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Retrospective study of CNS tumors in a tertiary care centre in Western Odisha - A 4 year study

Sobhagini Nayak[1], Kaustav Mohapatra[2], Jyotirmayee Mishra[1]*, Harish Chandra Singh[1]

[1]*Dept. of Pathology, Veer Surendra Sai Institute of Medical Sciences and Research, Sambalpur, Odisha, India*
[2]*Dept. of Pathology, MKCG Medical College & Hospital, Berhampur, Odisha, India*

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ABSTRACT

Background: Central nervous system (CNS) tumors comprise nearly 3% of all malignancies world-wide whereas in India it accounts for about 2%. In recent years there has been an increase in CNS tumors with new potential risk factors being observed.
Objective: The aim of the present study is to highlight the histopathological spectrum of brain tumors in a single tertiary care centre in Western Odisha.
Materials and Methods: This retrospective histopathological analysis of CNS tumors was conducted in the Department of Pathology, VIMSAR, Burla, Odisha, India from October 2016 to September 2020. In the span of 4 years, a total of 94 neurosurgical biopsies were studied. Histopathological examination of routinely processed tissue and hematoxylin and eosin (H&E) stained sections of corresponding cases were thoroughly examined. Immunohistochemistry (IHC) was done whenever required. Thereafter an approach was made to diagnose the cases, based on WHO classification system of 2016.
Results: A wide range of histopathological spectrum of CNS tumors was observed and was classified according to the WHO classification system of 2016. The primary CNS tumors were graded from Grade I to Grade IV. The most common CNS tumor in our study we found to be Astrocytic tumors (21 cases, 22.34%) followed by Schwannoma (19 cases, 20.21%) and meningiomas (18 cases, 19.14%). The incidence was more among males (59.51%) as compared to females (40.4%).
Conclusion: This study provides an information regarding the prevalence of disease in Western Odisha. Use of modern imaging technique helps to a major extent in making a provisional.

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1. Introduction

Primary brain tumors are heterogeneous group of tumors from variety of cells in central nervous system. Metastatic brain tumors are from cells other than the brain cells. CNS tumors are 3% of all cancers and more common in men than in women.[1] In India tumors of CNS constitute about 2% of all malignancies.[2] Metastatic tumors accounts for about half of the brain tumors. However association of brain tumors with high morbidity and mortality makes them the most dreaded form of cancers.[3]

Presently with improved radiological imaging, immunohistochemistry, molecular genetics and immune marker study, WHO has formulated newer classification and grading system. The major milestones in grading system by WHO were in 2000, 2007 and 2016. Recently the International Agency for Research on cancer also classified over exposure to low frequency non ionizing electromagnetic waves through mobile phones as possible carcinogenic to human being and importantial risk factors

* *Corresponding author*.
E-mail address: drjyotirmayeem15@gmail.com (J. Mishra).

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for brain tumors such as gliomas, meningiomas and acoustic neuromas.[4]

CNS tumors show a bimodal age distribution with one peak in children and second peak in 40-70 years of age.[5] More over the incidence of brain tumors is increasing gradually throughout the world and this is mainly attributed to the development of newer diagnostic techniques and increased frequency of imaging tests.[6,7] The brain tumors are more common in males with exception of meningioma which is more frequently seen in females. The signs and symptoms depends on the size, location and rate of growth of the tumors. The accurate and earlier diagnosis of CNS tumors has a major role in timely surgical intervention and targeted therapy resulting in decreased morbidity and mortality.

There is very scant study in brain tumors in our state Odisha in the past. So we were tempted to have this piece of study in VIMSAR, Burla, the prime referral institute of Western Odisha.

2. Materials and Methods

The present study is a retrospective analysis of the clinicopathological findings, CT scan reports, MRI findings and histomorphological diagnosis in reference to WHO classification and grading system 2016.[8] In a few cases IHC correlation was done, wherever required. We could not correlate with the molecular testing and cytogenetics study as there is no facility in any institution within our approach.

The present study was carried out among 94 cases in a span of 4 years study period from October 2016 to September 2020. Biopsy specimens from the Department of Neurosurgery were received in the Department of Pathology, VIMSAR, Burla, Odisha. Biopsy specimens were fixed in 10% formalin, processing was done using LICA Automated tissue processor and 4 μ thick sections were cut from tissue blocks. Routine Hematoxylin and Eosin stain was used for staining and mounted in DPX. All the sections were examined under the microscope by multiple experienced faculties. Histopathological findings were correlated with tumor location, CT scan, MRI findings and lesions were diagnosed referring classification grading system WHO (2016).

The non-neoplastic and inflammatory lesions were excluded from the study. Histomorphological diagnosis of all 94 cases of CNS tumors were obtained correlating with the age and sex of the patients, location of the tumors and IHC finding wherever required. Final results were analyzed and tabulated with age and sex distribution.

3. Results

On our study, a total of 94 cases of CNS tumors in a duration of 4 years from October 2016 to September 2020 where analyzed. The spectrum of different CNS tumors studied is depicted in the Table 1, which shows most common CNS tumor in our study to be Astrocytic tumors (21 cases, 22.34%) followed by Schwannoma (19 cases, 20.21%) and meningiomas (18 cases, 19.14%).

The incidence was more among male patients (56 cases, 59.51%) as compared to female patients (38 cases, 40.4%) as shown in Table 2. The male to female ratio was 1.4:1.

The age ranged from 2yrs to 84yrs with a mean age of 43yrs. The most frequent age group affected was between 41yrs to 50yrs (19 cases, 20.21%) followed by 4th decade (16 cases, 15.95%) and six decade (12 cases, 13.8%) (Table 3).

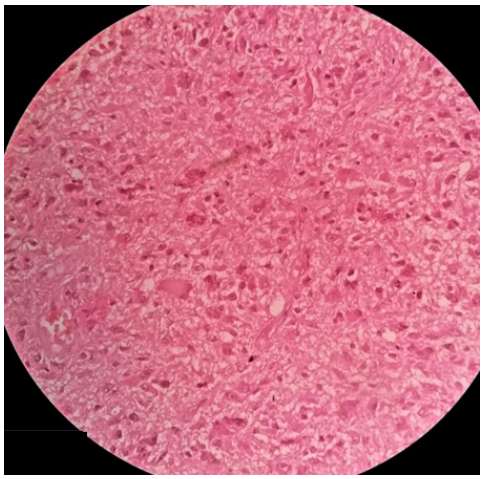


Figure 1: Microsection of astrocytoma showing minigemistocytes (H&E, x400)

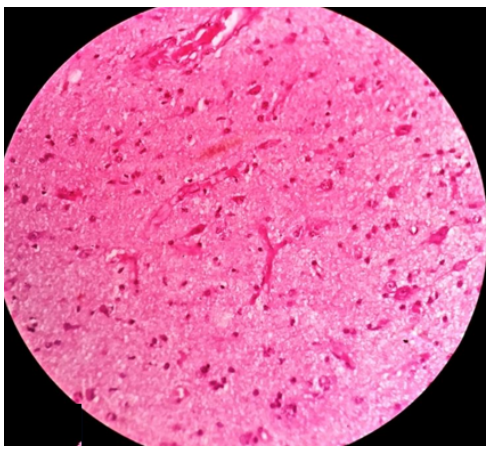


Figure 2: Microsection of pilocytic astrocytoma showing Rosenthal fibre (H&E, x400)

Most frequent diagnosis among female cases was of meningioma (10 cases, 26.3%). Among the male patients Astrocytic tumor was the most frequent diagnosis (14 cases, 25%). In our study the incidence of paediatric CNS tumors (< 14yrs of age) ranged from 2yrs to 14yrs and total number

Table 1: Spectrum of different CNS tumors (n=94)

Histological diagnosis	Total	%
Astrocytic tumors	21	22.3
Schwannoma	19	20.2
Meningeoma	18	19.1
Embryonal tomors	7	7.44
Ependymoma	4	4.25
Oligodendroglioma	4	4.25
Neurofibroma	4	4.25
MPNST	2	2.12
Pituitary tumor	2	2.12
Epidermoid cyst	2	2.12
Hemangiopericytoma	1	1.06
Craniopharyngioma	1	1.06
Choroid plexus tumor	1	1.06
Lipoma	1	1.06
Metastatic	7	7.44
Total	94	100%

Table 2: Sex wise distribution of CNS tumors

Histological diagnosis	Male	%	Female	%
Astrocytic tumors	14	25	7	18.42
Schwannoma	11	19.64	8	21.05
Meningeoma	8	14.28	10	26.3
Embryonal tomors	4	7.14	3	7.89
Ependymoma	2	3.57	2	5.26
Oligodendroglioma	3	5.35	1	2.63
Neurofibroma	2	3.57	2	5.26
MPNST	2	3.57	0	0
Pituitary tumor	0	0	2	5.26
Epidermoid cyst	2	3.57	0	0
Hemangiopericytoma	1	1.78	0	0
Craniopharyngioma	1	1.78	0	0
Choroid plexus tumor	1	1.78	0	0
Lipoma	1	1.78	0	0
Metastatic	4	7.14	3	7.89
Total	56(59.6%)		38(40.4%)	

Table 3: Age wise distribution of different cases

Histological diagnosis	No. of cases	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Astrocytic tumors	21	0	0	3	7	2	3	3	3
Schwannoma	19	0	1	3	4	6	3	2	0
Meningeoma	18	0	0	2	3	7	3	3	0
Embryonal tomors	7	5	2	0	0	0	0	0	0
Ependymoma	4	2	2	0	0	0	0	0	0
Oligodendroglioma	4	0	0	2	1	1	0	0	0
Neurofibroma	4	0	1	2	0	1	0	0	0
MPNST	2	1	0	0	1	0	0	0	0
Pituitary tumor	2	1	1	0	0	0	0	0	0
Epidermoid cyst	2	0	1	1	0	0	0	0	0
Hemangiopericytoma	1	0	0	0	0	1	0	0	0
Craniopharyngioma	1	0	1	0	0	0	0	0	0
Choroid plexus tumor	1	0	0	1	0	0	0	0	0
Lipoma	1	1	0	0	0	0	0	0	0
Metastatic	7	0	0	0	0	1	3	3	0
Total	94	10	9	14	16	19	12	11	3

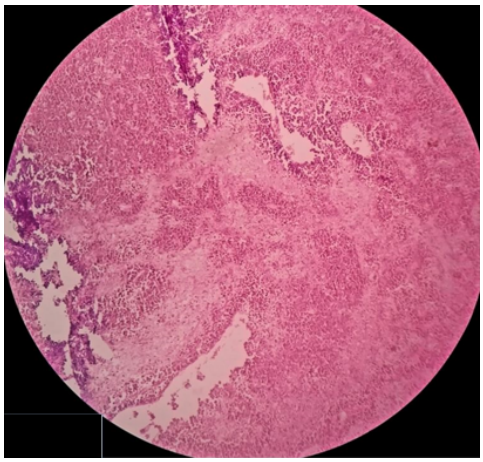


Figure 3: Microsection of glioblastoma showing pseudopalisading (H&E, x100)

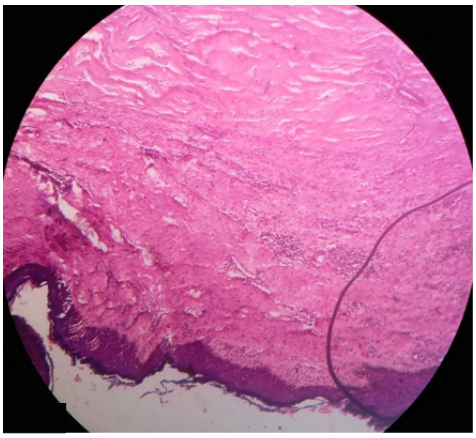


Figure 4: Microsection of epidermoid cyst showing stratified squamous epithelium (H&E, x400)

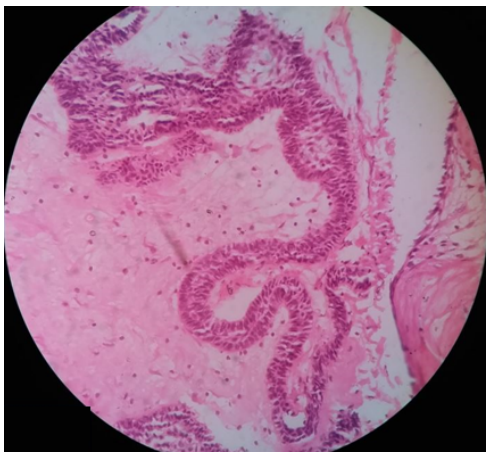


Figure 5: Microsection of craniopharyngioma showing adamentinomatous epithelium(H&E, x400)

of pediatric tumors accounts to 18 cases (19.14%).The most frequent paediatric tumor being embryonal tumors, 7 cases (7.49%) out of which medulloblastoma was seen in 5 cases (71.4%) and PNET in 2 cases (28.57%).

4. Discussion

A total of 94 cases of CNS tumors in a duration of 4 years were analyzed in our study. In our study of CNS tumors the predominant age group affected was 41 years to 50 years of age which is very close to this study of Hamdani et al (51yrs to 60yrs), by Mohammed AA et al (42 to 49yrs) and others.[9–12] The youngest case was a 2yrs male child (a case of lipoma) and oldest being 84yrs male (a case of astrocytoma WHO grade II with minigemistocytes, {Figure 1}) with a mean age of 43yrs which is close to that of Nimhans data (2010 - 14) that is 45yrs. Our study shows a male predominance (56 cases, 59.57%) as compared to female (38 cases, 40.4 8%) and male to female ratio of 1.4:1 which is very close to the observation of Mohammed AA et al that is 1.2:1, whereas Hamdani et al and Ghanghoria S et al observed a ratio to be 1:08.[9,10,13]There were 18 cases in paediatric age group (ranging from 2 years to 14 years) in our study (19.14%), which is similar to study of Mohammed et al.[10]The most frequent paediatric tumor being embryonal tumors 7 cases (7.49%), out of which medulloblastoma consisted of 5 cases (71.4%) and 2 cases (28.57%) were of PNET.

In our study Astrocytic tumor was most frequent tumor which consisted of 21 cases (22.34%). Out of the 21 cases of astrocytic tumors glioblastoma grade IV was diagnosed in 8 cases (38.0 9%) followed by WHO Grade II in 6 cases (28.57%), WHO grade **III** in 4 cases (19.04%) and WHO Grade I (Figure 2) in 3 cases (14.3%). The median age of glioblastoma grade IV (Figure 3) in the present study is 65 years and is close to the observation of CBTRUS data 2006-10. The astrocytic tumors are more common among males (14 cases, 66.6%) as compared to females (7 cases, 33.3%) with male to female ratio of 2:1. The next most common tumor type is schwannoma (19 cases, 20.2%). The majority presented as intradural extra medullary spinal space occupying lesion (SOL), one being situated in cerebropontine angle. The other most frequent tumor is meningioma (18 cases, 19.14%) compared to 13.5% by Madabhushi et al with median age of 47 years in our study.[14] Meningiomas showed a female preponderance (10 cases, 26.3%) that it similar to the observation by Renu Thambi et al (44.4%) and Surawicz et al with a male to female ratio of 1:1.2.[11,12] This finding is in accordance with other studies by Perry A et al, Longstreth WT Jr et al and Madabhushi V et al.[14–16]The highest subtype in grade 1 meningiomas being meningothelial type (4 cases, 22.2%) (out of which one is a retrobulbar tumor) followed by fibroblastic, transitional and psammomatous type with 3 cases each (16.6%). Angiomatous meningioma was found

in 2 cases (11.11%), one of which is supracellar SOL in 49yrs male. One case of atypical meningioma grade 2 was diagnosed histologically in right parietal lobe in a 45-year male and meningosarcoma was diagnosed in one case (5.5%) which was confirmed by immunohistochemistry.

Oligodendroglioma was diagnosed in 4 cases (4.25%) including anaplastic oligodendroglioma grade **III** in one case of 30 year male with radiological diagnosis of meningioma. All the four cases were found in frontal lobe. 4 cases of ependymoma were diagnosed histomorphologically with a median age of 10 years. Two of these were myxopapillary ependymoma WHO grade 1 and other 2 were WHO grade **II** tumors. Among the embryonal tumors of seven cases (7.4%), majority were medulloblastoma (5 cases, 71.42%) with one the cases presenting as drop metastasis, followed by two cases (28.57%) of PNET. Our findings in embryonal tumors was close to the observation of Madhabhushi et al (5.08%).[14] One of the PNET, in a 14-year male, presented as a recurrent SOL in left cerebrum after 2 years of primary diagnosis. Four cases (4.25%) of plexiform neurofibroma were observed in our study with a median age of 25 years, including 1 case of 10-year old child presented as thoracomeningocele later diagnosed histologically as neurofibroma.

Another case of 45 years male with intradural extramedullary spinal tumor was diagnosed histologically as a typical neurofibroma (low grade) over plexiform neurofibroma. Two cases of intradural spinal tumors in 4.5yrs and 6yrs old patients were diagnosed as MPNST (low grad) (2.12%). Immohistochemistry showed S-100 patchy positivity. Molecular and genetic study could not be availed. Two cases (2.12%) of Pituitary Adenoma were diagnosed histomorphologically and is lower compared to (6.2%) Mohammed et al, as well as to Massodi et al.[10,17] One of the case was a 14-year-old female presenting with hirsutism and the other was a 6 years female child presenting with precocious puberty. Two cases (2.12%) of epidermoid cyst (Figure 4) were diagnosed histomorphologically, one was a 22-year male presenting as pineal tumor radiologically and the other was a 3-year old female with a CT finding of tumor in the cerebellopontine angle as compared to the study by Ketan Desai et al.[18–21] One (1.06%) 19 years male patient with radio diagnosis of solid vascular ventricular tumor was diagnosed as choroid plexus papilloma (low-grade) histomorphologically as compared to observation by Divya et al i.e. 0.4-0.6%.[22] A 70 year male patient presented with epidural spinal tumor and complete destruction of T7 laminar pedicle was clinically diagnosed as thoracic spine myelopathy and grossly tissue appeared grayish white, but histomorphologically diagnosed as Haemangiopericytoma and confirmed by reticulin, vimentine and CD34 positivity. Another 52 years female patient with a suprasellar multiloculated lesion presented with headache, disorientation and no loss of vision or convulsion was clinically diagnosed as craniopharyngioma (Figure 5). Microscopic pictures showed fibromyxoid tissue with stellate cells and lined by basalloid epithelium and nest of epithelial cells with palisading and multiple foci of squamous metaplasia with wet keratin as well as cystic degeneration with calcification, was finally diagnosed as adamantinomatous craniopharyngio.[23] A two years old male child youngest among all presented with intradural extramedullary spinal SOL showed a typical histomorphology of lipoma.[24–26] Secondary involvement of CNS by direct extension orhematogenous metastasis is a common complicationof systemic cancer. In our study seven cases (7.4%)of metastatic tumor were diagnosed. The mostcommon involvement is cerebral hemisphere with ringenhancement and cerebral cyst (5 cases, 71%) is more than 59.3% as observed by Gupta Ansu et al.[27] Circumscribed space-occupying lesions weremost common presentation. One case of cerebellarcyst and spinal cord lesion in one was observed.[28] Adenocarcinomatous deposit in 4 cases (57.14%) hasa preponderance over papillary carcinoma (2 cases,28.57%) followed by one old treated case of primaryrenal cell carcinoma.

Among the adenocarcinomas two cases were colorectal carcinoma as primary (CEA positivity).[29,30] One of the cases presenting as lumbar dural lesion (positive for HER2 neu) showed ductal carcinoma in breast, detected afterward on FNAC. No primary could be correlated in another case. It was a circumscribed lesion surrounded by fibrosis and giving GFAP negativity and CK7 positivity. Among the papillary carcinomas, one male patient had a primary in thyroid (lesion in frontal lesion) and other one a female patient presented with unknown primary giving CA 125 positivity and CEA negativity pointing to ovarian primary. Seventh case was of a 70-year-old male with a history of renal cell carcinoma earlier. No immunostaining was possible in this case.

5. Conclusion

The present work shows that histomorphological study is the mainstay with radiodiagnostic and location corroboration, in diagnosis of most of the brain tumors. But IHC is a great supplementation to the final diagnosis in different cases and most importantly assisting diagnosis in the metastatic tumors in central nervous system.

6. Limitations

The present study was more confined in highlighting histomorphology of CNS tumors as there is no facility for molecular study.

7. Conflict of Interest

There is no conflict of interest.

8. Source of Funding

None.

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Author biography

Sobhagini Nayak, Associate Professor

Kaustav Mohapatra, Assistant Professor

Jyotirmayee Mishra, Associate Professor

Harish Chandra Singh, Professor & HOD

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