a study by Dr A Vincent Thamburaj. These tumors also occur extracranialy and intraspinaly. These tumors are more common in middle aged women with a peak during 4th -6th decade.(F: M intracranial 3.5:1 & Intra spinal 10:1), There is no sex predisposition in elderly or children. Based on histology and clinical behavior, WHO classification categorizes meningiomas into three grades, Grade I (benign), II (atypical) and III (malignant).Grade II and Grade III meningiomas recur with greater frequency.[2]Histological grade of meningioma is important in deciding subsequent therapeutic intervention and management. Surgery is the treatment of choice for Grade I tumors where as Grade II and grade III tumors require both surgery and radiotherapy. Histological grade and extent of surgical resection are very important parameters to predict recurrence of tumors [2]

Aim: The aim of this study was to determine the incidence of Meningioma among all CNS tumors occurring in the same period, Age and Sex predilection of all meningiomas, their location, any site preference of the histological variants, extent of surgical resection and relation of grade to recurrence if present and correlate findings with that in other studies on meningiomas found in medical literature.

MATERIALS AND METHODS

Study design: A meta analysis
Ethical approval: The study was undertaken after consent and clearance by the ethical committee of NRI Medical College and Academic Sciences, Chinnakakani.
Inclusion criteria: Of all CNS tumors, only cases of meningiomas during the period 2007 – 2012were included. Meningiomas in all age groups and both the sexes were included in the study.
Exclusion criteria: Other CNS tumors were excluded.
Sample size: One hundred twenty eight 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.

RESULTS

Of 507 CNS tumors, Meningiomas constituted 128 (25.25%). The most common affected age group was 41

– 50 years (Table 1). Females 94 (73.44%) were more commonly affected compared to males 34 (26.56%).

In all age groups females were more commonly involved except in the older age group of 71- 80 where males were more involved. Meningiomas were less common in the extremes of age with 4 cases in the 11-20 age group and 6 cases in the 71-80 age group.

The most common location was intracranial 110 (85.94%) cases with the convexities being commonly involved in 41 (37.27%) cases (Table 2). Of the rare sites within the intracranial location, 2(1.82%) cases each were seen in intraventricular location and in the foramen magnum. Intraspinal meningiomas were 16 (12.5%) cases with thoracic spine being most commonly involved 12 (75%) cases (Table3). Extra cranial meningiomas were 2 (1.56%) cases.

The most common clinical symptoms were headache, vomiting and seizures related to raised intracranial pressure. The more common radiological findings were mass lesions with effect on adjacent structures and peritumoral edema.

The most common histologic types were the fibroblastic and meningothelial types together comprising 46.88% of all meningiomas (Table4). The psammomatous variant was more common in the spinal location (56.25%)(Table5). Among the benign meningiomas relatively very rare variants like Angiomatous (2.34%), Metaplastic (0.78%), Microcystic (0.78%) and Secretory (2.34%) types were seen. Among the higher grades the various histological types seen were Clear cell (2.34%), Atypical (4.68%), Papillary (0.78%), Rhabdoid (0.78%) and anaplastic variant (0.78%).

Grade I meningiomas were 116 (90.63%), Grade II meningiomas were 9 (7.03%) and Grade III meningiomas were 3 (2.34%).Grade I tumors were more frequently seen in females (77.58%). Grade II (55.55%) and Grade III (100%) were more frequent in the male gender. Gross total resection was done in 115 cases and subtotal resection in 13 cases. Recurrences were more in Grade II (22.22%) and Grade III tumors (66.67%) mostly involving the parafalcine or parasagittal location.

Table 1: Age and Sex incidence of meningioma

Age in years	Female	Male	Total	Percentage
11- 20	2	2	4	3.13%
21 – 30	5	4	9	7.03%
31 – 40	17	8	25	19.53%
41 – 50	30	6	36	28.12%
51 – 60	26	2	28	21.88%
61 – 70	12	8	20	15.63%
71 – 80	2	4	6	4.68%
Total	94	34	128	100%

Table 2: Location of intracranial meningiomas

Location	Female	Male	Total	%
Convexities	32	9	41	37.27
Parafalcine	2	4	6	5.45
Parasagittal	6	4	10	9.09
Olfactory groove	2	1	3	2.73
Basifrontal	6	1	7	6.36
Sphenoidal	9	7	16	14.54
Suprasellar	3	1	4	3.64
Clinoidal	1	-	1	0.91
Petrous apex	1	-	1	0.91
Petroclival	1	1	2	1.82
Tentorial	3	1	4	3.64
CP angle	10	-	10	9.09
Foramen magnum	1	1	2	1.82
Cerebellum	1	-	1	0.91
Intraventricular	-	2	2	1.82
Total	78	32	110	100

Table 3: Location of Intraspinal meningiomas

Location	Female	Male	Total	%
Cervical	2	-	2	12.5%
Thoracic	11	1	12	75%
lumbar	-	1	1	6.25%
Conus	1	-	1	6.25%
Total	14	2	16	100%

Table 4: Histological Types of Meningiomas

Histological Types	Female	Male	Total	%
Meningothelial	22	8	30	23.44
Fibroblastic	26	4	30	23.44
Psammomatous	20	8	28	21.88
Transitional	17	3	20	15.63
Angiomatous	2	1	3	2.34
Metaplastic	-	1	1	0.78
Secretory	3	-	3	2.34
Microcystic	-	1	1	0.78
Clear cell	1	2	3	2.34
Atypical	3	3	6	4.69
Papillary	-	1	1	0.78
Rhabdoid	-	1	1	0.78
Anaplastic	-	1	1	0.78
Total	94	34	128	100

Table 5: Histological types in intraspinal region

Histological type	F	M	Total	%
Psammomatous	8	1	9	56.25%
Meningothelial	1	1	2	12.5%
Transitional	2	0	2	12.5%
Fibroblastic	2	0	2	12.5%
Clear cell	1	0	1	6.25%
Total	14	2	16	100%

DISCUSSION

Meningiomas account for 25 - 30% of all CNS tumours and are the most common tumours arising from the meninges.[1-3]Most benign meningiomas occur in adult women, but atypical and anaplastic forms seem to be more common in men and the younger age group. Childhood meningiomas are less common.[4,5]Most meningiomas are intracranial.[1]90% are supratentorial; the anterior cranial fossa is involved far more frequently than the posterior. Most of the intracranial tumors occur in the convexities. Intraspinal Meningiomas constitute 25-46% of all tumors occurring in the spinal cord and are more common in the thoracic region.[6,7] Extracranial location is rare. Histologically meningiomas are of three grades.Grade I meningiomas comprise 90%, Grade II Atypical meningiomas comprise between 4.7% to 7.2% of meningiomas, whereas Grade III malignant meningiomas comprise between 1.0% to 2.8%.[1-3]Majority are positive for EMA and 100% for Vimentin. High grade types may be negative or weakly reactive for both.[1] Irrespective of the sex of the patient progesterone receptors are expressed by many and lack of its expression is associated with poor outcome.[1-3]

Recurrence is not limited to meningiomas with malignant histological features. Benign meningiomas can also recur following incomplete resection, if large and associated with monosomy14 and del(1p36).[8]The extent of surgical resection depends on the site, size of the tumor and its relation to vital structures. Higher rates of recurrence are seen in younger age, male sex, parasagittal location and an aggressive histologic type. Reported recurrence rates of grade I, II, and III meningiomas are 7- 25%, 29-52%, 50-94%, respectively.[9,10]

The treatment in grade I tumors is total resection.[3,9]Surgery and adjuvant radiotherapy are the treatment of choice in grade II and grade III meningiomas.[9-10] Extent of surgical resection is one of the most important factor in predicting recurrence along with histological grading. Subtotal resections were associated with more recurrence or re growth.

In the present study of a total of 507 CNS tumors, Meningiomas were 128 and they comprised 25.25% similar to various studies done by AB Shah et al[11], Ruberti R F[12], Intisar SH Patty et al[13], Zalata et al[14] and Ejaz Butt et al.[15]The most common age group involved was the 40- 50year was similar to studies done by A B Shah et al, Ruberti et al,J amjoomet al[16] and Intisar SH Patty et al. Two cases involved the paediatric age group, constituting 1.56% which was similar to the study on meningiomas in children done by Nirav Mehta et al[4] where childhood meningiomas accounted for 1.92% of all meningiomas and a study done by Isabelle M Germano et al[5]where the incidence was 2.9%.

There were 110 intracranial meningiomas, constituting 85.94% of the total meningiomas similar to other studies done by Jhamjoom et al, Intisar SH Patty et al and Zalata et al. The most common location was the cerebral convexities followed by the parasagittal area and the CP angle similar to the various studies. Supratentorial meningiomas are more common than infra tentorial meningiomas. Rare intracranial location was the Intraventricular region constituting about 1.81%.[17]The most common location in the posterior cranial fossa was the CP angle similar to a study Dumitrescu et al[1]Another rare location is the Foramen magnum accounting for only 0.3% to 3.2% of all meningiomas with only 2 cases in this study constituting 1.82%.Foramen magnum meningiomas in the present study comprised 13.33% of all posterior fossa tumors and this correlates with literature where they comprised between 4.2% and 20% of all posterior fossa meningiomas.[18,19]Spinal meningiomas are less common than intracranial meningiomas comprising 7.5%- 12.7% of all meningiomas. Intraspinal meningiomas constitute 16 cases and 12.5%of all meningiomas occurring in the spinal cord similar to a study by Oren Gottfried et al. Intraspinal meningiomas are common in the 50 -60 age group, with female to male ratio being 7:1, **most** commonly involving the thoracic region similar to a study done by Oren N Gottfried et al. However in a study done by done by Nasrin Samadi et al the F: M ratio was lower1.3:1. Extracranial meningiomas are rare with two cases, comprising 1.56 % of all meningiomas; one identified in the infra temporal region and another involving the parietal bone.

The classical type – the Meningothelial variant cases were 30 (23.44%) cases in the present study being the most common histological type seen in all the studies by Sangamithra et al[20]Nasrin Samadi et al[21] S Babu et al[22]Thomas Backer et al[10] Angiomatous meningiomas are rare and comprise 2.1% of all the types of meningioma. Incidence of secretory meningioma varies from 1.2- 9.3% of all meningiomas being 2.34%in this study and correlated with the studies done by S Babu et al[22] and Regelsberger et al.[23] Microcystic meningiomas are rare and comprised 0.78% in the present study. Metaplastic meningiomas are rare 0.78%[24] and constituted 0.3%in a study by Mayo clinic and 0.001% in another cohort study with the most commonly encountered mesenchymal component being mature adipose tissue similar to cases reported by Uygur et al and Wayne K W Chan et al.[25,26]Psammomatous variant was the most common variant in the spinal region similar to the studies done by S Hoon et al[6] and Gottfried et al.[7]

Clear cell meningiomas are rare and constitute around 0.2% of all meningiomas and are more commonly seen in the spinal or cerebellopontine location with 3 cases in the present study.[3]Atypical meningiomas constitute around 4.7 – 7.2 % of all meningiomas according to WHO[1,2]with more than three the following features - increased cellularity, small cells with high N/C ratio, greater than 4 mitotic figures/ 10HPF, sheeting, prominent nucleoli and geographic necrosis. Papillary meningiomas are rare and constitute 1 – 2.5% of all meningiomas.[27]Rhabdoid meningiomas are rare with 1 case. Anaplastic meningiomas are rare and constitute 1-3% of all meningiomas and have a tendency to recur.

Meningiomas are graded into Grade I, Grade II and GradeIII with incidence in a ratio of 90.63%:7.03%: 2.34%in this study similar to a studies done by Nasrin

Samadi et al (86.1%: 8%: 5.9%) and Konstantinos Violaris et al(89.82%:5.82%:4.36%). Grade I meningiomas are benign and rarely recur. Grade II and Grade III meningiomas tend to recur more frequently. In all the reference studies Grade I tumors were more common. Higher incidence of Grade II tumors was noted in the studies done by S Babu et al[22](26%) and Thomas Backer et al(30.1%).Grade III tumors were less common in all the studies and comprised only 3 cases i.e 2.34% of all meningiomas in the present study. Of these, one case was a recurrent tumor and came with a history of previous surgery. All the three cases were male patients and belonged to different age groups. There was one case each of a papillary, rhabdoid and anaplastic types confirming that grade III tumors are more common in males.

Gross total resection (GTR) was done in 115 cases (89.84%) and subtotal resection was done in 13 cases (10.16%) in the present study. Surgical resection is the method of choice in the management of meningiomas and extent of resection depends on location and relationship to vital structures. Gross total resection reduces the risk of both subsequent recurrence and mortality.[3,10]

Recurrence of meningiomas was seen in 7 cases, of which 5 were seen in males. 3 were parafalcine or parasagittal in location and this correlates with a review done by Dzuick et al who found that tumors in this location tend to recur.[28]Recurrence rate in our study was 5.46%.Recurrence of meningiomas is related to histologic grade and extent of resection.[1,2,3]Grade II and Grade III tumors behave aggressively and tend to recur. Benign meningiomas which have been sub totally excised tend to recur. Age less than 40 years, cranial base meningiomas and the male sex are associated with recurrence in benign sub totally excised tumors.[28]2 of the recurrent benign tumors were males. In the present study recurrent Grade I tumors were 2.59%, Grade II were 22.22% and Grade III were 66.67% compared to various reported recurrence rates of grade I, II and grade III tumors which were between 7-25%, 29-52% and 50-94%respectively.[9] Subtotally resected tumors of any grade are more liable to recur. Our study included only 128 meningiomas and of these grade II and Grade III were very few in number compared to other studies.

CONCLUSION

Meningiomas are slow growing tumors arising from the meningothelial cells accounting for 25.25% of all CNS neoplasms with a wide variety of histological patterns. These tumors are more common in women and Grade I tumors are predominant, Grade II and Grade III tumors are less frequent. Recurrence of tumors depends on histological grade and extent of surgery. The incidence, sex predilection, histological types and behavior of meningiomas in this part of the world and other studies are similar despite geographic distance.

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Conflict of Interest: Nil

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