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Original Article

Pathological Diversity of Central Nervous System lesions in a Tertiary Care Centre

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ABSTRACT

Background: Space occupying Central nervous system (CNS) lesions have various causes like infections, neoplastic, inflammatory and vascular malformation. CNS tumors account for 2% of all malignancies with incidence of 5-10 per 1,00,000 population. These tumors although rare cause significant mortality and morbidity. The aim of the study was to describe the histological spectrum of CNS lesions and to provide overview of descriptive epidemiology of CNS lesions. **Materials and Methods:** This retrospective study was conducted in a tertiary care hospital for three years from August 2022 to August 2025.A total of 68 samples were studied. Relevant clinical and radiological details were collected. Diagnosis was done by histopathological examination and classified under World Health Organisation (WHO) categories. Statistical analysis was done. **Results**: In this study out of the 68 cases of CNS lesions predominant age group was 41-50 years with female preponderance. Primary CNS tumors (76.47%), non-neoplastic lesions (17.6%) and few metastatic cases (5.8%) were received. Common primary CNS tumors were astrocytoma (38.4%) followed by meningioma (32.6%) and schwannoma (15.3%). Least common tumor was craniopharyngioma (1.9%).Non neoplastic lesions comprised of cerebral abscess(33.3%),granulomatous inflammation (25%), epidermal cyst (16.6%), hemorrhage(16.6%) and reactive changes(8.3%). Among the metastatic CNS tumors two were from breast, one from lung and one from gastrointestinal tract. **Conclusion**: This study highlights the spectrum and frequency of various CNS lesions in a tertiary care hospital. Histopathological examination is gold standard with use of immunohistochemistry in arriving at a definitive diagnosis for treatment and prognosis in neuro-pathology.

Keywords: Central Obesity, dyslipidaemia, Hypertension, Cardiovascular morbidity, Inflammation, Insulin resistance, metabolic syndrome, homocysteine.

INTRODUCTION

Central nervous system (CNS) tumors account for 2% of all malignancies with incidence of 5-10 per 1,00,000 population. These tumors although rare cause significant mortality and morbidity. Majority cases lack any specific risk factors. (1)

In the past 20 years the incidence of brain tumors were common in India when compared to western countries. Because of lack of resources and experty in neuropathology challenges came up in diagnosing cases with rare histology, uncommon location and unfitting age group. Thus uniqueness of the lesions and tumor burden remain understated. (2)

Space occupying CNS lesions have various causes like infections, neoplastic, inflammatory and vascular malformation. Accurate diagnosis is needed for timely neurosurgical intervention. Brain tumors have a bimodal peak one at childhood other in adulthood 45-70years.(3)

Risk factors for brain tumors include genetic predisposition, ionizing radiation, dietary factors and chemical exposure. Clinical symptoms include headache, seizures, neurological deficit, vomiting, raised intracranial pressure and visual disturbances.(4)

Many brain tumors have been histologically graded according to World Health Organisation which is used for predicting the biological behaviour of tumors(1)

Histological spectrum of CNS lesions is broad among various age groups. In India due to privation of registration of new cases with local cancer registries the tumor burden gets unnoticed and underestimated(5). The aim of this study is to determine diversity of CNS lesions to highlight incidence and histopathological spectrum in a tertiary care hospital in India.

MATERIALS AND METHODS

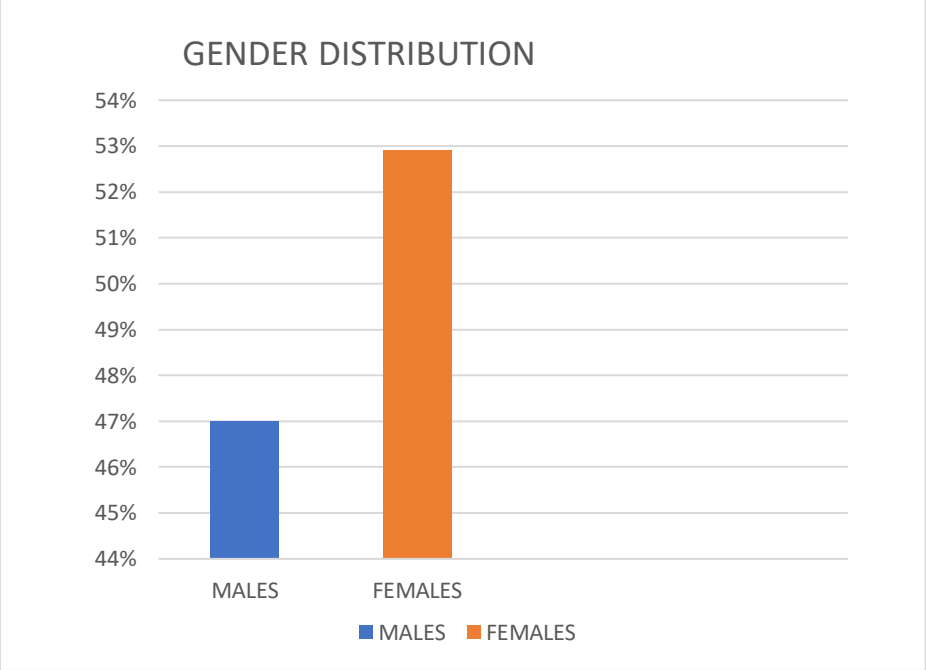
This retrospective study was conducted in a tertiary care hospital for three years from August 2022 to August 2025.A total of 68 samples were studied. Relevant clinical and radiological details were collected. Biopsy samples were fixed in 10%formalin followed by processing and embedding in paraffin wax. Sections were cut haematoxylin and eosin staining were done.Diagnosis was done by histopathological examination and classified under World Health Organisation(WHO) classification.Statistical analysis was done. Institutional ethical clearance was obtained.

Inclusion criteria-All biopsy samples with lesions located in brain during study period.
Exclusion criteria-Inadequate samples and poorly preserved biopsy samples.

RESULTS

In this study we retrieved 68 cases of CNS lesions over three years. Out of these 32(47%) were males and 36(52.9%)were females.(Figure 1)

Figure 1: Gender distribution of CNS Lesions



Among the 68 cases predominant age group was 41-50 years(26.4%) followed by 51-60years(25%),61-70 years(19.1%) and 31-40 years(17.6%) respectively. Least common age group was 0-10 years(1%).(Table 1)

Table 1: Age wise distribution of CNS Lesions

Age group(years)	Number(%)
0-10	1(1)
11-20	2(2)
21-30	3(40)
31-40	12(17.6)
41-50	18(26.4)
51-60	17(25)
61-70	13(19.1)

71-80	2(2)

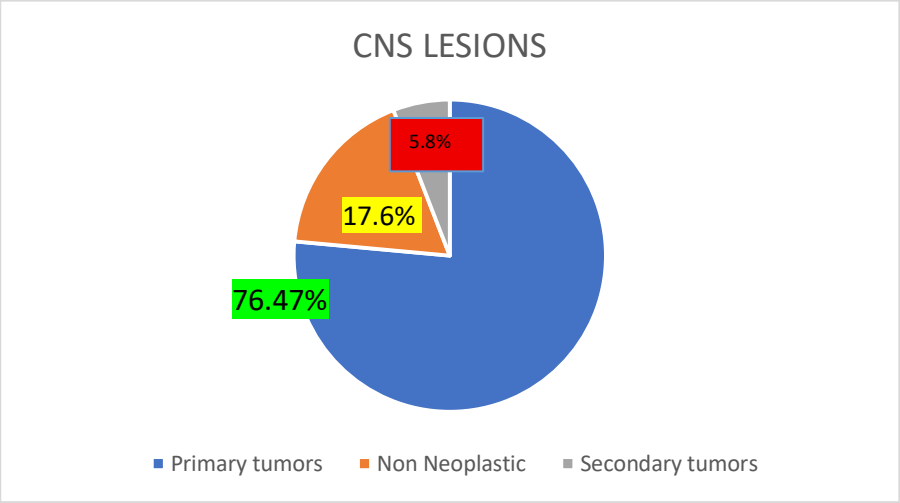
The commonest clinical symptoms in our study include headache,seizures and limb weakness. Less common symptoms were speech deficit and fever.(Table 2)

Table 2: Clinical symptoms in brain lesions

Clinical symptoms	Number of cases
Headache	34
Seizures	23
Limb weakness	19
Visual impairment	15
Vomiting	14
Altered sensorium	11
Tinnitus	5
Backache	5
Balance issues	5
Speech deficit	3
Fever	2

The present study showed predominantly primary CNS tumors (76.47%) followed by non-neoplastic lesions(17.6%) and few metastatic cases(5.8%).(Figure 2)

Figure 2: Categories of CNS lesions



This study represented common primary CNS tumors as astrocytoma (38.4%)followed by meningioma(32.6%) and schwannoma(15.3%).Least common tumor was craniopharyngioma(1.9%).(Table 3)

Table 3: Histological types of CNS Tumors

CNS Tumors	Number,n(%)
Astrocytoma	20(38.4%)
Meningioma	17(32.6%)
Schwannoma	8(15.3%)
Non Hodgkins Lymphoma	3(5.7%)
Medulloblastoma	2(3.8%)
Craniopharyngioma	1(1.9%)
Solitary fibrous tumor	1(1.9%)

The most common histological types as per the current study were neuroepithelial tumors(22 cases,42.3%).Out of 22 cases 20 were astrocytic tumors.The second most common tumors were meningeal tumors. Meningothelial meningioma(13 cases,25%) being the most common meningeal tumors. Astrocytic tumors have a male prediliction whereas meningiomas are frequent in female population.(Table 4)

Table 4: Gender wise distribution of neuroepithelial and meningeal tumors

Histologic category	Male	Female	Total
Neuroepithelial tumors-Astrocytic tumors			
Pilocytic astrocytoma	1	2	3
Diffuse astrocytoma	5	3	8
Anaplastic astrocytoma	1	0	1
Glioblastoma	5	2	7
Glioneuronal			
Neuroepithelial tumors-Embryonal tumors	0	1	1
Medulloblastoma	1	1	2
Meningeal tumors			
Meningothelial	3	10	13
Transitional	1	2	3
Angiomatous	1	0	1

The current study showed astrocytic tumors in older age group of 51-70 years unlike embryonal tumors common below 20 years of age. Meningiomas were seen in 41-60 years more frequently.(Table 5)

Table 5:Age wise distribution of neuroepithelial and meningeal tumors

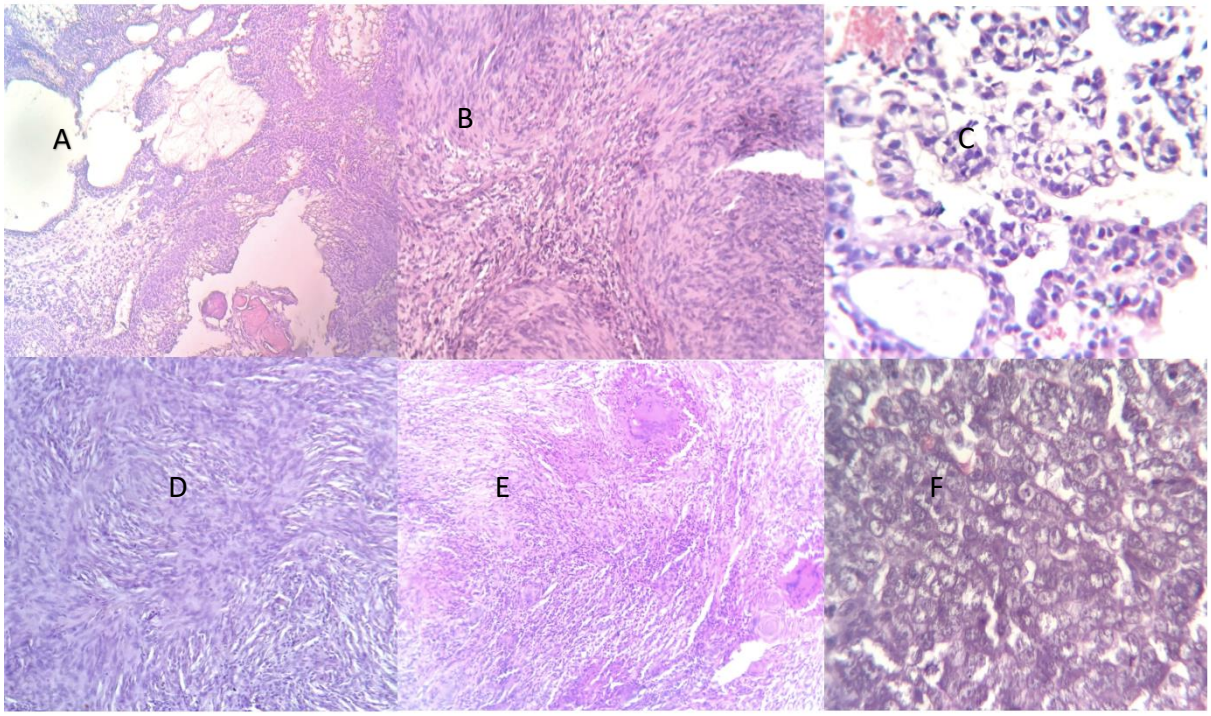
Histologic category	0-10 yrs	11-20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61-70 yrs	71-80 yrs
Neuroepithelial tumors-Astrocytic tumors								
Pilocytic astrocytoma				1	1	1		
Diffuse astrocytoma				2	1	2	3	
Anaplastic astrocytoma					1			
Glioblastoma				1	2	2	2	
Glioneuronal								
Neuroepithelial tumors-Embryonal tumors								
Medulloblastoma	1	1						
Meningeal tumors								
Meningothelial					5	6	1	1
Transitional				1	1		1	
Angiomatous						1		

This study showed non neoplastic lesions that comprised of cerebral abscess (33.3%), granulomatous inflammation(25%),epidermal cyst(16.6%),hemorrhage(16.6%) and reactive changes(8.3%).

The present study showed four metastatic CNS tumors two were from breast,one from lung and one from gastrointestinal tract.

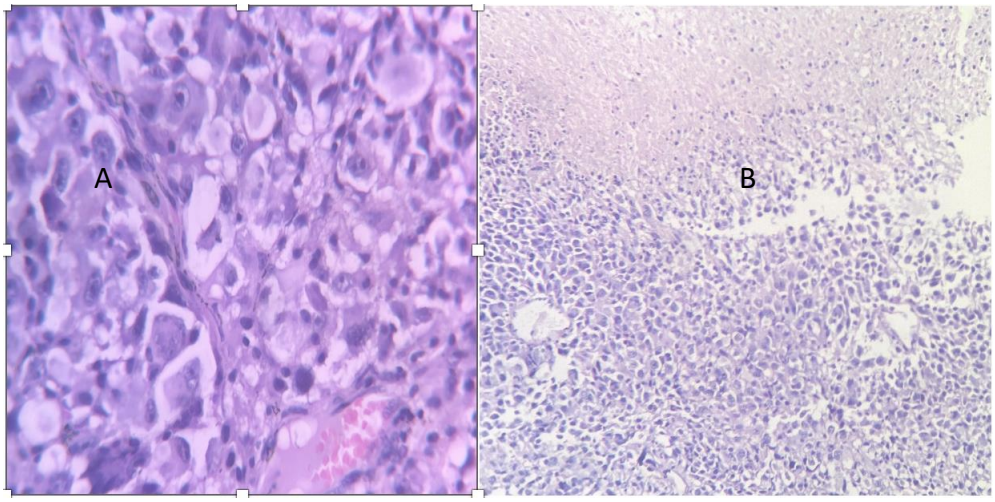
The microscopic features of common CNS lesions in our study are described in Figure 3

Figure 3.A) Adamantinomatous craniopharyngioma(H & E,100X) B) Hypercelluar areas in Schwannoma(H & E,400x) C)Metastatic tumor in brain(H & E,400X) D)Meningothelial Meningioma Grade 1,lobulated architecture, syncytial cells(H & E,400X) E)Granulomatous inflammation(H & E,100X) F)Anaplastic medulloblastoma(H & E,400X)



Microscopy pictures of glioblastoma are in Figure 4

Figure 4 A) Hypercellular astrocytic neoplasm(H & E,400X) B)Neoplastic cells surrounding the geographic necrosis(H & E,100X)



DISCUSSION

The CNS is a complex organ that encompass cerebrum, cerebellum, brain stem, spinal cord, meninges, cranial nerves and blood vessels. Classification of CNS tumors has changed over years from 2006 to 2021 with inclusion of variety of immunohistochemical and molecular markers.(6)

The vast majority of brain and other CNS tumors occur without a known cancer syndrome but 5-10% have a family history. Cancer syndromes associated are neurofibromatosis type I and II, tuberous sclerosis and Li Fraumeni syndrome. There are 11 risk single nucleotide polymorphisms(SNP) for glioblastoma and 19 risk SNPs for non glioblastoma.The most common pathway that confers risk in glioma are risk variants near TERT AND RTEL1.(7)

Most of the CNS lesions in this study that comprises of both neoplastic and non neoplastic lesions have headache as a common presenting complaint which is in concordance to study done by Reddy and Sujatha et al.(4,6)
Out of the total cases majority lesions were primary CNS tumors which was in concordance with study done by Nibhoria et al.(8)

The study done by Kaki et al showed CNS lesions more common in females similar to the current study.(9)
Khonglah et al exhibited common CNS lesions in age group of 31-40 years which was discordant with the present study.(5)
Shah et al showed 11-20 years as the most common age group. The common histological type of tumors were neuroepithelial tumors which had concordance with this study.(10)

In the study done by Maurya et al neuroepithelial tumors were the most frequent tumors followed by meningioma. The CNS tumors were female prevalent with common age group between 41-50 years similar to our study.(1)

According to Bhattacharya et al and Sen et al meningeal tumors were the most prevalent CNS tumors accounting to be 42.86% and 48% respectively discordant to the current study.(11,12)

Reddy et al showed astrocytomas as the commonest CNS tumors among age group of 41-50 years which was in concordance to our study however Shihora et al demonstrated CNS tumors in the age group of 31-40 years.(4,13) (Table 6)

Table 6: Comparison between the present study and other studies.

Studies	Bhattacharya et al [11]	Sen et al [12]	Maurya et al[1]	Shihora NV et al[13]	Reddy et al [4]	Present study
M/F ratio	1.2/1	1.5/1	0.7/1	1/1.4	1.03/1	1/1.12
Common histological types of tumors	Meningeal-(42.86%) Neuroepithelial-(38.09%)	Meningeal-48% Astrocytic-38%	Astrocytic-(31.30%) Meningioma-(27.82%)	Astrocytoma (33.3%) Meningioma (25.9%)	Astrocytoma (22.77%) Meningioma (22.22%)	Astrocytic tumors (38.46%) Meningioma (32.69%)
Common age group	Sixth decade	21-40years	41-50years	31-40 years	41-50 years	41-50years
Common symptoms	NA	NA	NA	Headache (47.7%) Limb weakness (10.78%)	Headache (48.7%) Neurological deficits (31.6%)	Headache (50%) Seizures (33.8%)

The present study showed astrocytoma of predominantly low grade type whereas the study done by Gore et al showed maximum cases of high grade astrocytoma. The commonest age group of high grade astrocytomas were 41-60 years similar to our study. Among the high grade astrocytomas, anaplastic astrocytoma were frequent followed by glioblastoma and gliosarcoma which was discordant with this study in which glioblastomas were common followed by diffuse astrocytomas.(2)

The patients diagnosed with meningioma had a mean age of 44 years with female preponderance owing to hormonal influences according to study done by Khonglah et al which was in concordance with the present study.(5)

According to study done by Nayak et al the commonest type of meningioma was meningothelial type which was in concordance with the existing study.(14)

Among the non neoplastic lesions the current study showed predominant cases of cerebral abscess similar to study done by Joshi et al.(15)But the study done by Shah et al showed AV malformation, brain abscess and subdural empyema as the most common non neoplastic lesions.(10)

Five common primary sites for metastatic CNS tumors are lung, breast, skin, kidney and gastrointestinal tract. CNS tumors inspite of less incidence among other malignancies due to their location and mass effects have a poor prognosis(3). The present study also showed breast, lung and gastrointestinal tract as the primary sites of tumor in metastasis.

As per the study done by Nayak et al seven cases of metastatic tumors were diagnosed. Adenocarcinomas had a preponderance over papillary carcinoma followed by primary renal cell carcinoma. The current study showed four cases of metastatic deposits. Secondary involvement of CNS can be by direct extension or hematogenous spread of systemic cancer.(14)

CONCLUSION

This study highlights the spectrum and frequency of various CNS lesions in a tertiary care hospital. Among the neoplastic entities astrocytomas and meningiomas were common. Histopathological examination of biopsies is gold standard with clinico-radiological correlation with use of immunohistochemistry in arriving at a definitive diagnosis in neuro-pathology. This will help in management and prognosis of CNS lesions.

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No funding was received for this research work

Competing interest

There are no known conflicts of interest associated with this publication

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