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Epidemiology of spinal injury patients admitted to the department of orthopaedics, King George Medical University

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ABSTRACT

Background: Socioeconomic structure, policies and cultural traditions play important roles in the determining the epidemiological characteristics of spinal injury patients. An understanding of epidemiology of spinal injuries is essential for planning and implementation of preventive measures as well as clinical services. The objective of this study is to describe the epidemiology of spinal injury patients admitted to the Department of Orthopaedics, King George Medical University (KGMU).
Methods: Age, sex, time since injury to admission, site of injury, mechanism of injury, stability of injury, vertebral level, collision type, visibility, type of road, associated injuries, complications and outcome at the end of hospital stay was recorded.
Results: Mean age of the 149 enrolled patients was 33.62±13.47 years. Male to female ratio was 2.63. More than fifty percent (52.3%) patients were admitted more than 48 hrs after injury. Most of the patients sustained injury in the house (59.1%). Falls were the most common mechanism of injury (79.2%). 54.23% of the falls were less than body height. Stable injuries (51%) were more common than unstable injuries. 21.48% patients had multiple levels of injury. 1st lumbar vertebra was the most common vertebra injured (20.88%). Ninty six (64.42%) patients had associated injuries. Most common complication were pulmonary (16.10%).
Conclusions: Traumatic spinal injuries predominantly involve young males. Household falls are the most common cause of traumatic spinal injuries. There is a need to determine the modifiable factors that contribute to household falls. There is a significant association between falls and complete injuries.

Keywords: Spine, Injury, Fall, Epidemiology

INTRODUCTION

Spinal cord injuries may be traumatic or non-traumatic.[1] Spinal cord injuries are devastating, affecting the patient medically as well as physically, and result in considerable mortality and morbidity.[2] They result in significant financial burden on the patient, patient's families as well as the society as the society has to bear the cost of healthcare treatments, rehabilitation and lost productivity.[3]

Epidemiology of spinal cord injuries varies from county to country, region to region and time to time. Demographic characteristics have been reported to be different in developing countries from developed countries.[4] Different regions of the world have reported different patterns of aetiology.[4,5] The proportion of complete injuries varies from time to time as well as well as country to country.[6] A study in China reported a decrease in the proportion of complete injuries from 67% thirty years back to 45% in the year 2014.[6]

In India, National Crime record Bureau is the nodal agency that collects data on injury. It uses police records as the source to collect data, which are likely to be incomplete as non-medico legal cases are not reported to the police. KGMU provides for 24 by 7 admission and treatment facilities. It has the only spinal injury unit of the state of Uttar Pradesh. It receives patients from Uttar Pradesh as well as Nepal. Uttar Pradesh is the most populous and one of the more backward states of India. There is a lack of published literature on epidemiology of traumatic spinal cord injury patients from Uttar Pradesh. A thorough understanding of epidemiology of spinal injuries is essential for planning and implementation of preventive measures as well as clinical services.

The objectives of this study were to describe the demographic characteristics, aetology, location and type of traumatic spinal cord injury and associated injures in patients of traumatic spinal cord injury admitted to the Department of Orthopaedics, KGMU.

METHODS

Spinal injury patients admitted to the department of Orthopaedics, KGMU were included in the study, subject to written informed consent. Written informed consent was obtained from the patients or their attendants in case of minor and comatose patients. To ensure representativeness of the data we included all the patients admitted on a randomly selected day of a week. Patients were enrolled during a one-year period from September 2017 to August 2018. We did not include spinal injury patients with concomitant burn injury as KGMU does not have a dedicated burn injury unit.

Subject to written informed consent, patients meeting the inclusion criteria were assessed for age, sex, time since injury to admission, site where the injury was sustained, mechanism of injury, type of injury (complete or incomplete, stable or unstable), vertebral level involved, regions involved by associated injuries and complications during hospital stay. Time since injury to admission was further categorized as <1 hour, 1-6 hours, 6-12 hours, 12-18 hours, 18-24 hours, 24-48 hours and > 48 hours. Site of injury was recorded in categories of road side, house hold, farm site, work place and railway crossing. Mechanism of injury was categorised into fall, road traffic accident, occupation related and assault. Falls were further categorized as less than body height, more than body height but less than twice the body height and more than twice the body height. Vehicles involved in the road traffic accident were recorded. Regions involved by associated injuries were recorded in categories of head, extremities, chest, pelvis and abdominal. Complications recorded during hospital included pressure ulcers, abnormal temperature control, pulmonary complications and urinary tract infection. Complications that are not likely to occur during hospital stay like autonomic dysreflexia and muscle spasms were not recorded.

Data was collected on a Microsoft Excel sheet. SPSS was used for analysis. Mean median and mode were used to describe continuous variable. Frequency tables are used to describe categorical variables.

RESULTS

One hundred forty-nine patients were enrolled in the study. One hundred eight patients (72.4%) were males and 41 (27.5%) were females. Male to female ratio was 2.63:1. The mean age of the patients was 33.63±13.47 years. Age distribution of the patients is shown in Table 1.

Table 1: Age distribution of patients.

Age group (in years)	No	Frequency (%)
<29	65	43.62
30-44	53	35.57
45-59	23	15.43
60-74	6	4.02
>74	2	1.34

Seventy-eight patients (52.3%) were admitted to hospital more than 48 hours after the injury, 24 (16.1%) were admitted between 24 hours to 48 hours and only 20 (13.4%) were admitted to hospital in less than 6 hours after the injury.

Table 2: Mechanism of injury.

Mechanism of Injury	No	Frequency (%)
Fall	118	79.2
Road traffic accident	26	17.4
Assault (hit by lathi)	3	2.0
Gun shot	1	0.006
Heavy object falling on patient	1	0.006
Total	149	100

Table 3: Age distribution of fall cases.

Fall	No.	%	Mean age
Less than body height	64	54.2	47.69
More than body height	47	39.8	35.18
Great height	7	5.9	20.86
Total	118	100.0	

One hundred eighteen patients (79.20%) sustained an injury due to a fall, twenty six (17.4%) sustained injury due to a road traffic accident, 3 patients sustained injury due to direct assault (being hit by a lathi), one patient (1.34%) sustained injury due to gunshot and one patient sustained injury due to a heavy object falling on him (Table 2). Of the 118 patients who sustained an injury due to a fall, sixty-four patients (54.23%) fell from a height which was less than body height, 47 patients

(39.8%) fell from a height greater than the body height but less than twice the body height, and 7 (5.9%) fell from a height twice the body height (Table 3).

The commonest mechanism of injury in road traffic accident cases was motorized two-wheeler slipping on the on road (19/26; 73.07%). Others (6/26; 26.03%) were due to a collision. Eighty-eight patients (59.1%) patients sustained injury with in house, 27 (18.12%) sustained injury at road side, 22 (14.76%) sustained injury at work place, 9 (6.04%) sustained injury at farm site and 3 (2.01%) sustained injury at railway crossing. Sex distribution of the injured according to site where the injury was sustained is shown in Table 4.

Table 4: Sex distribution of injured patients according to the site where injury was sustained.

Site	Males (%)	Females (%)	Total (%)
Road side	24 (88.88)	3 (12.12)	27 (100.00)
Household	52 (59.09)	36(40.01)	88(100.00)
Farm site	9 (100)	0(0.00)	9(100.00)
Workplace	20 (90.90)	2 (9.10)	22 (100.00)
Railway crossing	2 (66.67)	1 (33.33)	3 (100.00)

Of the 149 patients, 93 (62.41%) had complete injuries, 46 (30.87%) had incomplete injuries and 6.7% did not have any neurological deficit. Seventy-six (51.0%) injuries were stable while 73 (49%) were unstable. Single vertebral level was involved in 117 (78.52%) patients and more than one vertebral level injury was seen in 32 (21.48%) patients. Commonest vertebra involved was first lumbar vertebra (20.88%) followed by twelfth thoracic vertebra (20.33%). Associated injuries were seen in 96 (64.42%) patients (Table 5).

Table 5: Associated injuries.

Associated injury	No.	%
Head injury	36	24.16
Upper limb injury	21	14.09
Lower limb injury	23	15.43
Chest injury	10	6,71
Abdominal injury	2	1,34
Pelvis injury	4	2,68
Total	96	100.0

Fifty-five (36.91%) patients developed a total of sixty complications during the course of hospital stay (Table 6). Eight patients pressure ulcers of which five had stage 1 (non-blanchable erythema) and 3 had grade 2 (partial thickness) ulcer. All the eight responded to pressure relief techniques, good nutrition and daily cleaning of the skin. Seventeen patients had pneumonia and seven had atelectasis. Hyperthermia was seen in 14 patients and hypothermia was seen in 9 patients.

Table 6: Complications during the course of hospital stay.

Complication	No	Frequency (%)
Pressure ulcers	8	5.36
Abnormal temperature control	23	15.43
Pulmonary complication	24	16.10
Urinary Tract Infection	5	3.35
Total	60	100

DISCUSSION

The mean age of enrolled patients in our study was 33.62±13.47 years (Range; 13 to 75 years). A study from China that included patients admitted over a 12-year period has reported the mean age to be 45.4±14.1.[7] Another study from China has reported the mean age to be 45.7 years.[8] In developed countries there has been a shift towards more and more involvement of elderly population.[9] A lower mean age as seen in our study may be explained by the fact that India has a much younger population compared to China and the developed world.[10] However, a review paper from China has reported a range from 30 years to 50 years in different regions of China.[11] They reported a slightly lower mean age from Bejing region compared to other regions on account of younger population of Bejing region.[11] There might be variation in the age involved in different regions of India as well. A systematic review focusing on epidemiology of traumatic spinal cord injury in different states of India may be able to describe the actual age distribution in India.

In our study the two major age groups involved were 20-39 years (51.7%) and 40-59 years (29.5%) (Table 1b). A systematic review has reported a bimodal age distribution of spinal cord injury patients; the first peak being 15-29 and the second is over 65 year.[12] This bimodal distribution is explained by higher involvement of the 15-29-year age group in road traffic accidents and an ageing population (>65 years) being more prone to domestic falls. A study conducted in Japan investigated the age specific characteristics of spinal cord injury over a nineteen-year period.[13] It reported a bimodal distribution for the period 1995-98 with 37% cases in the <29 years age group and 32% cases in the 45-49 years age group. For the period 1995-98 only 17% of the patients belonged to the age group 60-74 years. The same study while reporting on patients in the period 2009-13 reported a trimodal distribution with the highest peak of 27.8% in the 60-74-year age group. Other peaks reported were 23.1% for the <29 years age group and 24.1% for the 45-49 years age group. These changes over time were attributed to the changing demographic profile i.e. an aging population. In our study, 43.62% of the patients belonged to <29 years age group, 35.57% belonged to 30-44 years age group and only 4.06% were in the 60-74 years age group (Table 1b). Predominant involvement of younger age groups as reported by us can be explained by the relatively younger population of India.

Male to female ratio in our study was 2.63:1. Higher involvement of males as reported by us has been reported by multiple studies across the world. Wide variations have been reported across time and regions in India. A study conducted on rural patients in a general hospital in India in the year 1986 reported the male female ration to be 13.5:1.[14] Another study conducted in Haryana (a state of India) in the year 2003 reported the ratio to be 2.96:1.[15] There is a wide variation in the male to female sex ratio across countries.[5] Previous studies have reported a male to female ratio of 2.5-4.4.[16,17,24,25] A study from China reported a trend of decreasing male to female ratio since the year 2002. This trend was attributed by them to increasing contribution of women to the workforce with industrialization.[8] An interesting finding of our study is that females constituted 40.01% of all injuries sustained in house which is considerable higher than the overall 27.5%. This may be explained by the rural background of our population where females largely stay at home compared to males who leave home for work. A study conducted on rural population in Bangladesh has reported higher odds for non-fatal falls in females compared to males.[18] Compared to men, women are more likely to trip than men in any age group, which may be related to gender differences in gait.[19]

Falls were the most common mechanism of injury in our study (79.2%). Falls being the most common cause of traumatic spinal cord injury in South Asia and India has been reported by other studies as well.[4,5] This is in contrast with the developed world where road traffic accidents are reported to be the most common mechanism of injury.[4] An interesting finding of our study is that of the 88 patients who sustained injures due to falls, 87 sustained an injury due to a fall in house. Falls may be due to intrinsic factors or extrinsic factors.[20] Extrinsic factors reported to associated with household falls are stairs, uneven floor and pets in the main entrance, lack of anti-slip loose throw rugs and slippery floor in the kitchen, lack of anti-slip loose throw rugs and objects on the floor in the room, lack of grab bars in the shower, lack of grab bars in the toilet and switch away from the bathroom door.[20] These are easily preventable. We did not collect any data on risk factors associated with falls as this was beyond the scope of our study and therefore, we are unable to comment on whether the falls were preventable or not. In our study, 26 (17,4%) patients sustained injury due to a road traffic accident, 3 (2.01%) patients sustained injury due to assault and 1 (0.006%) patient sustained injury due to gunshot. Violence is an important cause of traumatic spinal cord Injury in South Africa where it accounts for 61-62% of injuries.[22] Violence mainly related gunshots has been reported to be the cause in 12%-23% of traumatic spinal cord injuries in USA.[20,21,23] Different behavior pattern in different population can affect traumatic spinal cord injury etiology and this explains the difference in aetiology reported by us and that in other countries.[24]

In our study patients who sustained injury due to a fall, the highest mean age in decreased as the height of the fall increased. With increase in age, subjects become more prone to fall resulting in them falling at level surfaces and smaller heights.[25] This is on account of sedative use, cognitive impairment, disability of the lower extremities like arthritis, abnormalities of balance and gait, and foot problems.[26] The physiological process of aging also makes the elderly more prone to falls.[25] On the other younger being physically more fit are likely to be engaged in physical activities requiring them to be at greater height.

In our study the share of complete injuries was 62.4%. There is wide variation in the share of complete injuries depending on the country where the study was conducted and when was it conducted. A study from China has reported the proportion to be 67% thirty years back which has decreased to 45% in the year 2014.[6] They attributed this decrease to improvements in first aid technology that allow SCI patients to receive appropriate treatment at the right time which in turn may avoid aggravation of the injury as well as delays in treatment.

In our study, eighty-one (55.1%) patients had a total of 96 associated injuries. There is a wide variation in the prevalence of associated injuries in traumatic spinal cord injury patients. A study from China reported the prevalence to be 30.36% while a review article reported the prevalence of associated injuries to be 47%.[27] There is considerable variation regarding the commonest associated injury.[8,27-29] In our study the commonest associated injury was head injury. There is a wide variation in frequency (26%-74%) of head injuries reported in different populations of traumatic spinal cord injury.[28,29] A retrospective injury reporting the effect of concomitant head injury on recovery in traumatic spinal cord injury patients reported 34% of traumatic spinal cord injury patients had a mild head injury and 26% had a serious head injury.[28] A retrospective study conducted in China has reported thoracic injuries followed by lower extremity injuries to be the most common and 2nd most common associated injuries respectively.[8] Another review study reported head injury followed by chest injuries to be the most common associated injuries with traumatic spinal cord injury.[27]

Traumatic spinal cord injuries from C1 to T2 are frequently complicated by respiratory complications which may lead to death.[30] Acute respiratory difficulties may start within days of sustaining the injury.[31] Atelectasis, pneumonia and respiratory failure are common respiratory complications.[31,32] A constant watch of respiration is important. It is recommended that vital capacity and arterial blood gases should be monitored till the patient becomes stable.[33-35] Inability to regulate temperature within ambient range is commonly seen in traumatic spinal cord injury patients especially those with cervical and upper thoracic cord injuries. Reduced sensory input to thermoregulating centres and loss of sympathetic control of temperature and sweat regulation

below the level of injury are responsible for the phenomenon.[36]

Our study was conducted in a single tertiary care centre and therefore may not be representative of patients admitted at other hospitals. Another limitation small number of enrolled patients but this is a result of ensuring representativeness of the sample.

CONCLUSION

Traumatic spinal cord injury tends to involve young males. Falls (especially household falls) are the most common cause of traumatic spinal cord injury. There is a need to identify risk factors for household falls. Demographic characteristics and aetiology of patients reporting to KGMU is different from that reported in other countries. A national level data bank on traumatic spinal cord injury is the need of the hour as it may help us to understand the risk factors, the epidemiology of the injured and to plan preventive strategies.

Limitations of the study

Our study was conducted in a single tertiary care centre and therefore may not be representative of patients admitted at other hospitals. Another limitation small number of enrolled patients but this is a result of ensuring representativeness of the sample.

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