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A clinico-pathological study of primary intracranial neoplasms in a tertiary care hospital

Dr. Sai Sudha Muddha
Assistant Professor, Department Of Pathology, Sree Balaji Medical College & Hospital, Chennai

Dr. Anbumozhi. M. K
Associate Professor, Department Of Pathology, Sree Balaji Medical College & Hospital, Chennai

Dr. Vinutha Gali
Assistant Professor, Department Of Pathology, Sree Balaji Medical College & Hospital, Chennai

***Abstract*---**Background: Central nervous system neoplasms represent a unique, heterogeneous population of neoplasms and include both benign and malignant tumours. The tumours of central nervous system are reported to be less than 2% of all malignancies. Aim: To study the frequency of intracranial tumours and their histopathological typing and their correlation with several clinical variables such as age, sex and clinical symptoms . Material & Methods: Study Design: Hospital based Prospective observational study. Study area: Dept. of. Pathology, Study Period: 2 years. Study population: patients who presented with signs and symptoms of primary intracranial tumours were examined and followed up for the histopathological diagnosis. Sample size: Study population consisted a total of 68 patients. Sampling method: Simple Random sampling method. Inclusion criteria: Patients with both benign as well as malignant primary neoplasms of the brain including pituitary tumours. Exclusion criteria: All the spinal cord, calvarial and metastatic tumours were excluded. Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study. Study tools and Data collection procedure: Staining Procedures Adopted: After grossing, proper tissue bits were subjected for routine processing, fixation, dehydration, clearing and embedding in paraffin wax and blocks were made. Sections were prepared from the blocks and stained with Hematoxylin and Eosin stain. Statistical Analysis: The data was collected, compiled and compared statistically

by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%). Data analysis was performed by using SPSS Version 20. Results: Of the 68 primary intracranial tumours that were received, Gliomas were the most frequent tumours comprising 52.94% of cases. The other tumours were Meningiomas (33.82%), Medulloblastoma (4.41%), Vestibular Schwanomma (2.94%), Pituitary adenoma (2.94%) and Craniopharyngioma (2.94%) in the decreasing order of frequency. Conclusion: The most common age group involved was 50-59 years with mean age of 41.34 years. Males were more frequently affected than females with M: F ratio 1.5:1. Headache was the most common symptom (70.5%). Gliomas were the most frequent tumours constituting 52.94% of all primary intracranial tumours.

***Keywords*---**primary intracranial tumours, malignant tumors, gliomas, meningiomas.

Introduction

Central nervous system neoplasms represent a unique, heterogeneous population of neoplasms and include both benign and malignant tumours. The tumours of central nervous system are reported to be less than 2% of all malignancies [(1)]. In India, tumours of CNS constitute about 1.9% of all tumours [(2)]. Gliomas are most common type among primary intracranial tumours making 35 to 50% of the tumours [(3)]. Males are usually involved more frequently [(4)]. Meningiomas being an exception with higher rates in females (80% more than males) [(5)].

In contrast to other sites, benign CNS tumours may have the potential to become life threatening [(6)]. The malignant potential of CNS tumours is of two patterns, anatomic and biologic. The former includes deeply seated that could not be reached by the surgeon, and so may progress until becomes fatal. The latter includes aggressive tumours that grow rapidly with resulting neuropil invasion and destruction.

Heritable syndromes and ionizing radiations are the major two risk factors for primary intracranial neoplasms [(7)]. The signs and symptoms of intracranial tumours depend on the size of tumour, its location and its rate of growth. Although there are minor variations in the incidences reported from different centres of the world, the difference is not significant [(8)]. A 3 years cross sectional study conducted in kolkata , India, on intra cranial malignancies reported common occurrence of Astrocytomas (36.8%) , Glioblastoma multiforme (7.9%) of all tumours [(9)]. Hence the present study was undertaken to study the occurrence of intracranial tumours and their correlation with several clinical variables such as age, sex and clinical symptoms with the frequency of tumours.

Aim

To study the frequency of intracranial tumours and their histopathological typing and their correlation with several clinical variables such as age, sex and clinical symptoms with the frequency of tumours.

Material & Methods

Study Design: Hospital based Prospective observational study.
Study area: Dept. of. Pathology,
Study Period: 2 years.
Study population: patients who presented with signs and symptoms of primary intracranial tumours were examined and followed up for the histopathological diagnosis.
Sample size: Study Population consisted a total of 68 patients.
Sampling method: Simple Random sampling method.
Inclusion criteria: Patients with both benign as well as malignant primary neoplasms of the brain including pituitary tumours.
Exclusion criteria: All the spinal cord, calvarial and metastatic tumours were excluded.
Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedur

Staining Procedures Adopted

After grossing, proper tissue bits were subjected for routine processing, fixation, dehydration, clearing and embedding in paraffin wax and blocks were made. Sections were prepared from the blocks for the following routine stains.

1. Haematoxylin & Eosin
   Application of the basic dye haematoxylin, which colours basophilic structures with blue purple hue, and alcohol-based acidic eosin, which colours eosinophilic structures bright pink. The basophilic structures containing nucleic acids, such as the ribosomes and the chromatin-rich cell nucleus, and the cytoplasmic regions rich in RNA. The eosinophilic structures are composed of intracellular or extracellular protein. Most of the cytoplasm is eosinophilic. Red blood cells are stained intensely red.
2. PTAH staining, Results :
   1. Neuro glial fibres - Dark blue
   2. Nuclei - Blue
   3. Myelin - Blue
   4. Neurons – Pink.
3. Reticulin staining. Results: Reticulin fibres: Black.

Statistical Analysis

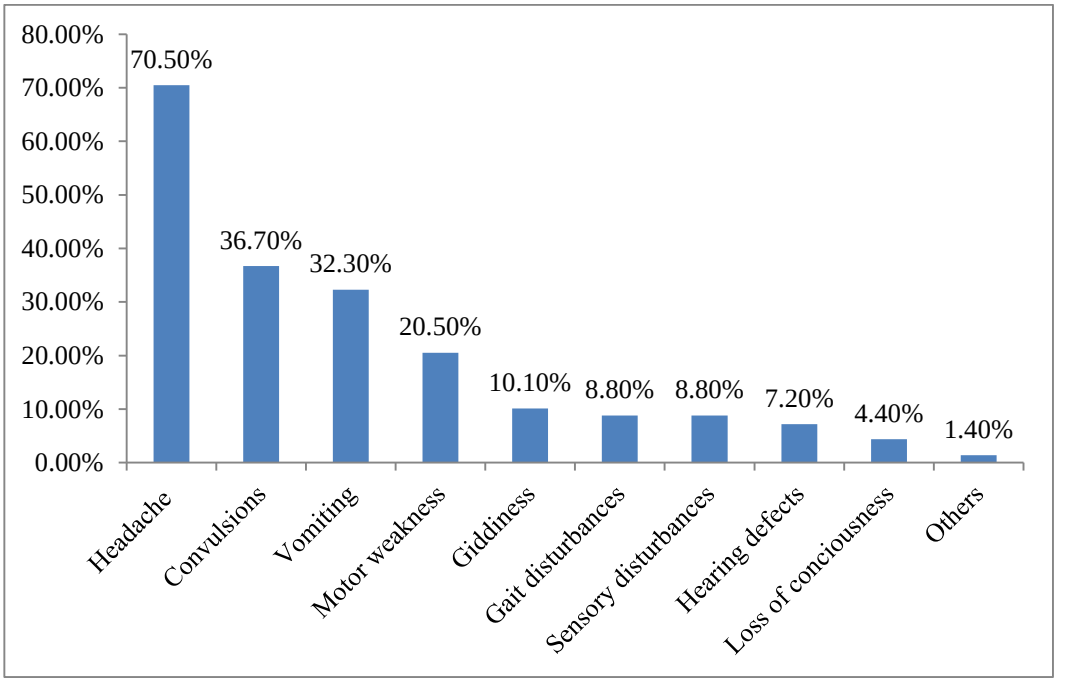
The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were

expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%). Data analysis was performed by using SPSS Version 20.

Observations and Results

The present study comprised of 68 cases of intracranial tumour specimens received in the department of pathology, the clinical data was collected from patients requisition forms and recorded as per proforma. The recent WHO classification was followed as standard for typing and grading of tumours. The cases were distributed in the age group of 6-65 years. The maximum numbers of patients were in the age group 50-59 years. Out of 68 cases, 41 cases were males and 27 cases were females. All the tumours shows male preponderance, except in meningiomas were there is a slight female predominance.

Figure 1: Distribution of different clinical presentations



In the present study, the most common symptom was headache(70.5%). The next frequent symptoms include convulsions(36.7%) and vomiting(32.3%). The other symptoms include motor weakness, giddiness, sensory disturbances, hearing loss, visual disturbances, etc. depending on the tumour site.

Table-1: Frequency distribution of different primary intracranial tumours

s.no	Histological subtype	No. of cases	percentage
1	Glioma	36	52.94%
2	Meningioma	23	33.82%

3	Medulloblastoma	3	4.41%
4	Schwannoma	2	2.94%
5	Pituitary adenoma	2	2.94%
6	Craniopharyngioma	2	2.94%

Of the 68 primary intracranial tumours that were received, gliomas were the most frequent tumours comprising 52.94% of cases. The other tumours were meningiomas (33.82%), medulloblastoma (4.41%), schwannoma (2.94%), pituitary adenoma (2.94%) and craniopharyngioma (2.94%) in the decreasing order of frequency.

Table-2: Age specific distribution of different tumours

Sl. no	Histological type	0-9 yrs	10-19 yrs	20-29 yrs	30-39 yrs	40-49 yrs	50-59 yrs	60 & above
1	Glioma	2	3	-	3	13	11	4
2	Meningioma	-	-	-	7	5	11	-
3	Medulloblastoma	2	1	-	-	-	-	-
4	Schwanoma	-	-	-	1	-	1	-
5	Pituitary adenoma	-	-	-	-	2	-	-
6	Craniopharyngioma	-	-	2	-	-	-	-
	Total(68)	4	4	2	11	20	23	4

In the present study, the highest frequency is seen in 50-59 years age group (23 cases) followed by 40-49 years age group (20cases).

Table-3: Sex distribution of different tumours

Sl.no	Histological type	Males	%	Females	%
1	Glioma	21	51.21%	15	55.55%
2	Meningioma	11	26.82%	12	44.44%
3	Medulloblastoma	3	7.31%	0	0.00%
4	Schwannoma	2	4.87%	0	0.00%
5	Pituitary adenoma	1	2.43%	1	3.70%
6	Craniopharyngioma	1	2.43%	1	3.70%
	Total(68)	41	69.11%	27	39.70%

In the present study, all the tumours were more common in males comprising 69.11% of cases as compared to females comprising 39.70% of cases.

Table – 4: Frequency distribution of different histological subtypes of gliomas

Sl.no	Glioma subtype	No.of cases	Percentage of gliomas
1	Astrocytoma	29	80.55%
3	Ependymoma	3	8.33%
4	Oligodendroglioma	3	8.33%
5	Oligoastrocytoma	1	2.77%
	Total	36	

In the present study, the most frequent sub type of glioma is Astrocytoma comprising 80.55%. The other subtypes include ependymoma (8.33%), oligodendroglioma (8.33%) and oligoastrocytoma (2.77%) in decreasing order.

Table – 5: Frequency distribution of different Astrocytic tumours

S.no	Astrocytic tumours	No of cases	percentage
1	Pilocytic astrocytoma – Grade I	1	3.44%
2	Fibrillary astrocytoma-– Grade II	5	17.24%
3	Anaplastic astrocytoma– Grade III	9	31.03%
4	Glioblastoma – Grade IV	14	48.27%
	Total	29	

In the present study, Glioblastoma was the most common astrocytic tumour (14 cases) followed by anaplastic astrocytoma , fibrillary astrocytoma and pilocytic astrocytoma.

Table-6: Frequency distribution of different subtypes of Meningiomas

Sl.no	Histological type	No.of cases	Percentage
1	Fibrous	7	30.43%
2	Meningothelial	6	26.07%
3	Transitional	5	21.73%
4	Psammomatous	2	8.69%
5	Angiomatous	2	8.69%
6	Lymphoplasmacytic	1	4.34%
	Total	23	100.00%

Out of total 68 cases, 23 cases were diagnosed as meningiomas (32.54%). They occurred in the age group of 32-52, with median age 42 years. They show female preponderance with frequency 54.54% occurred in females and 45.45% in males. Of all the histological subtypes found, Fibrous meningiomas (31.18%) were the most frequently occurring meningioma. The other subtypes seen are meningothelial, transitional, psammomatous, angiomatous and lymphoplasmacyte rich meningiomas in decreasing order. In the present study, 3 cases of medulloblastoma were observed constituting 4.41% of all intracranial tumours. Medulloblastomas were the most common childhood tumours, constituting 42.8% of all childhood tumours. All the cases were observed in male patients (male predominance) in our present study.

In the present study, two cases of vestibular schwanomma were observed constituting 2.94% of all primary intracranial tumours. The cases were seen in third and fifth decades, with mean age 43.5 years. Male predominance was observed. In our present study, two cases of pitutary adenoma comprising of 2.94% of all tumours were observed. The mean age of presentation of pitutary adenoma was 43.5 years. No sex predilection observed among these tumours. In the present study two cases of craniopharyngioma comprising 2.94% of all tumours were observed. Both the cases were seen in the age group of 20-29 years with mean age of 26 years. No sex predilection observed among these tumours.

Discussion

The present study was carried out on 68 CNS tumour specimens received at the department of Pathology. Clinical details were obtained from the patients requisition forms and recorded. The received specimens were examined and analysed for the histopathology of different intracranial tumours. Headache (70.5%) was the most common clinical finding in our study. Next common symptoms were convulsions (36.7%), vomiting (32.3%) and motor weakness (20.5%). A few cases of high grade tumours presented with loss of consciousness. Headache is documented as the most common symptom for all intracranial tumours in literature. The study conducted by Tamkeen masoodi et al [10], showed Headache (69.6%) was the most common symptom followed by seizures (35.9%) correlating with the results of the present study. Similar results were also reported in the study conducted by Intisar SH et al [11], were all patients with intracranial tumours had headache. Our present study also shows similar finding.

In the present study, 10.3% of tumours occurred in the age group 0-18 years. Of these , Medulloblastomas were the most common tumours comprising 42.8% of all childhood tumours followed by ependymomas comprising 28.5%, glioblastoma comprising14.2% and choroid plexus papilloma which made upto 14.2%% of all tumours in this age group. In the study conducted at TATA MEMORIAL HOSPITAL [12], Mumbai , the same age group had the similar frequency of tumours . Medulloblastomas with highest frequency comprising 24.5% of all tumours. Next most common tumours were astrocytomas with 19.2% incidence rate followed by ependymomas which made up to 13.8% of all cases.

In the present study out of 68 cases, 41 cases were males and 27 cases were females. Males were commonly affected (69.11%) as compared to females (39.70%), with male to female ratio of 1.67:1. The high grade tumours were especially more common in males. All the tumours were common in males except in meningiomas were there was a slight female predominance. In the study conducted by Jalali R et al [12], at TMH, Mumbai, the findings were similar with a male preponderance. Out of total 656 cases, 395 cases were males (60.2%) and 261 cases were females (39.80%). Barker et al [13] found the incidence of malignant gliomas to be especially higher among male patients. Provost et al [14], suggested the possible explanation for a high frequency of gliomas in males may be due to specific occupational exposures.

In the present study only primary intracranial neoplasms were included. 68 patients were diagnosed with histologically confirmed central nervous system neoplasms. The most common tumours in the present study were gliomas with a frequency of 52.94%. Among the gliomas, astrocytomas formed the bulk (50%). In a cross sectional study conducted on intracranial tumours in kolkota [9], India, gliomas were the most frequent tumours, constituting 60%. In a similar study conducted in Tata Memorial Hospital (TMH) [12], Mumbai, astrocytomas accounts 38.7% of tumours and were the most frequent tumours.

In the present study out of 36 cases of gliomas, 29 cases were diagnosed as Astrocytomas. The most common type was Glioblastoma accounting 14 cases,

38.9% of all gliomas. In the study conducted by Aryal et al[15], Nepal, Glioblastoma was the most common type of astrocytoma accounting 31.80% which is in agreement with the present study data. In the other studies like Khaled R Zalata et al [16] and Liang Chen et al [17], Vahini et al[18] also Glioblastoma was the most common type of astrocytoma. However , another study conducted by kumamoto,Japan[19] showed relatively lower frequency of malignant gliomas (14.8%). This discrepancy in incidence has been attributed to the ethnic differences between these populations.

In the present study, out of 36 cases of gliomas, 29 cases were diagnosed as astrocytomas in which 1 case was pilocytic astrocytoma (grade I), 5 cases were fibrous astrocytoma (Grade II) [Figure 2] , 9 cases were anaplastic astrocytoma (Grade III) and 14 cases were Glioblastoma (grade IV) [Figure 3]. In the present study remaining 7 cases were constituted by Oligodendroglioma, Ependymoma and Oligoastrocytoma . Three cases of oligodendroglioma constituting 8.33% of all intracranial tumours were noted in the present study. In the study conducted by Tamkeen masoodi et al [10], 3 cases of oligodendroglioma constituting 2.84% were reported, supports the findings of the present study.

One case of oligoastrocytoma constituting 1.47% of all intracranial tumours was diagnosed in the present study. Similar observations were made by Tamkeen masoodi et al[10] study, in which one case of oligoastrocytoma constituting 0.94% of all tumours was noted. Oligoastrocytomas were diagnosed by the presence of two different neoplastic cell types resembling the tumour cells in oligodendroglioma and diffuse astrocytoma.

In the present study, three cases of ependymoma constituting 4.41% of all intracranial tumours were observed in the present study which was in agreement with the Tamkeen masoodi et al [10] study, 4.72% cases were ependymomas. Ependymomas were diagnosed by the two morphological patterns of rosettes i.e, perivascular pseudo rosettes in which tumour cells arranged radially around blood vessels and true ependymal rosettes in which tumour cells arranged around a central lumen [Figure 4].

The second most common tumours found in our study were meningiomas(33.82%) [Figure 5&6]. This is in agreement with the study conducted in kumamoto [19], in which meningiomas made upto 33.3% and were again the second most common tumours after gliomas. In the present study, 3 cases of Medulloblastoma constituting 4.41% of all intracranial tumours were observed. Similar results were also reported in the studies conducted by Tamkeen masoodi et al (3.8%) [10] and Intisar SH patty (3.2%) [11], were the incidence of medulloblastoma was 4.4%, 3.8% and 3.2% .

In the present study Schwannomas were relatively less frequent, comprised 2.94% of all tumours compared with other studies like Tamkeen masoodi et al [10] study showed incidence of 11.6% and 9.8% in the study conducted at kumamoto [19]. Whereas in the study conducted by Intisar S H et al [20], only 5 cases of Schwanomma constituting 3.9% of all tumours which was in agreement with the present study. Pituitary adenomas were relatively less frequent tumours constituting 2.94% of all tumours in the present study, which was correlated with

the study conducted by Intisar S H et al [11], were only one case of pituitary adenoma (0.8%) was reported. While the same tumours were the second most common in the study at TMH [12] with a frequency of 8.3%. Pituitary adenomas were also the second most common tumours in the study at kumamoto [19] and comprised 18.3% of all tumours.

Craniopharyngiomas were among the less common tumours in the present study with a frequency of 2.94% while the same tumours made up to 3.7% of cases in the study at TMH [12] and 0.91% of cases in the study conducted by Tamkeen masoodi et al [10]. Craniopharyngiomas were diagnosed by the presence of squamous epithelium, wet keratin, calcification, cystic change and haemorrhages. In the present study, all the cases were Adamantinomatous type [Figure 7]. In conclusion, the median age of presentation of patients with brain tumours especially glioblastomas was lower in our present study when compared with that of western data. Tumours like Medulloblastoma, Schwannoma, Pituitary adenoma and craniopharyngioma were presented in lower number in the present study.

Conclusion

The most common age group involved was 50-59 years with mean age of 41.34 years. Males were more frequently affected than females with M: F ratio 1.5:1. Headache was the most common symptom (70.5%). • Gliomas were the most frequent tumours constituting 52.94% of all primary intracranial tumours. Majority of the gliomas were Astrocytomas. Tumours like Medulloblastoma, Schwannoma, Pituitary adenoma and Craniopharyngioma presented in lower number in our study.

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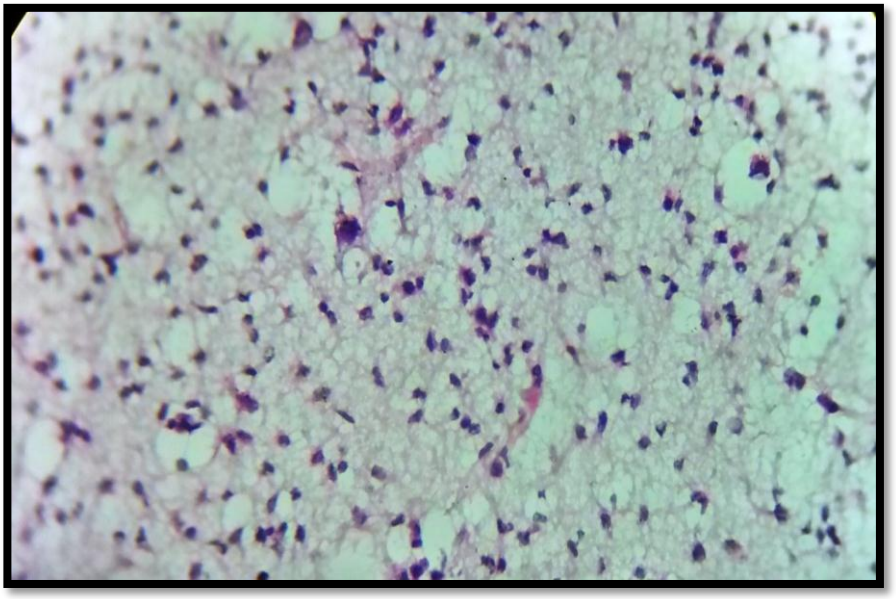

Figure 2: Fibrillary astrocytoma – neoplastic fibrillary astrocytes in the background of a loosely structured tumour matrix. (H&E stain : 400X)

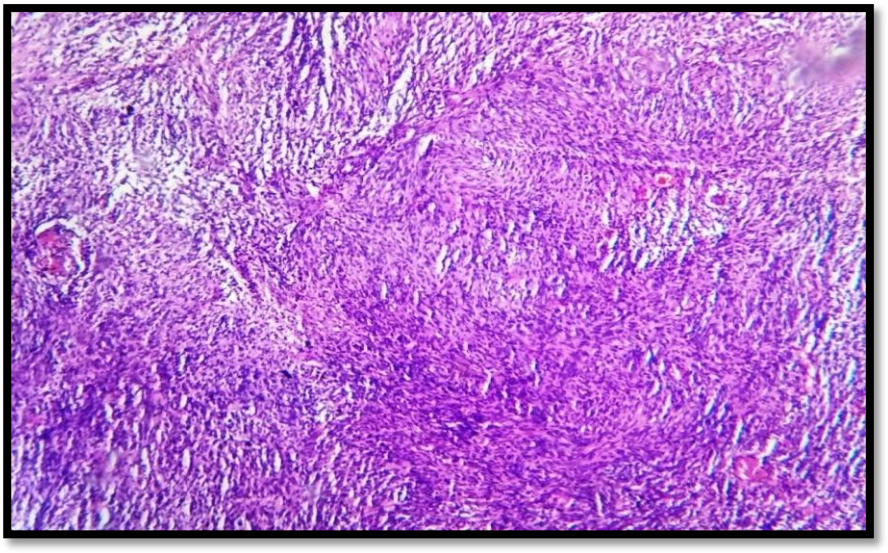

Figure 3 – Glioblastoma . Dense cellularity, marked nuclear pleomorphism and necrosis. (H&E Stain:100x)

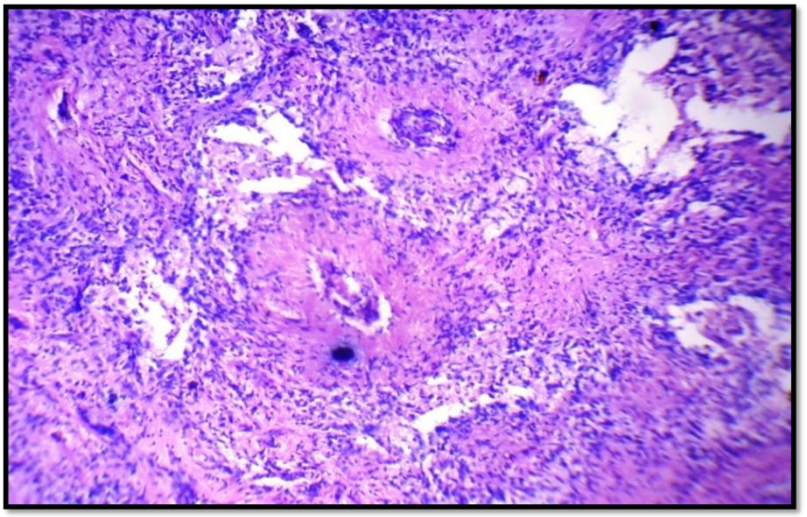

Figure 4- Ependymoma. Perivascular pseudorosettes formed by tumour cells. (H&E Stain: 100x)

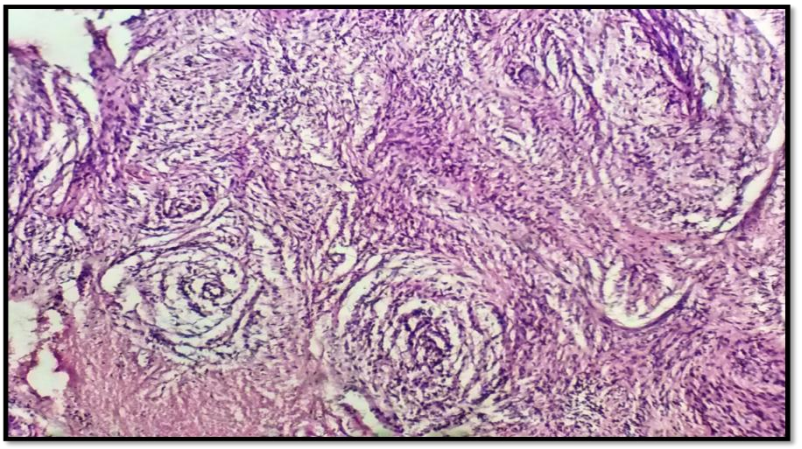

Figure 5: Fibrous meningioma. Spindle shaped tumour cells arranged in parallel and interlacing bundles. (H&E: 200X)

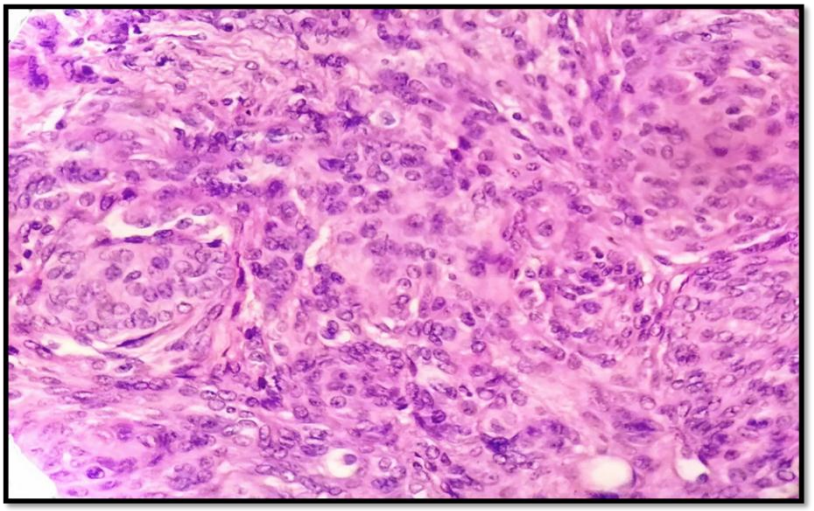

Figure 6- Meningotheliomatous meningioma. Meningothelial cells arranged in syncitial clusters. (H&E Stain :400X)

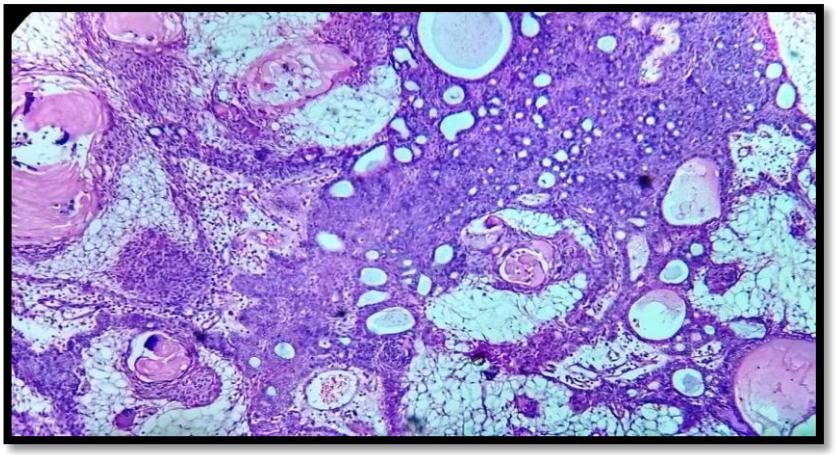

Figure 7– Craniopharyngioma Adamantinomatous type. Epithelial nests with cystic change and keratinisation(compact wet keratin). (H&E:100X)