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Spinal biopsies: a clinicopathologic review of 53 cases diagnosed between 2011 and 2018 at a tertiary hospital in Kampala, Uganda

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Abstract

Background: Early diagnosis of spinal cord neoplasia serves patients from developing a number of complications and even death.

Methods: After obtaining ethical approval, retrospectively, a total of 53 tissue blocks of patients attended at the spinal ward were reviewed. Statistical analysis was done using SPSS version 20.0, and *p* value of less than 0.05 was applied to establish the existence of statistical significance between the compared categorical variables.

Results: The mean age of the patients was 30.7 ± 15.96 years. Most of the patients 32.1% ($n = 17$) were aged ≤ 19 years, and majority of the neoplasia 77.3% ($n = 41$) were extramedullary. Also, majority of the neoplasia 60.4% ($n = 32$) were benign and the malignant ones were 35.8% ($n = 19$). The mean duration of onset of symptoms for benign and malignant neoplasia in this study was 13.1 ± 16.4 and 3.4 ± 2.8 years, respectively, with statistical difference (95% CI 2.09–17.35, $p = 0.014$).

Conclusion: The patients with spinal cord neoplasia in the present study were of young age, and majority of them had benign neoplasia that were extramedullary located. The mean duration of onset of symptoms for patients with malignant neoplasia was significantly shorter than that of benign neoplasia.

Keywords: Spinal biopsies, Neoplasia, Diagnoses, Clinicopathologic

Background

Primary spinal cord neoplasia (PSCN) include a group of neoplasia which originate from the parenchyma of the spinal cord or from tissues that are contained within the surrounding spinal canal such as meninges and nerves among many others [1–3]. The prevalence of the PSCN has been reported to range from 4 to 8% of all the neoplasia involving the nervous system [1, 2]. However, a prevalence of 12% was once reported in the literature [6]. When considering secondary spinal cord neoplasia (SSCN), it has been found that majority (84%) are extramedullary and the remaining 16% of them are intramedullary. Additionally, over 50% of the SSCN are a result of metastatic lung carcinomas particularly small cell lung carcinoma (SCLC) [7, 8]. Both males and females are affected equally with PSCN [6, 7, 9]. Paediatric PSCN are rare compared to the general population, and they account for less than 6% of all the SCN tumours [10]. According to the Central Brain Tumor Registry of the United States report of 2012, it was reported that the incidence rate of PSCN among children is 0.19 per 100,000 person-years compared to 0.7 per 100,000 person-years in adults, and the incidence rate increases with the increase in age [11].

Anatomically, the PSCN have been divided into two main types: extradural and intradural types based on their vicinity to the thecal sac which encloses the spinal cord and cauda equina [12, 13]. Extradural PSCN

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are located outside the thecal sac, and they account for approximately 60% of all PSCN [12]. The intradural types whose incidence is 30% are further subdivided into two types: extramedullary and intramedullary types [6, 13, 14]. Approximately 10% of the PSCN are naturally associated with both intradural and extradural components of the spinal cord parenchyma [12]. Intradural extramedullary PSCN adhere to the external areas of the spinal cord parenchyma, and the intradural intramedullary PSCN usually affect the true spinal cord parenchyma [6].

PSCN may sometimes be categorized based on the type of cells and/or tissue affected [15]. Based on this categorization, there are gliomas, meningiomas and nerve sheath neoplasia. Gliomas arise from glial cells; for example, ependymoma, astrocytoma, and oligodendroglioma [6, 9, 14]. On the other hand, the peripheral nerve tumours include schwannoma and neurofibromas [3, 8]. Of the gliomas, astrocytomas are the most common tumours with male predilection followed by ependymomas [1, 2, 9]. Meningiomas are the most common types of PSCN with unknown aetiology albeit they have been linked with radiation and neurofibromatosis [16]. They have female predilection with a reported male-to-female ratio of 1:4 [16].

PSCN present clinically with a variety of clinical symptoms. One study that included children aged less than 3 years of age who were diagnosed with intramedullary tumours reported that the majority of the children were presenting with pain and other symptoms included motor regression, abnormal gait, torticollis, and kyphoscoliosis [17]. Other studies reported that pain, weakness, and sensory disturbances are the commonest symptoms among 430 patients who were both children and adults [1, 18, 19]. Therefore, this shows that pain is the most common clinical feature among patients with PSCN.

Majority of the PSCN are benign and tend to be extradural unlike intramedullary ones, which are by far the rarest PSCN accounting for only 7% [20]. As it is for benign PSCN, even malignant neoplasia affecting the spinal cord are commonly found to be intradural, and most of them result from metastasis in the surrounding tissues particularly the spines [5–7].

This study aimed to determine the frequency of occurrence of the different PSCN for the cohort of 53 patients who attended at a tertiary hospital in the central part of Kampala, Uganda, between January 2011 and December 2019.

Methods

This was a descriptive cross-sectional study that included 53 patients with spinal cord lesions managed in the spinal unit from January 2011 to December 2019. Both CT scan and MRI were used for preoperative diagnosis, and all patients were treated surgically. Retrospectively, laboratory requisition forms were used to obtain the data regarding demographic characteristics, clinical features, type of surgical intervention, histological diagnosis and anatomical location of the lesion. Classification of the lesions was done based on their anatomical location. Statistical analysis of the collected data was performed using Statistical Package for Social Science (SPSS) version 23.0. Errors and missing data were checked after running frequency tables and crosstabs. Continuous and categorical variables were presented in the form of mean ± standard deviation and proportions, respectively. Association of the categorical variables was done using the Chi-square test. A two-tailed p value less than 0.05 was considered significant.

Results

Demographic characteristics of the patients

The mean ± SD of the patients was 30.7 ± 15.96 years) (range 8–65 years). The mean age for males and females was 25.8 ± 14.01 and 36.6 ± 16.44 years, respectively, and the difference between the mean age for males and females was significantly different (95% CI − 19.15 to 2.36, $p = 0.013$). Most of the patients 32.1% (n = 17) were aged ≤ 19 years. Regarding anatomical involvement of the spinal cord by the neoplasia, majority of the neoplasia 77.3% ($n = 41$) were extramedullary and the intramedullary ones were 22.6% ($n = 12$). Involvement of the spine bone by the neoplasia was most found in the thoracic bone 52.8% ($n = 28$) followed by involvement of the cervical bone by comprising of 15.1% ($n = 8$). Involvement of other areas of the spine bone including sacrococcygeal and sacrolumbar was found in 9.4% ($n = 5$). Also, majority of the neoplasia 60.4% (n = 32) were benign and the malignant ones were 35.8% ($n = 19$). Imaging guided biopsies using computed tomography (CT) scan and magnetic resonance imaging (MRI) were taken in 37.7% ($n = 20$) patients and the remaining 62.3% ($n = 33$) had their biopsies taken after operation. The mean duration of onset of symptoms for benign and malignant neoplasia in this study was 13.1 ± 16.4 and 3.4 ± 2.8 years, respectively, with statistical difference (95% CI 2.09–17.35, p = 0.014) (Table 1).

Clinical features of the patients included in the present study

Table 2 shows the clinical characteristics of the patients in this study. Weakness of either upper or lower limbs was the most common clinical presentation in this study, which comprised 32% ($n = 31$) followed by 19.6% ($n = 19$) of lower back pain, and stool incontinence was the least common clinical feature, which comprised

Table 1 Description of the characteristics of the patients ($N=53$)

Variable	*n* (%)	Mean ± SD
Age (years)		30.7 ± 15.96 years
≤ 19	17 (32.1)	
20–29	13 (24.5)	
30–39	9 (17.0)	
40–49	5 (9.4)	
≥ 50	9 (17.0)	
Sex		
Male	29 (54.7)	
Female	24 (45.3)	
Anatomical classification of the lesions		
Extradural	19 (35.8)	
Intradural extramedullary	22 (41.5)	
Intradural Intramedullary	12 (22.6)	
Area of the spine bone involved		
Cervical	8 (15.1)	
Thoracic	28 (52.8)	
Lumbar	8 (15.1)	
Thoracolumbar	4 (7.5)	
Others	5 (9.4)	
Behaviour of the lesions		
Benign and neoplastic	32 (60.4)	
Benign and non-neoplastic	2 (3.8)	
Malignant	19 (35.8)	
Duration of onset of symptoms		
Benign cases		13.1 ± 16.4 years
Malignant cases		3.4 ± 2.8 years
WHO grading for related tumours		
I of IV (pilocytic astrocytoma)	2 (3.8)	
II of IV (ependymoma)	2 (3.8)	
Nurick scale		
I	8 (15.1)	
II	14 (26.4)	
III	5 (9.4)	
IV	17 (32.1)	
V	9 (17.0)	

Grade 0, root signs or symptoms; Grade I, cord, pathological features, gait intact; Grade II, mild gait dysfunction, employed; Grade III, gait dysfunction, unemployed; Grade IV, moderate to marked gait dysfunction, walks with help; Grade V, marked gait dysfunction, wheel chair bound

only 1.0% ($n=1$) of all the cases. In addition, among patients with spinal metastases, the varsity majority 72.2% ($n=13$) were presenting with back pain. Metastatic workup was performed in all 34% ($n=18$) patients with suspected metastatic disease to the spinal cord by using plain radiography, CT scan and magnetic resonance imaging (MRI) in 16.7% ($n=3$), 61.1% ($n=11$), and 22.2% ($n=4$), respectively.

Table 2 Clinical features of the patients at presentation ($N=97$)

Clinical presentation	*n* (%)
Weakness of limbs	31 (32.0)
Back pain	19 (19.6)
Paralysis	17 (17.5)
Bladder symptoms	8 (8.2)
Paraplegia	8 (8.2)
Spinal cord compression	5 (5.2)
Loss of sensation	4 (4.1)
Hyperreflexia	4 (4.1)
Stool incontinence	1 (1.0)

Some of the patients had more than one clinical feature

Histological diagnoses of the spinal cord lesions

Regarding histological findings in this study (Table 3), majority of the diagnoses 64.2% ($n=34$) comprised benign lesions and malignant neoplasia were present in 35.8% ($n=19$) patients. Of the malignant tumours, only 1.9% ($n=1$) case was primary to the spinal cord (malignant schwannoma) and the rest 34% ($n=18$) were metastatic to the spinal cord being relatively dominated by 5.7% ($n=3$) of infiltrating ductal carcinoma of the breast. Meningioma was the most common histological type found in 28.3% ($n=15$) patients followed by schwannoma 11.3% ($n=6$).

Anatomical location of the spinal cord lesions among patients

Figure 1 presents the frequency of spinal cord lesions according to anatomical location of the tumour. Meningioma was the most common histological type of the neoplasia in this study, most of them, 15.1% ($n=8$), were intraductal extramedullary followed by 13.2% ($n=7$) of them that were extraductal. None of the meningiomas were intramedullary. All the glial neoplasia, 7.5% ($n=4$), in this study were located intramedullary. Of the malignant neoplasia, most of them, 26.4% ($n=14$), were extramedullary and the remaining 9.4% ($n=5$) were intramedullary, and none of the malignant neoplasia were intramedullary primary.

Treatment approaches among the patients

Surgical removal of the lesions was found in 90.6% ($n=48$) of all the patients and of those that were treated surgically, 32.1% ($n=17$), were treated surgically alone and majority of them had benign lesions. Of those treated surgically, laminectomy and microscopic resection were performed in 71.7% ($n=38$) and 18.9% ($n=10$) patients, respectively. Complete excision of the lesions was found in 75.5% ($n=40$), and the remaining patients

Table 3 Histological findings of the lesions ($N=53$)

Histological finding		*n* (%)
Primary benign tumours	**Meningioma**	**15 (28.3)**
	Schwannoma	6 (11.2)
	Ependymoma	2 (3.8)
	Neurofibroma	2 (3.8)
	Pilocytic astrocytoma	2 (3.8)
	Haemangioma	2 (3.8)
	Lipoma	2 (3.8)
	Haemangioblastoma	1 (1.9)
Primary malignant tumours	Malignant schwannoma	1 (1.9)
Metastatic tumours	Infiltrating ductal carcinoma of the breast	3 (5.7)
	Adenocarcinoma of the lung	2 (3.8)
	Clear cell carcinoma of the kidney	1 (1.9)
	Squamous cell carcinoma	1 (1.9)
	Fibrosarcoma	1 (1.9)
	Hodgkin lymphoma	3 (5.7)
	Burkitt lymphoma	3 (5.7)
	Diffuse large B cell lymphoma	2 (3.8)
	Papillary carcinoma of thyroid	2 (3.8)
Inflammatory lesions	Cysticercosis	1 (1.9)
	Schistosomiasis	1 (1.9)

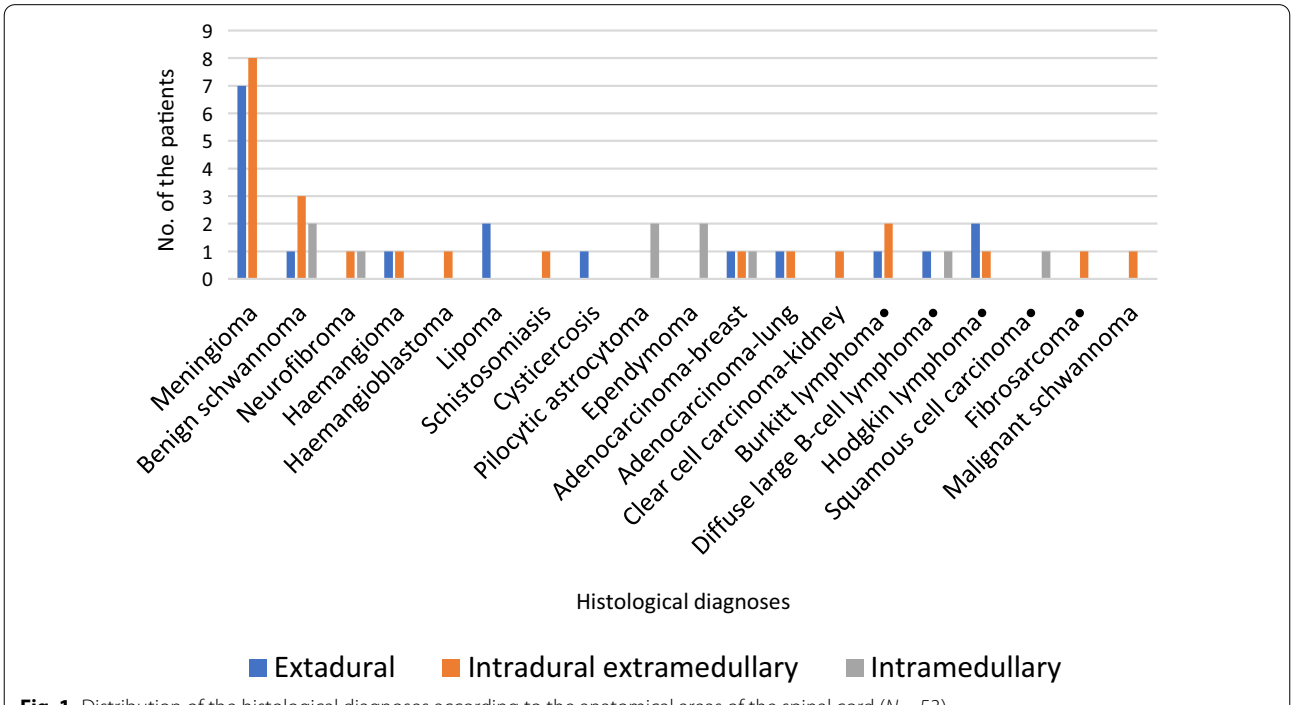

Fig. 1 Distribution of the histological diagnoses according to the anatomical areas of the spinal cord ($N=53$)

who were treated surgically, 24.5% ($n=13$), had incomplete excision, and therefore, they needed additional therapies, of whom 53.2% ($n=7$) and 46.2% ($n=6$) were further managed with radiotherapy and chemotherapy, respectively. Also, 13.2% ($n=7$) patients developed complications after surgery. Two patients who had parasitic infections (cysticercosis and schistosomiasis) were treated with praziquantel together with steroids. The mean length of stay at hospital before and after operation was 21 and 9 days, respectively (Table 4).

Clinical outcomes

The median follow-up period of the patients after operation and/or discharge was 39 months (range 1–48 months). At the end of the follow-up period, 20.8% ($n=11$) patients were lost to follow-up. The number of patients who died during the follow-up time was 11.3% ($n=6$) and majority of them were those who had a diagnosis of malignant tumours and particularly metastasis. Of all the cases followed up, 1.9% ($n=1$) patients with malignant schwannoma developed recurrence at the 33rd month of follow-up and they underwent removal of the recurrent tumour without complications. Other postoperative complications noted in this series included infections and neurological deficits, which were present in 3.8% ($n=2$) and 9.4% ($n=5$), and were managed by antibiotics and rehabilitation, respectively.

Discussion

Primary spinal cord neoplasia (PSCN) present clinically diversely, and there are a significant number of cases of SCN, which tend to be asymptomatic unlike secondary ones that are most likely to be symptomatic. Weakness of limbs was the most common presenting symptom among patients in the present study followed by pain contrarily to the findings in the studies of Jagadesh et al. [23] and Gadgil et al. [20] in which pain was the most common presenting symptom followed by muscle weakness but similar to the finding in the study of Chikani et al. [24]. Predominance of weakness of limbs among patients with spinal cord lesions was also previously reported by Cohen-Gadol et al. [25] and Venugopal et al. [13], which is similar to this study. Other studies have reported sensory loss to be the most common presenting symptoms. For example, Venugopal et al. [13] and Mwang'ombe and Ouma [26] reported that majority of the patients in their studies were presenting with sensory loss. The marked great variation in the clinical presentation of the patients with PSCN observed in various studies explains the reason for the difficulty in making correct diagnosis clinically. This necessitates the use of histological biopsies, which to some extent contributes to the delay in making the right diagnosis, therefore contributing to worsening of the prognosis of the patients.

Regarding the location of the spinal cord lesions in the spinal vertebra and cord in this study, it was observed that most of the lesions were located in the thoracic bone followed by cervical bone similar to the findings in other studies [3, 4, 8, 12]. However, in another study done by Chikani et al. it was reported that most of the spinal cord lesions were located in the cervical bone followed by thoracic bone [24]. The reason for the frequent involvement of thoracic and cervical spinal vertebra is not clearly known. Intradural extramedullary location of the spinal cord lesions in the present study was in agreement with the observation in the two previously done studies [4, 8]. There were a smaller number of lesions located intramedullary than in both extradural extramedullary and intradural extramedullary in this study. This is similar to the finding in the study of Nitin et al. [20] but different to the finding in the studies done by Payam et al. [27].

In the present study, 64.2% of the PSCN were benign in nature. This is similar to 80.4%, 86.5% and 70.6%, which were reported in previous studies [4, 8, 10]. In all the three previous studies, a large proportion of the neoplasia were meningioma, which was also similar to this study in which 28.3% of them were meningioma and most of them were found among females, which is again in agreement with other studies done previously [2, 7, 14]. However, this observation is different from the study done by Payama et al. in Iran in which most of majority benign PSCN were peripheral nerve sheath neoplasia (PNSN) and were predominated by schwannoma [27]. Anatomically, most of the meningioma in this study were intraductal extramedullary located, which is in keeping line with the observation in other studies [2, 4, 14]. Of the PNSN in this study, most of them comprised of benign schwannoma followed by neurofibroma.

Surgery has been the mainstay modality of treatment among patients with spinal cord lesion (intradural and

Table 4 Treatment modalities offered to the patients included in the study ($N=53$)

Treatment approaches	Nature of the lesion	
	Benign *n* (%)	Malignant *n* (%)
Surgery alone	11 (20.8)	6 (11.3)
Radiotherapy alone	4 (7.5)	2 (3.8)
Surgery and radiotherapy	4 (7.5)	3 (5.7)
Surgery and chemotherapy	6 (11.3)	3 (5.7)
Radiochemotherapy	7 (13.2)	2 (3.8)
Surgery and radiochemotherapy	2 (3.8)	3 (5.7)

intramedullary). Mild-to-moderate morbidity as well as mortality rates, which can either be perioperative or post-operative, has been documented in the literature. The morbidity rate of 15.1% in the present study was close to that of 13.3% reported in the study of Venugopal et al. [13] but slightly lower than 21% and 29% reported in the two previous studies [25, 26]. Although surgery faces challenge due to inoperability of the spinal cord lesions, still the rate of local recurrence is very low. In the present study, local recurrence was 1.9% and the other four previous studies reported no local recurrence [1, 7–9]. The mortality rate of 11.3% in this study was similar to 10.5% reported in the study by Cohen-Gadol et al. [25].

Conclusion

Majority of PSCN in the present study were benign and intradural extramedullary located. Most of patients were clinically presenting with weakness of the limbs followed by back pain. Occurrence of the PSCN among children in this study was less than the frequency of occurrence of them among adults. Complete surgical resection of the lesions among patients in the present study conferred better clinical outcomes with very low rates of morbidity and local recurrence similar to what has been reported in other studies.

Abbreviations

CNS: Central nervous system; PNSN: Peripheral nerve sheath neoplasm; PSCN: Primary spinal cord neoplasia; SCN: Spinal cord neoplasia; SSCN: Secondary spinal cord neoplasia; SCLC: Small cell lung carcinoma.

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Availability of data and materials

The datasets used during in this study are available from the corresponding author, and they may be provided when requested.

Declarations

Ethical approval and consent to participate

This research was approved by the institution review board of the school of biomedical science of the Makerere College of Health Science (MakCHS) (IRB/MakCHS-0041/20).

Consent for publication

This was not required because the data used were obtained retrospectively.

Competing interests

The author declares that he has no competing interests.

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