

Age differences in blunt chest trauma: a cross-sectional study

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Abstract

Introduction: Trauma is the most common cause of presentation to hospital emergency services. After extremity and cranial injuries, blunt thoracic trauma is the third most common injury.

Aim: In this study, we aimed to present and assess blunt chest trauma in adults aged below 65 and elderly (age ≥ 65).

Material and methods: In this study, 130 patients (86 young (age 18–64) and 44 elderly (age ≥ 65)) who applied to the emergency department with blunt thoracic trauma between October 2017 and October 2019 were evaluated retrospectively.

Results: Of the patients, 99 (76.1%) were male, and 31 (23.9%) were female. The mean age was 54.41 ± 20.13 years, and the patients were between 18 and 95 years of age. The most common cause of blunt thoracic trauma in the elderly group was a fall ($n = 27$; 61.3%), while in-vehicle traffic accident was most common in the young group ($n = 43$; 50%). “Flail chest,” which is observed as a complication after multiple rib fractures, was present in 1 patient in the young group and in 10 patients in the elderly group; the difference was statistically significant ($p > 0.05$). Seven (5.3%) patients died. The mean hospital stay was 5.1 (1–60) days, which was borderline-significantly higher in the elderly group ($p = 0.056$).

Conclusions: Due to its life-threatening properties, the detection of blunt thorax trauma is a priority among multiple-trauma patients. For this reason, an aggressive diagnosis and treatment approach is essential in the whole patient group, especially among the elderly.

Key words: thorax, aged, age factors, flail chest, rib fractures.

Introduction

Blunt chest trauma is the most common thoracic disease that requires consultation from the emergency department and constitutes 70% of all thoracic injuries [1, 2]. The most common mechanisms of blunt trauma are traffic accidents, falls, and the impact of heavy objects [3]. Blunt thoracic traumas are the third most common injury after

Streszczenie

Wprowadzenie: Urazy są najczęstszą przyczyną zgłoszeń do szpitalnych oddziałów ratunkowych. Po urazach kończyn i czaszki trzecim co do częstości występowania rodzajem urazu jest tępy uraz klatki piersiowej.

Cel pracy: W badaniu przeanalizowano i opisano występowanie urazów klatki piersiowej u osób dorosłych w wieku poniżej 65 lat oraz u osób w podeszłym wieku (≥ 65 lat).

Materiał i metody: Przeprowadzono retrospektywną ocenę 130 pacjentów (86 osób w wieku 18–64 lat i 44 osób w wieku ≥ 65 lat), którzy zgłosili się na oddział ratunkowy z tępym urazem klatki piersiowej od października 2017 do października 2019 r.

Wyniki: Analizowana grupa obejmowała 99 (76,1%) mężczyzn i 31 (23,9%) kobiet. Średni wiek pacjentów wynosił $54,41 \pm 20,13$ roku (przedział wiekowy 18–95 lat). Najczęstszą przyczyną tępego urazu klatki piersiowej u osób w podeszłym wieku był upadek ($n = 27$; 61,3%), a w grupie młodszej wypadek drogowy ($n = 43$; 50%). Wiotka klatka piersiowa, która stanowi powikłanie mnogiego złamania żeber, wystąpiła u jednego pacjenta w młodszym wieku i u 10 pacjentów w podeszłym wieku; różnica była istotna statystycznie ($p > 0,05$). Zmarło 7 (5,3%) pacjentów. Średni czas hospitalizacji wynosił 5,1 dnia (w przedziale 1–60 dni) i był dłuższy u osób starszych. Wartość różnicy była na granicy istotności statystycznej ($p = 0,056$).

Wnioski: Ze względu na zagrożenie dla życia wykrywanie tępych urazów klatki piersiowej stanowi priorytet u osób z urazami wielonarządowymi. Oznacza to, że w całej tej grupie pacjentów, zwłaszcza u osób w podeszłym wieku, konieczne jest zdecydowane podejście diagnostyczno-terapeutyczne.

Słowa kluczowe: klatka piersiowa, wiek, czynniki związane z wiekiem, wiotka klatka piersiowa, złamania żeber.

head and extremity injuries [4] and are directly responsible for 25% of all trauma-related deaths [5]. Thoracic trauma is responsible for 35% of trauma-associated deaths in the United States; it includes a wide range of injuries that can cause significant morbidity and mortality [6]. The mortality rate of blunt chest trauma is higher than penetrating ones [7]. Factors found to be associated with a high risk of

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morbidity and mortality were advanced age, pre-existing lung disease, the number of upper rib fractures, and flail chest [8]. Rib fractures are the most common complication in elderly patients with blunt chest trauma, and each fractured rib increases the probability of mortality by 19% and pneumonia by 27% [9, 10]. Increased age is an independent risk factor for bad news after traumatic injury. Elderly patients (defined as 65 years and older) have four times higher morbidity and mortality compared to younger patients matched with the same severity score, especially after thoracic and head trauma [11–13].

Aim

This study aimed to compare injury mechanisms, complications, length of hospital stay, morbidity, and mortality rates of young and elderly patients admitted to the emergency department with blunt chest trauma.

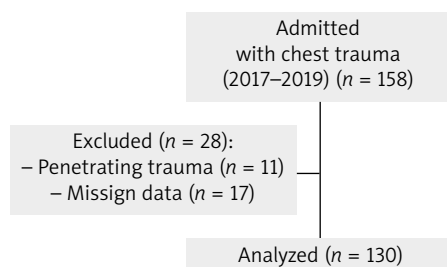


Figure 1. Study flow diagram

Table I. Chest Wall Injury Scale Scoring

| Score | Description |
|-------|---|
| I | Any size contusion, skin/subcutaneous laceration, 3 rib fractures |
| II | Skin/subcutaneous and muscle laceration, ≥ 3 adjacent closed rib fractures, nondisplaced sternum fracture, open or displaced clavicle, scapular fracture |
| III | Full-thickness laceration including pleura, open/displaced/flail sternum, unilateral flail segment of ≤ 3 ribs |
| IV | Avulsion of chest wall tissues with underlying rib fractures or unilateral flail segment of ≥ 3 ribs |
| V | Bilateral flail chest |

Table II. Distributions of mechanism of injury between age groups

| Injury mechanism | Age group | | | | Total | |
|-------------------------|-----------|-------|-----------|-------|-------|-------|
| | < 65 | | ≥ 65 | | n | % |
| | n | % | n | % | n | % |
| In-car traffic accident | 43 | 50.0 | 9 | 20.5 | 52 | 40.0 |
| Fall | 19 | 22.1 | 27 | 61.4 | 46 | 35.4 |
| Motorbike accident | 11 | 12.8 | 2 | 4.5 | 13 | 10.0 |
| Pedestrian | 6 | 7.0 | 2 | 4.5 | 8 | 6.2 |
| Animal-related accident | 3 | 3.5 | 3 | 6.8 | 6 | 4.6 |
| Assault | 4 | 4.7 | 1 | 2.3 | 5 | 3.8 |
| Total | 86 | 100.0 | 44 | 100.0 | 130 | 100.0 |

$\chi^2 = 22.424$; $p < 0.001$.

Material and methods

The study was conducted between October 2017 and October 2019 at Çanakkale Onsekiz Mart University (ÇOMU) Faculty of Medicine. Ethical approval was obtained from the Çanakkale Onsekiz Mart University local ethics committee (IRB Number: 2019-19, Date: 27.11.2019).

The records of 130 patients admitted to the emergency service due to thoracic trauma between October 2017 and October 2019 were reviewed. Seventeen patients with some missing data in the medical records and 11 patients admitted with penetrating chest trauma were excluded from the study (Figure 1).

The World Health Organization (WHO) defines people aged between 18 and 65 years as “young” and those aged 65 years and over as “elderly” [14]. Demographic data of the patients (age and sex), mechanism and type of injury (in-car traffic accident, fall, motorbike accident, pedestrian, animal-related accidents, and assault), bone and intrathoracic pathologies, comorbidity (vertebra, pelvis, extremity, thorax injury, and multiple injuries), hospitalization rates, duration of the treatment, and mortality rates were investigated. Various variables have been reviewed to identify patients at risk for blunt chest trauma and to predict trauma-related deaths.

Chest Wall Injury Scale score (CWIS) [15] results were collected from patients. The Chest Wall Injury Scale score uses the number and location of fractures, flail chest, along with laceration or soft-tissue avulsions, to generate a grade from I to V, with worse injuries carrying higher numbers (Table I).

All patients underwent conventional chest radiography, and computerized thorax tomography, as suggested [16, 17], and complete blood counts were analyzed.

Statistical analysis

Data were analyzed using SPSS version 25.0 software (SPSS Inc, Chicago, IL, IBM since version 19.0, USA). The results were presented as frequencies, percentages, means, standard deviations (SD), median, and range. The Kolmogorov-Smirnov test was performed to test whether the variables were normally distributed. The Mann-Whitney *U* test was used to compare numerical variables, and the χ^2 -square test was used for categorical variables. A *p*-value of < 0.05 was considered statistically significant.

Results

A total of 130 patients were included in the study, of whom 99 (76.1%) were male, and 31 (23.9) were female. The mean age was 54.12 ± 20.70 years (range: 18–95). While 86 of the patients were between 18 and 65 years old, 44 were 65 and above. In-car traffic accidents were the most common cause of blunt thorax trauma ($n = 52$; 40%). Concerning the age groups, the most common cause of the injury in the elderly group was a fall ($n = 27$; 61.3%), while in the young-age group in-vehicle traffic accidents were most common ($n = 43$; 50%); the difference in the injury type was statistically significant ($p < 0.001$) (Table II).

Table III. Distributions of types of injuries between groups

| Parameter | | Age groups | | | | χ^2 | P-value |
|-------------------|---------|------------|------|------------|------|----------|---------|
| | | < 65 years | | ≥ 65 years | | | |
| | | n | % | n | % | | |
| Extremity injury | Present | 25 | 29.1 | 14 | 31.8 | 0.105 | 0.746 |
| | Absent | 61 | 70.9 | 30 | 68.2 | | |
| Vertebra fracture | Present | 20 | 23.3 | 14 | 31.8 | 1.105 | 0.293 |
| | Absent | 66 | 76.7 | 30 | 68.2 | | |
| Rib fracture | Present | 42 | 48.8 | 26 | 59.1 | 1.227 | 0.268 |
| | Absent | 44 | 51.2 | 18 | 40.9 | | |
| Pneumothorax | Present | 11 | 12.8 | 8 | 18.2 | 0.678 | 0.410 |
| | Absent | 75 | 87.2 | 36 | 81.8 | | |
| Hemothorax | Present | 5 | 5.8 | 6 | 13.6 | 2.300* | 0.129 |
| | Absent | 81 | 94.2 | 38 | 86.4 | | |
| Hemopneumothorax | Present | 6 | 7.1 | 10 | 23.3 | 6.849 | 0.009 |
| | Absent | 80 | 92.9 | 33 | 76.7 | | |
| Flail chest | Present | 1 | 1.2 | 10 | 22.7 | 17.476* | < 0.001 |
| | Absent | 85 | 98.8 | 34 | 77.3 | | |
| Pneumomediastinum | Present | 3 | 5.8 | 2 | 8.3 | 0.176* | 0.675 |
| | Absent | 83 | 96.5 | 42 | 91.7 | | |

*Fisher's exact test.

Outpatient follow-up was recommended to patients with uncomplicated single or double rib fractures, who could accomplish their daily activities. Of the patients who underwent chest surgery at the emergency ward, 102 (78.4%) were hospitalized (young age: $n = 67$, elderly: $n = 35$), while outpatient follow-up was recommended to 28 (21.6%) patients; there was no difference concerning the age groups ($\chi^2 = 0.046$; 0.830).

The Chest Wall Injury Scale scores of both groups were evaluated. In the elderly group (median: 3.0, range: 1–5), significantly higher scores were observed compared to the younger age group (median: 2.0, range: 1–3) ($Z = 2.317$, $p = 0.02$). In both groups, the most common thoracic injuries were rib fractures (68 patients, 52%) (young-age: $n = 42$, elderly: $n = 26$) (Table III).

Flail chest, a complication of multiple rib fractures, was observed in one patient of the young- age and 10 of the elderly group; the difference was statistically significant ($\chi^2 = 17.476$; $p < 0.001$). Also, hemopneumothorax was more common among the elderly ($\chi^2 = 6.849$, $p = 0.009$) (Table III).

Vertebral fracture was observed in 34 (26%) patients (elderly: $n = 14$, young-age: $n = 25$). There was no statistically significant difference between the age groups concerning vertebral fractures. Thirty-nine (30%) patients had simultaneous limb injuries (elderly: $n = 25$, young-age: $n = 14$). Forty (30.8%) patients (27 in the young-age and 13 in the elderly group) underwent tube thoracostomy and use of the closed underwater drainage system. Medical therapy and respiratory physiotherapy were sufficient in the remaining 90 patients. They were advised on deep breathing, the three-ball spirometer, coughing, mobilization and sleeping in the supine position at 45–60°.

Patients underwent regular treatment for 1 month (69.2%). The median length of hospitalization was 4.0 (0–60)

days. In the elderly group (median: 5.0, range: 0–60 days), significantly longer hospitalization days were observed compared to the younger age group (median: 3.0, range: 0–32 days) ($Z = 2.018$, $p = 0.044$). Mortality was observed in 7 (5.4%) patients. In the emergency unit four cases of flail chest injury were managed by endotracheal intubation and intermittent positive-pressure ventilation. These four intubated patients died in the intensive care unit due to ventilation-perfusion incompatibility due to respiratory circulation disorder. The other three patients died due to hemodynamic shock. There was no statistically significant difference between the age groups regarding mortality ($\chi^2 = 0.268$, $p = 0.604$). The mortality rates between males ($n = 4$, 4.0%) and females ($n = 3$, 9.7%) were not significantly different ($\chi^2 = 1.472$, $p = 0.225$).

Discussion

Because of their life-threatening characteristics, the detection of thoracic trauma is considered a priority among patients with multiple injuries [18]. Blunt thoracic trauma mostly affects young people and is mainly seen as a result of traffic accidents [19, 20]. On the other hand, elderly patients exposed to blunt thoracic trauma carry a substantial risk of pneumonia, respiratory failure, and multiple organ failure. In this high-risk group, aggressive regional pain control is seen as a useful approach [21]. More than 50% of blunt chest traumas generally occur after fatal accidents, and the majority of these accidents are motor vehicle accidents (63% to 78%). There are followed by instances such as falling from a height, being hit by a blunt object and/or being blown up by explosives (10–17%) [22].

In our study, 52 (40%) patients had a history of in-vehicle traffic accidents, which was higher in the younger group, and the difference was statistically significant when com-

pared to the elderly group ($p < 0.05$). Falling from a height was the cause of 46 (35.3%) injuries; it was significantly more often caused by blunt thoracic trauma in the elderly group, and there was a statistically significant difference ($p < 0.05$). In the area where our hospital was located, people mostly made their living with agricultural activities. Thus, falls from height generally happen while collecting products from trees. This may be an explanation of why falls from height are more frequent, especially among the elderly. While 102 (78.4%) patients were hospitalized, outpatient follow-up was recommended to 28 (21.6%) patients. On the other hand, 67 (77.9%) of our young patients were hospitalized, compared to 35 (79.5%) from the elderly patients. No statistically significant difference was observed between the two groups ($p > 0.05$). The mean length of hospitalization was 5.1 days, and the duration of hospitalization was longer in the elderly group ($p = 0.044$). This may be explained by the higher morbidity rate in elderly patients.

Rib fractures are expected after 39% of blunt chest traumas and seen in 10% of all trauma admissions [23]. The morbidity rate of isolated chest trauma, especially in the elderly, has been reported as between 16% and 33% [9, 24]. In our study, 68 (52.3%) patients had rib fractures at admission. Thoracic injuries that cause flail chest cause severe pain, dyspnea, and respiratory dysfunction. Mortality and thoracic morbidity rates are two times higher in elderly patients with blunt chest trauma and rib fractures compared to younger patients with similar injuries [9].

Anatomically, a flail chest is the unilateral multiple rib fracture of 4 consecutive ribs. On the other hand, clinically, a flail chest is diagnosed if the incompetent segment of the chest wall is large enough to form paradoxical movements with respiration [23]. Flail chest is the most serious consequence of blunt thoracic trauma [25]. Comparing the age groups, flail chests seen after multiple rib fractures were present in 10 elderly patients and only 1 young patient. Flail chest was significantly more frequent in the elderly group compared to the younger patients ($p < 0.05$). Studies have reported the rate of vertebral fractures accompanied by thoracic injury as 45% [26]. In our research, coexisting vertebral fractures were observed in 34 (26%) patients. Thoracic injuries accompanied by thoracic vertebra fractures and/or thoracic vertebra surgery should be evaluated and followed up by the thoracic surgery and neurosurgery clinics in a multidisciplinary approach.

The mortality rate in blunt thoracic trauma varies between 4% and 20% [27]. Mortality was observed in 7 (5.3%) of our patients. There was no statistically significant difference in the mortality rate between the elderly and young-age patients ($p > 0.05$). CWIS scores was observed to be quite high in these patients.

Conclusions

Because of their life-threatening characteristics, thoracic trauma should be considered as a priority among patients with multiple injuries. Clinicians should exclude chest injury in the evaluation of blunt trauma. Close follow-up,

aggressive treatment, and comprehensive care are needed, especially in the elderly patient group, due to underlying comorbidities and reduced physiological reserve.

Disclosure

The authors report no conflict of interest.

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