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ORIGINAL RESEARCH

The clinical profile and acute care of patients with traumatic spinal cord injury at a tertiary care emergency centre in Addis Ababa, Ethiopia



Profil clinique et soins aigus apportés aux patients souffrant de lésions traumatiques de la moelle épinière dans un centre d'urgence de soins tertiaires à Addis-Abeba, Éthiopie

Finot Debebe^{a,*}, Assefu Woldetsadik^a, Adam D. Laytin^b, Aklilu Azazh^a, James Maskalyk^c

^a Addis Ababa University, Ethiopia

^b Oregon Health & Science University, USA

^c Emergency Medicine, University of Toronto, Canada

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Introduction: Traumatic spinal cord injuries can have catastrophic physical, psychological, and social consequences, particularly in low resource settings. Since many of these injuries result in irreversible damages, it is essential to understand risk factors for them and focus on primary prevention strategies. The objectives of this study are to describe the demographics, injury characteristics, and management of traumatic spinal cord injury victims presenting to the Adult Emergency Centre of Tikur Anbessa Specialised Hospital in Addis Ababa, the tertiary referral centre for emergency care in Ethiopia.

Methods: A prospective cross sectional survey was conducted from October 2013 to March 2014 in the Adult Emergency Centre of Tikur Anbessa Specialised Hospital. Patients were identified at triage and followed through admission to discharge from the emergency centre.

Results: Eighty-four patients with traumatic spinal cord injuries were identified. The mean age was 33 years and 86% were male. The most common mechanisms of injury were motor vehicle collisions (37%), falls (31%), and farming injuries (11%). The cervical spine (48%) was the most commonly injured region and 41% were complete spinal cord injuries. Most patients (77%) did not receive any prehospital care or medical care at other facilities prior to arrival in the Emergency Centre.

Conclusion: In our context, traumatic spinal cord injuries predominantly affect young men, and the majority of victims suffer severe injuries with little chance of recovery. Attention to occupational and road traffic safety is essential to mitigate the personal and societal burdens of traumatic spinal cord injuries. It is also imperative to focus on improving prehospital care and rehabilitation services for traumatic spinal cord injury victims.

Introduction: Les lésions traumatiques de la moelle épinière peuvent avoir des conséquences physiques, psychologiques et sociales catastrophiques, notamment dans un contexte caractérisé par de faibles ressources. La majorité de ces blessures résultant sur des dommages irréversibles, il est essentiel de comprendre les facteurs de risque qui y sont associés et de se concentrer sur les stratégies de prévention de base. Les objectifs de cette étude sont de décrire les caractéristiques démographiques et de la blessure, et la prise en charge des victimes de lésions traumatiques de la moelle épinière se présentant au Centre d'urgences pour adultes de l'hôpital spécialisé de Tikur Anbessa à Addis-Abeba, le centre de référence tertiaire pour la prise en charge d'urgence en Éthiopie.

Méthodes: Une étude prospective transversale a été menée entre octobre 2013 et mars 2014 au Centre d'urgences pour adultes de l'hôpital spécialisé de Tikur Anbessa. Les patients ont été identifiés au triage et suivis de leur admission à leur sortie du centre d'urgences.

Résultats: Quarante-vingt-quatre patients présentant des lésions traumatiques de la moelle épinière ont été identifiés. L'âge moyen était de 33 ans et 86% des patients étaient des hommes. Les mécanismes de blessure les plus courants étaient les collisions de véhicules motorisés (37%), les chutes (31%) et les blessures liées à une activité agricole (11%). La colonne cervicale était la région la plus fréquemment touchée (48%) et 41% étaient des lésions entraînant une interruption totale de la moelle épinière. La plupart des patients (77%) n'avaient pas reçu de soins avant d'arriver à l'hôpital ni de soins médicaux dans d'autres structures avant d'arriver aux Urgences.

Conclusion: Dans notre contexte, les lésions traumatiques de la moelle épinière affectent essentiellement les hommes jeunes, et la majorité des victimes souffrent de blessures graves, et ont peu de chances de guérir. Une attention à la sécurité au travail et à la sécurité routière est essentielle afin de diminuer le fardeau personnel et sociétal des lésions traumatiques de la moelle épinière. Il est également impératif de se concentrer sur l'amélioration de la prise en charge pré-hospitalière et des services de rééducation pour les victimes de blessures traumatiques de la moelle épinière.

African relevance

- In the African context traumatic spinal cord injuries predominantly affect young men.
- The majority of victims suffer severe injuries with little chance of recovery.

- Improving prehospital care and rehabilitation services are imperative.

Introduction

Traumatic spinal cord injuries (TSCI) can have catastrophic lifelong psychological and physical consequences.¹ Despite improvements in prehospital and emergency care, they remain

* Correspondence to Finot Debebe. gofinot@gmail.com

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a source of morbidity and mortality worldwide.² The burden of spinal pathology in sub-Saharan Africa, and particularly in Ethiopia, is largely unknown.³

Traumatic spinal cord injuries affect not only the victims of the injury, but also the victim's caretakers, families, communities, and society in general. The impact is even greater in developing countries like Ethiopia, where rehabilitation services for patients with TSCI services are virtually non-existent. Most TSCI victims are discharged from the hospital without receiving any intervention because they can afford neither the appropriate procedures nor rehabilitation services in private sectors.

Prehospital emergency medical care is in its infancy in Ethiopia. As a result, most TSCI victims are brought to the hospital by their caretakers or police officers from injury sites without receiving any prehospital care. Additionally, most Ethiopian TSCI patients have delayed presentations to the hospital, increasing the likelihood of developing complications of their injuries.^{7,8}

The primary objective of this study is to describe the demographics and injury characteristics of TSCI victims presenting to the Adult Emergency Centre of Tikur Anbessa Specialised Hospital, Addis Ababa, the tertiary referral centre for emergency care in Ethiopia. The secondary objective is to describe the current emergency centre (EC) management of these patients. These results are crucial for developing targeted TSCI prevention strategies.⁴ They also allow us to delineate gaps in the emergency care of these patients and highlight the importance of expanding and improving prehospital care and rehabilitation services in Ethiopia.³

Methods

Ethiopia is a country of 94 million people in East Africa. It is ranked 173 out of 187 on the UN Human Development Index, signifying a low level of development. Tikur Anbessa Specialised Hospital (TASH) is located in the nation's capital, Addis Ababa, and is the largest teaching hospital and tertiary referral centre in the country. It is home to Ethiopia's only emergency medicine and neurosurgery residency programmes. TASH has over 700 hospital beds and treats approximately 18,000 patients per year in its Adult Emergency Centre, the majority of whom are referred from other healthcare centres and hospitals around the country. TASH is one of only three public hospitals providing neurosurgical services in Ethiopia.

Despite its essential role, the hospital suffers from significant resource constraints, which limit surgical and radiological capacity. TASH's neurosurgery residency programme was in its infancy, with few faculty members at the time of this study. There were only 25 hospital beds dedicated to inpatient neurosurgical care. The hospital relies on donations for surgical materials and instruments necessary for spinal fixation, so they were not always readily available. Throughout the duration of this study, CT and MRI imaging were not consistently available onsite. Instead, plain X-rays were routinely used for initial screening studies.

We conducted a prospective cross-sectional study over 5.5 months between October 1, 2013 and March 15, 2014. Patients presenting to the Adult Emergency Centre at TASH with a clinical history of trauma and neurologic deficits were identified during triage and included in the study. Patients were excluded if they were younger than 14 years or had a Glasgow

Coma Score less than 15, concomitant head injuries, or significant comorbid medical conditions such as malignancy. Patients were also excluded if their clinical record was missing key data elements such as injury mechanism, severity, or complications. For each patient, information about demographics, injury event, prehospital care, clinical presentation, and emergency centre management was collected using a standardised questionnaire. Data were entered and analysed descriptively using SPSS version 20.

Ethical clearance was obtained from the Department of Emergency Medicine, Addis Ababa, Ethiopia. The research was conducted as part of the training in a postgraduate Emergency Medicine programme. Oral consent was obtained from the participants or their legal guardians. Confidentiality was maintained during data collection and afterwards.

Results

A total of 88 patients with TSCI were identified during the study period. Four TSCI victims were excluded because of incomplete data, leaving 84 for analysis.

Of the 84 included TSCI victims, 72 were male (85.7%), making the male:female ratio 6:1 (Table 1). The mean age at presentation was 33 (SD 13.8). Regarding their occupations, most TSCI victims were farmers ($n = 30$, 36.1%) or daily labourers ($n = 11$, 13.3%) (Fig. 1).

Patients with traumatic spinal cord injuries were referred to Tikur Anbessa Specialised Hospital from all over Ethiopia, with only 5 patients (6%) coming directly to the Adult Emergency Centre without being treated elsewhere first. The majority (53.6%) lived less than a six hour drive from the hospital. However, only 13 patients (15.5%) came to the hospital within six hours of sustaining their injuries, and the median time to presentation was 36 h (IQR 12–72 h). Over half of patients who presented over 6 h after injury (56.9%) reported that the referring hospitals did not refer them early, while 11.8% were delayed because of lack of transportation, and 9.8% were delayed by the desire to collect money prior to visiting a hospital.

The most common mechanisms of injury were motor vehicle injuries (36.9%) and falls from a height of greater than or equal to two metres (31%). Nine patients (10.7%) were injured by livestock, specifically oxen (Fig. 2). Work-related injuries occurred in 34.5% of patients.

The cervical spine was the most commonly injured body region (47.6%), and complete spinal cord injuries (ASIA class

Table 1 Age versus gender distribution of patients with traumatic spinal cord injuries in Tikur Anbessa Hospital, September 2014, Addis Ababa, Ethiopia.

Age (years)	Male <i>n</i> (%)	Female <i>n</i> (%)	Total
14–23	15 (17.9)	5 (6.0)	20 (23.8)
24–33	25 (29.8)	4 (4.8)	29 (34.5)
34–43	14 (16.7)	1 (1.2)	15 (17.9)
44–53	11 (13.1)	2 (2.4)	13 (15.5)
54–63	4 (4.8)	0	4 (4.8)
≥64	3 (3.6)	0	3 (3.6)
Total	72 (85.9)	12 (14.4)	84 (100)

Totals may not add to 100% due to rounding.

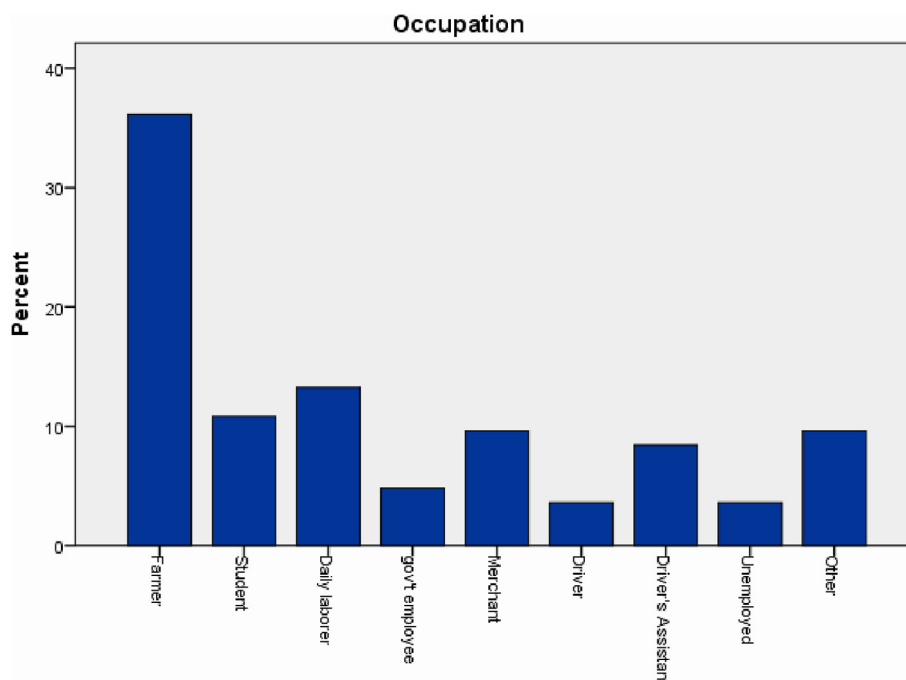


Figure 1 Occupations of patients with traumatic spinal cord injuries presenting to the Adult Emergency Centre at Tikur Anbessa Specialised Hospital.

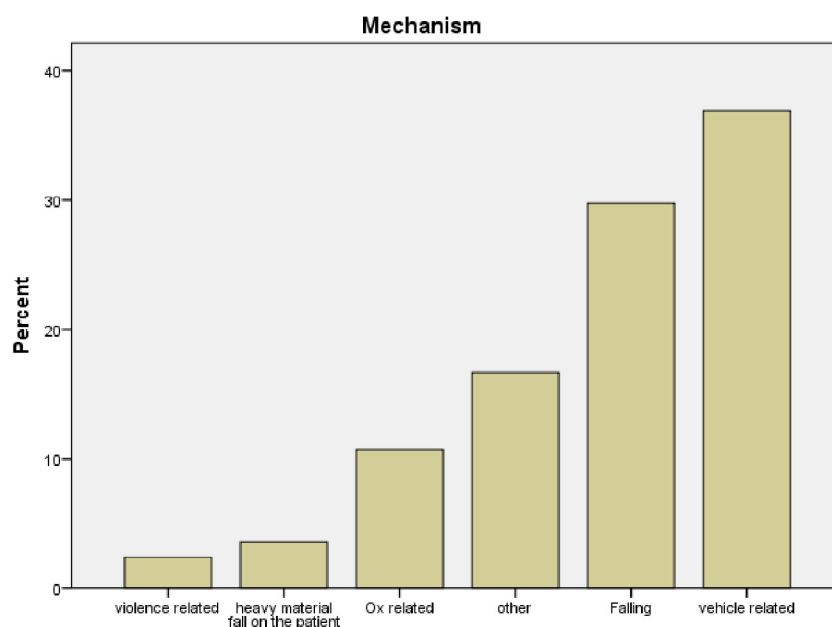


Figure 2 Mechanisms of injury among patients with traumatic spinal cord injury presenting to the Adult Emergency Centre at Tikur Anbessa Specialised Hospital.

A) were very common ($n = 34$, 40.5%) (Table 2). Many of the patients had concomitant injuries to other body systems ($n = 37$, 44%) most commonly extremity injuries (16.7%).

Out of the 84 patients with TSCI, 65 (77.4%) did not undergo spinal cord immobilisation prior to arrival at the hospital. Six patients had already developed secondary complications at the time of arrival, including three with pneumonia (3.6%), two with pressure sores (2.4%), and one with a urinary tract infection (1.2%).

Sixty-one patients (72.6%) were the financial providers for their families prior to injury, with a mean of five people depending on them (SD 5.13). Eight patients (9.5%) had no one to care for them after discharge.

The mean length of stay in the Adult Emergency Centre was 4.8 days (SD 3.04). Fifty patients (59.5%) stayed in the Adult Emergency Centre for more than 72 h. Sixty patients (71.4%) did not receive at least one essential component of TSCI care including analgesia, DVT

Table 2 Clinical profiles of patients with traumatic spinal cord injuries presenting to Tikur Anbessa Specialised Hospital, September 2014, Addis Ababa, Ethiopia ($n = 84$).

		Degree of severity using ASIA					Total n (%)
		A	B	C	D	E	
Level of injury	Cervical	13	10	5	6	6	40 (47.6)
	Thoracic	12	2	2	0	0	16 (19.0)
	Lumbar	8	3	4	4	6	25 (29.8)
	Thoracolumbar	0	1	0	0	1	2 (2.4)
	Cervical and thoracic	1	0	0	0	0	1 (1.2)
Immobilised prior to arrival to Tikur Anbessa	Yes	5	5	3	4	2	19 (22.6)
	No	29	11	8	6	11	65 (77.4)

ASIA, American Spinal Association classification.

prophylaxis, or immobilisation during their stay in the Adult Emergency Centre.

Overall, 37 patients (44%) were discharged home, 36 (42.9%) were admitted to the inpatient ward and nine patients (10.7%) were referred to other institutions. Two patients (2.4%) died in the Emergency Centre from respiratory failure. Fourteen patients were discharged home from the Emergency Centre because an inpatient ward bed was unavailable at TASH and they could not afford admission at a private hospital.

Discussion

TSCI is a common type of injury that can have devastating consequences for individuals and their communities. Similar studies conducted in United States, Norway, Nigeria, Senegal, Sierra Leone and other parts of the world show that TSCI predominantly affects the youngest and the most productive age groups in the community.^{1,10–17} The mean age of presentation in our study was similar to that reported in Senegal (36.1 years) and Nigeria (30 years in the Plateau State and 36.13 years in the Southeast region). The male to female ratio of 6:1 in our study is slightly lower than was reported in Nigeria's Plateau State (10:1) and higher than reported in southeast Nigeria (4.3:1). Further, the large number of young men with TSIs in our hospital reflects the high prevalence of workplace injuries, since young men tend to endure more risky working conditions. In our study, 92.5% of our patients were younger than 60 years, reflecting the low average age in Ethiopia, where the average life expectancy is 62. In Ethiopia, many people do not know their exact age, and often underestimate it.

Although the majority of our patients (53.6%) lived within a six hour drive from TASH, few came to the hospital within 6 h of sustaining their injuries (15.5%). Educating referring hospitals about the importance of timely transfer to specialised centres can result in earlier evaluation, and possibly earlier treatment and better outcomes. It would be best for patient care if referring centres transferred patients only after discussing their care with TASH's neurosurgical service to ensure appropriate stabilisation and safe transport, and to verify that the necessary resources for specialty care are available at TASH.

The most common mechanisms of injury in this study were motor vehicle injuries and falls. Factors contributing to the prevalence of motor vehicle injuries include the increasing usage of motor vehicles for transportation, a large number of old motor vehicles without modern safety features on the road, inadequate traffic regulations and poor road traffic

infrastructure. Farming-related injuries involving livestock accounted for one tenth of TSIs, and constitute a unique feature of our patient population. These typically occurred when farmers were pushed over by an ox, had an ox fall on them, or were thrown into a ditch by an ox. Over a third of our patients had work-related injuries, but most did not have insurance to pay for their healthcare expenses.

The majority of the patients had cervical spine injuries, followed by lumbar and thoracic spine injuries. This is similar to the pattern of injuries reported in Iran, Zimbabwe, Nigeria, Senegal, and other developing countries.^{5,6,18} As in other sub-Saharan African studies, complete spinal cord injuries were common in our study (40.5%). This rate is slightly lower than the one reported in Southeast Nigeria (47.06%) and higher than the one reported in Senegal (36.4%). Even though majority of our patients (94%) were referred from other hospitals, 77.4% did not undergo spinal cord immobilisation prior to arrival in the Adult Emergency Centre.

Many patients left without being admitted to hospital. This is distressing, and reflects a lack of capacity even at this referral level. Furthermore, many patients stayed in the Adult Emergency Centre for several days without receiving adequate care. This is an important focus for quality improvement work, both educating healthcare workers about appropriate care for TSCI victims, and ensuring that early and ongoing neurosurgical care is available both in the Adult Emergency Centre and inpatient wards. Finally, these shortcomings highlight the need for increased training opportunities for emergency medicine professionals in Ethiopia.

The emergency centre is not an ideal environment to provide ongoing care, or for victims' families to receive teaching and support. While efforts must be made at the prehospital level to get patients to the EC in a timely fashion, overcrowding in the EC is also a major threat to effective patient care. The EC does not have the staffing or resources to provide appropriate ongoing care for TSCI patients. The fact that the average EC length of stay for these critically injured patients was five days is a serious concern, since early intervention and rehabilitation are crucial to optimise TSCI victims' recovery.

Our study is valuable in identifying vulnerable populations and describing the severity and the mechanisms of TSCI treated in this setting. This study does have some limitations that impact its generalisability. It was conducted over a short period of time at a single institution. Because it was conducted at a neurosurgical referral centre, it likely selected for patients with more serious injuries and neurologic deficits. It did not include patients who did not seek medical care or who were

not transferred from a primary health centre, who were more likely to have stable fractures and partial spinal cord injuries. It also did not include patients who died at the scene or during transfer, or who had a GCS < 15. As such, it likely underestimates the burden of TSCI and the barriers to effective care in our setting. Further multicentred studies would help to describe the true scope of TSCI treated in Ethiopia.

In a very short time at a single centre, we captured data on 84 patients with serious TSCIs, representing hundreds of disability-adjusted life years lost to the injury and a large burden on families that relied on the TSCI victims to contribute to their economic security. Many of these injuries are preventable. Primary prevention, including road traffic safety, workplace safety, and improved and modernised farming conditions, is essential to reduce the burden of TSCI in Ethiopia.⁹ Increased attention to these injuries on a policy level is needed. Since delayed presentation and inadequate prehospital and prereferral care may contribute to poor outcomes, improving prehospital prereferral care systems are important goals for quality improvement efforts. Furthermore, Ethiopia needs additional emergency medicine, neurosurgical, and rehabilitation capacity as well as increased access to cross-sectional imaging to care for TSCI patients effectively.

Traumatic spinal cord injury is a devastating injury that affects the most productive age groups in our society, with many victims suffering severe injuries with little chance of recovery. Both injury prevention strategies addressing road traffic safety and workplace safety, and quality improvement efforts focusing on prehospital, emergency department, neurosurgical and rehabilitation care are essential to mitigate the personal and societal burdens of traumatic spinal cord injury in Ethiopia.

Dissemination of results

The results of the research have been presented to the health professionals that are currently working in the emergency centre. It will also be submitted to the Ethiopian Federal Ministry of Health.

Author contribution

The authors have all contributed equally to the conception of the work; the acquisition, analysis, or interpretation of data; drafting and revising; final approval of the version to be published; and agreed to be accountable for all aspects of the work.

Conflict of interest

The authors declare no conflict of interest.

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References

1. Lee BB, Cripps RA, Fitzharris M, et al. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord* 2014;**52**(2):110–6.
2. Hansebout RR, Kachur E. *Acute traumatic spinal cord injury*. Upto date. Available from: <<http://www.uptodate.com/contents/acute-traumatic-spinal-cord-injury>> accessed 24th Nov, 2015.
3. Abebe M, Munie T, Lende G, et al. Pattern of neurosurgical procedures in Ethiopia: Experience from two major neurosurgical centers in Addis Ababa. *East Cent Afr J Surg* 2011;**16**(1).
4. Devivo MJ. Epidemiology of traumatic spinal cord injury: trends and future implications. *Spinal Cord* 2012;**50**(5):365–72.
5. Nwadinigwe CU, Iloabuchi TC, Nwabude IA. Traumatic spinal cord injuries (SCI): a study of 104 cases. *Niger J Med* 2004;**13**:161–5.
6. Levy LF, Makarawo S, Madzivire D, et al. Problems, struggles and some success with spinal cord injury in Zimbabwe. *Spinal Cord* 1998;**36**:213–8.
7. Cadotte DW, Viswanathan A, Cadotte A, et al. The consequence of delayed neurosurgical care at Tikur Anbessa Hospital, Addis Ababa, Ethiopia. *World Neurosurg* 2010;**73**(4):270–5.
8. Aito SGruppo Italiano Studio Epidemiologico Mielolesioni GISEM, Group. Complications during the acute phase of traumatic spinal cord lesions. *Spinal Cord* 2003;**41**:629–35.
9. World Health Organization. In: Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, Mathers C, editors. *World Report on Road Traffic Injury Prevention*, Geneva.
10. World Health Organization. *Global Status Report on Road Safety: Time for Action*. Geneva: World Health Organization; 2009.
11. Hagen EM, Eide GE, Rekand T, et al. A 50-year follow-up of the incidence of traumatic spinal cord injuries in Western Norway. *Spinal Cord* 2010;**48**:313–8.
12. DeVivo MJ, Kartus PL, Rutt RD, et al. The influence of age at time of spinal cord injury on rehabilitation outcome. *Arch Neurol* 1990;**47**:681–91.
13. DeVivo MJ. Epidemiology of Spinal Cord Injury. In: Lin VW, editor. *Spinal Cord Medicine Principles and Practice*. New York, NY: Demos Medical Publishing; 2010. p. 78–84.
14. Draulans N, Kiekens C, Roels E, et al. Etiology of spinal cord injuries in Sub-Saharan Africa. *Spinal Cord* 2011;**49**(12):1148–54.
15. Igun GO, Obekpa OP, Ugwu BT, et al. Spinal injuries in the Plateau State, Nigeria. *East Afr Med J* 1999;**76**(2):75–9.
16. Solagberu BA. Spinal cord injuries in Ilorin, Nigeria. *West Afr J Med* 2002;**21**(3):230–2.
17. DeVivo MJ. Discharge disposition from model spinal cord injury care system rehabilitation programs. *Arch Phys Med Rehabil* 1999;**80**:785–90.
18. Wang D. *The Prevention of Acute Traumatic Spinal Cord Injury (ATSCI) in China* ISCoS Workshop 111, 28th Oct, Delhi, India, 2010.