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Research Article

Demographics of Traumatic Spinal Fractures in Indian Population Presenting to Tertiary Care Centre

Nitin Kimmatkar[1]* and Kantharaju H[2]

[1]Associate professor, level 1 trauma center, Government Medical College, Nagpur, Maharashtra, India

[2]Assistant professor, Department of Orthopaedics, Shridevi institute of medical sciences and research hospital, India.

***Corresponding Author:** Dr. Nitin Kimmatkar, Associate professor, level 1 trauma center, Government Medical College, Nagpur, Maharashtra, India.*

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Abstract

Background: In Indian state even after significant improvement in spinal fracture management, the epidemiology of these fractures was very little known due to its geographical, social, rural-urban and cultural variances.

Methods: Study was conducted during the period of June 2015 to December 2020. Total 252 traumatic spinal fracture patient's data was analysed by reviewing the medical records, the initial radiographs and CT-scans. Data was analysed to know demographic details, segmental distribution of fracture and type (OTA/AO classification), associated trauma and neurological deficit (America Spinal Injury Association Impairment Scale/ Frankel grade).

Results: Most of the patients were young age with an overall male to female ratio of 2.5:1. Fall from height (64.3%) is the most common injury mechanism followed by road traffic accidents (29.8%). Fracture in the cervical spine region (38.1%) were common, followed by lumbar (33.9%) and thoracic (27.79%). According to AO classification; 145 (50.7%) patients had type A fractures, 78(27.2%) type B fractures, and 63(22%) type C fractures. Total of (25.4%) patients had associated non-spinal injuries and 73.8% of spinal fracture patients had some type of neurological deficit.

Conclusion: Young working population are high risk group. Factors like illiteracy, lack of safety measures, low socioeconomic condition, transportation problem and unstructured health care system majorly influence the epidemiological distribution of these fractures. There is need of multicentre large scale prospective study and national registry for better understanding of these fractures and in preventive measures implementation.

Keywords: *epidemiology, traumatic spine fracture, neurological deficit.*

Introduction

The incidence of spinal fractures varies between 16 and 64 per 100,000 Population [1,2]. Spinal fractures frequently occur in the younger working population and causes severe disability and high mortality rate than other trauma [3]. In developing countries like India, a significantly higher incidence of these fractures in the younger working population causes devastating effects on family and society. The fall from height and road traffic accidents were common causes in the young population, while decreased bone mineral density in old age groups increases the risk of these fractures even after trivial trauma [4]. However, the study area and population significantly influence the incidence of these fractures, and it affects the prevention policies [5].

In India, traumatic injuries have increased significantly since past two decades. The rapid urbanization with road infrastructure-related problems, excessive speed and poor safety measures in working place were some major influencing factors for these injuries [6,7]. The epidemiological understanding of these fractures is vital for identifying high-risk groups, future policy planning, and preventive measures implementation to provide better health care facilities.

Material and Methods

A retrospective analysis of spinal fracture patients was admitted in a tertiary care centre at India between June2015 to December 2020. Patient's records were collected from the institutional Medical record department. The ethical approval for this study was taken from the institutional ethical committee. The inclusion criteria were traumatic spinal fracture patients admitted in our institute with plain radiograph, CT scan with complete medical record.

The patients admitted in other institutes, SCIWORA, expired patients before reaching our institute, and pathological spine fractures were excluded from the study. Total 252 patients met our study inclusion criteria. The objectives of this study is to know patient-related data and cause of Injury in the central Indian population, segmental distribution of fracture, fracture type (OTA/AO classification) [8,9] associated trauma and neurological deficit (America Spinal Injury Association Impairment Scale/ Frankel grade) [10]. Multiple fractures were defined as fractures in more than one vertebra. The statistical analysis was done using Microsoft Excel software to calculate the mean, average, percentage, and standard deviation.

Results

Patient demographic data: The study group included a total of 252 patients. Of these, 180(71.5%) were males and 72 (28.5%) were female with an overall male to female ratio of 2.5:1. The mean age of the study population was 37.7 ± 13.2 years [range between 18-78 years]. Total 168(66%) of patients belong to low socioeconomic status. There was 11 days mean delay [range between 5 hours to 29 days] from time of injury to hospital presentation.

Cause of Injury: Fall from height (162 patients, 64.3%) is the most common injury mechanism. Among these, 128 patients (50.8%) had high energy falls and 34 patients (13.5%) had low energy falls. The other most common mode of Injury was road traffic accidents (75 patients, 29.8%) [Figure 1]. The thoracic and lumbar segment fractures commonly occurred due to high energy fall. Road traffic accidents were the most common mechanism in cervical spine fractures [Figure 2].

Fracture type and distribution: A total of 286 fractures are documented. 34(13.4%) patients had fractures more than one vertebrae. In total, 109 fractures (38.1%) occurred to the cervical spine, 80 (27.79%) to the thoracic spine, and 97 (33.9%) to the lumbar spine. The most frequently injured vertebra was the first lumbar vertebra (20.3%), followed by the C6 vertebra (12.9%). According to AO classification; a total of 145(50.7%) type A fractures, 78(27.2%) type B fractures, and 63(22%) type C fractures [Figure 3&4].

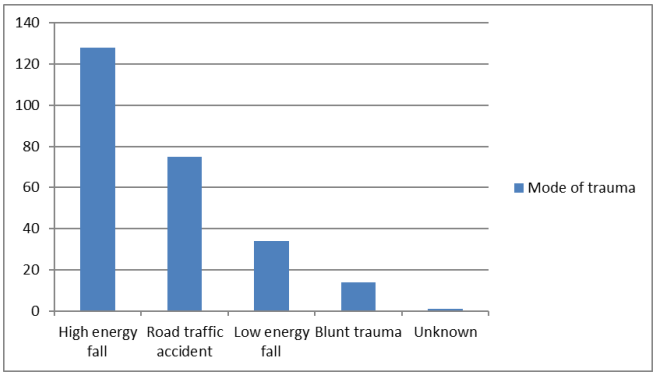

Figure 1: *Mode of trauma.*

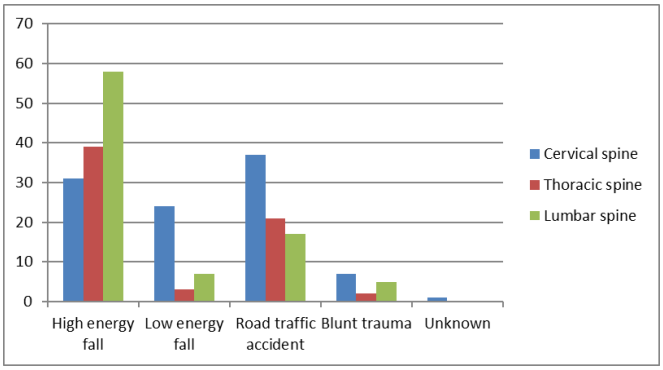

Figure 2: *Relationship between Mode of trauma and fracture location.*

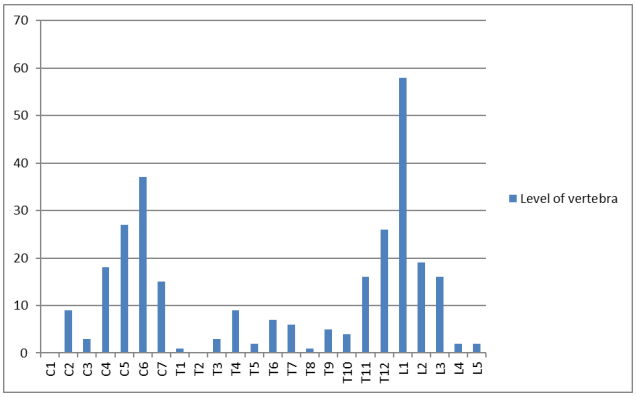

Figure 3: *Distribution of spinal fracture in each vertebra.*

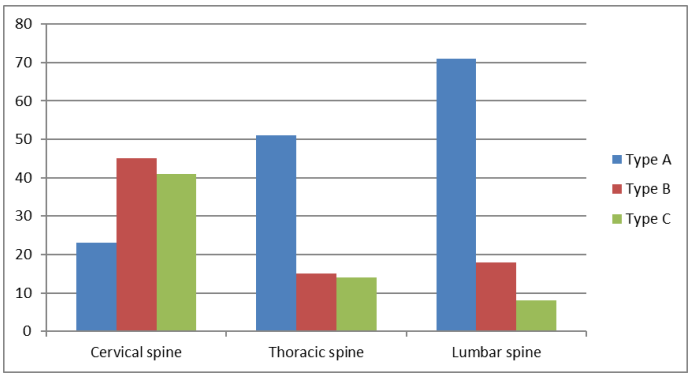

Figure 4: *Relationship between fracture type and spinal segment.*

Associated non-spinal injuries: A total of 64(25.4%) patients had associated non-spinal injuries. 27(42.2%) patients had chest injuries, 25(39%) patients had associated extremity injuries, 8 patients had associated head injuries and 4 patients had associated abdominal and pelvic injuries. In extremity injuries, 8 patients had upper extremity injuries and 17 patients had lower extremity injuries. Total 22(64.7%) patients with multiple vertebra fracture involvement had these injuries. The relation between associated non-spinal injuries and the cause of the accident were listed below [Table 1].

Table 1: The relation between associated injuries and cause of accident.

	Blunt trauma	Road traffic accidents	Fall	Total
Head Injury	5	2	1	8
Chest injury	3	19	5	27
Extremities injury	5	5	15	25
Abdomen and pelvis injury	0	1	3	4

Neurological deficit: In our study group total of 186 patients had some neurological involvement. Among these, 102 (40.5%) patients had complete neurological deficits, 43(17%) patients had complete motor deficits with incomplete sensory loss, 26(10.3) patients had incomplete motor and sensory deficits and 15(5.95%) patients had intact useful motor function. Total 66(26.2) patients had no neurological deficit. Results shows 54(90.6%) OTA/AO type C patients had neurological deficit [Figure-5]. The incidence of neurological deficit in each spinal region is listed below. [Table: 2]

Table 2: Incidence of neurological deficit in different spinal region.

Frankel type	Cervical	Thoracic	Lumbar	Total
A	53	28	21	102
B	19	9	15	43
C	11	7	8	26
D	5	2	8	15
E	12	19	35	66

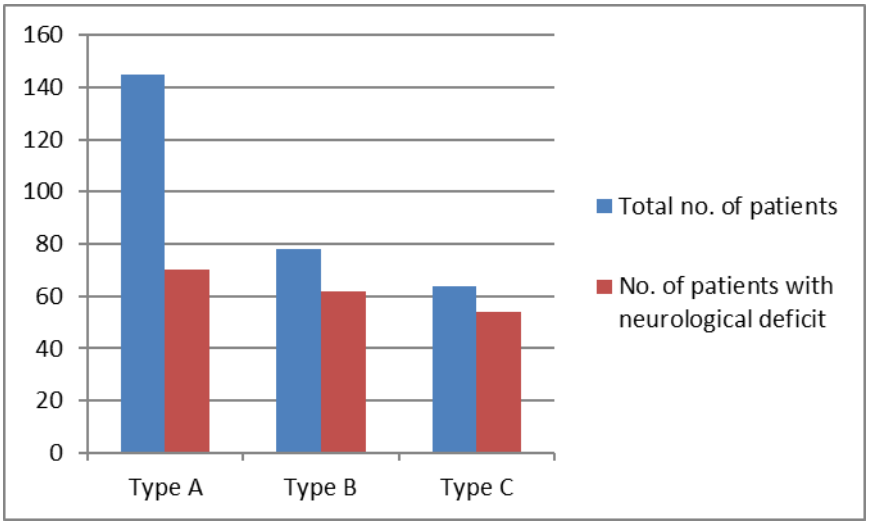

Figure 5: *Association between type of fracture and neurological deficit.*

Discussion

Conducting epidemiology studies in the Indian region is challenging due to its geographical, social, rural-urban and cultural variances [11, 12]. In Indian state even after significant improvement in spinal fracture management, the epidemiology of these fractures was very little known [11]. We hope this study provides some insight into the demographic characteristics of spine fractures for implementing preventative measures by the government and mitigating the burden of spine trauma in this region.

In this study, the younger population was more susceptible to these fractures and a higher number of males registered than females. India as a large youth population (mean age of 28.7 years) compared to developed country like United States (mean age of 38.5 years) and women account for only 20.3% of total labour force [13,14]. Young males being main wage earners and active members of family and the society are more exposed to risk factors due to outdoor working condition [15,16].

The delay in presentation to hospital is major concern in our study. We noticed an average mean delay of 11 days to hospital presentation from time of injury. This is significantly higher than developed countries [17,18]. The lack of awareness, transportation problem, non-structured health care delivery system and low economic condition were major factors influencing the delay in management of spinal fracture [19]. In this study, majority of patients belong to low economic status. The high number of these fractures in low economic status population, financial and psychological burden to patient family scares. According to global multidimensional poverty index (global MPI) 2020 India ranked 62nd among 107 countries with 27.91% head count ratio [20]. However Indian government launched world's largest health insurance program Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY) in 2018 to provide free access to health care for poor and vulnerable families [21].

In the present study, the fall from height is the leading mechanism of injury followed by road traffic accidents. The fall from height injuries most commonly occur in construction places and in agricultural fields. The poor safety measures at the construction site projects are major issue. Another major mechanism is road traffic accidents like motor vehicle accidents, pedestrian injuries. The gradual increase of spinal fracture in road traffic accident in recent years is major concern. In 1986 Chacko et al [22] reported 12.8% of spinal injuries due to road traffic accident cases which is significantly lower than present study (29.8%). The studies conducted in recent time in different Indian states also reported same trend [4,6 &16]. According to World Bank report (Guide for road safety opportunities and challenges) India accounts for 11% global death in road accidents with 450,000 cases per annum [23]. These injuries are relatively high in two wheelers driving mainly due to over speeding, not wearing safety helmet, alcohol intake, and poor road conditions.

The biomechanics of spine and cause of injuries significantly affect the pattern of fractures [8]. In this study, the cervical spine fractures were more common and majority of these fractures occurred due to road traffic accident. Cervical spine is more vulnerable to acceleration/deceleration force due to small vertebral size and relatively weak muscular support. In contrast, thoracolumbar fractures were most commonly due to high energy fall. The relative weakness of the thoracolumbar region against compression forces might be responsible for the greater number of these fractures [8,24].

Associated non-spinal injuries significantly affect the outcome in traumatic spinal fracture patients [25]. In our study total of 25.4% of patients had associated non-spinal injuries. Chest injuries were more common, followed by extremity injuries. In studies done by Birua GJ et al [4] and Leucht, Philipp, et al [8] Reported 17.55% and 54.4% of associated non-spinal injuries in spinal fractures respectively. These injuries were more common in male patients, high-energy trauma, type c fractures [8,26].

Neurological deficit was the catastrophic consequence of spinal fracture [27,28]. In this study, 73.8% of spinal fracture patients had some type of neurological deficit which is significantly high as compared to developed countries [28, 29]. In this region majority of spinal fractures without neurological involvement went undiagnosed due to lack of deformity and non-availability of radiographic investigation facilities in rural area. Most of these patients are getting symptomatic treatment from under-skilled local health care workers. Delay in the management of these injuries mainly due to transportation-related problems, low socioeconomic conditions and illiteracy, and inadequate resources. As result shows, neurological deficit was more common with cervical spine fractures followed by thoracic and lumbar vertebral fractures. It was most likely due to decreased spinal cord diameter and the increase of the spinal canal diameter from cranial to caudal vertebrae [30].

Retrospective nature and unreported patents are limitations to this study. Majority of patients presented to the tertiary care centre as a last option for management. So, we recommend multicentre studies with peripheral health care system involvement to identify the actual incidence of these fractures.

Conclusion

Spinal fractures are catastrophic injuries. The young working population is a high-risk group. High energy fall and Road traffic accidents are leading causes due to lack of safety measures. The associated non spinal injuries are more in high-energy traumatic condition. Majority of asymptomatic patients went un-reported due to lack of structured health care facility. The appropriate protective measures and creating awareness, especially in the younger population and improvement of health care facilities help mitigate these devastating injuries.

Conflict of Interest

The authors declare no conflict of interest.

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