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Original Research Article

Radiological and Histopathological Spectrum of CNS Tumors in Tertiary Care Centre: A Retrospective and Prospective Study

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Abstract

Background: To study the spectrum of CNS tumors in different age groups, locations, clinical presentations, their radiological and histo-pathological profile in local population of Kanpur. *Methods:* This study includes 119 radiologicaly diagnosed and operated cases of CNS tumors, registered between Sept. 2014 to Aug. 2017 in Pathology Department, RMCH and RC and various other hospitals, Kanpur and classified according to WHO 2007 classification along with grading (WHO Gr.I to Gr.IV) of tumors. *Results:* A wide range of histopathological spectrum of CNS tumors was observed. Overall tumors of neuroepithelial tissue (47.9%) was the most common entity followed by tumors of meninges (25.2%), cranial and spinal cord nerves (19.3%), metastatic tumors (4.2%), tumors of sellar region (1.7%) and lymphomas (1.7%). The most common CNS tumors found in childhood (1st and 2nd decade) were ependymoma (5.04%), low grade astrocytoma (3.36%) and medulloblastoma (1.68%). In adults (3rd to 6th decade) astrocytic tumors (21.0%) comprise the most common group followed by meningiomas (16.8%). While in elderly (>60 years) astrocytomas (10.1%) were most common followed by meningiomas (6.7%). Out of 119 cases, 80 (67.2%) were supratentorial, 24 (20.2%) infratentorial and 15 (12.6%) spinal. Most common presenting symptom in supratentorial tumors were headache (67.22%), seizure (47.89%) and motor weakness (37.81%) while in CPA tumors hearing loss and ataxia were the most common symptoms. Spinal tumors mainly presented with motor weakness and urinary symptom. *Conclusions:* Frequency of CNS tumors in local population in different age groups was found to be similar to studies conducted in different parts of India.

Keyword: WHO; CNS; CPA.

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Introduction

CNS tumors are not frequent tumors and constitute about 2% of all the malignancies. They predominantly occur in adult life at the age of 55–65 years, with a peak incidence of 13 cases/1,00,000 population.[1]

In paediatric population, CNS tumors are second most common solid tumors following leukemias. They account for 27% of all cancers during childhood and adolescence with an incidence of 2 cases/1,00,000 population.[2] More than 500 new cases of brain tumor are diagnosed every day, worldwide. The matter of concern is that the incidence and prevalence of brain tumor is increasing in both developed and developing countries.

In developing countries like India, due to lack of complete registration of newly diagnosed cases with local cancer registries, the exact tumor burden goes unnoticed and is underestimated. Hospital based prevalence data, therefore forms the basis for estimating the disease load. With increased availability of diagnostic facilities and better health care, the incidence of CNS tumors seems to be on rise in developing countries.

According to a study on Trends in the brain cancer incidence in India,[3] during childhood brain tumor is more common in girls while in adult both sexes are equally involved.

Brain tumors may be primary or secondary.

Secondary brain tumors are more common than primary brain tumors. A secondary brain tumor occurs by the metastasis from a primary tumor outside brain. Some types of malignancies are more likely to spread to the brain. The most likely spread of malignancies are of the lung, breast, bowel, kidney and skin especially malignant melanoma.

Primary brain tumors are a diverse group of neoplasms arising from different cells of CNS. They can be classified as extra-axial or intra-axial.[1]

Extra-axial tumors are mostly benign neoplasms and includes meningiomas, schwannomas, neurofibromas, pituitary tumors as well as mesenchymal tumors of the skull, spine and duramater. Out of these meningiomas and schwannomas comprise of 80% of extra-axial brain tumors. Meningiomas are more common in women with a ratio of 2:1 intracranially and 4:1 in the spine. Atypical and malignant meningiomas are slightly more common in males. They are uncommon in patient before the age of 40.[1]

Most of the *primary Intra-axial brain tumors* are malignant or potentially malignant. Most common of these include glial tumors, lymphomas, medulloblastomas and haemangioblastomas[1].

WHO classifies all the CNS tumors into seven categories: Tumors of neuroepithelial tissue, tumors of meninges, lymphomas and haematopoietic neoplasms, germ cell tumors, tumors of sellar region, tumors of cranial and spinal cord nerves and metastatic tumors. The spectra of the malignant tumors were different in adult and paediatric age groups. For the adults astrocytic tumors, tumors of meninges and metastatic tumors occupied the top three places while astrocytic tumors took the lead in pediatric cases followed by medulloblastomas and ependymomas.[4]

Materials and Methods

This cross-sectional comparative study was conducted in Department of Pathology, Rama Medical College Hospital and Research Centre and various other neurospeciality hospitals of Kanpur and includes prospective cases from September 2016 to August 2017 and retrospective cases registered between September 2014 to August 2016. Patients were enrolled from the indoor and outdoor cases attending the hospital. Total 119 radiologically diagnosed and operated cases of CNS tumors, received in the department of Pathology, for histopathological examination were included in this study. Out of 119, 36 cases were retrospective while 83 cases were prospective.

Patients having intra-axial or extra-axial tumors proved on radiological investigations are included in present study, whereas patients receiving pre-op radiotherapy, patients who fails to turn up for surgery and follow up and tumors of peripheral nervous system and non neoplastic conditions of the CNS were excluded. Relevant demographic data such as age, gender was recorded in study proforma along with detailed clinical history and radiological findings like CT scan/MRI, which ever was available.

The clinical details especially noted were: headache (severity, area involved, number of episodes/day and duration), vomiting episodes, seizures, visual disturbances, personality changes, vertigo and hemiparesis. Operative findings were also noted.

Most of the specimens (preserved in formalin after biopsy/surgical specimen) received in Pathology Department for histopathological examination were totally processed, while of the larger specimens representative areas were processed by standard technique. Sections were stained with Haematoxylin and Eosin. Detailed microscopic findings were recorded and tumors were classified according to WHO classification along with grading of the tumor.

Results

In present study, 119 (36 retrospective and 83 prospective) radiologically diagnosed and operated cases of CNS tumors, received in the Department of Pathology, Rama Medical College Hospital and Research Centre and various other neurospeciality hospitals of Kanpur were included.

Table 1: Age and Sex distribution of CNS tumors in Retrospective and Prospective cases.

	Retrospective Cases			Prospective Cases		
Age group	**n (no. of cases of CNS tumors)**	**Male**	**Female**	**n (no. of cases of CNS tumors)**	**Male**	**Female**
0–10 yrs	-	–	–	4	2	2
11–20 yrs	3	3	–	5	5	–
21–30 yrs	2	1	1	14	8	6
31–40 yrs	8	5	3	16	13	3
41–50 yrs	6	3	3	15	4	11
51–60 yrs	9	5	4	15	9	6
61–70 yrs	5	3	2	11	9	2
>70 yrs	3	2	1	3	–	3
Total cases	**36**	**22**	**14**	**83**	**50**	**33**

Male: Female- 1.5:1

Out of 119 cases of CNS tumors, 72 cases (61%) were found to be in males, while 47 cases (39%) in females, male: female ratio being about 1.5:1 (Fig. 1).

All the cases of CNS tumors showed a male predominance, except cases of meningiomas and schwannomas in which female predominance was seen, female:male ratio being 1.14:1 and 2.3:1 respectively. The highest number of cases were seen in age group 31–40 years and 51-60 years. Total number of cases seen in each of both age group was 24 out of 119 cases constituting 20.2% (Fig. 2).

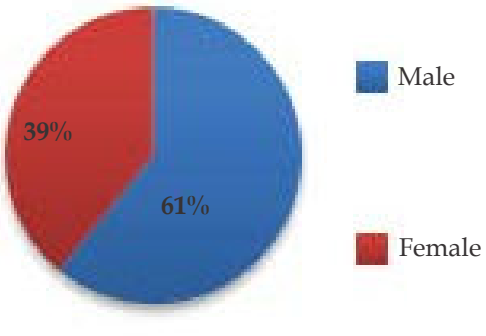

Fig 1: Gender distribution of CNS tumors

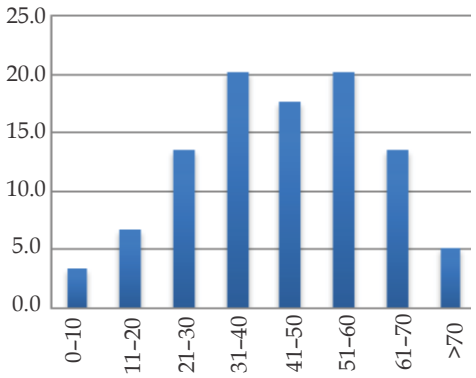

Fig. 2: Age-wise distribution of CNS tumors

The most common CNS tumors found in childhood (1st and 2nd decade) were ependymoma (5.04%), low grade astrocytoma (3.36%) and medulloblastoma (1.68%). In adults (3rd to 6th decade) astrocytic tumors (21.0%) comprise the most common group followed by meningiomas (16.8%). While in elderly (>60 years) astrocytomas (10.1%) were most common followed by meningiomas (6.7%) (Table 1).

Table 2: Percentage break-up of CNS tumors with histologic subtype and WHO grading.

Type of CNS tumor	n (no. of cases)	Percentage (%)	WHO grade
Tumors of neuroepithelial tissue	**57**	**47.9**	
a. Astrocytic tumors	**41**	**34.5**	Grade I
Low grade astrocytoma	10	8.4	Grade II
Diffuse astrocytoma	6	5.0	Grade III
Anaplastic astrocytoma	2	1.7	Grade IV
Glioblastoma multiforme	23	19.3	Grade II
b. Oligodendroglial tumors	**5**	**4.2**	Grade III
Oligodendroglioma	4	3.4	Grade I
Anaplastic oligodendroglioma	1	0.8	Grade I
c. Ependymal tumors	**8**	**6.7**	Grade II
Myxopapillary ependymoma	2	1.7	Grade IV
Subependymoma	2	1.7	Grade I
Ependymoma	4	3.4	Grade I
d. Embryonal tumors	**3**	**2.5**	Grade II
Medulloblastoma	3	2.5	Grade III
Tumors of meninges	**30**	**25.2**	Grade I
a. Meningothelial meningioma	24	20.2	Grade I
b. Angiomatous meningioma	2	1.7	Grade I
c. Atypical meningioma	2	1.7	Grade IV
d. Anaplastic meningioma	2	1.7	Grade IV
Tumors of cranial/spinal cord nerves	**23**	**19.3**	
a. Schwannoma	20	16.8	
b. Neurofibroma	3	2.5	
Tumors of sellar region	**2**	**1.7**	
Pituitary adenoma	**2**	**1.7**	
Haematopoietic tumors	**5**	**4.2**	
Lymphoma			
Metastatic tumors			

In the present study, tumors of neuroepithelial tissue constituted the largest category with 57 cases accounting for 47.9% of CNS tumors followed by tumors of meninges accounting for 25.2% (30 cases) of CNS tumors, cranial and spinal cord nerves comprising 19.3% (23 cases) of the total cases, metastatic tumors comprising 4.2% (5 cases), tumors of sellar region comprising 1.7% (2 cases) and lymphomas comprising 1.7% (2 cases) of CNS tumors.

A wide range of histopathological spectrum of neuroepithelial tissue tumors was observed and was classified according to the recent WHO classification system. The tumors were also graded according to WHO grading system from Grade I to Grade IV.

The tumors of neuroepithelial tissue comprised mainly of astrocytic tumors followed by ependymal tumors, oligodendroglial tumors and embryonal tumors. Among the neuroepithelial tissue tumors, the commonest astrocytic tumors accounted for 71.9% (41 cases), ependymal tumors accounted for 14.0% (8 cases), oligodendroglial tumors for 8.8% (5 cases) and embryonal tumors accounted for 5.3% (3 cases) of the total cases.

24.4% of astrocytomas were grade I, 14.6% were grade II, 4.9% were grade III and 56.1% were grade IV. Among the astrocytic tumors, glioblastoma multiforme grade IV (56.1%) was the commonest type followed by low grade astrocytoma grade I (24.4%), diffuse astrocytoma grade II (14.6%) and anaplastic astrocytoma grade III (4.9%).

Out of 8 cases of ependymal tumors, 4 cases were of ependymoma grade II accounting for 50.0% and 2 cases were each of myxopapillary ependymoma grade I and subependymoma grade I accounting each for 25.0% of the total cases of ependymal tumor (Table 2).

Among the 5 cases of oligodendroglial tumors, 4 cases were of oligodendroglioma grade II accounting for 80.0% and 1 case was of anaplastic oligodendroglioma grade III accounting for 20.0% of the total cases of oligodendroglial tumors.

In embryonal neoplasm, 3 cases of medulloblastoma grade IV tumor were found. It is a high grade malignant tumor, mostly seen in children.

Second most common CNS tumor found in present study was tumors originating from meninges.

86.7% of meningioma were grade I, 6.7% were grade II and 6.7% of meningioma were grade III tumors. Out of 30 cases of meningeal tumors, the most common was meningothelial meningioma grade I accounting for 80.0% (24 cases) of the total meningiomas, followed by angiomatous meningioma grade I accounting for 6.7% (2 cases), atypical meningioma grade II comprising 6.7% (2 cases) and anaplastic meningioma grade III accounting for 6.7% (2cases) of the total meningeal tumors. Third most common CNS tumor found in present study was tumors of cranial and spinal cord nerve. Out of these most common was schwannoma grade I accounting for 86.9% (20 cases) of total cases of tumors of cranial and spinal nerves, followed by neurofibroma grade I accounting for 13.0% (3 cases) (Table 2).

Among tumors of sellar region, 2 cases of pituitary adenoma were found accounting for 1.68% of total cases of CNS tumors. It is a grade I tumor. 2 cases of lymphoma comprising 1.68% and 5 cases of metastatic tumors comprising 4.2% of total CNS tumors were also seen. Both are grade IV tumor.

Majority i.e., 67.2% (80 cases) of CNS tumors were located in supratentorium. While 20.2% (24 cases) of CNS tumors were infratentorial and 12.6% (15 cases) were spinal.

In present study, glioblastoma multiforme was found to be the most common tumor in supratentorial area with 23 cases accounting for 28.8% of all supratentorial tumors. Schwannoma was found to be the most common tumor in infratentorial area with 14 cases accounting for 58.3% of all infratentorial tumors. Meningioma was found to be the most common tumor in spinal area with 6 cases accounting for 40.0% of all spinal tumors. Out of 80 cases of supratentorial tumors, 23 cases were of glioblastoma multiforme comprising 28.8%, 22 cases were of meningiomas comprising 27.5%, 18 cases were of astrocytomas comprising 22.5%, 5 cases of oligodendroglioma comprising 6.3%, 5 cases of metastatic tumors comprising 6.3%, 2 cases of schwannomas comprising 2.5%, 2 cases of pituitary adenomas comprising 2.5% and 1 case was of CNS lymphoma comprising 1.3% of all the supratentorial tumors. Out of 24 cases of infratentorial tumors, 14 cases were of schwannoma comprising 58.3%, 4 cases were of ependymoma comprising 16.7%, 3 cases were of medulloblastoma comprising 12.5%, 2 cases of meningioma comprising 8.3% and 1 case was of CNS lymphoma comprising 4.2% of the total infratentorial tumors. Out of 15 cases of spinal tumors, 6 cases were of meningioma comprising 40%, 4 cases were of schwannoma comprising 26.7%, 3 cases of neurofibroma comprising 20% and 2 cases were of ependymoma comprising 13.3% of all the spinal tumors.

In the present study, out of 80 cases of supratentorial tumors, 87.5% (70 cases) were found to be located in cerebral hemisphere and 12.5% (10 cases) were found in other sites like 3rd ventricle, pituitary fossa, petrous and sphenoidal parts of brain. Most common lobe involved was frontal, followed by temporal, parietal and occipital. Few cases of CNS tumor also involved 2 or more lobes simultaneously like parieto-occipital, fronto-parietal, temporo-occipital or temporo-parietal. All the cases of glioblastoma multiforme, astrocytoma and oligodendroglioma were found in supratentorium occupying the cerebral hemispheres except two cases of astrocytoma which were lying in 3rd ventricle. Out of 8 cases of ependymoma, 4 cases were present in 4th ventricle (infratentorium), 2 cases in 3rd ventricle (supratentorium) and 2 cases in spinal region. Cases of Medulloblastoma were located in cerebellum. Out of 30 cases of meningioma, 20 cases were located in cerebral hemisphere, 2 cases in sphenoidal region, 2 cases were located in cerebello-pontine angle and 6 cases in spinal region.

Among 20 cases of schwannoma, 14 cases were located in cerebello-pontine angle (infratentorial), 2 cases were seen in petrous part (supratentorial) and 4 cases in spinal region. All the cases of metastatic tumors were supratentorial occupying cerebral hemispheres and out of 2 cases of CNS lymphoma, 1 case was found in cerebral hemisphere and 1 case involved cerebellum.

In present study the most common symptoms of the CNS tumors were found to be headache comprising 66.38% (79 cases), followed by seizures comprising 47.89% (57 cases), motor weakness comprising 37.81% (45 cases), vomiting comprising 17.64% (21 cases), urinary incontinence comprising 15.96% (19 cases), ataxia comprising 15.12% (18 cases), language disturbances comprising 14.28% (17 cases), personality changes comprising 13.44% (16 cases), hearing loss comprising 13.44% (16 cases), visual disturbances comprising 8.40% (10 cases) and altered sensorium comprising 5.04% (6 cases) of the total cases of CNS tumors.

The most common presenting symptoms in cases of supratentorial tumors were found to be headache, seizure and motor weakness while tumors located at cerebello-pontine angles commonly presented with hearing loss and ataxia.

The CNS tumors located in spinal regions mainly presented with motor weakness and urinary incontinence.

Discussion

The incidence of CNS tumors is quite low in adults while they form the second most common childhood tumors after leukemia. Adult CNS tumors differ significantly from childhood brain tumors in relation to their sites of origin, clinical presentation, tendency to disseminate, histological features and their biological behaviour. In adults the predominant CNS tumor types are glial neoplasms, meningiomas and metastases, whereas, in children besides gliomas, other major tumor types including primitive embryonal neoplasms are also common. In recent times, an enhanced understanding of these biological differences between adult and childhood CNS tumors has led to investigations in distinct molecular and genetic pathways and therapeutic approaches for each tumor type. It has been observed world-wide that the incidence of CNS tumors is on a rise. Moreover due to high mortality seen in CNS tumors, they form the most challenging group of tumors for neurooncologists.

Among 119 cases of CNS tumors in the present study, 72 cases (61%) were found to be in males while 47 cases (39%) in females. In most of the CNS tumors, there was a slight male predominance, male:female ratio being about 1.5:1. This was in concordance with the study by Fahmida Arab Mallah *et al*.[5] in 2015 comprising of 100 cases of CNS tumors of age ranging from 13-65 years. Male:female ratio was found to be 1.5:1 showing slight male predominance. Similarly, in a study by Chawla N. *et al*.[6] in 2014 comprising of 77 cases of CNS tumors, 47 cases (61%) were found to be in males and 30 cases (39%) in females. Males outnumbered females in a ratio of 1.6:1. It is also in concordance with the present study. The cases of meningiomas and schwannomas in the present study showed a female predominance which is in accordance with the Lee *et al*.[7] study in 2010, which found that the incidence of meningioma was almost 3 times higher in females than in males. Nerve sheath tumors were also found to be more common in females than in males.

In the present study the highest number of cases of CNS tumors were seen in the age group 31-40 years and 51–60 years. Total number of cases seen in each of both age group was 24 out of 119 cases, constituting 20.2%. Whereas, in the study by Chawla N. *et al*.[6] in 2014, the highest incidence was seen in 36–50 years age group constituting 39%. Similarly, Chen *et al*.[8] in 2013 found the greatest number of cases of CNS tumors in the fifth decade. The findings were at variance with the present study which can be explained by the general agreement on the differences in the age incidence of different tumor types. For example, astrocytomas could be found at any age from infancy to over 70 years with the majority however occurring in the first four decades of life. Similarly oligodendrogliomas are most commonly seen in adults but are not uncommon in childhood or adolescence. A slight increase in the age range seen in the present study can be explained by late coming of the patients to the hospital.

The commonest CNS tumors in the present study were gliomas constituting 47.89% (57 cases), followed by meningiomas with 25.21% (30 cases) and schwannomas with 19.32% (23 cases) which is in concordance with the study by Nibhoria *et al*.[9] in 2015, in which the most common CNS tumors in the descending orders were gliomas (51.7%), followed by meningiomas (34.8%) and metastatic tumors (5.6%). The nationwide database in France is also in accordance with the present study, which revealed the percentage of tumors of neuroepithelial tissue and the meninges as 53.9% and 28.8% respectively, from 2004 to 2008.[10] Petrovic *et al*. (2010)[11] also found gliomas to be the commonest neoplasms in their series as did Jaffar *et al*.[12] (2011) with an incidence of 54%. Adnan H.A. *et al*.[13] in their study in 2017 also found glial tumors (35%) to be the most common type, followed by meningiomas (23%), neural tumors (11.8%) and metastasis (8.3%).

In the present study, among the astrocytic tumors, glioblastoma multiforme Grade IV (56%) was the commonest type followed by low grade astrocytoma Grade I (24.3%) and diffuse astrocytoma Grade II (14.6%), which is in concordance to the study by Mondal S. *et al*.[14] in 2016. According to their study, among the astrocytic tumors the most common were glioblastoma multiformes Grade IV (42.5%) followed by low grade astrocytomas Grade I (24.07%) and anaplastic astrocytomas Grade III (22.22%). Dhar *et al*.,[15] Ghanghoria *et al*.[16] and Ahmed *et al*.[17] also found similar findings in their series. While in Nibhoria *et al*.[9] study, anaplastic astrocytomas Grade III (45.7%) was the commonest type followed by diffuse astrocytomas Grade II (34.3%) and glioblastoma multiforme Grade IV (20%). Chawla N. *et al*.[6] in their study found diffuse astrocytoma Grade II (44.18%) to be the commonest followed by high grade astrocytoma Grade III

and IV (20.9%) and low grade astrocytoma Grade I (13.95%). According to Eastern Cancer Registry and information Centre (ECRIC), National Brain Tumour Registry[18], the most common morphological types of brain tumors recorded in England in 2006–2010 were astrocytomas (34%) and meningiomas (21%). Around 80% of astrocytomas were the Grade IV glioblastoma multiforme, which is in concordance to the present study. Jalali R *et al*.[19] in their study on incidence of central nervous tumors presenting in a tertiary cancer hospital from India, also found astrocytomas (38.7%) to be the most common primary tumors with the majority being high grades gliomas (59.9%).

The most common CNS tumors found in childhood (1st and 2nd decade), in this study were – ependymomas (50%), low grade astrocytomas (33%) and medulloblastomas (17%), which varies from the other two studies, Nibhoria *et al*[9] and Jhanvi Jaiswal *et al*.[20] In the Nibhoria *et al*.[9] study, the astrocytic tumors (25% of the pediatric tumors) takes a lead and according to Jhanvi Jaiswal *et al*.[20] study astrocytomas (25.1%), embryonal (20.6%) and ependymal tumors (14.8%) were the most frequently reported histology. This variance can be explained by the small sample size and short period of the present study.

The most common CNS tumors in adults in the present study were–glial tumors (42.05%), meningiomas (28.03%), neural tumors (21.49%) and metastatic tumors (4.67%) which is in accordance with the study by Adnan H.A. *et al*.[13] who found that, glial tumors were the most common type (35%) in adults, followed by meningiomas (23%), neural tumors (11.8%) and metastasis (8.3%).

The most common location of the CNS tumors in the present study was supratentorial 67.22% (80 cases), followed by infratentorial 20.16% (24 cases) and spinal 12.60% (15 cases) which was in accordance with the Masoodi *et al*.[21] study in 2012 who found 82 cases (89.1%) of supratentorial tumors, 10 cases (10.9%) of infratentorial tumors and 14 cases (13.2%) of spinal tumors. In Chawla N. *et al*.[6] study, majority (71.42%) of the CNS tumors were supratentorial occupying anterior fossa. Larjavaara S *et al*.[22] also found in their study that gliomas arise mainly from the supratentorium, with an excess in the frontal and temporal lobes. We also found frontal lobe 31.09% (37 cases) as the most common lobe involved followed by temporal 6.72% (8 cases) and parietal 3.36% (4 cases). Similar findings were also seen in studies by Mondal S *et al*[14] and Jalali R *et al*.[19] Mondal S *et al*.[14] found 33.84% (44 cases) of CNS tumors involving the frontal lobe.

Most common symptoms in the patients in the present study were headache 66.38% (79 cases) and seizures 47.89% (57 cases) which is in concordance to the Mondal S *et al*.[14] study, who also found headache 48.46% (63 cases) and seizures 36.92% (48 cases) to be the most common symptoms. Masoodi *et al*.[21] and Dhar *et al*.[15] also had the similar findings in their studies.

In the present study, 5 cases of metastases were found, all the metastatic tumors were adenocarcinoma. Two cases were metastasis from colonic adenocarcinoma and one was secondary from ductal carcinoma of breast. In the rest two cases primary site was unknown. Mondal S *et al*.[14] found two cases of metastatic tumors, both were adenocarcinoma. Aryal G[23] found eight cases of metastatic brain tumor and 87.5% (7 cases) of these were adenocarcinoma. In the present study, 1.68% (2 cases) of pituitary adenoma was found, Mondal S *et al*.[14] found 2.3% (3 cases) while Masoodi *et al*.[21] found higher incidence 11.32% (12 cases).

In the present study, an incidence of 8.77% was found for the oligodendroglial tumors which is almost same as that found in Mondal S *et al*. study[14] (8.46%). We found 1.68% (2 cases) of primary CNS lymphoma in the present study, Mondal S *et al*[14] found 0.76% (1 case) and Masoodi *et al*[21] found 1.89% (2 cases).

In the present study, meningioma comprised the second most common group of CNS tumors, constituting 25.21% (30 cases) of all cases. Out of 30 cases, 24 cases (80%) were intracranial and 6 cases (20%) were spinal. These findings were in concordance with findings of Masoodi *et al*.[21] study. In their study, out of 21 cases of meningiomas, 18 cases (85.71%) were intracranial and 3 cases (14.28%) were spinal.

In the present study, 86.67% (26 cases) of meningiomas were WHO Grade I tumors, 6.67% (2 cases) showed histological features of Grade II of WHO and 6.67% (2 cases) showed histological features of Grade III of WHO which is in accordance with the Masoodi *et al*.[21] study who found 95.23% (20 cases) of meningioma of WHO Grade I and 4.76% (1 case) of meningioma of WHO Grade II.

Conclusion

Rising global trends in the incidence of CNS tumors, irrespective of age have been observed. Various morphological types of CNS tumors occur at different age groups. The present study highlights the histological diversity in CNS

tumors in both, adult as well as pediatric age groups. MRI is accurate in preoperative diagnosis and assessing the characteristic of different CNS tumors. Histopathological diagnosis is necessary for the formulation of further management after neurosurgery and remains the yardstick against which all emerging techniques must be measured.

Hence, it is concluded that a multidisciplinary approach is ideal for CNS tumors. The neurosurgeon, neuroradiologist and neuropathologist form a triad that is essential for diagnosis, management and follow up of these cases. This is further to say that an extensive study for a longer period is required to see exact trend of CNS tumors in India.

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