Original Article

Histopathologic Pattern of Posterior Cranial Fossa Tumours in a West African Tertiary Hospital

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ABSTRACT

Introduction: The posterior cranial fossa contains many vital structures and mortality of patients with tumours occurring in this area is high. Studies done in other geographic locations showed a higher occurrence of posterior cranial fossa tumours in paediatric patients while benign tumours were more commonly seen. Epidemiological data of tumours in this area in our environment is scarce. This study was done to ascertain the histopathologic pattern of tumours in the posterior cranial fossa in a predominantly black population.

Method: A ten-year retrospective study of histologically diagnosed posterior cranial fossa tumours seen in our hospital facility was done. A total of 72 cases in which neurosurgical intervention was carried out were identified and this included all age groups. The age, sex, site of tumour and histological diagnosis were extracted from the patients' records.

Result: Adult patients predominated with 55.6% while the paediatric patients were 44.4%. The male to female ratio in the paediatric patients was 2.56:1 but the ratio was equal in the adult patients. WHO grade 1 tumours were the commonest tumours seen (45.8%) while grade II tumours were the least (4.2%). Medulloblastomas (20.83%), Pilocytic astrocytomas (18.6%) and Meningiomas (8.33%) were the commonest tumours seen. Commonest locations are in the cerebellar hemispheres (56.9%) and the fourth ventricle (13.89%).

Conclusion: Our study showed a higher occurrence of Medulloblastomas in contrast to other studies which have shown more of Schwannomas, a tumour type that was rare in this study. The relatively low number of metastatic tumours in this study may be due to lack of presentation of such patients.

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Introduction

The posterior cranial fossa is the infratentorial cranial space containing the cerebellum and brainstem with the fourth ventricle lying in between these two structures. Mass lesions within this compartment can lead to compression of the brainstem with subsequent herniation and death of the patient. Surgical intervention in the posterior fossa is apt to be fraught with high morbidities and mortality. Tumours in the posterior cranial fossa constitute 54-70% of pediatric brain tumours and 15-20% of brain tumours in adults. They are a heterogeneous group, arising from the structures within the fossa and/or its coverings and can either be benign or malignant with differing clinical presentation, behavior, management and prognosis. Tumours in the posterior cranial fossae are particularly life threatening and have a high morbidity and mortality in patients mainly due to the small space with so many vital structures. Benign tumours in this location are just as important as malignant ones due to their presenting with compression of vital areas in the brainstem.

Several institutional based studies, which involved paediatric and adult patients, have shown differences with the predominant view which suggests that the pediatric age group shows more posterior cranial fossa tumours. In these studies

benign tumours were also the most commonly seen particularly cerebellopontine angle tumours and gliomas both in Children and adults. Previous work done in this center had shown infratentorial tumours occurring more in the pediatric age group. There were however no description of the predominant histological tumour types seen in this surgically important area of the intracranial space.

Most studies of posterior fossae tumours suggested medulloblastomas and gliomas as the most common tumour type seen. Medulloblastoma and pilocytic astrocytoma were frequently seen in the paediatric age group while higher grade gliomas and metastatic tumours were more common in the adult patients. However studies coming from the Indian subcontinent suggests cerebellopontine angle tumours, particularly schwannomas, to be more common both in the paediatric and adult age groups. The study by Rehman et al showed cerebellopontine angle tumours to be the most common tumour both in adults and children while a later study by Dukipati et al had medulloblastoma being more common in children while cerebellopontine angle tumours were more in adults. The most recent study of posterior fossa tumours in a single institution by Gollapali et al had schwannomas constituting fifty percent of the tumours seen although distribution of the tumour within age groups was not mentioned.

Classification of central nervous system based tumours was initially based on their histogenesis. This classification system has been greatly modified in some of the tumours, particularly with diffuse gliomas and medulloblastomas, with the introduction of genetic mutations characteristic of different tumour types in their histological tumour type. However, the WHO has further introduced a grading system which helped to prognosticate and predict treatment outcomes. Continuing with the 2007 classification, the 2016 WHO classification of Central Nervous System tumours has graded neoplasms of the intracranial space into four based on their malignant behavior and recurrent potential(10). The grading system is based on the biological behavior of the tumour and their aggressiveness and helps to stratify different tumour types with regard to therapy and prognosis. This is particularly important in an area such as the posterior cranial fossa with many closely packed important structures which can easily be infiltrated by the more malignant tumours. This study is carried out to observe the frequency, histopathologic and grading pattern of posterior cranial fossa tumours in children and adults.

METHODS

This is a retrospective study of Nigerian patients who presented to the University College Hospital, Ibadan between 2004 and 2014 with clinical and radiological features of intracranial space occupying lesions within the posterior cranial space. The Department of Pathology in our University teaching hospital, the University College Hospital (UCH) Ibadan, was the largest neuropathological unit in the country during the study period. The data including age, sex, tumor site and histological diagnosis were collected. This study comprises of 72 consecutive cases of posterior cranial fossa tumors in all age groups. Pediatric patients were listed as aged 14 years and less at the time of surgical intervention. Neurosurgical operative intervention was carried out in all these cases. Following surgery, specimens were sent for histopathological evaluation and microscopic diagnosis was made. Non-operated patients were excluded from this study. Tumours were classified according to the 2016 WHO classification of brain tumours(10). SPSS version 20 was used to determine the descriptive statistics and chi square was used to determine the relationship of categorical variables.

RESULTS

A total of 426 patients with intracranial tumours were operated on from 2004 to 2014. Most of the patients were adults while 94 (22.1%) were in the paediatric age group. Only 72 (16.9%) of the total tumour seen were in the infratentorial region (Fig. 1). A total of 44 males and 28 females had tumours in the posterior fossa with a gross male to female ratio of 1.5:1.

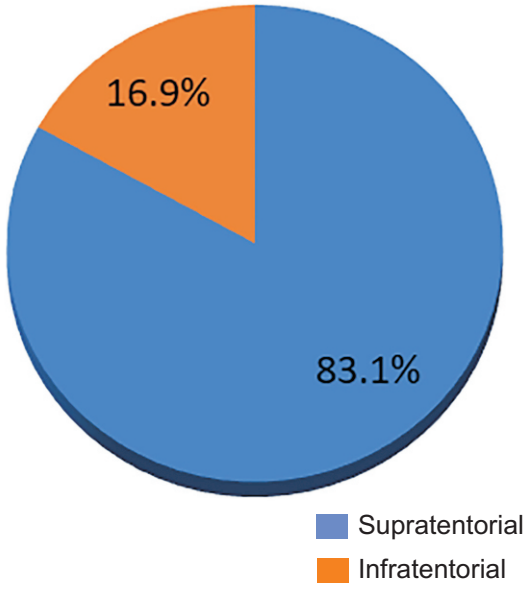

Fig 1: Distribution of tumour location in patients with intracranial tumours during the study period

During the study period, 34.04% (32) of the 94 pediatric patients seen had posterior fossa located tumours with 23 of them being below the age of 10yrs. In contrast, only 12.05% (40) of the adult population's tumours were in the posterior fossa. There was a significant difference in the occurrence of posterior fossa tumours among children of both sexes with a male to female ratio of 2.56:1 (χ=0.012). There was however no significant difference in posterior fossa tumours occurring in adults of both sexes with a ratio 1.11:1 (χ=0.542) (Fig. 2).

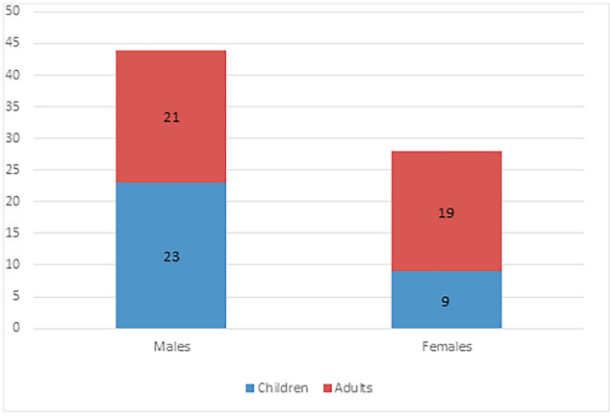

Fig 2: Frequency distribution of age and sex among patients with posterior fossa tumours

More than half (56.94%) of the infratentorial tumours were in the cerebellar hemispheres with the fourth ventricle (13.89%) and the cerebellopontine angle (12.5%) being the second and third commonest tumour locations (Fig. 3).

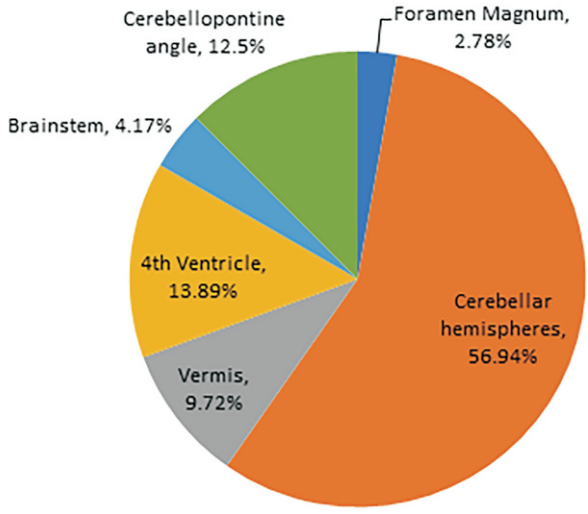

Fig 3: Location in percentages of posterior fossa tumours

In the paediatric patients, the location of tumours were more common in the fourth ventricle, vermis and brain stem compared to the adult population (fig. 4).

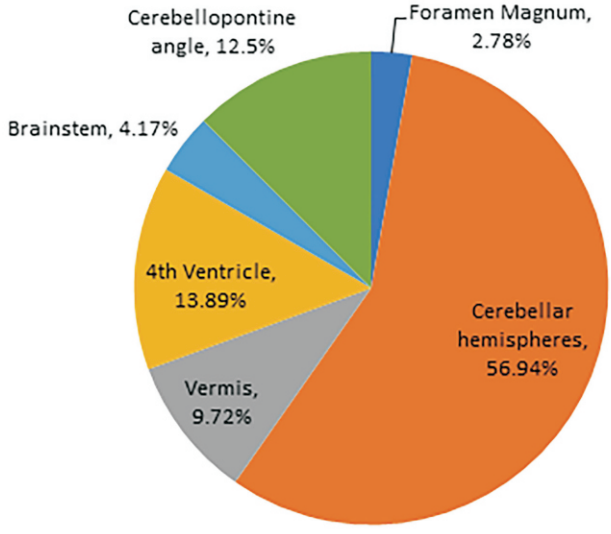

Fig 4: Location in percentages of posterior fossa tumours in paediatric patients

However cerebellar hemispheric location was more in the adult population compared to the paediatric

population (fig. 5). Interestingly, the percentage of tumours located in the cerebellopontine angle were the same in both population of patients.

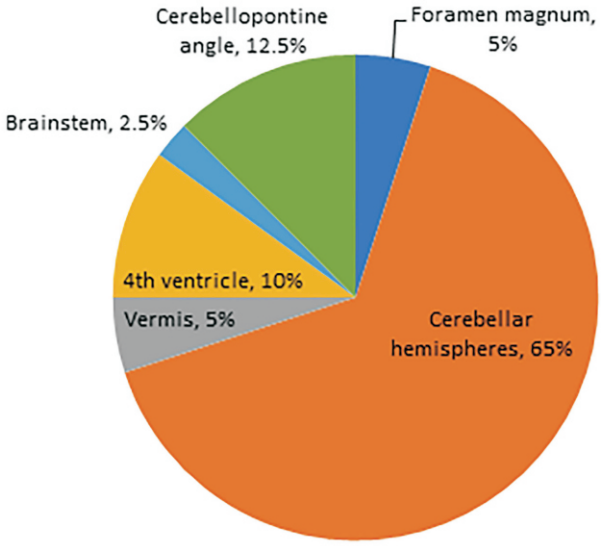

Fig 5: Location in percentages of posterior fossa tumours in adult patients

In the study population in general, the commonest tumours seen were medulloblastomas (20.83%), pilocytic astrocytomas (18.6%) and meningiomas (8.33%) (Table 1).

Table 1: Histology of posterior fossa tumours

HISTOLOGY	FREQUENCY	PERCENTAGE
Medulloblastoma	15	20.8
Pilocytic astrocytoma	13	18.1
Ependymoma	5	6.9
Anaplastic ependymoma	2	2.8
Anaplastic astrocytoma	3	4.2
Meningioma	6	8.3
Schwannoma	2	2.8
Immature teratoma	2	2.8
Mature teratoma	1	1.4
Atypical teratoid/Rhabdoid tumour	1	1.4
Hemangioblastoma	5	6.9
Glioblastoma	2	2.8
Pinealoblastoma	1	1.4
Metastases	3	4.2
Paraganglioma	2	2.8
Choroid plexus papilloma	1	1.4
Glomus tumour	2	2.8
Diffuse astrocytoma	1	1.4
Others	5	6.9
Total	**72**	**100.0**

The most common histological tumour type in the adults was meningioma representing 15.0% while medulloblastoma and haemangioblastoma each accounted for 12.5%. Only 3 (7.5%) of the tumours were metastases. However, in the paediatric population, pilocytic astrocytomas were the most common tumour type accounting for 34.38%, followed by medulloblastoma (31.25%). Most of the tumours in the paediatric age group had a male preponderance except for astrocytomas (Table 2). This was however not the case in the adult group in which more of the tumours seen had a female preponderance (Table 3).

Table 2. Histological tumour types in Paediatric patients

TUMOUR TYPE	MALE	FEMALE
Medulloblastoma	6	4
Pilocytic Astrocytoma	9	2
Diffuse Astrocytoma	-	1
Tuberculoma	1	-
Ependymoma	2	1
Glioblastoma	1	-
Atypical teratoid/Rhabdoid tumour	1	-
Choroid plexus papilloma	1	-
Anaplastic Ependymoma	1	-
Immature Teratoma	1	1
Total	23	9

Table 3. Histological tumour types in the adult Patients

TUMOUR TYPE	MALE	FEMALE
Pinealoblastoma	1	-
Haemagioblastoma	2	3
Medulloblastoma	3	2
Pilocytic Atrocytoma	1	1
Anaplastic Astrocytoma	2	1
Glomus tumour	2	-
Meningioma	2	4
Paraganglioma	-	2
Ependymoma	1	1
Schwannoma	2	-
Metastasis	1	2
Mature Teratoma	-	1
Anaplastic Ependymoma	-	1
Glioblastoma	1	-
Arachnoid cyst	-	1
Others	3	-
Total	21	19

DISCUSSION

The presence of a mass lesion in the posterior cranial fossa can result in adverse effects for the patient. With obstruction of flow of cerebrospinal fluid, obstructive hydrocephalus can occur with the patient presenting with features of raised intracranial pressure. During surgical intervention, important neural and vascular structures can be injured resulting in morbidities and mortality for the patient. These are some of the reasons why tumours of the posterior cranial fossa are of importance.

Our study shows that posterior fossa tumours accounted for 16.9% of all tumours operated in our centre in the study period. The patients' age ranged from 10 months to 87 years. Amongst children that presented, posterior fossa tumours made up 34.04% which is less than what was documented by Zakrzewski et al (11) (47%) in Poland but similar to findings by Rehman et al(2) in Lahore, Pakistan (38.7%). The frequency increases to 41.1% in patients that are less than 10 years old in this study, a similar finding to other studies by Arora et al(12) and Wanyoike (13), which also showed a higher frequency of tumours in the younger age group. In a previous study by Ogun et al(5) infratentorial tumours made up 49.4% of childhood tumours in Ibadan. Infratentorial tumours were seen in 66.7% of cases in Karachi by Ahmed and coworkers(14). There were 44 males and 28 females in this study with a male to female ratio of 1.57:1. Previous studies on gender ratio of intracranial tumours obtained in this center have shown a male to female ratio of 1.2:3(5,6,15,16). This male predominance was also reported by Rehman et al(2) and Dukkipati et al(3). Shah et al(8) reported male: female ratio of 1.1:1 while a reversal is seen in a study in Kenya(13), here the ratio of males to females is 1: 1.8.

More than half of the tumours (56.94%) arose from the cerebellar hemispheres and ten cases (18.89%) from the 4th ventricle. In the study by Hanif and Shafqat(17), 38% of infratentorial tumours arose from the hemispheres and 8.5% from the 4th ventricle. Almost two third of the tumours in adults arose from the cerebellar hemispheres with a small percentage arising from the vermis. More tumours are located in the vermis and fourth ventricle in the paediatric population of patients than in adults. The percentage of fourth ventricular tumours in paediatric patients also doubled that of adults in this population but interestingly cerebellopontine angle tumours were of equal rates in both populations. The difference in the rate of tumour location in the vermis and fourth ventricle may probably be reflected in the more frequent occurrence of medulloblastomas and Pilocytic astrocytoma, which have a predilection for the vermis and fourth ventricle, in the paediatric population(7).

Medulloblastoma was the commonest tumour seen in the posterior cranial fossa in this study accounting for 20.83% of all the cases. Adult medulloblastoma constituted 50% of the paediatric medulloblastoma in this study, similar to the finding by Rehman et al(2) who also had the same figure. This was followed by pilocytic astrocytoma which was seen in 18.06%. This contrasts with the study by Rehman et al(2) and Dukkipati et al(3) where acoustic neuromas were the commonest tumours seen, making up 32.25% and 23.07% of posterior fossa tumours respectively. In this series schwannomas accounted for only 2.8% of the cases. For reasons yet unknown, nerve sheaths tumours of the VIIIth cranial nerves, particularly, vestibular schwannoma, or 'acoustic neuromas' are only occasionally encountered in our country both ante- and postmortem. The few cases encountered in the clinical practice are the rare ones seen with the sporadic case of central neurofibromatosis, Nf2.

In the paediatric age group, the most common histological tumour type was pilocytic astrocytoma which make up 34.38% of the tumours. Medulloblastoma accounted for additional 31.25%. This order is similar to the earlier studies by Ogun et al(5) where astrocytomas and medulloblastoma made up 26% and 16.9% respectively though their study included all intracranial tumours. In the series by Ahmed et al(14) 70.4% of infratentorial cases

were medulloblastoma and in the series by Wanyoike(13) medulloblastoma made up 29.7% of posterior fossa tumours in children.

In the adult population, meningiomas are the most common posterior fossa tumour in this series accounting for 15.0% of cases. This is followed by medulloblastoma and haemagioblastoma each accounting for 12.5% of the cases. Meningiomas are uncommon in the paediatric age group as was also seen in this study. In the work by Rehman et al(2) only 2 of the 7 cases of meningiomas were seen in the paediatric age group.

Only 3 cases of metastatic brain tumours in the posterior fossa were seen in this study and all were in the adult population where they represent 7.5% of the cases. This small percentage of the metastases may be due to non-referral of these patients to the neurosurgical service by the primary managing teams.

CONCLUSION

Posterior fossa tumours encompass a wide variety of histological tumour types. There is a great variation in the frequencies of the tumours in age groups. The commonest posterior fossa tumour in this series was medulloblastoma. In the paediatic age group, pilocytic astrocytoma was the most common while meningiomas were the most common in the adult population. There is rarity of metastases in this series which may be due to non-referral of patients with this condition to the neurosurgeons by the primary managing teams.

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