# PATTERN AND OUTCOME OF SPINAL INJURY AT KENYATTA NATIONAL HOSPITAL

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## ABSTRACT

**Background:** Spinal injuries constitute a significant portion of the injuries sustained after trauma and are responsible for significant morbidity and mortality. Determination of the current burden of spinal injuries in Kenya has not been done and will enable development of effective prevention and treatment measures.
**Methods:** Spinal injury victims meeting the inclusion criteria were recruited consecutively between August 2013 and January 2014 to a sample size of forty nine patients. Independent variables were recorded on pretested standard forms. The recruited patients were then followed up for a period of three months to determine outcome measures.
**Results:** A total of 49 patients were admitted during a 6 month period. The mean age was 37.6 years (14 – 70) with a male to female ratio was 15.3:1. Road Traffic Accident was the most common cause of injury (55%). Fifty five percent of the patients had a cervical spine injury with C5 being the most commonly injured vertebrae. The overall 3 month mortality rate was 40.8% with average time between injury and death being 129 hours. Forty eight point three percent of patients had a pain grade of 2 or more at the end of the 3 months. Thirty eight percent of the patients who survived to 3 months had American Spinal Injury Association (ASIA) Impairment Scale (AIS) A – complete injury. Forty four point eight percent of patients developed bed sores by three months. It was determined that the greatest positive correlation with mortality was use of alcohol, and high neurologic level of injury. The smoking status, presence of comorbid conditions and alcohol use had no influence on the percentage change in AIS.
**Conclusions:** Spinal injury constitutes a significant disease burden at KNH affecting males in the most economically productive age group as a consequence of road traffic accident thus road safety initiatives should be intensified to reduce the number of spinal injuries. Improvement in the emergency response infrastructure and development of clear and concise referral criteria for the lower level hospitals will ensure timely management of spinal injuries. Establishment of more spine centers, training of more spine surgery personnel and provision of cost effective spinal surgery implants will improve the management of spine injuries.

## INTRODUCTION

Spinal injury is defined as an insult to the spinal column leading to a change, either temporary or permanent, in its normal neural and supportive function. Patients with spinal injury usually have permanent and debilitating neurologic deficits and skeletal deformities that lower the patients' quality of life significantly.

No study on the pattern of spinal injury has been carried out at Kenyatta National Hospital (KNH) and in addition no literature is available on the outcome of spinal injured patients thus this study aims to increase the body of knowledge in this area. This study seeks to determine the current pattern of spinal injury in KNH and also to assess the outcome over a three month follow up period.

## MATERIALS AND METHODS

This prospective study recruited patients presenting with spinal injury to the Accident and Emergency department of KNH and needing admission to the orthopaedic surgery wards over a period of 6 months.

Inclusion criteria were patients with X ray evidence of vertebral fracture. Patients managed at another facility for a week prior to referral and with preexisting spine conditions were excluded from the study. Recruitment was consecutive for the six month period.

Approval to perform the study was sought and obtained from the ethics, research and standards committee of Kenyatta National Hospital/University of Nairobi. Written informed consent was obtained from study participants after a thorough explanation of the study and its aims and reassurance that all the data will be handled with utmost confidentiality. In patients unable to give informed consent whether due to age considerations or head injury, consent was obtained from the next of kin.

Patient demographics, cause of injury, co-morbidities, smoking history as pack years, the occupation of the patient was determined and filled into the standardized pretested forms. The neurologic examination was based on the ASIA international standards examination with determination of the AIS. Radiologic findings were also recorded.

The patients were then followed up for a period of three months following recruitment at intervals of one week, four weeks, two months and three months. The above neurologic examination was repeated and recorded. The patients were also examined for pressure sore development and the grade of the sore recorded at each follow up encounter. None of the patients were lost to follow up in the 3 month period after injury.

## RESULTS

A total of 49 patients were recruited during the 6 month study period. This represents approximately 2 patients per week. There was a male predominance of 15.3:1 with an average age of 37.6 years. The age distribution showed bimodal peaks at 21 – 30 and the 41 – 50 age groups (Figure 1). Seventy six percent of the victims were involved in manual labour occupations pre injury. The most common cause of spinal injury was Road Traffic Accident (RTA) (55%) followed by fall from a height (37%) as shown in Figure 2. The other causes of injury were industrial accidents and animal attacks.
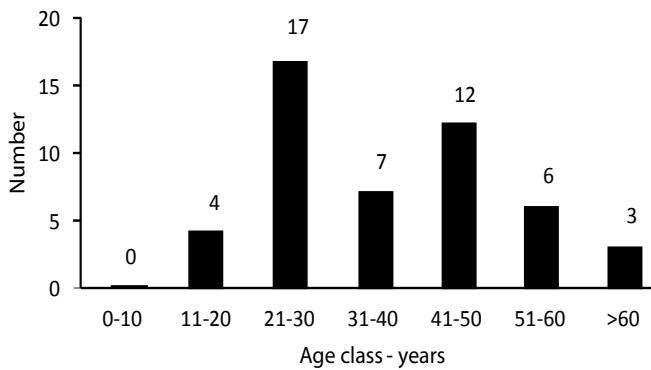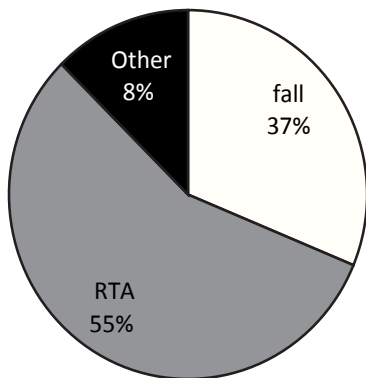
**Figure 1**
*Age distribution*



**Figure 2**
*Cause of injury*



The average time from injury to presentation was 32 hours (1 – 144) with 47% of patients being referrals from peripheral facilities. Only 13% of patients presented within 6 hours of injury.

Smokers constituted 31% of the patients. Alcohol consumption prior to injury was determined in 27%. Significant pre morbid medical conditions were present in 12%. Associated injuries were present in 59% with soft tissue (38%) and head injuries (24%) being the most common. Overall the cervical spine was the most commonly injured spinal segment representing 55% of the injuries (Figure 3). The most commonly injured single vertebral level was C5 followed by L1 (Figure 4). The highest neurologic level of injury was C3 while the lowest was L1. C4 at 24.5% was the most commonly injured neurologic level.

**Figure 3**
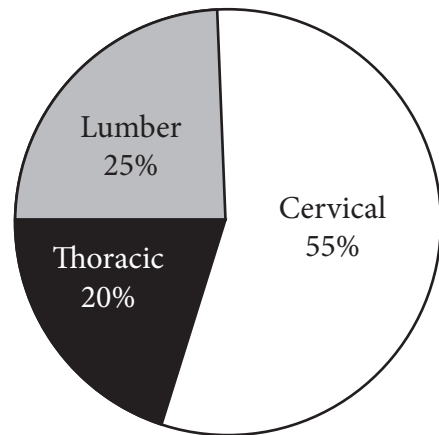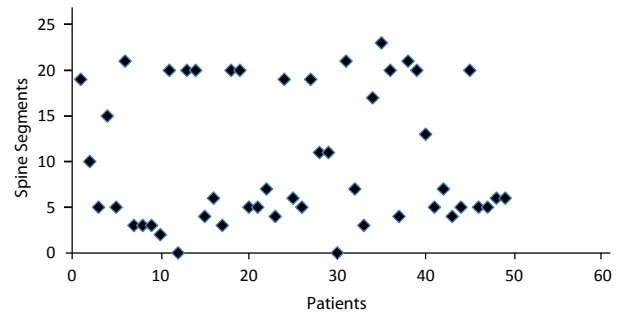*Injuries according to spine segment*



**Figure 4**
*Vertebral level of injury scatter gram*



The y axis codes for the vertebral level where 0 = no vertebral injury, 1 = C1 and 24 = L5

During the 3 month follow up period, all the study participants underwent plain X ray imaging. However only 49% underwent computed tomography scanning and 35% magnetic resonance imaging. Based on the imaging studies the commonest pattern of injury was wedge compression fracture (31%) with the other mechanisms shown in Figure 4. By determining the most common patterns of injury according to the cause it was found that some patterns were more prevalent in some cases (Table 1).
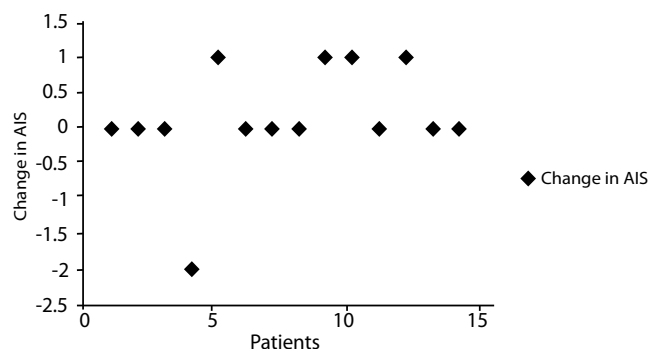
**Table 1**

*Commonest pattern of injury according to cause of injury*

| Cause | No. of patients | Commonest pattern | (%) |
|---|---|---|---|
| RTA – passenger/driver | 17 | Fracture dislocation | 27.8 |
| RTA – pedestrian | 10 | Wedge compression | 40 |
| Fall from height | 18 | Burst fracture | 50 |

There was an overall mortality rate of 40.8% with an average time from injury to death of 125.8 hours (36 – 900). The largest number of deaths occurred in the patients with cervical spine injuries (Table 2). Of the 29 patients who survived to 3 months, 16 had no change in AIS, 12 had an improvement in AIS while 1 had deterioration in AIS. All of the 12 patients who had an improvement in AIS had an initial incomplete spinal cord injury (AIS B onwards). Surgical management was undertaken in 14 of the patients. The average time between presentation and surgery was 36.4 days (10 – 84). Of these patients, 9 of them had no change in AIS, 4 had an improvement of 1 grade while 1 had deterioration in AIS (Figure 5). Bed sores developed in 44.8% of the survivors by 3 months.

**Table 2**

*Mortality rate in specific spinal segments*

| Spine segment | Total number | Deaths | Mortality rate (%) |
|---|---|---|---|
| Cervical | 27 | 16 | 59.3 |
| Thoracic | 10 | 2 | 20.0 |
| Lumbar | 12 | 2 | 16.7 |

**Figure 5**

*Scatter gram of change in AIS for patients who underwent surgery*



Correlation of mortality with presence of co morbid conditions, smoking status and alcohol use was done using Pearson product moment correlation. It showed a medium positive correlation of alcohol use and mortality only (Table 3). Using the point biserial method to determine association between presence of comorbid condition, smoking history, alcohol use, intervention, time to surgery and the change in AIS over 3 months, there was no correlation. Although there was a positive correlation between time to presentation and mortality, it was small in magnitude (r=0.25). There was also a positive correlation between a high neurologic level of injury and mortality (r = 0.46).

**Table 3**

*Correlation with mortality*

| Variable | r value |
|---|---|
| Comorbid condition | 0.07 |
| Smoking | 0.17 |
| Alcohol use | 0.35 |

r value between 0.5 – 1 denotes a strong positive correlation, 0.3 – 0.5 a medium positive correlation and 0.1 – 0.3 a weak positive correlation.

## DISCUSSION

In the six month recruitment period, 49 patients were admitted to the orthopaedic surgery wards with spinal injury. This corresponds to approximately 2 patients each week. This has significantly increased compared to the study done by Gichuhi (1) where only 5 patients were admitted with spinal injury over a 6 month period in 2004.

From the study, spinal injury mainly affects males in the economically productive age groups. It also affects individuals whose main occupation involves manual labour so it is expected that upon rehabilitation they cannot go back to their pre injury occupations. This situation is mirrored in other studies (2-4).

The most common cause of spinal injury in this study is RTA. This follows the worldwide trend (3-7). The pattern of injury has been shown in this study to differ depending on whether the victim was a car occupant, pedestrian or if he fell from a height. This is in keeping with the findings of Robertson *et al*. (8). None of the injuries were as a result of sporting activities.

Eighty three point seven percent of the spinal injury patients presented more than 6 hours post trauma. The average time to presentation of 32 hours is quite high despite less than half being referrals managed at other hospitals. This is attributed to a poorly developed emergency response infrastructure and financial constraints to rapid referral. Early definitive care is expected to reduce secondary damage to the spinal cord.

There was a bimodal peak of injuries with the cervical and lumbar spine being the most commonly injured segments. This is in keeping with the trend expected of a country in transition between a developing and developed economy (5). These are in addition

transitional areas and due to change of rigidity between the different segments these are the areas exposed to the highest force.

All of the patients underwent plain X ray imaging. However not all patients were investigated with Computed Tomography (CT) and/or Magnetic Resonance Imaging (MRI). This is probably related to the higher costs of these imaging modalities and thus a higher threshold before clinician request.

Wedge compression fractures were found to be the most common vertebral injuries followed by burst fractures. Burst fractures were more common where a patient fell from a height indicating a vertical compression mechanism of injury. The frequency of fracture dislocation injuries was high in car occupant RTA victims; this was probably as a result of high energy injury in RTA. This suggests that it is possible to infer the mechanism and cause of injury by studying the vertebral fracture pattern. This can be used in medico legal cases as evidence and also in assessment of insurance claims.

The overall mortality rate following spinal injury is quite high (40.8%); it was highest among patients with cervical spine injuries (59%). This underscores the importance of cervical spine immobilization from the accident scene until either clearance or definitive management.

The highest percentage of patients assessed during the study period had an AIS A denoting a complete injury. The study also shows that majority of patients show no improvement in AIS grade between admission and 3 months possibly indicating that the final injury grade is determined by the severity of the initial injury.

This study did not get any correlation between smoking, alcohol use, comorbidities and the change in AIS. The strongest independent predictor of mortality was found to be alcohol intoxication at time of injury. Smoking history and comorbidities were found to correlate to the mortality rate to a smaller degree. Other independent predictors of mortality from spine injury were found to be time to presentation and higher neurologic level of injury.

Slightly less than half of the patients who survived to 3 months developed a bed sore. These are the patients that need to be targeted for more intensive efforts to prevent bed sore development. It is probable that the high number of spinal injury patients overwhelm the staff in the wards and thus these spinal injured patients are not turned as regularly as is required. There may also be reduced availability of ripple mattresses. A study to determine if this is the case would suggest that separation of these patients into a separate spinal injury unit with adequate staffing and equipment will ensure that these patients receive the more intensive care needed to prevent bed sores.

Only a small percentage of patients underwent surgical management of the spinal injury and of these the time to surgery was prolonged (range 10 – 84 days). The probable cause for this was unavailability of the correct spine instrumentation implants.

## CONCLUSIONS

Road safety initiatives should be intensified to reduce the number of spinal injuries. Improvement in the emergency response infrastructure and development of clear and concise referral criteria for the lower level hospitals will ensure timely management of spinal injuries.

Establishment of more spine centers and training of more spine personnel will also go a long way towards reducing the time to management of spine injuries. Provision of cost effective spinal surgery implants will ensure timely surgical intervention where indicated. In addition, increase in number of spine surgeons will facilitate surgical management of spine injured patients.

Reduction in cost of imaging modalities especially CT scan and MRI will enhance the radiological assessment of spinal injured patients.

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