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Original Article

# Risk Factors Predicting Mortality in Spinal Cord Injury in Nigeria

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ABSTRACT

Objectives: Among spinal cord injured patients managed conservatively in Nigeria, to determine the number of death within the 6 month of injury and to identify risk factors that may be associated with such mortality. Design and setting: A retrospective cohort study set in Nigeria . Methods: Patients were identified from the hospital trauma database. Over 11-year period (January 1997- December 2007) mortality within the first 6 month of spinal cord injury was determined and risk factors examined. Results: 582 patients were eligible for the study and data were obtained for 422 (72.5%) patients with a mean age of 37.2 (±14.2) years at 6 months follow-up. There were a total of 144 (34.1%) deaths during the period reviewed. Significant risk factors associated with such mortality were age, presentation after 24hrs, multiple hospital presentation, injury severity score (ISS), cervical spine injury, and complete neurologic deficit at presentation. Conclusion: This study identified prognostic factors that may assist clinicians in identifying and categorizing patients into treatment plan that could reduce mortality.



## 1. Introduction

Spinal cord injury in Nigeria is associated with significant morbidity and mortality [1-11]. The socio-economic realities, inadequate attendant care and the poor post discharge rehabilitation of the victims may be responsible. Trauma Related Injury Severity Score (TRISS) is one of the methods designed to correlate the severity of trauma and probability of survival. However, the use of the TRISS has yielded mixed results [12-14].

Studies [15-16] have identified many risk factors [13,16-27] for mortality in spinal cord injury, but none of these risk factors has been study in the developing world that has its peculiarities. In order to make a valid general assessment in spine trauma of patient status and to perform triage in emergency situations, it is important to identify which factors influence mortality [12].

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The aim of the present study is therefore to identify independent risk factors associated with mortality in spinal cord injured patients managed conservatively in Nigeria.

## 2. Materials and Methods

The records of patients admitted at the University of Abuja Teaching Hospital, Gwagwalada from 1st January 1997 to 31st December 2007; and at the National Orthopaedic Hospital Lagos for SCI from 1st January 2000 to 31st December 2007 were reviewed. All spinal cord injured patients admitted onto the ward, conservatively managed and follow up for 6 months were included in this study. Patients who do not have neurologic deficit, those that opted out of the study and surgically managed patients before reporting in our centres were excluded from this study.

Data extracted were age, sex, cause of accident, time of presentation, number of treatment facilities visit, injury severity score (ISS), level of injury, neurology at presentation and mortality. Level of injury was defined as cervical spine injury when its include C1-C7; thoracic injury when it is T1- T10 and thoracolumbar injury when it is T11- L2.

The conservative treatment for cervical spine injury involved keeping patients in bed with decompression and alignment maintained by longitudinal traction with skull traction using Gardner-Wells, Crutchfield calliper or Cone's traction for 6 weeks and then Philadelphia collar applied for additional 3 -6 months. For thoracic and lumbar fractures, the patients were managed with thoracolumbar brace in bed for 6 weeks and then discharged on the brace for another 3 month irrespective of the neurologic status.

Complications recorded within the first 6 months of injury were designated as dependent variables to identify potential risk associations. Parametric data were analyzed using an unpaired "t" test and categorical data using ƛ2 analysis or Fisher's Exact Test. The measures of risk were determined by crude odds ratios (ORs) and adjusted odds ratios (adjusted ORs). The ORs were adjusted using multi-variate logistic regression; 95% confidence intervals (CI) were used and p-value of <0.05 is significant. Statistical Package for Social Sciences (SPSS) 17.0 (SPSS Inc. Chicago, Illinois, USA) was employed for this analysis

## 3. Results

### *3.1. Characteristic of the study population*

There were 584 spinal cord injured patients during the study period. Records at 6 months were not available for 160 patients who were excluded from the study. The majority of the patients were male (n = 346; 81.9%). The mean age of the patients was 37.2 (±14.2) years (median age-32yrs), range from 14 to 78 years. Three hundred and seventy-two (88.2%) patients sustained injury following road traffic injury (RTI) and this is shown in Table 1. Three hundred and fourteen (74.4%) patients presented after 24 hrs of trauma. Two hundred and fifty-four (60.2%) patients had multiple hospital presentation. Cervical spine was the level of injury in 329 (77.9%) patients. Fifty-eight (13.7%) patients had complete neurologic deficit at presentation. Mortality at the end of June 2008 was 144 patients (34.1%).

**Table 1: Mechanism of Injury**

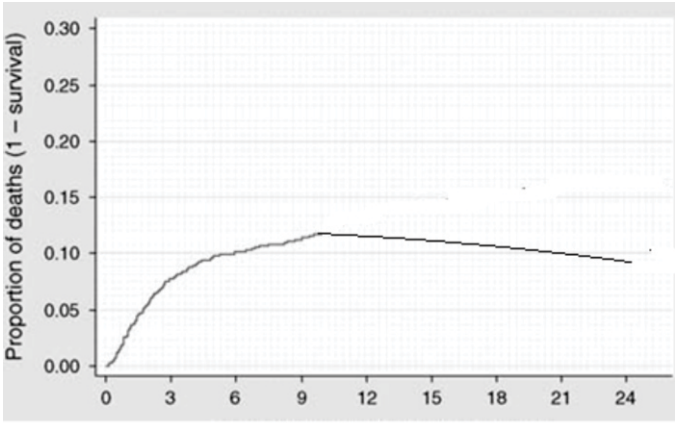
| Cause of Injury | |
|---|---|
| RTI | 372 (88.2%) |
| Fall | 32 (7.6%) |
| Assault | 8 (1.8%) |
| Penetrating Injury | 4 (0.9%) |
| Others | 6 (1.5%) |

### 3.2.Predictors of mortality

Figure 1 shows the cumulative incidence of death in spinal cord injured patients with 110 (76.4%) deaths occurring within the first 3 months in this study.

The following risk factors were significantly associated with mortality in the first 6 months (Table 1 & 2): age, gender, motor vehicular accident, presentation after 24hrs, multiple hospital presentation, ISS, cervical spine injury and complete neurologic deficit at presentation.

**Fig. 1. Cumulative incidence of death after spinal cord injury**




| Time(Mth) | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| At risk | 422 | 364 | 325 | 312 | 302 | 288 | 278 |
| Deaths | - | 58 | 39 | 13 | 10 | 14 | 10 |

After the univariate analyses, a significant association was found between age and gender and motor vehicular accident (p= 0.008). To avoid multicollinearity in the final multivariate regression analysis, a multi-multivariate analysis was done to include age, gender and motor vehicular accident with mortality as outcome. Results indicated that age remained significantly associated with mortality, whereas gender and motor vehicular accidents were not. Therefore, gender and motor vehicular accident were then excluded in the final model.

Age, presentation after 24hrs, multiple hospital presentation, ISS, cervical spine injury, and complete neurologic deficit at presentation are independently associated with mortality after multivariate analysis

## 4. Discussion

Majority of the spinal cord injured patients were young male adults. This has been noted in many reports [1-11], from Nigeria reviewed. This was also the findings in a developing country like Brazil [26]. These are economically active people with attendant socio-economic problems to a developing country like Nigeria. Road traffic injury remains the most common cause of SCI in Nigeria, like in USA[28].

This study shows that in spinal cord injured managed conservatively in Nigeria, 76.4% of deaths occurred within 3 months of injury. Mortality is an obvious indicator of quality of care[26]. In this review the crude mortality is 34.1%. This corresponds to 33.3% to 41% mortality noted in epidemiologic case series. Mortality was then corrected when patients with significant brain injury, haemodynamic instability and multiple organ-system injuries were excluded from the crude mortality figure. This corrected mortality considered only patients with pure spinal cord injury [26,28]. The mortality figure after correction was then 19.9%. This finding is higher compared to acceptable mortality of 5% to 10% in patients with spinal trauma [26]. This high figure may be due to patients' selection criteria in this study and the poor health care delivery system in Nigeria.

**Table 2: Risk factors associated with mortality in spinal cord injured patients**

| Variables | Mortality | OR | Adjusted OR[1] | *P*-value |
|---|---|---|---|---|
| 1.Age (years) | 98/296 (33.1%) | 1 | 1 | - |
| ≤32 | 46/126 (36.5%) | 2.1 | 2.1(1.3-3.4) | 0.01‡ |
| >32 | | | | |
| 2.Gender | | | | |
| Male | 118/346 (34.1%) | 1.4 | 1.2(0.6-1.5) | 0.53* |
| Female | 26/76 (34.2%) | 1 | 1 | - |
| 3.Mech. Of injury | | | | |
| RTI | 132/358 (36.9%) | 1.3 | 1.2(0.7-2.1) | 0.44* |
| Fall | 10/32 (31.3%) | 1.8 | 2.6(0.6-11.2) | 0.15* |
| Assault | 1/8 (12.5%) | 1.2 | 1.0(0.6-1.8) | 0.86* |
| Penetrating injury | 1/4 (25.0%) | 0.7 | 0.5(0.1-1.4) | 0.64* |
| Others | 0/6 (0%) | 1 | 1 | - |
| 4.Time of presentation | | | | |
| < 24hrs | 48/108 (44.4%) | 1 | 1 | - |
| >24hrs | 96/314 (30.6%) | 2.5 | 2.3(1.0-4.4) | - |
| 5.Multiple hospital presentation | | | | 0.001* |
| 1 | 32/168 (19.0%) | 1 | 1 | |
| >1 | 101/254 (39.8%) | 3.3 | 2.8(1.5-6.0) | 0.01* |
| 6.Level of fracture | | | | 0.83* |
| Cervical | 128/328 (39.0%) | 3.0 | 2.8(1.0-7.7) | - |
| Thoracic | 13/63 (20.6%) | 1.2 | 1.0(0.6-1.4) | |
| Thoracolumbar | 3/30 (10.0%) | 1 | 1 | |
| 7.Neurologic deficit at presentation | | | | <0.001* |
| ASIA A | | | | 0.54* |
| B | 32/58 (55.2%) | 3.0 | 2.8(1.0-7.2) | 0.42* |
| C | 100/280 (35.7%) | 2.4 | 2.2(0.8-6.4) | - |
| D | 9/45 (20.0%) | 2.0 | 1.8(1.0-5.2) | 0.001α |
| | 3/39 (20.0%) | 1 | 1 | |
| | 27(84)/16(4) | | | |
| 8. ISSµ | | | | |

OR- Odd ratio, RTI- road traffic injury, ISS- injury severity score, ASIA- American Spinal Injury Association
1Adjusted for age, gender, mechanism of injury, time of presentation, hospital visit, level of injury, neurologic deficit at presentation; 95% confidence interval in parenthesis
* Exact Fisher's test/ƛ2, ‡ t test, α Mann- Whitney U test, µ median (interquartile interval)

This study shows that age, multiple hospital presentation, p resentation after 24hrs, ISS, cervical spine injury and complete neurologic deficit at presentation are associated with mortality in patient with spinal cord injury in Nigeria. Age [12,20,23], cervical spine injury [12], ISS [26] and complete neurologic deficit [27] at presentation have been shown as predictors for adverse prognosis. Multiple hospital presentation and late presentation prevalent in a developing country like Nigeria is a social problem with root in infrastructural underdevelopment. Our hospitals lack basic resuscitation equipment with inexperience, noncommittal and overworked staff. Most centres do not have dedicated trauma team and the attention received by spinal cord injured patients usually pale compared to the severity of their injuries. This explains why patients have multiple referrals to many centres that then contribute to increase mortality. In addition, there is non-exist organized prehospital transport system in Nigeria, with patients presenting later in a trauma centre with attendant poor prognosis [29].

## 5. Conclusion

This study is limited by small sample size, patients' selection, exact causes of death could not be ascertain due to facilities and cultural inclination and listed patients that may introduce bias; but it identified prognostic factors that may assist clinicians in identifying and co-opting patients into treatment plan that could reduce mortality.

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