Research Article

Histopathological spectrum of brain tumors: A 4-year retrospective study from a single tertiary care facility

Shaista Mushtaq Hamdani, Nazia Quyoom Dar, Ruby Reshi

Department of Pathology, Government Medical College, Srinagar, Jammu and Kashmir, India

Correspondence to: Shaista Mushtaq Hamdani, E-mail: shaistahamdani@gmail.com

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ABSTRACT

Background: Central nervous system (CNS) tumors are infrequent tumors comprising <2% of all malignancies. However, a rising global trend in these tumors has been observed over the years with new potential risk factors being identified for brain tumors. **Objective:** The aim of the present study is to highlight the histopathological spectrum of brain tumors in a single tertiary care center in our region. **Materials and Methods:** This retrospective histopathological analysis of brain tumors was carried out in the Postgraduate Department of Pathology, Government Medical College, Srinagar, Jammu and Kashmir, India, from January 2015 to December 2018. During this period, a total of 117 neurosurgical biopsies were retrieved from the archives of the department. The diagnoses in all the cases were made on histopathological examination of routinely processed tissue. The hematoxylin and eosin (H and E) stained sections in all cases were reviewed by the authors, and diagnosis was confirmed applying the WHO classification 2007. The relative frequency of tumors and the distribution as per age, sex, and location of the lesion were analyzed. **Results:** A wide range of histopathological spectrum of CNS tumors was observed and was classified according to the WHO classification system of 2007. The primary CNS tumors were graded from Grade I to Grade 1V. Overall tumors of meninges (41.02%) were the most common entity followed by the astrocytic tumors (35.04%). **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 the diagnosis of varied types of brain tumors. Further utility of immunohistochemistry aids in confirmation of the disease.

KEY WORDS: Central Nervous System Tumors; Glioma; Meningioma; Histopathology; Immunohistochemistry

INTRODUCTION

The central nervous system (CNS) consists of cerebrum, cerebellum, brain stem, spinal cord, meninges, 12 paired cranial nerves, and the blood vessels supplying these structures. Tumors of CNS are reported to be <2% of all malignancies.[1] In India, tumors of the CNS constitute about 1.9% of all tumors.[2] However, their association with a high morbidity and mortality makes them the most dreaded form of cancer.[3]

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The majority of brain tumors are sporadic lesions, and till date, heritable genetic syndromes and prior ionizing radiation exposures such as computed tomography scans and X-rays are the only known risk factors accounting for <10% of all brain tumors. Recently, the International Agency for Research on Cancer also classified overexposure to low frequency, non-ionizing electromagnetic waves through mobile phones as possibly carcinogenic to human beings, and a potential risk factors for brain tumors such as glioma, meningioma, and acoustic neuromas.[4]

CNS tumors show a bimodal age distribution with one peak in children and second peak in 45–70 years of age.[5] The tumors are more common in males, with the exception of meningiomas which are more frequently seen in females. The signs and symptoms of intracranial tumors depend on the size of tumor, its location, and its rate of growth.

Tumors of the nervous system are histologically typed by the WHO as tumors of neuroepithelial tissue, peripheral nerves, meninges, mesenchymal non-meningothelial tumors, lymphomas, germ cell tumors, and metastatic tumors.[6] The exact histopathological diagnosis of CNS tumors using newer diagnostic criteria and techniques such as use of histochemical stain and immunohistochemistry (IHC) has played a major role in differential diagnosis and improving diagnostic accuracy which is essential to predict the grading and prognosis.[7]

The present study was conducted with a view to have insight into the pattern of CNS neoplasms in our region due to the paucity of study on the subject.

MATERIALS AND METHODS

The present study was conducted in the Postgraduate Department of Pathology, Government Medical College, Srinagar, over a period of 4 years from January 2015 to December 2018. A permission for the study was obtained from the Institutional Ethical Committee. A total of 117 biopsies of CNS tumors were retrieved from the archives of the department. Patient's clinical data including age, sex, location of the lesion, and details of imaging investigations were obtained in all cases. The slides were reviewed by the authors, and histological diagnosis was confirmed using 2007 WHO classification. IHC staining 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

The age of the patients ranged from 4 years to 85 years with a mean age of 44.5 years. Peak incidence was seen in 51–60 years of age. Age-wise distribution of different tumor types is shown in Table 1.

Males slightly outnumbered females with male:female ratio of 1:0.8. The sex-wise distribution of common brain tumors is given in Table 2.

Headache was the most common symptom (68.2%) of presentation followed by seizures (34%), visual disturbances (28.3%), motor deficits (25%), and behavioral changes (5.3%).

Majority of the tumors were supratentorial (102 cases, 87.17 %) and rest were infratentorial (15 cases, 12.82%). Among supratentorial lesions, majority of the lesions were found in cerebrum and frontal lobe was the most common intracranial site involved (23.2%). Infratentorial lesions included 5 cases of vestibular schwannoma, 1 case of cerebellopontine angle meningioma, 2 cases each of pilocytic astrocytoma, ependymoma, and cerebellar metastases, and 1 case each of medulloblastoma, cerebellar hemangioblastoma, and fourth ventricular choroid plexus papilloma.

In our study, meningioma was the most common lesion (48 cases, 41.02%) followed by astrocytoma (41 cases, 35.04%). The relative frequency of various brain tumors is given in Table 3.

Out of 48 cases of meningiomas, Grade I lesions were most common (39 cases) followed by Grade III lesions (7 cases) and Grade II lesions (2 cases). Among astrocytomas, the greatest number of lesions grade wise were Grade IV (21 cases) followed by Grade II (14 cases), Grade I (2 cases), and Grade III (4 cases).

The other supratentorial lesions in our study included 6 cases of pituitary adenoma found in the age range of

Table 1: Age-wise distribution of common brain tumors

Histologic Type	Age groups (years)									
	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	Total
Meningioma	-	2	2	8	12	17	7	-	-	48
Astrocytoma	1	3	11	5	7	10	3	1	-	41
Pituitary adenoma	-	-	2	1	1	1	-	-	1	06
Schwannoma	-	-	1	2	2	-	-	-	-	05
Ependymoma	2	2	-	-	-	-	-	-	-	04
Metastasis	-	-	1	-	-	-	2	1	-	04
Oligodendroglioma	-	-	-	1	1	-	-	-	-	02
Lymphoma	-	-	-	-	-	2	-	-	-	02
Oligoastrocytoma	-	-	-	-	-	1	-	-	-	01
Medulloblastoma	-	-	1	-	-	-	-	-	-	01
Hemangioblastoma	-	-	-	1	-	-	-	-	-	01
Choroid plexus papilloma	-	-	-	1	-	-	-	-	-	01
Central neurocytoma	-	-	-	1	-	-	-	-	-	01
Total	3	7	18	20	23	31	12	2	1	117

Table 2: Sex-wise distribution of common brain tumors

Histologic type	Gender	
	Male	Female
Meningioma	28	20
Astrocytoma	22	19
Pituitary adenoma	2	4
Schwannoma	1	4
Ependymoma	3	1
Metastatic tumors	3	1
Oligodendroglioma	2	0
Lymphoma	0	2
Oligoastrocytoma	1	0
Medulloblastoma	1	0
Hemangioblastoma	1	0
Choroid plexus papilloma	1	0
Central neurocytoma	0	1
Total	65	52

Table 3: The relative frequencies of brain tumors

Histologic type	No. of cases (%)
Meningioma	48 (41.02)
Astrocytoma	41 (35.04)
Pituitary adenoma	6 (5.12)
Schwannoma	5 (4.27)
Ependymoma	4 (3.41)
Metastatic tumor	4 (3.41)
Oligodendroglioma	2 (1.7)
Lymphoma	2 (1.7)
Oligoastrocytoma	1 (0.86)
Medulloblastoma	1 (0.86)
Hemangioblastoma	1 (0.86)
Choroid plexus papilloma	1 (0.86)
Central neurocytoma	1 (0.86)
Total	117 (100)

20–60 years, 2 cases of cerebral metastasis, 1 case of ovarian carcinoma metastasis in a young female and other was a case of cerebral metastasis of renal cell carcinoma, and 2 cases each of ependymoma, primary CNS lymphoma, and oligodendroglioma. Besides, we had one case each of oligoastrocytoma and central neurocytoma.

DISCUSSION

In our study, we noted that meningioma was the most common brain tumor (41.02%) in our population. The same was found by Surawicz *et al*.[8] in the USA and Lee *et al*.[9] in Korea also noticed that the most common tumor was meningioma. However, Patty[10] and Ahmed *et al*.[11] reported astrocytomas to be the most common tumors in their studies. The difference in the relative frequency and the tumor distribution among populations in different countries may be due to various genetic and environmental factors.

In our study, astrocytoma was more common in males than females – 53.65% of astrocytomas were seen in males. According to Surawicz *et al.*, gliomas affect about 40% more males than females.[8] Our study showed that male-to-female ratio was 1:0.8. According to Yeole too, brain and nervous system cancer was more common in males than females.[12] However, in our study, meningiomas also were seen more commonly in males (58.33%) than in females (41.66%). This was contrary to the findings of Surawicz *et al*.[8] who reported that meningiomas were the only tumors with a significant excess in females in the US population. This could be a reflection of the fact that in our set up males often interact more with the health-care system compared to the females, which increases their chances of detection of a tumor.

Among astrocytomas, glioblastoma was the most common (51.2%) similar to that observed by other workers.[13,14]

In our study, CNS tumor was seen in the sixth decade (51–60 years) followed by the fifth and fourth decades, this finding was in contrast to previously published studies.[15,16] Furthermore, we got one case of Grade IV astrocytoma (glioblastoma multiforme) at the age of 22 years and one case of pituitary adenoma at the 21 years of age.

Frontal lobe was the most common site of involvement in brain tumors (23.2%). This is in agreement with the findings of studies conducted by Torres *et al*.[13] and Jalali and Dutta.[17]

The present study thus reflects the histopathological spectrum of brain tumors from our center. In-depth studies from across various hospitals in the state are required to have a representative data on the incidence of brain tumors from our state. These could then be used to provide the baseline data to better understand the epidemiological profile and etiology of primary brain tumors and guide research toward those with highest mortality and/or incidence.

CONCLUSION

Brain tumors are heterogeneous, and they differ not only in their histomorphological features but also have a distinct biological background and disease course. Rising global trends in the incidence of CNS tumors have been observed irrespective of age. Although there is availability of advanced imaging techniques at present, still histopathological examination is gold standard in their diagnosis. Although the conventional H and E staining is the mainstay for pathologic diagnosis, IHC also plays a major role in differential diagnosis and improving diagnostic accuracy. This study may provide the representative incidence of various types of CNS tumors.

However, a nationwide multicenter study is necessary in the future for improved research.

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