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Histomorphology of Intracranial Tumors in Benin-City, Nigeria

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ABSTRACT: Intracranial tumors are a heterogenous group of lesions attracting significant morbidity and mortality. Before the establishment of neurosurgical services in the University of Benin Teaching Hospital in 2006, patients with intracranial surgical pathologies in the Edo-Delta axis (and several surrounding states) of Nigeria travelled far to other regions of the country and abroad for diagnoses and treatment. However, in the past thirteen years, a cohort emerged, of patients with intracranial tumors who were diagnosed and treated in our tertiary health institution. To describe the histomorphology of intracranial tumors in the Edo-Delta region of Nigeria. A retrospective database study of intracranial tumors diagnosed at the histopathology department of our hospital between July 2006 and December 2018. Demographic and clinical data were retrieved from the records of the department. Data was analyzed using SPSS 20.0. A total of 150 (65 males and 85 females) intracranial tumors were diagnosed during the period studied i.e. male-female ratio of 1:1.3. Peak incidence was in the 4th decade and mean age was 39.76±20.30. Meningiomas were the commonest intracranial tumors (47.3%); followed by gliomas (23.3%), metastasis (6%) embryonal tumors and pituitary adenomas contributed 5.3% each, locally invasive head and neck tumors (4%). Astrocytomas constituted 68.6% of gliomas; glioblastomas alone constituted 45.83% of astrocytic lesions, 31.4% of all gliomas and 7.3% of intracranial tumors. The commonest intracranial tumors in children were gliomas (45.8%), mostly ependymomas and pilocytic astrocytomas. Histopathological diagnosis remains pivotal in the management of intracranial tumors, predicting behavior, and determining treatment and the prognosis of the lesion. The patterns of occurrence of intracranial tumors in this study, are similar to that described elsewhere

Keywords: Intracranial Tumors; Central nervous System, Brain tumors, Histopathology

INTRODUCTION

Intracranial tumors (ICTs) are a mixed group of tumors originating from or occurring within the brain and meninges. Intracranial tumors (ICTs) have varying degrees of malignancy. [1] Even benign tumors may be lethal as a consequence of their intracranial location, and their tendency to locally infiltrate or transform to malignancy. [1,2] Malignant primary brain tumours are among the most difficult cancers to treat, with a 5 year overall survival no greater than 35%.[3] Many intracranial low grade tumors of the brain are also not amenable to resection, because they involve large areas of the brain or critical structures. [2] The reported incidence of brain tumors varies between countries worldwide and between ethnic groups within the same country. Developed countries appear to have the highest rates of brain tumors. This may be due to better registration systems in developed countries and discrepancies in diagnostic criteria and brain tumors registration/ data recording between regions.[1,4] . A meaningful, observable, pattern of occurrence of intracranial lesions tend to emerge, with the establishment of neuropathological, and neuroradiological services in support of neurosurgical and neurological services, [5,6] Immunohistochemical techniques and advances in molecular biology have improved understanding of brain tumor pathogenesis, and several clinically significant genetic alterations have been described, which form the basis of the 2016 WHO histologic

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classification of tumors of the Central Nervous System. [7] However, the non-uniform availability of immunohistochemical facilities and resources for molecular diagnosis in health institutions in developing countries makes the adoption of the 2016 WHO classification of brain tumors challenging (and in some places, the 2007 classification[8]); further contributing to inconsistencies in brain tumor data recording.

GLOBOCAN data (2002), showed the annual, global, age standardized incidence of primary malignant intracranial tumours to be approximately 3.7 per 100,000 for males and 2.6 per 100,000 for females. [9,10] GLOBOCAN data 2012 estimates the worldwide incidence of malignant brain and other CNS tumors to be 3.4/100000 person-years. [11] According to Cancer Research UK, the average number of new cases of brain tumors in the UK between 2014 and 2016 was 11,725 per year. These constituted 3% of all new cancer cases within same period; and represented a 36% rise in brain tumor incidence since the early 1900s. [6] Based on GLOBAL BURDEN OF DISEASE data, in 2016 there were 330, 000 new cases of Central Nervous System (CNS) cancers worldwide with age standardized incidence rate of 4.63 per 100, 000. This represents a 17.3% increase in Central Nervous System (CNS) cancer incidence between 1990 and 2016. Based on same data, USA had 24,725 new cases of CNS cancer in 2016. [12]

Trends over time point to a rising incidence of intracranial tumors (ICTs). Factors such as, the use of cell phones; exposure to high tension wires; the use of hair dyes; head trauma; and dietary exposure to N-nitrosourea compounds; have been cited as risk factors for developing intracranial tumors, with conflicting data; but ionizing radiation to the head has been unequivocally identified as a risk factor for glial and meningeal neoplasms. [4] Reports of rising incidence of primary brain tumors may need to be interpreted with caution, as changes and inconsistences in standards of definition and reporting; may be the real reasons for the observed increases [3, 13]. Improved diagnostic imaging and improved access to services have resulted in higher detection rates, better diagnosis of brain tumors. Histopathological technology has also increased the specificity of tumor diagnosis, resulting in an apparent increase in specific tumor types which may merely be a consequence of fewer non-specific diagnoses. Studies in developed nations investigating whether time trends can be accounted for by these factors suggest that the reported increase in brain tumors is likely to be an artefact of changing diagnostic and reporting practice. [3]

It is important to study and describe locally, the occurrence of CNS cancer in our environment to guide practice; while attempting to harmonize data with global records for better understanding of local, regional and global epidemiology of CNS tumors.[14] Though evidence suggest geographical differences in the incidence and distribution of ICTs, there is wide variability even amongst available data on similar populations, when sourced from different databases. [13] The once strikingly different picture of ICTs in Africans compared to the Caucasians, is believed to have be partly influenced by factors such as shorter life expectancy, sociocultural factors that delay patient seeking expert care, poor hospital attendance, and dearth of expertise and facilities needed for proper diagnosis of brain

tumors. [13,14] These factors contribute to a picture of an apparently low incidence of ICTs and a different profile in terms of tumor types. With improvements in medical awareness, Expertise, Neuroimaging techniques and changing socioeconomic conditions and life styles; differences are becoming less marked and one expects a true picture of the frequency of ICTs in Africans to emerge [14]. A 2010 publication of a 5-year review of data from the Ibadan cancer registry showed that, overall, CNS tumors accounted for 2.5% of all newly diagnosed registered tumors between 2004 and 2008. [15,16] This figure is comparable to Cancer Research UK, findings for 2014 to 2016 in which brain tumors constituted 3% of all new cancer cases in the UK. [6] In the past, ICTs were thought to be rare among negroes; [17, 18] but studies on intracranial tumors in the African populations have tended to disprove such claims. [17,19,20] Data on the frequency, sub-types and clinicopathologic characteristics of ICTs in Nigerians and Africans in general, are however still quite limited and the few studies done have varying results.[21] The existing body of data on CNS tumors in Nigerians, from which a national pattern can be drawn continues to enlarge, as more centers acquire the personnel and facilities needed to cater to this group of patients.

We here present an audit of work done at the Histopathology Department of the University of Benin Teaching Hospital, between July 2006 and December 2018, and describe the histomorphology of intracranial tumors in the Edo-Delta region of Nigeria, based on 150 samples of intracranial masses from patients diagnosed in our center.

PATIENTS MATERIALS AND METHODS

This is a retrospective data base study of intracranial tumors (ICTs), diagnosed at the histopathology department of the University of Benin teaching Hospital between July 2006 and December 2018. Data on all intracranial mass specimens received within the study period were retrieved from departmental records and a review of available literature was performed. Cases that were not histopathologically confirmed were excluded from the study. Inflammatory mass lesions (e.g. abscesses and tuberculomas) were excluded from the study. Lesions primarily arising from the skull which did not neurologically encroach on the brain, invade into the cranial cavity, or present as an intracranial mass were also excluded. The data retrieved from departmental records include age, gender, specific histological diagnosis and WHO histologic grades of lesion where available. The cases were classified using the 2007 WHO Classification of Tumours of the Central Nervous System (CNS), though a few entities recently recognized in the 2016 classification of CNS tumors are also included. All diagnoses were made from haematoxylin and eosin stained, 3-5μm sections, of formalin fixed and paraffin embedded samples of intracranial mass specimens. In cases where required, special histochemical and immunohistochemical stains were used to demonstrate neuronal and glial cells, reticulin and collagen.

The data obtained was entered into the Statistical Programme for Social Sciences, version 20 (SPSS Inc, IL, USA) and subjected to analysis. Confidentiality of the identity of the patients and personal health information was maintained.

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RESULTS

This series comprises 150 surgical pathology specimens from brain tumor patients received and diagnosed between July 2006 and December 2018 at the pathology department of the University of Benin Teaching Hospital, Benin-city, Edo State, Nigeria. The total number of surgical specimens received in the department within the same period was 35,215. Intracranial tumors therefore represent 0.43% of surgical specimen received within the study period. The average number of intracranial tumors diagnosed per year was 12, but the actual numbers of intracranial tumor specimens received and histologically diagnosed increased from 1 in 2006 to 26 in 2018 as shown in Figure 1. The ages of patients range between 15 months and 83 years with peak incidence in the 4th decade of life with lesser peaks in the 1st and 6th decades. Mean age of all patients was 39.76±20.30. There were 65 males and 85 females giving a Male-female ratio of 1:1.3. Meningiomas were the commonest intracranial tumors in adults, (51.6%), followed by Gliomas (19%). Other common lesions were Metastatic tumors (7.1%) and Pituitary adenomas (6.3%). Twenty four tumors (16%), occurred in children aged 0-15years; 45.8% of which were glial tumors, mostly Ependymomas and pilocytic astrocytomas. Age distribution (Figure 2); and Age-Sex distribution of patients(Table I); The Histologic types of tumors (Table II); Histologic type-Age distribution (Table III); and Sex distribution of tumor types (Figure 3) are as displayed.

Meningiomas

Meningiomas constitute 47.3% (71) of tumors in this series. There were 21 males and 50 females with male-female ratio of 1:2.4. Age range was 3-75years and mean age was 46.42±18.02years. Where assigned, the Histologic patterns of meningiomas seen include: Syncytial meningioma -28.88%; transitional meningioma -31.11%; fibrous meningioma-22.22%; psamomatous meningioma-8.88%; Microcytic meningioma- 6.66%; and Papillary Meningioma -2.22% (Table V). WHO grades were not always assigned or documented (in earlier years), but where assigned, greater than 96% of meningiomas were WHO grade I/IV lesions.

Glial tumors

There were 35 Glial tumors constituting 23.3% of intracranial tumors were seen in this series. Twenty-four (68.6%) were astrocytomas, while Ependymomas and Oligodendrogliomas accounted for 7(20%) and 4(11.4%) respectively. There were 21 males, and 14 females, giving a male-female ratio of 1.5:1. The age range for glial tumors was 2-65 years. Mean age was 32.80±20.92 years. Overall low grade gliomas made up 51.4% of all glial tumors. The frequencies and percentages of various Glial tumors are as displayed in Table IV.

Astrocytomas constituted 16% of all ICTs in this study. Patients were predominantly males (18), with fewer females(6). Male-female ratio= 3:1. The mean age was 38.13±20.63years and age range was 3-65 years. Glioblastomas account for 45. 83% (11 of 24) astrocytic lesions and 31.4% of all Gliomas in this series. Glioblastomas ranged between 5 and 65years; out of 11 glioblastomas, 9(81.82%) were in their 5-7th decade, one of

which was a gliosarcoma. Others occurred in the first two decades of life. Other astrocytic lesions seen include: Anaplastic astrocytomas (4); diffuse low grade astrocytoma (4); Pilocytic astrocytoma (3); Pilomyxoid astrocytoma (1); and Pleomorphic Xanthoastrocytoma (1).

There were 7 **ependymal lesions**: 1 myxopapillary ependymoma; 4 Ependymomas (WHO grade II/IV) and 2 anaplastic Ependymomas (WHO grade III/IV). Age range was 2-53 years; with modal age group being the first decade (57.14%). Male-female ratio was 1:1.3.
There were 4 **Oligodendrogliomas**, all WHO grade II/IV lesions. Age range was 9-34years. Mean age was 26.00±11.63years. All Oligodendrogliomas were seen in females, majority (75%) were seen in the 3rd and 4th decades.

Embryonal tumors

Embryonal tumors constitute 5.3% (8) of tumors in this series. These include Medulloblastomas (62.5%), Embryonal tumor with neuroblastic differentiation (25%) and Primitive Neuroectodermal tumors (12.5%). Male-female ratio was 7:1. Age range is 15 months to 28 years, with mean age of 15.81±9.89.

Pituitary adenomas

There were 8 Pituitary adenomas, constituting 5.3% of intracranial tumors in this study. Male-female ratio was 1.67:1. age range was 29-83 years, and Mean age was 56.88±17.29 years.

Craniopharyngiomas

Craniopharygiomas constituted 2.7% of tumors seen. All craniopharyngioma pateints were females with ages between 13 and 36, and mean age of 24±11years.

Mesenchymal non-meningothelial tumors

Three mesenchymal non-meningothelial lesions are recorded, consisting of 2 heamangioblastomas, and 1 cavernous hemangioma. This group makes up 2% of all intracranial masses in this series. All were males. Ages ranged between 18-55years. Mean age = 32.00±20.07years. The patients with heamangioblastoma were seen in their 2nd and 3rd decades while the cavernous hemangioma was in the 6th decade.

Neuronal/mixed neuronal glial tumors, cranial/paraspinal nerve tumors, & germ cell tumors

A single case each of central neurocytoma in a 49 year old female; a schwannoma in a 24 year-old male; and, a Germinoma in a 28 year-old male; each constituting 0.7% of tumors in this series, are recorded.

Metastatic tumors constitute 6%(9) of tumors in this series, with male-female ratio of 1: 3.5. Ages ranged between 22 and 64 years. Mean age was 43.67±13.20. Most (88.89%) were metastatic carcinomas. A case of metastatic Giant cell tumor of Bone in a 40 year-old male is also recorded.

Locally invasive Head and Neck tumors extending into the intracranial compartment include 2 tumors each from the Orbit; the Sinonasal region; and the scalp/skull bones. They constitute 4% of ICTs. Specific entities include: intra-orbital embryonal rhabdomyosarcoma; adenoid cystic carcinoma of the lacrimal gland, undifferentiated carcinoma from the sinonasal region; an olfactory neuroblastoma; a squamous cell carcinoma arising from the scalp; and a plasmacytoma involving the skull and scalp. Ages

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ranged between 16 years and 61years with mean age of 40.5±16.35; and a male-female ratio of 1:1.

Miscellaneous tumors

Other mass lesions encountered include 2 epidermoid cysts, both in females; and an Ependymal cyst in a male; all three were posterior fossa lesions in children less than 10 years of age.

No **pineal region, Melanocytic, Lymphoid,** or **Histiocytic tumors** were seen in this series.

DISCUSSION

150 surgical pathology specimens from brain tumor patients were received and diagnosed at an average of twelve per year. The total number of surgical specimens received in the department within the same period was 35,215. Intracranial tumors therefore represent 0.43% of surgical specimens received within the study period. These rates appear to be within the average range observed in major centers in Nigeria. Soyemi et al. reported 56 cases of intracranial tumours seen over 5 years in Lagos, averaging about 11 per year, and representing 0.4% of all surgical biopsies.[22] Jibrin et al. reported 121 intracranial specimens, representing, 0.6% of the total specimen received over an 11-year period, also averaging about 11 per year, 102 of these were intracranial tumors. [21] Olasode et al. in Ibadan reported, 210 intracranial neoplasms, also seen over an eleven year period, but these included surgical as well as autopsy specimens which may account for the much higher number. The study also covered a period when there were fewer neurosurgical facilities in the country and the University College Hospital Ibadan, received neurosurgical patients from a much wider area, including Edo-delta area and the rest of the Niger delta. The total number of surgical specimens received was however not stated. [23]

The peak incidence of all intracranial tumors was in the 4th decade of life with lesser peaks in the 1st and 6th decades. This picture appears to be influenced by the large meningioma group, 25% of which occurred in the 4th decade alone. When meningiomas are excluded, most tumor types peaked individually within the first three decades, with overall peak incidence for all being in the first decade of life for children and the third decade for adults. Studies in Nigerian populations have documented similar trends. Olasode et al., recorded peak ages of occurrence of intracranial neoplasms between five and nine years in children and between 25 and 30 years in adults. [23] Ohaegbulam et al., recorded the highest number of tumors in the first decade, while Jibrin et al., recorded a peak incidence in the 4th decade, perhaps also influenced by a large meningioma component of 41%.[21,24] In adults, meningiomas were the commonest (51.6%), followed by Gliomas (19%). Other common lesions were Metastatic tumors (7.1%) and Pituitary adenomas (6.3%). Twenty four tumors (16%), occurred in children aged 0-15years; 45.8% of which were glial tumors, mostly Ependymomas and pilocytic astrocytomas. Olasode et al., recorded 35.7% in Ibadan, while Jibrin et al., recorded 11.8% in Abuja. In both series Gliomas were the most frequently occurring tumors in children.[21,23] Meningiomas were the most frequent tumor type overall constituting 47.3% of all intracranial tumors. This is high compared to previous studies in our environment. Rates that have been reported vary greatly from 41% in Abuja, to 29% in Lagos; with other studies documenting rates less than 20%. [21,23,24,25]

Male-female ratio amongst meningiomas was 1:2.4 in consonance with well documented female predilection of meningiomas. Some meningiomas (7.1%) occurred in children below sixteen years of age, a rate higher than the 4.9% recorded in Abuja by Jibrin et al. [21] Although WHO grades were not always assigned; where assigned, greater than 96% of meningiomas were WHO grade I/IV lesions and Transitional meningiomas were the most frequent subtype.

Gliomas constituted 23.3% of intracranial tumors in this series similar to rates in other Nigerian studies. [21,24] In this study, low grade gliomas made up 51.4% of all gliomas. Others have documented lower rates.[25] There was a male predominance amongst glioma patients, which was even more pronounced amongst astrocytoma patients, a trend well documented in literature. [26,27] Astrocytomas constituted 16% of all tumors in this study. Studies have documented astrocytomas to be the commonest type of primary intracranial neoplasms, with most common subtype or majority being glioblastomas.[23,26,28] Glioblastomas constituted 45.83% of astrocytic lesions; 31.4% of all Gliomas; and 7.3% of intracranial tumors in this series. The ages of glioblastoma patients ranged between 5 and 65years. Eighty-two percent were in the 5-7th decade while others occurred in the first two decades of life. This, also is a trend in other studies.[23] All Oligodendrogliomas (4) in this series were WHO grade II/IV and occurred in females. They constituted 11.4% of gliomas and 2.7% of all ICTs. Only one occurred in a child. Olasode et al reported 8 oligodendrogliomas, equally divided among children and adults; in which all childhood oligodendrogliomas also occurred in females, but in adults, there was an equal sex distribution. [23] Epidemiological data however suggest that oligodendrogliomas are rare in children; affects men more frequently than women; and is more common in whites than blacks in USA. [26] Ependymomas made up 20% of all gliomas and 4.7% of all ICTs. There was a slight female preponderance and majority (57.14%) occurred in the first decade. Most were low grade lesions.

In the region of the sella were encountered pituitary adenomas, craniopharygiomas and one meningioma. Pituitary adenomas made up 5.3% of all tumors; and craniopharygiomas, made up 2.7%. This is less than what has been reported in other studies in Nigeria which have reported rates up to 22% for pituitary adenomas and 9% for craniopharyngioma. All craniopharyngiomas occurred in females. Embryonal tumors constitute 5.3% (8) of tumors in this series. Male-female ratio was 7:1. Specific entities seen include Medulloblastomas (62.5%), Embryonal tumor with neuroblastic differentiation (25%) and Primitive Neuroectodermal tumor (PNET) (12.5%). Majority (62.5%) occurred in children below 16 years of age, similar to other studies, although Jibrin et al., found an equal distribution of medulloblastomas between adults and children with no sex predilection.[21,23] Three mesenchymal non-meningothelial lesions are recorded, consisting of 2 heamangioblastomas, and 1 cavernous hemangioma. This group makes up 2% of all intracranial tumors in this series. All were male adults. The patients with heamangioblastoma were seen in their 2nd and 3rd decades while the cavernous hemangioma was in the 6th decade. In Olasode's study, three of the ten vascular neoplasms occurred in childhood and the remaining seven cases occurred in adults. While

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all the childhood cases occurred in females, there was a male predominance amongst the adult cases (sex ratio being 5:2). The vascular tumours encountered included haemangioblastoma, capillary teleangiectasia and cavernous haemangioma.[23] A single case each of central neurocytoma in a 49 year old female; a schwannoma in a 24 year-old male; and, a Germinoma in a 28 year-old male; each constituting 0.7% of tumors in this series, are recorded. Metastatic tumors constitute 6% of all ICTs in our study. The proportion metastatic tumors in this study, is much lower than rates observed in the past, but closer to the findings in more recent publications. Odeku recorded that between 1957 and 1971, 28% of intracranial masses seen in Ibadan were metastatic. Olasode et al. record that 23% of intracranial tumors seen in Ibadan between 1980 and 1990 were metastatic lesions. [23] The two commonest sources of secondary neoplasms were choriocarcinoma in adults and disseminated Burkitt's lymphoma in children. In more recent times, Jibrin et al. documented a 4% rate of secondary ICTs in Abuja, between 2005 and 2015; and Ogun et al., looking at central nervous system tumors in children in Ibadan, between 2001 and 2010, noted an almost complete absence of secondary tumors, in contrast to high rates of Burkitt's lymphoma involvement of the CNS documented in previous publications from same institution. [16, 21] This trend of sustained decreasing incidence of secondary tumors of the CNS is likely due to significant improvements in onco-diagnosis, resulting in earlier treatment of cancers in general; and improved treatment of childhood and gynecological diseases, specifically. Head and Neck invasive lesions extending into the intracranial compartment included tumors from the orbit, the sinonasal region, and the scalp/skull bone. The ages of patients ranged from 16 years to 61years and no sex predilection is observed. Similar tumors have been reported in other series. [24] Other miscellaneous intracranial mass lesions encountered include 2 epidermoid cysts, both in females; and an Ependymal cyst in a male; all three were posterior fossa lesions in children less than 10 years of age. Pineal region, Melanocytic, Lymphoid, and Histiocytic tumors were not seen in this series. They are also relatively rare in other studies [29,30,31], though germ cell tumors and primary CNS lymphomas each constituted up to 2-3% of ICTs in some series. [32,33]

Conflict of interest: None.
Abbreviations: ICTs - Intracranial tumors; CNS - Central Nervous system.

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TABLES AND FIGURES

Table I. Age-Sex distribution of patients

Age group	Sex		Total frequency	Percentage
	Male	Female		
<10	8	10	18	12.0
11-20	8	3	11	7.3
21- 30	11	8	19	12.7
31- 40	8	21	29	19.3
41-50	6	15	21	14.0
51-60	10	14	24	16.0
61-70	8	12	20	13.3
71-80	5	2	7	4.7
81-90	1	0	1	0.7
Total	**65**	**85**	**150**	**100.0**

Table III. Histologic types of tumors

CLASS	Frequency	Percentage
Meningiomas	**71**	**47.3%**
Glial Tumors	**35**	**23.3%**
Astrocytoma	24	16.0%
Oligodendroglioma	4	2.7%
Ependymoma	7	4.6%
Pituitary Adenoma	**8**	**5.3%**
Craniopharygioma	**4**	**2.7%**
Embryonal Tumors	**8**	**5.3%**
Neuronal/ Mixed Neuronal-Glial	**1**	**0.7%**
Germ Cell Tumors	**1**	**0.7%**
Cranial Paraspinal Nerves	**1**	**0.7%**
Mesenchymal/ Non Meningothelial	**3**	**2.0%**
Miscellaneous	**3**	**2.0%**
Metastatic Tumors	**9**	**6.0%**
Loc. Inv Head/Neck Tumors	**6**	**4.0%**
Total	**150**	**100.0%**

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Table II: Age-Histologic type distribution

CLASS	AGE GROUPS(years)									TOTAL
	0-10	11-20	21- 30	31- 40	41-50	51-60	61-70	71-80	81-90	
GLIAL TUMORS	8	3	4	5	6	4	5	0	0	**35**
Astrocytoma	3	3	2	2	6	3	5	0	0	24
Oligodendroglioma	1	0	1	2	0	0	0	0	0	4
Ependymoma	4	0	1	1	0	1	0	0	0	7
Embryonal Tumors	2	3	3	0	0	0	0	0	0	**8**
Pituitary Adenoma	0	0	1	1	1	2	1	1	1	**8**
Craniopharygioma	0	2	0	2	0	0	0	0	0	**4**
Mesenchymal/ Non Meningothelial	0	1	1	0	0	1	0	0	0	**3**
Neuronal/ Mixed Neuronal-Glial	0	0	0	0	1	0	0	0	0	**1**
Germ Cell Tumors	0	0	1	0	0	0	0	0	0	**1**
Cranial Paraspinal Nerves	0	0	1	0	0	0	0	0	0	**1**
Miscellaneous	3	0	0	0	0	0	0	0	0	**3**
Metastatic	0	0	2	3	1	2	1	0	0	**9**
Loc. Inv. Head/Neck	0	1	1	0	3	0	1	0	0	**6**
Sub-Total	***13***	***10***	***14***	***11***	***12***	***10***	***8***	***1***	***0***	***79***
Meningiomas	5	1	5	18	9	15	12	6	0	**71**
Total	**18**	**11**	**19**	**29**	**21**	**24**	**20**	**7**	**1**	**150**

Table IV: Histologic types and WHO grades of Glial tumors

WHO GRADE	ASTROCYTOMA	OLIGODENDROGLIOMA	EPENDYMOMAS	TOTAL
WHO I/IV	Pilocytic Astrocytoma 3		Myxopapillary Ependymoma 1	4(11.4%)
WHO II/IV	Diffuse Astrocytoma 4 Pilomyxoid Astrocytoma 1 Pleomorphic Xanthoastrocytoma 1	Oligodendroglioma 4	Ependymoma 4	14 (40%)
WHO III/IV	Anaplastic Astrocytoma 4		Anaplastic Ependymoma 2	6 (17.1%)
WHO IV/IV	Glioblastoma 11			11(31.4%)
Total	**24(68.6%)**	**4 (11.4%)**	**7(20%)**	**35 (100%)**

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Table V: Histologic patterns Meningiomas

Histologic patterns of meningioma	Frequency (%)
Syncytial	13 (28.88%)
Transitional	14 (31.11%)
Fibrous	10 (22.22%)
Psammomatous	4 (8.88%)
Microcystic	3 (6.66%)
Papillary	1 (2.22%)
subtotal	45 (100%)
*Histologic patterns not assigned/documented in 26 (36.62%) of total of 71 cases.	

Figure 1: Number of intracranial masses diagnosed per year, from 2006 to 2018

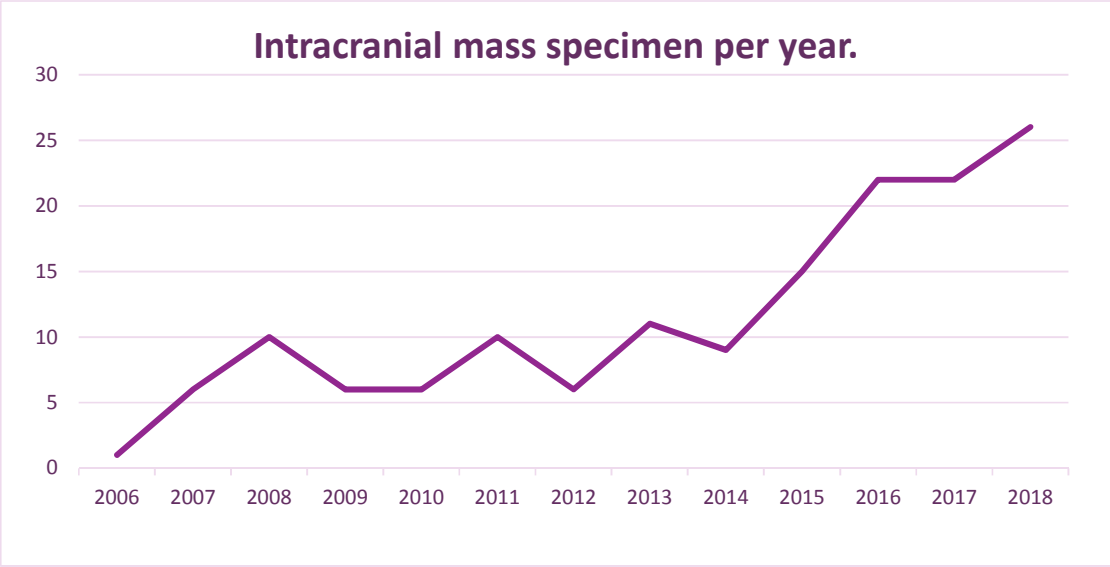

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Figure 2: Age distribution of patients

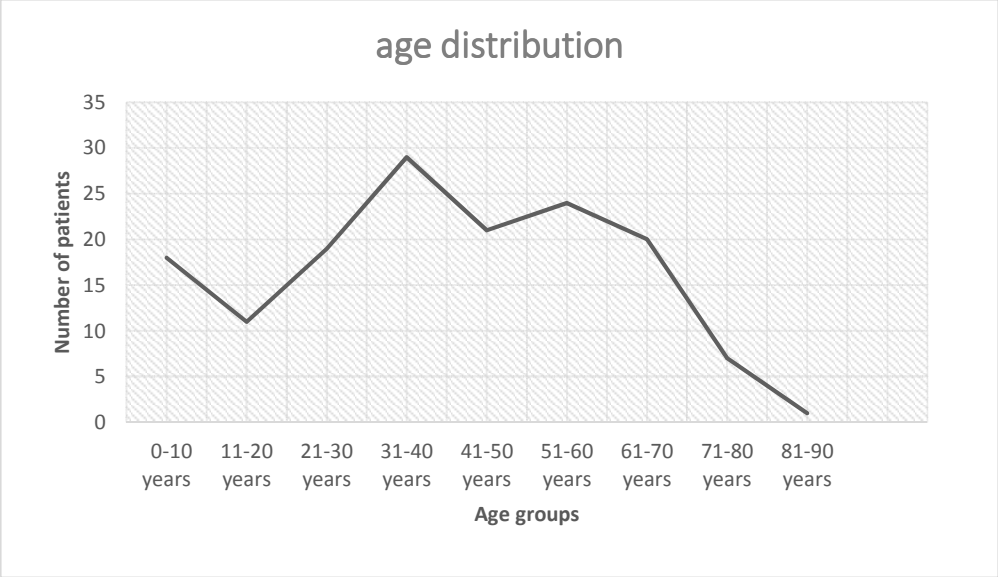

Figure 3: Sex distribution of tumor types