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**Research Article**

**A clinico - epidemiological study of traumatic spine injuries in a rural tertiary care centre in India: Our experience**

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**Abstract**

**Introduction:** Traumatic spinal cord injuries are on the rise. Spine injuries are one of the common causes of major morbidity and mortality. These are frequently related to high energy trauma like falls, road traffic accidents (RTAs) and assaults.

**Objectives:** To analyse the clinico - epidemiological pattern of traumatic spinal cord injuries, common injury modes, presentations, age and gender distribution, level of injuries, pre-hospitalisation practices, severity of neurological deficits and treatment options.

**Methods:** A prospective study was conducted on 43 patients with traumatic spinal injuries from Jan 2012 to June 2013. Data on epidemiology, mode of injury and presentation, level of spinal injury, severity of neurological deficits and the patient's knowledge about such injuries were analysed.

**Results:** The most common mode of injury was fall from height followed by RTAs. Maximum injuries were to the cervical spine (55.8%), followed by thoracic (25.5%) lumbar (16.2%) and thoraco - lumbar injuries (2.3%). The average patient age was 40.2 years with a male to female ratio of 42 : 1. None of the patients received any prehospital treatment. Among these were 21 paraplegics (48.8%), 9 quadriplegics (20.9 %), 4 with quadriparesis (9.3%) and 9 with paraparesis. All patients were stabilised surgically. Mortality accounted to 23.25%.

**Conclusion:** There is an emergent need to create awareness among the rural population regarding traumatic spinal injuries, preventive safety measures in the work field and safe driving practices to reduce the incidence and prevalence of these injuries. Pre hospital first aid, transportation and medical facilities should be improved and made accessible and affordable to the susceptible weaker population.

**Keywords:** Spinal cord injury, neurological deficit, awareness, preventive safety measures

**1. Introduction**

Traumatic spinal injuries are one of the most common causes of major morbidity and mortality. The incidence of traumatic spinal cord injuries has increased considerably over the past three decades. These injuries occur mainly due to road traffic accidents, falls from height at work place<sup>1</sup>. The focus predominantly has often been on the management of these injuries and seldom on the epidemiology of patients presenting with neurological deficit to a tertiary care centre. In our study, an effort has been made to focus on the epidemiological factors involving traumatic spine injuries, common modes of



injuries and their presentations, demographic profiles and socio economic background of patients, level and severity of the spinal cord injury and the patient's awareness about traumatic spinal cord injuries. Attention has been given to the pre hospital treatment, management in a tertiary care centre and post-operative rehabilitation. A survey of these factors may help us to stratify the susceptible population groups and the concomitant risk factors, also aid in taking preventive safety measures. To educate the rural population, health care personnel's and paramedics, about what measures should be taken to avert, and primarily manage these injuries is the need of the hour.

### 1.1 Aims and Objectives

- To identify the incidence and epidemiology of traumatic spinal cord injuries with neurologic deficits among the rural population.
- To recognise the common modes of traumatic spine injuries and their presentations to a tertiary care centre.
- To determine the level of spinal injury and severity of neurological deficits.
- To identify pre-hospitalisation practices and first aid measures.
- To assess the indications, objectives of the treatment, surgical interventional methods and their functional outcomes and prognosis of the patient.
- To assess the level of knowledge of the rural population about traumatic spinal injuries, to create awareness among them regarding the preventive measures and safe driving practices.

## 2. Materials And Methods

This was a prospective study conducted in a tertiary rural health care centre in India. Study sample comprised of 43 adult patients who presented to the emergency department with traumatic spinal cord injuries with neurological deficits. Study period was from Jan 2012 to June 2013. Data on demographic and social background, mode of injury and presentation, level of spinal injury, severity of neurological deficits and the patient's awareness about such injuries were analysed. Institutional ethical committee approval and informed consent was obtained from each patient prior to any intervention.

Patients younger than 18 years of age and with associated severe head injury requiring active surgical intervention for the same or abdominal injury were excluded from the study. Patients with associated extremity trauma, chest trauma and mild head injuries were included.

A detailed pro-forma was used to collect the data needed.

After thorough clinical assessment, radiological evaluation was done using X ray/ CT/ MRI to localise the level of spinal injury and focal neurological deficits. The severity and neurological level of the injury were determined by American Spinal Injury Association (ASIA) classification of SCI, which is a widely accepted system describing the level and the extent of injury based on a systematic motor and sensory examination of neurological function.

The American Spinal Injury Association (ASIA) Impairment Scale A – E (A: complete; B, C and D: incomplete; E: normal)<sup>(2)</sup>

- ASIA A* – No motor or sensory function is preserved below the level of injury (and in the sacral segments S4 – S5)
- ASIA B* – Sensory but not motor function is preserved below the neurological level (includes the sacral segments S4 – S5)
- ASIA C* – Motor function is preserved below the neurological level, but too little to represent a practically usable function (more than half of key muscles below the neurological level have a muscle grade less than 3)
- ASIA D* – Motor function is preserved below the neurological level, to an extent that provides practically usable function (at least half of key muscles below the neurological level have a muscle grade of 3 or more on a scale from 0 to 5)
- ASIA E* – Motor and sensory functions are normal

Initial stabilisation was done using cervical collar. All patients were taken up for the surgical intervention depending on the level of spinal injury. Post-operative follow up of the patients was done till the time of discharge. Outcome was analysed on the basis of improvement in the clinical status of the patient. Postoperative prognosis was assessed by



individual and group exercises programme, ambulation, gait training, bladder and bowel management and return to normal activity. Regular limbs and chest physiotherapy, daily nursing care, psychological support and counselling sessions for the patient and the family were given.

Descriptive statistics were used to compute age, gender and aetiology distribution.

Secondary complications like pulmonary embolism, deep vein thrombosis, pressure sores, urinary tract infections, spasticity, depression and neuropathic pains were also assessed for.

### 3. Results

Study group comprised of 43 adult patients including 42 males and 1 female patient. (Fig1.&2. Table1.)

Fig 1. Pie diagram showing gender distribution of the study population

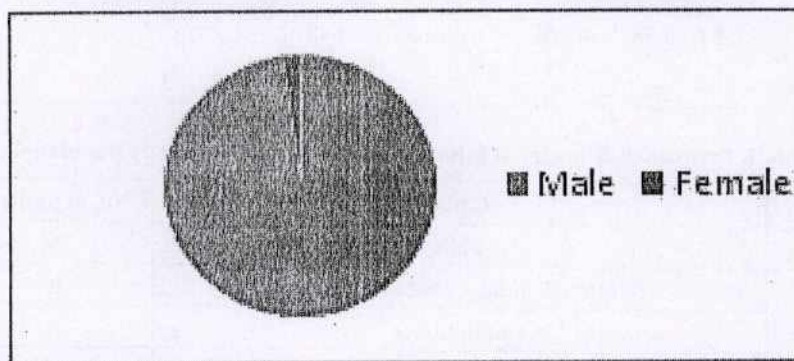
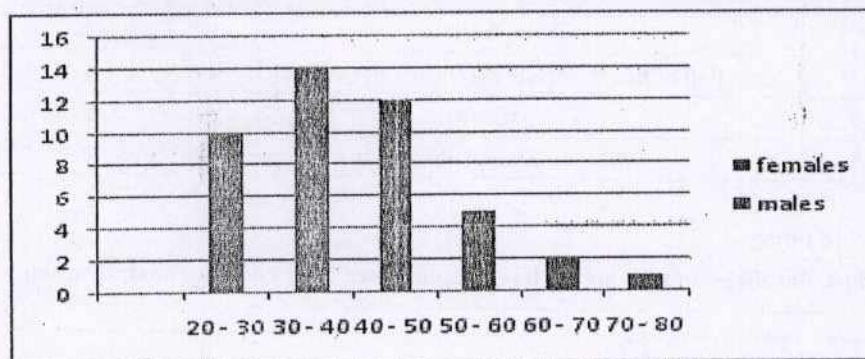


Fig 2. Bar diagram showing age and gender distribution of the study population



Age in years a →

Table 1. Age distribution of the study population

S. No	Age group (in years)	No. of patients
1.	20 – 30	10
2.	30 – 40	14
3.	40 – 50	11
4.	50 – 60	5
5.	60 – 70	2
6.	70 – 80	1

### 3.1 Cause of the spinal injury

Fig 3. Bar diagram showing frequency & mode of injury

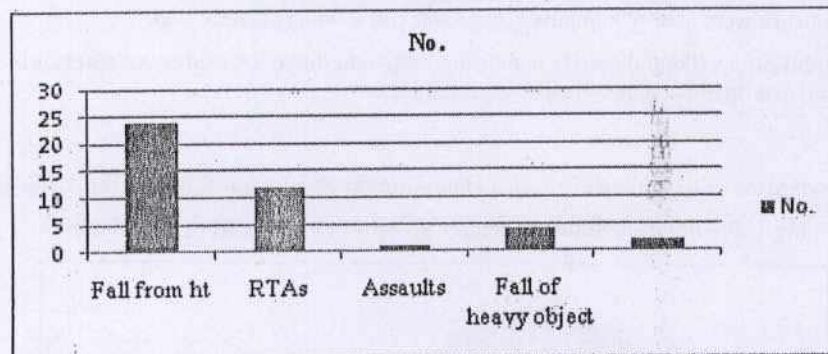


Table 2. Frequency & modes of injury commonly seen in the study population.

S. No.	Cause	No. of patients
1.	<b>Falls</b>	24
1.1	Fall from buildings / construction sites	16
1.2	Fall from tree	8
2.	<b>Road traffic accidents</b>	12
2.1	Two wheelers	9
2.2	Four wheelers	3
3.	<b>Fall of heavy objects overhead / neck / back</b>	4
4.	Assaults	1
5.	<b>Others – Stampedes / skids</b>	2

### 3.2 Level of Spinal cord injury

Fig 4. Bar diagram showing the level of spinal cord injury among the study group

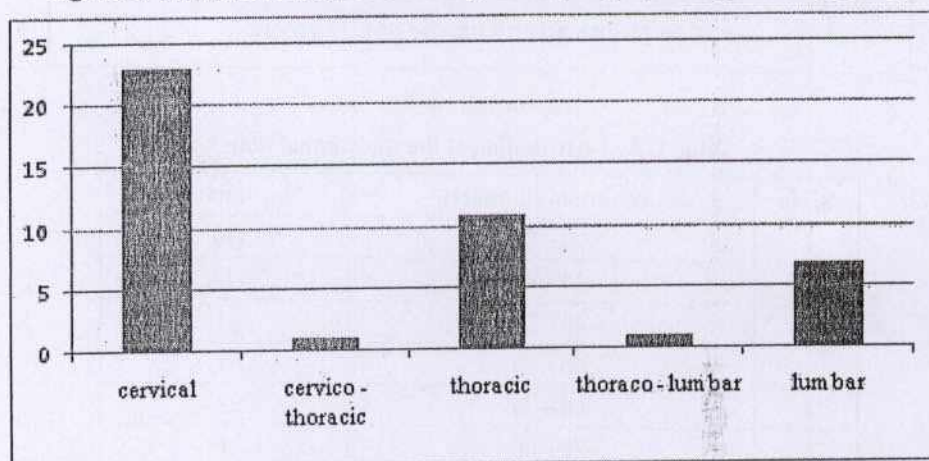




Table 3. Levels of spinal cord injury among the study group

S.No	Level	No. of patients
1.	Cervical	23
	C2 – C3	1
	C3 – C4	4
	C3 – C5	4
	C4 – C5	1
	C5 – C6	9
	C6 – C7	4
2.	Cervico thoracic ( C7 – T1 )	1
3.	Thoracic	11
	T3 – T4	1
	T6	1
	T11	2
	T12	7
4.	Thoraco lumbar ( T12 – L1 )	1
5.	Lumbar	7
	L1	6
	L2	1
	Total	43

### 3.3 Neurological deficits

Fig 5. Bar diagram showing the frequency of presentations of spinal injury patients

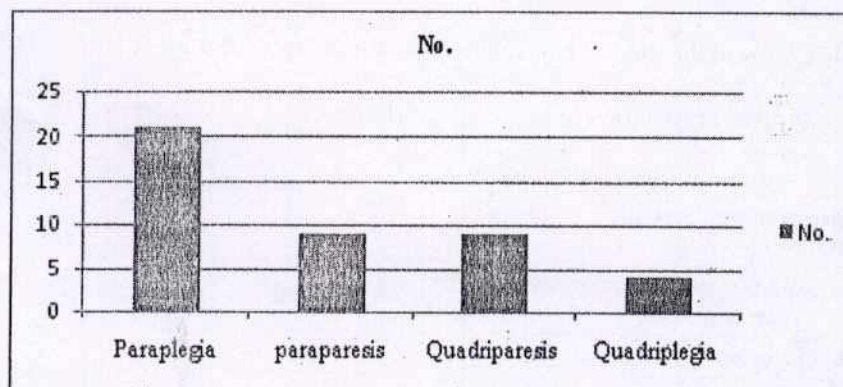


Table 4. Injury zone and the common modes of presentations of spinal injury

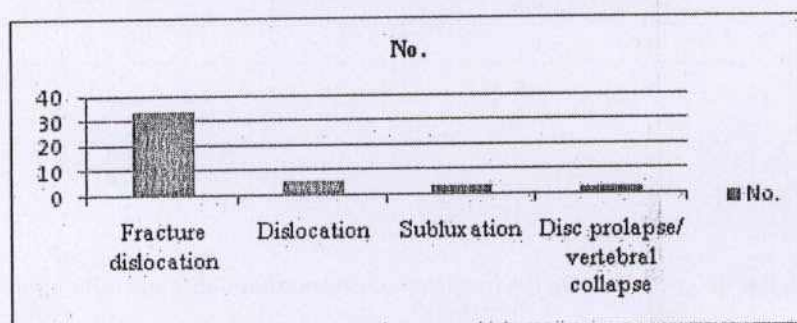
S.No	Injury Zone	Quadriplegia	Paraplegia	Paraparesis	Quadriparesis	No.
1.	Cervical	9	11	-	3	23
2.	Cervico – thoracic	-	-	-	1	1
3.	Thoracic	-	7	4	-	11
4.	Thoraco -luminar	-	1	-	-	1
5.	Lumbar	-	2	5	-	7
	Total	9	21	9	4	43

## 3.4 Injury type on radiological assessment ( X ray / CT / MRI )

Table 5. Radiological injury type

S.No	Injury type	No. of Patients
1.	Fracture dislocation	33
2.	Subluxation	3
3.	Dislocation	5
4.	Vertebral collapse / disc prolapse	2

Fig 6. Bar diagram showing the type of injury on radiological assessment



## 3.5 Surgical intervention

Table 6. Type of the surgical intervention done depending on the injury type and level

S.No	Surgical procedure	Cervical	Cervico - thoracic	Thoracic	Thoraco - lumbar	lumbar
1.	Anterior discectomy + disc implantation/ fusion	4	-	-	-	-
2.	Anterior discectomy/corpectomy + iliac bone grafting + plate & screw fixation	15	-	-	-	-
3.	Partial laminectomy + decompression + pedicle screw fixation	-	1	11	1	7
3.	Decompressive laminectomy	3	-	-	-	-
4.	Reduction & skull traction	1	-	-	-	-
	Total	23	1	11	1	7



### 3.6 Post-operative complications

**Table 7. Frequency of post-operative complications among the patients**

S.No	Complication	No. of patients
1.	Wound site infection	4
2.	Respiratory infection	18
3.	Pressure sore	26
4.	Deep vein thrombosis	3
5.	Urinary tract infections	16
6.	Psychological (depression)	14
7.	Myocardial infarction	1

Majority of patients were paraplegics (48.8%) while only 20.9% were quadriplegics. 11 (25.58%) patients had associated extra spinal injury of extremities, chest or head (4 with multiple rib fractures with pneumothorax / hemothorax, 5 with mild head injuries, 3 with extremity fractures and 2 with mild abdominal trauma). (Table 4, Fig5.)

27 patients (62.7 %) were brought to hospital within 24 hours of injury and rest 16 patients presented with a delay of either 48 or 72 hours. Mean hospital stay was  $40 \pm 10$  days. 10 (23.25 %) patients died during the course of hospital admission. The complication rate in the study was 31(70.29%) (Table7.). Pressure ulcers (60.4 %) and respiratory tract infections were predominant followed by urinary tract infections and psychological depression. Commonest cause of death was high cervical injury with respiratory paralysis superimposed with infections and aspiration pneumonitis (60%). 7 of the patients who died were quadriplegic and 3 of them were paraplegic. 2 patients succumbed to events of pulmonary embolism and deep vein thrombosis (30%) and myocardial infarction (1 patient). Among 33 patients available for final follow up, 19 patients were self-ambulating, 12 returned to work and 18 had no remaining neurological deficits or pain.

### 4. Discussion

Spine injuries are commonly related to high energy accidents like falls or motor vehicle accidents. Patients with spinal injuries often have other associated injuries to the abdomen, chest, extremities, or head. These injuries occur commonly among the young and middle-aged population and cause severe devastating debility. The detrimental consequences are not only physical, also mental and socio – economical. It is essential to identify the causes and modes of such injuries and in turn avert them.

The most common cause of spinal cord injuries, in our study, was due to falls from heights followed by road traffic accidents. (Table2. Fig3.) These falls from heights included falls from tree, those at construction works, accidental falls due to inadequate safety measures at house, suicidal attempts or other assaults. It is important to explore the causes of these falls and motor vehicle accidents so that apt preventive strategies and safety measures can be initiated both at work place and while driving to reduce these injuries. In our study we noticed lack of strict traffic regulations, the poor infrastructure of the existing roadways, drunk driving, over enthusiasm among younger generation as some of the causes of motor vehicle accidents. Also since the locality is in the vicinity of a national highway no proper speed limit was observed among the drivers.

The most vulnerable age group in the present study is 30 – 40 years followed by 40 – 50 years which is the most productive population group of the society (Table 1.). This is comparable with the study conducted by Shrestha et al.<sup>3</sup> where the common age group was from 30 – 49 years.

Regarding the gender distribution of Spinal Cord Injuries, our study showed that males were predominantly affected than females similar to other studies<sup>3</sup>. This is due to the fact that males are the primary labour force involved in construction works; driving, heavy objects work etc. and are almost exclusively the fatalities of these accidents. On the contrary, females are less involved in outdoor activities involving climbing trees, working at heights and driving.

A couple of patients were targets of local violence and assaults owing to the lack of self-conduct and illiteracy among the prevalent rural population.



None of the patients in the study had any awareness of spinal cord injuries and none received any pre hospital first aid. No proper method of transportation was done. Most of them were brought without neck immobilisation or spinal boards. Some were brought in unsuitable vehicles like bullock carts, auto – rickshaws, tempos and a very few by 108 ambulance services. This throws light into the inaccessible transport facilities, poorly infrastructured village roads, inadequate referral system, poor socio – economic status and illiteracy and ignorance among the rural population of our country. In spite of the measures implemented at local primary health centres by the government and ambulance services, poverty remains a major setback for affordability of medical facilities to these backward communities.

Appropriate evaluation of a spinal trauma requires a thorough clinical and radiographic assessment, after ensuring the patient's other vital organ systems are intact. A "complete" neurologic injury signifies the complete absence of any sensation or motor function below the level of the injury. An "incomplete" neurologic injury means that there is some residual spinal cord and nerves function below the level of the injury and has better prognosis for potential recovery<sup>4</sup>. Spinal cord injury has been classified by a level of injury as defined by the American Spinal Injury Association (ASIA)<sup>2</sup>. The same scoring was used in our study to stratify the patients.

Acute spine trauma necessitates full evaluation in order to rule out any associated injury to the abdomen, chest or head. Radiographic evaluation usually begins with x-rays of the spine both anterior and lateral view. CT scan is a valuable tool that provides precise anatomy of the bones and location of fracture. MRI imaging allows for the visualization of soft, spinal cord, intervertebral discs, as well as the ligaments. MRI scan is indicated in all patients with neurologic deficit after trauma in order to evaluate for spinal cord compression or other neural injury<sup>3</sup>. In our study, all patients were initially evaluated with spine x rays and subsequent assessment with CT/MRI.

The frequency of head injuries varies from 26 % to 74 % in various patient populations with traumatic spinal cord injuries<sup>5,6</sup>. Those who are injured in traffic accidents and falls run a particular risk of sustaining a concomitant head injury. Concomitant head injuries are especially associated with cervical spinal cord injuries<sup>5</sup>. In our study, associated mild head injury was noted in 5 patients (11.6 %) who were managed conservatively. Chest injuries were treated with intercostal chest drains and extremity traumas with appropriate casts and splints.

Primarily all spinal injuries are managed with immobilization. The aim is to reduce further damage to the injured spinal cord during the early stages of recovery. Bed rest with logrolling is advised. In some patients traction may be used to achieve additional spine immobilization.

Use of steroids (methylprednisolone) in spinal cord injury has been long debated. The efficacy has been shown only when treatment is started within eight hours of the injury. Higher complication rates, postoperative infection, gastric ulcers, and pulmonary complications have been noted in patients treated with steroids<sup>7</sup>.

Steroids were not given to any patient in our study.

Operative intervention is usually considered for unstable fractures or with impending neurologic deficit. For patients with significant neurologic compromise, early intervention and stabilization may lead to improved postoperative neurologic recovery and mobilization and afford long term functional benefits. Significant spinal cord compression necessitates emergent surgical intervention to achieve full decompression of any bone or soft tissue that is intruding upon the spinal cord<sup>3</sup>.

For patients with spinal instability, the use of instrumentation and fusion of the spine at the level of fracture is warranted. Surgery is delayed until the patient is medically stabilized to allow the active bleeding or trauma to be managed. Surgery is performed emergently only in cases where progressive neurologic deterioration occurs. The choice of instrumentation depends on the type and location of the fracture, as well as the presence or absence of neurologic compromise.

Surgical approaches for reconstruction include either posterior and anterior stabilisation or a combination of both. In our study maximum patients in the cervical group underwent anterior discectomy/ corpectomy + iliac bone grafting + plate & screw fixation with satisfactory results. Other techniques adopted were anterior discectomy + disc implantation/ fusion, decompressive laminectomy and skull traction and reduction. Partial laminectomy + decompression + pedicle screw fixation was done for thoracic, thoraco – lumbar and lumbar injuries. (Table 6.)

Although no statistical differences in the level of functional motor recovery between early and delayed surgery were identified in some studies, early surgery allowed quick mobilization and less intensive respiratory physiotherapy, thus



shorter hospitalizations and rehabilitation time<sup>8</sup>. However, in our study comparisons of this factor was not made due to variable time of presentations after injury.

Primarily rehabilitation, psycho social support and counselling, extremity motion exercises and strength training are useful during the postoperative period to maintain flexibility and improve functional potential for recovery at the earliest. Assistive devices and occupational therapy training can help patients get maximal functional independence.

The limitation of this study is that it is a hospital based study which may not be accurately insightful of trends of spinal cord injury in rural population. Secondly being a referral tertiary centre, patients presented with a delay of 24- 72 hours. The results of the study could have varied in the setting of an acute injury.

## 5. Conclusion

Treatment of spinal injuries is a multi – disciplinary approach. The goal of management is to prevent further deformity and neurologic deficit. Operative treatment with decompression of spinal cord and spine stabilization is most universally recommended. Choice of the surgical procedure is decided based on the location of fracture and neurologic compromise. Management relies primarily on early intervention, post-operative care and rehabilitation. Increased awareness among health care professionals and general population regarding spinal cord injuries and upgrading the availability of pre hospital treatment is paramount to decrease the morbidity, increase survival and improve the quality of life of these patients.

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