

## Descriptive characteristics of spinal traumas in the Eastern Anatolia region of Türkiye: a 3-year retrospective analysis

*Türkiye’de Doğu Anadolu bölgesinde spinal travmaların tanımlayıcı özellikleri:  
3 yıllık retrospektif analiz*

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### Abstract

**Purpose:** Understanding the descriptive characteristics of traumatic spinal injuries such as etiology, epidemiology, mortality and their associations with mortality may facilitate the diagnosis and management of spinal traumas. Moreover, its incidence can be reduced through eliminating preventable causes. The present study aimed to assess the descriptive characteristics of spinal traumas and the conditions associated with mortality in our country.

**Materials and methods:** Our study was conducted retrospectively in the emergency service of a tertiary care hospital. Data of patients visiting to our hospital’s emergency room between 2020 and 2023 with spinal trauma, were obtained from the hospital information management system by scanning electronic patient records for inclusion in the study.

**Results:** A total of 1835 patients were included in our study, of which 427 (23.3%) were female and 1408 (76.7%) were male. The most common complaint of the included patients who presented to the emergency room was observed as falls (n=1112). 52.8% (n=968) of those patients with special traumas had other concomitant injury. 3.7% (n=68) of the included patients resulted in death.

**Conclusion:** Falls are the most common cause of special traumas in our country and concomitant head trauma and thoracic trauma are closely associated with mortality. While men are more frequently presented to the emergency room with special trauma, there has been no difference between both sexes in terms of mortality rate. Moreover, the most common vertebral fractures after spinal trauma occur in the parts of the corpus and spinous processes of the lumbar vertebrae.

**Keywords:** Vertebra fracture, spinal trauma, etiology, epidemiology, Eastern Anatolia.

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### Öz

**Amaç:** Spinal travmaların etiyojoloji, epidemiyoloji, mortalite, mortalite ile ilişkili tanımlayıcı özelliklerinin bilinmesi spinal travmaların tanı, tedavisini kolaylaştırabilir. Ayrıca önlenbilir nedenlerin ortadan kaldırılması ile görülme sıklığı azaltılabilir. Bu çalışmada da ülkemizde spinal travmaların tanımlayıcı özellikleri ve mortalite ile ilişkili durumların değerlendirilmesi amaçlandı.

**Gereç ve yöntem:** Çalışmamız üçüncü düzey bir hastanenin acil servisinde retrospektif olarak yapılmıştır. 2020-2023 yılları arasında hastanemiz acil servisine omurga travması nedeniyle başvuran hastaların verileri, çalışmaya dahil edilmek üzere hastane bilgi yönetim sisteminden elektronik hasta kayıtları taranarak elde edildi.

**Bulgular:** Çalışmamıza toplamda 1835 hasta dahil edilmiştir. Bu hastalardan 427 tanesi kadındı. Çalışmaya dahil edilen hastaların en sık acile başvuru şikâyeti düşme (n=1112) olarak gözlemlendi. Çalışmaya alınan hastalardan %52,8’inde (n=968) spinal travmaya eşlik eden başka bir yaralanma daha mevcuttu. Çalışmaya dahil edilen hastalardan %3,7’si (n=68) exitus olarak sonlanmıştı.

**Sonuç:** Ülkemizde en sık spinal travma nedeni düşmeler olup eşlik eden kafa travması ve toraks travması olması mortalite ile yakından ilişkilidir. Spinal travma ile erkekler daha sık acil servise başvururken mortalite oranı açısından her iki cinsiyet arasında bir fark bulunmamıştır. Ayrıca spinal travma sonrasında en sık görülen vertebra fraktürü lomber vertebranın corpus ve processus spinosus kısımlarındadır.

**Anahtar kelimeler:** Vertebra fraktürü, spinal travma, etiyojoloji, epidemiyoloji, Doğu Anadolu.

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## Introduction

Physicians dealing with the trauma frequently encounter spinal traumas (ST) and vertebral fractures (VFr). The incidence of VFr has been reported as 24-90 cases per 100.000 people [1]. Despite current treatment modalities, prolonged rehabilitation, prolonged absence from work or permanent disability may occur. Consequently, VFr is often associated with a significant impact on daily life activities, leading to a considerable primary and secondary socioeconomic cost burden.

Today, changing living conditions have led to changes in the socio-demographic characteristics and trauma mechanisms of patients impacted by ST. Increased life expectancy has also increased the risk of VFr development at advanced ages [2]. The mechanism of trauma can result from various causes such as falls, traffic accidents, gunshot wounds, battery, sports injuries, etc. Currently, it has been reported that ST and VFr-related injuries frequently occur as a result of falls in elderly patients and motor vehicle accidents in young patients [3]. Different results were obtained in similar studies. This may vary with factors such as geographical structure, level of development of the country and differences in driving legislation [4].

Concomitant injuries in patients with spinal trauma vary depending on factors such as the patient's presence of comorbid diseases, treatment options (the need for surgical repair) and gender in the studies [4, 5]. A study analyzed concomitant injuries based on the three spinal regions: cervical, thoracic, and lumbar. That study demonstrated that cranial injuries were the most common in patients with cervical ST, lung injuries were the most common in patients with thoracic ST, and intra-abdominal organ injuries were the most common in patients with lumbar ST [6]. Another study found that patients with lumbar ST had a higher risk for concurrent thoracic and retroperitoneal cavity visceral injuries [7].

We consider that the data we will obtain from the center where our study was conducted will be descriptive for the Eastern Anatolia region of our country, due to frequent admission of patients from rural centers and other provinces in the Eastern Anatolia region. Given the

different outcomes of ST in different countries and regions, in this study, we aimed to assess the demographic variations in ST in our region, the most common vertebra and part of the vertebra where a fracture occurs if VFr occurs, the mechanism of injury, treatment options (outpatient, inpatient), the presence of comorbid conditions and concomitant injuries.

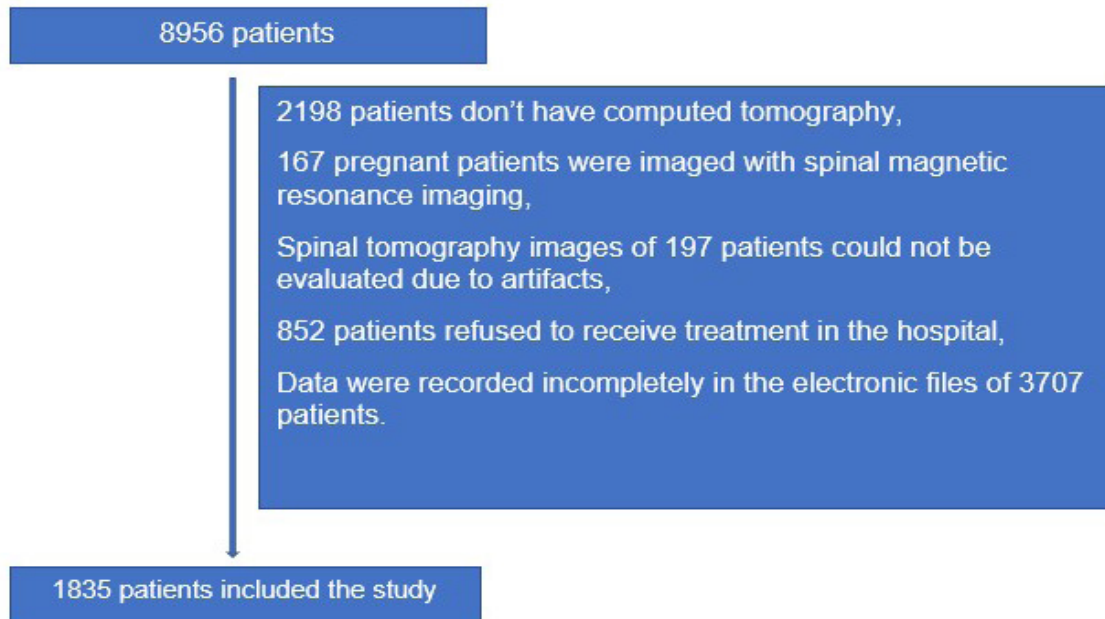
## Material and method

Our study was conducted retrospectively in the emergency room of a tertiary care hospital. Data of patients visiting to our hospital's emergency room from January 1, 2020 to January 1, 2023 with ST and suspected with Vfr, were obtained from the hospital information management system by scanning electronic patient records for inclusion in the study.

Ethical approval for this study was obtained from Ataturk University Faculty of Medicine Clinical Research Ethics Committee.

## Study population

From January 1, 2020 to January 1, 2023, 8956 patients presenting to the emergency room with suspected VFr who had ST were identified from the hospital information management system. No age range was determined for the patients included in our study. Patients for whom we could access all data and patient records from the electronic system were included in the study. Patients who were found to have only vertebral radiographs in the electronic patient files were excluded from the study. Also, patients who were seen to be pregnant and who received spinal magnetic resonance imaging for spinal imaging were excluded from the study. In addition, since the study evaluated patients who were first presented to the emergency room, patients who received spinal tomography other than at the time of presentation to the emergency room or whose image quality was not suitable for spinal evaluation were also excluded from the study. Patients who were planned to be included in the study but whose data were incomplete were also excluded. Patients who requested discharge during clinical observation were also excluded from the study because we could not follow their final status. When all inclusion and exclusion criteria were applied, 1835 patients were included in the study (Figure 1).



**Figure 1.** Flow chart showing the patients included in the study

### Acquisition of data

The electronic health records of patients with suspected VFr who had ST in the emergency room including age, gender, trauma mechanism, presence of accompanying comorbid conditions (such as diabetes mellitus, hypertension, coronary artery disease, chronic endocrine disorders requiring chronic medication use), treatment modality (outpatient, inpatient treatments), presence of VFr, if VFr is present, which part of the vertebral column is affected (cervical, thoracic, lumbar), which part of the vertebra is affected (corpus, transverse process, spinous process), the presence of concomitant injury, which part of the vertebra is affected if concomitant injury is present (brain, thorax, abdomen, genitourinary, pelvis, extremity, neck, maxillofacial), the clinical outcomes of the patients (death or discharge) and vertebral tomography images were obtained from the electronic patient records.

The CT scans for the patients at the time of their presentation to the emergency department were re-evaluated by two radiologists with 5-10 years of professional experience. Patients' vertebral and other systemic pathologies were recorded.

### Statistical analysis

Statistical analyses were performed with the IBM SPSS 20 statistical analysis program. Data are presented as percentages and numbers. Comparisons between categorical variables were made using the Pearson Chi-square test or Fisher's Exact test. The statistical significance level was taken as  $p < 0.05$ .

### Results

A total of 1835 patients were included in our study, of which 427 (23.3%) were female and 1408 (76.7%) were male. The most common complaint of the included patients who presented to the emergency room was observed as falls ( $n=1112$ ). 442 patients were evaluated in the emergency room due to ST caused by traffic accidents. VFr was present in 833 of the patients included in our study. The most commonly injured vertebrae were lumbar vertebrae ( $n=568$ ). The socio-demographic characteristics of the patients included in the study and the descriptive characteristics of their trauma are summarized in Table 1.

**Table 1.** Socio-demographic characteristics of the patients and descriptive characteristics of their trauma

<b>Variable</b>	<b>Mean±SD (min-max)</b>	
Age	36.8±21.5 (0-93)	
<b>Variable</b>	<b>n</b>	<b>%</b>
<b>Gender</b>		
Female	427	23.3
Male	1408	76.7
<b>Cause of trauma</b>		
Falls	1112	61
Traffic accident	442	24
Battery	83	4.5
Animal attack	50	2.7
Gunshot wound	8	0.4
Sharp object injuries	16	0.8
Electric shock	36	2
Vaccines	24	1.2
Trapped under rubble or Injured by falling object	64	3.4
<b>Type of Medical Care</b>		
Hospitalization	1108	60
Discharged from emergency	727	40
<b>Receiving spinal surgical treatment</b>		
Presence of fracture in any vertebra	833	45
Fractured cervical vertebra	63	3.4
Fractured thoracic vertebra	202	11
Fractured lumbar vertebrae	568	30.6
Vertebral corpus fracture	309	16.5
Spinous process fracture	395	21.5
Transverse process fracture	112	6.1
Spondylolisthesis	13	0.7
Odontoid process	4	0.2

Of the patients included in the study, 52.8% (n=968) had another concomitant injury associated with ST. The most common concomitant injury was thoracic trauma (n=357). The rate of consultation to neurosurgery clinic in patients with ST was 29.9% (n=548). Of the patients included

in the study, 5.3% (n=97) had comorbid diseases such as diabetes, hypertension, ischemic heart disease, and heart failure. The rate of death in patients was 3.7% (n=68). Other concomitant injuries associated with ST and consultation information are summarized in Table 2.

**Table 2.** Other concomitant injuries in patients with spinal trauma and their consultation information

Variable	n	%
<b>Presence of other concomitant injuries associated with spinal trauma</b>	968	52.8
Thoracic injury	357	19.5
Extremity injury	336	18.3
Head trauma	269	14.6
Maxillofacial injury	227	12.4
Abdominal injury	126	6.9
Pelvic injury	120	6.5
Neck injury	9	0.5
Genitourinary injury	3	0.2
<b>Patients requested for consultation</b>	1080	58.9
Number of patients for whom neurosurgical consultation was requested	548	29.9
Number of patients requested for orthopedic consultation	407	22.2
Number of patients requested for thoracic surgery consultation	355	19.4
Number of patients requested for general surgery consultation	140	7.6
Number of patients requested for otolaryngology consultation	136	7.4
Number of patients requested for ophthalmology consultation	107	5.8
Number of patients requested for urology consultation	83	4.5
Number of patients requiring maxillofacial surgery consultation	79	4.3
Number of patients requested for cardiovascular surgery consultation	47	2.6
Number of patients requested for pediatric surgery consultation	45	2.5
Number of patients for whom plastic and reconstructive surgery consultation was requested	39	2.1
<b>Patient's outcome</b>		
Death	68	3.7
Discharge	1767	96.3
<b>The presence of chronic disease</b>		
Having a chronic disease	97	5.3
No chronic disease	1738	94.7

Of the patients included in the study, 3.7% (n=68) resulted in death. An examination of the association between the outcome of these patients and the presence of traumas other than ST, indicated that the presence of concomitant

injury with ST was associated with the patient's outcome ( $p<0.001$ ). The association of gender, concomitant injury and consultations with patient's outcome is summarized in Table 3.

**Table 3.** Association of gender, concomitant injury and consultations with patient's outcome

Variable	Patient's outcome				P value (%)
	Death		Discharged		
	Number of (n)	Percentage (%)	Number (n)	Percentage (%)	
<b>Gender</b>					
Female	20	29.4%	407	23%	0.222
Male	48	70.6%	1360	77%	
<b>Concomitant injury</b>					
Concomitant injury	63	92.6%	905	51.2%	<0.001
No concomitant injury	5	7.4%	862	48.8%	
<b>Concomitant head injury</b>					
Concomitant head injury	40	58.8%	229	13%	<0.001
No concomitant head injury	28	41.2%	1538	87%	
<b>Concomitant thorax injury</b>					
Concomitant thorax injury	40	58.8%	317	17.9%	<0.001
No concomitant thoracic injury	28	41.2%	1450	82.1%	
<b>Concomitant abdominal injury</b>					
Concomitant abdominal injury	15	22.1%	111	6.3%	<0.001
No concomitant abdominal injury	53	77.9%	1656	93.7%	
<b>Concomitant pelvic injury</b>					
Concomitant pelvic injury	13	19.1%	107	6.1%	<0.001
No concomitant pelvic injury	55	80.9%	1660	93.9%	
<b>Concomitant extremity injury</b>					
Concomitant extremity injury	18	26.5%	318	18%	0.076
No concomitant extremity injury	50	73.5%	1449	82%	
<b>Concomitant neck injury</b>					
Concomitant neck injury	1	1.5%	8	0.5%	0.289
No concomitant neck injury	67	98.5%	1759	99.5%	
<b>Concomitant maxillofacial injury</b>					
Concomitant maxillofacial injury	12	17.6%	215	12.2%	0.178
No concomitant maxillofacial injury	56	82.4%	1552	87.8%	
<b>Concomitant genitourinary injury</b>					
Concomitant genitourinary injury	0	0%	3	0.2%	1
No concomitant genitourinary injury	68	100%	1764	99.8%	
<b>Consultation requested</b>					
Consultation requested	68	100%	1012	57.3%	<0.001
Consultation not requested	0	0%	755	42.7%	

**Table 3.** Association of gender, concomitant injury and consultations with patient's outcome (continued)

Variable	Patient's outcome				P value (%)
	Death		Discharged		
	Number of (n)	Percentage (%)	Number (n)	Percentage (%)	
Neurosurgery consultation requested	58	85.3%	490	27.7%	<b>&lt;0.001</b>
Not requested	10	14.7%	1277	72.3%	
Thoracic surgery consultation requested	39	57.4%	316	17.9%	<b>&lt;0.001</b>
Not requested	29	42.6%	1450	82.1%	
General surgery consultation requested	20	29.4%	120	6.8%	<b>&lt;0.001</b>
Not requested	48	70.6%	1647	93.2%	
Orthopedic consultation requested	22	32.4%	385	21.8%	<b>0.04</b>
Not requested	46	67.6%	1382	78.2%	
Urology consultation requested	10	14.7%	73	4.1%	<b>&lt;0.001</b>
Not requested	58	85.3%	1693	95.9%	
Ophthalmology consultation requested	5	7.4%	102	5.8%	0.779
Not requested	63	92.6%	1664	94.2%	
Otolaryngology consultation requested	8	11.8%	128	7.2%	0.163
Not requested	60	88.2%	1639	92.8%	
Maxillofacial surgery consultation requested	4	5.9%	75	4.2%	0.534
Not requested	64	94.1%	1692	95.8%	
Pediatric surgery consultation requested	3	4.4%	42	2.4%	0.231
Not requested	65	95.6%	1725	97.6%	
Cardiovascular surgery consultation requested	2	2.9%	45	2.5%	0.692
Not requested	66	97.1%	1722	97.5%	
Plastic-reconstructive surgery consultation requested	5	7.4%	34	1.9%	<b>0.013</b>
Not requested	63	92.6%	1733	98.1%	
Patient has a comorbidity	52	76.5%	1686	95.4%	<b>&lt;0.001</b>
Patient has no comorbidity	16	23.5%	81	4.6%	

## Discussion

As a result of our study, we observed that patients with ST who were evaluated at our hospital over the past three years had a mortality rate of 3.7%, which was independent of gender. While the incidence of ST was observed more frequently in male patients in our study consistent with the literature, no significant difference was observed between both genders in terms of mortality, which aligns with the findings of the study of Barbiellini Amidei et al. [8]. This may be linked with patient-dependent factors such as concomitant comorbid diseases, age at exposure to trauma, social engagement or the type of trauma.

The etiology of ST may differ depending on the country and region of residence. Some previous studies have shown that falls are the primary etiology of ST in developing countries, while motor vehicle accidents are the typical primary etiology in developed countries [9]. Alshahri and Alshehri [10] identified motor vehicle accidents as the most common cause of ST in their country. A study conducted in our country in 2013 found that falls were the most common etiologic cause of ST, consistent with our findings [11]. The decrease in motor vehicle accidents in various countries can be attributed to different factors [9]. The fact that the vehicles produced in today's technology are more protective, increased compliance with traffic rules, and legal regulations, potentially leading to less severe motor vehicle accidents.

Our study showed that the most common vertebrae fractured as a result of ST were lumbar vertebrae. In the study by Mahmud et al. [12] however, cervical vertebral fractures were observed most frequently. However, the most common etiology in the study by Mahmud et al. [12] was motor vehicle accidents, while the most common etiology of ST in our study was falls. Hence, the level of fractured vertebra may have changed depending on the mechanism of trauma. Furthermore, the fact that lumbar vertebrae are less protected and more flexible may increase the frequency of lumbar vertebral fractures. Shahriari et al. [13] also identified fractures in the corpus and transverse process of the lumbar vertebrae most frequently in patients with ST resulting from a fall. Yet, when the same study was evaluated in detail, it was observed

that spinous process fractures in ST caused by falls were higher than spinous process fractures in motor vehicle accidents, the second most common cause of ST [13]. In our study, corpus and spinous process fractures were frequently observed in the lumbar vertebrae. Falls on the spinous process during falls or hyper-extension movement to avoid falls may have increased the injuries in the posterior vertebrae.

Injuries in other systems are likely to be present in patients with ST. The likelihood of concurrent injuries with ST was observed in 63% of patients with cervical spine injury, 79% of patients with thoracic spine injury, and 71% of patients with lumbar spine injury [6]. Of the patients included in our study, 52.8% had another concurrent injury with ST. These injuries may affect the brain, thorax, abdomen, genitourinary system or extremities. Studies are showing that abdominal injury is frequent, especially in patients with lumbar VFr [13]. In contrast to this, in our study, thoracic injuries were observed to be the most common concurrent injury in patients with VFr. Similarly, Anandasivam et al. [6] emphasized that the most common concurrent injury in patients with lumbar VFr was in the thoracic region.

The mortality rate in patients with ST is between 4-18% [14]. Our study found a mortality rate of 3.7% which is consistent with the literature. In patients with ST, mortality was most commonly observed in patients with cervical VFr [8]. In our study, the association of mortality with the injured vertebral region was not evaluated. Nevertheless, the association of mortality with concurrent injuries of the patients was evaluated. Mortality will increase as concurrent injuries increase in patients with ST. In our study, 63 of the 68 patients who resulted in death had concurrent injuries. Our study showed that head traumas, and thoracic traumas in particular, were more prevalent among other injuries in patients resulting in death. When trauma patients are evaluated overall in the literature, brain and thorax injuries have a high rate among the leading causes of premature death. Since the first visits of ST patients to the hospital were evaluated in this study, it is not surprising that brain and thorax injuries were frequently observed in our patients resulting in death. Also, our work on this situation showed



that the most frequent consultation requested, apart from the neurosurgery clinic, was for the thoracic surgery clinic in patients resulting in death.

Our study has several limitations. Since our study was retrospective, our data were collected by scanning electronic patient records. This has resulted in missing data. Furthermore, we were unable to obtain outcome information for some patients who requested to seek treatment at other centers. We had to exclude these patients from the study, which resulted in missing data. The association of mortality with the level of VFr of our patients was not evaluated. Moreover, when evaluating the etiologies of ST in patients, the fall group was not divided into falls from their height level or falls from a height. Therefore, the difference between these two groups could not be evaluated.

In conclusion, our study is significant for highlighting the descriptive characteristics of STs in the recent period in Türkiye, particularly in the Eastern region. While ST is a more common cause for the male population presenting to the emergency room, there is no difference between both sexes in terms of mortality. ST is more common in young and middle-aged individuals who are active in daily life. Despite variations in etiology, considering the frequency of ST in the group who are active in daily life, the advancing technology, and living conditions today, falls are the most common cause of ST. Although it depends on the etiology of ST, VFr is most commonly seen in the corpus and spinous process region in the lumbar region. Concomitant injuries are common. However, head trauma and thoracic trauma are the most common concomitant injuries and are also the most frequently associated with mortality.

**Conflict of interest:** No conflict of interest was declared by the authors.

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**Ethics committee approval:** Permission was obtained from Ataturk University Clinical Research Ethics Committee for the study (permission date: 21.02.2024, permission number 1/43).

#### **Authors' contributions**

M.C. constructed the main idea and hypothesis of the study. M.C., F.T. and K.K. developed the theory and arranged/edited the material and method section. M.C., F.T. and K.K. have evaluated the data in the results section. The discussion section of the article was written by M.C. and F.T.. K.K. reviewed, corrected, and approved. In addition, all authors discussed the entire study and approved the final version.