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Study of Meningioma at a tertiary care center, Gwalior: A five Year study

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Abstract:-

Background:-M*eningiomas are most common benign neoplasm of central nervous system that arises from meningial arachnoid cells of brain and spinal cord. Meningiomas are slow growing tumor with slightly female predominance because of its association with progesterone receptor. Histological differentiation of meningioma has a great prognostic implication.*

Aim*: - Aim of the study is to evaluate the different histological variant of meningiomas and its prevalence at a tertiary care center, G. R. Medical College Gwalior, Madhya Pradesh.*

Material and methods*: - This is a 5 year retrospective and prospective cohort study of meningioma from January 2013 to December 2017. In this study, received 117 histological specimens from neurosurgery department of G R Medical College were processed for histo-pathological examination and reporting. The data was collected, retrieved, tabulated, summarized and compared statistically by frequency distribution and percentage Proportion. Chi-square (X2) test was applied to evaluate the significant (p-value) ratio of difference statistically*

Result*: - In the present study the most common variant of meningioma was meningothelial meningioma and most common age group was 41- 50 year. According to WHO grading frequency of meningioma was; Grade I meningioma 94.89% while grade II 1.70% and grade III were 3.41% in our study. Male to female ratio was 47:53%.*

Conclusion*: - In our study of 117 cases, meningothelial meningioma was the most common histomorphological variant of meningioma while according to WHO grading of meningiomas, 94.89% were belongs to grade I meningioma and rest grade II (atypical) 1.70% and grade III (anaplastic) meningiomas contributed 3.41%*

Key words – *Meningiomas, WHO Grading of meningiomas, Psammoma bodies.*

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I. Introduction

Meningiomas are predominantly benign tumors of adults; most often encountered in middle or later adult life [1, 2, 3]. Females are afflicted more commonly than males (especially at spinal level) [4], and some studies suggest a particularly increased prevalence in woman with breast carcinoma [5]. Some Meningiomas show frequent expressions of progesterone sometime estrogen or androgen and the rapid enlargement of tumor during pregnancy or luteal phase indicate hormonal influence [6]. Amongst all primary central nervous system tumors, Meningiomas stand to about 25% the cell of origin is meningothelial cell also known as arachnoid cell. This tumor is mostly attached to inner aspect of dura and graded by WHO (World Health Organization) as Grade I, II, and III [3]

In autopsy series, asymptomatic (quiescent) Meningiomas have been identified in 2% of autopsied patients; whereas, in imaging-based screening studies of the general population, Meningiomas are identified in up to 1%.of adults [7]. Recently it has been noticed that the incidence of meningioma is seem to be increasing in older adults [8]. The neurological deficit effectively reduced with timely debulking surgery [9]. Tumor location is a critical factor determining prognosis and therapy opinion, especially surgical respectability [10]. In clinical practice, however the diagnosis is based on light microscopy of routinely stained haematoxylin and eosin sections criteria given by world health organization [11]. This classifications scheme provides guidelines for tumor grading and subtypes.

WHO classification for brain tumors including Meningioma was first published in 1979 and the latest edition published in 2016 [12]. WHO classification of 2016 and 2007 are similar as far as grading of meningioma is concern both categorized into grades I to III. Salient feature of grading were summarized in table no.1

Table no.1:- WHO classification of Meningioma

WHO Grade	Frequency	Pathologic features	Histological types	Recurrence rates
Grade I	80-90%	Pleomorphic: occasional mitotic figures: lacks criteria of anaplastic or atypical Meningiomas	• Meningothelial • Psammomatous • Secretory • Fibroblastic • Angiomatous • Lypmphoplasmocyte rich • Transitional microcytic • Metaplastic	7-20%
Grade II	05-15%	≥ 4mitotic figures per 10 high power fields: or Exhibit at least three of following features- • Hypercellularity • Patternless, sheet like growth • Macronucleoli • Small cell component with high nuclear :cytoplasmic ratio • Zones of necrosis	• Clear cell • Choroidal • Atypical	30-40%
Grade III	01-03%	≥ 20 mitotic figures per 10 high power field or frank anaplastic features.	• Papillary • Rhabdoid • Anaplastic	50-80%

The morphological changes for grading a tumor could be focal or diffuse and their grading is as;. Grade I lesion may have pleomorphic feature with occasional mitotic figures. Grade II lesion i.e atypical meningiomas has more than 4 mitotic figure/10HPF and exhibit 3 features out of Hypercellularity, Patternless, sheet like growth, Macronucleoli, Small cell component with high nuclear :cytoplasmic ratio , and Zones of necrosis. chordoid and clear cell morphology also included in grade II. Grade III i.e. anaplastic meningioma contain ≥ 20 mitotic figures /10 HPF (High Power Field) and exhibit a lot of differentiated features resulting in carcinoma, melanoma, or sarcoma like appearances [13]. It also shows papillary and rhabdoid morphology [14]. Brain invasion is not a criterion for increasing the grading [15].

Normal meningothelial cells and cells of meningiomas have ability to differentiate into epithelial and mesenchymal cells Meningiomas may show more than one histomorphological spectrum due to the variation in histological pattern of tumor [16]. Present study is aimed to know the histomorphological patterns of meningiomas at our institute and to discuss our observations with alike studies in India and abroad.

II. Materials and methods

It is a 5 year retro-prospective study from January 2013 to December 2017. The specimens were received in department of pathology G.R. Medical College from the neurosurgery department of our institute.

Specimens were fixed immediately in 10% buffered formalin if not preserved from surgical site. After that following procedures were performed in department of pathology;

- Proper labeling of the specimen was checked or done before further processing.
- Gross examination of the specimen was done which includes
    1. Site, Size, shape, color, appearance on surface, and consistency of specimen.
    2. Cutting of specimen to observe color, consistency and content of specimen.
    3. Biting of specimen for further procedures.

- Further procedures include; fixation, dehydration, clearing, embedding, microtomy, staining and mounting of specimen were done as per standard procedures of our department. Staining was done with routine hematoxylin and eosin stain. Mounting was done with DPX(distyrene, plasticiser and xylene,)
- Prepared slides were examined under binocular microscope make Olympus using objective lens of 10x (low power) and 40x (high power) with the eye piece of 5/10x.
- Reporting and diagnosis of meningiomas were done as per WHO criteria.

The data was collected, retrieved, tabulated, summarized and compared statistically by frequency distribution and percentage Proportion. Chi-square (X2) test was applied to evaluate the significant *(p-value)* ratio of difference statistically using EpiCalc 2000 software.

III. Results

Total 117 specimens received during study period, were included in the present study. Age group wise distribution of the patients in the study is summarized in table no. 2 and figure no. 1which is statistically significant (*p=0.000001).*

Table no. 2: Age group wise distribution of patient in study

Age groups	No. of cases	%
0-10	02	1.7
11-20	04	3.4
21-30	12	10.25
31-40	27	23.07
41-50	37	31.6
51-60	24	20.5
61-70	07	5.9
71-80	04	3.4

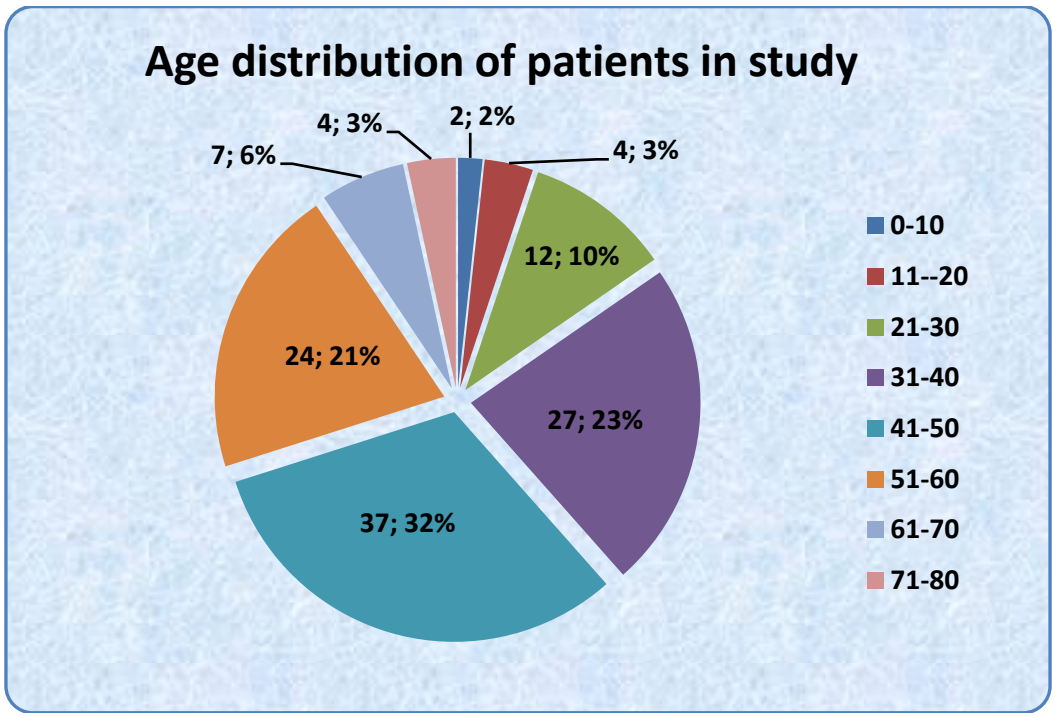

Figure no.1: Age distribution of patient in study

In our study of 117 cases, male and female patients were 55 (47%) and 62 (53%) respectively, howsoever sex distribution of the patients was statistically insignificant (*p*=0.517535) (figure no. 2.)

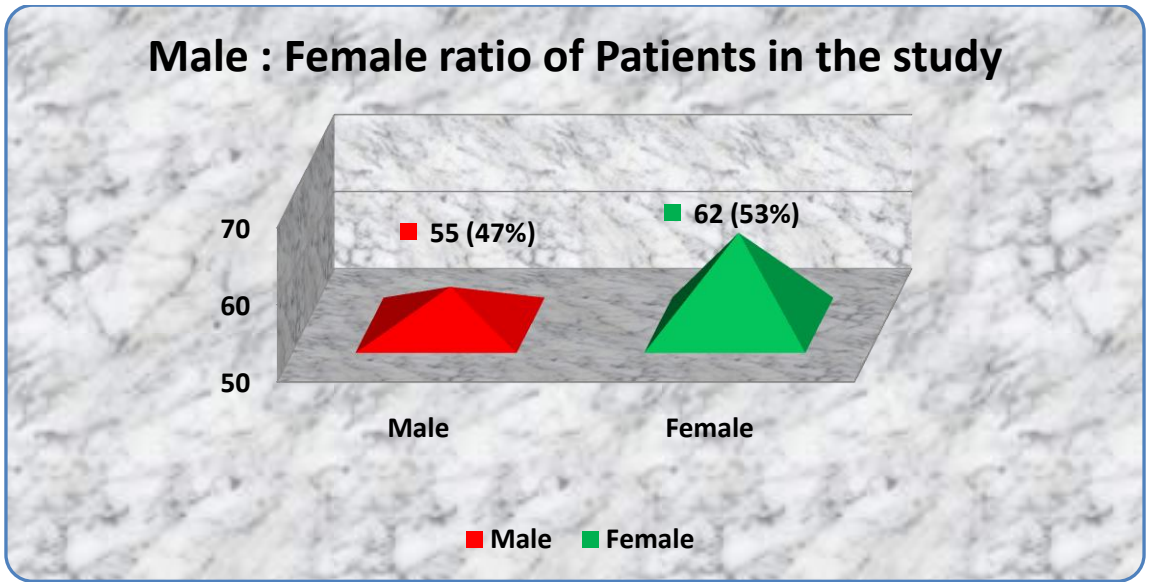

Figure no. 2: Male to Female ratio of patient in study

Histomorphological pattern of Meningiomas was compiled in table no 3 and figure no. 3. Most common type was Meningothelial meningioma (MM) 62.42% (n=73) followed by Psammomatous meningioma (PM) 12.82%(n=15), Fibroblastic Meningioma (FM) 7.69% (n=09), Transitional Meningioma (TM) 5.98% (n=07), Angioblastic Meningioma (AM) 5.98% (n=07), Papillary Meningioma (Pa M) 3.41% (n=04), and Atypical Meningioma (At M) 1.70% (n=02) which is statistically significant (p=0.000002).

Table no. 3: histomorphological variants of meningioma in the study

Variants	No of cases	Percentage
Meningothelial Meningioma (MM)	73	62.42
Psammomatous Meningioma (PM)	15	12.82
Fibroblastic Meningioma (FM)	09	7.69
Transitional Meningioma (TM)	07	5.98
Angioblastic Meningioma (AM)	07	5.98
Papillary Meningioma (Pa M)	04	3.41
Atypical Meningioma (At M)	02	1.70

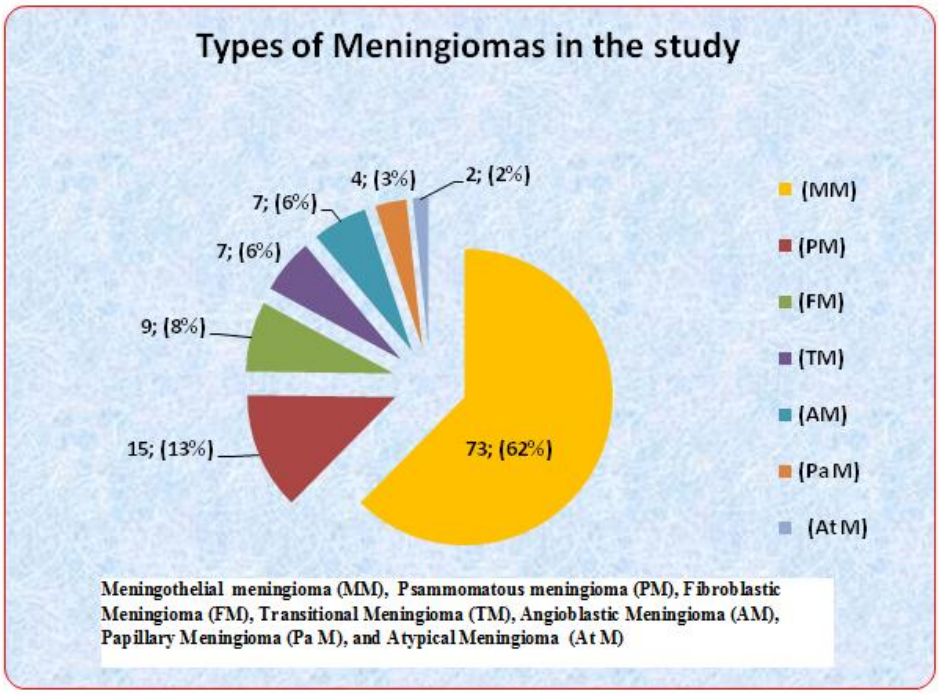

Figure no. 3: histomorphological variants of meningioma in the study

Microscopic pictures of different type of meningiomas are shown in Figure no.4-7 i.e. Figure 4 meningothelial meningioma, Figure 5 Psammomatus Meningioma, Figure 6 Clear cell meningioma and Figure 7 atypical meningioma.

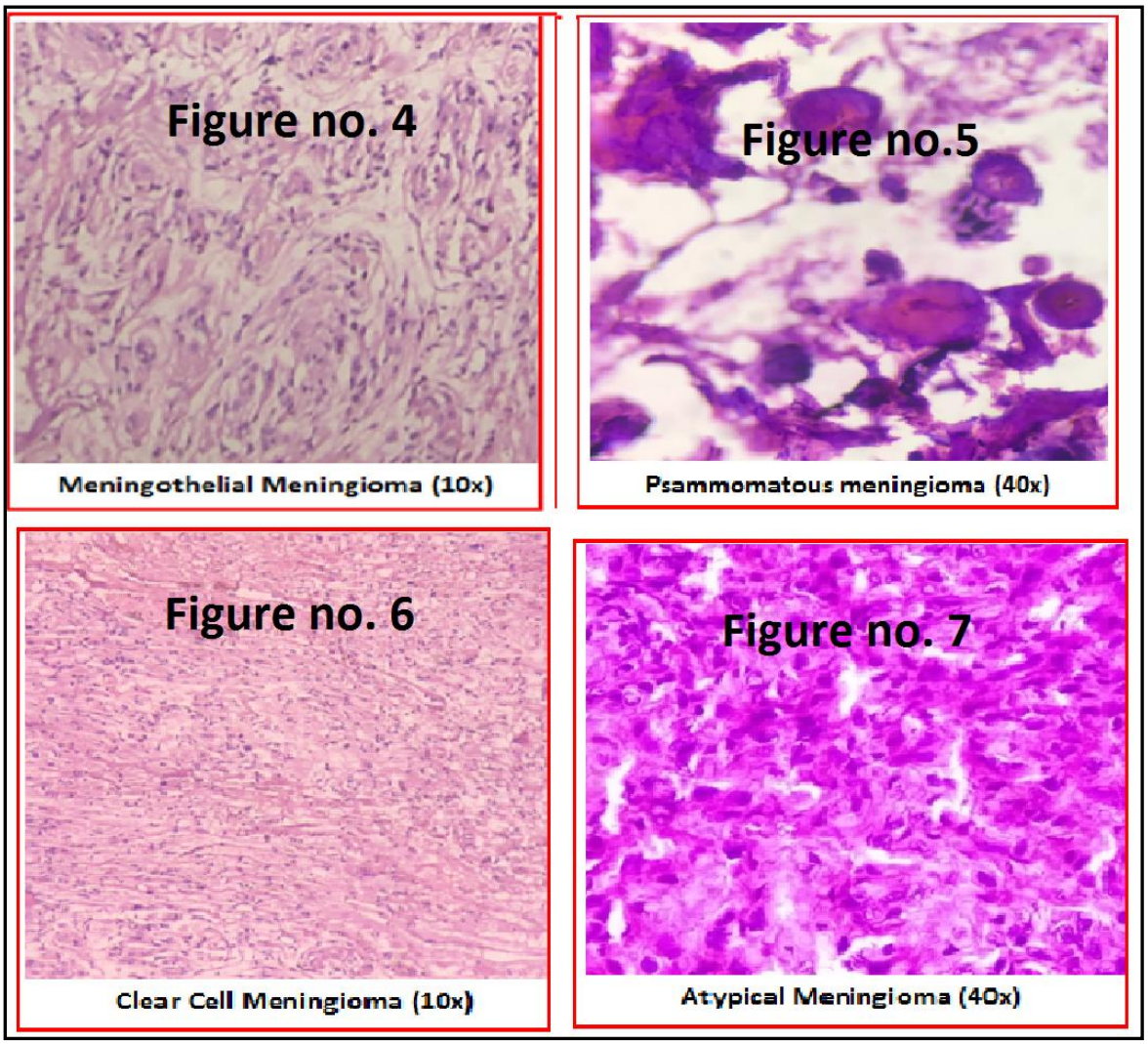

Figure no. 4-7: microscopic pictures of different types of meningiomas

According to the 2016 WHO Classification of Tumors of the Central Nervous System, meningiomas are classified into Grade I, II, and III. Grade I meningioma involve Meningothelial, psammomatous, secretory, fibroblastic, angiomatous, transitional, microcytic, metaplastic lypmphoplasmocyte rich and grade II involve Clear cell, choroidal, atypical, while grade III involves Papillary, rhabdoid, anaplastic. Frequency of meningioma in the present study was; Grade I meningioma 94.89 %, grade II 1.70 and grade III were 3.41%, (figure no 8) which is statistically significant (p= 0.000002).

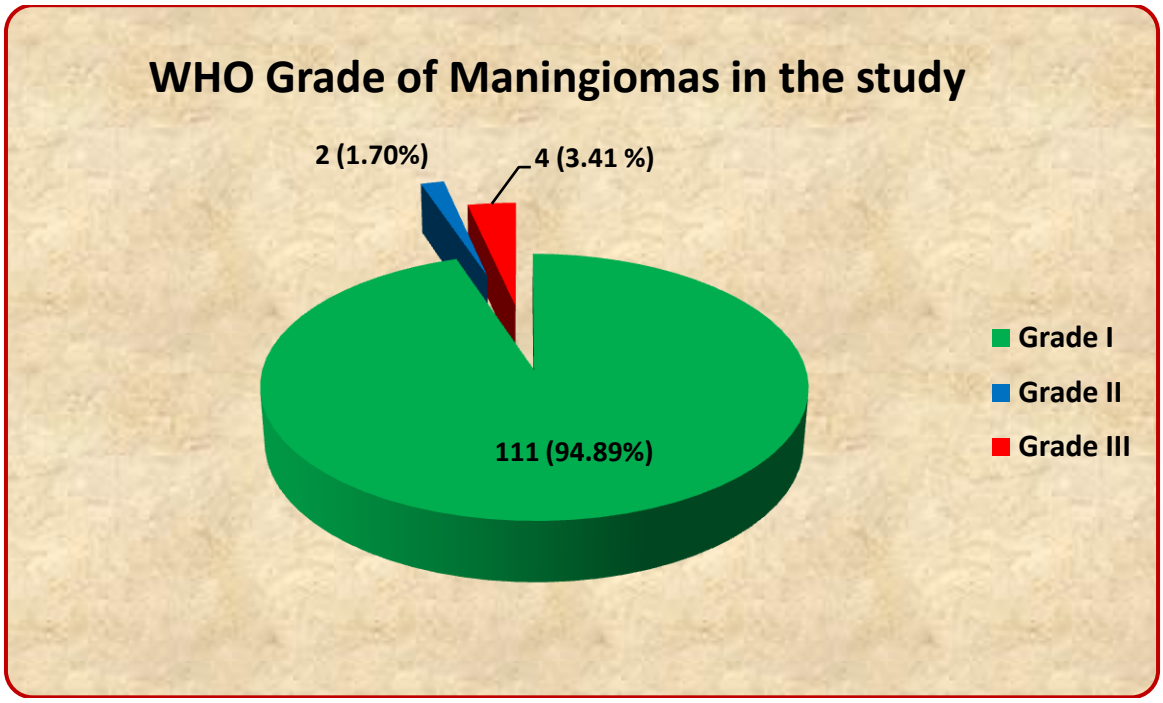

Figure no. 8: Frequency of meningiomas according to WHO Grading

IV. Discussion

In the present study, we have made the diagnosis of meningiomas according to the 2016 World Health Organization Classification of Tumors of the Central Nervous System [15].

In the present study most common age group for meningioma was 41-50 year (n=37,31.6%), second most common group was 31-40 years (n=27, 23.07%) followed by 51-60 years (n=24, 20.5%), 21-30 years (n=12, 10.25%), 61-70 years (n=07,5.9%), 71-80 years 11-20 years each (n=4,3.4%), and 0-10 years (n=02,1.7%) which is alike with the study done by Reddy R et al 2016 [17] where most common age group was 41-50 years (31.5%) followed by 51-60 years (26.3%), 31-40 years (15.7%), 61-70 years (10.5%), 71 -80 years each (10.5%) , 21-30 years (5.2%), and reported no case in the age groups of 1-10 and 11-20. The study of Lakshmi SS et al 2015[18], Shah AB et al [19], Ruberti et al [20], amjoom J et al [21] also reported most common age group was 41-50 year. While in the study of Dhanapandiyan SJ et al 2016 [22] most common age group was 31-40 year (38.88%) followed by 41-50 year (27.78%) and so on. In our and alike studies, we have observed that cases of meningiomas are more common in between the age of 30-60 years (approximately 70%) while it is less common childhood [23, 24] and above 60.

In our study, male to female ratio was 55 (47%) and 62 (53%) respectively, howsoever it is statistically insignificant (p=0.517535) which is similar to the study of Dhanapandiyan SJ et al 2016[22] where Male to Female ratio was 44.44% and 55.55% respectively while significant female dominance was reported by Reddy R et al 2016 [17] 68.4%. Female predominance in meningiomas is due to its association with progesterone hormone receptor [6].

In our study most common variant of meningioma was Meningothelial meningioma 62.42% (n=73) followed by Psammomatous meningioma 12.82 % (n=15), Fibroblastic Meningioma 7.69% (n=09), Transitional Meningioma 5.98% (n=07), Angioblastic Meningioma 5.98% (n=07), Papillary Meningioma 3.41% (n=04), and Atypical Meningioma `1.70% (n=02). Data's of other similar studies on histopathological variants of meningiomas are summarized in the table no. 4.

Table no. 4 Histopathological variants of meningiomas in different studies.

Study	cases	MM %	PM %	TM	FM %	AM %	Pa M %	AtM %	Others %
Reddy R et al 2016 [17]	19	42.1	26.6	10.5	5.2	5.2	5.2	5.2	-
Dhanapandian SJ et al 2016 [22]	18	38.89	5.56	11.11	11.11	5.56	-	16.67	11.03
Lakshmi SS et al 2015 [18]	128	23.44	21.88	15.63	23.44	2.34	0.78	4.69	7.99
Present study	117	62.42	12.82	5.98	7.69	5.98	3.41	1.70	--

Abbreviation used: Meningothelial meningioma (MM), Psammomatous meningioma (PM), Fibroblastic Meningioma (FM), Transitional Meningioma (TM), Angioblastic Meningioma (AM), Papillary Meningioma (Pa M), and Atypical Meningioma (At M)

In the present study and in other similar studies most common variant of meningioma is meningothelial meningioma; in present study 62.42%, reddy R et al 2016 42.1% [17] , Dhanapandian SJ et al 2016 38.89%[22] , Lakshmi SS et al 2015 23.44%[18]. The second most common variant in our study is psammomatous meningioma, similarly reported by Reddy R et al 2016 [17] 26.6%, while in the study of Dhanapandian SJ et al 2016 [22] second most common variant was atypical meningioma 16.67%, whereas in the study of Lakshmi SS et al 2015 [18] it was fibroblastic meningioma 23.44%. Frequency of other variants of meningiomas was between 0-20% and in different studies there is a substantial variation in the frequency of meningiomas. Most of meningioma showed increased fibrosis and collagen formation irrespective of tumor type [25], Studies have shown that psammoma bodies may prove to be a protective factor against recurrence [26].

In the present study, frequency grading of meningioma was; Grade I meningioma 94.89 % while Grade II 1.70% and Grade III were 3.41% which is almost alike as reported by Reddy R et al 2016 [17]; Grade I 89.6% ,Grade II 5.2% and Grade III 5.2%. In the WHO Histological analysis range of grading was; Grade I 80–90%, Grade II 5–15% and Grade III 1–3%. Here our observations are further strengthening the data of WHO and other studies.

The histopathological diagnosis and WHO grading of meningioma is very important for the surgical and medical management as well as in the prognosis of the patient. The treatment in grade I tumors is total resection[27,28] Surgery and adjuvant radiotherapy are the treatment of choice in grade II and grade III meningiomas.[28, 29] 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

V. Conclusion

Outcome of present study is that meningiomas are common tumors of central nervous system, and its most common histological variant is meningothelial meningioma. Grade I meningioma has good prognosis whereas grade II and grade III meningiomas has low frequency but comes with poor prognosis. It is most commonly prevalent in middle aged person with no significant gender variation. Histopathological and WHO grading is important for the treatment and prognosis of the patients.

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Competing Interests

Authors have declared that no competing interests exist.

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