ORIGINAL ARTICLE

The relationship between the presence of scapula fracture and mortality and morbidity in cases with blunt thoracic trauma

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ABSTRACT

BACKGROUND: Scapula fractures (SFs) occur as a result of high-energy trauma and are significant in terms of life-threatening injuries. There are few studies showing the relationship between SFs and mortality and morbidity in patients with blunt thoracic trauma (BTT). Our study aims to investigate the relationship between SF and mortality and morbidity in BTT.

METHODS: Adult patients admitted to the emergency department of Kahramanmaras Sutcu Imam University, School of Medicine with BTT between January 2019 and April 2021 were retrospectively scanned from hospital records. Patients' age, gender, trauma mechanism, additional organ injuries, need for intensive care, length of hospital stay, morbidity, and mortality rates were recorded. Statistical results were expressed as frequency, percentage, and mean±standard deviation (min–max). In comparisons between groups, $p<0.05$ was accepted as the significance level.

RESULTS: Two hundred and thirty-eight cases were included in our study. The scapular fracture was present in 86 cases (36.1%). About 43% of the cases with SFs were falling from a height. Intrathoracic injuries accompanying SF were determined as rib fracture, lung contusion, pneumothorax, hemothorax, and sternum fracture, respectively (91.9%, 80.2%, 41.9%, 37.2%, and 15.1%). Extrathoracic injuries associated with SF were vertebral fractures, intracranial injuries, clavicle fractures, extremity fractures, and intra-abdominal injuries (18.6%, 16.3%, 12.8%, 10.5%, and 5.8%), respectively. When the groups with and without SF were compared, a statistically significant relationship was found between SF and the number of rib fractures, lung contusion, pneumothorax, and hemothorax ($p<0.001$, $p=0.001$, $p=0.001$, $p=0.001$). In extrathoracic injuries, there was a significant relationship between SFs and vertebral fractures, intracranial injuries, and clavicle fractures ($p=0.004$, $p<0.001$, $p=0.005$). There was no difference observed between the groups regarding sternum fractures, extremity fractures, and intra-abdominal organ injuries ($p=0.288$, $p=0.682$, $p=0.261$). In cases with accompanying SF, there was a significant difference in terms of length of hospital stay, need for intensive care, and mortality ($p<0.001$, $p=0.001$, $p=0.002$).

CONCLUSION: The most common intrathoracic injuries accompanying SFs were rib fractures and lung contusion, and the most common extrathoracic injuries were vertebral fractures and intracranial injuries. Moreover, it was found that SF was highly correlated with length of hospital stay, need for intensive care, and mortality. The most common cause of mortality was found to be intracranial hemorrhage. Imaging of other systems is important in cases with SFs. Particular attention should be paid to head-and-neck injuries.

Keywords: Blunt chest trauma; prognostic factor; scapula fracture.

INTRODUCTION

Scapula fractures (SFs) account for 3–5% of all fractures. Anatomically, the scapula is strongly protected by the muscles that provide movement. Therefore, SF typically results from a high-energy blunt trauma mechanism.[1–3] Motor vehicle accidents are the cause of 50% of SFs.[4,5]

Cite this article as: Kozanlı F, Güler Ö. The relationship between the presence of scapula fracture and mortality and morbidity in cases with blunt thoracic trauma. Ulus Travma Acil Cerrahi Derg 2023;29:218-223.

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Ulus Travma Acil Cerrahi Derg 2023;29(2):218-223 DOI: 10.14744/tjtes.2022.02362 Submitted: 20.10.2021 Revised: 17.01.2022 Accepted: 17.02.2022

Scapular fractures are 80–95% associated with additional chest trauma such as pneumothorax and pulmonary contusion. At the same time, intra-abdominal organ injuries, brain injuries, and pelvic fractures may accompany SF.[6] Mortality rates reaching approximately 15% have been reported in traumas accompanied bySFs.[4,7] Therefore, the patient with SF should be evaluated as a multi-trauma patient.[8]

Plain radiographic diagnosis of SFs is very difficult. Anteroposterior chest and shoulder roentgenograms should be taken in cases with suspected SF. However, the skin folds covering the scapula or the pleural line of the pneumothorax can be seen on the X-ray, which may cause an error in interpretation.[9] Computed tomography is the gold standard imaging method in the diagnosis of SF.[2]

There are many studies in the literature examining SFs. Most of the studies in the literature include anatomical localization, fracture typing, associated injuries, operative and non-operative treatment methods, and surgical complications of SF. (denis ramponi, peter, and pramod). However, the number of studies revealing the relationship between SFs accompanying blunt thoracic trauma (BTT), its morbidity, and mortality is limited.

This study aims to investigate the demographic characteristics, trauma mechanisms, additional organ injuries, need for intensive care, length of hospital stay, the relationship between the presence of SF and morbidity, and mortality in patients with both BTT and SF applied to our hospital.

MATERIALS AND METHODS

Patient Selection

Our study was carried out in accordance with the Declaration of Helsinki, and approved by the institutional ethics committee (ethics committee decision no: 10/08/2021/05). The files of cases over the age of 18 who applied to KahramanmarasSutcu Imam University, School of Medicine between January 2019 and April 2021 were retrospectively analyzed. Only cases with BTT were included in the study. Patients' age, gender, trauma mechanism (traffic accident, falling from a height, animal smashing, falling under dent, beating, agricultural accidents, etc.), additional organ injuries, and the need for intensive care were determined. Length of hospital stay, morbidity, and mortality rates of the patients were recorded.

Cases with penetrating thoracic trauma, cases under the age of 18, cases without any injury related to BTT, cases with minor chest trauma due to BTT, and not requiring hospitalization were excluded from the study. Patients with injuries due to BTT were divided into two groups: Those with SF (Group 1) and those without SF (Group 2). Detailed information about the cases was obtained from the electronic database of the hospital.

Statistical Analysis

Statistical program for social sciences 20 was used for statistical analysis. Numerical data were given as mean±standard deviation (min–max), frequency, and percentage. The Chi-square test was used for categorical data in comparisons between groups. The normality of the data was evaluated by the Shapiro–Wilk test. For comparisons between groups, The t-test was used for normally distributed data, and the Mann–Whitney U test was used for data not normally distributed.

RESULTS

A total of 238 cases, 163 male (68.5%) and 75 female (31.5%), who were brought to our emergency department due to BTT, were included in our study. The mean age of our cases was 55.27±18.65 (20–100) years. The scapular fracture was present in 86 (36.13%) of 238 patients who were injured due to BTT. The mean age was 57.7±17.3 (20–100) years in Group 1 and 53.97±19.27 (20–91) years in Group 2, and there was no statistically significant difference regarding age (p=0.153). The mechanism of trauma was falling from a height in 37 (43%) of 86 cases in Group 1 and 73 (48%) of 152 cases in Group 2.

Table 1. Trauma mechanisms of blunt thoracic trauma

Trauma mechanism	Group 1		Group 2		Total	
	n	%	n	%	n	%
Falling from height	37	43	73	48	110	46.2
In-vehicle traffical accident	31	36	56	36.8	87	36.5
Out of vehicle traffical accident	5	5.8	6	4	11	4.6
Motorcycle accident	5	5.8	2	1.3	7	3
Animal bump	1	1.3	6	4	7	3
Other*	7	8.1	9	5.9	16	6.7
Total	86	100	152	100	238	100

*Stay in a dent, work accident, tractor accident.

Trauma mechanisms of Group 1 and Group 2 were given in Table 1.

There was at least one rib fracture in 202 patients (84.8%). One or more rib fractures were detected in 79 (91.9%) of 86 cases in Group 1. In Group 2, 123 (80.9%) of the cases had at least one rib fracture. The mean number of rib fractures in Group 1 was 4.8±2.78 (0–14), while the mean number of rib fractures in Group 2 was 2.45±1.90 (0–10). There was a statistically significant relationship between the number of rib fractures and SF (p<0.001). Injuries to intrathoracic structures in Group 1 and Group 2 were given in Table 2, injuries to extrathoracic structures were given in Table 3. The pelvic fracture was observed in only five of the cases with SF. Statistical analysis could not be performed because this group was too small to form a sample.

The mean hospital stay was 7.51±6.18 (0–20) days in Group 1 and 3.34±2.98 (0–30) days in Group 2. It was observed that SF accompanying BTTs had a statistically significant relationship with the increasing length of hospital stay (p<0.001). Intensive care was required in 41 (47.7%) of 86 patients in Group 1 and 23 (35.9%) of 152 patients in Group 2. Criteria for intensive care unit observation were GCS < 14, need for intubation, hemodynamic instability, underwent major thoracic surgery, and, cases operated jointly by multiple trauma units. There was a statistically significant difference between the presence of SF and the need for intensive care in BBT (p<0.001).

Mortality occurred in 8 cases (3.3%) due to extrathoracic organ injuries. Seven (8.1%) of the cases in Group 1 and one (0.7%) of the cases in Group 2 died. It was observed that there was a statistically significant relationship between mortality and SF (p=0.002). Five (2.1%) of the deaths were due to intracranial reasons, 1 (0.4%) due to disseminated intravascular coagulation caused by pre-operative massive blood transfusion, 1 (0.4%) due to sepsis, and 1 (0.4%) due to massive pulmonary thromboembolism.

DISCUSSION

SFs are rare injuries.[2,10] According to the literature, half of SFs occur as a result of motor vehicle accidents.[4,11] In our study, the most common trauma mechanism causing SF was falling from a height, and the second most common form of trauma was an in-vehicle traffic accident. Due to the rapid development of the building sector and agricultural labor with high trees in our region, we relate the fact that the trauma mechanism most frequently found in SFs differs from the literature to accidents that occur in the form of falling from trees and construction.

Blunt chest trauma is most common in males and between the 2nd and 5th decades.[12] In our study, although the majority of the patients were male, it was seen that injuries occurred most frequently in the 6th decade, unlike the literature. The male population in the 5th decade and above living in our region is engaged in agriculture, which is the traditional source of livelihood. In our study, most of the injuries in this age group were caused by falls from trees.

Table 2. Intrathoracic injuries in blunt thoracic trauma

Intrathoracic injuries	Group 1		Group 2		Total		p-value
	n	%	n	%	n	%	
Rib fracture	79	91.9	123	80.9	202	84.8	<0.001
Pulmonary contusion	69	80.2	47	30.9	116	48.7	<0.001
Pneumothorax	36	41.9	41	27	77	32.3	<0.001
Hemothorax	32	37.2	20	13.2	52	21.8	<0.001
Sternum fracture	13	15.1	32	21.1	45	18.9	=0.261

Table 3. Extrathoracic injuries in blunt thoracic trauma

Extrathoracic injuries	Group 1		Group 2		Total		p-value
	n	%	n	%	n	%	
Vertebral fracture	16	18.6	10	6.6	26	10.9	=0.004
Intracranial injury	14	16.3	5	3.3	19	8	<0.001
Clavicula fracture	11	12.8	5	3.3	16	6.7	=0.005
Extremity fracture	9	10.5	10	6.6	19	7.9	=0.288
Intraabdominal injury	5	5.8	7	4.6	12	5	=0.682

Rib fractures were the most common intrathoracic injury in BTT in our study, which was similar to the literature. One or more rib fractures were detected in 79 (91.9%) of 86 patients with SF. The number of rib fractures was also statistically significantly increased in patients with SF. The rate of our cases with rib fractures was considerably higher than in the literature. In the previous studies, rib fractures were also found to be associated with SF.[6,13,14] To the best of our knowledge, no similar study was found that revealed a statistically significant correlation between the increased number of rib fractures and SF. We think that these significantly higher rates of rib fractures are due to the difference in both the trauma mechanism and the average age. We believe that the increase in the number of rib fractures, particularly in advanced decades, may also be related to age-related osteoporotic changes.

In many sources, additional injuries accompanying SF have been studied collectively as pneumothorax, pulmonary contusion, closed head trauma, and spleen/liver lacerations.[1,4,7,15] In the study of Zyskowski et al.,[6] which included 21 cases, thoracic and extrathoracic injuries accompanying SF were classified, and the rate of lung contusion associated with SF was found to be 19%, and pneumothorax cases were 14.28%. In the study of Veysi et al.,[16] it was reported that 28% of the cases had a pneumothorax, and 15.2% had lung contusion. In our series consisting of 238 cases, 69 (80.2%) of 86 cases with SF developed lung contusion, and 36 (41.8%) developed pneumothorax. A statistically significant correlation was found between pneumothorax and lung contusion and SF. Our findings were not compatible with the literature in this respect.[7,13] Our study suggests that the significantly higher rate of lung contusion and pneumothorax development in patients with SF is due to our increased rib fractures. Moreover, the current studies in this area have been conducted with fewer cases, and the characteristics of the devices used in imaging are unknown. Since the imaging devices used in our hospital have advanced technical features and have the opportunity to take sections from 3D, reconstruction, and multiple windows, we may have detected injuries that were not noticed in the previous studies. Hemothorax developed in 32 (37.2%) of 86 patients with BTT in whom SF was detected. We found a statistically significant relationship between SF and the development of hemothorax. In the present literature, we did not find any grouping and statistical studies regarding hemothorax. The sternal fracture was detected in 13 (15.1%) of our cases with SF, and no statistically significant relationship was found between SF and sternal fracture (p=0.261). In the study of Zyskowski et al.,[6] the rate of sternum fracture in patients with SF was found to be 4.8%. Our findings were consistent with the literature.

The most common extrathoracic organ injuries accompanying cases with SFs were vertebral fractures at various levels. A statistically significant relationship was found between SF and vertebral fracture. In this respect, we obtained quite different results from the literature.[7,16] When categorizing the vertebral fractures, we found that cervical vertebra injuries are at a negligible level. Furthermore, the rate of intracranial injury in cases with SF was statistically significantly higher than those without SF. For this reason, we think that it would be useful to perform imaging of the relevant region in terms of cranial and cervical injuries in cases with SF.

The significant relationship between clavicle fractures and SF in our study was consistent with the literature.[16] It is not surprising that clavicle fractures frequently accompany SF. The force and site of action required for fracture of the scapula are similar to those required for fracture of the clavicle. We could not detect a significant relationship between SF and extremity fractures and intra-abdominal organ injuries. There are studies in the literature that show significantly varied results in this regard.[1,6,16–18]

Interestingly, the only finding in our study that did not overlap with the literature was the absence of brachial plexus and vascular injury in any of our cases.[7,13,16] Our region is a geographically scattered rural settlement. We think that as the severity of the trauma increases, neurovascular injuries may occur, and severely injured cases die before reaching our hospital due to geographical difficulties.

A recent study examined whether SF was a marker for increased mortality, length of hospital stay, and admission to the intensive care unit. The study showed that SFs were not associated with these outcomes, and it was reported that there was no difference between the group with SF and the group without SF in terms of total hospital stay (17.4 days, 20.8 days, respectively, p=0.69).[16] In our study, a significant difference was found between the groups with and without SF in terms of length of stay in the hospital. The length of hospital stay was longer in the group with SF (7.51±6.18 days in Group 1 and 3.34±2.98 days in Group 2, p<0.001). In terms of the total length of stay, it was determined that our hospital stay was shorter than the current studies. In addition, it was determined that patients with SFs had higher rates of hospitalization in the intensive care unit.[16,17] Since the criteria for admission to the intensive care unit were not clearly stated in the previous studies, a comparison cannot be made in this respect. We think that the high rates of hospitalization and need for the intensive care unit are associated with the increased morbidity due to our high rates of broken ribs, hemothorax, pneumothorax, and lung contusion, which increased significantly with SF.

In other studies mortality rates of up to 15% have been reported in traumas accompanied by SFs. Our mortality rates were quite low compared to the literature (8.1%). Contrary to the literature, it was observed that there was a statistically significant relationship between mortality and SF in our study (p=0.002).[4,7,16–18] The highest rate of deaths occurred due to intracranial hemorrhage in the early period. One of the findings of our study was that SF most frequently accompanies intracranial hemorrhages as extrathoracic organ injury. We did

not have any mortality directly related to the thoracic injury. There are very few up-to-date studies with large case series in the literature on SFs. Because of these factors, comparing our findings to the literature is difficult. There is no clear consensus in current studies regarding the relationship between SFs and mortality and morbidity of traumas.

Mortality rates directly related to SF are low and accompanying organ injuries are the main causes of trauma-related deaths. Although our hospital stay was short, we think that our lower mortality rate is associated with more intensive care unit admission rate. With the wide spread use of tomography, the diagnosis of SF has become easier. Cases with additional organ injuries may appear stable in the 1st h of trauma due to the activation of the compensatory mechanisms. Minimal additional organ injuries and hemorrhages may be overlooked in the first imaging or clinically insignificant injuries on initial imaging may progress to a level that requires surgery. Changes in hemodynamic parameters and consciousness levels of patients hospitalized in the intensive care unit are followed more closely. Deterioration of hemodynamic stability is noticed much earlier in intensive care units and allows necessary vital interventions. In the light of the findings of our study, we think that SF should be a marker for admission to the intensive care unit.

Conclusion

SFs occur as a result of high-energy trauma mechanisms. They mostly accompany the thoracic wall and intrathoracic organ injuries. Other organ injuries that may accompany the SF are the main cause of trauma-related mortality rather than the direct fracture itself.

Our study revealed that SFs often accompanied rib fractures and lung contusions as intrathoracic organ injuries. Moreover, unlike other literature studies, SF was found to be highly associated with hemothorax, long hospital stay, increased need for intensive care, mortality, and morbidity in our study. It has been determined that the most common extrathoracic organ injury was vertebral fractures at various levels. Intracranial hemorrhages were the most common cause of mortality in our study.

In every case with SF, examination and imaging of other systems should be performed meticulously. Particular attention should be paid to head-and-neck injuries. If there is doubt in the anamnesis and physical examination, the diagnosis should be made with appropriate imaging methods, and the cases with SF should be followed up in the intensive care unit as much as possible.

Ethics Committee Approval: This study was approved by the Kahramanmaraş Sütçü İmam University Non-interventional Clinical Research Ethics Committee (Date: 10.08.2021, Decision No: 05).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: F.K.; Design: F.K.; Supervision: F.K.; Resource: F.K.; Materials: Ö.G.; Data: F.K.; Analysis: F.K.; Literature search: Ö.G.; Writing: F.K.; Critical revision: F.K.

Conflict of Interest: None declared.

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

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ORİJİNAL ÇALIŞMA - *ÖZ*

Künt toraks travmalı olgularda skapula kırığı varlığının mortalite ve morbidite ile ilişkisi

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AMAÇ: Skapula kırıkları yüksek enerjili travmalar sonucunda meydana gelir ve hayatı tehdit eden yaralanmalara eşlik etmesi bakımından önemlidir. Künt toraks travmalı hastalarda skapula kırığının mortalite ve morbidite ile ilişkisini ortaya koyan az sayıda çalışma bulunmaktadır. Çalışmamızın amacı künt toraks travmasında skapula kırığının mortalite ve morbidite ile ilişkisini araştırmaktır.

GEREÇ VE YÖNTEM: Kahramanmaraş Sütçü İmam Üniveristesi Hastanesi Acil Servis'ine Ocak 2019–Nisan 2021 tarihleri arasında künt toraks travması ile başvuran erişkin hastalar hastane kayıtlarından geriye dönük olarak tarandı. Hastaların yaşı, cinsiyeti, travma mekanizması, ek organ yaralanmaları, yoğun bakım ihtiyacı, hastanede yatış süresi, morbidite ve mortalite oranları hastane kaydedildi. İstatistiksel sonuçlar frekans, yüzde, ortalama±standart sapma (min-maks) olarak ifade edildi. Gruplar arası karşılaştırmalarda $p<0.05$ anlamlı kabul edildi.

BULGULAR: Çalışmamıza 238 olgu alındı. Seksen altı olguda (%36.1) skapula kırığı mevcuttu. Skapula kırığı tespit edilen hastaların %43'ü yüksekten düşme idi. Buna eşlik eden toraks içi yaralanmalar sırasıyla kaburga kırığı, akciğer kontüzyonu, pnömotoraks, hemotoraks ve sternum kırığı olarak tespit edildi (%91.9, %80.2, %41.9, %37.2, %15.1). Skapula kırığı ile birliktelik gösteren toraks dışı yaralanmalar ise sırasıyla vertebra kırıkları, intrakranial yaralanmalar, klavikula kırığı, ekstremite kırıkları ve karın içi yaralanmalardı (%18.6, %16.3, %12.8, %10.5, %5.8). Skapula kırığına sahip olan ve olmayan gruplar karşılaştırıldığında, skapula kırığı ile kaburga kırığı sayısı, akciğer kontüzyonu, pnömotoraks ve hemotoraks arasında istatistiksel olarak anlamlı ilişki saptandı ($p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$). Toraks dışı yaralanmalarda ise skapula kırığı ile vertebra kırıkları, intrakranial yaralanmalar ve klavikula kırığı arasında anlamlı ilişki izlendi ($p=0.004$, $p<0.001$, $p=0.005$). Sternum kırığı, ekstremite kırığı ve karın içi organ yaralanmaları açısından gruplar arasında fark izlenmedi ($p=0.288$, $p=0.682$, $p=0.261$). Skapula kırığının eşlik ettiği olgularda hastane yatış süresi, yoğun bakım gereksinimi ve mortalite açısından anlamlı fark mevcuttu ($p<0.001$, $p<0.001$, $p=0.002$).

TARTIŞMA: Skapula kırıklarına eşlik eden en sık toraks içi yaralanmalar kaburga kırıkları ve akciğer kontüzyonu, toraks dışı yaralanmalar vertebra kırığı ve intrakranial yaralanmalar olarak saptandı. Ayrıca skapula kırığının hastanede yatış süresi, yoğun bakım ihtiyacı ve mortalite ile yüksek ilişkisi olduğu tespit edildi. En sık mortalite nedeni ise intrakranial kanama olarak tespit edildi. Skapula kırığı tespit edilen olgularda diğer sistemlerin görüntülemesi önemlidir. Özellikle baş-boyun yaralanmaları açısından dikkatli olunmalıdır.

Anahtar sözcükler: Künt göğüs travması; prognostik faktör; skapula kırığı.

Ulus Travma Acil Cerrahi Derg 2023;29(2):218-223 doi: 10.14744/tjtes.2022.02362