Histopathological spectrum of central nervous system lesions

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Abstract

Introduction: Central nervous system (CNS) neoplasms, in India, constitute 1.9% of all cancers and in U.S. adults - 2% of all cancers. Many of the non-neoplastic CNS lesions can clinically & radiologically simulate brain tumours. In such cases, histopathological examination (HPE) can be helpful in differentiating between neoplastic and non-neoplastic etiologies. **Materials and Methods:** This retrospective descriptive study of histopathological analysis of brain tumours was carried out in TMMC&RC, Department of Pathology from January 2015 to December 2018. The biopsies were processed by routine histological techniques and H&E stained sections were analyzed. Special stains and IHC were performed wherever appropriate. The diagnosed brain tumours were classified according to WHO 2016 classification system. **Results:** A total of 96 CNS biopsies were studied. The neoplasms constituted 62 (64.6%) cases, which included 60 (96.8%) primary, 1 (1.6%) metastatic and 1 miscellaneous lesion (1.6%). The 3 most common primary tumours were Astrocytic tumours, Schwannomas and Meningiomas. About 34(35.4%) cases were non neoplastic out of which the 2 most common lesions were: Cystic Lesions and non-specific inflammation. Patients' age ranged from 5 days to 80 years. The ratio of number of male and female patients was 1:1.67. IHC for Glial Fibrillary Acidic Protein (GFAP) was positive in astrocytomas and mixed neuronal-glial tumours. **Conclusion:** The present study provides information regarding the spectrum and frequency of various CNS lesions in our area and concludes that histological examination of biopsies is gold standard for accurate diagnosis of various lesions of CNS when coupled with radiological and clinical data.

Keywords: Astrocytomas, CNS, Meningiomas.

Introduction

In terms of disease burden, 2016 data shows that there were 3,30,000 new cases of CNS cancer with 2,27,000 deaths globally. Considering the age-standardised incidence rates for CNS cancers, these rates increased globally by 17.3% between 1990 and 2016. The region with the maximum number of new cases of CNS cancer for both sexes in 2016 was East Asia, followed in order by western Europe, and then south Asia. The top 3 countries having the highest number of new cases of CNS tumours were China, USA, and India [1].

The incidence rates of brain tumours between countries worldwide have shown almost threefold differences; with differences also seen between different ethnic groups within same country. Added to this complexity is the fact that the predominant CNS tumours are also different amongst adults and children Developed countries seems to have the highest rates of brain tumours which may in fact be the result of better registration systems which include benign tumours. The incidence of brain tumours rises with increasing age from 30 years old onwards, showing a similar trend with virtually all other adult cancers. The risk factors for neurocarcinogenesis is a combination of genetic predisposition with many environmental factors, the most well-established environmental risk factor being exposure to high doses of ionising radiation. Current thinking suggests that brain tumours develop as a consequence of accumulated genetic alterations in combination with many externally acting agents—chemical, physical or biological—that damage DNA [2,3].

An understanding of the epidemiology is required which may facilitate early detection and treatment of CNS tumours. Patients having CNS neoplasms present clinically in a fairly characteristic manner with majority of them presenting with headache, vomiting and/or seizures. Diagnostic challenges because of atypical presentation, requires advanced neuro-radiological procedures such as Computed Tomography scans and/or Magnetic Resonance

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Imaging scans, to localize it [4,5,6]. Earlier brain tumours in India were thought to be uncommon, but over time and with advances in neuroimaging techniques over past few decades, it has become obvious that brain tumours in our country are as common as elsewhere in the world [6].

In developing countries like India, newly diagnosed cases are not routinely registered with local cancer registries. This causes underestimation of such cases and data.

Hospital-based Prevalence data is therefore the basis to estimate this disease load.

This study aims to provide frequency of CNS tumours in our tertiary care setup and compare the frequency of these CNS tumours and lesions with published literature in India & worldwide.

Materials & Methods

Setting: The Department of Pathology, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, India.

Study design: Retrospective study.

Period of data collection: January 2015 and December 2018.

Sample size: 96 CNS lesions biopsies.

Inclusion criteria: All CNS biopsies received in the department of pathology during the study period.

Exclusion criteria: Inadequate biopsies and poorly preserved tissue specimens were excluded from study.

Ethical consideration & permission: The present study was conducted after informed written consent being obtained from all the patients who underwent surgery.

Data analysis: - Data was compiled in MS Excel, checked for its correctness and then analyzed using online statistical calculator.

Method: Biopsies of CNS lesions were preserved in 10% formalin, followed by fixation for 24 hours. Haematoxylin and Eosin stained sections of these CNS lesions were obtained by routine processing and paraffin embedding. Special stains supplemented by IHC, wherever required, were employed.

Clinical history of all cases was collected in a pretested proforma meeting the objectives of the study. Diagnosis is made in accordance with the latest WHO 2016 classification and diagnostic criteria for CNS neoplasms [7].

Results

Out of total 96 cases, 62 were neoplastic lesions and 34 were non – neoplastic lesions. The ratio of number of Male (n=60) and female (n=36) patients was (60/36) 1.67:1 (Figure 1). Out of total 60 biopsies from male patients, 39 turned out to be neoplastic and 21 were non-neoplastic. Of the total 36 biopsies from female patients, 23 turned out to be neoplastic and 13 were non-neoplastic (Figure 2).

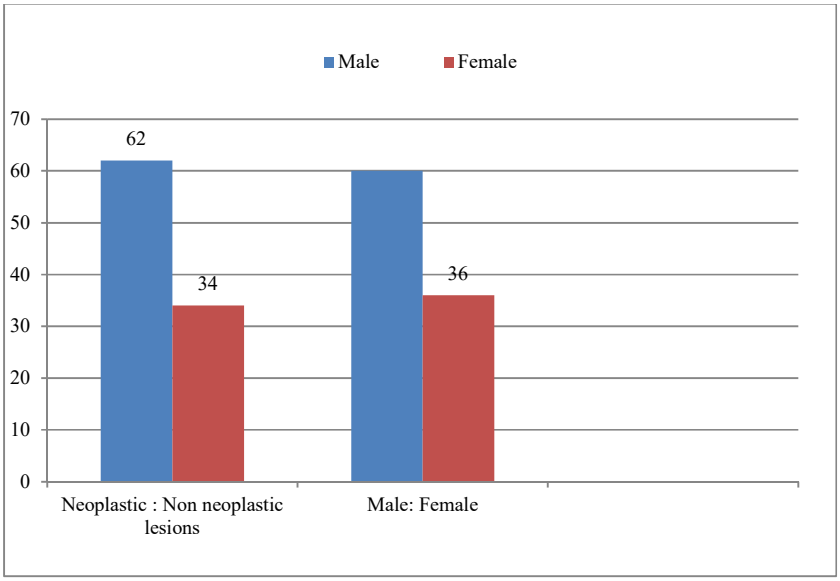

Fig-1: The ratio of number of male and female patients.

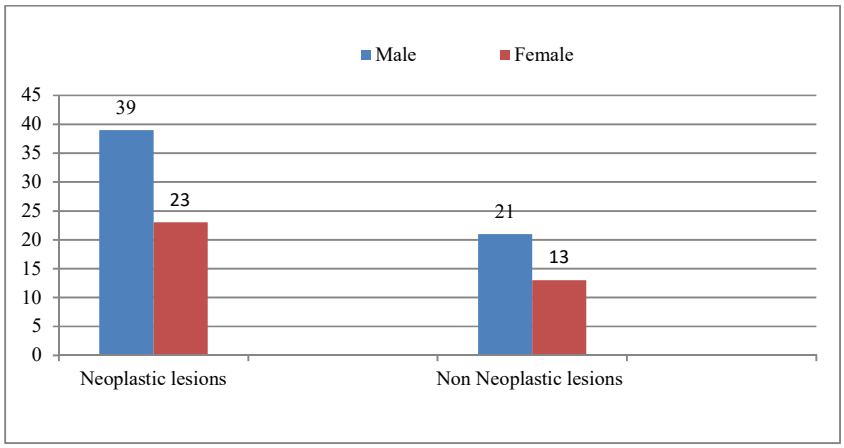

Fig-2: Distribution of biopsies in male and female patients.

Headache, vomiting and seizures were the most frequent presenting symptoms (headache being the most common) of patients and radiological examination showed SOLs (space occupying lesions) in most of the cases. The neoplastic lesions (39 cases were male and 23 cases were female) comprised of 62/96 (64.6%) cases, which included 60(96.8%) primary, 1(1.6%) metastatic lesion and 1 miscellaneous lesion (1.6%).

Among primary CNS tumours, majority cases were Astrocytic tumours (n=17), followed by Schwannomas (n=14) and Meningiomas (n=12). The distribution of various other neoplastic lesions is as shown below.

Table-1: Distribution and frequency of neoplastic lesions.

Diffuse astrocytic and oligodendroglial tumours	1) Astrocytic tumors = 17 2) Oligodendroglial tumors = 1	Embryonal tumors	0
Neuronal and mixed neuronal-glial tumours	2	Tumors of uncertain histogenesis	Hemangioblastoma = 1
Ependymal tumors	4	Mesenchymal non-meningothelial tumors	1) Lipoma, = 3 2) Hemangiomas = 2
Tumors of meninges	Meningiomas =12	Tumors of sellar region	Craniopharyngioma = 1
Tumors of cranial & paraspinal nerves	1) Neurofibroma =0 2) Schwannomas =14	Metastatic tumors	1
Choroid plexus tumors	1	Tumours of pineal region	2
		Miscellaneous	1
			Total = 62

Out of total of 96 cases, 34 (35.4%) cases were non-neoplastic. Majority cases were showing Abscess and non-specific inflammation (n=8, 23.5%), followed by cystic lesions (n=7, 20.5%). The distribution of various other non-neoplastic lesions is as tabulated below.

Table-2: Distribution and frequency of various non-neoplastic lesions.

Developmental malformations	Meningomyelocoele-3 Meningocoele-2 Rachischisis-1	**Infectious lesions**	Amoebic brain abscess-1 Neurocysticercosis-1 Hydatid cyst-1
		Abscess and non-specific inflammation	8
Granulomatous lesions	6	**Hematoma**	4
Cystic lesions	Dermoid cyst-1 Epidermoid cyst-3 Arachnoid cyst-2 Sebaceous cyst-1		
			Total = 34

Discussion

The pathogenesis of spontaneously occurring CNS neoplasms in humans is a combination of genetic and environmental factors. CNS neoplasms associated with AIDS namely CNS lymphoma, has recently shown an increased trend due to increase in number of AIDS cases.

A variety of tumours occurs in CNS, but still accounts for less than 2% of all malignancies. But because of their location and mass effects, they generally have a poor prognosis [8,9].

The present study shows that 96 cases of CNS lesions share many of the features common with other published series.

The most common presenting symptom in present series was headache which is supported by the findings of many other studies as well. [6,12]. The frequency of cystic lesions of CNS in the present study (n=7; 20.5%) compared well with other studies [10,11,12], which also revealed epidermoid cyst to be the predominant cystic lesion. The male to female ratio of 1.69:1 for malignant lesions and 1.61:1 for non-neoplastic lesions in present study of 96 biopsies show a pattern of male predominance. Patients' age ranged from 5 days to 80 years which is different from studies conducted by Mohammad Sajjad et al, Ghanghoria et al, their studies showed age range of 09-70, 1-85 years, respectively [4,13].

The results of present study as compared to various other studies is as shown below.

Table-3: Present study compared with similar other studies.

Histological Type						
	Present Study	Aryal G [14]	Katsura et al [15]	Verma et al [16]	Monga K et al, [17]	Hema NA et al [18]
Neuroepithelial tumours	33 (53.2%)	38.6%	31.68%	61.6%	51.42%	56.3%
Meningeal tumours	12 (19.4%)	14%	15.71%	14.8%	17.14%	12.5%
Tumours of cranial & paraspinal nerves	14 (22.6%)	5.2%	11.85%	4.95%	4.28%	16.6%
Pituitary tumours	2 (3.2%)	5.2%	9.44%	7.6%	10%	2.1%
Metastatic tumours	1 (1.6%)	14%	4.28%	3.89%	1.42%	0%

In the present study, tumours of the neuroepithelial origin (n=33,53.2%) represented maximum number of cases of intracranial neoplasms amongst all primary CNS tumours - in close agreement with observations made in various other studies by Verma et al, Monga K et al, Hema NA et al and Anand et al. [16,17,18,19].

The studies by Katsura et al (31.68%), Aryal G (38.6%) and Chawla et al (38.7%)., showed lower relative frequencies [14,15,20]. Ependymoma constituted 6.4% of all CNS neoplasms which is comparable to 4.0% and 4.7% incidence reported by Masoodi et al and Mollah et al [5,21]. The relative frequency of 19.4% of meningiomas in the present study is in close agreement with other studies which reported 18% (Chawla et al.,), 17.14% (Monga K et al.), 15.17% (Katsura et al) and 11% (Kalyani D et al.,) [12], [15,17,20]. However, meningiomas constituted the predominant subgroup in studies by Ghanghoria S et al in a similar way in studies done by Surawicz et al, in USA and Lee et al in Korea [4,22,23].

The relative frequency of pituitary tumours in the present study was 3.2%, in close agreement with study by Hema NA et, which showed a relative frequency of 2.1% [18]. The relative frequency of tumours of cranial & paraspinal nerves 22.6% is a bit higher in the present study group as compared with other studies. This difference in relative frequencies of different CNS lesions in the present study with other similar published studies may be attributed to differences in sample size, population and regional characteristics. Cystic lesions, cerebral abscess and Non-specific inflammations were the predominant non-neoplastic lesions of present study.

Limitation of the present study

1. Few IHC markers like TP53, INI1, MIB 1, CD 1a, CEA, TTF1 could not be employed at our centre, and these cases were referred to higher centres for these specific marker studies.
2. The specimens for this study were obtained from a restricted geographical population from regional area of Moradabad.

Importance of the present study: The present study has highlighted the relative frequency of different CNS lesions in Moradabad region. In developing countries like India, newly diagnosed cases are not routinely registered with local cancer registries which causes underestimation of such cases and data. Such Hospital-based Prevalence data and studies is therefore the basis to estimate this disease load. Primary CNS tumours and lesions are heterogeneous entities frequently encountered in clinical practice.

Many studies and reports have suggested incidence and pattern of intracranial neoplasms as subjects of considerable geographic and racial variation [24]. Keeping track of the change in trends of various CNS lesions is essential so that improvements in clinical practices can be employed in a timely fashion [25].

Conclusions

Histopathological study is the gold standard and along with clinico-radiological correlation with use of IHC, wherever required, plays important role in arriving at a definitive diagnosis in neuro-pathology.

What this study adds to the existing knowledge?

The utility of IHC has been emphasized in the present study. GFAP which is a sensitive and specific marker for glial differentiation and establishing the origin of astrocytic tumours, was employed wherever required.

This study thus shows that with the basic IHC panel and H&E stained section examination, diagnosis is possible in most cases. Additional and advanced IHC markers are needed in only limited number of cases.

Author's contribution

Dr. Himanshu Joshi, Dr. Seema Awasthi, Dr. Shyamoli Dutta: Diagnosis.

Dr. Rashmi Bhardwaj: Diagnosis, data analysis and manuscript preparation.

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Conflict of interest: None declared
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