East African Medical Journal Vol. 77 No. 1 January 2000
INTRACRANIAL NEOPLASMS IN IBADAN, NIGERIA
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ABSTRACT

Objective: **To determine the pattern of histopathological variants of intracranial neoplasms, relative distribution of the variants in the age groups and also to determine the gender differences that exist in these tumours.**
Design: **Case control study.**
Setting: **Department of Pathology, University College Hospital, Ibadan, Nigeria.**
Patients: **Two hundred and ten histologically confirmed cases of intracranial neoplasms seen during eleven-year period (1980 to 1990) were analysed.**
Interventions: **Slides of tumours stained with haematoxylin and eosin, reticulin and phosphotungstic acid haematoxylin.**
Results: **Two hundred and ten intracronial neoplasms comprising 172 primary and 48 secondary neoplasms were seen. One hundred and thirty five neoplasms occurred in adults and 75 in children. There was no gender difference, the ratio being 1:1. Gliomas accounted for the largest group of tumours followed by metastases to the brain. Of the gliomas, astrocytoma was the commonest. Craniopharyngiomas were found to be common in children. Germ cell tumours were found to be uncommon.**
Conclusion: **Gliomas are the commonest group of intracranial neoplasms in both adults and children. This is followed by metastatic tumours. Tumours of the sella turcica are predominantly found in children. Involvement of the brain in disseminated Burkitt's lymphomas is predominantly found in Africans as the Burkitt's tumour is uncommon in non Africans.**

INTRODUCTION

The nervous system develops from neuroectoderm in the embryo. The neuroectoderm differentiates into a neuroepithelium from which three primitive tissues are derived, namely, the neuroblast, the spongioblast and the primitive ependymal cell. The definitive neurons, glial cells and ependymal lining are formed respectively from these primitive tissues. Intracranial neoplasms may arise at any level of differentiation of these cells, from the most primitive cell to the terminally differentiated cell. This provided the basis for the older embryogenetic classifications of intracranial neoplasms in which terms like neuroblastoma, spongioblastoma, astroblastoma and ependymoblastoma were coined to indicate neoplasms arising from these primitive cells(1).

Advances in our understanding of the morphobiology of intracranial neoplasms have tended to change the system of classification to incorporate the histogenesis of the neoplasms and the line of differentiation observed by light microscopy.

Bailey and Cushing(1) concluded that intracranial neoplasms were not common in Negroes. The relative rarity of intracranial neoplasms in Negroes, especially in Africa is probably related to the lack of neurosurgical facilities and under-diagnosis. With the establishment of neurosurgical facilities on the continent, intracranial neoplasms are no longer thought to be rare(2).

In 1962, the Rockefeller Foundation of New York established a neurosurgical facility in the Department of Surgery, University College Hospital, Ibadan. The present work aims at examining intracranial neoplasm in Nigerians seen in the University College Hospital, Ibadan and to contribute to the evolving picture of intracranial neoplasms seen in Ibadan, Nigeria from the pathologist's point of view.

MATERIALS AND METHODS

The study covers eleven years, from 1980 to 1990. The surgical day books of the Department of Pathology, University College, Ibadan were scrutinised for all intracranial neoplasms diagnosed during the study period. The post mortem protocol register was also examined, and all the protocol sheets for the study period with a provisional anatomical diagnosis of primary or secondary intracranial neoplasms were examined. Clinical details such as age and sex were obtained from the records of the Cancer Registry of the University of Ibadan. The specimens were processed in paraffin and stained with haematoxylin and eosin. In certain cases, phosphotungistic acid, haematoxylin, reticulin, trichrome and periodic acid Schiff stains were used to demonstrate neuroglia, reticulin, collagen fibres and mucopolysaccharides, respectively.

RESULTS

Two hundred and ten intracranial neoplasms were seen during the study period, out of which 172 (73%) were primary and 48 (27%) secondary neoplasms.

Tables 1 and 2 show the age distribution of intracranial neoplasms in children and adults. Seventy five neoplasms (35.7%) occurred in children, and 135 (64.3%) occurred in adults. The peak ages of occurrence

Table 1

Age and sex distribution of 75 intracranial neoplasms in children

	Type	Age group 0-4 M	0-4 F	5-9 M	5-9 F	10-14 M	10-14 F	Total M	Total F	
(A)	*Primary intracranial neoplasms*									
A1	*Neuroepithelial neoplasms (43)*									
	Astocytomas	4	-	6	9	4	7	14	16	(30)
	Medulloblastoma (PNBT)	-	1	3	3	1	-	4	4	(8)
	Oligodendrogliomas	-	-	-	1	-	3	0	4	(4)
	Glioblastoma multiforme	-	-	-	-	1	-	1	0	(1)
	Ependymomas	-	-	-	-	-	-	0	0	(0)
A2	*Other primary intracranial neoplasms (19)*									
	Craniopharyngiomas	-	-	2	3	3	4	5	7	(12)
	Pituitary adenomas	-	-	-	2	-	1	0	3	(3)
	Vascular tumours	-	3	-	-	-	-	0	3	(3)
	Teratomas	1	-	-	-	-	-	1	(0)	(1)
	Meningiomas	-	-	-	-	-	-	0	0	(0)
	Germinomas	-	-	-	-	-	-	0	0	(0)
(B)	*Secondary intracranial neoplasms (13)*									
	Metastatic tumours	2	1	-	2	1	-	3	3	(6)
	Burkitt's lymphoma	-	-	4	1	1	1	5	2	(7)
	Total	7	5	15	21	11	16	33	42	(75)

Key: M – Male; F – Female

Table 2

Age and sex distribution of 135 intracranial neoplasms in adults

Type	Age group 15-19 M	15-19 F	20-24 M	20-24 F	25-29 M	25-29 F	30-34 M	30-34 F	35-39 M	35-39 F	40-44 M	40-44 F	45-49 M	45-49 F	50-54 M	50-54 F	55-59 M	55-59 F	60-64 M	60-64 F	65-69 M	65-69 F	Total M	Total F	total
(A) *Primary intracranial neoplasms*																									
A1 *Neuroepithelial neoplasms (27)*	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	total
Astocytomas	2	2	0	0	5	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	11	3	14
Glioblastoma Multiforme	0	0	0	0	2	1	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	1	5	3	8
Oligodendrogliomas	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	2	2	4
Ependymoma	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Medulloblastoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2 *Other primary intracranial neoplasms (73)*																									
Pituitary adenomas	0	1	0	0	1	4	4	1	1	1	7	2	1	1	5	0	1	0	0	3	0	0	20	13	33
Meningiomas	1	0	0	2	0	1	0	0	3	2	0	1	2	1	4	0	1	1	0	2	3	0	14	10	24
Vascular tumours	1	1	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	5	2	7
Craniopharyngiomas	1	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	5	2	7
Germiomas	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Teratomas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(B) *Secondary intracranial neoplasms (35)*																									
Metastatic tumours	0	1	0	1	0	3	2	7	0	5	0	2	1	1	2	1	1	1	2	2	0	0	8	24	32
Burkitt's lymphoma	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
Total	6	8	3	4	9	9	12	8	6	9	10	7	5	5	11	1	3	3	4	8	3	1	72	63	135

Key: M – Male; F – Female

of intracranial neoplasms were between five and nine years in children and between 25 and 30 years in adults. Intracranial neoplasms were uncommon above 65 years of age (Table 2).

There was no sex difference overall, the male: female ratio being 1:1. The histological types of intracranial neoplasms encountered in the current study are shown in Table 3. Astrocytomas were the single commonest primary intracranial neoplasms, accounting for 20.9% of the cases. Other relatively common primary intracranial neoplasms encountered included pituitary adenomas (17.1%), meningiomas (11.4%) and craniopharyngiomas (9%). Uncommon histological variants of primary intracranial neoplasms included germinomas (two cases), teratoma and ependymona (one case each), Table 3. Secondary intracranial neoplasms accounted for 23% of the cases.

Table 3

Histological types of the 210 intracranial neoplasms

	Type	No. of cases	Percentage (%)
(A)	*Primary intracranial neoplasms*		
A1	*Neuroepithelial neoplasms*		
	Astrocytomas	44	20.9
	Glioblastoma	9	4.3
	Oligodendrogliomas	8	3.8
	Medulloblastoma	8	3.8
	Ependymoma	1	0.5
A2	*Other primary intracranial neoplasms*		
	Pituitary adenomas	36	17.1
	Meningiomas	24	11.4
	Craniopharyngiomas	19	9.0
	Vascular tumours	10	4.8
	Germinoma	2	0.9
	Teratomas	1	0.5
(B)	*Secondary metastatic neoplasms*	48	23
	Total	210	100%

Key: M – Male; F – Female

The two commonest primary sources of these metastatic neoplasms were choriocarcinoma (23%) and disseminated Burkitt's lymphoma (21%). In childhood, other important primary sources of metastastis apart from Burkitt's lymphoma included embryonal rhabdomysarcoma and retinoblastoma.

Neuroepithelial tumours: Seventy (33.3%) of the neoplasms were neuroepithelial in or origin. Thirty eight (54.3%) of these neoplasms occurred in male patients while the remaining 32 cases (45.7%) occurred in females. The male predominance was most marked in adults aged 15 years and above where the overall male to female ratio was 19:8.

Forty four (62.9%) of these neoplasms were astrocytomas out of which 30 (68.2%) occurred in children aged below 15 years and 14 (13.8%) in adults (Tables 1 and 2). Out of the nine glioblastomas seen, one occurred in a male child aged 12 years, while the remaining eight cases occurred in adults.

The eight oligodendrogliomas were equally divided among children and adults. In childhood, all four cases of oligodendrogliomas occurred in females, whereas in adults, there was an equal sex distribution.

All eight medulloblastomas encountered in the present study occurred in children below 15 years of age, four patients being males, and four females (Table 1).

Other primary intracranial neoplasms: Thirty three (91.7%) of the 36 pituitary adenomas occurred in adults and only three (8.3%) occurred in children less than 15 years of age (Tables 1 and 2).

All 24 meningiomas occurred in adults. Twelve (63.2%) of the 19 craniopharyngiomas occurred in childhood and the remaining seven cases (31.8%) occurred in adults (Table 1).

Three (30%) of the ten vascular neoplasms occurred in childhood and the remaining seven cases (70%) occurred in adults. All three childhood cases occurred in female patients, in contrast to a male predominance in adults (sex ratio being 5:2). The vascular tumours encountered included haemangioblastoma, capillary teleangiectasia and cavernous haemangioma.

The two germinomas occurred in adult patients while the teratoma occurred in a male child.

Secondary intacranial neoplasms: Eleven (23%) of the 48 secondary intracranial neoplasms were choriocarcinomas (Table 4). Ten (21 %) cases were Burkitt's lymphoma, three in adults and seven in children, they together accounted for the commonest metastatic intracranial neoplasms.

Table 4

Histological types and sex distribution of 48 secondary metastatic neoplasms

Type of neoplasm	Male	Female	Total	%
Choriocarcinoma	-	11	11	23
Burkitt's lymphoma	5	5	10	21
Bronchogenic carcinoma	3	4	7	14.6
Breast carcinoma	-	4	4	8
Embryonal rhabdomyosarcoma	1	2	3	6.3
(eye)	2	1	3	6.3
Undifferentiated carcinoma	-	2	2	4.0
Retinoblastoma	1	-	1	2.1
Primary liver cell carcinoma	-	1	1	2.1
Malignant melanoma	1	-	1	2.1
Carcinoma of the ovary	-	1	1	2.1
Carcinoma of the rectum	-	1	1	2.1
Carcinoma of the thyroid	1	-	1	2.1
Carcinoma of the oesophagus	1	-	1	2.1
Yolk sac tumour	1	-	1	2.1
Total	16	32	48	100

Table 5

Comparison of the distribution frequency of histological types of brain neoplasms in Africans and non-Africans

	Neoplasm	Caucasians[1] (non-Africans) 2023 cases (%) (1932)	Rhodesians[5] Levy 12 % (1959)	Bantus[6] Gelfand 61 cases (%) (1955)	Senegalese[4] [1]Colloma 12 cases (%) (1963)	Nigeria[8] Jackson and Okubadejo 12 cases % (1963)	Nigeria[10] Odeku Janota 46 cases (%) (1963)	Nigeria Present series 210 cases
(A)	*Primary intracranial neoplasms*							
A1	*Neuroepithelial tumours*							
	Astrocytomas	12.6	50	26	4.7	16.8	8.6	20.9
	Oligondrogliomas	1.3	-	-	-	8.3	2.2	3.8
	Ependymoma	1.1	-	6	-	-	6.5	0.5
	Glioblastoma	10.3	-	-	20.9	-	2.2	4.3
	Medulloblastoma	4.3	-	5	2.3	25	8.6	3.8
A2	*Other primary intracranial tumours*							
	Meningiomas	13.4	25	43	30.2	25	24	11.4
	Vascular tumour	2.0	-	5	-	-	-	4.8
	Teratoma	0.3	-	-	-	-	-	2.20.5
	Craniopharyngioma	0.7	-	-	-	8.3	11.0	0.9
	Pituitary adenoma	4.6	8.3	-	2.3	8.3	6.5	9.1
(B)	*Secondary metastatic neoplasm (including Burkitt's)*							
	Others	4.2	-	-	1.6	-	6.5	
	Gliomas (not specified)	13	-	-	7	-	-	23
	Miscellanous	14.4	16.7	15	16.3	-	15.2	-

Seven (14.6%) neoplasms were metastatic bronchial carcinoma. Other histological types of secondary intracranial neoplasms encountered included neuroblastoma, hepatocellular carcinoma, malignant melanoma, ovarian carcinoma of the rectum, carcinoma of the thyroid, carcinoma of the oesophagus and yolk sac tumour, which accounted for one case each (Table 4).

DISCUSSION

Until recently, intracranial neoplasms were considered to be rare in Africa(2-5). Initial studies relied on autopsy for verification(5,6). Since the advent of neurosurgery in Nigeria and other parts of the continent, more cases are being documented with surgical biopses providing additional specimens(7).

Gliomas accounted for the commonest group of intracranial tumours (33%) followed by metastases (23%). Previous studies have shown metastatic neoplasms to be the commonest intracranial neoplasms(8) Odeku *et al* (2,7) from Ibadan in previous studies found metastases to range from 6.5% to 28%. The high frequency of astrocytomas contributed to the number of gliomas in the study.

The relatively high proportion of metastases seen in this study and previous studies from this environment reflect the importance of choriocarcinoma as a major source of metastases(9). Choriocarcinoma is a tumour of adult females in the reproductive age group. Choriocarcinoma is however not an important source of metastases in non Africans, the lung and breast being more important sources of secondaries in the brain(10). This is expected to change as lung and breast carcinomas and of recent colonic cancers continue its upward trend in Africa(8).

Multicentric Burkitt's lymphoma with involvement of the brain provided for a significant number of secondary intracranial neoplasms accounting for 21% of the total number of secondary intracranial neoplasms. Burkitt's lymphoma is a neoplasm primarily involving the jaw and abdomen of African children and is unusual in Caucasians(11). The higher incidence found in this study when compared to 10% found in a previous study(12) may reflect the present socio-economic climate in the country with the prohibitive cost of treatment, and therefore progression of the disease with brain involvement. Involvement of the brain is usually associated with widespread organ involvement and has a poor prognosis(11).

Gliomas accounted for 33% of the total number of intracranial neoplasms. This contrast with previous experiences(4,5) in which gliomas were believed to be uncommon in Africans. The appreciable increase in gliomas represented by the very high numbers of astrocytomas may be attributed to the increasing use of neurodiagnostic facilities and the concentration of neurosurgery in Ibadan, which serves as a referral centre for intracranial neoplasms.

The peak age incidence for astrocytomas was between five and nine years in children and 30 to 34 years in adults. This agrees with the findings of Aghadiuno *et al* (12) in children and of Jackson and Okubadejo(13) in adults.

By contrast, the peak age incidence of gliomas in Caucasians is found the fifth decade of life(14). This is due to the higher frequency of glioblastomas, which form the largest group of gliomas in Caucasian series,

as compared with their relative rarity in Africans (Table 5). Only nine of the 44 neuroepithilial neoplasms in the present series were glioblastomas. The frequency of astrocytomas in this study is comparable to Gelfand's finding of 26% in South African Bantus(15).

Oliogodendrogliomas appear proportionately more common in Nigerian than in Caucasians. In the current study, they accounted for 3.8% of all intracranial neoplasms. This is less than the 8.3% reported by Jackson and Okubadejo(13), but more than those reported among other African(16-18) series.

The incidence of ependymoma is low in most studies. It formed only 0.5% of all intracranial neoplasms in this study which is comparable to the figure of 1.1% in Cushing's Caucasian series. Previous Nigerian and Bantu(15) series have revealed incidences of 6.5% and 6%, respectively. In American series, ependymona is more common in children than adults(19). By contrast in the present study, ependymoma occurred only in adults.

Medulloblastoma is the commonest intracranial neoplasm in American children(19), but in the present study was the third commonest neoplasms after astrocytoma and craniopharyngioma. No adult case of medulloblastoma was recorded, but in Americans(19), it accounts for 1.3% of adult intracranial neoplasms.

Pituitary adenomas are the most prevalent primary non-neuroepithelial intracranial neoplasms, accounting for 17.1% of all neoplasms. This is comparable to the figure of 17.8% in Cushing's series(1).

Lower relative incidence of pituitary adenomas have been observed in Egyptian(20), Ghananian(21), Senegalese(18) and I'vorian(22) series. The high figure in the present study may reflect improvements in clinical diagnosis and investigations.

Meningiomas accounted for 11.4% overall in the current study, which is comparable to the figure of 13.4% given by Cushing(1). Meningiomas have been found to have a consistently high incidence in African series(13,18,21). The incidence in Nigerian adults in the present study was 18%. In this study, meningiomas were more common in males than in females. In other studies, a slight female preponderance has been observed(20). Craniopharyngiomas accounted for 9.1% of the total which is twice the relative incidence of 4.6% recorded in the series of Cushing(1). Craniopharyngiomas are more common in African children than American children(12,19).

Although the diagnostic yield of intracranial neoplasms has improved with the acquisition of a computerised tomography scanner in the University College Hospital, Ibadan, it is apparent that there will always be a need for histopathologists to confirm the diagnosis of intracranial neoplasms and to provide the definitive diagnosis in a significant number of cases where the CT scanner is found not to be helpful(23).

REFERENCES

1. Cushing H. Intracranial tumours. Notes upon a series of two thousand verified cases with surgical mortality, percentages pertaining thereto. Sprinfield Ill; Charles C. Thomas, 1932; pp. 1-50.
2. Odeku E.L., Adeloye A., Osuntokun B.O., Williams A.O. Intracranial tumour patients in Ibadan, Nigeria. *Afr. J. Med. Sci.* 1973; **4**:1271 36.
3. Sutherland S. Intracranial tumours *J. Pathol. Bacteriol.* 1934; **39**:209-211.
4. Muwasi E.M.K. and Trowell H.C. Neurological disease among African natives of Uganda. A review of 269 cases. *East Afr. Med. J.* 1944; **21**:22-24.
5. Edington G.M. Neurological lesions in the Gold Coast. *Brit. J. Cancer* 1956; **10**:595-599.
6. Higginson J. Seattle Cancer incidence in the Bantu and Cape coloured races of South Africa. Report of a cancer survey in the Transvaal (1953-55), 1960.
7. Odeku E.L. Intracranial masses in Ibadan. *West Afr. Med. J.* 1965; **16**:31-42.
8. Hardman J.M., Yong Hong Y. The central nervous system. In Silverberg S.G. (ed.). Principles and Practice of Surgical Pathology. Churchill-Livingstone. 2nd edition: 1989; 1579-1630.
9. Adeloye A., Odeku E.L. and Williams A.O. Metastatic tumours of the brain and its developing structures in Ibadan. *Afr. J. Med. Sci.* 1976; **5**:181-184.
10. Rosai J. Adeerman's Surgical Pathology. C.U. Mosby Company 1981; pp.1713-1790.
11. Janota I. Involvement of the nervous system in malignant lymphoma in Nigeria. *Brit. J. Cancer.* 1966; **20**:47-49.
12. Aghadiuno P.U., Adeloye A., Olumide A.A. and Nottidge V.A. Intracranial neoplasms in children in Ibadan, Nigeria. *Child's Nerv. Syst.* 1985; **1**:39-44.
13. Jackson J.G. and Okubadejo D.A. A review of Intracranial tumours seen in necropsies at the University College Hospital, Ibadan between 1957 and 1961. *West Afr. Med. J.* 1963; **12**:251-263.
14. Leestma E.J. Brain tumours *Amer. J. Path.* 1980; **100**: 243-317.
15. Gelfand M. Neoplasms of the brain in the Bantus. Centr. Afr. J. Med. 1959; **5**:486-488.
16. Ng. H.K., Poon W.S., South J.R., Lee J.C. Tumours of the Central Nervous System in Chinese in Hong Kong. A historical review. *Aust. N.Z.J. Surg.* 1988; **58**:573-8.
17. Levy L.F. Neurosurgery in the Rhodesian African. *East Afr. Med. J.* 1959; **36**:392-407.
18. Collomb H., Courson B. and Phillipe Y. et al. *Bull Soc. Med. d' Afrique noure.* 1963; **8**:262-6.
19. Schoenberg B.S., Schoenberg D.G. and Christine B.W., et al. The epidemiology of primary intracranial neoplasms of childhood: a population study. *Mayo Clin. Proc.* 1976; **51**: 51-56.
20. Sorour 0., Rifaat M. and Loft C. The relative frequency of brain tumours in Egypt. *Afr. J. Med. Sci.* 1973; **4**:L179-186.
21. Adeloye A. Neoplasms of the brain in the African. *Surg. Neurol.* 1970; **11**:247-255.
22. Giorciano C.H. Tumours du system nervous en Cote d'lvoire. *Afr. J. Med. Sci.* 1970; **4**:197-207.
23. Choksey M.S., Valentine A., Shawdon H., Freer C.E. and Lindsay K.W. Computed tomography in the diagnosis of malignant brain tumours. Do all patients require biopsy? *J. Neurol. Neurosurg. Psychiatr.* 1989; **52**:821-825.