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Clinical profile and outcome of surgical management of intramedullary spinal cord tumours: A single center study in a developing country

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ABSTRACT

Objective: There is as yet a paucity of data on intramedullary spinal cord tumours (IMSCTs) in sub-Saharan Africa. This study aims to define the clinical profile and outcome of management of IMSCTs in a Nigerian tertiary hospital.

Methods: This is a retrospective study of all the patients who had surgery for IMSCTs in our hospital over a 14 year period.

Results: There were 20 patients, 9 males, 11 females, in this study. The median age was 33 years (range = 7–78 years). The median duration of symptoms was 12 months (range = 1–120 months). Motor deficit was present in all but one (95%) of our patients. Only 25% of the patients presented in good functional status (McCormick grades I and II). The tumours were confined to the thoracic region in 10 patients (50%), while tumours in the thoracic region extending to the adjoining cervical and lumbar regions were seen in 6 patients (30%). Gross total tumour resection was achieved in 60% of the patients and subtotal resection in the remaining 40%. Astrocytoma and ependymoma were the most common tumours, each occurring in 35% of the cases. Six patients (30.0%) improved, 12 patients (60.0%) remained neurologically the same, while 2 patients (10.0%) deteriorated at the time of last follow up. The mortality rate was 15%. The preoperative functional status was a significant predictor of postoperative outcome ($p = 0.03$).

Conclusion: Astrocytoma and ependymoma were the most common histological tumour types among our patients. Late presentation and poor pre-operative functional status were prominent features of our patients' cohort.

1. Introduction

Intramedullary spinal cord tumours (IMSCTs) are rare lesions of the central nervous system (CNS). They account for 2–4% of all CNS neoplasms and about 20–25% of all spinal tumours.[1] IMSCTs are most commonly located in the cervical region presumably because of higher level of grey matter at this level of the spinal cord.[2,3] They may present with sensory, motor or autonomic symptoms and may, especially in children, be asymptomatic for a long time or present with nonspecific complaints.[4–6] The mainstay of treatment is surgical resection while radiotherapy and chemotherapy are often reserved for high grade tumours, tumour recurrence, or cases where surgical resection is contraindicated.[2] The safety of surgical excision has improved with advancements in neuroimaging and microsurgical techniques, use of ultrasonic aspirators and intraoperative electrophysiological monitoring.[2,7,8] These state of the art surgical adjuncts are, however, often not available in resource challenged settings like Nigeria. In sub-Saharan Africa, there is dearth of data driven literature on spinal tumours in general and IMSCTs in particular.[6] This is, at least in part, due to the rarity of these lesions and the grossly inadequate neurosurgical workforce necessary for diagnosis and documentation of these tumours. This report, which to the best our knowledge, is the first one dedicated to the

Abbreviations: IMSCT, Intramedullary spinal cord tumours; CNS, Central nervous system; WHO, World health organisation.

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subject from Nigeria aims to define the clinical profile and outcome of management of these rare tumours in the most populous nation in Africa.

2. Materials and methods

This is a retrospective study of all the patients who presented to our service and subsequently had surgery for intramedullary spinal cord tumours between January 2004 and December 2018. Data was collected from hospital case notes, operation and pathology registers. We obtained information on the age and sex of the patients, duration of symptoms before presentation, the presenting symptoms, anatomical location of the tumours, imaging findings, preoperative and postoperative functional grades, histology of tumours, extent of tumour resection, outcome of surgeries and duration of follow up. The pre and postoperative functional grade was classified using McCormick scale. All the patients were operated on in prone position through standard posterior approaches. Laminectomy was performed in all cases. Other than operating loupes/microscope, no other surgical adjunct or intraoperative electrophysiological monitoring was employed. There was no access to frozen tumour pathology at our centre in the years covered by the study. Spinal stabilization (using rigid vertical struts and spinal process wires)[9] was done in only one of the cases. The patient with instrumented fusion had T7-10 laminectomy. Good functional status was defined as McCormick grades I, II, and III, and poor status as grades IV and V. Statistical analysis was done with IBM's Statistical Package for the Social Sciences (SPSS) version 20 (IBM, New York, USA). The quantitative variables were expressed in means and standard deviations while the qualitative variables were expressed in frequencies and percentages. The association between variables and outcome of care was determined by Pearson Chi square or Fisher exact tests. A *p*-value less than 0.05 was considered as significant.

3. Results

There were 20 patients in this study, 9 males, 11 females (M:*F* = 1:1.2), accounting for 22. 5% of operated cases of spinal tumours in our centre during the study period. The age ranged from 7 to 78 years with a median of 33 years. There was a bimodal age distribution with the highest incidence seen in the 20–29 and 40–59 age groups (Fig. 1). The duration of symptoms ranged from 1 to 120 months with a median of 12 months. The duration of symptoms was more than 6 months in 80% of the patients (Table 1). Motor deficit was present in 95% of the patients while only one patient (5%) presented with pain alone. Only 25% of the patients presented in good functional grade (McCormick grades I and II), 30% presented with severe motor deficit/dependent (McCormick grade IV) while 45% were either quadriplegic or paraplegic at presentation (McCormick grade V) (Table 2). Thoracic tumour location was the most common, occurring alone in 10 patients (50%) and in combination with cervical and lumbar regions in another 6 patients (30%) (Table 3). Gross total tumour resection was achieved in 60% of our patients and subtotal tumour resection in the remaining 40%. Astrocytoma and ependymoma were the most common tumours each occurring in 35% of the cases, cavernous haemangioma accounted for 10% of the cases (Table 4). Of the 2 patients with high grade tumours in whom adjuvant radiotherapy and chemotherapy were adjudged to have been indicated, only the patient with grade IV astrocytoma was able to afford the treatment modality. Postoperative neurological improvement occurred in 6 patients (30.0%), 12 patients (60.0%) remained neurologically the same, while 2 patients (10.0%) deteriorated. Outcome of treatment was good in 40% of the patients. The preoperative functional status was a significant predictor of postoperative outcome ($p = 0.03$). There was no correlation between duration of symptoms ($p = 0.417$), extent of surgical resection ($p = 0.516$), spinal region location of the tumours ($p = 0.686$) and the outcome of care. Three of our patients (15%) died, 2 with aggressive tumours and one patient with high cervical tumour. Apart from the 2 patients who deteriorated after surgery, the only other complication of surgery in the study was superficial surgical site infection in one of the patient. The mean duration of follow up was 10.71 months (range = 2–43 months). Only 6 patients (30%) were followed up for more than a year.

4. Discussion

In sub-Saharan Africa, there is paucity of published literature on spinal cord tumours. This is particularly so for series that focuses on intramedullary spinal cord tumours alone. Globally, large studies on IMSCTs are not abundant because of relative rarity of these tumours.[7,10] We operated on 20 patients in our service during the 15-year study duration. Our sample size though small is comparable to some other studies on the subject in LMICs.[10,11] The 22.5% proportion of our spinal tumours accounted for by IMSCTs is also within the 20–25% documented range.[1]

There was almost equal distribution of tumours between males and females in our patients' population, with a trend in favour of females (M:*F* = 1:1.2). This is different from the reported male predominance of

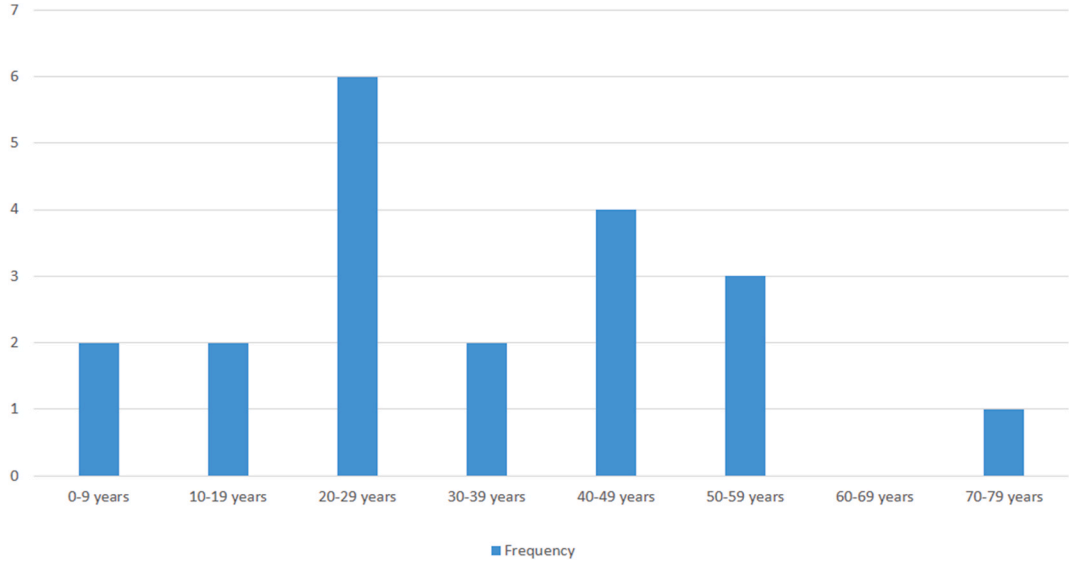

Fig. 1. The age distribution of the patients.

Table 1
Clinical and demographic characteristics of the patients.

Variables	Number	Percentage
Sex		
Male	9	45.0
Females	11	55.0
Duration of symptoms		
<6 months	4	20
6–12 months	1 0	50.0
>12 months	6	30.0
Pre-operative functional grade		
Good	5	25.0
Poor	15	75
Extent of resection		
Gross total	12	60.0
Sub-total	8	40.0
Post-operative neurological status		
Neurologically the same	12	60.0
Improved	6	30.0
Deteriorated	2	10.0
Duration of follow-up		
<6 months	7	35.0
6–12 months	7	35.0
>12 months	6	30.0

these tumours.[7,10–13] While this may be due to small sample size, it may also be a corroboration of female predominance of spinal tumours in our environment as earlier reported in our centre.[6] Our patients were also predominantly adults (80.0%) which is in agreement with the findings in the literature.[7,13,14] In the series by Garcés-Ambrossi et al,[14] 17% of the patients were paediatrics, while this age group accounted for 6.7% of the patients in the series by Boström et al.[7]

All but one of our patients (95%) presented with motor deficit. This figure is significantly higher than the 66% reported by Bahtti et al[11] and the 37.5% reported by Fathy et al.[10] Indeed 75% of our patients were in very poor functional status at presentation (McCormick grade IV and V). The proportions of patients in the same grades were 37.5% and 19.8% in the series by Fathy et al[10] and Matsuyama et al[15] respectively. The median duration of symptoms in our study is 12 months which is significantly longer than 6.8 months mean duration of symptoms in the series by Bhatti et al[11] and may, in part, explain the worse preoperative functional status of a larger proportion of our patients. There has been previous documentation of delayed presentation of patients with neurosurgical presentations including brain tumours in our environment, resulting in large tumours with the attendant surgical morbidity and mortality. The predominance of IMSCTs in the cervical spinal cord has been widely documented.[10–13] However, the tumours in our series are predominantly thoracic, involving the thoracic region alone in half of the cases. While we do not have particular explanation for this variation, similar finding was also reported by Boström et al.[7]

Surgical resection is considered the standard of care for IMSCTs while radiotherapy and chemotherapy are often reserved for high grade tumours, tumour recurrence, or cases where surgical resection is contraindicated.[2] The primary goal of treatment is gross total resection, but this is not always feasible especially in infiltrative tumours like astrocytomas where there is no clear tumour-cord interphase and thus no defined plane of surgical dissection, particularly so in the absence of surgical adjuncts.[16] We were able to achieve gross total resection in three-fifth of our patients, 57.1% of ependymomas, 42.9% of astrocytic tumours, and 83.3% of other histologic tumour types. The proportion of our patients who had total tumour resection was similar to the 62.5% and 64.3% reported respectively by Fathy et al[10] and Boström et al,[7] but lower than the 83.3% in the series by Sandalcioglu et al.[12] The higher rate of gross total tumour excision in the latter 2 studies may be due to the use of intraoperative electrophysiological monitoring in most of the patients in the series by Boström et al,[7] and in all of the patients in the series by Sandalcioglu et al.[12]

Table 2
Pre-operative and post-operative McCormick grades of the patients ($p = 0.03$).

McCormick grades	Pre-operative [N (%)]	Post-operative [N (%)]
I	1 (5.0)	3 (15.0)
II	4 (20.0)	3 (15.0)
III	–	2 (10.0)
IV	6 (30.0)	4 (20.0)
V	9 (45.0)	8 (40.0)

Table 3
Tumour locations.

Location	Frequency	Percentage
Cervical	4	20.0
Thoracic	10	50.0
Cervico-thoracic	3	15.0
Thoraco-lumbar	3	15.0
Total	20	100.0

Ependymomas and astrocytic tumours (six WHO grade 2 tumours, and one WHO grade IV tumour) were the most common histological tumour types in our study each accounting for 35% of the tumour. The age distribution of the tumours in this series is in agreement with the literature with ependymoma being the most common type in the adults (37.5% of the cases) and astrocytoma being the most common paediatric IMSCTs (75% of our cases).[7,10,17] Although metastasis was the most common histological tumour type in an earlier series on spinal tumours in our center, there was no case of metastasis in this study in keeping with documented rarity of intramedullary metastases.[2,6,18]

A large proportion of our patients either improved or at least remained neurologically the same following surgery. The percentage of our patients with this outcome (90%) is similar to the 85.7% in the series by Boström et al,[7] and 93.75% reported by Fathy et al,[10] although the 30% post-operative improvement rate in our study was lower than the 56.25% in the latter study. There are evidences to show that outcome of care depends on the pre-operative neurological status of the patients, extent of surgical resection, the location of the tumour as well as the histology and grades of the tumours.[8,10,12,19] Good pre-operative functional status and total tumour resections are considered of good prognostic values while thoracic tumour location and higher tumour grades predicts poor outcome. In the present study, only the pre-operative neurological status correlated with the outcome of care. This may be due to small sample size of our study. Nevertheless, our finding reinforces the need for early surgical intervention in these patients.[12,20]

Superficial surgical site infection occurred in one of our patients. Other than the 2 patients who deteriorated neurologically after surgery, this was the only observed complication in this study. The 3 patients with cervical-thoracic tumours were followed up for evidence of Swan Neck deformity and instability. None of them had developed these complications at the time of last follow up visits which were unfortunately relatively short: 4 months, 7 months and 48 months.

This study, though limited by being a single centre study with relatively small sample size and short duration of follow up, provides an insight into the epidemiology of IMSCTs in a large sub-Saharan African

Table 4
Tumour histology.

Tumour	Frequency	Percentage
Ependymoma	7	35.0
Grade II astrocytoma	6	30.0
Grade IV astrocytoma	1	5.0
Haemangioblastoma	1	5.0
Cavernous haemangioma	2	10.0
Non-Hodgkin's lymphoma	1	5.0
Ganglioglioma	1	5.0
Lipoma	1	5.0
Total	20	100.0

country and hopefully will act as a stimulus for similar studies with a view to defining the epidemiology and improve treatment of these tumours in this region.

5. Conclusion

IMSCT accounted for 22.5% of spinal tumours in our centre. The thoracic spinal cord is the most common tumour location in our study. A significant proportion of our patients presented late and in poor functional status. The preoperative functional status was a significant predictor of post-operative outcome among our patients.

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CRediT authorship contribution statement

Toyin Ayofe Oyemolade: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **James Ayokunle Balogun:** Writing – review & editing, Resources, Methodology, Investigation, Conceptualization. **Oluwakemi Aderonke Badejo:** Writing – review & editing, Resources, Methodology, Investigation, Conceptualization. **Adefolarin Obanisola Malomo:** Writing – review & editing, Resources, Methodology, Investigation, Conceptualization. **Matthew Temitayo Shokunbi:** Writing – review & editing, Resources, Methodology, Investigation, Conceptualization. **Olusola Kayode Idowu:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Augustine Abiodun Adeolu:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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