

Histopathological overview of central nervous system tumours in North Maharashtra, India: a single center study

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Abstract

Background: Central nervous system (CNS) tumor are considered as most notorious in all types of cancers. Incidence of CNS tumors in developing countries is lower as compared to developed countries, but increased rate has been observed in both. The aim of the study was to highlight the incidence and histological spectrum of CNS tumors in our region. To diagnose and classify brain tumours according to WHO 2007 classification.

Material and Methods: This retrospective histopathological analysis of brain tumors was carried out in department of Pathology from January 2014 to December 2015. During this period, a total of 38 neurosurgical specimens were received in department. The specimens were processed by routine histotechniques and immunohistochemistry was performed whenever required. The diagnosed brain tumor studied and classified according to WHO classifications.

Results: Among 38 cases, tumours of meningeal tissue (40%) were commonest followed by neuroepithelial tissue (34%). Cranial and spinal nerve sheath tumour (18%) and rarely metastatic tumours (5.3%) were encountered. Tumours were seen in all age groups but mean age group affected was 41-50 years accounting for 14 (36.8%) cases. Male to female ratio of 0.81:1.22 was noted with female preponderance.

Conclusion: The present study helps to provide information regarding the burden of disease in our area. Despite the use of modern imaging technique that helps in provisional diagnosis of disease, histological examination is gold standard in diagnosis of varied types. Further utility of immunohistochemistry aids in confirmation and prognosis of disease.

Keywords: CNS tumours, Glioma, Meningioma, Histopathology, Immunohistochemistry.

Introduction

Primary Central nervous system (CNS) tumours are rare in incidence, but they are the second most common tumours in childhood after the most common malignancy leukemia.⁽¹⁾ They are considered to be the most notorious of all cancers, as they represents with characteristic of unique, heterogeneous population of neoplasm having both benign and malignant tumors and reported to be less than 2% of all malignant neoplasms.⁽²⁾

CNS tumours is known to mankind since 1774, when Louis first reported fungal tumour of the Dura mater. Previously its was stated that incidence of brain tumour in India was uncommon, but over the time with evolution of newer investigative neuroimaging techniques in India during the past 2 decades, it has become obvious that brain tumours are as common in this country as elsewhere in the world.⁽³⁾

The majority of brain tumours are sporadic lesion, to date genetic syndromes, prior ionizing radiation exposure like CT scans, X-rays are only known risk factors accounting for <10% of all brain tumours. Recently IARC also classified over exposure to low frequency, non-ionizing electromagnetic waves via mobile phones are possibly carcinogenic to human beings, and a potential risk factors for brain tumours such as Glioma, meningioma, and acoustic neuromas.⁽⁴⁾

Tumours of the nervous system are histologically typed by WHO as tumours of neuroepithelial tissue, peripheral nerves, meninges, mesenchymal non-meningothelial tumours, lymphomas, germ cell tumours

and metastatic tumours.⁽⁵⁾ The exact histopathological diagnosis of CNS tumors using newer diagnostic criteria, techniques like use of histochemical stain and immunohistochemistry (IHC) has played major role in differential diagnosis and improving diagnostic accuracy which is essential to predict the grading and prognosis. However this newer diagnostic criteria and techniques have affected the relative frequencies of CNS tumors.^(6,7)

In malice of these newer advances, there is ample increase in incidence of CNS tumour is seen among children under 14 years, and in adults 70 years and older. Incidence rate is higher from 1991 to 1995 in comparison to what was seen from 1975 to 1979.⁽⁸⁾

In India, the incidence of CNS tumour is 1.9% of all tumours. According to Bhopal cancer registry in India, age adjusted incidence rate of CNS tumours during 1988-2003 showed that there was increase in incidence from 0.5 to 2.4 for male and 0.5 to 1.1 for females, respectively.⁽⁹⁾

The CNS tumors that outweigh in adults differ from those seen in children. The annual incidence of CNS tumors ranges according to published Western data from 10 to 17/100,000 persons for intracranial tumours and from 1 to 2/100,000 persons for intra spinal tumours. Of these about half are primary tumours and the rest are metastatic. Tumours of the CNS account for 20% of all cancers of childhood. Malignant CNS tumours are the second most commonest cause of death under 15 year age group in both males and females.⁽¹⁰⁾

The purpose of this study is to provide current overview of epidemiology of CNS tumour in our hospital setup and study the incidence of these lesions by using revised WHO classification and compare with published literature in India and worldwide.

Materials and Methods

This retrospective study was done in Department of Pathology over the period of two years from January 2014 to December 2015 on neurosurgical biopsies received from Department of Neurosurgery. A total of 38 biopsies of CNS tumours received. Patient's clinical data including details of imaging investigations and perioperative findings were obtained in all cases. Gross features of all specimens assessed and processed by routine paraffin embedding techniques. Sections were stained with H & E technique, histological characterization was done with WHO classification. Immunohistochemical (IHC) stain was done whenever required. Final results were analyzed and data prepared to study histological patterns of CNS tumors with age and sex distribution in our area.

Results

During the study period, 38 cases of CNS tumours were found. Among them primary CNS tumours were 36 cases (94.7%), and 02 (5.3%) were metastatic.

In primary CNS tumours on the basis of origin of cell type, tumours of meninges (39.4%) were the commonest followed by tumours of Neuroepithelial cells (34.2%) and cranial & peripheral nerve sheath tumours (18.4%). (Table 1)

Table 1: Histopathological Spectrum of CNS tumour according to their location

Types of tumour	No. of Cases	% of total case
Neuroepithelial tumours	13	34.21
Meningeal tumours	15	39.47
Tumours of cranial nerves and Peripheral nerve sheath	07	18.42
Pituitary tumour	01	2.63
Metastatic tumours	02	5.27
Total	38	100

In neuroepithelial (glial) cell tumours, Astrocytomas were the predominantly tumour found. Out of which according to WHO classification of CNS tumour, Grade II diffuse astrocytoma having diffuse morphology with mild nuclear pleomorphism and hyperchromasia (Fig. 1A) were the commonest followed

by Grade IV Glioblastoma multiforme (GBM) with dense cellularity and palisading of tumour cells around necrosis with pleomorphism (Fig 1B, 1C) and Grade III anaplastic astrocytoma. Immunohistochemistry (IHC) done to confirm the higher grades of lesions like Grade IV astrocytoma showing diffuse positivity for GFAP and P-53 marker (Fig. 2A and 2B). We don't found Grade I astrocytoma.

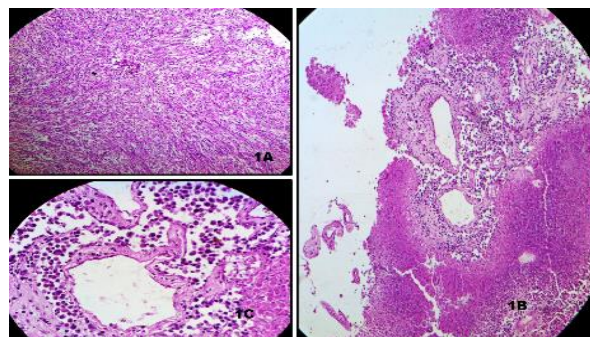


Fig. 1A-Photomicrograph of Grade II astrocytoma showing diffuse morphology and mild nuclear pleomorphism and modest hyperchromasia. (H&E x100), B and C- Grade IV astrocytoma showing dense cellularity, peripheral palisading of tumour cells around necrosis and pleomorphism. (H&E x100 and x400 respectively)

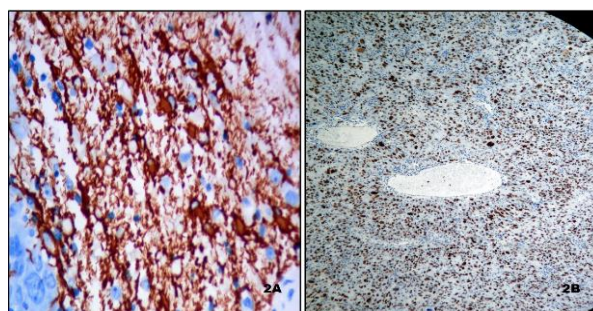


Fig. 2: Showing IHC staining of Grade IV astrocytoma, A- Showing diffuse GFAP positivity (x400), B- Showing diffuse P-53 positivity. (x400)

In our study, maximum number of CNS tumours were found beyond 40 years age, among them 41-50 years age groups peoples were mostly had the lesions. Lowest age group where tumour noted were 11-20, in that one case was found with glioblastoma multiforme in a male patient at the age of 17 years, (Table 2). Out of 40 cases, CNS tumours, meningioma were most commonly found followed by astrocytoma and schwannoma, in them slight tendency for females in comparison to males were noted. Female to Male ratio was 1.22:0.81 (Table 3).

Table 2: Age wise distribution of CNS tumour

Histological types	Age group (years)							Total
	0-10	11-20	21-30	31-40	41-50	51-60	>60	
Astrocytoma	--	01	--	03	05	02	02	13
Meningioma			02	03	07	03		15
Schwannoma			01	01	02	02	01	07
Metastatic							02	02
Pituitary adenoma		01						01
Total		02	03	07	14	07	05	38

Table 3: Gender distribution of various lesions

Histological type	Male	Female	Total
Astrocytoma	09	04	13 (34%)
Meningioma	05	10	15 (40%)
Schwannoma	03	04	07 (18%)
Metastatic tumours	01	01	02 (5%)
Pituitary adenoma	00	01	01 (3%)
Total	18 (47.36%)	20 (52.64%)	38 (100%)

We also get a case spinal schwannoma which was clinico-radio logically diagnosed as Myxopapillary ependymoma but on histology its showed cellular schwannoma without Antoni A and B pattern and IHC studies showed diffuse positivity for S-100 and GFAP negativity ruled out Myxopapillary ependymoma and confirmed it as Cellular Schwannoma (Fig. 3A, B, C)

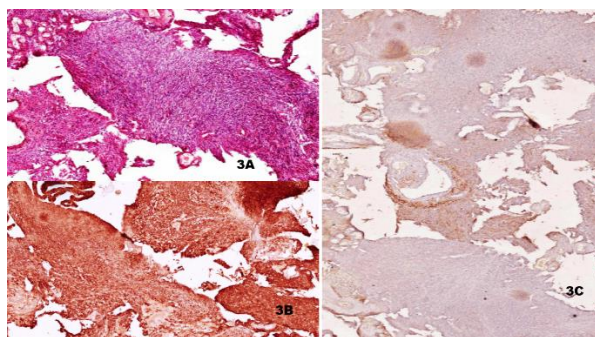


Fig. 3A: Microscopy showing features of cellular schwannoma without Antoni A and B (x100), B- IHC showing diffuse S-100 positivity of cellular schwannoma. (x100), C- IHC showing GFAP negativity for schwannoma. (x100)

Discussion

CNS is the host of the greatest variety of tumours, accounting for less than 2% of all malignancies and because of their location they have a guarded prognosis.^(9,11) However the pathogenesis of spontaneously occurring CNS neoplasms in man is unknown, but recently there is increase in cases of CNS lymphoma is observed due to AIDS pandemic.

In our study, we noted that meningioma (39.4%) is the most common tumour followed by astrocytoma (34.2%), this is in concordance with study by Surawicz et al,⁽¹²⁾ Lee et al (31.2%)⁽¹³⁾ and recently in India study by Ghanghoria et al (41.5%).⁽¹⁴⁾

But studies from other countries in worldwide showed that most common CNS tumour were astrocytoma in United states (49.6%),⁽¹⁵⁾ Germany (41.7%),⁽¹⁶⁾ Croatia (58.3%)⁽¹⁷⁾ and from India Dastur and Lalitaet al⁽¹⁸⁾ also found the similar results in their study. Similarly in our study incidence of CNS tumour were in accordance with literatures published in India and worldwide. (Table 4)

Table 4: Showing the incidence of CNS tumours in comparison with other studies from India and worldwide

Histological type	Present study	Aryal G, ⁽⁶⁾ Nepal	Lee et al, ⁽¹³⁾ Korea	Katsura et al ⁽²¹⁾ Japan	Verma et al ⁽²²⁾ India	Ghanghoria et al, ⁽¹⁴⁾ India	Monga K et al, ⁽¹⁹⁾ India
Neuroepithelial tumour	34.21	38.6	17.7	31.68	61.6	24.61	51.42%
Meningeal tumour	39.47	14%	30.6	15.71	14.8	41.54	17.14%
Cranial nerve tumour	18.42	5.2%	11.1	11.85	4.95	6.15	4.28%
Pituitary tumour	2.63	5.2%	13.8	9.44	7.6	--	10%
Metastatic tumours	5.26	14%	--	4.28	3.89	--	1.42%

In our study we also got one case of Pituitary adenoma (Fig. 4) showing sinusoidal and trabecular pattern of tumour cells with round to oval nuclei seen in 21 years of female with hyperprolactinemia and two cases of metastatic brain tumours, with primary in breast diagnosed with invasive ductal carcinoma of breast-NOS type. This findings were in concordance with previously published studies by Lee et al⁽¹³⁾ and Aryal G.⁽⁶⁾ Unfortunately we lost the follow up of the patient as she was referred to higher center.

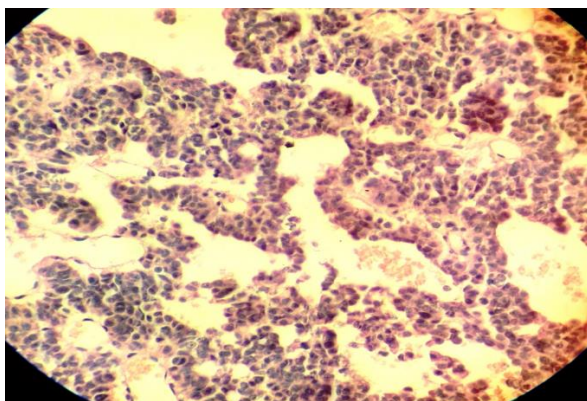


Fig. 4: Photomicrograph of pituitary adenoma showing sinusoidal /trabecular pattern of tumour cells with round to oval nucleus with variable amount of cytoplasm. (H&E x400)

In present study, Out of 13 cases of astrocytoma, Grade II astrocytoma (53.8%) were more common followed by Grade IV and III. We don't get the cases with the Grade I, as this may due to late presentation of our patients to the hospital could be the main cause of getting high grade astrocytoma in our study. In studies by Monga et al⁽¹⁹⁾ in Rajasthan, India found that Grade III (43.8%) and IV (25%) astrocytoma were the most common, followed by Grade II (12.5%). This grading of tumour improves the prognosis of patients, it aids to neurosurgeon in choosing choice of chemo or radiotherapy. There is concord on the variances in the age incidence of different CNS tumours. As it is said to be having bimodal peak, one during childhood and second peak after fifth decade. Neuroepithelial tumours could be found in any age group from infancy to over 70 years with most of them occurring in first four decade of life.⁽²⁰⁾

In our study CNS tumour seen in the fifth decades (41-50 years) followed by fourth and sixth decades, this finding was in contrast to previously published studies.^(14,19,20) Also we got one case of Grade IV astrocytoma (Glioblastoma Multiforme) at the age of 17 years and one case of Pituitary adenoma at the 20 year of age.

There is in general male preponderance in most of parts of the world including Indian subcontinent where sex ratio has been found to be 2.2:1. Males were affected more than female, but in our study we got incidence of CNS tumour more common in female, which was slightly higher due to more case of meningioma which were mostly found in female. Our study showed that male to female ratio was 0.81:1.22, which was in contrast to previously published Indian and foreign studies^(9,12,14,18-20) and accordance to findings by Aryal G (0.9:1)⁽⁶⁾ and Lee et al(1:1.43).⁽¹³⁾

Brain tumours are heterogeneous as most of them differ in histomorphological features. Though there is availability of advanced imaging technique, histopathological examination is gold standard in diagnosis of them. Sometimes they may not be straightforward to diagnose creating a diagnostic dilemmas in pathologist mind due to overlapping histomorphological features in benign as well as certain non-neoplastic lesion which mimics as brain tumours. Uses of immunohistochemistry markers become authoritative for confirmatory diagnosis of brain tumours.⁽¹¹⁾ In the present study use of IHC helps us to diagnose the Glioblastoma multiforme in a young boy of age 17 years, who were clinically and radio-logically diagnosed as meningioma at temporoparietal region. On histology it was having morphology and features of GBM, later on confirmed by using IHC markers.

Conclusions

Primary CNS tumours are the heterogeneous, comprising a large spectrum of different tumour entities associated with distinct biological background and disease course. Histopathological study helps in knowing their epidemiology and burden of disease in community. From practical point of view, an accurate diagnosis of brain tumour is possible after careful assessment of histomorphological features along with clinical and radiological imaging information. Though the conventional H and E staining is the mainstay for pathologic diagnosis, IHC also has played a major role

in differential diagnosis and improving diagnostic accuracy in neuro-oncologic pathology.

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