ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF PATHOLOGY.

HISTOPATHOLOGICAL PATTERN OF CENTRAL NERVOUS SYSTEM TUMORS: A 5-YEAR RETROSPECTIVE STUDY, AT A TERTIARY HOSPITAL IN ETHIOPIA.

A STUDY PAPER AS PARTIAL FULFILMENT FOR REQUIREMENT OF DIPLOMA PROGRAM IN SPECIALITY OF PATHOLOGY

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A STUDY PAPER AS PARTIAL FULFILLMENT FOR REQUIREMENT OF DIPLOMA PROGRAM IN SPECIALTY OF PATHOLOGY SUBMITTED TO TIKUR ANBESSA HOSPITAL, COLLEGE OF HEALTH SCIENCES, SCHOOL OF MEDICINE AND DEPARTMENT OF PATHOLOGY, ADDIS ABABA ETHIOPIA.

HISTOPATHOLOGICAL PATTERN OF CENTRAL NERVOUS SYSTEM TUMORS: A 5-YEAR RETROSPECTIVE STUDY, AT A TERTIARY HOSPITAL IN ETHIOPIA FROM JANUARY 2015 TO AUGUST 2019 SUBMITTED TO DEPARTMENT OF PATHOLOGY.

Prepared by _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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Contents

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Acronyms and abbreviations

AAU …… Addis Ababa University

ATRT ……. Atypical Teratoid/Rhabdoid Tumor

BLH ……. Black Lion Hospital

CBTRUS ……. Central Brain Tumor Registry of the United States

CNS ……. Central Nervous System

GBM……. Glioblastoma Multiforme

H & E …… Hematoxylin and Eosin

PNET …….. Primitive Neuroectodermal Tumor

TAH …….. Tikur Anbessa Hospital

WHO …… World Health Organization

ABSTRACT

Introduction: *Central nervous system tumors are a heterogeneous group of neoplasms, they differ not only in their histomorphological features but also have a distinct biological background and disease course. CNS tumors are confined to the brain, spinal cord, meninges, cranial and Para spinal nerves, with each tumor having its own features, location, morphology, prognosis and treatment.*

Objective:*The purpose of this study is to provide the histopathological pattern of CNS tumors in a tertiary care center in Ethiopia.*

Material and method: *A retrospective descriptive histopathological analysis of central nervous system tumors carried out in the Postgraduate Department of Pathology in Tikur Anbessa Specialized Referral Hospital (TAH), Addis Ababa, Ethiopia. Patients data were retrieved from the archives of the department of Pathology for a period of 5 years from January 01, 2015 to August 31, 2019.*

Result:*A total of 565 cases were analyzed and a wide range of histopathological diagnosis of CNS tumors was observed. Patients ages ranged from 2minths-80 years with a mean age of 36.9 years and a male to female ratio of 1:1.11. Majority of tumors had intracranial location(499 cases, 88.3%).Most of CNS tumors were low grade belonged to Grade I 70% followed by grade II 14. 8%. Tumors of meningeal tissue were most common 51.9% followed by neuroepithelial 24.2 %. When examining the data pertaining to specific types of tumors, most frequent type of CNS tumors was meningioma(272 cases, 48.1%) followed by astrocytoma (86 cases, 15.2%).*

Conclusion:*The present study thus reflects the histopathological patterns of CNS tumors from our center. Although there is availability of advanced imaging techniques at present, still histopathological examination is gold standard in their diagnosis.The conventional H & E staining is the mainstay for pathologic diagnosis, and IHC also plays a major role in differential diagnosis and improving diagnostic accuracy.*

KEY WORDS: -CNS Tumors, Meningioma, Astrocytoma& Histopathology

Introduction

Central nervous system tumors are a heterogeneous group of neoplasms,they differ not only in their histomorphological features but also have a distinct biological background and disease course. CNS tumors are confined to the brain, spinal cord, meninges, cranial and Para spinal nerves, with each tumor having its own features, location, morphology, prognosis and treatment. (1,2) The unparalleled complexity of the central nervous system (CNS) is mirrored by the ever increasing diversity of recognizing of neoplastic entities that can afflict the organ system. The WHO Classification of tumors of the CNS recognizes more than 50 clinicopathological entities with a great variation in histology, biological behavior, response to therapy. (1,3)

Tumors of the CNS are histologically categorized by the WHO as tumors of neuroepithelial tissue,cranial & para spinal nerves,meninges, lymphomas & hematopoietic neoplasms, germ cell tumors, tumors of the sellar region and metastatic tumors. (1)

The annual incidence of tumors of the CNS ranges from 10 to 17 per 100,000 persons for intracranial tumors and 1 to 2 per 100,000 persons for intraspinal tumors; the majority of these are primary tumors, and only one fourth to one half are metastatic. The five most common primary sites are lung, breast, skin (melanoma), kidney and gastrointestinal tract accounting for about 80% of all metastases. Some rare tumors (e.g., choriocarcinoma) have a high likelihood of metastasizing to the brain. (4) CNS tumors account for less than 2% above all malignancies. However, they cause significant morbidity; majority of patients die within first year of diagnosis of malignant lesion and less than 3% survive more than 3 years. (3)According to the most recent Central Brain Tumor Registry of the United States (CBTRUS), primary CNS tumors are now the most common of all solid neoplasms in children and adolescents (0-19 years) and the second leading cause of cancer mortality in individuals aged younger than 20 years. (5)

The age distribution of brain tumors is bimodal, with a peak incidence in children and a second, larger peak in adults aged 45–70 years. (3 ,6,7) The tumors are more common in males, with the exception of meningioma's which are more frequently seen in females.

The majority of brain tumors are sporadic lesions, and till date, the rare heritable genetic syndromes and prior ionizing radiation exposures are the only established risk factors and account for < 10 % of all brain tumors. (3,8,9)

primary CNS neoplasms varies significantly by location, histologic group, & age; knowledge of this fact will often serve to considerably narrow the range of diagnostic possibilities. Site of lesion is important because any CNS neoplasm, regardless of histologic grade or classification, may have lethal consequences if situated in a critical brain region. Tumors that predominate in adults differ from those seen in children. Seventy percent of childhood CNS tumors arise in the posterior fossa; a comparable number of tumors in adults arise within the cerebral hemispheres above the tentorium. (4,10,11)

Prognosis is associated with clinical findings, such as (age, performance status, location, radiological features, extent of surgical resection, proliferation indices, genetic alterations) andhistologic grading. (1)Histological grading is a means of predicting the biological behavior of a neoplasm. In the clinical setting, tumor grade is a key factor influencing the choice of therapies, particularly determining the use of adjuvant radiation and specific chemotherapy protocols.Brain tumors are graded, not staged; WHO grade is one component of a combination of criteria used to predict a response to therapy and outcome, which ranges from I (most indolent) to IV (most aggressive). (1,10,11)

According to CBTRUS in 2016, Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2009–2013. (5) found out that: Brain and other CNS tumors were the most common cancer site among those age 0–14 years, with an average annual age-adjusted incidence rate of 5.47 per 100,000 populations. Leukemia is the second most common neoplasm in those age, with incidence of 5.00 per 100,000 populations.

The Incidence varies with age, overall average annual age-adjusted incidence was 22.36, 5.70 for children and adolescents age 0–19 years, and 29.18 for adults age 20+ years per 100,000 populations. The median age at diagnosis for all primary brain and other CNS tumors is 59.0 years.Meningioma and glioblastoma are primarily diagnosed at older ages (median age of 66.0 and 64.0 years, respectively).The study demonstrates tumors were more common in female's accounts 57.9% than males, 42.1%;however malignant tumors occurred more in males 55.2% and 44.8% in females.

Among CBTRUS major histology groupings, incidence rates were highest for tumors of the meninges (8.30), followed by the neuroepithelial tissue (6.60),the sellar region (3.85), &tumors

of the cranial and spinal nerves (1.83). on specific histology the most frequently reported histology were meningioma (36.6%), followed by tumors of the pituitary (15.9%) and glioblastoma (14.9%).

The study also show the most common tumor site is the meninges, representing 37.0%,followed by the cerebrum accounts 19.0% (frontal lobe were more affected), the pituitary and craniopharyngeal duct 17.0%, cranial nerves and the spinal cord/cauda equina account for 10.0%, and Brain stem tumors account for 2.0%.

The CBTRUS Statistical Report also describe the three of the most common histologic types: meningioma and glioblastoma for adults, and embryonal tumors for children and adolescents.Meningioma's were the most frequently reported tumor, accounting for 37.0% overall,most of them were WHO grade I 81.1%,16.9% were WHO grade II, and 1.7% were WHO grade III.Incidence increases with age, a dramatic increase after age 65 years. Even among the population age 85 years and older, these rates continue to be high. Diagnosis were highest from 35–54 years, where approximately 3 times higher in females.In children age 0–14 years, it wasone of the least common tumor, where incidence rates for males and females are approximately equal. It was significantly higher in Blacks than in Whites. Age had a large effect on relative survival after diagnosis with malignant meningioma: 10-year survival was 77.7% for age group 20–44 years, and 37.1% for age 75+ years.

Glioblastoma were the third most frequently reported histology and the most common malignant tumor overall, accounts for 14.9% of all CNS tumors and 46.6% of primary malignant brain tumors.Incidence of glioblastoma increases with age, with rates highest in the age 75 to 84 years. It was more common in older adults and less common in children; comprise approximately 2.9% of all CNS tumors reported among age 0–19 years.The tumor were 1.57 times more common in males and about 1.93 times higher among Whites as compared to Blacks. Relative survival estimates for glioblastomas were quite low; 5.5% of patients survived five years post diagnosis.These survival estimates are somewhat higher for the small number of patients who was diagnosed under age 20 years.

Embryonal Tumors were the most frequently reported histology grouping in children age 0–4 years, and the second most common tumor type in children and adolescents age 0–19 years,

comprises 10.8%,(only second to Gliomas account for approximately 47.4%).It represents 1.0% of tumors diagnosed overall age groups.Embryonal tumors within the CBTRUS histologic grouping scheme includes multiple different types with majority of them were medulloblastoma accounts for 63.7%, atypical teratoid/rhabdoid tumor (ATRT) 15.4%,and primitive neuroectodermal tumor (PNET) 12.5%. Relative survival estimates for embryonal tumors were low but vary significantly by histology. 10-year survival is 64.7% for medulloblastoma, 39.7% for PNET, and 25.8% for ATRT.

A study by Jat KC et.al. from Sardar Patel Medical College, Bikane,India in 2016; a total of 59 cases of CNS tumors were studied between 2011-2015. (12) found out that CNS tumors weremore common in male than female, with male to female ratio 1.80:1. Highest incidence of tumors found in 5th decade followed by 4th decade.Majority of tumors had intracranial location (93.23%) of which frontal lobe is more affected and the rest 6.77% located in extracranial region. Almost all were primary (98.3%), and 1 (1.7%) metastatic. On the basis of histology neuroepithelial tumors were most common (67.79%) of which astrocytoma is the most frequent followed by meningeal tumors (22.03%).

In addition, the study demonstrated the majority of lesions belong to Grade I (32.7%), and among astrocytoma the most common was grade IV or glioblastoma multiforme (GBM). In case of meningioma almost all were grade I, only one case was grade III, anaplastic.

A study by Hamdani et.al.from Government Medical College, Srinagar, Jammu and Kashmir, India, in 2019; A total of 117 biopsies of CNS tumors were studied over a period of 4 years from 2015 to 2018. (13) found out that a mean age with diagnosis of CNS tumors were 44.5 years with Peak incidence was seen in 51–60 years of age. Males slightly outnumbered females with male: female ratio of 1:0.8.Majority of tumors were supratentorial (87.17 %), most of them were found in cerebrum &frontal lobe and the rest infratentorial (12.82%).

In this study, meningioma was the most common lesion (41.02%), most of them were Grade I followed by astrocytoma (35.04%), among astrocytoma, the greatest number of lesions were Grade IV.The study also demonstrated 2 cases each of cerebral metastasis, primary CNS lymphoma.

A study by Zalata KR et al. Mansoura University, Egypt in 2011; 1618 cases of CNS tumors were analyzed over a period of 8-years from 1999 to 2007.(14), found out that the median age of diagnosis was 43 years with aPeak incidence the sixth decade and Children (<15 years) were represent 10.25%.In this study, males constituted 52.3% of all cases which is slightly higher than females.Intracranial tumors represented 86.7% of cases compared to 13.3% for spinal tumors. About all studied CNS tumors 45.6% were located in the cerebral hemispheres, frontal lobe was most frequently involved (more than 50% of cerebral sites) followed by the temporoparietal region.

The study also demonstrated that majority of lesions were primary represented 94.2% and metastatic tumors were 5.8%. Gliomas represent the highest frequency (35.2%), followed by meningioma (25.6%). From glial tumors astrocytoma was the most common type of which most of them were high grade (Glioblastoma),followed by ependymoma. As to meningioma the most common histologic subtype was meningothelial meningioma.The most common primary spinal tumor in this publication was nerve sheath tumors (28%) followed by meningioma (22%) and gliomas (17.5%).

Significance of the Study

Studies, particularly in Western countries, have indicated an increasing occurrence and mortality rates of CNS tumors in the last few decades,mainlyattributed to the increased availability of diagnostic imaging and specialized medical care. (15,18) There is also an increase in the diagnosis of CNS tumors because of increased health care services with the adequate facilities in our country. The 2018 Globocan estimates indicate that in Ethiopia, brain and nervous system cancers were the 17th cause of cancer morbidity and the 15th in mortality, with 774 new cancer cases and 686 deaths in 2018. (19) However, no published study regarding the histopathological pattern of CNS tumors available in Ethiopia, so it is important to have a study in this area in our country and can provide a pile of valuable information for future epidemiological studies.

Objective

General objective;

This study described the histopathological pattern of central nervous system tumors.

Specific objective;

1.Evaluated and determined the relative frequency of CNS tumors.

2.Assessed on demographic data including age and sex, along with histopathological diagnosis.

3.Assessed the distribution of CNS tumors with regard to anatomic location and WHO grade.

4. Compared and contrasted major study findings from around the world with that of our findings in the current study.

Methods and Materials

Design

This study used a retrospectivedescriptive histopathological analysis of central nervous system tumors in Tikur Anbessa Specialized Referral Hospital (TAH), Department of Pathology, in Addis Ababa, Ethiopia.Patients data were retrieved from the archives of the department of Pathology.

Study Area

Ethiopia is the second-most populous country in the continent of Africa, with a population of more than 100 million.Tikur Anbessa is the teaching hospital of Addis Ababa University which is the largest referral hospital in the country.Department of Pathology, TAH,Addis Ababa, Ethiopia is the oldest pathology department in Ethiopia which is established in 1974. The department gives hematology, cytopathology, surgical pathology and neonatal autopsy services.surgical biopsy specimens received in 10% formalin was undergo routine tissue processing and stained with Hematoxylin and eosin stain. No immunohistochemistry or special stain was used. This study was conducted on patients with central nervous system tumors for whom biopsy was taken & histologic diagnosis was given at pathology department,TAH, Ethiopia.

Data Collection

The data was retrieved from the archives of the department of Pathology for a period of 5 years from January 01, 2015 to August 31, 2019.The data consisted ofbiopsy specimen number, patient'sdemographic data including age &sex, histopathologic diagnosis of CNS tumor with WHO grade and anatomic location of the lesion.

Inclusion and Exclusion Criteria

Inclusion Criteria:

Patients of all ageswith CNS tumor who presented to department of Pathology at TAH between the study period from January 01, 2015 to August 31, 2019 and hadhistopathological diagnosis wereincluded in this study.

Exclusion Criteria:

Non-neoplastic lesions, Neurological lesions other thanthe CNS, cases withincomplete data & without definitive diagnosis were excluded from study.

Data analysis

The Collected data from the study was organized, crosschecked and analyzed using IBM SPSS version 23. Tumors were categorized and graded according to WHO Classification of tumors of the CNS, 2007

Study Parameters

Age and Sex of the patient

Anatomic location of the tumor

Histopathological type and WHO Grade of tumors

Ethical considerations

Ethical permission sought from the Department of Pathology, College of Health Sciences, Addis Ababa University, and ethics committee at Tikur Anbessa hospital. Names of patients or their chart numbers were not mentioned in the study to keep the confidentiality of the patients.

RESULT

A total of 565 cases of central nervous system tumors from January 2015 to August 2019; for five years' period were collected and analyzed. The distribution of 565 cases according to age, sex, anatomic site, histopathological type and their grading according WHO classification were presented in tables or figures. Following results were made:

CNS tumors were higher in female (297 cases, 52.6%) in comparison with male (268 cases, 47.4%). Male to female ratio was 1: 1.11. Distribution of tumors according to sex is given in Table 1.

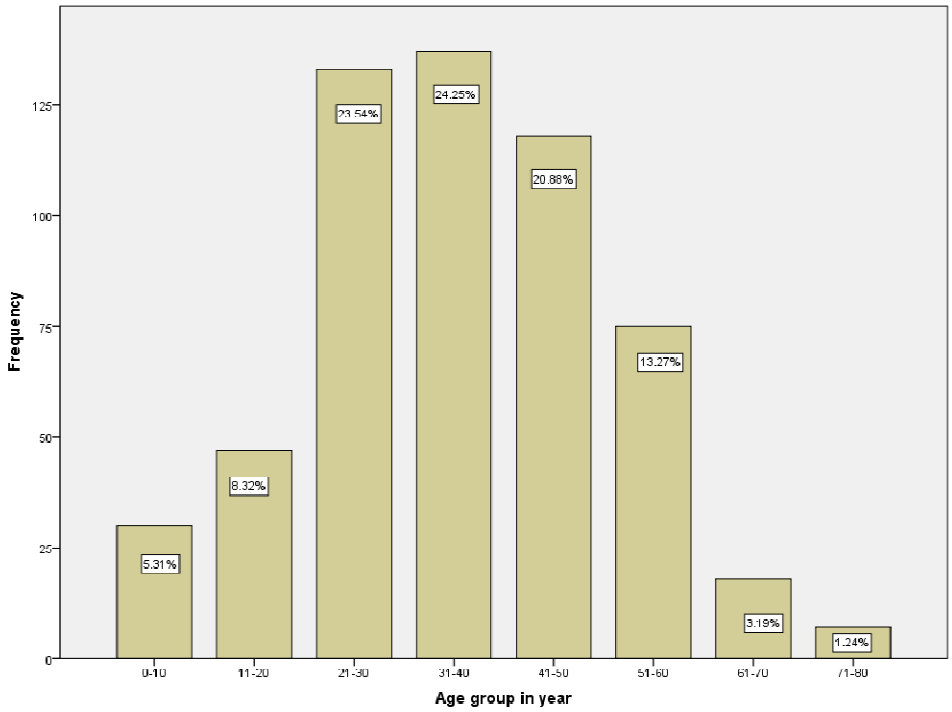
Table 1: Distribution of Tumors According to Sex.

No	Histopathological Diagnosis	Female Case (%)	Male Case (%)	Total Case (%)
1	Meningioma	185 (68)	87 (32)	272 (48.1)
2	Astrocytoma	31 (36)	55 (64)	86 (15.2)
3	Pituitary adenoma	20 (33.9)	39 (66.1)	59 (10.4)
4	Schwannoma	23 (42.6)	31 (57.4)	54 (9.6)
5	Ependymoma	6 (35.3)	11 (64.7)	17 (3)
6	Medulloblastoma	5 (29.4)	12 (70.6)	17 (3)
7	Hemangioblastoma	4 (33.3)	8 (66.7)	12 (2.1)
8	Carcinoma	5 (55.6)	4 (44.4)	9 (1.6)
9	Craniopharyngioma	2 (25)	6 (75)	8 (1.4)
10	Oligodendroglioma	4 (80)	1 (20)	5 (0.9)
11	Hemangiopericytoma	3 (75)	1 (25)	4 (0.7)
12	Central neurocytoma	3 (75)	1 (25)	4 (0.7)
13	Choroid plexus tumors	1 (50)	1 (50)	2 (0.4)
14	Ganglioglioma	_	2 (100)	2 (0.4)
15	Hemangioma	1 (50)	1 (50)	2 (0.4)

16	Lymphoma	_	2 (100)	2 (0.4)
17	Oligoastrocytoma	1 (100)	_	1 (0.2)
18	Gangliocytoma	1 (100)	_	1 (0.2)
19	Ganglioneuroma	_	1 (100)	1 (0.2)
20	Angiosarcoma	_	1 (100)	1 (0.2)
21	Melanoma	_	1 (100)	1 (0.2)
22	Germinoma	_	1 (100)	1 (0.2)
23	Chondroma	_	1 (100)	1 (0.2)
24	Fibrolipoma	_	1 (100)	1 (0.2)
25	Desmoplastic infantile astrocytoma	1 (100)	_	1 (0.2)
26	Neurofibroma	1 (100)	_	1 (0.2)
	Total	297 (52.6)	268 (47.4)	565 (100)

The age of patients with CNS tumor diagnosis were ranged from 2 months to 80 years with a mean age of 36.9 years. Peak incidence was found in the 4th decade of life (31-40 yrs.) accounted for 24.3% followed by 3rd decade (21-30 yrs.) 23.5%. Both ends of age groups have tapered frequency. Age-wise distribution of cases is shown in Figure 1.

Figure 1: Distribution of Cases According to Age groups.



As shown in Table 2, a total of 26 different histologic diagnoseswere made and their distribution based on age groups shows that meningioma was occurred in all age groups except in the 1st decade of life and the highest frequency was in the 4th decade which accounts 85 (15%) followed by 5th decade 63 (11.2%) cases.The highest frequency of astrocytoma diagnosis was occurred in the 3rd& 4th decades that accounts 17 (3%) cases each followed by 5th decade 15(2.7%). Astrocytoma was also the most common histologic type that diagnosed in the 1st decade of life which represents 13(2.3%) cases followed by medulloblastoma 5 (0.9%) and craniopharyngioma 4 (0.7%) cases.

No.	Diagnosis	Age Group in Year Case No. (%)								Total
		0-10	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	
1	**Meningioma**		7 (1.2)	57(10.1)	85(**15.**0)	63(11.2)	47(8.3)	9(1.6)	4(.7)	**272(48.1)**
2	**Astrocytoma**	13(2.3)	12 (2.1)	17 (**3.**0)	17**(3**.0)	15(2.7)	9(1.6)	3(.5)		**86(15.2)**

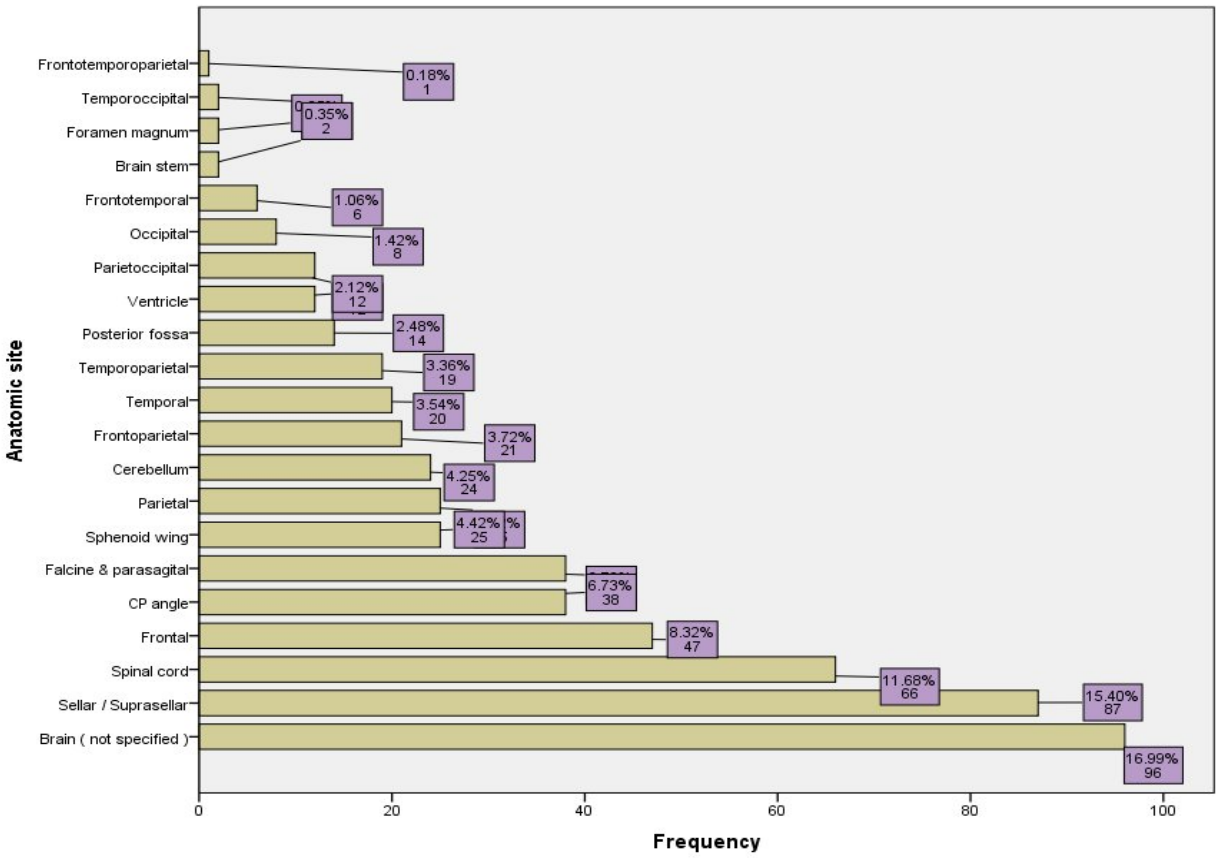
Table 2. Distribution of Histologic Diagnosis Based on Age Groups.

3	Pituitary adenoma		5 (.9)	24 (**4.2**)	7(1.2)	12(2.1)	7(1.2)	3(.5)	1(.2)	**59(10.4)**
4	Schwannoma	1(.2)	2 (.4)	13(.2.3)	17(**3.**0)	11(1.9)	8(1.4)	1(.2)	1(.2)	54(9.6)
5	Medulloblastoma	5(.9)	8 (**1.4**)	3(.5)		1(.2)				17(.3)
6	Ependymoma	2(.4)	2(.4)	4(.7)	3(.5)	5**(.9)**	1(.2)			17(.3)
7	Hemangioblastoma		2(.4)	4**(.7)**	1(.2)	3(.5)	2(.4)			12(2.1)
8	**Carcinoma**			1(.2)	2(.4)	4**(.7)**	1(.2)	1(.2)		9(1.6)
9	Craniopharyngioma	4(.7)	2(.4)	2(.4)						8(1.4)
10	Oligodendroglioma		1(.2)	2(.4)	1(.2)			1(.2)		5(.9)
11	Hemangiopericytoma			2(.4)	1(.2)	1(.2)				4(.7)
12	Central neurocytoma		3(.5)		1					4(.7)
13	**Lymphoma**				1(.2)	1(.2)				2(.4)
14	Hemangioma		1(.2)			1(.2)				2(.4)
15	Ganglioglioma	2(.4)								2(.4)
16	Choroid plexus tumours			1(.2)	1(.2)					2(.4)
17	Neurofibroma		1(.2)							1(.2)
18	Desmoplastic infantile astrocytoma	1(.2)								1(.2)
19	Fibrolipoma			1(.2)						1(.2)
20	Chondroma			1(.2)						1(.2)
21	Germinoma	1(.2)								1(.2)
22	**Melanoma**					1(.2)				1(.2)
23	Angiosarcoma								1(.2)	1(.2)
24	Ganglioneuroma			1(.2)						1(.2)
25	Gangliocytoma		1(.2)							1(.2)
26	Oligoastrocytoma	1(.2)								1(.2)
	Total	30(5.3)	47(8.3)	133(23.5)	137(24.2)	118(20.9)	75(13.3)	18(3.2)	7(1.2)	565(100)

As shown in Figure 2, majority of tumors had intracranial location represented (499 case, 88.3%) compared to (66 cases, 11.7%) for spinal tumors. The proportion of tumors in the brain, with no other details given, was higher represented 96 (17%) cases followed by sellar/suprasellar location 87 (15.4%) cases. Frontal lobe was the more involved site 47 (8.3%) cases followed by parietal lobe 25 (4.4%) of the cerebral hemisphere in the represented figure. Rare sites included temporoccipital, brainstem, foramen magnum accounted for 2 (0.35%) cases each and 1 (0.18%)

case was in frontotemporoparietal area.Out of the 66 tumors of the spinal cord; meningioma & schwannoma accounted for 25 (37.9%) cases each followed by ependymoma 10 (15. 2%) cases. Astrocytoma, gangliocytoma, ganglioneuroma, neurofibroma, hemangioma and fibrolipoma 1 (1.5%) case each were diagnosed in the spinal cord.

Figure 2: Distribution of Cases According Site Involved.



As shown in Table 3, total of 565 CNS tumors were diagnosed during five-year period. Of these, (555 cases, 98.2%) were primary, and (10 cases, 1.8%) were metastatic. On the basis of major categories meningeal tumors were most common (293 cases, 51.9%) followed by neuroepithelial tumors (137 cases, 24.2 %). Tumors of the sellar region comprising 67 (11.9%) cases, most of them were pituitary adenoma 59 (10.4%) and craniopharyngioma were 8 (1.4%) cases. From 55 (9.7%) cases of Cranial & paraspinal nerves; 54 (9.6%) cases were schwannoma and 1 (0.2%) case was neurofibroma. Among the 10 (1.8%) cases of metastatic tumors most of them were

carcinoma accounting for 9 (1.6%) cases and 1 (0.2%) case of melanoma. The other rare tumors diagnosedover five-years period were 2 (0.4%) cases of lymphoma and 1 (0.2%) case germinoma.

Table 3. Distribution of CNS Tumors According to Major Categories and Histopathological Diagnosis

No	Major Classes	Histopathological Diagnosis	No. of Cases (%)	Total Cases (%)
1	Meningeal	- Menigioma	272 (48.1)	293 (51.9)
		- Hemangioblastoma	12 (2.1)	
		- Hemangiopericytoma	4 (0.7)	
		- Hemangioma	2 (0.4)	
		- Angiosarcoma	1 (0.2)	
		- Chondroma	1 (0.2)	
		- Fibrolipoma	1 (0.2)	
2	Neuroepithelial	- Astrocytoma	86 (15.2)	137 (24.2)
		- Ependymoma	17 (3)	
		- Medulooblastoma	17 (3)	
		- Oligodendroglioma	5 (0.9)	
		- Central Neurocytoma	4 (0.7)	
		- Choroid Plexus Tumor	2 (0.4)	
		- Ganglioglioma	2 (0.4)	
		- Oliogoastrocytoma	1 (0.2)	
		- Desmoplastic Infantile Astrocytoma	1 (0.2)	
		- Gangliocytoma	1 (0.2)	
		- Ganglioneuroma	1 (0.2)	
3	Tumors of Sellar Region	- Pituitary Adenoma	59 (10.4)	67 (11.9)
		- Craniopharyngioma	8 (1.4)	

4	Cranial & Paraspinal Nerves	- Schwannoma - Neurofibroma	54 (9.6) 1 (0.2)	55 (9.7)
5	Metastatic	- Carcinoma - Melanoma	9 (1.6) 1 (0.2)	10 (1.8)
6	Lymohoma & Hematopoietic	- Lymphoma	2 (0.4)	2 (0.4)
7	Germ Cell Tumors	- Germinoma	1 (0.2)	1 (0.2)
Total			565 (100)	565 (100)

In Table 4, according to WHO classification, 487 cases were graded, in which the majority of lesions were belonged to WHO Grade I (341 cases, 70%) followed by WHO grade II (72 cases, 14.8%), WHO grade IV (64 cases, 13.1%) and WHO grade III (10 cases, 2.1%). In our study the most frequent type of CNS tumor was meningioma (272 cases, 48.1%) followed by astrocytoma (86 cases, 15.2%) and pituitary adenoma (59 cases, 10.4%). Among the 293 (51.9%) tumors of the meningeal tissue, the majorities were accounted for meningioma 272 (48.1%) cases followed by hemangioblastoma 12 (2.1%) and 4 (0.7%) cases of hemangiopericytoma. Two cases of Hemangioma were diagnosed accounting for (0.4%). Angiosarcoma, chondroma and fibrolipoma were diagnosed in one patient (0.2%) each of tumors derived from meningeal tissue.

Table 4. Distribution of Cases According to WHO Grading System

No.	Histopathological Diagnosis	Grading			
		Grade I	Grade II	Grade III	Grade IV
1	Meningioma	239 (87.9)	29 (10.7)	4 (1.5)	_

2	Astrocytoma	21 (24.4)	17 (19.8)	1 (1.2)	47 (54.6)
3	Schwannoma	54 (100)	_	_	_
4	Ependymoma	2 (1.8)	14 (82.4)	1 (5.9)	_
5	Medulloblastoma	_	_	_	17 (100)
6	Hemangioblastoma	12 (100)	_	_	_
7	Craniopharyngioma	8 (100)	_	_	_
8	Oligodendroglioma	_	2 (40)	3 (60)	_
9	Hemangiopericytoma	_	4 (100)	_	_
10	Central neurocytoma	_	4 (100)	_	_
11	Choroid plexus tumors	_	1 (50)	1 (50)	_
12	Ganglioglioma	2 (100)	_	_	_
13	Oligoastrocytoma	_	1 (100)	_	_
14	Gangliocytoma	1 (100)	_	_	_
15	Desmoplastic infantile astrocytoma	1 (100)	_	_	_
16	Neurofibroma	1 (100)	_	_	_
Sub Total		341 (70)	72 (14.8)	10 (2.1)	64 (13.1)
Grand Total					487 (100)

A total of 272 cases of Meningioma were diagnosed in the study period. Majority were female 185 (68%) cases compared to male 87 (32%) cases. Patients age with diagnosis of meningioma were ranging from 16 to 80 years with a mean age of 41.7 years. The most common histological subtypes of meningioma were meningeothelial accounted for 133 (48.9%) cases followed by transitional 61 (22.4%) cases. Fibroblastic and psammomatous type accounted for 16 (5.9%)

cases each. Microcystic 9 (3.3%), angiomatous 7 (2.6%) and clear cell 2 (0.7%) cases. secretory and rhabdoid type was 1 (0.4%) case each. In addition, 23 (8.4%) atypical and 3 (1.1%) cases of anaplastic meningioma were diagnosed. Most of meningioma were WHO grade I 239 (87.9%) cases followed by WHO grade II 29 (10.7%) and WHO grade III 14 (1.5%). Histopathological Subtypes of meningioma is given in Table 5.

Table 5. Subtypes of Meningioma with WHO Grade.

No.	Histologic Type	WHO Grade			Total (%)
		Grade I	Grade II	Grade III	
1	Meningiothelial	131	2	_	133 (48.9)
2	Transitional (Mixed)	59	2	_	61 (22.4)
3	Fibroblastic	16	_	_	16 (5.9)
4	Psammomatous	16	_	_	16 (5.9)
5	Microcystic	9	_	_	9 (3.3)
6	Angiomatous	7	_	_	7 (2.6)
7	Secretary	1	_	_	1 (0.4)
8	Clear Cell	_	2	_	2 (0.7)
9	Rhabdiod	_	_	1	1 (0.4)
10	Atypical	_	23	_	23 (8.4)
11	Anaplastic (Malignant)	_	_	3	3 (1.1)
Total		239 (87.9)	29 (10.7)	4 (1.5)	272 (100)

Tumors of neuroepithelial tissue were the second most frequently occurring group of CNS tumors. Within this group, the majorities were accounted under the subgroup astrocytoma 86 (15.2%) cases followed by ependymoma and medulloblastoma 17 (3%) cases each. Oligodendroglioma 5 (0.9%) case and central neurocytoma 4 (0.7%) cases were diagnosed. Choroid plexus tumors and ganglioglioma 2 (0.4%) cases each. Oligoastrocytoma, desmoplastic

infantile astrocytoma, gangliocytoma and ganglioneuroma were diagnosed in one patient (0.2%) each.

Among the 86 tumors of astrocytoma majorities were male 55 (64%) cases compared to female 31(36%) cases. Patients age with a diagnosis of astrocytic tumors were ranging from 2 years to 70 years with a mean age of 31.7 years. The most common subtype was WHO grade IVastrocytoma or glioblastoma multiforme (GBM) comprising 47 (54.6%)cases, followed by WHO grade I astrocytoma 21 (24.4%) cases, 17 (19.8%) cases of WHO grade II and 1 (1.2%) case of WHO grade III.

In Table 6, Out of 86 astrocytic tumors, twenty-one cases of pilocytic astrocytoma, nine cases fibrillary astrocytoma, two cases gemistocytic astrocytoma, four cases of pleomorphic xantho astrocytoma, one case anaplastic astrocytoma, forty-seven cases glioblastoma multiforme were diagnosed. Six case gliosarcoma, one case small cell and giant cell glioblastoma variant each was also included in forty-seven cases of GBM.

Table 6. Frequency of Astrocytic Tumors.

No.	Tumors	No. of Cases	Total (%)
1	Glioblastoma - Gliosarcoma - Small Cell - Giant Cell	39 6 1 1	47 (54.6)
2	Pilocytic Astrocytoma	21	21 (24.4)
3	Diffuse Astrocytoma - Fibrillary - Gemistocytic	2 9 2	13 (15.1)
4	Pleomorphic Xantho Astrocytoma	4	4 (4.7)
5	Anaplastic Astrocytoma	1	1 (1.2)
	Total	86	86 (100)

In Table 7, the age with diagnosis of Glioblastoma ranges from 8 to 70 years, and it occurs in all age groups with the highest frequency was in the 4thdecade which accounts 13 cases followed by the 5th decade 11 cases out of 47 cases. Out of 21 cases of Pilocytic Astrocytoma most of them were diagnosed in the 1st decade which represents 9 cases followed by 2nd& 3rddecade which accounts 6 & 5 cases respectively. Pilocytic Astrocytoma was the most frequently diagnosed

astrocytic tumor in the 1st decade of life followed by Glioblastoma and Pleomorphic Xanthoastrocytoma.

Table 7. Subtypes of Astrocytoma with Age Group.

No.	Diagnosis	Age Group in Year Case No. (%)							Total
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	
1	Glioblastoma	3	2	7	**13**	11	8	3	47(54.6)
2	Pilocytic Astrocytoma	**9**	6	5		1			21(24.4)
3	Diffuse Astrocytoma		2	**4**	**4**	3			13(15.1)
4	Pleomorphic Xanthoastrocytoma	1	2				1		4(4.7)
5	Anaplastic Astrocytoma			1					1(1.2)
	Total	13(15.1)	12(13.95)	**17(19.8)**	**17(19.8)**	15(17.3)	9(10.5)	**3(3.5)**	86(100)

DISCUSSION

In our study, we noted that meningioma was the most common CNS tumor (48.1%) in our population. The same was found by Ostrom QT et al (5) in the USA and Hamdani et.al (13) in India, also noticed that the most common tumor was meningioma. However, Jat KC et.al (12) in

India and Zalata KR et al (14) in Egypt reported astrocytoma to be the most common tumor in their studies.

David N. Louis.et al. WHO, 2016. (16) stated that meningioma was more common in females than males with median age of 65 years and most of them were WHO grade I. This was in agreement with our study meningioma in female was 68% and 87.9% was grade I but the median age was younger ,42 years. A report from USA, CBTRUS in 2016, and Zalata KR et al. (14) in Egypt were similar. This was contrary to the findings from India; Jat KC et.al. (12) & Hamdani et.al.(13) reported meningioma was more common in males than females with median age of 49, 54 respectively.

In this study, astrocytoma was more common in males than females – 64% of astrocytoma was seen in males. Among astrocytoma, glioblastoma was the most common (54. 6%).This was similar to that observed by other workers. (5,12.14). The mean age of patients with astrocytoma in our study was younger, represented 31.2 years, compared to that measured in India 39.8, Egypt 57 and 64 years in USA. (5,12,14).

The current study showed that most of CNS tumors were low grade belonged to Grade I (70%) followed by grade II (14. 8%) in contrary to a study by Jat KC et al. in India, found out that majority of lesions belonged to grade I (32.7 %) and IV (32.7%) followed by grade II (29.1%). (12)

According to CBTRUS in 2016, CNS tumors are more common in females than males. This is in agreement with the findings of our study, tumors are more common in female (52.6%) in comparison with male (47. 4%).However, Jat KC et.al (12) & Hamdani et.al.(13) in india and Zalata KR et al. (14) in Egypt reported males outnumbered females in their studies.

In our study the age distribution of all CNS tumors showed a gradual increase in tumor cases with increasing age, peaking in the age group 21-40 years and tapering off thereafter. A similar pattern was observed in one study in Washington, DC by Fan et al, whoalso reported proportionally low frequencies of CNS tumors at both ends of the age spectrum (below 10 years old and greater than 70 years), but the highest frequency was noted in the higher age group (50-59 years). (17)

In addition, the average age of patients with CNS tumor diagnosis was also youngest 36.9 years with peak incidence 31-40 years followed by 21-30 years, in contrast to previously published studies; mean age of patients diagnosed with CNS tumor, in one an American report: was 59 years, in India was 44.5 years and in Egypt was 43 years. (5,13,14) A possible explanation for this discrepancy may lie in the youngest populations in our country.

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

CONCLUSION

CNS tumors are heterogeneous, and they differ not only in their histomorphological features but alsovaries significantly by biologic behavior, anatomic location & age distribution; knowledge of

this fact will often serve to considerably narrow the range of diagnostic possibilities. 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 & 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 profile of various types of CNS tumors. However, a nationwide multicenter study is necessary in the future for improved research.

Limitation of the study

1. No published data available for comparison on the subject in our country and even in Africa very few papers were published.
2. Poor data handling system in our department, some of the cases were lost.
3. some of the request as well as report papers were not properly filled hence difficult to get the appropriate data.

Recommendation

1. Ancillary tests like special stains and immunohistochemistry which increase the diagnostic accuracy and minimize cases signed out with differential diagnosis and/or without definitive diagnosis.
2. Data archives of the department should be improved.
3. Multicenter longer period studies on this subject with better sample size is recommended to make statistically significant conclusion.

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