



Retrospective Analysis of 91 Patients with Spinal Trauma Examined at Emergency Department

Acil Serviste Değerlendirilen 91 Spinal Travmalı Hastanın Retrospektif Analizi

Spinal Traumas in our Province

İbrahim Burak Atıcı¹, Serdal Albayrak¹, Emre Durdağ², Hakan Yılmaz³, Ömer Doğan Alataş⁴, Evrim Gül⁴, Aysel Gürçan⁵
¹Beyin ve Sinir Cerrahisi Kliniği, Elazığ Eğitim ve Araştırma Hastanesi, Elazığ, ²Beyin ve Sinir Cerrahisi, İstanbul Medipol Üniversitesi, İstanbul, ³Beyin ve Sinir Cerrahisi Kliniği, Düzce Devlet Hastanesi, Düzce, ⁴İlk ve Acil Yardım Kliniği, Elazığ Eğitim ve Araştırma Hastanesi, Elazığ, ⁵Fizik Tedavi Rehabilitasyon Kliniği, Elazığ Eğitim ve Araştırma Hastanesi, Elazığ, Türkiye

Özet

Amaç: Spinal travma dünyada travmayla ilişkili hastalıkların en önemli nedenlerinden birisidir. Spinal yaralanmalar sıklıkla trafik kazaları (%40), düşmeler (%20-30), spor yaralanmaları (%10-20) ve ateşli silah yaralanmaları sonucunda meydana gelir. Bu çalışmanın amacı bölgemizdeki spinal travmaların insidansını, yaralanma mekanizmasını ve spinal travma çeşitlerini 91 hastayı retrospektif olarak inceleyerek ortaya koymaktır. **Gereç ve Yöntem:** 2010-2013 yılları arasında 91 hasta spinal travmayla Elazığ Eğitim ve Araştırma Hastanesi acil servis ve beyin cerrahisi kliniğine başvuru. Trafik kazaları araç içi ve araç dışı trafik kazaları olarak, düşmeler yüksekliğe göre 1 metre-aşağısından düşme ve 1 metrenin yukarisından düşme olarak sınıflandırıldı. **Bulgular:** 36 hasta 1 metrenin yukarisından düşme nedeniyle, 18 hasta 1 metre ve aşağısından düşme nedeniyle, 20 hasta araç içi trafik kazası nedeniyle, 14 hasta araç dışı trafik kazası nedeniyle, 2 hasta spor yaralanması nedeniyle ve 1 hasta intihar nedeniyle kabul edildi. 31 hasta nörolojik defisit ve radyolojik instabilite nedeniyle operasyona girdi. 58 hastada konservatif tedavi uygulandı. 1 hasta pre-operatif dönemde hayatını kaybetti. **Tartışma:** Bu çalışmada, bölgemizdeki spinal travmaların insidansını, yaralanma mekanizmasını ve spinal travma çeşitlerini bir epidemiyolojik çalışma olarak ortaya koymak amaçlanmıştır.

Anahtar Kelimeler

Spinal Travma Epidemiyolojisi; Nörolojik Defisit; Spinal Travma; Spinal Instabilite

Abstract

Aim: Spinal trauma is one of the most important causes of trauma-related morbidity worldwide. Spinal injuries are often caused by traffic accidents (40%), falls (20-30%), sports injuries (10-20%), and firearm injuries. The aim of this study is to stress incidence and injury mechanism of spinal traumas and types of spinal traumas in our province by retrospectively reviewing 91 patients. **Material and Method:** 91 patients applied to the emergency department and neurosurgery clinic of Elazığ Education and Research Hospital with spinal trauma between 2010 and 2013. Traffic accidents were classified as in-vehicle or out-of-vehicle accidents and falls were classified according to height as follows: falls from a height≤1 m and those from a height>1 m. **Result:** 36 patients were admitted due to falls from a height>1 m, 18 patients were admitted due to falls from a height≤1 m, 20 patients were admitted due to in-vehicle traffic accidents, 14 patients were admitted due to out-of-vehicle traffic accidents, 2 patients were admitted due to sports injuries and one patient was admitted due to assault. Thirty-one patients underwent surgery due to neurological deficit and/or radiological instability. Fifty-eight patients were managed with conservative approach. One patient died during the pre-operative period. **Discussion:** The aim of this study was to indicate incidence of spinal trauma, mechanism of injury, and types of spinal trauma in our province as an epidemiological study.

Keywords

Epidemiology of Spinal Trauma; Neurological Deficit; Spinal Trauma; Spinal Instability

DOI: 10.4328/JCAM.3927

Received: 02.10.2015 Accepted: 05.11.2015 Printed: 01.01.2016

J Clin Anal Med 2016;7(1): 80-4

Corresponding Author: Hakan Yılmaz, Beyin ve Sinir Cerrahisi Kliniği, Düzce Devlet Hastanesi, Düzce, Türkiye.

GSM: +905066211829 E-Mail: dr_hakanyilmaz@hotmail.com

Introduction

Spinal trauma is one of the most important causes of trauma-related morbidity worldwide with a frequency of 5 per 100,000 cases. In our country, its frequency becomes increasingly higher over time due to a higher density of younger population and an increasing number of motor vehicles [1].

Of the cases with spinal trauma, 80% are male and younger than 40 years. Spinal trauma is observed in 5% of all injuries. Over 60% of vertebral fractures are observed at the thoracolumbar region (T12-L2). There is vertebral fracture or dislocation in 0.23% of the world population, and paraplegia or quadriplegia develops in 10-15% of these individuals. It is most frequently observed at 16-25 years of age in our country, as seen in the world [2,3]

Spinal injuries are often caused by traffic accidents (40%), falls (20-30%), sports injuries (10-20%), pathological fractures (4%), and firearm injuries (2,3). In a previous study, spinal traumas were most commonly observed at the cervical region (60%), followed by the thoracolumbar junction (20%), lumbar region (10%), thoracic region (8%), and sacral region (2%) [3].

After trauma, various types of injuries can occur at the spinal column, which is exposed to flexion, extension, shearing, or rotation because of forces acting against normal alignment. Fractures can occur due to spinal injuries, and neurological deficit may develop due to fractures within the spinal canal. Neurological deficit may result from damage occurring in medulla spinalis regardless of fracture. The main goals of management include removing mechanical compression, restoring deformities, and establishing a stable and functional spinal column [4].

In the emergency room, the first-line imaging modality should be x-ray radiography and subsequent computerized tomography (CT) according to trauma region. The diagnosis could be supported by magnetic resonance imaging (MR) in cases with suspected neurological deficit, spinal cord damage, and ligament injuries [2,3].

In this study, the aim was to indicate epidemiology of spinal trauma, mechanism of injury, and types of spinal trauma in our province by retrospectively reviewing 91 patients who applied to Elazig Education and Research Hospital within the previous 3 years.

Material and Method

We retrospectively reviewed 91 patients who applied to the emergency department of Elazig Education and Research Hospital with spinal trauma between 2010 and 2013 and were admitted to the neurosurgery clinic.

All patients were assessed regarding age, sex, neurological examination, trauma mechanism, trauma severity, comorbid disease, the presence or absence of surgical intervention, and mortality. The patients were neurologically classified according to the American Spinal Injury Association Impairment Scale (ASIA).

Traffic accidents were classified as in-vehicle or out-of-vehicle accidents, while falls were classified according to height as follows: falls from a height≤1m and those from a height>1m. The research protocol was approved by the local ethical committee.

Statistical analysis

Descriptive statistics [mean, median, SD (standard deviation),

minimum, maximum, and frequencies] were used for assessing the demographics and clinical parameters. Statistical analyses were performed using the SPSS program for Windows v. 17. 00. Baseline data were expressed as means±SD.

Results

91 patients, who presented to the emergency department with spinal trauma and were consulted by the neurosurgery department and admitted to the neurosurgery clinic, were retrospectively evaluated. Of the patients, 27 (29.6%) were women while 64 (70.4%) were men (Table 1). The mean age was 41.3 years, ranging from 13 to 85 years (Table 2).

Table 1. The sex of cases

Sex	Cases	%
Male	64	70.4
Female	27	29.6

Table 2. Age of cases

Age	Number of cases
0-9 Age	
10-19 Age	6
20-29 Age	18
30-39 Age	21
40-49 Age	23
50-59 Age	12
60-69 Age	4
70-79 Age	3
80-89 Age	4
Total	91

When mechanism of injury was assessed, it was found that 36 patients (39.5%) were admitted due to falls from a height >1 m, 20 patients (21.9%) due to in-vehicle traffic accidents, 18 patients (19.7%) due to falls from a height≤1 m, 14 patients (15.3%) due to out-of-vehicle traffic accidents, 2 patients (2.1%) due to sports injury, and one patient (1.0%) due to assault. Fractures were detected in 9 patients who presented with falls (Table 3).

Table 3. Cause of spinal trauma

Mechanism of injury	Range
Fall from high>1	36 Cases (%39.5)
In-vehicle traffic accident	20 Cases (%21.9)
Fall from a height≤1 m	18 Cases (%19.7)
Out of vehicle traffic accident	14 Cases (%15.3)
Sport injury	2 Cases (%2)
Assault	1 Cases (%1)

When localization of trauma was assessed, it was seen that there was trauma at the cervical region in 12 patients (13.1%), at the thoracic region in 11 patients (12.08%), at the thoracolumbar junction in 45 patients (49.1%), at the lumbar region in 21 patients (23.07), and at the sacral region in 2 patients (2.1%). Dislocation was most commonly observed at the cervical region, while compression fracture and burst fracture were more commonly observed at the thoracic region and thoracolumbar junction, respectively (Table 4, 5). Systemic examina-

Table 4. Localization of trauma

Localization of trauma	Range
Cervical region	12 Cases (%13.1)
Thoracic region	11 Cases (%12.08)
Thoracolumbar junction	45 Cases (%49.1)
Lumbar region	21 Cases (%23.07)
Sacral region	2 Cases (%2.1)

Table 5. Region of trauma localization

Cervical region	Number of cases
C1+C2 fracture	4
C2 corpus fracture	1
C3-4 dislocation	1
C5-6 dislocation	3
C5 spinous process fracture	2
Thoracal region	
Th 5-6 compression fracture	2
Th 8-9 compression fracture	3
Th 11 compression fracture	6
Thoracolumbar junction	
Th 12 compression fracture	22
Th 12 burst fracture	23
Lumbar region	
L1 compression fracture	1
L1 burst fracture	7
L1+L2 compression fracture	2
L2 compression fracture	4
L2 burst fracture	3
L4 compression fracture	1
L5 compression fracture	3
L5 transvers process fracture	4
Sacral region	
S1-2 dislocation	1
Sacrum left ala fracture	1

tions and evaluations were performed in patients with spinal trauma who were assessed in the emergency department. It was found that there was cerebral edema in 3 patients (3.2%), cerebral contusion in one patient (1.0%), rib fractures in 4 patients (4.3%), hemopneumothorax in one patient (1.0%), intraabdominal injury in 4 patients (4.3%), and extremity factures in 11 patients (12.0%).

In neurological examinations, the patients were classified according to the American Spinal Injury Association Impairment (ASIA) scale. In our series, the patients were classified as follows according to ASIA: 3 patients as ASIA-A, 2 patients as ASIA-B, 3 patients as ASIA-C, 2 patients as ASIA-D, and 81 patients as ASIA-E. Neurological deficit was observed in 10 patients (10.9%).

In our study, 31 patients (34%) underwent surgery due to neurological deficit and/or radiological instability. In 2 patients, surgery was indicated, but these patients were managed with conservative approaches as they declined surgery. Conservative approach was preferred in 58 cases (66%). Surgically, 14 patients underwent laminectomy plus posterior stabilization plus fusion, while 17 patients underwent posterior stabilization plus fusion.

The most common complications in cases that underwent surgery were wound infection and deep venous thrombosis. Wound infection occurred in 5 patients, while deep venous thrombosis developed in 2 patients during post-operative follow-up. The mortality rate was 2.1%. One patient, who had a preoperative neurological score of ASIA-A, died during the late post-operative period. Respiratory distress occurred after surgery in this patient. Another patient, with multi-trauma, died during hour 3 of intensive care unit admission, with a diagnosis of sacral fracture and retroperitoneal hemorrhage.

After surgery, neurological recovery was observed in 2 ASIA-C patients and 2 ASIA-D patients; however no neurological improvement was detected in 5 patients. The cases were referred to the rehabilitation clinic after surgery.

Discussion

In recent years, spinal traumas become one of most important causes of labor-force loss and increased costs related to diseases. Increasing number of motor vehicle accidents are the main reason. In studies from the United States, spinal trauma incidence has been reported as 40: 1,000,000. Approximately 12,000 new cases occur annually [5].

Vertebral fractures are more commonly seen in young adults and men with a male: female ratio of 4: 1 [5]. In multicenter retrospective studies, a male predominance is observed. In a multicenter study on vertebral fractures by Gertzbein et al., of the cases, 66.8% were men and 33.2% were women, while Cotler et al. reported that there were 32 men (72.7%) and 12 women (27.3%) in a series including 44 patients [6,7]. Again, in a series of 95 cases, Dickson et al. reported that there were 71 men (74.7%) and 24 women (25.3%), while Roy Camille et al. reported that there were 75 men (65.2%) and 40 women (34.8%) in a series including 115 patients [5,8]. Consistent with literature, in our study 29.6% were women while 70.4% were men..

Spinal traumas are more frequent in the second and fourth decades [9]. Median age at the time of trauma can vary between developed and developing countries. In the United States, the median age increased from 28.9 years in the 1970s (reported in larger, multicenter studies) to 38.0 years in the 2000s [10]. Spinal traumas are observed at 35-54 years of age in developed countries. However, it was found that risk for spinal injury is significantly increased at 20-40 years of age in developing countries [9,11]. In our study, the mean age was 41.3 years.

Spinal traumas are frequently a result of motor vehicle accidents and falls. While motor vehicle accidents are the leading causes in different series in the literature, some papers suggested falls as the leading cause [12,13]. The mean age may vary based on trauma etiology. In the study by Gertzbein et al., fractures resulted from motor vehicle accidents in 51%, falls in 34%, industrial accidents in 5%, at home in 2%, and miscellaneous injuries in 8% of the cases [6]. In the study by Cotler et al. (14), fractures occurred due to motor vehicle accidents in 47.8%, falls in 38.5%, accidents involving pedestrians in 4.7%, collisions caused by any object in 4.7%, firearm injury in 2.3%, and diving head first in 2.3% of the cases [14]. In our study, the most common cause of trauma was fall from height, followed by motor vehicle accidents. Fall from height was observed in 39.5% of the cases with a median age ranging from

50-75 years. Falls were observed in 19.7% of the cases with ages ranging from 42 to 85 years. Motor vehicle incidence was 37.2% with ages ranging from 20 to 57 years. The higher incidence of falls from height could be explained by socioeconomic and sociocultural differences in our province.

In spinal traumas, computerized tomography should be the first choice of imaging modality at presentation after direct x-ray radiographs. In many centers, CT scan is routinely used as first-line imaging modality in the radiological evaluation of cases with spinal trauma. CT scans can readily detect abnormalities that can be missed by direct x-ray radiographs [15]. However, CT scans can fail to establish accurate diagnoses. In particular, spinal canal, root damage, medulla spinalis, and ligament injuries can be more objectively assessed by using MR imaging [15]. In our studies, all patients underwent CT scans after direct x-ray radiograph. Diagnosis was confirmed by MR imaging in cervical trauma cases with neurological deficit. In our study, MR images were obtained in 17 cases (18.6%).

Spinal traumas are most commonly observed at the thoracolumbar region. In some series, the cervical region is the most common trauma site. In a study by Knutsdottir et al., the upper cervical region was the most frequently seen injury site due to trauma, followed by the thoracolumbar, lumbar, thoracic, and sacral regions [12]. In a study by Karacan et al., T12 and L1 vertebrae were the most frequently involved regions following spinal trauma [16]. Type and localization of trauma may vary based on differences in study populations, study settings, and sociocultural levels among studies. In our study, the most frequently observed trauma site was the thoracolumbar region, followed by the lumbar and cervical regions.

Mechanism of injury can differ according to environmental factors in spinal trauma and it may display seasonal variations [17]. The frequency of trauma is increased during holidays. In our study, 21.9% (n=20) of the cases occurred during autumn, while 17.5% (n=16) and 26.3% (n=24) occurred during winter and spring, respectively. The number of cases presented during summer was 31 (34%). In our province, incidences of falls from trees were significantly increased during the spring and summer, as our province is an agricultural area. The increases in the number of motor vehicle accidents and falls were significant during holidays.

Neurological deficit is observed in 14-38% of all vertebral traumas and fractures [18, 19]. In a study by Dickson et al., mean time to operation was 15.7 days, while mean length of hospital stay was 107 days [20]. In a study by Cotler et al., mean time to operation was 6.9 days, while mean length of hospital stay was 46.5 days [14]. The prolonged hospitalization in vertebral fractures results from the presence of additional injuries as vertebral fractures occur by severe traumas, challenges in rehabilitation due to neurological damage, and longer rehabilitation periods [21]. In our series, the rate of neurological deficit was 10.9%. Application time to the emergency department after trauma was assessed in our study. It was seen that 80 of 91 patients presented to emergency departments the same day of the injuries. In patients who had indication for surgery, mean time to operation was 2 days and mean length of hospital stay was 10.2 days. All patients with neurological deficit were transferred to physical therapy and rehabilitation clinics after

follow-up in neurosurgery.

Management of spinal traumas includes surgical and conservative approaches. Surgery should be preferred in case of neurological deficit and instability [18]. In our study, 31 patients (34%) underwent surgery due to neurological deficit and/or radiological instability. Conservative approach was preferred in 58 patients (66%).

The most common complication was wound infection and deep venous thrombosis in cases undergoing surgery. Wound infection occurred in 5 patients, while deep venous thrombosis developed in 2 patients during post-operative follow-up. The mortality rate was 2.1%.

Conclusion

In conclusion, spinal trauma appears as a public health problem due to labor-force loss and costs related to these injuries. The purpose of this study was to indicate the incidence of spinal trauma, mechanism of injury, types of spinal trauma, and seasonal variations in spinal traumas in our province, by retrospectively reviewing 91 patients who applied to xxxxxx Hospital within the previous 3 years.

ASIA Classification

- A Complete: No preserved motor and sensorial function at S4-S5 segments.
- B Incomplete: No motor function below neurological level; only sensorial functions are preserved including S4-S5 segments.
- C Incomplete: Motor function was preserved below neurological level, over one-half of key muscles under neurological levels has a value<3.
- D Incomplete: Motor function was preserved below neurological level, at least one-half of key muscles under neurological levels has a value≥3.
- E Normal: Motor and sensorial functions are normal.

Ethical Statement

Ethics committee approval was received for this study.

Informed Consent

Written informed consent was obtained from patients who participated in this study.

Acknowledgements

We would like to thank all of our department staff members for their valuable efforts during the study period.

Conflict of Interest

No conflict of interest was declared by the authors.

Financial Disclosure

The authors declared that this study has received no financial support.

References

1. Roy-Camille R, Saillant G, Mazel C. Plating of Thoracic, Thoracolumbar and Lumbar Injuries with Pedicle Screw Plates. Orthop Clin North Am 1986; 17: 147–159.

2. Ege R: Vertebra-Omurga, Editor. R. Ege. Ankara: Türk Hava Kurumu Basımevi; 1992.

3. McCormack T, Karaikovic E, Gaines RW. The load sharing classification of spine fractures. Spine 1994; 19(15): 1741–4.

4. Panjabi MH, Kato Y, Hoffmann H, Cholewicki J. Canal and Intervertebral Foramen Encoachments of a Burst Fracture; Effects from the Center of Rotation. Spine 2001; 26(11): 1231–1237.

5. Spinal cord injury facts and figures at a glance. National Spinal Cord Injury Statistical Center. J Spinal Cord Med 2012; 35(1): 68-9.

6. Gertzbein SD, Court-Brown CM, Marks P, Martin C, Fazl M, Schwartz M,et al. The

- neurologic outcome following surgery for spinal fractures. *Spine* 1988; 13: 641–4.
7. Cotler JM, Vernace JV, Michalski JA. The use of Harrington rods in thoracolumbar fractures. *Orthop Clin N Am* 1986; 17: 87-103.
8. Roy-Camille R, Saillant G, Mazel C: Plating of Thoracic, Thoracolumbar and Lumbar Injuries with Pedicle Screw Plates. *Orthop Clin North Am* 1986; 17: 147–159.
9. Gur A, Kemaloglu MS, Cevik R, Sarac AJ, Nas K, Kapukaya A, et al. Characteristics of traumatic spinal cord injuries in south-eastern Anatolia, Turkey: a comparative approach to 10 years' experience. *Int J Rehabil Res* 2005; 28(1): 57–62.
10. Bourassa-Moreau E, Mac-Thiong JM, Feldman DE, Thompson C, Parent S. Non-neurological outcomes following complete traumatic spinal cord injury: The impact of surgical timing. *J Neurotrauma* 2013; 30(18): 1596-601.
11. Fassett DR, Harrop JS, Maltenfort M, Jeyamohan SB, Ratliff JD, Anderson DG, et al. Mortality rates in geriatric patients with spinal cord injuries. *J Neurosurg Spine* 2007; 7(3): 277–81.
12. Knútsdóttir S, Thórisdóttir H, Sigvaldason K, Jónsson H Jr, Björnsson A, Ingvarsson P. Epidemiology of traumatic spinal cord injuries in Iceland from 1975 to 2009. *Spinal Cord* 2012; 50: 123-6.
13. Ackery A, Tator C, Krassioukov A. A global perspective on spinal cord injury epidemiology. *J Neurotrauma* 2004; 21: 1355-70.
14. Cotler JM, Vernace JV, Michalski JA. The use of Harrington rods in thoracolumbar fractures. *Orthop Clin N Am* 1986; 17: 87-103.
15. Korkusuz Z. Harrington enstrümantasyonu. Ege R, Editör. *Vertebra Omurga*, Ankara: THK Basımevi; 1992. s 309-319.
16. Karacan I, Koyuncu H, Pekel O, Sümbüloğlu G, KirnapM, Dursun H, et al. Traumatic spinal cord injuries in Turkey:a nation-wide epidemiological study. *Spinal Cord* 2000; 38: 697-701.
17. Draulans N, Kiekens C, Roels E, Peers K. Etiology of spinal cord injuries in Sub-Saharan Africa. *Spinal Cord* 2011; 49: 1148-54.
18. Vaccaro AR, An HS, Lin S, Sun S, Balderston RA, Cotler JM. Noncontiguous injuries of the spine. *J Spinal Disord* 1992; 5: 320-9.
19. Leucht P, Fischer K, Muhr G, Mueller EJ. Epidemiology of traumatic spine fractures. *Injury* 2009; 40: 166-72.
20. Dickson JH, Harrington PR, Erwin WD. Results of reduction and stabilization of the severely fractured thoracic and lumbar spine. *J Bone and Joint Surg* 1978; 60: 799-805.
21. Graziano GP. Cotrel-Dubousset hook and rod combinations for spine fractures. *Journal of Spinal Disorders* 1993; 6: 380-385.

How to cite this article:

Atıcı İB, Albayrak S, Durdağ E, Yılmaz H, Alataş ÖD, Gül E, Gürcan A. Retrospective Analysis of 91 Patients with Spinal Trauma Who Examined at Emergency Department. *J Clin Anal Med* 2016;7(1): 80-4.