ORIGINAL ARTICLE

# Epidemiology of Non-Disaster Spinal Injuries at a Spine Unit

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## ABSTRACT

**Objective**: To describe the demography, types of injuries and their management in all non-disaster spinal injury patients admitted to the Spine Unit of a tertiary care hospital in Pakistan from 2001-2008.

**Study Design**: Case series.

**Place and Duration of Study**: Spine Unit, Orthopaedic Department, Combined Military Hospital, Rawalpindi, from April 2001 to December 2008.

**Methodology**: Data of all new non-disaster spinal injury patient admissions, kept in a custom-built database at Spine Unit, was analyzed. Demography, type of injuries and their management was described in percentages.

**Results:** Five hundred and twenty one non-disaster patients were selected out of a total 671 new admissions with spinal injuries. Mean age was 39.1 years and 77% were males. Mechanisms of injury included; fall in 62% and road traffic accidents in 32%. Fracture dislocations and burst fractures were equally distributed (36% each). Most of the injuries (43.6%) were at $T_{11}$-$L_1$ level. Forty three percent patients had complete spinal cord injury (SCI), 33% had incomplete SCI and 24% did not have any SCI. Eight patients had concomitant spinal injury at a different level. Twelve percent patients had associated other major injuries. Seventy percent patients were treated surgically. Average follow-up was for 4 years.

**Conclusion**: Non-disaster spinal injury was frequent in young males usually due to fall or road traffic accident. It involved fracture dislocation or burst fracture at $T_{11}$-$L_1$, level in most cases requiring surgical treatment.

**Key words:** *Epidemiology. Demography. Spinal injuries. Spinal cord injury. Pakistan.*

## INTRODUCTION

Some spinal injuries may kill the patient at site of the accident while other may lead to a life-long disability. In most of the instances these injuries are preventable. Unfortunately, their incidence is steeply rising in developing countries.[1] For planning proper prevention, it is important to understand the epidemiology of these injuries, which vary from region to region in the world.[2-4] In developed countries understanding of epidemiology of spinal injuries has led to proper health care planning, allocation of resources, implementation of preventive measures and ultimately to improved patient care and survival.[5,6]

Spinal injuries include injuries to spinal column and spinal cord. There are many studies published in literature on epidemiology of spinal cord injuries (SCI) in developed countries, but studies on spinal injuries as a whole are only few and far between. In addition most of these studies are retrospective and from non-specialized units. The annual incidence of spinal column injuries ranges from 19-88/100,000.[7] Incidence of spinal cord injury is 15-50 per million per year.[8] The prevalence of SCI is 480-813 per million.[9] There are few reports on demographics of spinal injuries in Pakistan but exact incidence of these injuries in this region is not known.[1,10,11]

The objective of the present study was to describe the epidemiology of all non-disaster spinal injury patients admitted to the Spine Unit of a tertiary care hospital in Pakistan from April 2001 to December 2008.

## METHODOLOGY

This observational study was carried out at the Spine Unit, Orthopaedic Department, Combined Military Hospital, Rawalpindi. All new non-disaster patients admitted with spinal injury between 2001 and 2008 were included. All patients admitted with spinal injury due to earthquake in October 2005 were excluded. Necessary permission was taken from hospital ethical committee. Patient data were kept in a custom-built database at the Spine Unit. Study parameters included patient's demography, mechanism of injury, level, diagnosis, days before admission, days before operation, neurological status, treatment, associated spinal injuries, associated other injuries, associated co-morbid factors, approach, operation, and implants used.

Mechanism of injury was classified as road traffic accidents (RTA), falls, hit by falling heavy objects and fire arm injuries. Thoraco-lumbar fractures were classified according to Denis Classification into compression fractures, burst fractures, chance fractures, and fracture dislocations. Neurological status was classified using

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*Received July 13, 2009; accepted August 10, 2010.*

American Spinal Injury Association (ASIA) impairment scale, as A, B, C, D and E. A is complete neurological deficit; B, C and D are incomplete grades of neurological deficit and E is full neurological recovery or normal. Different types of spinal operations performed are summarized in Figures 1-3.

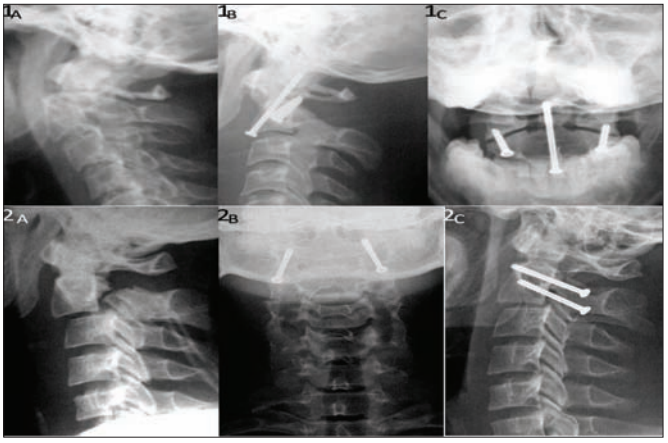

**Figure 1:** Upper cervical spine operations. **(1A)**. Odontoid peg fr type 2 and C1 posterior arch fr. **(1B and C)**. Odontoid peg screw and anterior trans-articular screw fixation. **(2A)**. Displaced hangman's fr. **(2B and C)**. C2 pedicle screw fixation for osteo-synthesis of hangman's fr.

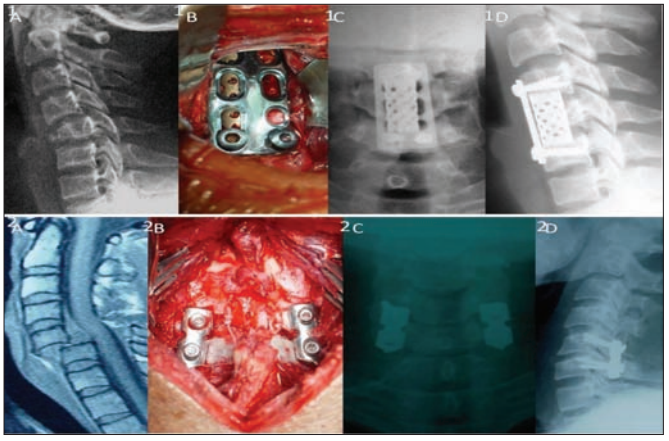

**Figure 2:** Lower cervical spine operations. **(1A)**. Burst fr C5. **(1B)**. Intra-op picture after C5 corpectomy and cage/ plate reconstruction. **(1C and D)**. Post-op AP and Lat X-rays. **(2A)**. Bilateral facet dislocation C5/6. **(2B)**. Intra-op picture after reduction of dislocation and lateral-mass plating. **(2 C and D)**. Post-op AP and Lat X-rays.

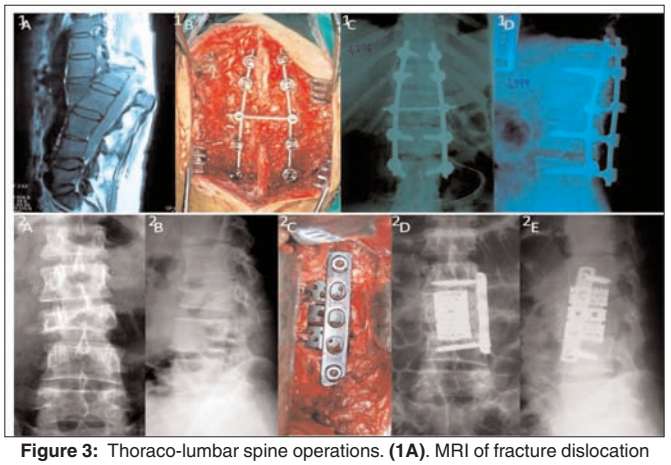

**Figure 3:** Thoraco-lumbar spine operations. **(1A)**. MRI of fracture dislocation T12/L1. Intra-op picture of vertebrectomy and reconstruction with pedicle screw fixation. **(1C and D)**. Post-op X-rays. **(2A and B)**. X-rays of lumbo-sacral spine showing Burst fr L3. **2C**. Intra-op picture after corpectomy L3, cage and plate reconstruction. **(2D and E)**. Post-op AP and Lat X-rays.

All available operated patients were followed-up at 6 weeks, 3 months, 6 months and then yearly. The parameters noted at follow-up were neurological status, reduction of deformity, mobility, back pain, patient satisfaction and complications. Data were loaded in SPSS version 12.0 and analyzed for descriptive statistics and frequencies.

## RESULTS

Six hundred and seventy one new patients with spinal injury were admitted between 2001 and 2008. Out of them 150 patients had spinal injury due to earthquake in October 2005 and got excluded from study. Out of the remaining 521 patients, 363 (70%) were managed surgically and 158 (30%) were managed conservatively. Those 521 patients had 529 major spinal injuries.

Mean age was 39.1±16.17 years ranging form 2-85 years. There were 402 (77%) males and 119 (23%) females. Two hundred and three (39%) patients were admitted within 24 hours of injury, 367 (70%) patients were admitted within 2 weeks; 408 (78%) patients were admitted within one month and 113 (22%) patients were admitted more than one month after injury. Most common mechanisms of injury were fall from height (n=323, 62%), road traffic accident (n=166, 32%) hit by falling objects (n=21, 4%) and fire arm injuries (n=11, 2%).

Most common diagnoses were fracture dislocations (n=188, 36%) burst fractures (n=187, 36%), facet dislocations (n=42, 8%) and compressions fracture (n=40, 8%). Most of the injuries were in thoraco-lumbar spine (n=369, 71%), lower cervical spine (n=93, 18%), upper cervical spine (n=42, 8%) and sacrum (n=9, 2%). In 8 (n=2%) cases, injuries were at multiple levels. Detail of level wise injury distribution is given in Figure 4.

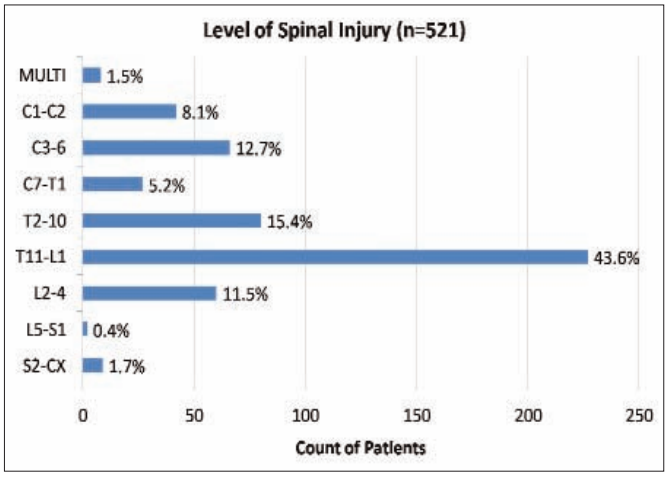


**Figure 4:** Levels of spine involved in injury. Showing maximum number of patients at thoraco-lumbar junction.

Two hundred and twenty three (43%) patients had complete spinal cord injury (ASIA-A), 20 (4%) had ASIA-B; 80 (15%) had ASIA-C, 71 (14%) had ASIA-D and 127

(24%) did not have any spinal cord injury on admission (ASIA-E). In 251 (48%) cases, patients had only one-level spinal injury, 253 (48%) had two-level spinal injury, 14 (3%) had three-level, 2 had four-level and 1 patient had five-levels of spinal injury. Sixty-four (12%) patients had other associated skeletal, head, chest, abdominal and pelvic injuries. Thirty one (6%) patients had associated medical problems. Only 8 (2%) patients had surgery within 24 hours of injury, 207 (57%) patients had surgery within 2 weeks of injury and rest had surgery after that for primary pathology or secondary deformity.

Among 363 (70% of total admissions) treated surgically, a total of 382 operations were performed. Eighteen patients had multiple operations. Upper cervical spine was operated in 24 (7%) cases, lower cervical spine in 64 (18%) cases and thoraco-lumbar spine was operated in 267 (74%) cases.

In upper cervical spine, Peg Screw fixation was done in 5 (1%) cases, pedicle screw fixation in 3 cases (0.8%), posterior trans articular fixation screw fixation in 3 (0.8%) cases and occipito cervical fusion in 3 (0.8%) cases. In lower cervical spine, anterior cervical discectomy and fusion was done in 22 (6%) cases, anterior cervical corpectomy and fusion in 14 (4%) cases, interspinous wiring in 13 (4%) cases, and lateral mass plating in 12 (3%) cases. In thoracolumbar spine pedicle screw fixation was done in 179 (49%) cases, followed by corpectomy 29 (8%) cases and vertebroplasty in 22 (8%) cases.

Among the implants used, pedicle screws were used in 209 (58%) patients, cervical spine plates in 37 (10%) patients, cement was used in 27 (7%) patients and stainless wire in 22 (6%) patients. AO screws were used in 20 (5%) patients while cages were used in 9 (3%) patients.

Out of 521 cases originally included in this study only 102 (20%) patients were available for follow-up. Average follow-up was for 4 years (ranging from 1-8 years). All patients available for follow-up belonged to operated group, initially ASIA-A cases were 34 (33%) which decreased to 20 (21%); ASIA-B cases were 4 (4%) which decreased to 2 (2%); ASIA-C cases were 18 (18%) which were 7 (7%), ASIA-D cases were 18 (18%) which were 8 (8%) and neurologically intact patients (ASIA-E) were 28 (27%) who increased to 64 (63%). Full 100% reduction was achieved in 41 (40%), 90% in 36 (35%) and in only 9 (9%) it was 50% or below.

At the end of follow-up period 65 (64%) could walk independently, 8 (8%) required some assistance and 29 (28%) remained wheel chair bound. Fifty two (51%) patients had no back pain. Thirty five (34%) required off and on analgesics, 9 (9%) required regular analgesics and 6 (6%) had little or no relief in pain. Seventy (69%) cases were fully satisfied with their management of injury, 28 (27%) were partly satisfied and 4 (4%) were not satisfied at all. Implant failure occurred in 12 (12%) cases. Prominent implants occurred in 5 (5%), wound infection in 3 (3%), spasticity in 3 (3%), neuropathic pains in 2 (2%), one case (1%) each of deep vein thrombosis, increased neurological deficit and surgery at wrong level. Four patients expired on long-term follow-up.

Exploring the trends fall was more evenly distributed among all age groups in males. RTA was more common mechanism of injury in males up to middle age. Most common mechanism of injury in burst and compression fractures was fall from heights and in fracture dislocations it was RTAs. Almost all cases of atlanto-axial instability were due to low energy falls. Falls involved relatively upper parts of spine and RTAs involved all regions of spine. Higher level of injury in spine resulted in more severe neurological deficit except at occipito-cervical junction.

## DISCUSSION

Our data shows significant differences in average age and gender distribution as compared to other studies.[1,12,13] We have lesser number of cervical spine injuries reporting to our centre as compared to other papers, this may be due to poor evacuation facilities for trauma patients in our country.[14] This has been shown by this study that only 39% patients were admitted within 24 hours of injury, this is the golden time during which patients with major cervical spine injury can be saved. This shows we need to improve our emergency services for early evacuation of spinal injury patients to proper spine centres.

Fall from heights and RTAs are two major causes of spinal injury, this has been shown by this and other studies.[15] In developing countries, the commonest mechanism of spinal injury is fall from heights, this has been shown by this study as well.[3] Falls usually result in compression and burst fracture while RTAs result mostly in fracture dislocations, this has been proven by this and many international studies.[16] This also highlights higher incidence of compression fractures in senile population. Sport injuries were non-existent in this study. We had some fire arm injuries, these patients usually have stable spine.[17] Many patients who have associated skeletal injuries also have concomitant spinal injury at a different level.[18] In this study in almost 50% of patients, spinal injury was present at more than one continuous level and in 8 patients there was a concomitant spinal injury at a different level. These concomitant injuries are present mostly in poly-trauma patients.[19] In this study multiple skeletal and other major organ injuries occurred in 12% patients.

We have operated at each and every level of spine, both from anterior and posterior approaches. Most common operation performed was pedicle screw fixation followed

by corpectomy and reconstructions. We had only 20% patients available for follow-up, all of these were operated cases. Most of the patients had excellent correction of deformity, minimal postoperative pain and were fully satisfied with surgical outcome. Recovery of neurological deficit was maximum in incomplete injuries as compared to complete injuries. We had very low complication rate in group. Incidence of major neurological deficit after surgical operations for spinal injuries ranges from 0-2% in literature,[20] in this study it was 1%.

This study highlights the need for educating people for prevention of spinal injury due to fall from heights, general accident prevention measures and sticking to traffic rules to prevent RTAs. This study also highlights poor patient evacuation system of our country as compared to developed countries as only 39% patients presented within 24 hours of injury and 22% patients presented after one month. This long delay in patient referral resulted in change in management of spinal injuries to major deformity correction, increased hospital stay and loss of precious time by the patient for readjustment in society.

There is a strong need to do a comprehensive follow-up in all patients with spinal injury, to know the overall outcome. These peace time spinal injuries also need to be compared with spinal injuries occurring during major disasters like earthquakes, to know the changing demands for spinal injury management in major disasters.

## CONCLUSION

This study describes the incidence of various types of spinal injuries, their management options and outcome of operative treatment. These are the results based on large number of patients admitted at a dedicated spinal surgery unit and can be extrapolated to depict epidemiology of spinal injuries in Pakistan. This data can be utilized for major health care planning and formulation of guidelines for spinal injury prevention in our setup.

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