

Injury – Intervention Time in Spine Injured Patients in a Tertiary Hospital In North Central Nigeria

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Abstract

Background: Spine injuries present with devastating physical incapacitation with extreme morbid psychological and nihilistic consequences. The need for early presentation and urgent intervention by trained physicians is required in order to limit further deterioration by way of increase intervention time. This will further mitigate the effect of the impact and positively ameliorate the effect of secondary response. In this way the supposedly guarded outcome and its consequential effects may be mitigated. In these patients, the duration from the time of injury to first intervention by trained physician in an accredited institution is critical in preventing further morbidity and enhancing better outcome. We sought to determine the extent of this time lag to intervention in our center.

Patients and Method: This is a retrospective study of the duration taken for acute spine injured patients to present in Jos University Teaching Hospital from June 2013 to June 2023. Information about when the injury was sustained to the time of first intervention in the accident and emergency department, mechanism of injuries, clinical and radiographic spine level of injuries and severity with respect to American Spinal Injury Association (ASIA) grading of the victims obtained from records in the accident and emergency department, patient folders and operation register.

Results: There were 151 spine injured patients admitted via the accident and emergency department of Jos University Teaching Hospital (JUTH) by two units (neurosurgeons and orthopedic surgeons) and managed between January 2014 and December 2023 that made the criteria. There were 131 males and 20 females with male: female ratio of 6.5:1. The mean age was 39.2±136 years. The median age was 37 with IQR 28-47 years. Road traffic crash was responsible for 86 (56.9%) falling from height was 31(20.5%), mining associated injuries 31(20.5%) building collapse 2(1.3%), objects falling on individual was 1 (1.3%) and gunshot 1(1.3%). Cervical spine injuries were 54(35.7%), thoracic spine were 38(25.1%) while 59(39.0%) were lumbar spine injuries. Cervical spine injuries were 54(35.7%), thoracic spine injuries were 38 (25.1%) while 59 (39.0%) sustained lumbar spine injuries. The number of patients with their respective ASIA grading of the injuries were A 110(72.8%), B 20(13.2%), C 10(6.5%), D 6 and E was 5(3.3%). The average injury- intervention time was 64.7 ±61.2 hours.

Conclusion: The average duration of time spent to convey patients to the nearest facility (JUTH) for the intervention is over a day. This is a long way to achieve early optimal care for patients that require this urgent critical care requiring highly specialized form of treatment in which timely intervention is lifesaving in preventing lifelong morbidity and mortality

Keywords: Acute spine injury; Injury-intervention time

Introduction

Spinal injuries present as sudden life-threatening insult to the cord and adjoining structures with overwhelming deterioration of all neurological functions. It is a leading cause of death globally [1,2]. In this regard injury-presentation time can be of essence in determining the efficiency of our pre-hospital setting, state of preparedness of our emergency department which further provides a window of opportunity to determine the efficacy and efficiency of our early intervention in the accident

and emergency department. The import of this is how it highlights and possibly reduce the impact of primary injuries on the overall outcome [3]. This is based on the premise that the risk of further secondary injuries in patients with acute traumatic spine injuries may be lessened in patients who present within 360 minutes to obtain acute care and surgical intervention within 24 hours from the time of injury [4]. Besides, time, being this hidden link of trauma care may define the golden hour when resuscitation and stabilization becomes most beneficial

to the patient and gratifying to the attending physician. It is of importance to note that most of the knowledge of influence of time on the empirical outcome of intervention in our setting are anecdotal and few. This is further compromised by obvious ethical concerns and often not recorded. In spite of this, injury-presentation time must to be accorded high consideration in early intervention of spine injured and other trauma patients.

In well organize trauma systems severely injured are brought directly to the major trauma centers because they are more equipped and provide more optimal care hence the lower mortality in such specialized centers [5]. The period and interval of such debacle is of ethical relevance when other aspect of intervention in critical care such as transport, means of transport, distance covered, reception protocols and financial burden are factored in. However, the relevance of time is not often considered in our routine recordings. It is of great concern that a clinically significant variable such as injury-presentation time that contributes significantly to the outcome of pre-hospital care and early interventions is not often assessed [6]. This, in the long run often become the neglected but veritable stitch which when sought early saves the ninth. Despite this apparent neglect the importance of time of injury to presentation in specialized care is highlighted in advance trauma life support (ATLS) guidelines among trauma patients [7].

The right time of surgical intervention to achieve optimal outcome of neurologic recovery in traumatic spine injury is contentious [8]. What may not be contentious is the fact that early presentation and early life saving measures may go a long way to prevent morbidity and mortality among such patients. Moreover, timely intervention balanced by adequate availability of resources may be useful in optimizing these critical conditions especially in accident and emergency departments [9].

While early intervention in the process of optimizing the victim has not been clearly defined, early surgery is defined as surgical decompression within 24 hours of injury [10-13]. Despite the recommendation for intervention within 24 hours, a significant number of patients with complete injuries are not essentially treated within this interval of time, rather incomplete injured are often offered more priority [14]. Although this practice may be subject of ethical consideration the outcome of these injuries may be considered as guarded. The spine tissue is not also immune to uneventful resolution [15,16]. The current guidelines that justify early intervention in incomplete injuries has sound pathophysiologic basis and is not inimical in most instances [17].

Advocates of early trauma care suggest mandatory institution of care as early as possible or even at the field [18]. The import of this pre-hospital care is to improve the impact early hospital intervention and reduce high mortality that occurs at this stage especially as noted in Africa [18]. In Ghana, for instance 81% mortality was recorded while 72% recorded in Latin America and 59% mortality in (Seattle) USA [19]. These early trauma related deaths are due to life threatening conditions (airway obstruction and bleeding). Immediate intervention with available emergency medical services can be lifesaving. Fortunately, most of these preventable deaths among which spine injured are also involved may be avoidable with the presence of formal Emergency Medical and functional ambulance services. This is lacking in our setting and in most low- and middle-income countries. The presence of which could mitigate the impact of

the time lag in injury-presentation of spine patient to specialist center [18,20].

There must be a formal time-honored system in which the severely ill or the severely injured are conveyed to obtain formal and impactful medical care. Acute spine injured presents with both immediate threat of grievous devastating physical and psychological consequences which has profound effect on hemodynamic status of the patient. It has potential of creating victims with tendency of developing multiple devastating irrecoverable complications like sores and contractures.

In Nigeria there has been upsurge in the construction of structures by the federal road safety corps along major highways [21]. The incorporation of this into emergency medical service care may rightly impact on early intervention and better outcome in trauma care not only among spine injured patients. Concerted efforts must be made to reduce injury-presentation time in order to ameliorate the morbidity associated with this debacle. One of the ways is the introduction of emergency medical service. This can be made in specific designated sites in cities and major high ways.

The need for concerted efforts must be viewed with urgency in order to limit the devastating effect of further loss of sensory, motor and autonomic deficit and unfavorable consequences particularly on the integuments [22]. Besides the perception of delay may limit the confidence on the health care system. The role of early in-hospital care is to further strengthen the achievement of the pre-hospital setting such that further disability and mortality may be curtailed to the barest minimum. This will involve the need for comparative evaluation of morbidity and mortality rates of persons with life threatening but treatable injuries such as spine injured in centers handling similar cases at regular intervals [23]. Discrepancy will however exist because of problems of deficiencies in availability of human and material resources [18,23].

Patients and Method

This is a retrospective study of the duration taken by all acute spine injured patients to present in Jos University Teaching Hospital from January 2014 to December 2023. Information about patient's biodata and time of injury was sustained to the point of early intervention, mechanism of injuries, clinical and radiographic evidence depicting the anatomical (cervical, thoracic or lumbar) level of injuries. American Spine Injury Association (ASIA) grading of patients was obtained from records in accident and emergency department, patient folders and operation records.

Results

A total of 151 patients admitted by the accident and emergency department of Jos University Teaching Hospital (JUTH) during the period, January 2014 to December 2023. There were 131(86.8%) male and 20(13.2%) female with male: female ratio of 6.5:1. The mean age of the patients was 39.2±13.6 years. The median age was 37 years with IQR of 28-47 years. The mean age of male patients was 38.3 years while that of female was 44.6 years. Majority of patients fall within 30 and 49 years with 75(79%) cases. Road traffic crash was responsible for 86(56.9%) patients, falling from height was 31(20.5%) patients, mining associated injuries 31(20.5%) patients, building collapse 2(1.3%) patients, objects falling on individual was 1(0.006%) and gunshot 1(0.006%). Cervical spine in-

juries were sustained among 54(35.8%) patients, thoracic spine injuries among 38(25.1%) while 59(39.1%) sustained lumbar spine injuries. Severity of injury was graded using American Spinal Injury Association (ASIA) system in which A were 110(72.8%), B were 20(13.2%), C were 10(6.6%), D were 6(3.9%) and E, were 5(3.3%). Patients that remained in the course treatment until discharge of were 120(79.5%), those who discharge themselves against medical advice were 20(13.2%), 4(2.6%) developed extensive pressure sores that limited surgical intervention while 7(4.6%) mortality recorded in the course of treatment. The mean time of presentation was 64.7(+61.3) hours while the median time was 48 hours with IQR of 24-72 hours. Only 19 (12.6%) presented in 24 hours out of which 12(7.9%) patients presented within 6 hours,61(40%) presented between 24 hour and 48 hours while 46 (30.3%) between 72 and 96 hours. The number of spine injuries across years shows that the highest number of spine injuries occurred in 2022, with 35.1%, followed by 2023 with34.4%. Conversely, the years 2015, 2018, and 2019 had the lowest incidence.

Table A: Injury-presenting time.

Time in days (hours)	Frequency n-151	Percent
<1(<24hours)	19	12.5
1-2 (24-48hours)	61	40.1
3-4 (49-96hours)	46	30.3
5-6 (97-144hours)	10	6.6
≥7(≥145hours)	16	10.5
Mean±SD, Median (IQR)	64.7±61.3	48(24-72)
Total	151	100

SD= Standard Deviation; IQR=Interquartile Range

Table B: Age and frequency of presentation.

Variable	Frequency n-151	Percent
Age (years)		
<30	41	27.1
30-39	44	29.1
40-49	30	19.9
50-59	19	12.6
≥60	17	11.3
Mean±SD	39.1±13.6	Median (IQR)=37(28-46)
Sex		
Female	20	13.2
Male	131	85.8

SD= Standard Deviation; IQR=Interquartile Range

The average age of study participants was 39.2±136years, median age was 37 years, with an interquartile range (IQR) of 28-47 years. The mean age of male participants was 38.3years while that of females was 44.6years. The age distribution indicated that the majority of cases fall within the age range of 30 to 49 years, with a total of 75 cases (49.0%) while those aged 60 years and above were the least (11.2%). The study participants were 20 female cases (13.8%) and 131 male cases (85.2%), demonstrating a clear gender disparity in spinal injury cases.

Table 1C: Patients status and outcome of course of intervention.

Variable	Frequency n-151	Percentage
Normal	120	79.5
DAMA	20	13.2
Dead	7	4.7
Pressure Sore	4	2.6

Table 2C: Asia scoring and number of patients.

A	110	72.8
B	20	13.2
C	10	6.6
D	6	4
E	5	3.4

Table D: Level of injuries with number of patients.

Cervical	54	35.7
Lumbar	59	39.1
Thoracic	38	25.2

Table E: Relationship between intervention time and Sex of study participant (Relationship of gender and time of presentation).

Variable	Mean±SD	Median (IQR)	Mann Whiney U	P-value
Sex			994	0.046*
Male	67.3±62.7	48(24-72)		
Female	48.7±49.7	24(12-72)		

*= Statistically Significant; SD = Standard Deviation; IQR = Interquartile Range

Table F: Relationship between mechanism of injury and injury-presenting time, MOI, ASIA score and level of injury.

Variable	Mean±SD	Median (IQR)	Kruskal Wallis	P-value
MOI			11.041	0.012*
RTC	58.2±55.6	48(24-72)		
Fall	75.3±88.4	48(33-72)		
Mining	78.2±40.6	72(48-96)		
Building collapse	25.5±31.8	25(3-48)		
Gunshot	48	48		
Object Fall	5	5		
Asia			4.03	0.402
A	60.7±49.1	48(24-72)		
B	101.1±109.7	84(25-138)		
C	47.4±38.6	42(19-78)		
D	54.0±31.8	60(18-78)		
E	42.7±46.9	24(8-96)		
Level			3.38	0.185
C	68.4±56.2	48(36-72)		
L	56.4±52.0	48(24-72)		
T	71.9±80.2	72(28-78)		

*= Statistically Significant; SD = Standard Deviation; IQR = Interquartile Range

Table G: Association between injury-presenting time and Sex.

Time (days)	Sex		X2	P-value
	Female	Male		
<1(<24hours)	8(38.1)	11(8.4)		
1-2 (24-48hours)	6(28.6)	55(42.0)		
3-4 (49-96hours)	4(19.0)	42(32.1)		
5-6 (97-144hours)	2(9.5)	8(6.1)		
≥7(≥145hours)	1(4.8)	15(11.5)		
Total	21(13.8)	131(86.2)	15.685	0.003*

The table illustrates the association between the time lag before treatment and the gender of the patients. Among females, 8 cases (38.1%) received treatment within Less than 1 day (<24 hours), while among males, 11 cases (8.4%) did. Females accounted for 6 cases (28.6%) receiving treatment within 1-2 days (24-48 hours), while males accounted for 55 cases (42.0%).

Four cases (19.0%) among females and 42 cases (32.1%)

among males received treatment within 3-4 days (49-96 hours). Two cases (9.5%) among females and 8 cases (6.1%) among males received treatment within 5-6 days (97-144 hours). One case (4.8%) among females and 15 cases (11.5%) among males received treatment at 7 days(≥ 145 hours) or more.

The chi-square test revealed a significant association between the time lag before treatment and gender ($X^2 = 15.685$, $p = 0.003^*$), indicating that the distribution of time intervals before treatment significantly differs between males and females.

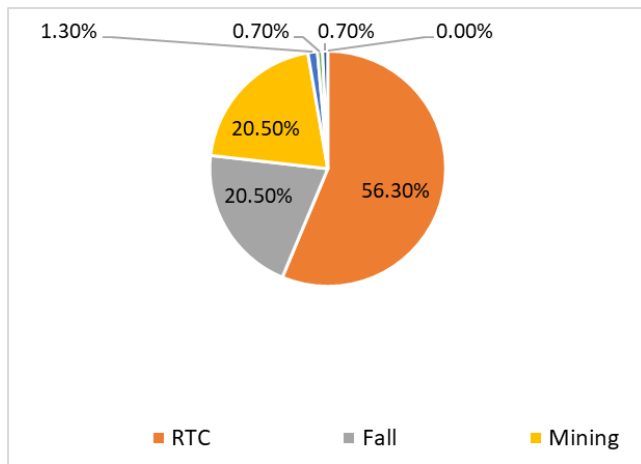


Figure 1: Pie chart mechanism of injury.

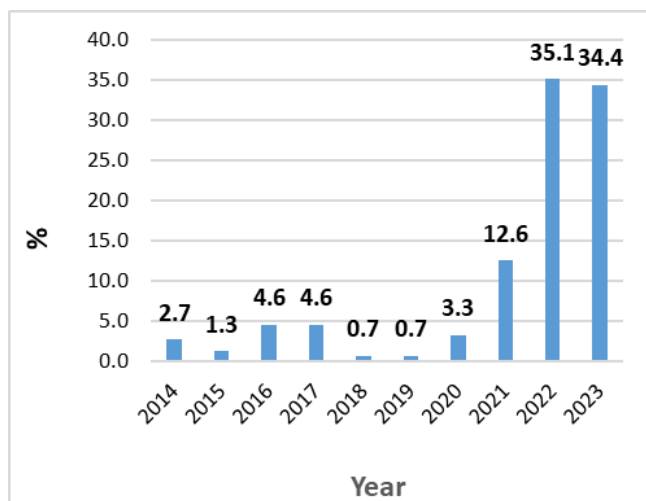


Figure 2: Yearly incidence of spinal injury for ten-year period (2014-2023).

Discussion

Injury-presenting time varies from one patient to another [24]. Our overall injury-presenting time is 64.7 +- 62.7 hours. This is a far cry from what obtains in advanced countries with respect to victims of traumatic injuries. In an ideal and optimally functioning trauma system it is considered acceptable for only 10% of patients to arrive after 360 minutes(6hours) of injury [25]. In our study however, only 12(7.9%) presented within the 360 minutes. This is a far cry from ideal as majority of our patients presented between 24 hours and 96 hours (74.4%). Those who presented within 24-48 hour accounted for 61(40.1%) while those between 49-96 hours accounted for 30.3% of cases. Only 19 (12.6%) patients presented within 24 hours out of which 12(7.9%) arrived in the golden hours of 6(360 minutes). This clearly signify gross delay in arrival of patients that needed critical care within a short period.

There was no statistically significant difference in injury-presenting time among ASIA score categorization (Table F).

However, patient with ASIA B had the highest mean injury-presenting time of 101.1 hours. Perhaps the preservation of sensory function propelled this group not to present early. But ASIA E presented early 42.7 hour (male) and 24 hours(female) among all of them which shows that patients with paraparesis are more eager to recover. ASIA A with 60.7 hours while the rest of the ASIA A, C, D, and have mean injury-presenting time ranging from 42.7 to 54.0 hours. This delayed presentation can be explained by the level of preparedness of the relations, believe pattern and possibly distance from the hospital or the means of transportation.

The influence of mechanism of injury on the injury-presenting time is noted with object falling on individual presenting early while mining associated injuries present late. This is not unexpected because most of these group of patients (miners) are not physically, emotionally and financially prepared for the sudden disability and hence the delay. These are itinerant work force in practice and often considered” casual” in their practice of mining with no formal training nor resources to cater for uncertainty.

It is important to note that despite the severity of the ailment some of the delay is from patronage of traditional healers and prayer homes prior to presentation [26]. These alternative cares are apparently popular as a result of historical and cultural practices that are often cheaper. This conception still persist despite acknowledgement of the fact that orthodox intervention is the better option and of necessity.

In spite of the lateness in presentation a significant number of these patients still could not afford the definitive treatment meant for them. Among our patients 20(13.2%) discharged themselves against medical and surgical advice despite persuasion from the attending physicians and the social welfare department and were never seen again. This often occur among persons of low socioeconomic status, male gender and younger age often on drugs [27]. In addition, this tendency to abscond are almost always due to poor finances and the weakness in the health care financing system that cannot intervene further without directly outsourcing financial support from sympathizers or relations [26,27].

Patients with spinal cord injuries are at high risk of mortality and 48% mortality was reported in India within week and 52% after a week of sustaining injury [28,30]. There is correlation between mortality and spinal level of injury and spine injury-presentation time as all the diseased patients sustained mid-cervical injuries. High mortality is reported among complete injuries and pulmonary complications are most commonly implicated. Higher mortality in lumbar spine injury was however reported in Southern Iran [29]. These patients also sustained associated injuries to the chest and abdomen. This pattern of injuries is common among the miners.

Pressure sores remain a great source of concern in spine injured patients because apart from pulmonary and urinary systems it constitutes a great source of sepsis to a spine patient. Among the others that got healed at early stage 4(2.6%) became recalcitrant to treatment protocol and became a source of great debility. This is often complicated by osteomyelitis, joint destruction, muscle necrosis, soft tissue erosions and recurrence [31,32]. This lesion is very difficult and expensive to manage. Consequent over these futures is the rising number of spines

injured patients in our center over the period is due to the availability of spine services becoming visible and available to the community. This is exhibited by the modest increase in number of spine injured (Figure 2) presenting for treatment compared to the number that were treated between 1984 to 1997 in the same center and in other centers such as in Maiduguri Ilorin and in Maiduguri, Nigeria [33,34].

The gross gender disparity as depicted by the ratio clearly demonstrates that spine injuries, although a sub-set of trauma, is a disease of the male not only in Nigeria, but also in Iceland (Europe) [35]. Women emerged prominently only in inadvertent situations such as road traffic crash, falls, falling object and building collapse. Whereas male gender, are involve in deliberate events in search of means of livelihood. This is evident by increasing deliberate involvement in mining which although dangerous still attracts enormous patronage among the young adult male. Despite this, the injury presenting-time among women is shorter than that of men despite the fact that they are less financially endowed. Factors such as family support and the role of responsible spouse suffices here.

Road traffic crash has remain the major and established cause of spinal cord injuries in developing countries and in developed countries [32-35]. While in developed countries not using seat belt is the main cause of injuries in those climes, in Nigeria, other causes suffice. The intervention of Federal Road Safety corps has reduced the presentation time of accidentally injured patients on the highway. In spite of this, the injury-presenting time has remained high 58.2 hours (Table C). The distance from site of crash may be responsible but the input of the bread winner or the person responsible for the bills in decision making might have prolong this period.

The emerging trend with respect to mechanism of injuries is the prominence of mining associated injuries which is becoming more visible [26]. The city of Jos made its global prominence as a result of its historic commercial mining fields of tin and columbite over the past century. Commercial mechanize mining started in 1904 and became a prominent export commodity for the country [36,37]. The absence of regulated, mechanize and protected mining protocols gave room to sudden rise of itinerant artisans who are relentlessly becoming victims of fallen land mass and often buried alive [37]. The occupational hazards exposed to these miners exceeds the tolerable and acceptable limits which are often not clearly defined. While in Malaysia issue of work place hazards among miners are those of ergonomics and disabilities which usually occur after retirement but in our setting, it's a matter of life threatening and incapacitating spine injuries and even death [38].

There are many causes of spine injuries spine injuries yet trauma does not discriminate among all ages. It is known to be common among young male individuals [39,40]. The age difference is grossly skewed to the detriment of the young. Patients below 40 years alone, responsible for 56.3% of all the victims of spine injuries in our study. What may be responsible is the abundant amount of energy and the quest to succeed and the instinctive pursuit to thrive in the mist of harsh economic reality unemployment among the youths. In underdeveloped and poor countries pedestrians, passengers, in buses and trucks drivers and cyclists suffer higher burden of morbidity and mortality due to increase exposure to hazardous but legitimate activities [41]. The mean age of these male patients is 38.3 years

while that of female is 44.6 years. Almost all of the victims of mining mishaps are young adults and usually from low socio-economic class too. This portents' an unimaginably dangerous, disproportionate burden of incapacitation on the families and society as a whole. They form the bulk 20(13.2%) of those who sign against further intervention due lack of funds for investigation and treatment.

Conclusion

Too much time is spent in deciding to when to present spine injured victims to a tertiary health care center in our setting. This does not contribute positively to early intervention. The absence of emergency medical services even makes it even worse. The tertiary health care system still dependent on cash and carry method which does not auger well for conditions that that are live threatening requiring immediate intervention. Primary prevention must involve identifying high risk sports, occupations and involvement of stake holders in health education and training of artisans on safety precautions.

Elaborate emergency response care with a compliment of well-trained team with a functional ambulance is required to limit injury-presenting time. The aim is to attain to emergency care within minutes of injury. This will definitely require mobilization of both human and material resource by the Government. For the mining disasters it is imperative to make policies in which only accredited mining companies with expertise and proven records are allowed to embark on mechanized mining as the mineral reserves lie deep underground. In the interim training of these artisan miners on the safety precautions in mining and provision of ambulances to be deployed around major mining camps to reduce the injury-intervention time and to mitigate the unfavorable outcome. In the overall, strengthening the health system and improving the socioeconomic status of the citizenry is paramount.

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