

Original Research Article

Histomorphological spectrum of central nervous system lesions in a tertiary care hospital

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ABSTRACT

Background: Central nervous system (CNS) lesions show considerable geographic and racial variations with respect to the incidence and their pattern of distribution. CNS neoplasm account for 2% of all cancers. There has been a rapid increase in incidence of CNS tumors. Many non-neoplastic CNS lesions can clinically and radiologically mimic brain tumors and to differentiate them histopathological examination is necessary.

Methods: This was a descriptive cross-sectional study of 30 cases, carried out from March 2020 to February 2021, in a tertiary health care hospital. The cases were diagnosed histopathologically and categorized according to the WHO 2021 classification.

Results: The study included 30 cases. 3 (10%) of them were non-neoplastic while 27 (90%) were neoplastic with glioblastoma and diffuse astrocytoma being the most common. Overall, tumors of neuroepithelial tissue (60%) was the most common entity. Frontal lobe was the most commonly observed site in the neoplastic lesion. Headache was the most common presentation. Age range varied from 7 years to 66 years with the mean age of 32.7 years.

Conclusions: The spectrum of neoplastic lesions were astrocytoma, glioblastoma, ependymoma, hemangioblastoma, medulloblastoma, meningioma, non-hodgkins lymphoma, oligodendroglioma, pituitary adenoma, schwannoma and non-neoplastic were A-V malformation, brain abscess, subdural empyema.

Keywords: CNS lesions, CNS tumors, Histopathological

INTRODUCTION

Since 1774, when Louis first documented a fungal tumour of the dura mater, space-occupying tumours in the cerebral cavity have been well-known to humans. Three decades ago and earlier, medical teachers in India frequently stated that brain tumours were uncommon in Indians. With the advancement of new investigative tools in India over the last two decades, it has become clear that brain tumours are just as widespread in India as they are anywhere else.¹

CNS lesions show considerable geographic and racial variations with respect to the incidence and their pattern of distribution. The histological spectrum of CNS lesions

is broad and it varies among extremes of age groups.² CNS cancer incidence rates increased globally by 17.3 percent between 1990 and 2016, when age-standardised rates are taken into account.³ CNS neoplasm account for 2% of all cancers. There has been a rapid increase in incidence of CNS tumors. Many non-neoplastic CNS lesions can clinically and radiologically mimic brain tumors and to differentiate them histopathological examination is necessary.

Clinical signs and symptoms of primary brain tumors may be general or focal. The increasing intracranial pressure causes general symptoms including headaches and convulsions. Tissue damage is the cause of focal symptoms like unilateral weakness or personality shifts.

Most common and first symptoms of primary brain tumor are headache, generalized seizures, unilateral weakness, unsteadiness, expressive language disorder, visual problems.⁴

In this study we saw the histopathological spectrum of CNS lesions which included non-neoplastic and neoplastic lesions. The neoplastic lesions were classified and graded according to the WHO classification 2021.

METHODS

This was a descriptive cross-sectional study was carried out from March 2020 to February 2021 in the Department of Pathology, Rural Medical College, Loni.

All the cases of CNS lesions in all age groups received in the Department of Pathology, Loni from March 2020 to February 2021 were included in the study while inadequate biopsy, necrosed tissue specimen, poorly preserved tissue specimen were excluded.

These biopsy specimens were fixed in 10% buffered formalin. After overnight fixation, the tissues were dehydrated with ascending grades of alcohol, cleared with xylene and embedded in paraffin to prepare blocks. These blocks of tissue were cut using a rotary microtome into sections of 3-5 micrometer of thickness. The sections were stained with haematoxylin and eosin. Patient’s clinical data including age, sex, location of lesion, clinical findings and details of imaging investigations were obtained. Histological diagnosis and grading was done by using 2021, WHO classification and grading of CNS tumors. Whenever necessary IHC markers were used for confirming diagnosis.

Finally, the results were analysed and the data prepared to determine the relative frequencies of various histopathological patterns, distribution of age, sex, clinical manifestation and location of various CNS lesions.

Statistical analysis software namely SYSTAT version 12 (By Crane’s software, Bangalore) was used to analyse the data under this study.

RESULTS

This was a descriptive cross-sectional study of 30 cases, carried out from March 2020 to February 2021, in a tertiary health care hospital. The present study had 3 (10%) non-neoplastic and 27 (90%) neoplastic lesion.

Non-neoplastic lesions consisted of AV malformation, brain abscess and subdural empyema in equal frequency and neoplastic lesions were astrocytoma, glioblastoma, ependymoma, hemangioblastoma, medulloblastoma, meningioma, non-Hodgkin’s lymphoma, oligodendroglioma, pituitary adenoma, schwannoma (Figure 1-5). Astrocytoma and glioblastoma were the most common

neoplastic lesion and were 22.2% in each which was followed by meningiomas that consisted 11.1% of cases (Table 1).

Table 1: Histomorphological distribution of lesions.

Distribution	No. of cases	Percentage
Neoplastic lesions		
Astrocytoma	6	22.2
Glioblastoma	6	22.2
Oligodendroglioma	2	7.4
Medulloblastoma	2	7.4
Hemangioblastoma	2	7.4
Non-hodgkins lymphoma	1	3.7
Pituitary adenoma	1	3.7
Meningioma	3	11.1
Ependymoma	2	7.4
Schwannoma	2	7.4
Non-peoplastic		
Subdural empyepa	1	33.3
A-V malformation	1	33.3
Brain abscess	1	33.3

Table 2: Gender wise distribution of CNS lesions.

Histology	Male	Female
Astrocytoma	4	2
Glioblastoma	2	4
Medulloblastoma	1	1
Ependymoma	1	1
Hemangioblastoma	2	0
Meningioma	2	1
Oligodendroglioma	0	2
Lymphoma	1	0
Schwannoma	2	0
Pituitary adenoma	0	1
Brain abscess	1	0
Av malformation	0	1
Subdural empyema	1	0
Total	17	13

Out of 30 cases, 18 were males and 12 were females with male to female ratio 1.3:1. Pediatric cases accounted for 6, while adults were 24 (Table 2). The mean age for all cases was 32.7 years. In pediatric age group, medulloblastoma and glioblastoma were the most common lesion. Most common age group involved was 11-20 years that considered 7 cases. And least number of cases were involved in age 61 and above. Astrocytoma was more frequent in age group 31-40, while glioblastoma in 0-10 and 41-60 years (Table 3).

Cranial and paraspinal nerve tumors were 7.4%. Sellar region tumors were 3.7% and lymphomas were 3.7%. In astrocytoma, the study had diffuse and pilocytic

astrocytoma, diffuse astrocytoma were more common. In ependymoma consisted of classical and anaplastic ependymoma. Meningioma consisted of 2 cases of meningothelial meningioma and 1 case of angiomatous meningioma. Neuroepithelial tumors were the dominant

lesions in this study consisting of 19 cases (66.5%) followed by meningeal tumors making 3 cases (10%) of the cases, tumors of cranial and peripheral nerve and tumor of uncertain histogenesis each 2 cases (7.4%), Sellar region tumors and primary CNS lymphoma 1 case (3.4%).

Table 3: Age distribution of CNS lesions.

Neoplastic lesions	0-10	11-20	21-30	31-40	41-50	51-60	61-90	Total
Astrocytoma		1	2	3				6
Glioblastoma	2	1			2	1		6
Medulloblastoma	1	1						2
Ependymoma			1			1		2
Hemangioblastoma		1	1					2
Meningioma				1		1	1	3
Oligodendroglioma				1	1			2
Lymphoma			1					1
Schwannoma		1				1		2
Pituitary adenoma		1						1
Brain abscess					1			1
Av malformation					1			1
Subdural empyema		1						1
Total	3	7	5	5	5	4	1	30

Table 4: Location wise distribution of CNS lesions.

Locations	Adult cases	Paediatric cases	Male	Female	Total percentage
					N (%)
Frontal	5		2	3	5 (16.7)
Fronto-parietal	4	1	2	3	5 (16.7)
Fronto-temporal	1		1		1 (3.3)
Parietal	2		2		2 (6.7)
Temporal	3	1	2	2	4 (13.4)
Temporo-parietal	2		1	1	2 (6.7)
4th ventricle	1	1	1	1	2 (6.7)
Brainstem	1			1	1 (3.3)
Mid brain		1	1		1 (3.3)
Spinal intramedullary	1		1		1 (3.3)
Cerebro-pontine angle	1		1		1 (3.3)
Cerebellum	2	1	2	1	3 (1)
Others (sphenoid wing, sellar)	1	1	1	1	2 (6.7)

Table 5: Comparison of histological type of CNS lesions.

Histology type	Present study	Aryal	Kastura et al	Verma et al	Monga et al	Hema et al	Joshi et al	Chen et al	Lee et al	Ahsan et al
Neuroepithelial	66.6	38.6	31.68	61.6	51.42	56.3	53.6	38.0	19.4	56.0
Meningeal tumors	11.1	14	15.7	14.8	17.14	12.5	19.4	36.5	31.2	28.3
Crainial and paraspinal nerve tumors	7.4	5.2	11.85	4.95	4.28	16.6	22.6	13.3	1.8	5.4
Sellar region tumors	3.7	5.2	9.44	7.6	10	2.1	3.2	4.1	15.8	2.6
Metastatic tumors	0	14	4.28	3.89	1.42	0	1.6	5.1	0	4.9
Lymphoma	3.7	1.7						1.7	1.8	2.4

Location wise frontal lobe along with frontoparietal lobe was the most common location involved. Overall frontal, parietal and temporal lobes were the common locations (Table 4). Males showed more variation and distribution than female cases. Laterality wise right-side lesions were equal to left sided lesions. Headache, vomiting, giddiness, seizures, visual problems, tingling, numbness, hemiparesis and fever were among some of the clinical manifestations in the patients.

Overall, according to WHO grading, grade 4 tumors were commonest 9 (33%) followed by grade 1 and grade 2, 8 cases (29.6%) each. Grade 3 accounted for 1 case (3.7%).

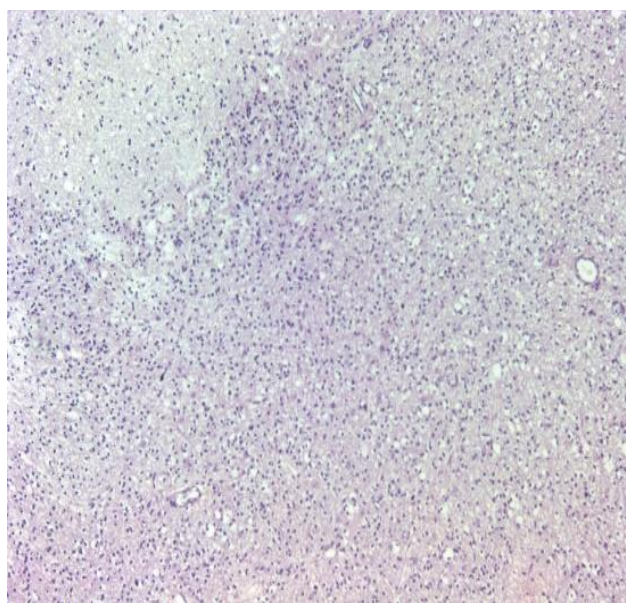


Figure 1: Diffuse astrocytoma, (×100).

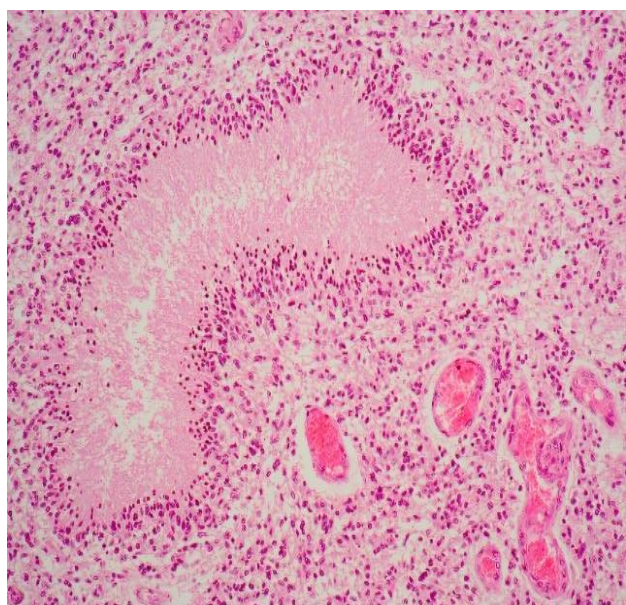


Figure 2: Glioblastoma multiforme showing necrosis and pseudopalisading. (×100).

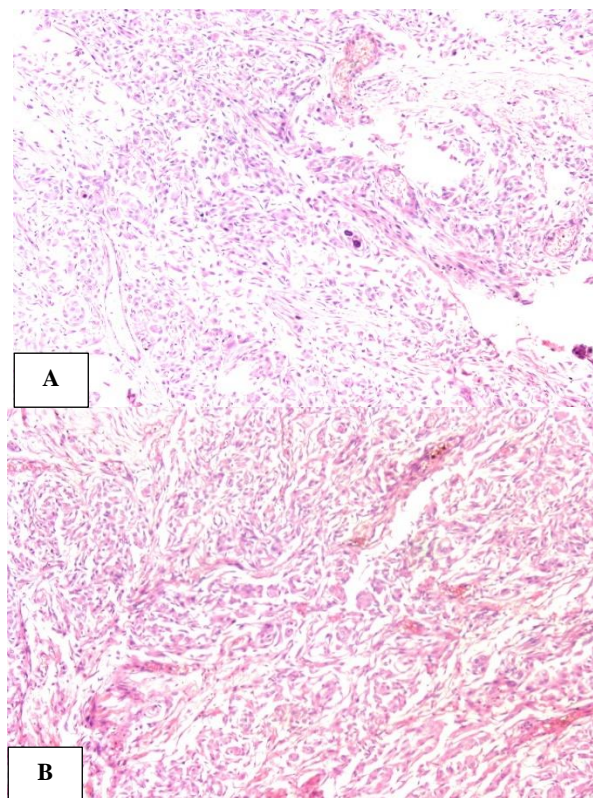


Figure 3: (A and B) Meningothelial meningioma showing psammoma bodies at (×100) and (×400).

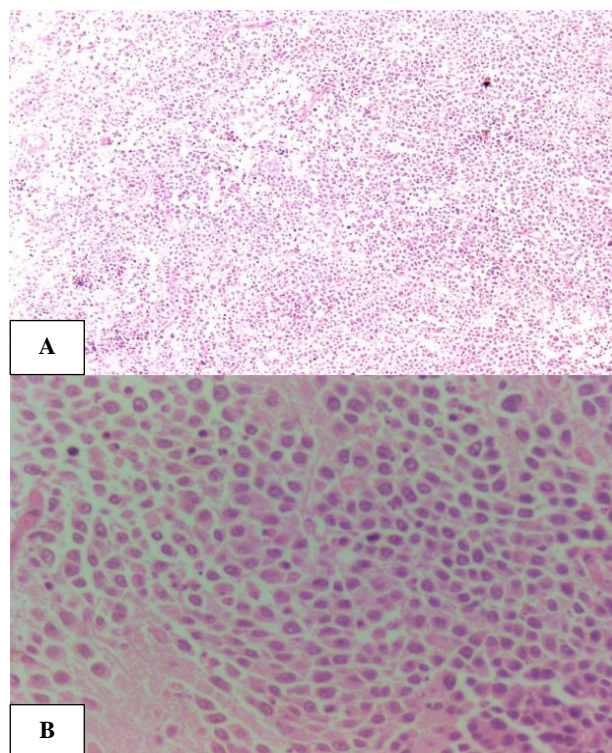


Figure 4: (A and B) Non-hodgkins lymphoma at (×100) and (×400).

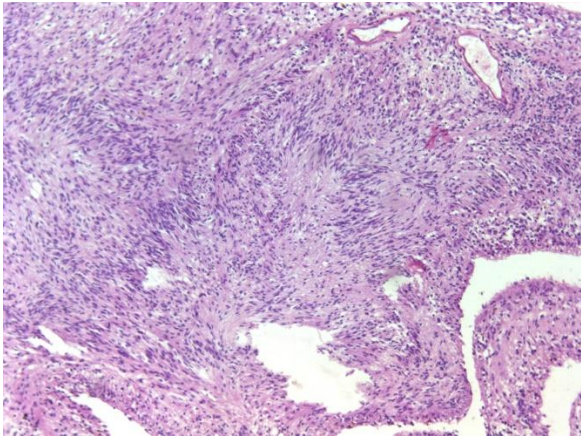


Figure 5: Schwannoma showing verocay bodies (×100).

DISCUSSION

In the present study, out of 30 cases 3 (10%) were non-neoplastic while 27 (90%) were neoplastic. Similar studies done by Rathod et al, Joshi et al and Khonglah et al showed non-neoplastic lesions less than neoplastic lesions. Khonglah et al had very similar finding even when the sample size was much higher.¹⁻³ Studies done by Joshi et al and Rathod et al showed little more incidence of non-neoplastic lesion compared to the present study through they were much less than the neoplastic lesions.^{1,3} In non-neoplastic, the present study included A-V malformation, brain abscess and subdural empyema which was similar to study done by Joshi et al who had abscess and non-specific inflammatory conditions most common and in contrast to study done by Khonglah et al that had cystic lesions the most common.^{2,3}

In the present study, neuroepithelial tumors were the most common histological type of tumors (Table 5). In contrast to present study, study done by Lee et al had meningothelial tumors the most common histological type of tumor.⁵ The present study had no cases of metastatic lesions which was against other studies like Aryal, Desai et al, Nirbhorja et al.^{2,6-8} Aryal found adenocarcinoma and hepatocellular carcinoma as most common metastatic lesions.⁶

In present study the most common age group involved was 11-20 years which was in contrast to studies conducted by Rathod et al 20-50 years, Khonglah et al 31-40 years, Aryal 41-60 years and Desai et al 41-50 years.^{1,2,6,7}

In the study, 6 cases (20%) were pediatric age group and 24 cases (80%) in adult age group. Similar pediatric distribution was seen by Khonglah et al, Nirbhorja, Vimal et al and Jaiswal et al accounting for 23.4%, 12.2%, 10%, 16.2% adult population respectively.^{2,8-10}

Overall slight male dominance was observed in the study with M:F being 1.3:1. Similar studies were recorded by Nirbhorja (1.2:1), Thakur (1.05 :1), Mohammad (1.2:1), Mehta (1.23:1), Hamdani (1:0.8), Adnan (1.4:1), Masoodi (1.12:1) and Lakshmi et al (1.08:1), while Sumathi et al (0.9:1) and Lee et al (1:1.43), Vimal et al and Desai et al showed equal M:F ratio with M:F of 1:0.95 and 1:0.98 respectively.^{5,7-9,11-18}

In this study, most of the cases were grade 4 tumors followed by grade 1 and grade 2. These findings were in contrast with Vimal et al and Mehta et al found grade 1 tumors commonest followed grade 2 tumors.^{9,13}

Frontal and frontoparietal lobe (16 cases each) were the commonest location for the tumors in present study. This finding was supported by studies conducted by Khonglah et al, Mehta et al, Hamdani et al, Massodi et al, Vimal et al and Pidakala et al where frontal lobe was commonest location.^{2,9,13,14,16,19} Lakshmi et al and Sumathi et al found parietal lobe being common followed by frontal lobe.^{17,18}

In the present study, most of the patients had multiple clinical symptoms. The most common clinical presentation was headache. Kalyani et al, Masoodi et al, Khonglah et al, Rathod et al, Joshi et al, Benjarge et al and Mahmoud et al also reported similar observation.^{1-3,16,21,22}

CONCLUSION

The histological diversity of CNS lesions in both paediatrics and in adults is seen in this study. The spectrum of neoplastic lesions were astrocytoma, glioblastoma, ependymoma, hemangioblastoma, medulloblastoma, meningioma, non-Hodgkin's lymphoma, oligodendroglioma, pituitary adenoma, schwannoma and non-neoplastic were A-V malformation, brain abscess, subdural empyema.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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