

Original Research Article

A study of histopathological spectrum of central nervous system lesions at a tertiary health care center of South Gujarat, India

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ABSTRACT

Background: Central nervous system lesions can have varied aetiology like infectious, inflammatory and neoplastic. Establishing an accurate aetiology is essential for timely diagnosis and neurosurgical intervention. The annual incidence of tumours of CNS ranges from 10 to 17 per 100,000 people for intracranial tumours and 1 to 2 per 100,000 people for intraspinal tumours; the majority of these are primary tumours, and only one fourth to one half are metastatic. The present study attempts to provide preliminary data on morphological patterns of intracranial lesions and to study clinicopathological spectrum.

Methods: The present study was carried out at a tertiary care center from January 2015 to September 2017. A total of 65 cases of CNS lesions were analyzed. In case of CNS tumours reporting were done according to WHO criteria for classification and grading.

Results: Out of 65 cases studied, 51 cases (78.46%) were of neoplastic lesions and 14 cases (21.54%) of non-neoplastic lesions. Among 14 cases of non-neoplastic lesions 2 cases were of reactive/cystic lesions, 4 cases were of infective lesions, and 8 cases were of congenital lesions. In the present study, out of 51 neoplastic cases most common cases were of astrocytoma.

Conclusions: The exact histopathological diagnosis of Central Nervous system lesions is essential to predict the prognosis and treatment. Management strategies and prognosis of tumours depends on the correlation of factors like the types, grades of tumours, its location, size and stage of development.

Keywords: Central nervous system lesions, Central nervous system tumours, WHO grading

INTRODUCTION

Central nervous system lesions can have varied an etiology like infectious, inflammatory and neoplastic. Establishing an accurate etiology is essential for timely diagnosis and neurosurgical intervention.¹

With development of recent investigation techniques in India in past two decades, it has become obvious that CNS tumours are as common as in this country as elsewhere in the world.²

The majority of these are primary tumours, and only one fourth to one half are metastatic.³ Tumours of the CNS accounts for less than 2% of all malignancies. The majority of the patients die within first year of diagnosis of malignant lesion and less than 3% survive more than 3 years.⁴

Site of lesion is important because any CNS neoplasm, regardless of histologic grade or classification, may have lethal consequences if situated in a critical brain region. Seventy percent of childhood CNS tumors arise in the

posterior fossa; a comparable number of tumors in adults arise within the cerebral hemispheres above the tentorium. The central nervous system (CNS) tumors that predominate in adults differ from those seen in children.³

Characterizing the different forms and range of CNS neoplasms in different regions may provide etiological clues to some tumour types. The unparalleled complexity of the central nervous system (CNS) is mirrored by the ever increasing diversity of recognizing of neoplastic entities that can afflict the organ.³ The major classes of primary brain tumors to be considered here include gliomas, neuronal tumors, poorly differentiated tumors, and a group of other less common tumors. The five most common primary sites are lung, breast, skin (melanoma), kidney and gastrointestinal tract accounting for about 80% of all metastases. Some rare tumors (e.g., Choriocarcinoma) have a high likelihood of metastasizing to the brain.³

Low-grade tumors include low-grade astrocytoma's, oligodendrogliomas and mixed tumors, have been found over time to progress to high grade tumors. The time varies depending on the genetic and morphological makeup of the tumor. The same can be determined by proper examination of surgical specimen. Prognosis of high grade tumor is grave and few of the patients may not even survive 1 year after diagnosis.⁵

METHODS

The present study was carried out at a tertiary care center from January 2015 to September 2017. A total of 65 cases of CNS lesions were analyzed. A detailed history of each patient regarding age, chief complaints and radiological findings were taken. The surgically resected specimens were fixed in 10% formal saline. Study duration of this study is January 2015 to September 2017

Inclusion criteria

All specimen/biopsies of lesions of CNS, which is adequate and representative of the lesion and received in department of pathology for histopathological examination.

Exclusion criteria

Inadequately preserved specimen with handling artefacts, Improper clinical record(history and examination)

Control(s): Not required

Study design is Cross sectional observation study (Prospective).

Thorough gross examination of each mass for its size, shape and consistency was done. Several representative areas of tissue were taken from received surgical specimen and subjected to routine paraffin embedding.

Hematoxylin and Eosin staining was done in all cases. Tissue sections were examined under light microscopy and histopathological evaluation and reporting was done. In case of CNS tumours reporting were done according to WHO criteria for classification and grading.

Grading continues to be important in the diagnosis of CNS tumours. Grading applies to the full spectrum of CNS neoplasm. Histological grading is still used based on morphology, despite the very important prognostic significance of the molecular characteristics. Endothelial proliferation and necrosis are hallmark of malignant CNS tumours.⁶

WHO grading system for CNS tumours is described in Table 1.

Table 1: WHO grading system for CNS tumors 2007.⁶

WHO grade I	Low proliferative potential (atypia, mitosis, necrosis vascular proliferation absent) are considered grade I
WHO grade II	Tumors with cytologic atypia alone are considered grade II
WHO grade III	Tumors with atypia and mitosis are considered grade III
WHO grade IV	Tumors with atypia, mitoses, endothelial proliferation and/or necrosis are considered grade IV.

RESULTS

The present study was done on a total of 65 cases of CNS lesions, which were received and studied at a tertiary care hospital between Jan 2015 to Sept 2017. Out of 65 cases studied, 51 cases (78.46%) were of neoplastic lesions and 14 cases (21.54%) of non-neoplastic lesions. Among 14 cases of non-neoplastic lesions 2 cases (3.08% of total CNS lesions) were of reactive/cystic lesions, 4 cases (6.15% of total CNS lesions) were of infective lesions, and 8 cases (12.31% of total CNS lesions) were of congenital lesions.

Out of 51 cases of CNS tumours, 43 cases were from adult age group (84.31%) whereas 8 cases were from pediatric group (5.69%).

The highest incidence of CNS lesions was seen between 31-40 years (26.15%) of age group. Second peak was observed between 0-10 years (16.92%) of age group. In the present study, out of 65 cases of CNS lesions, 36 cases were female (55.38%) and 29 cases were male (44.62%). Male to female ratio was 1:1.4 showing female preponderance.

In the present study, the most common symptom was headache (47.70%), followed by body/limb weakness (10.78%) and Back swelling/lumbosacral swelling (9.24%). Frequency of presence of other symptoms was

also seen in following order: Abnormal gait/difficulty in walking (07.69%), Giddiness (06.15%), Convulsion (04.62%), Hearing loss (03.07%), Vision loss (03.07%), Backache (03.07%), Occipital swelling (03.07%) and neck rigidity (01.54%). (Table 2).

Table 2: Distribution of CNS lesions according to chief complain.

Clinical Features/Chief complain	No. of cases	Percentage (%)
Headache	31	47.70
Body-weakness/Limb-weakness	07	10.78
Back swelling/Lumbo-sacral swelling/Sacral-Swelling	06	09.24
Abnormal gait/ difficulty in walking	05	07.69
Giddiness	04	06.15
Convulsion	03	04.62
Hearing loss	02	03.07
Vision loss	02	03.07
Backache	02	03.07
Occipital Swelling	02	03.07
Neck rigidity	01	01.54
Total	65	100

In the present study, out of 65 cases of CNS lesions, 50 cases were of intracranial origin (76.92%) and 15 cases were of spinal (23.08%) origin. Distribution of CNS tumours according to their locations are described in Table 3.

In the present study, out of 11 cases of low grade astrocytoma, there were 6 male and 5 female cases. Out

of 6 cases of high grade astrocytoma, there were 2 male and 4 female cases. Among 17 cases of astrocytoma, there were 9 female and 8 Male cases showing female preponderance.

Total 11 cases of schwannoma had 5 male and 6 female cases, showing slight female preponderance in present study. Out of 13 cases of meningioma 10 female and 3 male cases were noted which showed female to male ratio 3.3:1, indicating female predominance. Detailed gender wise distribution of common histological types of CNS lesions is mentioned in Table 4.

In the present study, out of 51 cases of CNS tumours, 22 cases (43.14%) were of neuroepithelial tumours. Out of 22 cases of neuroepithelial tumours, maximum 17 cases (33.33% cases) of astrocytic tumours were seen.

After neuroepithelial tumours second most common main histological type was of tumours of meningeal origin 13 cases (25.49%) were seen, followed by 11 cases (21.58%) of cranial and spinal nerve tumours. 4 cases (7.84%) were of tumour of sellar region were seen. Only one (1.96%) case of metastatic tumour was noted.

In the present study, out of 51 neoplastic cases most common cases were of astrocytoma (33.33%) (Total 17 cases- 11 cases low grade and 6 cases high grade astrocytoma), followed by second most common cases of meningioma (13 cases; 25.49%) and followed by cases of schwannoma (11 cases; 21.57%). Other tumours in decreasing frequency were as: choroid plexus papilloma (2 cases; pituitary adenoma (2 cases; 03.92%), craniopharyngioma (2cases; medulloblastoma (1 case; 01.96%), oligodendroglioma (1 case; ependymoma (1 case; 01.96%) and CNS metastasis (1 case; 01.96%).

Table 3: Distribution of CNS lesions according to locations.

Location of CNS lesion	No. of cases	%		
Intracranial	Frontal lobe	18	27.69	
	Temporal lobe	02	03.07	
	Parietal lobe	00	00.00	
	Occipital lobe	02	03.07	
	Pituitary/Sellar region	04	06.16	
	Others (also includes lesion involving more than one lobe)	12	18.46	
	Infratentorial	Cerebellum	03	04.62
		Brain Stem	01	01.54
		Others	08	12.31
Spinal	15	23.08		
Total	65	100		

Out of 14 non-neoplastic cases, 8 cases (57.14%) were of congenital lesions, 4 cases (28.57%) were of infective lesions and 2 cases were of reactive/cystic lesions. Out of

8 congenital lesions, 7 cases were of meningomyelocele and 1 case was of encephalocele. Out of 4 cases of infective lesions 2 cases (14.28%) were of brain

abscess/empyema and 2 cases were of CNS tuberculosis. (7.14%) of epidermoid cyst were noted (Table 5). One case (7.14%) of reactive gliosis and one case

Table 4: Gender wise distribution of common histological types of CNS lesions.

Histological type		Gender		Total	
		Male	Female		
Neoplastic lesions	Low grade astrocytoma	06	05	11	
	High grade astrocytoma	02	04	06	
	Medulloblastoma	01	00	01	
	Oligodendroglioma	01	00	01	
	Choroid plexus papilloma	01	01	02	
	Schwannoma	05	06	11	
	Meningioma	03	10	13	
	Pituitary adenoma	01	01	02	
	Ependymoma	01	00	01	
	Craniopharyngioma	00	02	02	
	CNS metastasis	01	00	01	
	Non-neoplastic lesions	Reactive/cystic Lesions	Reactive gliosis	01	00
Epidermoid cyst			00	01	01
Infective lesions		CNS tuberculosis	01	01	02
		Abscess/Empyema	01	01	02
Congenital lesions		Meningomyelocele	03	04	07
		Encephalocele	01	00	01
Total		29	36	65	

Table 5: Distribution CNS lesions according to common histological types.

Common histological types		Total	
Neoplastic lesions (total 51 cases)	Low grade astrocytoma	11	
	High grade astrocytoma	06	
	Medulloblastoma	01	
	Oligodendroglioma	01	
	Choroid plexus papilloma	02	
	Schwannoma	11	
	Meningioma	13	
	Pituitary adenoma	02	
	Ependymoma	01	
	Craniopharyngioma	02	
	CNS metastasis	01	
	Non- neoplastic lesions (total 14 cases)	Reactive/cystic lesions (total 2 cases)	Reactive gliosis
Epidermoid cyst			01
Infective lesions (total 4 cases)		CNS tuberculosis	02
		Abscess/Empyema	02
Congenital lesions (total 8 cases)		Meningomyelocele	07
		Encephalocele	01
Total		65	

In the present study, out of 17 cases of astrocytic tumours, 3 cases were from WHO grade I, 8 cases were from WHO grade II, 2 cases were from WHO grade III and 4 cases were from WHO grade IV. One case of oligodendroglioma fell in WHO grade II. Two cases of

choroid plexus papilloma belonged to WHO grade I. One case of medulloblastoma was of WHO grade IV and one case of Ependymoma was of WHO grade II.

Among meningioma, 12 cases were of WHO grade I and one case was of WHO grade III. 11 cases of schwannoma

belonged to WHO grade I. Two cases of craniopharyngioma were of WHO grade I. 30 tumours were of WHO grade I, 10 tumours were of WHO grade II, 5 tumours were of WHO grade IV and 3 tumours were of WHO grade III observed. Most common grade found in present study was WHO grade I (Table 6).

In present study, a total 17 cases of astrocytic tumour were found, among which 3 cases of pilocytic

astrocytoma (WHO grade I) (17.65%) were found. 5 cases of diffuse fibrillary astrocytoma and 3 cases of gemistocytic astrocytoma were noted from 8 cases of WHO grade II astrocytic tumours (47.05%). Two cases of Anaplastic astrocytoma (WHO grade III) (11.77%) and four cases of glioblastoma (WHO grade IV) (23.53%) were noted. Most common astrocytic tumours were of WHO grade II.

Table 6: Distribution of CNS tumours according to WHO grading.

Histological types	No. of cases			
	WHO grade I	WHO grade II	WHO grade III	WHO grade IV
Astrocytoma	03	08	02	04
Oligodendroglioma	00	01	00	00
Choroid plexus Papilloma	02	00	00	00
Medulloblastoma	00	00	00	01
Ependymoma	00	01	00	00
Meningioma	12	00	01	00
Schwannoma	11	00	00	00
Craniopharyngioma	02	00	00	00
Total	30	10	03	05

In the present study, there were 13 cases of meningioma, among which 12 cases were of WHO grade I (92.31%) and 1 case of WHO grade III (7.69%). Among WHO grade I meningioma, 6 cases (46.16%) were of transitional meningioma. One case each of psammomatous meningioma, meningotheliomatous meningioma and fibroblastic meningioma was seen (7.69%). Two cases fell in category of other.

DISCUSSION

A total of 65 cases of CNS lesions were studied at a tertiary care centre which were received from Jan 2015 to Sep 2017, MRI and CT findings/ diagnoses were provided in all of them. The tumours were reported and graded as per guidelines given in WHO CNS tumour classification.

In the present study, most cases (29.40%) were from 31-40 years age group and in Ghanghoria et al, study most cases showed (24.62%) from 31-40 years age group whereas in Gupta et al, study most cases (27.30%) belonged to 41-50yrs age group.^{7,8} In the present study, authors found that mean age of CNS tumours was 36 years, where as in Kothari et al, it was 43 years and in Rathod et al, it was 38 years.^{2,9}

In the present study, 19.60% cases were from <20 years age group same as Ghanghoria et al, study which showed 20% cases whereas in Gupta et al, study 06.60% only were from <20 years age group.^{7,10} In present study, 5.88% cases were from >60 years age group whereas in Ghanghoria et al, Gupta et al, study show 10.77% and

17.70% cases from >60 years age group respectively.^{7,8} The age distribution of all CNS tumors showed a gradual increase in tumour cases with increasing age, peaking in the age group 31-40 years and tapering off thereafter. The rise in incidence of CNS tumours is consistent with virtually all other adult tumours.¹¹ CNS tumours in late adulthood are often associated with environmental, occupational, lifestyle risk factors and can be ascribed to the cumulative effect of exposure over a prolonged period of time.¹²

Table 7: Male to female ratio comparison between various studies.

Male: Female ratio	Majid et al, Study ¹⁵	Neelakantaiah et al, ¹³ study	Present study
All CNS tumours	1.7:1	1:1.14	1:1.3

In the present study, male to female ratio for CNS lesion cases was 1:1.3, which indicate slight f s was 1:1.4; whereas male to female ratio for CNS tumour emale preponderance. Male to female ratio of 1:1.14 was seen in Neelakantaiah et al, study which also indicates slight female preponderance, which is also consistent with Kothari et al, study.^{13,14} Possible explanation for observed gender variations may arise as a result of possible variability in the susceptibility of X and Y chromosomes to tumourigenic stimuli, while others postulate a protective effect of female sex hormones against brain tumours. (Table 7).

In the present study, 84.31% cases were intracranial, and 15.69% cases were spinal. Which is quite comparable with study by Majid et al, 76.92% intracranial and 23.08% spinal cases and Andrews et al, study, 86.66% intracranial cases and 13.34% spinal cases.^{15,16}

In the present study, tumours presenting supratentorially were 76.74% and infratentorial were 23.26% which is comparable with Majid et al, study showing supratentorial presentation 82.86% and Infratentorial presentation 17.14% and in Andrews et al, study supratentorial presentation were 88.46% whereas infratentorial presentation were 11.54%.^{15,16} In the present study, among neuroepithelial tumours astrocytic tumors were commonest 33.33% (17 cases), which is comparable to Kothari et al, study (30%), Neelakantaiah et al, study (44%) and Majid et al, study (27.7%).^{9,13,15} In the present study, authors found choroid plexus papilloma 3.92% cases, which is comparable to Neelakantaiah et al, study (02.00%) and Majid et al, study (01.50%).^{13,15} In the present study, oligodendroglial tumor was 1.96%, whereas in Majid et al, study 6.20% and Kothari et al, study 8% cases were seen.^{9,15} Embryonal tumours in present study were 1.96% whereas in Majid et al, study (06.20%), Neelakantaiah et al, study (04.00%) and Kothari et al, study (08.00%).^{9,13,15}

In the present study, ependymal tumors were 1.96% whereas in Majid et al, study 3.10% cases were seen.¹⁵

Table 8: Comparison of distribution of CNS tumours in children and adolescents (0-20 years).

Histological type	Gupta et al Study, ⁸	Present study
Pilocytic astrocytoma	05(23.80%)	01(10.00%)
Diffuse fibrillary astrocytoma	-	01(10.00%)
Glioblastoma	-	01 (10.00%)
Craniopharyngioma	02(09.50%)	02 (20.00%)
Choroid plexus papilloma	-	02 (20.00%)
Schwannoma	03(14.30%)	02 (20.00%)
Medulloblastoma	05 (23.80%)	01 (10.00%)
Ependymoma	03(14.30%)	-
Anaplastic oligoastrocytoma	01 (04.80%)	-
Meningioma	01(04.80%)	-
Subependymal giant cell astrocytoma	01 (04.80%)	-
Total	21 (100%)	10 (100%)

In the present study, authors found that, the commonest CNS tumours in children and adolescent (0-20 years) were craniopharyngioma, choroid plexus papilloma and schwannoma each having 20% frequency followed by pilocytic astrocytoma, diffuse fibrillary astrocytoma, glioblastoma and medulloblastoma were each had 10%

frequency. In Gupta et al, study, most common tumours were pilocytic astrocytoma and medulloblastoma having 23.80% frequency followed by schwannoma and ependymoma having 14.30% frequency, followed by craniopharyngioma having 9.5% frequency.⁸

International literature reports the most common tumours as being pilocytic astrocytoma, medulloblastoma, ependymoma and craniopharyngioma and germ cell tumours in varying numbers in different regions.^{10,11,14,17} The presence of low occurrence in the present study population is certainly notable; however, as the total number of paediatric patients in the sample group was relatively small, no firm conclusion can be drawn in this matter (Table 8).

In the present study, according to WHO classification, 48 cases were graded, most common was grade I (62.50%) and least common was grade III (06.25%), followed by grade II (20.83%) and grade IV (10.42). In Jat et al, study found majority cases were belonged to Grade I (32.70%) and grade IV (32.70%), followed by grade II (29.10%) and grade III (05.50%).⁵ (Table 9).

Table 9: Comparison of CNS tumours distribution according to WHO grades.

WHO grades	Jat et al, study ⁵	Present study
WHO grade I	32.70%	62.50%
WHO grade II	29.10%	20.83%
WHO grade III	05.50%	06.25%
WHO grade IV	32.70%	10.42%

In the present study, authors noted one case of epidermoid cyst which is 1.54% of total CNS lesions studied. Kothari et al, study also showed one case of epidermoid cyst constituting 4.00%.⁹ One case of gliosis was noted in the present study (1.54%) whereas in Majid et al, study showed frequency of gliosis as 3%.¹⁵ In the present study, authors found two cases of CNS tuberculosis which constitute 03.07% of total CNS lesions, whereas Majid et al, study showed frequency of 7%.¹⁵ In the present study, two cases of cerebellar abscess/ empyema were noted (03.07%). Neelakantaiah et al, study showed 6% abscess cases out of total CNS lesions, which is comparable to present study.¹³ In the present study, authors found 7 cases of meningomyelocele (10.77%) and one case of Encephalocele (1.54%) out of total CNS lesions. In present study most common lesion of Congenital CNS lesion was meningomyelocele (Neural tube defects) comparable to Veriety et al, study.¹⁸

CONCLUSION

A total of 65 study subjects were enrolled in this study irrespective of age and sex. Data collected when Central Nervous System lesions biopsy specimens were sent at a

tertiary care center attached with a medical care center. The study has highlighted the relative frequency of different Central Nervous System lesions at a tertiary care center. Central Nervous tumours are relatively uncommon but are among the most feared of cancers. It alters the patient sense of self by causing paralysis, seizures, cognitive impairment and personality changes. It is the second most neurological disease superseded only by stroke.

But now, there is substantial increase in incidence of Central Nervous System tumours mostly attributed to improvement in neuroimaging. Incidence and pattern of Central Nervous System neoplasms are subject to considerable geographical and racial variations. The availability of clinical information and neuro- imaging techniques like CT scan and MRI are of considerable importance for final histopathological diagnosis. The exact histopathological diagnosis of Central Nervous system lesions is essential to predict the prognosis and treatment. Management strategies and prognosis of tumours depends on the correlation of factors like the types, grades of tumours, its location, size and stage of development.

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