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Research Article

Spinal Injuries

Analysis of Traumatic Spinal Injuries : A Prospective Study at A Tertiary care Hospital

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Background: Traumatic spinal cord injuries (TSCIs) are significant contributors to global trauma morbidity and mortality. High-velocity trauma from falls and road traffic accidents commonly cause spine fractures, often resulting in neurological deficits. Understanding the epidemiology and outcomes of TSCI is critical for improving care and prognosis. This study aimed to determine the epidemiological profile of traumatic spine injuries at a tertiary care centre and to evaluate patient outcomes over three months.

Methods: 60 consecutive patients with radiologically confirmed traumatic spinal injuries admitted to a tertiary care hospital between July 2023 and August 2024 were enrolled. Patients were evaluated for demographic data, injury mechanism (falls from height, road traffic accidents, assault, etc.), level of spine involvement (cervical, dorsal, lumbar), fracture classification [American Orthopedic (AO) Spine classification], and neurological status using the American Spinal Injury Association (ASIA) impairment scale. Pain was assessed by visual analog score (VAS). All patients received standard surgical or conservative management under neurosurgical care. Outcomes were measured by changes in ASIA grade and pain scores at 3 months post-injury. Descriptive statistics were used to summarize patient characteristics. Chi-square and t-tests were applied for categorical and continuous comparisons, respectively; p-value <0.05 was considered significant.

Results: The mean age of patients was 37.6 years (SD 15.9), with 75% aged 20–44 years. There was a male predominance (M:F ratio ≈3.6:1). The most common age group was 20–34 years (n=24, 40%). Falls from height accounted for 66.7% of injuries and road traffic accidents 31.67%, one patient suffered injury due to fall of heavyweight material. Cervical spine injuries comprised 21.7%, while dorsal and lumbar injuries comprised 78.3%. AO Spine classification showed a predominance of Type A (compression) injuries. At presentation, 50% of patients had severe neurological impairment (ASIA grade A–B). By three months, 15 (25%) patients with partial neurological deficit (ASIA B-C-D) improved by at least one ASIA grade; improvement was significantly associated with incomplete injury (p <0.05). The mean VAS pain score improved significantly from 5.72 pre-treatment to 0.37 at follow-up in operated patients.

Conclusion: In this cohort of mainly young adults, falls and road accidents were the leading causes of traumatic spine injury. A majority presented with thoracolumbar fractures and significant neurological deficits. Early management led to modest neurological recovery in many patients; incomplete injuries had better outcomes. These findings reinforce the importance of prevention of fall from height (FFH) and Road Traffic Accidents (RTA), and of rapid, standardized care for TSCI. Given the small sample and short follow-up, larger studies are needed to confirm these epidemiological patterns.

Keywords: Traumatic spinal cord injury; Fall from height, Road Traffic accident, Neurological deficit

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Introduction

Traumatic spinal cord injury (TSCI) is an important public health problem leading to severe morbidity and permanent disability. Worldwide, most important cause of TSCI is automobile accidents followed by falls.(1) In India, rapid industrialization and inadequate safety measures contribute to high rates of spinal trauma with road traffic accidents (RTA) being the most common cause of trauma as per World Health Organisation (WHO) first worldwide status report.(2) Cervical spine injuries are an important component in patients presenting to emergency with head injuries with C2 being the most common level of injury.(3) This study was conducted to determine the characteristics and epidemiology of spinal trauma patients and explore association between patient and injury characteristics.

Materials and Methods

This prospective observational study was conducted on 60 patients presenting to emergency department with radiologically proven traumatic spinal cord injury at a tertiary care hospital from July 2023 to August 2024. Data was collected in the form of detailed history, epidemiological profile, clinical examination with relevant radiological examinations. Patients were evaluated using AO classification of spine fracture, ASIA grading and VAS score. Neurosurgeon consultation was taken in view of spine injury and patients were followed up for 3 months with conclusion of the study in November 2024.

Results

Table 1: Age and sex distribution with mode of injury (n=60).

Age Group	Males (n=47)	Females (n=13)	Total (n=60)	Fall fromheight (n=40)	Road traffic accident (n=19)
<19 years	2	4	6	6	1
20–34 years	21	3	24	16	8
35–44 years	8	3	11	7	4
45–64 years	11	2	13	9	3
≥65 years	5	1	6	3	3
Mean (SD)	38.94 (15.64)	32.62 (16.42)	37.57 (15.91)	35.28 (11.89)	36.80 (16.16)

Out of 60 patients, 47 were males and 13 were females.

Most common age group noted in our study was between 20-34 years (n=24, 40%). Cervical and dorsolumbar spine injuries were also most commonly noted in this age group. Out of 47 males, 28 had FFH, 18 were involved in RTA and one patient had fall of heavyweight.

12 females had FFH and one female was involved in RTA. 11 out of 12 females had a history of fall at home whereas 17 out of 28 males had an accidental fall at workplace.

Table 2: Causes of fall from height (FFH) (n=40).

Cause of FFH	No. of Cases	Percentage
Accidental (domestic/occupational)	34	85.0%
Electric shock	2	5.0%
Alcohol intoxication	2	5.0%
Other (medical)	2	5.0%

Majority of the incidences of fall took place at either workplace or at home, constituting 85% of cases.

Table 3: Level of spinal injury (n=60).

Spinal Segment	No. of Patients	Percentage
Cervical (C1–C7)	13	21.7%
Upper dorsal (D1-D9)	5	8.3%
Dorso-lumbar (D10-L12)	36	60.0%
Lower lumbar (L3-L5)	6	10.0%
Sacral/Coccyx (S1-Coccyx)	0	0.0%

Majority of the cases had involvement of lower dorsal and upper lumbar vertebrae signifying that the weight bearing areas of spine suffer the most in injury especially during FFH whereas Cervical followed in terms of involvement with 13 cases having this injury seen mostly in RTA.

Table 4: Comparison between AO fracture type and ASIA grading

Fracture type AO		Total				
		A	B	C	D	E
A	39 (65%)	7	0	5	4	23
B	6 (10%)	1	1	1	0	3
C	15 (25%)	10	0	4	0	1
TOTAL = 60		18 (30%)	1 (1.7%)	10 (16.7%)	4 (6.7%)	27 (45%)

The most common fracture as per AO classification was type A seen in 65% patients but was most commonly associated with ASIA - E grading (neurologically preserved). Type C fractures seen in 25% cases had the maximum association with Complete neurological deficit (n=10).

Table 5: Comparison of mean radiological indices at pre-op, post op and follow up period

VBCR = Vertebral Body Compression Ratio
AVH = Anterior Vertebral Height
PVH = Posterior Vertebral Height
AVBC = Average Vertebral Body Compression

	MEAN	Wedge Angle	Cobb's Angle	VBCR = AVH/PVH	AVBC (%) = V2/[V1+ (V3)/2]
Operative patients	Pre op	12.63	15.48	0.699	66.98 %
	Post op	11.35	5.72	0.863	88.44 %
	Follow up	11.37	8.86	0.846	87.67 %
	Mean Correction	1.26	6.62	0.147	20.68 %
Non operative patients	At presentation	11.28	16.01	0.854	78.24
	Follow upafter 3 months	11.74	15.58	0.832	81.23

All the above mentioned radiological indices showed a sharp improvement post surgical intervention although the values still less after 3 months of follow up as compared to the pre operative values. This may be attributed to the shear force or load that the vertebrae faces once the patients regain complete mobility and increased contraction of paraspinal muscles which increases the curvature of spine.

Table 6: Visual Analogs Score

	Operated Patients (n = 37)	Non Operated Patients (n = 8)
Pre op/At Presentation	5.72	5.5
At Discharge	3.2	3.6
Follow up	0.37	0.875

38 dorsal and lumbar spine fracture patients and 12 cervical spine fracture patients underwent surgery (n=50) whereas 9 dorsolumbar fracture patients and one cervical fracture patient were managed conservatively (n=10). A total of 15 patients were lost to follow up. In operated patients, the reduction in VAS score after intervention was attributed to reduction in the regional kyphotic angle and increase in vertebral height measured through VBCR and AVBC. In non-operated patients, the reduction in VAS score with time was attributed to the fact that these patients had less deformities and minor complications.

Discussion

Traumatic spinal cord injury contributes significantly to global health outcome related to trauma. Spinal injuries frequently result from preventable factors such as motor vehicle accidents, falls, sports injuries etc. The data on worldwide and Indian population and literature showed RTA to be the most common cause as evident in studies conducted by Kumar R et al(4), Adawi MM et al(5) and Hasler RM et al(6) whereas Indian Literature showed fall from height to be the most common mode as seen in studies by Chhabra HS et al(7), Singh R et al(8), Kumar S et al(9), Jain M et al(10) and Mittal S et al(11). 67% (n=40) patients in our study had spinal injury due to falls out of which 55% (n=22) predominantly at homes.

Study done by Lohanathan A et al(12) demonstrated that increase in height of fall proportionately increased risk and severity for spine injury whereas study done by Velmahos GC et al(13) showed no relation of severity of injury with height of fall. In our study, height at which fall happened doesn't show any statistical significance with severity of injury. Lumbar vertebrae was most common segment injured in our patients due to FFH which was similar to findings of studies by Chhabra HS et al(7), Gururaj G(14) and Singh R et al(8). Two-wheelers (84.2%) were most commonly involved population in RTA in our study where 36.84% patients had cervical injury and 26.3% had upper thoracic injuries. Research by Zhao QM et al(15) also showed presence of more cervical and thoracic injuries as compared to lumbar area involvement in automobile accidents. 47 males and 13 females were affected with TSCI in our study which is comparable with studies done by Chhabra HS et al(7), Kumar S et al(9), Mittal S et al(11), Algahtany M et al(16), Adawi MM et al(5), Zhao QM et al(15) and Khare S et al(17) which showed 55-85% males predominance and only 15-40 % female involvement. In contrast, study done by Algahtany M et al(16) recorded a higher female patient load (58.3%) as large portion of the affected population were elderly people which clearly illustrates the aging phenomenon of spine fractures especially among females.(18)

As per AO classification, Type A > Type C > Type B were noted in our study which is in concordance with studies conducted by Jain M et al(10), Mittal S et al(11) and Adawi MM et al(5).

Type A is the most common because during trauma or fall an axial force greater than the forces a vertebral body can tolerate is exerted onto the vertebrae resulting in a compression fracture.(19)

25 % patients with partial neurological deficit in our study showed improvement of atleast 1 grade in follow up assessments. Whereas those with complete neurological deficit (30%) and neurologically preserved patients (45%) showed no change in neurological status over time.

Radiological indices showed improvement after surgical interventions where kyphotic angle improved from 15.48° preoperatively to 5.72° immediately post operatively with increase in value to 8.86 at 3 months follow up. Average correction in kyphotic angle ranged from 6° to 7° in studies by Sallam AM et al(20), Alvine GF et al(21), Huang W et al(22) and Sasso RC et al(23).

Mean VBCR improved from 0.699 pre operatively to 0.863 post operatively with mean correction of 0.15. Mean correction ranged from 0.08 to 0.13 in studies by Adawi MM et al(5) and Yung AW et al(24).

Mean VAS score in operated patients at the end of 3 month follow up was 0.37 and in non-operative patients was 0.87. Significant improvement in VAS score was noted after correction of kyphotic deformity and Cobb's angle. Siebenga J et al(25) and Cecchinato R et al(26) studies showed similar results in terms of comparison of VAS score where it was comparatively less in operated patients.

Conclusion

Traumatic spinal cord injury predominantly affects the young and economically productive population, with falls and road traffic accidents being the major causes. Fracture morphology and severity of the injury significantly influence neurological and functional outcomes.

Early surgical intervention with adequate deformity correction improves pain and overall recovery, while complications are more frequent in patients with complete spinal cord injury. Improved awareness, preventive safety measures and establishment of a comprehensive national database are essential for reducing the burden of traumatic spinal cord injuries and improving patient care.

LIMITATIONS

The study was limited by a small sample size. Duration of follow up was relatively short and some patients were lost to follow up (n=15) as patients reported to the tertiary care hospital from neighbouring states and cities.

ETHICAL CONSIDERATIONS

A written informed consent was taken from every patient after due information, discussion and explanation to any doubts. The study was undertaken after due approval from Institutional Ethics Committee.

CONFLICTS OF INTEREST

The authors declare that they have no financial conflict of interest with regard to the content of this study.

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None

References

1. World Health Organization. International Spinal Cord Society. International perspectives on spinal cord injury. World Health Organization; 2013. [Article] [DOI:10.56801/seejph.vi.108] [PubMed] [Google Scholar]

2. India PS. National Crime Records Bureau. Ministry of Home Affairs. Retrieved August. 2020;15:2024. [Article] [DOI:10.4103/iopn.iopn_18_23] [PubMed] [Google Scholar]

3. Looby S, Flanders A. Spine Trauma. Radiologic Clinics of North America. 2011, 49(1): 129-163. [Article] [DOI:10.1016/j.rcl.2010.07.019] [PubMed] [Google Scholar]

4. Kumar R, Lim J, Mekary R, Rattani A, Dewan M, Sharif S, Osorio-Fonseca E, Park K. Traumatic Spinal Injury: Global Epidemiology and Worldwide Volume. World Neurosurgery. 2018, 113: e345-e363. [Article] [DOI:10.1016/j.wneu.2018.02.033] [PubMed] [Google Scholar]

5. Adawi M, Aboulfetouh I, Saleh A, Younis W. Posterior short-segment fixation with implanting pedicle screw in the fractured level as a feasible method for treatment of thoracolumbar fracture. Egyptian Journal of Neurosurgery. 2019, 34(1). [Article] [DOI:10.1186/s41984-018-0026-3] [PubMed] [Google Scholar]

6. Hasler R, Exadaktylos A, Bouamra O, Benneker L, Clancy M, Sieber R, Zimmermann H, Lecky F. Epidemiology and predictors of spinal injury in adult major trauma patients: European cohort study. European Spine Journal. 2011, 20(12): 2174-2180. [Article] [DOI:10.1007/s00586-011-1866-7] [PubMed] [Google Scholar]

7. Chhabra H, Arora M. Demographic profile of traumatic injuries admitted at Indian Spinal Injuries Centre with special emphasis on mode of injury: a retrospective study. Spinal Cord. 2012, 50(10): 745-754. [Article] [DOI:10.1038/sc.2012.45] [PubMed] [Google Scholar]

8. Singh R, Sharma SC, Mittal R, Sharma A. Traumatic spinal cord injuries in Haryana: an epidemiological study. Indian journal of community medicine. 2003 Oct 1;28(4):184. [Article] [DOI:10.21276/aimdr.2017.3.2.or6] [PubMed] [Google Scholar]

9. Kumar S, Verma V, Sharma V, Singh S. Epidemiology of spinal injury patients admitted to the department of orthopaedics, King George Medical University. International Journal of Research in Orthopaedics. 2019, 5(6): 1196. [Article] [DOI:10.18203/issn.2455-4510.intjresorthop20194829] [PubMed] [Google Scholar]

10. Jain M, Mohanty C, Doki S, Radhakrishnan R, Khutia S, Patra S, Biswas M. Traumatic spine injuries in Eastern India. International Journal of Critical Illness and Injury Science. 2021, 11(2): 79-85. [Article] [DOI:10.4103/ijciis.ijciis_95_20] [PubMed] [Google Scholar]

11. Mittal S, Rana A, Ahuja K, Ifthekar S, sarkar B, Kandwal P. Pattern of spine fracture in Sub-Himalayan region: A prospective study. Journal of Clinical Orthopaedics and Trauma. 2021, 15: 27-32. [Article] [DOI:10.1016/j.jcot.2020.11.003] [PubMed] [Google Scholar]

12. Lohanathan A, Jyothirmayi C, Kundavaram A. An Elucidation of Pattern of Injuries in Patients with Fall from Height. Indian Journal of Critical Care Medicine. 2020, 24(8): 683-687. [Article] [DOI:10.5005/jp-journals-10071-23520] [PubMed] [Google Scholar]

13. Velmahos G, Spaniolas K, Alam H, de Moya M, Gervasini A, Petrovick L, Conn A. Falls from Height: Spine, Spine, Spine!. Journal of the American College of Surgeons. 2006, 203(5): 605-611. [Article] [DOI:10.1016/j.jamcollsurg.2006.07.002] [PubMed] [Google Scholar]

14. Gururaj G. Injuries in India: A national perspective. Burden of disease in India. 2005. [Crossref] [PubMed] [Google Scholar]

15. Zhao Q, Gu X, Yang H, Liu Z. Surgical outcome of posterior fixation, including fractured vertebra, for thoracolumbar fractures. Neurosciences. 2015, 20(4): 362-367. [Article] [DOI:10.17712/nsj.2015.4.20150318] [PubMed] [Google Scholar]

16. Algahtany M, McFaull S, Chen L, Zhang S, Saarela O, Alqahtani F, Cusimano M. The Changing Etiology and Epidemiology of Traumatic Spinal Injury: A Population-Based Study. World Neurosurgery. 2021, 149: e116-e127. [Article] [DOI:10.1016/j.wneu.2021.02.066] [PubMed] [Google Scholar]

17. Khare S, Sharma V. Surgical outcome of posterior short segment trans-pedicle screw fixation for thoracolumbar fractures. Journal of Orthopaedics. 2013, 10(4): 162-167. [Article] [DOI:10.1016/j.jor.2013.09.010] [PubMed] [Google Scholar]

18. El Tecle N, Dahdaleh N, Bydon M, Ray W, Torner J, Hitchon P. The natural history of complete spinal cord injury: a pooled analysis of 1162 patients and a meta-analysis of modern data. Journal of Neurosurgery: Spine. 2018, 28(4): 436-443. [Article] [DOI:10.3171/2017.7.spine17107] [PubMed] [Google Scholar]

19. Donnally III CJ, Margevicius S, Varacallo M. Vertebral compression fractures. InStatPearls [Internet]. 2025 May 4. StatPearls Publishing. [Article] [DOI:10.53347/rid-53015] [PubMed] [Google Scholar]

20. Sallam A, Abdel Ghany W, Ali A, Habib M, Toubar A, Kabil M, Salem A, Abouzeid Mourad S, Nada M. Publisher Correction: Short-segment posterior fixation with index level screws versus long-segment posterior fixation for thoracolumbar spine fracture: angle of correction and pain. Egyptian Journal of Neurosurgery. 2018, 33(1). [Article] [DOI:10.1186/s41984-018-0021-8] [PubMed] [Google Scholar]

21. Alvine G, Swain J, Asher M, Burton D. Treatment of Thoracolumbar Burst Fractures with Variable Screw Placement or Isola Instrumentation and Arthrodesis. Journal of Spinal Disorders & Techniques. 2004, 17(4): 251-264. [Article] [DOI:10.1097/01.bsd.0000095827.98982.88] [PubMed] [Google Scholar]

22. HUANG W, LUO T. Efficacy analysis of pedicle screw internal fixation of fractured vertebrae in the treatment of thoracolumbar fractures. Experimental and Therapeutic Medicine. 2013, 5(3): 678-682. [Article] [DOI:10.3892/etm.2013.914] [PubMed] [Google Scholar]

23. SASSO R, COTLER H, REUBEN J. Posterior Fixation of Thoracic and Lumbar Fractures Using DC Plates and Pedicle Screws. Spine. 1991, 16(Supplement): S134-S139. [Article] [DOI:10.1097/00007632-199103001-00019] [PubMed] [Google Scholar]

24. Yung A, Thng P. Radiological Outcome of Short Segment Posterior Stabilisation and Fusion in Thoracolumbar Spine Acute Fracture. Annals of the Academy of Medicine, Singapore. 2011, 40(3): 140-144. [Article] [DOI:10.47102/annals-acadmedsg.v40n3p140] [PubMed] [Google Scholar]

25. Siebenga J, Leferink V, Segers M, Elzinga M, Bakker F, ten D, Rommens P, Patka P. A prospective cohort study comparing the VAS spine score and Roland–Morris disability questionnaire in patients with a type A traumatic thoracolumbar spinal fracture. European Spine Journal. 2008, 17(8): 1096-1100. [Article] [DOI:10.1007/s00586-008-0705-y] [PubMed] [Google Scholar]

26. Cecchinato R, Berjano P, Damilano M, Lamartina C. Spinal osteotomies to treat post-traumatic thoracolumbar deformity. European Journal of Orthopaedic Surgery & Traumatology. 2014, 24(S1): 31-37. [Article] [DOI:10.1007/s00590-014-1464-6] [PubMed] [Google Scholar]