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Descriptive Epidemiology of Cranial-Spine Tumours in the Lake Zone Region of Mwanza, Tanzania: A cross-sectional

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Abstract

Background: The term cranial-spinal tumours refer to a mixed group of neoplasms originating from anywhere along the cranium extending up to the sacral region of the spine, including superficial scalp neoplasms to the deep-seated lesions of variable histopathologic pattern, with various presentations, some presenting as primary benign or malignant, metastatic, unilateral or bilateral lesions.

Objective: To understand the demographic characteristics and histopathologic patterns of cranial-spinal tumours (CSTs) at a tertiary hospital in Mwanza.

Methods: Patients who underwent surgery for CSTs at our institution between January 2014 and December 2022 and had histopathologic results were included in a retrospective database. Patients with clinical and radiological diagnosis of CSTs without histopathological results were excluded. Collected data included basic demographics, clinical presentation, and histopathologic findings.

Results: A total of 151 cranial spinal tumours in 72 (47.7%) males and 79 (52.3%) female patients were recorded. Pediatric and adult patients were 27% and 73%, respectively. The predominant age group was 40 and 49 years (23.5%). The most common histopathological diagnosis was meningioma (31.3%), followed by gliomas (16.7%), metastatic tumors (10.7%), and lymphomas (7.3%). The meningothelial meningioma was the most common among meningiomas (48.5%). Glioblastoma Multiforme accounted for 36% of the gliomas. Medulloblastoma was the most common among the pediatric group.

Conclusion: This retrospective study established a baseline profile of cranial-spinal tumors of 151 patients based on the histopathological experience at BMC. The peak age group was between 40 and 49 years. Meningioma was the most common neoplasm, whereas medulloblastoma was the most common among the pediatric population.

Keywords: *Cranial- spine tumours, Histopathology, Descriptive epidemiology, Bugando Medical Centre, Metastases.*

Introduction

The term 'cranial-spinal tumours' (CSTs) refers to a mixed group of neoplasms originating from anywhere along the cranium extending up to the sacral region of the spine, including superficial scalp neoplasms to the deep-seated lesions of variable histopathologic pattern, with various presentations, some presenting as primary benign or malignant, metastatic, and solitary and bilateral lesions. Annually, there are more than 350,000 cranial-spinal tumours reported globally, and prior epidemiologic reviews report that more than 75% are from high and upper-middle-income countries, with incidence ranging from 6.29 cases per 100,000 in high-income countries (HICs) to 4.81 in low and middle-income countries (LMICs), although this could significantly underestimate the true

burden in LMICs due to diagnostic limitations (1–3).

In Africa, the paucity of epidemiological descriptive cancer data, especially on paediatric and adult central nervous system tumours, has been reported by some authors(4,5). Recent reports from the National Cancer Treatment Guidelines in Tanzania, primarily Central nervous system tumours, are less than 3% of the common conditions (6) Although this report could have been under-reported by the vast geographical nature and lack of a unified national CSTs registry, hindering the capacity to capture the true incidence and characteristics of CSTs in the country, and importantly, the epidemiology of brain tumours in this region has not been reported. As diagnostic and surgical capacity improves in LMICs, accurate reporting of the incidence and pathology will be critical.

In this study, we performed a cross-sectional descriptive analysis of demographic and histopathologic characteristics of CSTs in the lake zone region of Mwanza seen at a tertiary referral centre in Tanzania for a period of 8 years and reviewed the literature in comparison with published hospital-based registries and larger national cancer databases.

Methods

Study design

A hospital-based cross-sectional descriptive retrospective study was conducted to determine the demographic and histological patterns of cranio-spinal tumours among patients operated at our institution from January 2014 to December 2022. Only patients with histopathological confirmation were included. Descriptive epidemiologic profiles were tabulated for the patients by age, sex, and histological types of brain tumours.

Study area

This study was conducted at our institution, which is a tertiary consultant zonal referral hospital in Mwanza region, located in the Lake Zone in Tanzania, serving a population of about 18 million people.

Inclusion and exclusion criteria

Only patients with cranial-spinal tumours diagnosed and confirmed radiographically, with a biopsy for histopathology taken at our hospital. Patients with features of clinical brain or spine tumours and radiographically, however, without a histopathological diagnosis were excluded.

A report on surgical outcomes and prognosis was not included as it was not the objective of the study. Examination of hematoxylin and eosin (H&E) stained slides from retrieved paraffin blocks was done in all cases by pathologists for pathological typing of C.N.S. tumours. The classification and nomenclature used in the present study were according to the 2016 WHO classification. (7)Data from the hospital electronic registry were recorded and screened for missing information, with outliers corrected. Data was cleaned and entered an Excel datasheet for analysis. The data was put into tables, percentages, graphical presentations, and diagrams to give an overview of the data. Data has been reported in line with the STROCSS criteria.(8)

Results

The study identified 151 cases of CSTs, 72(47.7%) were males, and 79(52.3%) were females, with a ratio of 1:1.1. The annual

incidence for CSTs in the year 2022 alone was 3 per 1000 person-year based on hospital admissions in the department of neurosurgery. Patients' ages ranged from 0 to 100 years, with a mean age at diagnosis of 36.9 years (± 3.6 years). As demonstrated in Figure 1, there were two peaks between 0-9.9 years and 40-49.9 years. There were more adult cases110 (73%) than pediatric (<18) group 41(27%). See figure 1.

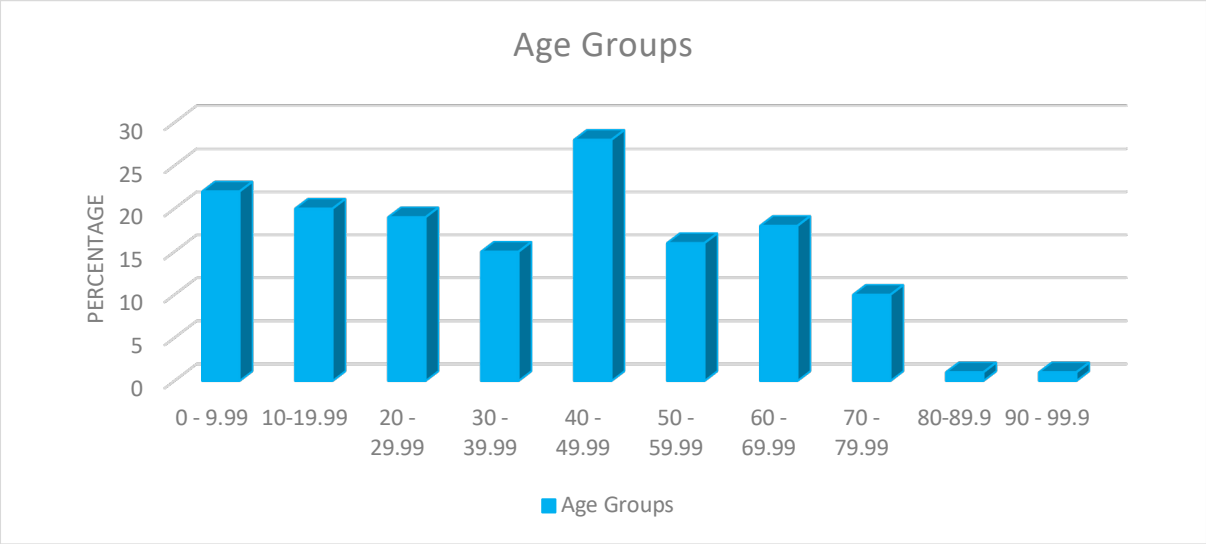

Figure 1. Showing the age group distribution in percentage for all cases of the study

Sign and symptoms

The most presenting symptom was headache by 28.40%, followed by convulsion by10%, and the least presenting symptoms were back pain and back swelling or ulcer by 2%. Regarding topographical location, primary intracranial tumors represented 90.5% of cases compared to 9.5% for spinal tumors as shown in Figure 2 below.

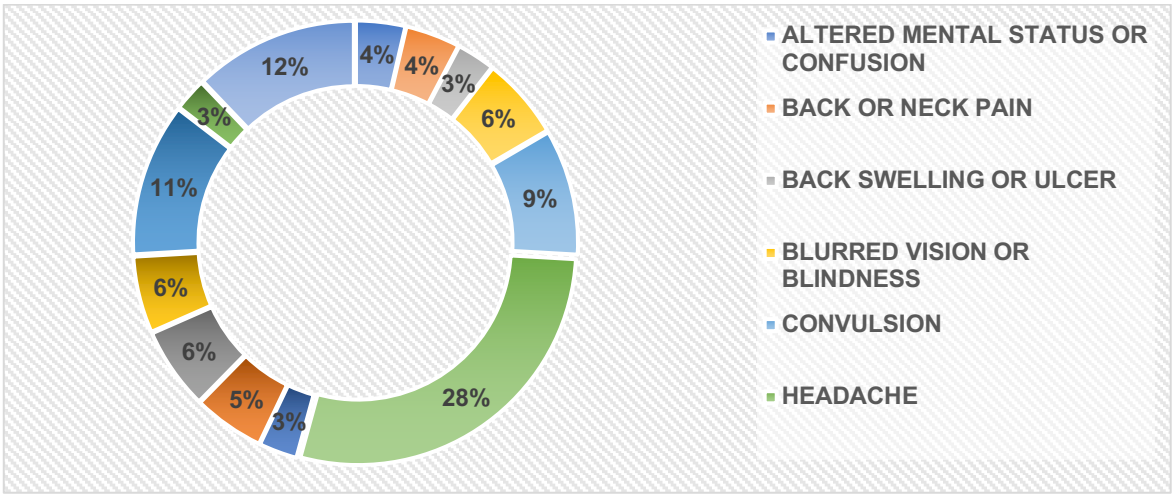

Figure 2. Summarising the presenting signs and symptoms among patients

Histopathological types

Among the cranial tumours, supratentorial tumours presented 70% vs infratentorial tumors 30 %. The frequency of histopathological types is displayed in Figure 3.

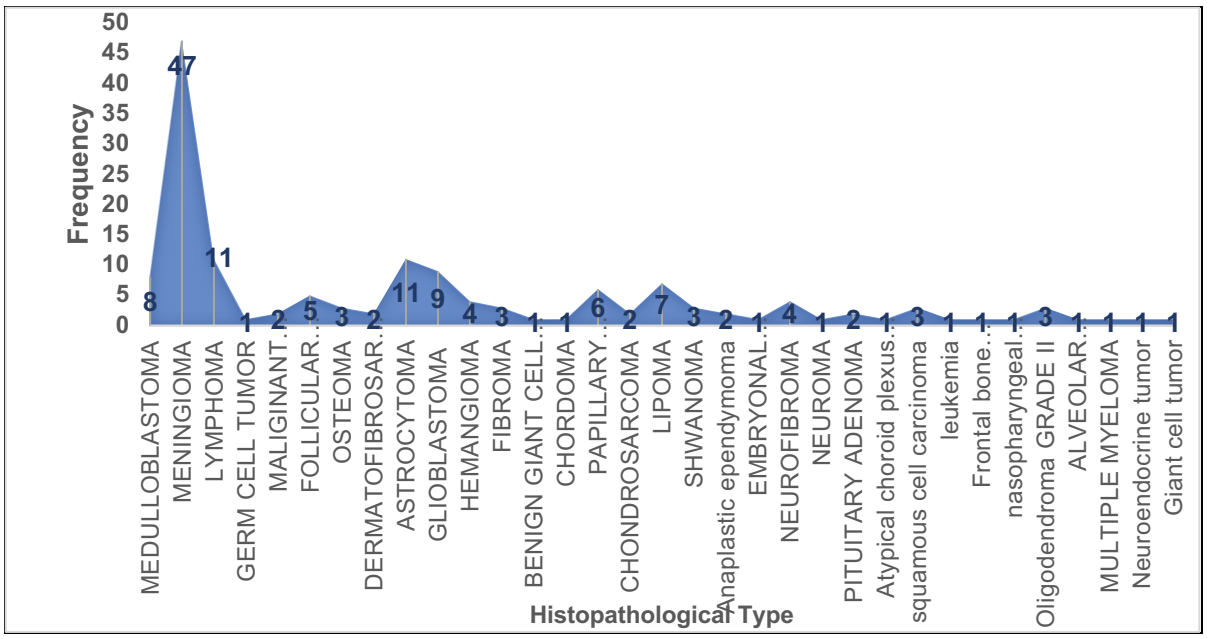

Figure 3. The histopathological frequency for all cases in this cohort

As shown from the figure above, Meningioma cases were the highest (31.3%), Gliomas represented 16.7%, metastases 10.7%, Lymphomas 7.3%, Medulloblastoma 5.3% and the remaining were varyingly less than 3 %. Among the meningiomas, the WHO I meningothelial subtype was the most frequent 43% followed by the WHO II subtypes. In the glioma group, astrocytoma was the highest, 44%, followed by glioblastoma multiforme 36%, oligodendroglioma 12% and anaplastic ependymoma 8%. There were 41 cases of pediatric tumors. Medulloblastoma were the highest among children 19.5% and the remaining were less than 5%. Metastatic tumors represented only 10.6% (16/151), with most of the tumors being primary CSTs. Among the metastatic tumors. Among the metastases, adenocarcinomas (37.5%) were the most frequent, followed by follicular thyroid carcinoma (31.3%) and squamous cell carcinoma (18.8%).

Discussion

This was the first reported epidemiological study on CSTs in the lake zone region of Mwanza. This suggests that the true burden of brain tumours in LMICs is unknown. In the sub-Saharan region, this is worsened by delayed presentation(9) and poor access to adjuvant therapies. The risk factors that remain are yet to be fully established, although a few have been mentioned, including ionising radiation (10). In Tanzania, there is not yet a single centralized national registry capturing all incident CSTs in all regions, considering the few centres offering neurosurgical services in the vast nation.

Table 1: The Most Common Tumour Pathologies and Regional Distribution from Hospital-Based Studies and Large National Tumour Registries

Region	Meningiomas	Gliomas
Africa	*South Africa* (10)	Delta Region *(Egypt)*(25)
	Yaounde *(Cameroon)*(28)	*Nigeria*(18)
	Mulago *(Uganda)*(29)	Tema*, (Ghana)*(17)
	Sub-Saharan Africa (4)	Kenyatta National Hospital *(Kenya)* (30)
	Mwanza -Tanzania - This Study	
Middle East	Madinah *(Saudi Arabia)*(15)	United Arab Emirates(31)
	Iran (32)	
Asia	Japan (13)	China(14)
	Korea(20)	India(34)
	West Bengal (India)(33)	
Europe	Catania *(Italy)* (12)	France(11)
	Girona*(Spain)*(35)	England(36)
	Georgia(19)	
Americas	USA (16)	Central &South America(23)

This is no surprise, as several published findings from our survey of literature, data regarding epidemiological and histopathological characteristics of CSTs in several countries have mostly been based on institutional studies rather than large established national brain tumour registries(11), with findings which were consistent with larger organized registries from Europe and the United States. Given the differences in epidemiological characteristics in geographical regions, race and sex, there is a need for greater understanding of the epidemiological and histopathological varieties of our region.

In this operative series, the annual incidence for CSTs in the year 2022 alone was 3 per 1000 person-year based on hospital admissions in the department of neurosurgery. This was comparable to incidence rates reported in larger national registries(1,12–14). Although there were more female cases than males, this was not statistically significant as no sex predominance (1.1:1) was noted, as similarly reported by Khan (Khan et al., 2020) and the Chinese series(15). Other authors reported a female predominance(13,16,17). As with most studies, headache was the most common presenting symptom (18,19)

In this series, the median age was comparable with other African studies(4). Similarly, two peaks were noted as the most affected age groups, a finding in line with other series (16)(20) In contrast, Chaima`s group(13) reported a much older peak of incidence (75-80 years) in the Catania province, similar to the Korean series(21)Moreover, in our series the paediatric group, the mean age was comparably older than the series by Togo et al (5.5) and Stagno et al(6.5) (9).

The variations in global histopathology in different regions of the world have been echoed

in many studies around the world.(1,22) Meningioma was the most common, followed by gliomas, metastatic tumours, and lymphomas. These findings were similar to those reported in the Sub-Saharan series, most African series(Table 1) (4,23)and the CITBRUS(17). In contrast, a similar number of large series, including the Central and South American(24) registry, reported gliomas as the most common histological subtype. Among the meningiomas, the meningothelial subtype WHO I was the most frequent, followed by the grade II subtypes, and we found no sexual predominance, in contrast to the Korean series, which reported a female predominance.(21)

Regarding the paediatric population, overall medulloblastoma was the most common brain tumour, consistent with the reports from the sub-Saharan systematic review by Herdel et al(25), the Moroccan paediatric series(5), and the global CONCORD-3 study (22), however, contrasting with the 10-year paediatric operative series at CURE children's hospital in Uganda (Stagno et al, 2014), who reported pilocytic astrocytomas. In tandem with most studies, cranial neoplasms were more frequent than spine tumours, as reported by Bell et al. Additionally, intracranial tumours were evidently more frequent than other cranial lesions in the cranial group. This was consistent with findings from the Egyptian series (26). In this study, we found that glioblastoma was the most common among malignant tumours, 36%. This finding was comparable to those in the CBTRUS statistical report (Ostrom, Cioffi, et al., 2019).

In the literature, it has long been reported that the most frequent cranial brain tumours are brain metastases, among which lung cancer, breast cancer, melanoma, and renal cell carcinoma have been the most reported. (27,28).In contrast, adenocarcinoma was the most common among metastatic cases, and none of the lung or breast cancer cases was recorded in this study. Given these findings, we pose the argument that metastatic tumours are no longer the most common type of intracranial tumour. In a general review of the reported literature with the purpose of establishing statistical support for this long-known fact, we found that (Table 1) among several regions in Africa and the Western world. In most registries we have seen that meningiomas or gliomas were the most common cranial tumors, and interestingly, no single publication mentioned brain metastasis as the most frequent tumor hence supporting the notion that metastases are no longer the most common cranial tumors and perhaps, it's high time we lend a hand in updating the scientific literature and hence reinstate that meningiomas and gliomas are the most common type of intracranial tumors.

The reduced incidence of metastases as noted by some authors, (38,39) could be attributed to the several advancements in early diagnostics and treatment of notorious known metastatic tumours, which have, in effect, reduced the incidence of disease progression to the extent of metastasis. In contrast, Joseph et al projected that the incidence of brain metastases is projected to rise because survival rates of lung cancer, breast cancer, and melanoma continue to improve with current advancements in treatment (40), although in our opinion, the numbers may not be reflected in future cancer registries. Our findings were generally consistent with past registries from other regions of the world. The results in this

study could be used in health education to raise public awareness of the magnitude of the cranio-spinal tumours. Further study is warranted to determine the risk factors and clinical outcomes, as well as the need for a unified national registry.

Study limitations

This study is not without limitations. It is a retrospective analysis and thus limited by the study limitations therein. There was limited use of immunohistochemistry and genetic studies due to a lack of funding, and this could have affected the underreporting of rare histological subtypes. The role of funding in brain tumor research has been emphasized by several international authorities(41).

Conclusion

This retrospective study established a baseline profile of cranial-spinal tumours of 151 patients based primarily on the histopathological experience at a tertiary care hospital in the Lake Zone region of Mwanza, Tanzania. The most affected age group was observed in patients between 40 and 49 years, with no sex preponderance. Meningioma was found to be the most common neoplasm, followed by gliomas, metastatic tumours, and lymphomas, whereas medulloblastoma was most common among the paediatric population.

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Conflicts of interest

The authors declare no competing interests.

Sources of funding

There are no sources of funding for this research.

Ethical approval

Ethical clearance was requested and obtained from the Ethical Approval Committee. Informed consent from participants was obtained before conducting the study. Confidentiality of participants was maintained at all levels of the study, and the name and address of the patient were omitted at all levels. Ref. No. BU/36/DRI/008/Vol I.

Author contributions

LJ contributed to the conception and design of the study, acquired, analyzed and interpreted the data, and drafted and revised the manuscript. KL, GM, DS, AM, PC, OL contributed to the design of the study, data interpretation and critically revised the manuscript. HJ, EEM contributed to the design of the study, data interpretation and critically revised the manuscript.

KS and MM contributed to the conception and design of the study, data interpretation and critically revised the manuscript. All authors read and approved the final manuscript.

Data availability

Data is available at the editor's request.

Declaration of generative AI in scientific writing

The authors disclose no use of AI and AI-assisted technologies in the writing process of the manuscript.

References

1. Agha R, Abdall-Razak A, Crossley E, Dowlut N, Iosifidis C, Mathew G. STROCSS 2019 guideline: strengthening the reporting of cohort studies in surgery. *Int J Surg.* 2019; 72:156–165.
2. Andrews NB, Ramesh R, Odjidja T. A preliminary survey of central nervous system tumors in Tema, Ghana. *West Afr J Med.* 2003;22(2):167–172.
3. Balogun JA, Bankole OB, Okere O, Uche EO, Balogun FM, Shilong DJ, et al. Epidemiology of brain tumors among adolescents and young adults in Nigeria. *J Clin Neurosci.* 2022; 96:50–55.
4. Barnholtz-Sloan JS, Sloan AE, Davis FG, Vigneau FD, Lai P, Sawaya RE. Incidence proportions of brain metastases in patients diagnosed (1973–2001) in the Metropolitan Detroit Cancer Surveillance System. *J Clin Oncol.* 2004;22(14):2865–2872.
5. Bauchet L, Rigau V, Mathieu-Daudé H, Figarella-Branger D, Hugues D, Palusseau L, et al. French brain tumor data bank: methodology and first results on 10,000 cases. *J Neurooncol.* 2007;84(2):189–199.
6. Bell JS, Koffie RM, Rattani A, Dewan MC, Baticulon RE, Qureshi MM, et al. Global incidence of brain and spinal tumors by geographic region and income level based on cancer registry data. *J Clin Neurosci.* 2019; 66:121–127.
7. Bhattacharya S, Maiti B, Konar K. Histopathological profile of central nervous system tumors in a peripheral tertiary care centre of West Bengal. *J Lab Physicians.* 2023;15(1):38–44.
8. Bondy ML, Scheurer ME, Malmer B, Barnholtz-Sloan JS, Davis FG, Il'yasova D, et al. Brain tumor epidemiology: consensus from the Brain Tumor Epidemiology Consortium. *Cancer.* 2008;113(7 Suppl):1953–1968.
9. Bovi JA. Prevention of brain metastases. *Front Neurol.* 2018;9:758.
10. Chebil C, Boumediene F, Cicero CE, Rascunà C, Di Prima A, Torrisi AAM, et al. Epidemiology of primary brain tumors in the Province of Catania during the 2003–2016 period. *Neuroepidemiology.* 2021;55(6):473–483.
11. Eyenga VC, Ngah JE, Atangana R, Etom E, Ngowe MN, Bassong Y, et al. Central nervous system tumours in Cameroon: histopathology and demography. *Sante.* 2008;18(1):39–42.
12. Fuentes-Raspall R, Solans M, Roca-Barceló A, Vilardell L, Puigdemont M, Del Barco S, et al. Descriptive epidemiology of primary malignant and non-malignant central nervous tumors in Spain: results from the Girona Cancer Registry (1994–2013). *Cancer Epidemiol.* 2017;50(Pt A):1–8.
13. Gigineishvili D, Gigineishvili T, Tsiskaridze A, Shakarishvili R. Incidence rates of primary brain tumours in Georgia: a population-based study. *BMC Neurol.* 2014; 14:29.
14. Girardi F, Rous B, Stiller CA, Gatta G, Fersht N, Storm HH, et al. The histology of brain tumors for 67,331 children and 671,085 adults diagnosed in 60 countries during 2000–2014: a global population-based study (CONCORD-3). *Neuro Oncol.* 2021;23(10):1765–1776.
15. Herdell V, Lassarén P, Boop FA, Bartek JJ, Uche EO, Tisell M. Surgical outcomes of pediatric brain tumors in Sub-Saharan Africa: a systematic review. *Brain Spine.* 2022; 2:100912.
16. Jazayeri SB, Rahimi-Movaghar V, Shokraneh F, Saadat S, Ramezani R. Epidemiology of primary CNS tumors in Iran: a systematic review. *Asian Pac J Cancer Prev.* 2013;14(6):3979–3985.
17. Jiang T, Tang GF, Lin Y, Peng XX, Zhang X, Zhai XW, et al. Prevalence estimates for primary brain tumors in China: a multicenter cross-sectional study. *Chin Med J (Engl).* 2011;124(17):2578–2583.
18. Johnson JD, Young B. Demographics of brain metastasis. *Neurosurg Clin N Am.* 1996;7(3):337–344.

19. Kakusa BW, Xu LW, Vaca SD, Nalwanga J, Kiryabwire J, Ssenyonjo H, et al. Central nervous system tumors in Uganda: outcomes of surgical treatment and complications assessed through telephone survey. *World Neurosurg.* 2019;129: e866–e880.
20. Kaneko S, Nomura K, Yoshimura T, Yamaguchi N. Trend of brain tumor incidence by histological subtypes in Japan: estimation from the Brain Tumor Registry of Japan, 1973–1993. *J Neurooncol.* 2002;60(1):61–69.
21. Kanmounye US, Karekezi C, Nyalundja AD, Awad AK, Laeke T, Balogun JA. Adult brain tumors in Sub-Saharan Africa: a scoping review. *Neuro Oncol.* 2022;24(9):1436–1449
22. Karkouri M, Zafad S, Khattab M, Benjaafar N, El Kacemi H, Sefiani S, et al. Epidemiologic profile of pediatric brain tumors in Morocco. *Childs Nerv Syst.* 2010;26(8):1021–1027.
23. Kelly A, Lekgwara P, Mda S. The epidemiology and outcome of patients admitted for elective brain tumour surgery at a single neurosurgical centre in South Africa. *Interdiscip Neurosurg.* 2020; 21:100750.
24. Khan S, Kambris MEK, AlShamsi ET. Epidemiology of brain tumors in the United Arab Emirates: a national registry cross-sectional study. *BMC Neurol.* 2020;20(1):301.
25. Lee CH, Jung KW, Yoo H, Park S, Lee SH. Epidemiology of primary brain and central nervous system tumors in Korea. *J Korean Neurosurg Soc.* 2010;48(2):145–152.
26. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, et al. The 2016 World Health Organization classification of tumors of the central nervous system: a summary. *Acta Neuropathol.* 2016;131(6):803–820.
27. Mbi Feh MKN, Lyon KA, Brahmaroutu AV, Tadipatri R, Fonkem E. The need for a central brain tumor registry in Africa: a review of central nervous system tumors in Africa from 1960 to 2017. *Neurooncol Pract.* 2021;8(3):337–344.
28. Miranda-Filho A, Piñeros M, Soerjomataram I, Deltour I, Bray F. Cancers of the brain and CNS: global patterns and trends in incidence. *Neuro Oncol.* 2017;19(2):270–280.
29. Mohammed AA, Hamdan AN, Homoud AS. Histopathological profile of brain tumors: a 12-year retrospective study from Madinah, Saudi Arabia. *Asian J Neurosurg.* 2019;14(4):1106–1111.
30. Ministry of Health, Community Development, Gender, Elderly and Children Tanzania. National Cancer Treatment Guidelines. Tanzania; 2020.
31. Mwang'ombe NJ, Ombachi RB. Brain tumours at the Kenyatta National Hospital, Nairobi. *East Afr Med J.* 2000;77(8):444–447.
32. Mwita CC, Rowland T, Gwer S. Burden of brain tumors in low- and middle-income countries: a systematic review protocol. *JBI Database System Rev Implement Rep.* 2018;16(3):609–614.
33. Ostrom QT, Adel Fahmideh M, Cote DJ, Muskens IS, Schraw JM, Scheurer ME, et al. Risk factors for childhood and adult primary brain tumors. *Neuro Oncol.* 2019;21(11):1357–1375.
34. Ostrom QT, Cioffi G, Gittleman H, Patil N, Waite K, Kruchko C, et al. CBTRUS statistical report: primary brain and other central nervous system tumors diagnosed in the United States in 2012–2016. *Neuro Oncol.* 2019;21(Suppl 5):v1–v100.
35. Piñeros M, Sierra MS, Izarzugaza MI, Forman D. Descriptive epidemiology of brain and central nervous system cancers in Central and South America. *Cancer Epidemiol.* 2016;44(Suppl 1):S141–S149.
36. Sacks P, Rahman M. Epidemiology of brain metastases. *Neurosurg Clin N Am.* 2020;31(4):481–488.
37. Schouten LJ, Rutten J, Huveneers HAM, Twijnstra A. Incidence of brain metastases in a cohort of patients with carcinoma of the breast,

colon, kidney, and lung and melanoma. *Cancer.* 2002;94(10):2698–2705.

38. Stagno V, Mugamba J, Ssenyonga P, Kaaya BN, Warf BC. Presentation, pathology, and treatment outcome of brain tumors in 172 consecutive children at CURE Children's Hospital of Uganda. *Childs Nerv Syst.* 2014;30(1):137–146.
39. Wanis HA, Møller H, Ashkan K, Davies EA. The incidence of major subtypes of primary brain tumors in adults in England 1995–2017. *Neuro Oncol.* 2021;23(8):1371–1382.
40. Yeole BB. Trends in brain cancer incidence in India. *Asian Pac J Cancer Prev.* 2008;9(2):267–270.
41. Zalata KR, El-Tantawy DA, Abdel-Aziz A, Ibraheim AWM, Halaka AH, Gawish HH, et al. Frequency of central nervous system tumors in Delta region, Egypt. *Indian J Pathol Microbiol.* 2011;54(2):299–306.