Original Article

Histopathological Pattern Of Intracranial Neoplasms In A Neurosurgical Centre In Nigeria

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ABSTRACT

Background: *The pattern of intracranial neoplasms in Nigeria has evolved over the years, with the introduction of additional neurological facilities in each of the major geopolitical regions of the country. This study represents the most current and largest study from Ibadan, Nigeria, covering a 17-year period.*
Materials and Method: *This was a 17-year histopathological review of all intracranial biopsies seen at the Department of Pathology, University College Hospital Ibadan.*
Results: *Intracranial neoplasms accounted for 1.6% of 82,379 surgical biopsies seen and 0.8% of the 9,463 autopsies performed during the study period. There was a gradual increase over the years from 26 cases in 1991 to 49 cases in 2007. The male to female ratio was 1.3:1. Neuroepithelial neoplasms accounted for 32.8%, meningeal neoplasms 28.6%, and sellar region neoplasms for 21.8% of cases. 91.3% were primary, while 8.7% were metastatic neoplasms. 21.6% of all intracranial neoplasms were infratentorial, while 78.4% were supratentorial. The cerebral convexity, sellar region and posterior cranial fossa were the most common locations of intracranial neoplasms. Astrocytic neoplasms were the most frequent neuroepithelial neoplasms, with pilocytic astrocytomas accounting for 38.6% of the neuroepithelial neoplasms. Transitional meningiomas accounted for 44.6% of the meningeal neoplasms. Pituitary adenoma and craniopharyngioma comprised 14% and 7.9% of all intracranial neoplasms respectively. Metastatic neoplasms included rhabdomyosarcoma (16.1%), Burkitt's lymphoma (9.7%), soft tissue sarcoma (6.5%), malignant melanoma (6.5%), thyroid carcinoma (6.5%) and choriocarcinoma (6.5%).*
Conclusion: *The pattern of intracranial neoplasms displayed in this study reveals several interesting observations, which include similarities with previous published studies in West Africa and other parts of the world.*

Key Words: Histopathological, Pattern, Intracranial, Neoplasm

INTRODUCTION

The neurosurgical unit at the University College Hospital Ibadan, Nigeria happens to be the largest and busiest in the West African sub region. This creates the need for periodic reappraisal of the pattern of intracranial neoplasms in our practice.
Intracranial neoplasms arise from the brain and its covering structures, and each neoplasm is characterized by its own biology, which is a very significant determinant of the clinical presentation, modality of treatment and overall prognosis.
Not much is known regarding the aetiological factors and mechanisms of neoplastic transformation in the human central nervous system (CNS), and relatively few definitive observations regarding the environmental and occupational causes of primary CNS neoplasms have been made.[1] For example, vinyl chloride has been implicated in the development of glioma.[2] Epstein-Barr virus infection, organ transplantation and the acquired immunodeficiency syndrome (AIDS) are involved in the aetiopathogenesis of primary CNS lymphoma.[3,4] Simian virus (SV-40) infection has also been associated with the development of ependymomas.[5]

A number of specific familial tumour syndromes and chromosomal abnormalities are associated with primary CNS neoplasms. These include

neurofibromatosis type I (17q11), neurofibromatosis type II (22q12), Von Hippel-Lindau disease (3p25-26), tuberous sclerosis (9q34, 16p13), Li-Fraumeni syndrome (17p13), Turcot syndrome type 1 (3p21, 7p22), Turcot syndrome type 2 (5q21), and the naevoid basal cell carcinoma syndrome (Gorlin's syndrome) (9q22.3). [6,7]

The study of intracranial neoplasms in Nigeria is still evolving, and most of the existing literature has emanated from studies in Ibadan, where the first neurosurgical facility in Nigeria was established in the University College Hospital Ibadan, by Odeku in 1962.[8] Among other findings, these studies from Ibadan have shown that gliomas are the most common primary intracranial neoplasms in Ibadan, sellar region neoplasms are relatively more frequent than in Caucasians, and that the majority of metastases are due to choriocarcinoma and multicentric CNS involvement by Burkitt's lymphoma.[9-14] The only other studies from Nigeria documented in the literature are by Ohaegbulam *et al.* (1980) from Enugu[15] and by Igun (2001) from Jos.[16] Ohaegbulam *et al.* documented 48 intracranial neoplasms seen over a five-year period at Enugu, Nigeria. They observed that in contrast to Caucasians, their patients had a low incidence of gliomas and high incidence of meningiomas and pituitary neoplasms.[15] Igun observed that brain tumours were the third most frequent tumours encountered and had a poor outcome with mortality of 83%.[16]

Worldwide, tumours of the central nervous system (CNS) account for less than 2% of all malignancies, with approximately 176,000 new cases diagnosed in the year 2000 and an estimated mortality of 128,000.[17] Although the geographical variation in the incidence of CNS tumours is less than for most other human neoplasms, CNS tumours are relatively more common in developed than in developing countries, and their incidence is higher in whites than in blacks. Incidence and mortality rates are also higher in males than in females. [18]

Primary brain neoplasms account for 85% to 90% of all primary central nervous system (CNS) neoplasms. Available registry data from the Surveillance, Epidemiology, and End Results (SEER) database from 1996 to 2000 indicate that the combined incidence of primary invasive CNS neoplasms in the United States is 6.6 per 100,000 persons per year with an estimated mortality of 4.7 per 100,000 persons per year. [19]

The aim of the present study was to determine the histopathological pattern of intracranial neoplasms at our hospital so as to identify any changes in the frequency and patterns of occurrence of intracranial neoplasms in comparison to previous studies from Ibadan, and to compare the results with those of studies from other centres.

MATERIALS AND METHODS

The study covered a seventeen-year period from January 1991 to December 2007. The surgical day books and the original histopathology request cards of the Department of Pathology, University College Hospital, Ibadan, was used as primary sources of information regarding all intracranial neoplasms diagnosed during the study period. In addition, the post-mortem protocol registers were also examined in order to retrieve all cases of primary and secondary intracranial neoplasms diagnosed at autopsy during the study period. Another source of information was the Cancer Registry data on intracranial tumours registered during the study period. The case notes of individual patients were also retrieved in order to obtain additional clinical information.

Information concerning the age, sex, anatomical location and original histological diagnosis were obtained from the above-listed records. Individual cases were histologically verified by retrieving the original glass slides. Where slides could not be retrieved, the paraffin blocks were obtained, re-cut and stained with haematoxylin and eosin. Where the original slides or blocks could not be retrieved, such cases were excluded from further analysis.
The cases were classified and graded using the 2007 World Health Organization Classification for CNS neoplasms. The information obtained was tabulated and analysed using the chi-square test for discrete variables and the Student t test for continuous variables. Levels of statistical significance were set at $p \leq 0.05$.

Ethical approval for the study was obtained from the joint University of Ibadan-University College Hospital, Ibadan Ethical review committee.

RESULTS

Four hundred and nineteen intracranial neoplasms were recorded in the Department of Pathology, University College Hospital, Ibadan, during the study period. These comprised 348 (83.1%) surgical biopsy specimens and 71 (16.9%) autopsy cases. Intracranial neoplasms thus accounted for 1.6% of the 82,379 surgical biopsies seen and 0.8% of the 9,463 autopsies received in the Department of Pathology during the period under review.

After exclusion of unsuitable cases by the criteria earlier outlined, 356 cases were enrolled into the study. These 356 cases consisted of 285 surgical biopsies (80.1%) and 71 (19.9%) autopsy specimens.

Figure 1 shows the annual occurrence of intracranial neoplasms at University College Hospital, Ibadan, during the study period. There was an overall gradual increase from 26 cases per annum in 1991 to 49 cases per annum in 2007.

GENDER AND AGE DISTRIBUTION

There were 204 males (57.3%) and 152 females (42.7%) with a male to female ratio of 1.3:1. The ages of the patients with brain neoplasms at the time of diagnosis ranged from less than 1 year to 79 years, with a mean age of 32.7 ± 18.9 years. There was an overall bimodal age distribution, with peak ages of occurrence during the first and fifth decades of life (Figure 2). The mean age of male patients with brain neoplasms (32.9 ± 19.8 years) was not significantly different from the mean age of female patients (32.3 ± 17.7 years), t = 0.284, degree of freedom (d.f.) = 354, p = 0.8. There were 264 (74.2%) adults (comprising 147 males and 117 females) and 92 (25.8%) children (comprising 57 males and 35 females) with an adult to child ratio of 2.9:1. Intracranial neoplasms occurred most frequently in adult males. However, this finding was not significant, χ^2 = 1.1, d.f = 1, p= 0.3.

MAJOR CLASSES OF CNS NEOPLASMS

Table 1 shows the major classes of CNS neoplasms in the present study. Neuroepithelial neoplasms (32.8%), meningeal neoplasms (28.6%) and sellar region neoplasms (21.8%) were the three most common CNS neoplasms. Metastatic neoplasms accounted for only 8.7% of the cases, while primary neoplasms accounted for 91.3%.

Male preponderance occurred in all the groups of CNS neoplasms, except in the meningeal neoplasms and cranial nerve neoplasms, where female predominance was observed. Neuroepithelial and germ cell neoplasms predominantly occurred during the first two decades of life. The other groups of CNS neoplasms predominantly occurred between the fourth and sixth decades of life.

ANATOMICAL DISTRIBUTION OF CNS NEOPLASMS

Seventy-seven neoplasms (21.6%) were located in the infratentorial compartment, while 279 neoplasms (78.3%) were supratentorial. Thus, the ratio of supratentorial to infratentorial neoplasms was 3.6:1. The cerebral convexity, base of skull/sellar region and posterior cranial fossa were the most common locations for intracranial neoplasms.

Primary neoplasms occurred most frequently in the cerebral convexity (37.8%), followed by the base of skull/sellar region (33.8%) then the posterior cranial fossa (21.5%), and were multifocal in 2.2% of cases. Secondary neoplasms occurred most commonly in the cerebral convexity (67.7%) and were multifocal in 25.8% of cases. Both primary and secondary CNS neoplasms were more frequently supratentorial than infratentorial. The ratio of supratentorial to infratentorial neoplasms in males (3.3:1) was less than that in females (4.2:1). However, this difference was not significant, χ^2 = 1.0, d.f. = 1, p = 0.3.

The ratio of supratentorial to infratentorial neoplasms in adults (6.5:1) was significantly greater than the ratio of supratentorial to

infratentorial neoplasms in children (1.2:1), χ^2 = 42.2, d.f. = 1, p< 0.001.

There was a predominance of supratentorial occurrence among each of the major groups of the neoplasms except for germ cell and cranial nerve neoplasms.

HISTOLOGICAL TYPES OF CNS NEOPLASM

Neuroepithelial neoplasms

Astrocytic neoplasms were the most frequent neuroepithelial neoplasms, accounting for 88 cases (61.5%), followed by embryonal (17.5%) and ependymal neoplasms (7.7%). Each of these neoplasms was more common in males than females.

There was an overall bimodal age distribution, with peaks in the first and sixth decades of life, but the age distribution of astrocytic neoplasms was trimodal with peaks in the first, fourth and sixth decades. By contrast, ependymal and embryonal neoplasms both had a unimodal peak incidence in the first decade of life, while oligodendroglial neoplasms were most frequent in the second decade of life. The overall mean age of patients with neuroepithelial neoplasms was 22.9 $\pm$ 19.6 years. The mean age for males was 30.9 $\pm$ 20.0 years was less than that of the females which was 24.0 $\pm$ 17.7 years; t = 1.9, d.f.= 1, p= 0.054.

Eighty-three (58%) of the neuroepithelial neoplasms were supratentorial, while sixty (42%) were infratentorial. All histological types of neuroepithelial neoplasms displayed supratentorial predominance, except for embryonal neoplasms, which displayed infratentorial predominance.

Astrocytic neoplasms

There were 88 cases of astrocytic neoplasms (comprising 61.5% of the neuroepithelial and 24.7% of all CNS neoplasms). Thirty-five (39.8%) of the astrocytic neoplasms were WHO grade I neoplasms, ten (11.4%) were grade II, and sixteen (18.2%) were grade III neoplasms.

They occurred in 54 males and 34 females. The age range was from 3 years to 79 years, with a mean age of 28.7 $\pm$ 20 years. The mean age for males (31.4 $\pm$ 21.3 years) was higher than that of females (24.5 $\pm$ 17.4 years), although this was not significantly different; t = 1.6, d.f.= 80, p= 0.1.
Pilocytic astrocytoma accounted for 34 cases (38.6%), glioblastoma accounted for 27 cases (30.7%), anaplastic astrocytoma accounted for 16 cases (18.2%) while gemistocytic astrocytoma accounted for five cases (5.7%). Most histological variants of astrocytoma showed a male preponderance, apart from pilomyxoid astrocytoma and gemistocytic astrocytoma.

Pilocytic astrocytoma, pilomyxoid astrocytoma and subependymal giant cell astrocytoma predominated in the first decade of life. Anaplastic astrocytoma predominated in the fourth decade, while glioblastoma had a peak in the sixth decade. Pilocytic, pilomyxoid and subependymal giant cell astrocytomas predominated in children, whereas anaplastic astrocytoma and glioblastoma were adult neoplasms.

One case of subependymal giant cell astrocytoma occurred in an 8 year old male. It was located in the right lateral and third ventricles of an 8 year old male. This patient presented with classical clinical features of tuberous sclerosis (café au lait spots, shagreen patches and facial angiofibromas). He died a few hours after surgical excision of the intracranial tumour.[24] Except for the pilocytic astrocytomas, which were predominantly cerebellar (64.7%) there was a supratentorial predilection among higher grade astrocytomas (particularly anaplastic astrocytomas (75%) and glioblastoma (74.1%).

Embryonal neoplasms

The embryonal neoplasms (25 cases) accounted for 17.5% of the neuroepithelial neoplasms and 7% of all central nervous system neoplasms.
They comprised 23 medulloblastomas and 2 neuroblastomas. They were all WHO grade IV neoplasms and affected 18 males (72%) and 7 females (28%). Whereas medulloblastomas showed a male predominance, with a male to female ratio of 2.8:1, neuroblastomas showed an equal sex frequency. The peak age of occurrence of embryonal neoplasms overall and of medulloblastomas was in the first decade of life. Eighteen (78.3%) of the medulloblastomas occurred in children. However, neuroblastoma was

restricted to adults. The mean age of patients with medulloblastoma (11.5 ± 12.7 years) was less than that of patients with neuroblastoma (45 ± 22.6 years); t = -2.1, d.f. = 1.055, p = 0.3.
Embryonal neoplasms occurred more commonly in the infratentorial region, affecting 18 children and 5 adults, while both patients with supratentorial neoplasms were adults. The most frequent location of embryonal neoplasms was in the cerebellum, which was the location of all of the medulloblastomas. One of the neuroblastomas was dural based, while the second affected the optic nerve.

Ependymal neoplasms

Eleven ependymal neoplasms were seen in this study, constituting 7.7% of the neuroepithelial and 3.1% of all CNS neoplasms. Nine of these were WHO grade I /II neoplasms (well-differentiated ependymoma) and two were WHO grade III neoplasms (anaplastic ependymoma).

Seven patients with ependymoma (63.6%) were males and four (36.4%) were females. Four neoplasms occurred in adults and seven in children. The peak age of occurrence for both grade II and III neoplasms was in the first two decades of life.

All four adult neoplasms were supratentorial, whereas four (57.1%) of the paediatric neoplasms occurred in the fourth ventricle.

Oligodendroglial neoplasms

Eight cases were seen in this family constituting 5.6% of the gliomas and 2.2% of all CNS neoplasms. Six oligodendrogliomas were well-differentiated (WHO grade II) neoplasms and two were anaplastic (WHO grade III) neoplasms.

Five (62.5%) cases occurred in males and three (37.5%) occurred in females. Three neoplasms occurred in children and five in adults. The peak occurrence of oligodendroglial neoplasms occurred in the second decade of life, accounting for four (50%) of the cases.

All of the neoplasms arose within the cerebral hemispheres, and the most common location was in the frontoparietal region.

MENINGEAL NEOPLASMS

One hundred and one cases (28.4% of all CNS neoplasms) were neoplasms of the meninges. Ninety-four (93.1%) were meningiomas, four (3.96%) were mesenchymal neoplasms and three (2.97%) were haemangioblastomas.

Meningiomas

Eighty-four (89.4%) of the 94 meningiomas were WHO grade 1 (benign meningiomas), including transitional, meningothelial, and fibroblastic variants, in descending order of frequency. Three (3.6%) meningiomas were WHO grade II (atypical meningiomas), while seven (9.9%) were WHO grade III (anaplastic meningiomas).

Fifty-eight (57.4%) occurred in females and 43 (42.6%) occurred in males. Fifty-three of the female neoplasms were grade I, two were grade II and three were grade III meningiomas. By contrast, thirty-four of the male neoplasms were grade 1, four were grade II and five were grade III meningiomas. Although grade II and grade III neoplasms were both relatively more common in males than in females, this was not statistically significant; $\chi 2 = 3.158$, d.f. = 2, p = 0.2.

The overall peak age range of occurrence was in the fifth decade of life. However, whereas the peak age was in the fifth decade for meningiomas, mesenchymal neoplasms had a peak occurrence in the third decade. Eighty-eight (93.6%) of the 94 meningiomas occurred in adults, while six (6.4%) occurred in children. Seventy-eight of the adult meningiomas were WHO grade I, three were grade II and seven were grade III neoplasms. All of the six meningiomas in children were WHO grade I neoplasms. However, this difference was not statistically significant, due to the small number of cases; $\chi 2 = 0.763$, d.f. = 2, p = 0.7.
Eighty-five of the 94 meningiomas (90.5%) were supratentorial in location, while nine meningiomas (9.5%) were infratentorial. All of the major histological types of meningioma displayed a predominantly supratentorial location. The most common sites for meningioma were in the cerebral convexity, base of skull and sellar region and posterior cranial fossa in descending order of frequency.

Mesenchymal neoplasms of the meninges

The mesenchymal neoplasms of the meninges comprised four haemangiopericytomas (three being WHO grade II and one being WHO grade III). Two of the haemangiopericytomas were infratentorial, while the remaining two were supratentorial.

Haemangioblastoma

There were three cerebellar haemangioblastomas. These neoplasms occurred in a 21 year old male, a 23 year old male and a 42 year old female. All three cases were WHO grade I neoplasms.

Sellar Region Neoplasms

These comprised fifty pituitary adenomas and 28 craniopharyngiomas.

Pituitary adenomas

These neoplasms occurred in 29 males (58%) and 21 (42%) females. The peak occurrence was in the fifth decade of life. All of the pituitary adenomas occurred in adults.

Craniopharyngiomas

These neoplasms were all classified as WHO grade I neoplasms. They occurred in seventeen male (60.7%) and eleven female (39.3%) patients. They were most frequent in the second decade of life and then declined in frequency with increasing age.

GERM CELL TUMOUR

There was one germ cell tumour, accounting for 0.3% of all CNS neoplasms. This was an immature (malignant) teratoma in the left cerebral hemisphere of a 3 year old boy.

CRANIAL NERVE TUMOUR

There was one cranial nerve tumour, accounting for 0.3% of all CNS neoplasms. This was a schwannoma located in the cerebellopontine angle of a 44 year old woman.

TUMOUR OF THE HAEMATOPOIETIC SYSTEM

There was haematopoietic system tumour, accounting for 0.3% of all CNS neoplasms. This was a lymphoblastic lymphoma (high grade non-Hodgkin's lymphoma) in the temporoparietal cortex of a 31 year old male. The HIV status of this patient was not known.

METASTATIC NEOPLASMS

Metastatic neoplasms were 31 in number, accounting for 8.7% of all CNS neoplasms. They occurred most frequently in the fifth and sixth decades of life (Table 1). Twenty-four cases (77.4%) occurred in adults while seven cases (22.6%) occurred in children.

The male to female gender ratio of children with metastatic neoplasms (2.5:1) was not significantly greater than that of the adults (2:1); $\chi 2 = 0.560$, d.f. =1, $p = 0.6$.

The majority (93.5%) of the cases were supratentorial and the most common site was the cerebral cortex. The most common histological type was rhabdomyosarcoma with 5 cases consisting 16.1% of the metastatic neoplasms.

DISCUSSION

The neurosurgical unit of the University College Hospital, Ibadan serves most of the western states of Nigeria, which collectively have a population of over twelve million people.[31] The University College Hospital, Ibadan is the largest teaching hospital in the south western geopolitical zone of Nigeria and the hospital provides a major part of the adult and paediatric neurology, neurosurgery and neuropathology services in this area.

A meaningful pattern of occurrence of CNS neoplasms appears to have emerged in Ibadan, with the gradual expansion of available neurological, neurosurgical and pathology services in the teaching hospital[13,14,24,26].

This analysis of 356 intracranial neoplasms represents the largest and most recent compilation of data that has emerged from Ibadan, Nigeria (Figure 1).

The present study has revealed that there has been an overall gradual increase in the annual occurrence of CNS neoplasms in Ibadan. This agrees with the earlier observation by Olasode *et al* that with improvement in neurosurgical facilities, more cases of intracranial neoplasms are being diagnosed in Ibadan.[13,14]

TABLES AND ILLUSTRATIONS

Figure 1

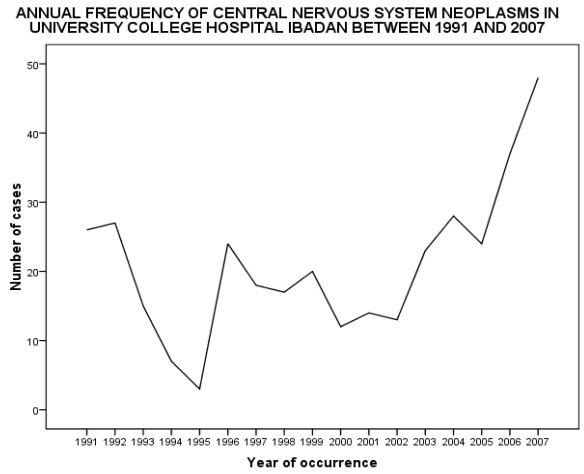

Figure 2

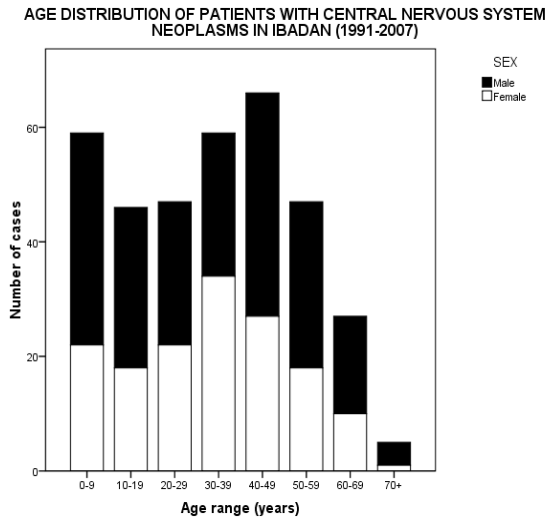

Figure 3

GENDER DISTRIBUTION OF CENTRAL NERVOUS SYSTEM TUMOURS IN IBADAN (1991-2007)

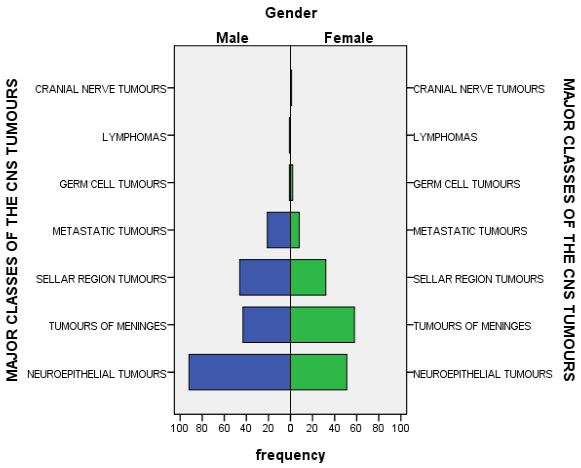

Figure 4

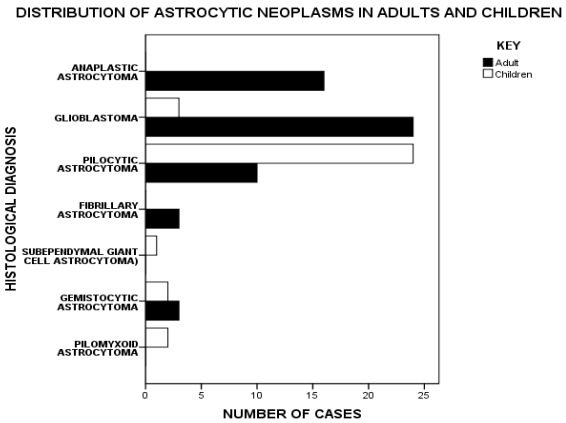

TABLE 1- MAJOR CLASSES OF CNS NEOPLASMS

MAJOR CLASSES	AGE RANGE (YEARS)								TOTAL
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	≥70	
Neuroepithelial neoplasms	41	27	20	17	13	16	6	3	143
Sellar region neoplasms	7	10	10	19	19	7	6	0	78
Neoplasms of meninges	5	4	14	19	27	18	12	2	101
Metastatic neoplasms	5	5	3	3	6	6	3	0	31
Germ cell neoplasms	1	0	0	0	0	0	0	0	1
Cranial nerve neoplasms	0	0	0	0	1	0	0	0	1
Lymphomas	0	0	0	1	0	0	0	0	1
Total	59	46	47	59	66	47	27	5	356

Considering the anatomical distribution, the majority of intracranial neoplasms in the present study were supratentorial, with supratentorial to infratentorial tumour ratios of 3.6:1 overall, 6.5:1 in adults and 1.2:1 in children (Figure 2).

The last ratio is similar to that of 1.125:1 reported in the childhood series of Aghadiuno *et al* from Ibadan.[26] Our findings also agree with those of the earlier study of Idowu *et al* from Ibadan.[27] Huang *et al* reported a relatively lower ratio of 2.44:1 among Chinese patients.[28]

Neuroepithelial neoplasms consisted 32.8% of all the central nervous system neoplasms and showed a male preponderance with high frequency within the first two decades of life (Figure 3). These findings are similar to the findings by Olasode *et al*. who observed that 33.3% of all intracranial neoplasms were neuroepithelial neoplasms, and which also accounted for 57% of all childhood intracranial neoplasms.[13,14]

In this study, astrocytic neoplasms (61.5%), embryonal neoplasms (17.5%), and ependymal neoplasms (7.7%) were the three most common neuroepithelial neoplasms (Figure 4). These findings are in contrast to the findings by Olasode *et al*. in an earlier study from Ibadan, where the three most common neuroepithelial neoplasms were astrocytic neoplasms (75.7%), oligodendrogliomas (11.4%) and embryonal neoplasms (11.4%).[13,14] This suggests that the relative frequency of oligodendrogliomas has declined, whereas that of ependymoma has increased. The reason for this difference is not clear.

There was a single case of subependymal giant cell astrocytoma in the right lateral and third ventricles of an 8-year-old male. This patient presented with clinical features of tuberous sclerosis. This case has been exhaustively documented in a previous case report.[24]

There was an overall bimodal age distribution which peaked in the first and sixth decades of life. By contrast, analysis of the data of Olasode *et al* reveals a peak during the third decade of life. The age distribution of astrocytic neoplasms in our present study displayed an initial peak in the 1st decade (agreeing with the findings of Olasode *et al*).[13,14] Aghadiuno *et al* noted that astrocytoma was the most common primary intracranial neoplasm in children.[26] In contrast to this finding, Izuora *et al* reported that craniopharyngioma was the most common childhood tumour in Enugu.[29] Astrocytic neoplasms displayed 2 subsequent peaks in the fourth and sixth decades, due to glioblastoma, anaplastic astrocytoma and gemistocytic astrocytoma. In the study of Olasode *et al*, astrocytic neoplasms were rare in patients aged above 49 years of age, which is in contrast to our findings.[13,14]

Ependymal and embryonal neoplasms both had a unimodal peak frequency in the 1st decade of life. This agrees with findings of Aghadiuno from Ibadan, Nigeria. Izuora *et al* from Enugu, Nigeria noted that in their childhood series, medulloblastoma was confined to the first 5 years of life.[29]

Meningeal neoplasms accounted for 28.4% of all intracranial neoplasms in the present study, with Ninety-four (94%) being meningiomas, four (4%) mesenchymal neoplasms and three (3%) haemangioblastomas. By contrast to our findings, meningiomas only accounted for 11.4% of all intracranial neoplasms in the study of Olasode *et al*.[13,14] In the study of Idowu *et al* also from Ibadan, meningiomas accounted for 23% of primary intracranial neoplasms.[27] These results indicate that there has been an increase in the relative frequency of meningiomas in Ibadan since the period covered by the study of Olasode *et al*.[13,14] Our findings of female preponderance of the meningiomas were similar to the findings by of Sorour in Egypt[23] and that of Idowu[27] it however differs from the findings of Olasode[13,14] and Odeku[9,10] in which a male predominance was reported. These findings might be due to increasing presentation of females with meningiomas for orthodox medical treatment.

The finding in this study that transitional meningiomas were the most frequent type is similar to finding of previous studies from Ibadan.[9,21]

In this study, craniopharyngiomas accounted for 7.9% of all intracranial neoplasms and 35.9% of sellar region neoplasms, and were most frequent in the second decade of life. Olasode *et al* from Ibadan reported that craniopharyngiomas comprised 9.1% of intracranial neoplasms, which agrees fairly well with the present study, while Idowu *et al* reported that 15.9% of all primary intracranial neoplasms were craniopharyngiomas.[14,15,27] The present study and that of Olasode *et al* included both primary and secondary neoplasms, whereas that of Idowu *et al* concentrated only on symptomatic primary neoplasms, which accounts for this discrepancy. Our study and both previous studies also reported a preponderance of these neoplasms in children, as had earlier been reported by Adeloye *et al*, also from Ibadan.[13,14,26,27,] These findings are similar to that of Izuora in Enugu about 2 decades ago where he noted the preponderance of craniopharyngiomas among childhood neoplasms from Enugu, Nigeria[29].

Pituitary adenomas comprised 14% of all intracranial neoplasms and 68.1% of the sellar region neoplasms, with a male to female ratio of 1.4:1. This is comparable to the findings of Olasode *et al* and Idowu *et al*, in which pituitary adenomas accounted for 17.1% and 16.8% of all intracranial neoplasms respectively, with a male to female ratio of 1.25:1 and 1.4:1, respectively.[14,15,27] In contrast to these findings, Odeku *et al* reported a female preponderance for pituitary adenomas in Ibadan.[9,11]

The peak occurrence of pituitary adenomas was in the fifth decade of life, similar to the finding of Olasode *et al*, but differing slightly from Odeku's finding of a peak incidence in the fourth decade.[10,11,14] In Caucasian series, the peak occurrence of pituitary adenomas is between 30 and 50 years, which agrees with our findings, but there is a female predominance, unlike what has been observed in the present study.[30]

Metastatic neoplasms accounted for 8.7% of all CNS neoplasms and occurred most frequently in the fifth and sixth decades of life. By contrast, 3% of all CNS neoplasms in the study of Olasode *et al* were metastatic neoplasms.[13,14] This difference may partly be accounted for by the decline in the rate of post-mortem examinations in our centre. There has been a progressive decline in the autopsy rate in Ibadan from 19% in 1984 to 3.6% in 2003.[31] This decline in autopsy rates will result in reduced detection of metastatic CNS neoplasms.

Twenty-four cases (77.4%) occurred in adults while seven cases (22.6%) occurred in children. In the study of Olasode *et al*, the corresponding figures were 72.9% for adult and 27.1% for children, which agrees closely with the present study.[13,14]

The male to female gender ratio of adults with metastatic neoplasms (2:1) in the present study was significantly different from the male to female ratio of 0.3:1 reported by Olasode *et al*.[13,14] The major reason for this difference is the predominance of metastatic choriocarcinoma in the series of Olasode *et al*.[13,14]

This study found only one case each of immature teratoma, schwannoma and lymphoblastic lymphoma. In the study of Olasode *et al*, there was only germ cell tumour (germinoma) and no cases of schwannoma or primary CNS lymphoma were observed. This attests to the rarity of these neoplasms in the indigenous population.[13,14]

SUMMARY

In summary, the pattern of intracranial neoplasms displayed in this study reveals several interesting observations, which includes similarities with previous published studies in West Africa and other parts of the world. The major difference between our findings with those of other previous studies were in the metastatic group of neoplasms which in our studies accounted for 8.1% as against 23% in one of the largest previous series.[13,14,] However, the finding of high frequency of astrocytoma and meningiomas are quite similar.

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