Available online at www.iponlinejournal.com

Journal homepage: www.innovativepublication.com/journal/ijpo

Original Research Article

Clinico-pathological study of central nervous system tumors

Madhukar Reddy Kadaru

Assistant Professor, Dept. of Pathology, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India

Article Info

Received: 7th December, 2018

Accepted: 15th February, 2019

Published Online: 9th August, 2019

Keywords: CNS tumors.

Abstract

Introduction: Central nervous system tumors show varied histomorphological spectrum although they are less frequent when compared to other sites. Central nervous system (CNS) tumors refer to neoplasms that originate in the brain and spinal cord of which over 90% are located in the brain. CNS malignancies account for approximately 1.7% of new cancers annually.

Aims and Objectives: 1: To study the demography and determine the relative frequency of the various histopathological types of CNS tumors; 2: To relate the occurrence of the various types of CNS tumors with age, sex, signs, symptoms, location and to study the various spectrum of histopathological features of CNS tumors and grade according to WHO classification (2007).

Results and Conclusion: The most frequent type of CNS tumor was meningioma followed by astrocytoma of which WHO grade IV tumor was frequent and schwannoma. The peak incidence was in 41-50 years age group. Overall Males are affected more than females, with male to female ratio of 1.2:1 except in meningioma where there is a female preponderance with male to female ratio of 1:2.1. The most frequent clinical feature was headache and seizures in supratentorial tumors of intracranial region, backache, weakness and sensory disturbances in spinal cord tumors. The most commonest site of occurrence was frontal lobe followed by multilobe involvement.

Introduction

Central nervous system tumors show varied histomorphological spectrum although they are less frequent when compared to other sites.[1]

Central nervous system (CNS) tumors refer to neoplasms that originate in the brain and spinal cord of which over 90% are located in the brain. CNS malignancies account for approximately 1.7% of new cancers annually.[2]

Neoplasms of the CNS can occur in both adults and paediatric populations.Although adult and children may experience similar tumors, their incidence vary greatly with age.[3]

The age adjusted incidence rate of CNS tumors in India is 1.9/100,000 persons. The overall incidence rate of CNS malignancies is increasing all over the world.[4]

Heritable syndromes and ionizing radiations are the only two established causes of primary CNS neoplasms.[5] The signs and symptoms of intracranial tumors depend on the size of tumor, its location and its rate of growth.

According to the WHO classification tumors of CNS comprise more than 50 clinico-pathological entities.[6] The major categories include the tumors of neuroepithelial tissue, cranial and paraspinal nerves, meninges, sellar region, lymphomas and haematopoietic neoplasms, germ cell and metastatic tumors.

The most common neoplasms among adults are glioblastomas, meningiomas and metastasis to CNS neoplasms, whereas in the paediatric age group pilocytic astrocytomas, medulloblastomas and ependymoma, oligodendroglioma and various subtypes. It is important to identify oligodendroglial component in order to determine the most effective chemotherapy to treat gliomas.[7]

Non glial tumors include embryonal tumors, choroid plexus tumors, pineal tumors, meningeal tumors, germ cell tumors, tumors of the sellar region and hematopoietic tumors.

The correct histological diagnosis of CNS tumors is essential to predict the prognosis.[3] CNS tumors ranks ninth among the top ten malignancies in India.[8]

The present study was conducted with a view to have insight into the pattern of CNS neoplasms in our institute due to rarity of study on the subject. In this study the incidence, age, sex and site of CNS tumors, including tumors of the cranial and peripheral nerves have been determined by analyzing 87 cases according to WHO classification and grading.

Aims and Objectives

1. To study the demography of central nervous system tumors and to determine the relative frequency of the various histopathological types of CNS tumors.

*Corresponding Author: Madhukar Reddy Kadaru, Assistant Professor, Dept. of Pathology, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India
Email: mkadaru@gmail.com
http://doi.org/10.18231/j.ijpo.2019.076

2. To relate the occurrence of the various types of CNS tumors with age, sex, signs, symptoms and location.
3. To study the various spectrum of histopathological features of CNS tumors and grade according to WHO classification (2007).

Materials and Methods

The present cross-sectional study was conducted at the Department of Pathology, Kamineni institute of medical sciences and General Hospital over a period of 4 years from July 2014 to July 2018 (retrospective period of 2 years and prospective period of 2 years). The study population included 87 cases (32 cases retrospective, 55 cases prospective) of CNS neoplasms reported during this period.

For retrospective cases, the histopathological reports maintained in the histopathology section of the department were reviewed and haematoxylin and eosin stained slides of every case were analysed and re-examined. For the prospective cases, 4-5 µm sections were prepared from the corresponding paraffin blocks. Standard procedure for H&E staining was performed using Harris haematoxylin and aqueous Eosin.

Histopathological examination with WHO grading system was applied for each tumor.

The clinical information was obtained from case records of the patients retrieved from medical records section.

Inclusion Criteria

All primary and metastatic tumours presenting with neurological symptoms were included in the study.

Exclusion Criteria

Non neoplastic lesions presenting with neurological symptoms and tumours diagnosed on the basis of neuroimaging studies without histological confirmation were excluded.

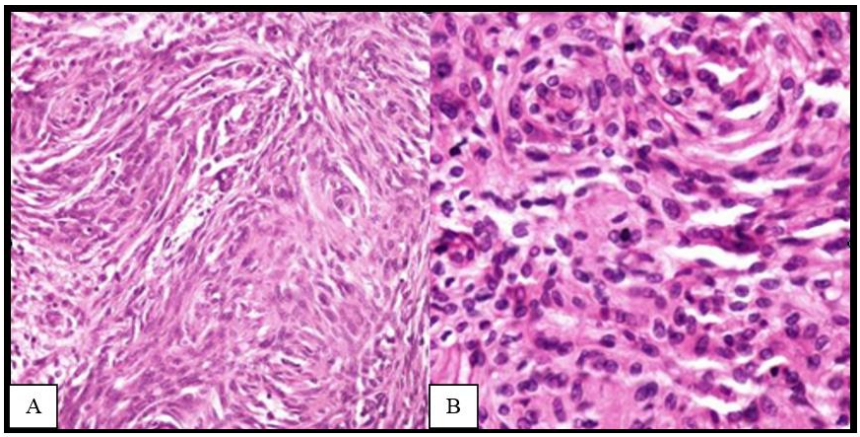

Fig. 1: Meningothelial meningioma showing whorls of tumour cell (H & E, A-X20, B-X40)

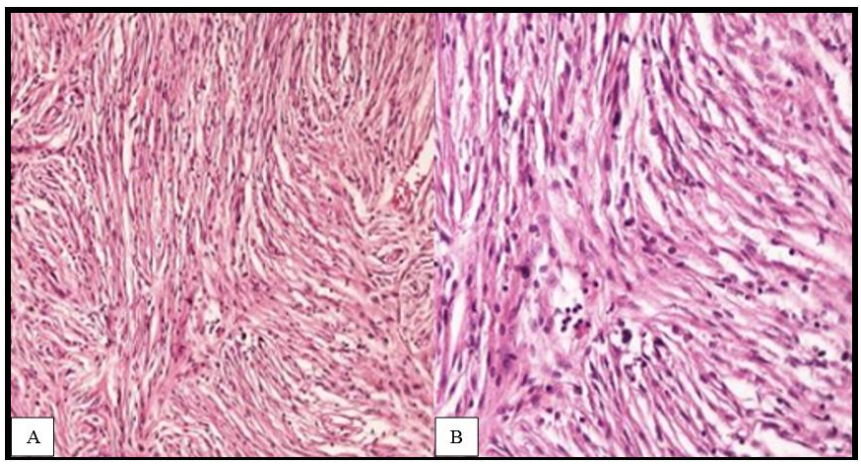

Fig. 2: Fibrous meningioma with bundles of spindle shaped Cells (H&E, A-X10, B-X20)

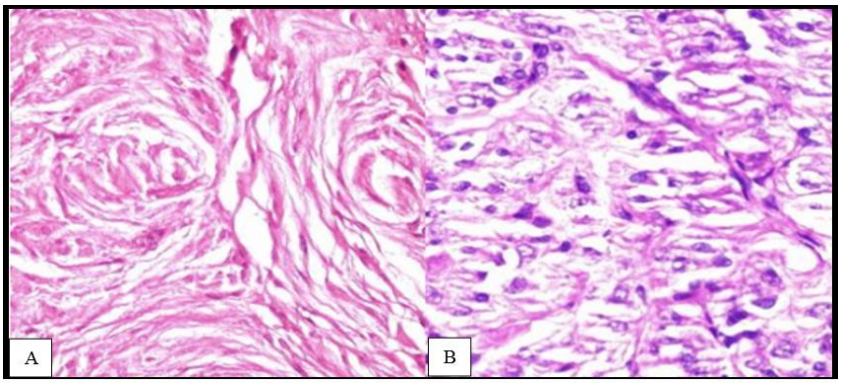

Fig. 3: Transitional meningioma with tumour cells in whorls and bundles (H&E, A-X20, B-X40)

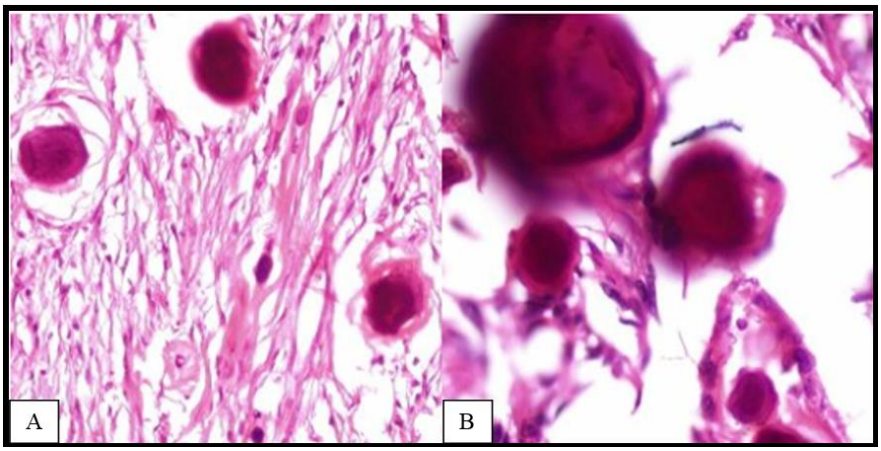

Fig. 4: Psammomatous meningioma showing many psamomma bodies with spindle shaped cells in the background (H &E, A-X20, B-X40)

Observations and Results

The patients age ranged from 3-72 years, with a peak age between 41 and 50 years and a mean age of 45 years. The age wise distribution of this tumors are 1-10 years (8.04%), 11-20 years (9.19%), 21-30 years (10.34%), 31-40 years (4.59%), 41-50 years (37.93%), 51-60 years (9.19%), 61-70 years (17.24%), 71-80 years (3.44%).

There were 48(55.17%) males and 39(44.82%) females with M:F ratio of 1.2:1. Majority of the cases were intracranial 82 cases (94.25%) whereas the remaining 5 cases (5.74%) were spinal cord tumours. Of the intracranial cases, 73 cases (89.02%) were supratentorial and 9 cases (10.97%) were infratentorial. Of the supratentorial tumours there were 34 (39.08%) frontal lobe, 21 cases (27.13%) frontoparietal and multilobe involvement, 12 cases (13.79%) parietal lobe, 05 cases (5.74%) temporal lobe, 3 cases (3.44%) occipital lobe. Among the Infratentorial tumors 9 cases (10.17%), 5 cases (55.55%) were in cerebellopontine region while remaining 4 cases (44.44%) were in cerebellum.

The signs and symptoms of patients with intracranial tumours were headache and vomiting, supratentorial region tumours caused seizures and focal neurological deficits, while infratentorial tumours caused vertigo and confusion. Backache and weakness was a common symptoms in patients with spinal tumours.

Out of 32 cases of meningiomas, 27 cases(84.37%) were intracranial, 5 cases (15.62%) were spinal.31 cases (96.87%) were benign (WHO I) including 16 cases (51.61%) meningotheliomatous meningioma, 5 cases (16.12%) fibroblastic meningioma, 3 cases (9.67%) psammomatous meningioma, 3 cases (9.67%) transitional meningioma, 1 case (3.22%) chordoid meningioma, 1 case (3.22%) clear cell meningioma and 1 case (3.22%) angiomatous meningioma. Of the remaining 1 case (3.22%) was atypical (WHO grade II) meningioma. The mean age of the meningiomas were 44.5 years, with M:F ratio of 1:2.1.

Among astrocytomas, there were 5 cases (26.31%) WHO I (pilocytic astrocytoma), 4 cases (21.05%) WHO grade II (diffuse astrocytoma), 3 cases (15.78%) WHO grade III (anaplastic astrocytoma) and 7 cases (36.84%) WHO grade IV (glioblastoma) excluding 2 cases of gliosarcoma.

The mean age for astrocytoma was 52.5 years with M:F ratio 1.7:1, the patient mean age was 19.5 years for grade I (pilocytic astrocytoma), 22.5 years for grade II (diffuse astrocytoma), 54.9 years for grade III (anaplastic astrocytoma)and 62.1 years for grade IV(glioblastoma).

Table 1: Distribution of CNS tumors with subtypes

Tumors	No. of. cases	Percentage
Astrocytoma	19	21.83%
Oligodendroglioma	07	8.04%
Oligoastrocytoma	06	6.89%
Medulloblastoma	06	6.89%
Schwannoma	11	12.64%
Meningioma	32	36.78%
Gliosarcoma	02	2.29%
Gangliocytic paraganglioma	01	1.14%
Astroblastoma	01	1.14%
Haemangioblastoma	01	1.14%
Metastatic deposits	01	1.14%
Total	87	100%

Table 2: Distribution of astrocytoma according to WHO grading

Who grading	No of cases	% of total cases
Grade I (Pilocytic astrocytoma)	5	26.31%
Grade II (Diffuse astrocytoma)	4	21.05%
Grade III (Anaplastic astrocytoma)	3	15.78%
Grade IV (Glioblastoma)	7	36.84%
Total	19	100%

Table 3: Frequency of age distribution of CNS tumors

Age group in years	Males	Females	Total	% of total
1-10	4	3	7	8.04%
11-20	6	2	8	9.19%
21-30	5	4	9	10.34%
31-40	1	3	4	4.59%
41-50	12	21	33	37.93%
51-60	6	2	8	9.19%
61-70	12	3	15	17.24%
71-80	2	1	3	3.44%
Total	48	39	87	100%

Table 4: Site wise Distribution of CNS tumors

Site	No. of cases	Percentage
Frontal lobe	34	39.08%
Parietal lobe	12	13.79%
Temporal lobe	05	05.74%
Occipital lobe	03	03.44%
Multilobe Involvement	21	27.13%
Cerebellum	4	4.59%
Sellar/suprasellar	3	3.44%
Cerebellopontine Angle	5	5.74%
Total	87	100%

Table 5: Clinical presentation of different types CNS tumors

Histology	Headache	Vomiting	Weakness	Seizure	Visual Distrubance	Cranial Nerve Palsy	Back ache
Astrocytoma	19	7	8	11	3	9	1
Oligodendroglioma	2	2	_	2	_	_	_
Oligoastrocytoma	1	_	_	1	_	_	_
Medulloblastoma	2	1	1	1	2	2	_
Meningioma	12	2	7	4	4	4	3
Schwannoma	3	1	7	_	2	4	1

Table 6: Frequency of sex distribution of CNS tumors

Histological subtype	Male to female ratio
Neuroepithelial Tumors	
Astrocytoma	1.7:1
Oligodendroglioma	1.2:1
Mixed neuronoglial tumors	1:1.2
Meningioma	1:2.1
Schwannoma	1.3:1
Medulloblastoma	2:1
Total	1.2:1

Discussion

The present study emphasizes the relative frequency of currence of CNS tumors and also to relate the various types of CNS tumors with age, sex, signs, symptoms, location and neurological findings.

Age Distribution of CNS Tumours

So it was concluded that peak incidence was in 41-50 years of age group and majority of cases 29.88% were seen between 41-50 years.

The present study is correlating with the study done by Sangeetha N et al.,[9] (2014) which showed the most common age group to be 41-50 years (23.89%).

It is contrasting with the study observed by Masoodi T et al.,[10] (2012) and Intisar H et al.,(2008) found the most common age group to be 31-50 years and 50-59 years respectively.

Sex Distribution of CNS Tumours

In the present study, male to female ratio is 1.2:1,

The ratio of male to female in the overall evaluation of CNS tumors is 1.2:1in the present study.CNS tumors showed male preponderance.

According to study conducted by Sangeetha N et al.[9] (2014) the M:F ratio is 1.4:1, Massodi T et al.[10] (2012) found the M:F ratio of the CNS tumours to be 1.12:1, Intisar .P et al.[12](2008) found M:F ratio is 1.5:1..

The present study is correlating with Sangeetha N et al.[9] Masoodi et al.,[10] Intisar P et al[12] where the studies concluded with male preponderance.

In contrasting, Aryal G et al[11] (2011) the ratio of male to female for all CNS tumors in their study was 0.9:1,where female preponderance is observed.

Sex Distribution According to the Histological Sub type:

In the present study all the histological tumors showed male preponderance. Except in meningiomas where there is a female preponderance with M:F Ratio 1.2:1.

Present study is correlating with Sangeetha .N et al.[9] (2014) where the male to female ratio was 1:2.3 in meningiomas, Intisar .p et al [12](2008) M:F ratio is 0.9:1, Aryal G et al.[11](2011) M:F ratio is 0.3:1, in all these studies meningiomas showed female preponderance.

Location/ site of the CNS Tumours

The study showed 39.08% of the tumors were in the frontal lobe location, 27.13% of the cases in multilobe involvement and 13.79% were located in parietal lobe. In present study, frontal lobe was the commonest site 39.08%, this is in agreement to the findings of Masoodi T et al., Torres et al, Andrews et al., Jalali and Datta et al., and Jamal et al.

In the study tumors like meningioma, oligodendroglioma, mixed gliomas, gliosarcoma were seen in the frontal lobe.

Clinical Manifestation of CNS Tumours

Masoodi T et al.[10] has found head ache was the commonest symptom followed by seizures, visual disturbances weakness limbs, sphincter disturbances, and personality changes.

In this study, commonest feature associated with CNS tumours were head ache, followed by seizures, weakness and vomiting.

The commonest tumor among the intra cranial tumors is headache, among spinal tumors is backache.

Histological typing of CNS Tumours:

The present study correlates with the studies by Sangeetha N et al.[9] Das et al.,[13] Suh et al.[14] and Lee et al.,[15] These studies observed meningioma made up the largest subgroup among all the CNS tumours.

Meningioma was the most common tumour among the clinically diagnosed tumours followed by neuroepithelial tumours, schwannoma and pituitary tumour among atomic bomb survivors in Hiroshima and Nagasaki, Japan.

In the present study, most common tumour tumour was meningioma 32 cases (36.78%). Meningiomas exhibited a wide range of histological appearences like.

1. Meningotheliomatous meningioma (51.61%)
2. Fibroblastic meningioma (16.12%)
3. Psammomatous meningioma (9.67%)
4. Transitional meningioma (9.67%)
5. Clear cell meningioma (3.22%)
6. Chordoid meningioma (3.22%)
7. Angiomatous meningioma (3.22%)
8. Atypical meningioma (3.22%)

Of the above subtypes, meningothelial,fibrous are most common showing 15 and 12 cases respectively, followed by psammomatous meningioma, clear meningioma, chordoid meningioma, angiomatous meningioma and atypical meningioma.

In contrast to the present study, Massodi T et al.[10], 2012 has observed astrocytoma was the commonest CNS tumour constituting 41.5% of all neoplasms. Ahmad et al.,[16] Gosh et al.,[17] also reported astrocytoma as the commonest tumour in theris respective studies..

In the present study astrocytoma was the second commonest tumour 19 cases (21.83%) which is correlating with Sangeetha N et al.[9], 2014 which constitutes 46 cases (25.56%).

Among astrocytoma most common tumour type was WHO grade IV (glioblastoma) constitutes 7 cases (33.33%) similar to that observed by Sangeeth N et al.,[9] and in constrasting to the present study, Irfan A et al.,[18] has observed low grade astrocytoma I and II was highest in number which comprised of only 16.9% of glioblastomas out of total 63.7% astrocytomas.

Meningioma was the second common tumour in the study conducted by Massodi T et al.,[10] which showed 21 cases(19.8%) of all CNS neoplasms. Similar observations are made by Ahmad et al.,[16]

Summary

1. The present study was conducted over a period of 4 years which included 2 years of retrospective and 2 years of prospective study. During these 4 years, 87 cases of CNS tumors were noted.
2. The distribution of cases included 19(21.83%) cases of astrocytoma, 07(8.04%) cases of oligodendroglioma, 06(6.89%) cases of oligoastrocytoma, 06(6.89%) cases of medulloblastoma,11 (12.64%) cases of schwannoma, 32 (36.78%) cases of meningioma, 02(2.29%) cases of gliosarcoma and 01(1.14%) case each of gangliocytic paraganglioma, Astroblastoma, haemangioblastoma and metastatic deposits. (Table 1)
3. The most frequent type of CNS tumor observed was meningioma (32 cases, 36.78%) followed by astrocytoma (19 cases, 21.83%) among which, WHO grade IV (Glioblastoma) was high in frequency (7 cases, 36.84%). (Table 2)
4. Of the 87 cases,7 cases (8.04%) were in the age range of 1-10 years, 8 cases (9.19%) were in the age range of 11-20 years, 9 cases (10.34%) were in the age range of 21-30 years, 4 cases (4.59%) were in the age range of 31-40 years, 33 cases (37.93%) were in the age range of 41-50 years, 8 cases (9.19%) were in the age range of 51-60 years, 15 cases (17.24%) were in the age range of 61-70 years age group and 3 cases (3.44%) were in the age group of 71-80 years. (Table 3)
5. Out of 87 cases, 48 were male (55.17%) and 39 were female (44.82%). These tumors showed preponderance in males with M:F ratio of 1.2:1. Except in meningioma where there was a female preponderance with M:F ratio of 1:2.1.(Table 6)
6. The most common presenting symptom was Headache (42%). (Table 5)
7. The most common site of occurrence of CNS tumor was frontal lobe (39.08%) followed by multilobe involvement (27.13%). (Table 4).

Conclusion

The most frequent type of CNS tumor was meningioma followed by astrocytoma of which WHO grade IV tumor was frequent and schwannoma. The peak incidence was in 41-50 years age group. Overall Males are affected more than females, with male to female ratio of 1.2:1 except in meningioma where there is a female preponderance with male to female ratio of 1:2.1. The most frequent clinical feature was headache and seizures in supratentorial tumors of intracranial region, backache, weakness and sensory disturbances in spinal cord tumors. The most commonest site of occurrence was frontal lobe followed by multilobe involvement.

Conflict of Interest: None

Funding: None.

References

1. Nibhoria S, Tiwana KK, Phutela R, Bajaj A, Chhabra S, Bansal S. Histopathological spectrum of Central Nervous System Tumors: A Single Centre Study of 100 cases. *Int J Sci Stud* 2015:3(6):130-4.
2. Parkin DM, Bray F, Ferlay J, Pisani P (Global cancer statistics,). *CA Cancer J Clin* 2005;55:74-108.
3. Sangeetha N, Aruna Latha R, Chandramouleeshwari K.A Five Year Retrospective study of central nervous system tumors. *Int J Innovative Res Stud* 2014;3(5).
4. Curado. M. P., Edwards, B., Shin. H.R., Storm. H., Ferlay. J., Heanue. M. and Boyle. P., eds (2007) Cancer Incidence in Five Continents, Vol. IX. IARC Scientific Publications No. 160, Lyon, IARC.
5. Preston-Martin S. Epidemiology of Primary CNS neoplasms. *Neurol Clin* 1996;14(2):273-90.
6. Louis DN, Ohgaki H, Weistler OD. The 2007 WHO classification of Tumours of the Central Nervous System. *Acta Neuropathol* 2007;114(2):97-109.
7. Sanai N, Chang S, Berger MS: Low grade gliomas in adults. *J Neurosurg* 2011;115(5):948-65.
8. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray, F. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer;

2013. Available from: http://globocan.iarc.fr, accessed on 09/10/2014.
9. Sangeetha. N. A Five Year Retrospective Study of Central Nervous System Tumors. *Int J Int Res Stud* 2014;3(5).
10. Masoodi Tamkeen. Pattern of Central Nervous System Neoplasms: A study of 106 Cases-Epidemiology, JK-Practitioner. 2012;17(4).
11. Aryal G. Histopathological pattern of central nervous system tumor: A three year retrospective study. *J Pathol Nepal* 2011;1:22-5.
12. Intisar S.H Patty, Central nervous System tumors a clinicopathological study. *J Dohuk Univ* 2008;11(1).
13. Das A, Chapman C A T, Yap W M. Histological subtypes of symptomatic central nervous system tumours in Singapore. *J Neurol Neurosurg Psychiatry* 2000;68:372-4.
14. Suh YL, Koo H, Kim TS. Tumors of the central nervous system in Korea: a multicentre study of 3221 cases. *J Neurooncol* 2002;56:251-9.
15. Lee CH, Jung KW, Yoo H. Epidemiology of primary brain and central nervous system tumors in Korea. *J Korean Neurosurg Soc* 2010;48(2):145-52.
16. Ahmed Z, Muzaffar S, Kayani N. Histological pattern of central nervous system neoplasms. *J Pak Med Assoc* 2001;51(4):154-7.
17. Ghosh A, Sarkar S, Begum Z. The first cross sectional survey on intracranial malignancy in Kolkata, India: reflection of the state of the art in Southern West Bengal. *Asian Pac J Cancer Prev* 2004;5(3):259-7.
18. Irfan A. Quereshi A Intracranial space occupying lesions. Review of 386 cases. *J Pak Med Assoc* 1995;45(3):19-21.

How to cite this article: *Kadaru MR. Clinico-pathological study of central nervous system tumors. Indian J Pathol Oncol* 2019;6(3):393-9.