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Egyptian Journal of Neurosurgery (2023) 38:67
https://doi.org/10.1186/s41984-023-00254-5

Egyptian Journal of Neurosurgery

RESEARCH Open Access

Clinical profile of paediatric spinal cord damage in a developing country's rural-area tertiary hospital neurosurgery

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Abstract

Background Spinal cord damage (SCD) is rare in children, hence the paucity of literature on the subject, particularly in developing countries. This study aims to define the clinical epidemiology of paediatric SCD in a Nigerian tertiary health facility.

Methods A retrospective review of a 42-month long prospectively collected clinical data on paediatric SCD in a rural neurosurgery unit.

Results There were 37 children (20 males) accounting for about 12% of the paediatric neurosurgical patients we managed during the study period. The mean age was 6.9 years (peak = 0–4 years, 43.2%). Traumatic spinal cord injury (SCI) was the cause of SCD in 54.1% (20/37) of the cases, spinal bifida in 37.8%, spinal cord tumour in 5.4%, and spinal tuberculosis in 2.7%. The mean age of patients with traumatic SCI was 11.5 years, while the median age for spinal bifida was 3 days. Traumatic SCI was caused by road traffic accident in 70% (14/20), and falls in 25%. The cervical spinal cord was the location of the spinal cord damage in 51.4% of all the cases in this study, lumbosacral in 24.3%, and sacral in 10.8%. Traumatic SCI was predominantly located in the cervical region in (90%, 18/20) while spinal bifida was most commonly lumbosacral (64.3%, 9/14).

Conclusion Spinal cord damage accounted for more than a tenth (12.1%) of our paediatric neurosurgical workload in this rural neurosurgery, and are mostly due to traumatic SCI and spinal bifida.

Keywords Spinal cord damage, Paediatric, Epidemiology, Rural Neurosurgery, Developing country

Introduction

Spinal cord damage (SCD) may result from trauma and non-traumatic causes such as tumours, infections/inflammation, vascular diseases, congenital anomalies, and demyelinating lesions among others [1–4]. Comparatively well-reported in adults, it is relatively uncommon in the paediatric population, but when it occurs may result in devastating consequences due to lifelong disabilities, morbidities, and mortality; as well as the huge financial costs of long-term specialized care and rehabilitation needed in such cases [1, 3–5]. There is, therefore, paucity of published data on the epidemiology of SCD among children compared to adult population [1].

Even so, this same sparse extant literature weighs heavily in favour of only traumatic spinal cord injury (SCI) (as against non-traumatic causes of spinal cord dysfunction, SCDys); and not unexpectedly features better data quality in high income countries compared to the developing

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ones, the low-medium income countries (LMIC) [1, 3]. Furthermore, the non-traumatic aetiologies of SCD that get reported in the literature are usually only tumours and infections [3].

All said, data from sub-Saharan Africa (SSA) were conspicuously absent in the recent global mapping for the epidemiology of paediatric spinal cord damage by the International Spinal Cord Society (ISCoS) Prevention Committee [1]. In Nigeria, our large SSA country, there is no national register for spinal cord damage, adult or paediatrics, and although there have been several publications on congenital lesions from our country [6–9], little or nothing exists in terms of published literature on traumatic spinal cord injury, spinal cord tumours and other causes of SCD in an exclusively paediatric population [10, 11]. This study therefore aims to define the clinical epidemiology of paediatric SCD in a Nigerian tertiary health facility.

Methods

This is a retrospective review of prospectively collected clinical data on patients aged 0–18 years who were diagnosed with spinal cord damage in a frontline rural tertiary health facility over a period of 42 months. We collected data on the age and gender of the patients, the diagnosis, aetiology of the paediatric SCD, whether traumatic or non-traumatic; trauma causation; the location of spinal cord damage on the neuraxis, functional grade of the injury; mode of treatment and outcome of care. The functional grade was classified using the Frankel grading system (A = complete injury, B = incomplete, sensory preservation, C = incomplete, non-functional motor preservation, D = incomplete, useful motor preservation, E = intact motor and sensory functions) [12]. Outcome of care was classified into good [Frankel Grades D and E (Power grade ≥ 3 to grade 5, on the MRC, UK scale [13])] and poor [Frankel Grades C, B and A (power grades 0–2)]. The data were analysed with the IBM's Statistical Package for the Social Sciences (SPSS) version 20 (IBM, New York, USA).

Results

We managed 37 children, 20 males and 17 females (M:F = 1.2:1) with spinal cord damage during the study period, accounting for 12.1% of our paediatric neurosurgical workload. The mean age was 6.9 years with peak incidence in the 0–4 years age group which accounted for 43.2% of the cases (Table 1). Traumatic spinal cord injury was the cause of spinal cord damage in 54.1% of the cases (20/37), spinal bifida in 37.8% (14/37), spinal cord tumour in 5.4% (2/37), and tuberculosis of the spine in 2.7% (1/37). There were more males in the cohort with traumatic SCI (M:F = 1.9:1), while the reverse was the case with spinal bifida (M:F = 1:1.8) (Table 2). The mean age of patients with traumatic SCI was 11.5 years (range = 4–18 years), while the median age of patients with spinal bifida was 3 days (Range = 5 h–5 years). All but 2 of the patients with spinal bifida presented within the first 10 days of life. Road traffic accident was the cause of traumatic SCI in 70% of the cases (14/20) while falls accounted for 25% (Table 3).

The cervical spinal cord was the location of the damage in 51.4% of all the cases in this study subjects, lumbosacral in 24.3%, and sacral 10.8% (Table 1). Traumatic SCI was located in the cervical region in 90% (18/20), thoracic in 1 patient and both cervical and thoracic in another patient. Spinal bifida was lumbosacral in 64.3% of the cases (9/14), sacral in 28.6% (4/14) and lumbar in 7.1% (1/14). One each of the spinal cord tumours was located in the cervical and thoracic segment and both

Table 1 Clinical and demographic characteristics of the patients

Variables	Frequency	Percentage
Gender		
Male	20	54.1
Females	17	45.9
Age distribution		
0–4 years	16	43.2
5–9 years	8	21.6
10–14 years	5	13.5
15–18 years	8	21.6
Location		
Cervical	19	51.4
Thoracic	3	8.1
Lumbar	1	2.7
Sacral	4	10.8
Cervical and thoracic	1	2.7
Lumbosacral	9	24.3
Neurological status at last medical evaluation		
Neurologically the same	32	86.5
Improved	5	13.5
Deteriorated	–	–
Total	37	100

Table 2 Aetiologies of spinal cord damage in children

Aetiology	MaleN (%)	FemalesN (%)
TSCI†	13 (65.0)	7 (35.0)
Spinal bifida	5 (35.7)	9 (64.3)
Spinal cord tumours	1 (50.0)	1 (50.0)
Tuberculosis of the spine	1 (100.0)	–

†TSCI = Traumatic spinal cord injury

Table 3 Aetiologies of traumatic spinal cord injury in children

Aetiology	Frequency	Percentage
Motorcycle	9	45.0
Motor vehicle	5	25.0
Fall	5	25.0
Others	1	5.0
Total	20	100.0

Table 4 Paediatric spinal cord damage in a rural practice: Outcome of care

Outcome	Frequency	Percentage
Good	20	54.1
Poor	7	18.9
DAMA†	6	16.2
Referred	2	5.4
Defaulted	2	5.4
Total	37	100.0

† DAMA = Discharge against medical advice

were intramedullary. The single case of tuberculosis was located in the thoracic spine.

All the cases of traumatic SCI were managed non-operatively while 5 of the 14 (35.5%) patients with spinal bifida had surgery. The outcome of care was good in 74.1% (20/27) of the cases, poor in 25.9% (7/27, 5 operated and 1 yet to be operated cases of spinal bifida, and a case of complete TSCI), 6 patients discharged against medical advice, while the two patients with spinal cord tumours defaulted from the clinic because of lack of fund for the proposed surgery (Table 4).

Discussion

Spinal cord damage (SCD) is rare among children and there is as yet dearth of quality epidemiological data on the subject globally, particularly so in the LMICs. This study is a descriptive analysis of 37 paediatric patients with spinal cord damage seen at a tertiary hospital located in a rural area of Nigeria, an African LMIC. There were more males than females in our patients population. Traumatic SCI and spinal bifida were the aetiologies in majority of the cases (91.9%). The patients with non-traumatic SCD were younger than those with trauma. Road traffic accident was the most common cause of traumatic SCI in this cohort. Spinal cord tumours and tuberculosis of the spine are rare in our practice while there were no cases of transverse myelitis or vascular diseases in this study. A significant number of our patients in whom surgery was indicated (9 cases, 7 with spinal bifida and 2 with spinal cord tumours) did not have the proposed surgery because of sociocultural and economic constraints.

Traumatic SCI was the most common cause of SCD in this series. This finding and the male predominance in this cohort of patients have been widely reported [1, 3, 4, 14–16], though there were more non-traumatic cases in the series by Galvin et al. [2] and Lee et al. [5]. Similar to the literature [4, 15–19], the peak incidence is in older children in our patients, road traffic accident is the most common cause of the traumatic SCI, and the vast majority of the injuries in our patients are located in the cervical spine. Although road traffic accident is the leading cause of traumatic SCI, motorcycle rather than motor vehicle accounted for majority of these cases, an indication of the proliferation of this less expensive mono-transport mode of mass transit in our nation, as in most other LMICs [20]. The latter, together with a large population of pedestrian paediatric road users resulting from almost universal lack of effective mass transit system, inability of a reasonable proportion of the population to afford commercial motor vehicles, and the need for a significant proportion of children to supplement family income by hawking goods on the high ways may at least in part explain the predominance of traumatic cause of paediatric SCD in our study compared to the non-traumatic causes that predominate in the series by Galvin et al. [2] and Lee et al. [5]. There is therefore need for concerted national effort including but not limited to review and enforcement of extant laws in order to protect these vulnerable road users in our country and LMICs settings like our own.

Spinal bifida, accounting for about a third of the total burden and about four-fifth of non-traumatic cases, is the second most common cause of SCD among children in this study subjects. The reported number (14/37) of this congenital anomaly, though somewhat lower than previous publications on spinal bifida from some urban parts of our country [6–9], is actually proportionately larger than reported in the literature elsewhere [4, 5, 21]. Our figures of spinal bifida representing 37.8% of total SCD and 82.4% of non-traumatic SCD are higher than the 10.4% and 17.9% reported by Lee et al. [5], and 5.8% and 22% reported by Kulshrestha et al. [4]. In the series by van den Berg et al. [21], neural tube defects accounted for 45% of the non-traumatic SCD among the paediatric population. This high number of neural tube defect in our study may in part be explained by the well-known poor awareness of neural tube defect prevention measures among women of child bearing ages and absence of a robust nationwide neural tube defect prevention programme in our country [22–24]. This calls for a robust national policy on the highly preventable neonatal/paediatric disease burden.

Spinal cord tumour and infection accounted for only a small percentage of our patients (Table 2). Our proportion of SCD resulting from spinal cord tumours is lower than in most series [1, 3, 5, 10], although similar finding to ours was reported by Kulshrestha et al. [4]. The rarity of spinal cord tumours among children in our country was reported in a review of the largest data as yet on spine tumours in our country [10]. Tuberculosis of the spine and other infections would have been expected to be prevalent in settings like ours, especially on the background of the high rates in a previous publication from our country [11]. This rarity of infections in our study may be due to the contemporary general improvement in the nutritional and health status of the population, effectiveness of tuberculosis preventive measures, and improved access to effective treatment for same.

Other documented non-traumatic causes of SCD such as demyelinating lesions, vascular pathology, transverse myelitis and syringomyelia were not encountered in this study. This may in part be due to the relatively small number of our patients. However, the rarity of these lesions had been previously reported in a review of non-traumatic causes of paraplegia among paediatric patients over a 15 year period at the foremost teaching hospital in our country [11]. In the series, there were only 2 cases (1.8%) of transverse myelitis, and a single case (0.9%) of syringomyelia.

This report is limited by the fact of it being a single-author, single-institution study with a relatively small sample size. It nevertheless gives a glimpse into the burden of spinal cord damage among children in a rural neurosurgical practice in a developing country. We hope it will serve as a springboard for more robust regional or even national studies in our country and in fact many other LMICs with a view to providing quality data for the global definition of the epidemiology of spinal cord damage in the paediatric population.

Conclusion

In this survey from a Nigerian rural tertiary-hospital neurosurgery practice, paediatric spinal cord damage accounted for 12.1% of our paediatric neurosurgical workload. Traumatic SCI and spinal bifida were the cause of spinal cord damage in most of our patients. Spinal cord tumour and infections were rare while transverse myelitis and other non-traumatic causes of spinal cord damage were not seen among our patients. Review and enforcement of traffic laws and robust national neural tube defect prevention policies will go a long way in reducing the prevalence of paediatric spinal cord damage in our country.

Abbreviations

SCD	Spinal cord damage
SCDys	Spinal cord dysfunction
SCI	Spinal cord injury
LMIC	Low-medium income country
SSA	Sub-Saharan Africa
ISCoS	International spinal cord society
SPSS	Statistical package for the social sciences
MRC	Medical research council

Acknowledgements

To the resident doctors, house officers, and nursing staffs who rendered some help in the data-gathering phase of the study.

Author contributions

TAO, AOA, and INE contributed to the study conception and design. Data collection was done by TAO and INE. TAO and AOA analysed the data. The first draft of the manuscript was written by TAO. AOA and INE critically reviewed the manuscript. All authors read and approved the final manuscript.

Funding

No funding was received for conducting this study.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This is an observational study. The FMC Owo Research Ethics Committee has confirmed that no ethical approval is required.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Received: 19 July 2023 Accepted: 21 August 2023
Published online: 16 November 2023

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