ORIGINAL ARTICLE

Phnx Med J. March 2023, Volume 5 No 1
DOI:10.38175/phnx.1242837

The Effect of Trauma Mechanism on the Frequency of Accompanying Vertebral Fracture in Cases with Thoracic Trauma

Toraks Travmalı Olgularda Travma Mekanizmasının Vertebra Fraktürü Eşlik Etme Sıklığına Etkisi

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ABSTRACT

Objective: *Thoracic traumas are the third most common trauma among all trauma cases after head-neck and extremity traumas. The most common causes are motor vehicle accidents, falls from height, gunshot wounds, and stab wounds. In our study, it was aimed to investigate the mechanism of trauma and its effect on the frequency of accompanying vertebral fracture in patients who applied to the emergency department of a university hospital due to thoracic trauma.*

Material Method: *Our study was planned retrospectively. The information of the patients who applied to the emergency department of our hospital between 01.01.2017 and 01.01.2021 due to thoracic trauma was examined. Demographic characteristics of the patients, mechanism of trauma, trauma-related thoracic injuries and accompanying vertebral fractures were evaluated.*

Results: *The data of 515 patients exposed to thoracic trauma were analyzed. The median age of the patients included in the study was 52 and 72.4% (n: 373) were male. 96.3% (n: 496) of the patients presented because of blunt trauma. The most common trauma mechanisms were in-vehicle traffic accident (46.6% n:240) and falling from height (30.9% n:159).*

Pneumothorax was found in 34.7% (n: 179) of the patients, hemothorax in 40.2% (n: 207), and costal fracture in 81.9% (n: 422). The frequency of concomitant vertebral fracture was 33.98% (n: 175). Vertebral fractures were most commonly detected in the lumbar region (53.1%) and were most common in patients admitted after a non-vehicle traffic accident. A significant difference was found between the mechanism of trauma and accompanying vertebral fracture; vertebral fracture was seen in 53.8% (n:28) of the patients who applied after a non-vehicle traffic accident. (p=0.004)

Conclusion: *It should be kept in mind that the trauma mechanism may increase the frequency of accompanying vertebral fracture in patients admitted to the emergency department after blunt trauma and evaluated for thoracic trauma.*

ÖZET

Amaç: *Toraks travmaları baş-boyun ve ekstremite travmalarından sonra tüm travma olguları içinde üçüncü sıklıkta karşımıza çıkmaktadır. En sık sebepler motorlu araç kazaları, yüksekten düşmeler, ateşli silah yaralanmaları ve kesici-delici alet yaralanmalarıdır. Çalışmamızda bir üniversite hastanesinin acil servisine toraks travması nedeni ile başvuran hastalarda travma mekanizmasının ve vertebra fraktürü eşlik etme sıklığı üzerindeki etkisinin araştırılması amaçlanmıştır.*

Materyal Metot: *Çalışmamız retrospektif olarak planlanmıştır. 01.01.2017-01.01.2021 tarihleri arasında hastanemiz acil servisine toraks travması nedeniyle başvuran hastaların bilgileri incelenmiştir. Hastaların demografik özellikleri, travma mekanizması, travmaya bağlı toraks yaralanmaları ve eşlik eden vertebra fraktürleri değerlendirilmiştir.*

Bulgular: *Toraks travmasına maruz kalan 515 hastanın verileri incelenmiştir. Çalışmaya dahil edilen hastaların median yaşı 52 ve % 72,4'ü (n: 373) erkekti. Hastaların % 96,3'ü (n: 496) künt travma nedeniyle başvurmuştu. En sık karşılaşılan travma mekanizmaları araç içi trafik kazası (%46,6 n:240) ve yüksekten düşmeydi (% 30,9 n:159).*

Hastaların % 34,7 (n: 179)' sinde pnömotoraks, % 40,2 (n: 207)'sinde hemotoraks, % 81.9 (n:422)'sinde kosta fraktürü saptandı. Eşlik eden vertebra fraktürü sıklığı % 33.98 (n: 175)'di. Vertebra fraktürleri en sık lomber bölgede saptandı (%53.1) ve en sık araç dışı trafik kazası sonrası başvuran hastalarda görüldü. Travma mekanizması ile vertebra fraktürü eşlik etmesi arasında anlamlı fark bulundu; araç dışı trafik kazası sonrası başvuran hastaların % 53.8 (n:28)'inde vertebra fraktürü görüldü. (p=0,004)

Sonuç: *Künt travma sonrası acil servise başvuran ve toraks travması nedeniyle değerlendirilen hastalarda, travma mekanizmasının vertebra fraktürü eşlik etme sıklığını artırabileceği akılda tutulmalıdır.*

Keywords:
Emergency department
Thoracic trauma
Vertebral fracture in thoracic trauma

Anahtar Kelimeler:
Acil servis
Toraks travması
Toraks travmalarında vertebra fraktürü

INTRODUCTION

Trauma is the third leading cause of death in all ages, after cancer and cardiovascular diseases, and ranks first in the young population (1,2). Thoracic traumas are the third most common trauma among all trauma cases after head-neck and extremity traumas (1,3). The most common

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Cite as: Öztok B, Tekten, Yakşi O. The effect of trauma mechanism on the frequency of accompanying vertebral fracture in cases with thoracic trauma. Phnx Med J. 2023;5(1):42-45.
Received: 26.01.2023 **Accepted:** 21.02.2023

causes of thoracic trauma in emergency departments are motor vehicle accidents, falls from height, gunshot wounds, and stab wounds. Thoracic traumas are divided into two groups as blunt (70%) and penetrating (30%) traumas (3).

Extrathoracic organ injuries accompany high-energy traumas, which increases mortality and morbidity and leads to prolonged hospital stay (4). In the literature, there are studies similar to ours in which vertebral fractures accompanying thoracic traumas are examined (5,6). However, there are not enough studies examining the relationship between the trauma mechanism and vertebral fracture in thoracic traumas.

In this study, we aimed to investigate the effect of trauma mechanism on the frequency of accompanying vertebral fracture in thoracic traumas and to contribute to the literature.

MATERIAL AND METHOD

Our study started with the approval of local Ethics Committee. The data of 515 patients who applied to the emergency department due to thoracic trauma between 01.01.2017 and 01.01.2021 were reviewed retrospectively. Patients were evaluated based on age, gender, trauma mechanism, trauma-related thoracic pathologies, vertebral fractures, and presence of extrathoracic pathologies based on computed tomography (CT) findings.

Pneumothorax, hemothorax, parenchymal contusion and costal fractures were evaluated in the patients. According to thorax CT findings, it was classified as no pneumothorax:0, 20% ↓: 1, 20-40:2, 40% ↑:3. Hemothorax was classified as no:0, minimal:1, moderate:2, massive:3. No contusion was classified as 0 segmentary:1, lumbar:2, diffuse:3. The presence of costal fracture was recorded.

Concomitant vertebral fractures were recorded according to CT findings. Vertebral fractures were classified according to their localization as cervical, thoracic and lumbar. Vertebral fractures detected in the patients were categorized according to the trauma mechanism.

Statistical Analyses

The data of the two groups were compared with the Mann-Whitney U test. The relationship between two categorical variables was examined with Pearson's Chi-square test or Fisher's Exact test. Continuous data were summarized as median (25th-75th percentile) and categorical data as frequency and percentage. Statistical software SPSS version 23 (SPSS Inc. , Armonk , NY) was used for all analyses . Significance level was determined as $p < 0.05$.

RESULTS

72.4% (n: 373) of the patients included in the study were male and 27.5% (n:142) were female. The median age was calculated as 52 (37-65). 96.3% (n: 496) of the applications made to the emergency department were due to thoracic trauma caused by blunt trauma. Considering the distribution of trauma mechanisms, it was seen that the most common reasons for admission were in-vehicle traffic accidents (IVTA) (46.6%, n:240) and falls from a height (30.9%, n: 159) (Table 1).

The most common lung pathology developing due to thoracic trauma in patients was costal fracture (81.9%, n: 422) and the least common was pneumothorax (34.8%, n: 179). It was observed that pneumothorax was below 20% in 132 (25.6%) patients, between 20-40% in 38 (7.4%) patients, and over 40 % in 9 (1.7%) patients. Lung contusion was present in 55.1% (n: 284) of the patients, segmental contusion in 195 (37.9%) patients, lumbar contusion in 83 (16.1%) patients, and diffuse contusion in 6 (1.2%) patients. Hemothorax was seen in 40.2% (n: 207) of the patients, minimal in 171 (33.2%) patients, moderate in 35 (6.8%) patients, and massive in 1 (0.2%) patient (Table 2).

Conservative treatment was performed in 413 (80.2%) patients, tube thoracostomy in 98 (19%) patients, and

Table 1: General characteristic.

	median	25th, 75th percentile
Age, year	52	37 - 65
Gender	**n**	**%**
Male	373	72.4
Female	142	27.5
Trauma type		
Blunt	496	96.3
Penetrating	19	3.7
Trauma mechanism		
Falling from high	159	30.9
IVTA	240	46.6
NVTA	52	10.1
Motorcycle	18	3.5
Assault	19	3.7
Animal trauma	8	1.6
Gunshot wound	4	0.8
Stab wound	15	2.9

IVTA: In-vehicle traffic accident, NVTA: Non-vehicle traffic accident

Table 2: Pathologies of lung.

Pneumothorax	**n**	**%**
Present	179	34.8
<20%	132	25.6
20%-40%	38	7.4
>40%	9	1.7
Hemothorax		
Present	207	40.2
Minimal	171	33.2
Mederate	35	6.8
Massive	1	0.2
Contusion		
Present	284	55.1
segmental	195	37.9
Lumbar	83	16.1
Diffuse	6	1.2
Costal fracture		
Not Present	93	18.1
Present	422	81.9

emergency surgical intervention in 4 (0.2%) patients for injuries due to thoracic trauma (Table 3).

The incidence of extrathoracic injury with pulmonary pathology was found to be 50.5% (n: 260). Extremity fractures, intracranial hemorrhages, maxillofacial fractures, intra-abdominal injuries and pelvic fractures were found in the patients included in the study. A statistically significant difference was found between the accompanying extrathoracic injury and age, and the patients with extrathoracic injuries were younger (median age 48 (33-63 years)) age (p=0.003). There was no statistically significant difference between gender and extrathoracic injuries (p=0.796).

A statistically significant difference was found between extrathoracic injury and trauma mechanism. It was observed that trauma mechanism was accompanied by extrathoracic injury in 55.4% (n: 133) of the patients who applied due to an in-vehicle traffic accident, in 73.0% (n: 38) of the patients who applied due to non-vehicle traffic accident (NVTA), in 72.2% (n:13) of the patients who applied after a motorcycle accident, in 37.7% (n: 60) of the patients who applied due to falling from height, in 52.6% (n: 10) of the patients who applied due to assault (p<0.001) (Table 4).

Vertebral fracture was seen in 33.9% (n: 175) of patients with thoracic trauma. The median age was calculated as 56 (38-69) in patients with accompanying vertebral fracture (p=0.027). There was no statistically significant difference between gender and vertebral fracture. All of the patients with vertebral fracture were admitted after blunt trauma. A significant difference was found between the mechanism of trauma and accompanying vertebral fracture; simultaneous vertebral fracture was found in 53.8% (n: 28) of the patients who applied after a non-vehicle traffic accident and in 44.4% (n: 8) of the patients who applied due to a motorcycle accident (Table 5).

Vertebral fractures were seen with a frequency of 47.4% (n: 83) in the lumbar region, 36.5% (n: 64) in the thoracic region, and 16.0% (n: 28) in the cervical region.

Table 3: Thorax Treatment

Thorax Treatment	n	%
Conservative	413	80.2
Tube thoracostomy	98	19.0
Thoracotomy	4	0.8

Table 4: Extrathoracic pathology.

	Extrathoracic pathology		
	n	%	Z/χ 2 , p
Trauma mechanism			44.31, <0.001
Falling from high	60	37.7	
IVTA	133	55.4	
NVTA	38	73.0	
Motorcycle	13	72.2	
Assault	10	52.6	
Animal trauma	2	25.0	
Gunshot wound	3	75.0	
Stab wound	1	6.6	

IVTA: In-vehicle traffic accident, NVTA: Non-vehicle traffic accident

Table 5: Vertebral Fracture.

	Vertebral Fracture		
	n	%	Z/χ 2 , p
Trauma mechanism			19.91, 0.004
Falling from high	61	38.3	
IVTA	73	30.4	
NVTA	28	53.8	
Motorcycle	8	44.4	
Assault	5	26.3	
Animal trauma	0	0.0	
Gunshot wound	0	0.0	
Stab wound	0	0.0	

IVTA: In-vehicle traffic accident, NVTA: Non-vehicle traffic accident

DISCUSSION

In our study, we aimed to examine the effects of trauma mechanism on the incidence of vertebral fracture in patients evaluated for thoracic trauma in the emergency department. In general, the incidence of vertebral fracture in patients admitted to the emergency department due to blunt trauma is around 7% (7). Although the incidence of vertebral fracture is low in blunt traumas, vertebral fracture is more common in patients with thoracic pathology as a result of trauma. In our study, we found vertebral fracture in 33.9% (n:175) of patients with thoracic trauma. When we classified these patients according to the trauma mechanisms, we determined that the frequency of accompanying vertebral fracture was statistically significant in patients admitted due to non-vehicle traffic accident. We think that this epidemiological information is important in the approach of patients admitted to the emergency department due to high-energy trauma.

Studies have shown that the transition region from the thoracic vertebrae to the lumbar vertebrae is the region most prone to fracture development in patients exposed to blunt trauma. The kyphotic structure in the thoracic region returns to lordosis in the lumbar region, and the risk of injury in the angulation region increases with exposure to trauma. In addition, the support of the ribs to the vertebrae in the thoracic region reduces the rate of thoracic vertebral fractures (8,9). Lumbar vertebral fractures were seen more frequently in our study, and our results are consistent with the literature. However, in the study of Wang et al., thoracic vertebral fractures were observed more frequently in patients with thoracic trauma with first rib fracture (10). In blunt traumas, the rate of fracture development increases with age due to degenerative changes. Osteopenia, degenerative diseases of bone and soft tissue in the elderly population can be shown as causes that increase the rate of injury (11). While the age range where fractures are most common in the literature is 70-79, in our study, the median age was calculated as 56 in patients with accompanying

vertebral fractures, which is inconsistent with the literature. We believe that this age group is exposed to trauma more frequently due to being more active in business and social life, and for this reason, our study is not compatible with the literature. In the study of Wang et al., similar to our study, the majority of patients with accompanying vertebral fractures were patients under 60 years of age (2). In addition, studies have been conducted showing that the presence of aortic calcification in patients may be associated with vertebral and other bone fractures (12). In the light of this information, we think that a more detailed examination should be done in terms of vertebral fracture in elderly patients with osteopenia, degenerative bone pathology or aortic calcification who applied to the emergency department with blunt trauma. Diagnosis of thoracolumbar vertebral fracture is made by physical examination together with computerized tomography in emergency conditions. Although plain radiography gives findings related to fracture, the diagnostic accuracy is superior in CT (13). In cases where the diagnosis of vertebral fracture is delayed or undiagnosed, complications such as radiculopathy or spinal cord injury may develop in 19-50% (13). Therefore, we think that an earlier CT decision should be made in elderly patients presenting due to trauma.

Vertebral traumatic injuries often occur after motor vehicle accidents, falls from height, recreational injuries and work accidents (14). Motor vehicle accidents are the most common mechanism in adults with 36.70%, followed by falls from a height with 31.70% (7). In our study, 33.9% (n: 175) of the patients with thoracic trauma were accompanied by vertebral fracture. All of the patients with vertebral fracture had applied after blunt trauma. We detected vertebral fracture in 53.8% (n: 28) of the patients who applied after NVTA, 44.4% (n: 8) of the patients applied due to motorcycle accident, 38.3% (n: 61) of the patients who applied due to falling from a height, and 30.4% (n: 73) of the patients who applied after IVTA. The most common pathology in patients evaluated for thoracic trauma is rib fracture, and it should be considered as a sign of a serious injury and accompanying other organ injuries should be kept in mind (15).

CONCLUSION

The incidence of vertebral fracture increases significantly in thoracic injuries, which are frequently seen as a result of blunt trauma. The frequency of accompanying vertebral fracture should be considered in patients with thoracic trauma who apply to the emergency department due to motor vehicle accidents and falls from a height. We believe that the evaluation of patients with thoracic trauma by the emergency department physicians by keeping this information in mind will guide to early diagnosis and prevent serious complications such as spinal cord injury.

Conflict of Interest: No conflict of interest was declared by the authors.
Ethics: Approved by Abant İzzet Baysal University Medical Ethics Review Committee of dated 25.05.2021 and numbered 2021/124.).
Funding: There is no financial support of any person or institution in this research.
Approval of final manuscript: All authors.

KAYNAKLAR

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