RESEARCH ARTICLE

Lung Injuries Associated with Scapular Fractures in Adult Traumatic Patients

Najmeh Zarei Jelyani, MD[1]; Ali Reza Torabi Jahromi[1]; Razieh Sadat Mousavi-Roknabadi, MD[1];Saeid Esmaeilian, MD[2]; Pourya Medhati[1]

Research performed at Shiraz University of Medical Sciences, Shiraz, Iran

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Abstract

Background: Scapular fractures are among the orthopedic injuries, which are associated with other injuries, such as lung injuries. This study aimed to evaluate the prevalence of lung injuries associated with scapular fractures in traumatic patients referred to a main trauma center in the south of Iran.

Methods: The present retrospective cross-sectional study was conducted from April 2016 to June 2019 on adult traumatic patients, who were referred to one of the main trauma centers in the south of Iran, and their data were recorded in the hospital information system. The patients with chest computed tomography, and those whose scapula fractures were reported and confirmed by a radiologist were included in this study. All patients' data were extracted from their medical files and then analyzed.

Results: A total of 100 patients were enrolled, and the majority (78%) of the cases were male. The mean±SD age of the patients was 40.71±14.071 years, and 55% of the cases had lung injuries (P=0.158). Furthermore, most of the causes of scapular fracture were due to car-motorcycle accidents (30%) and car overturning (27%). Lung contusion (31%) and hemothorax (30%) were the most types of lung injuries. The mean±SD duration of hospitalization was estimated at 4.94±7.90 days. The mean age (OR=-0.207, P=0.039) and intensive care unit admission rate (OR=0.267, P=0.007) were statistically different in patients with and without lung injuries.

Conclusion: Although scapula fractures were not significantly associated with lung injuries in this study, the occurrence of 55% of the lung injuries was clinically important, which should be considered by emergency physicians.

Level of evidence: III

Keywords: Blunt Injuries, Lung Injury, Thoracic Injury, Scapula

Introduction

Scapular fractures are among orthopedic injuries. The National Trauma Data Bank reported a total of 106,119 patients with scapular fractures between 2002 and 2012, which accounts for 1.74% of all trauma patients (1). Scapular fracture typically occurs following high-energy trauma (including several criteria, such as falling from height >3m, motor vehicle accident ≥50km/h, ejection from the vehicle, car rollover, cabin shortening ≥50cm, struck pedestrian ≥10km/h, struck [motor] cyclist ≥30km/h, and compressed underneath the heavy object) due to the specific anatomy and location of the scapula, which is in the posterior part of the chest, and a thick layer of muscle surrounding it (2).

The best way to diagnose a scapular fracture is a chest computed tomography (CT) scan (2). Since patients with scapular fractures typically present with multiple traumas, chest CT scan is performed for them upon arrival in the emergency room before screening for scapular fractures (3). In these situations, a CT scan is more reliable than a plain X-ray. This advantage improves the reliability of scapula angulation estimation, reversal, and measurement of the glenopolar angle (4).

Although the fracture can heal on its own without intervention, it can be associated with other injuries, including damage to the lung on the same side, chest wall, and shoulder girdle. Orthopedic injuries associated with

Corresponding Author: Razieh Sadat Mousavi-Roknabadi, Emergency Medicine Department, Faculty of Medicine, Shiraz University of Medical Sciences, Namazi Hospital, Shiraz, Iran
Email: mousavi_razieh@sums.ac.ir

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this fracture also consist of fractures of the ribs, proximal part of the humerus, and clavicle. Associated lung injuries include pneumothorax, hemothorax, and lung contusion, which can present acutely or even after two or three days. These accompanying injuries and their impact on people's life quality have led to the importance of this fracture (5-7). Lung injuries were more severe and common in people with scapular fractures. A study reported that the most important cause of this fracture is motorcycle accidents, falling down, and sports injuries (8).

To the best of our knowledge, few studies were performed on lung injuries associated with scapular fracture. Therefore, this study aimed to investigate the prevalence of lung injuries associated with scapular fractures in traumatic patients referred to a main trauma center in the south of Iran.

Materials and Methods

This retrospective cross-sectional study was conducted from April 2016 to June 2019 on the traumatic patients, who were referred to Shahid Rajaei Hospital affiliated to Shiraz University of Medical Sciences, Shiraz, Iran, one of the main and biggest trauma centers in the south of Iran.

The inclusion criteria were all adult (>18 years) traumatic patients with the diagnosis of scapular fracture whose data were recorded and available in the hospital information system (HIS). Given that the best way to diagnose scapular fracture is a chest CT scan (3), the patients with chest CT scan without contrast, and those whose scapula fractures were reported and confirmed by a radiologist were included in this study. The lung CT scans were evaluated on the images that were recorded in the INFINITT picture archiving and communication system (PACS) of the hospital. On the other hand, the patients with penetrating thoracic trauma, which can cause direct damage to the lungs, as well as those with uncompleted medical files, were excluded from the study.

All patients' data were extracted from their medical files. Data were collected in a data-gathering form covering such information as age, gender, vital signs, duration of hospitalization, intensive care unit (ICU) admission, type of lung injuries, other associated injuries, referral to the operating room, intra-hospital intervention for fractures, and outcomes.

All analyses were performed in SPSS software (version 16.0) using the Chi-square and Fisher's exact tests for proportions, as well as independent t-test, one-way ANOVA, and Mann-Whitney test for the means. Results were presented as mean±SD for continuous variables and were summarized in number (percentage) for categorical ones. Two-sided P<0.05 and confidence interval of 95% were considered to be statistically significant.

The study protocol was approved by the local Ethics Committee of Shiraz University of Medical Sciences, Shiraz, Iran (IR.sums.med.rec.1398.196). To consider the ethical issues, the collected data were not revealed to anyone, except for the researchers.

Results

Out of 150 traumatic patients with scapular fracture, 100 cases met the inclusion criteria, the majority (78%) of whom were male (P<0.001). The mean±SD age of the patients was obtained at 40.71±14.071 years (age range: 15-82 years) (Table 1).

Table 1. Patients' characteristics and the association among the studied variables

Variables	Total (n=100)	With lung injuries (n=55)	Without lung injuries (n=45)	Odds ratio (OR)	P-value
Age (mean±SD)	40.71±14.07	43.33±12.69	37.51±15.11		
Male	39.72±12.29	41.43±11.17	38.03±13.89	-0.207	0.039*
Female	44.23±18.07	48.40±15.39	35.29±20.45		
P-value	0.182	0.124	0.532		
Gender (%)					
Male	78 (78)	40 (72.7)	38 (84.4)	-0.141	0.163
Female	22 (22)	15 (27.3)	7 (15.6)		
P-value	<0.001*	<0.001*	<0.001*		
Mechanism of trauma (%)					
Car-car accident	10 (10)	5 (9.1)	5 (11.1)		
Car-motorcycle accident	30 (30)	19 (34.6)	11 (24.4)		
Car overturning	27 (27)	7 (12.7)	20 (44.4)	0.039	0.701
Car-person accident	17 (17)	7 (12.7)	10 (22.2)		
Falling down (>20 feet)	11 (11)	6 (10.9)	5 (11.1)		
Blunt trauma	5 (5)	1 (1.8)	4 (8.9)		
Side of scapula fracture (%)					
One-sided	98 (98)	53 (96.4)	45 (100)	0.057	0.577
Two-sided	2 (2)	2 (3.6)	0 (0)		
Side of lung injuries (%)					
One-sided	45 (45)	45 (81.8)	-	-	-
Two-sided	10 (10)	10 (18.1)			
Type of lung injuries (%)					
Contusion	31 (31)	31 (56.4)	-	-	-
Hemothorax	30 (30)	30 (54.6)			
Pneumothorax	15 (15)	15 (27.3)			
Accompanying injuries (%)					

Clavicle	18 (18)	11 (20)	7 (15.6)	0.058	0.570
Rib	8 (8)	7 (12.7)	1 (2.2)	0.193	0.055
Shoulder griddle	8 (8)	3 (5.5)	5 (11.1)	-0.104	0.304
Humerus	4 (4)	2 (3.6)	2 (4.4)	-0.021	0.839
Other accompanying injuries	32 (31)	18 (32.7)	14 (31.1)	-0.002	0.982
Vital signs (mean±SD)					
Systolic blood pressure (mmHg)	130.15±18.73	130.95±21.13	129.18±15.48	0.047	0.641
Diastolic blood pressure (mmHg)	82.77±14.21	83.24±12.69	82.20±15.11	-0.036	0.719
Heart rate (/minutes)	85.62±12.44	85.22±14.50	86.11±12.44	0.036	0.723
Respiratory rate (/minutes)	17.52±7.27	18.24±3.68	16.64±1.54	-0.109	0.278
Temperature (°C)	36.97±0.23	36.99±0.161	36.94±0.284	-0.091	0.367
Glasgow Coma Scale (/15)	14.76±1.27	14.56±1.67	15.0±0.0	0.171	0.088
Management of lung injuries (%)					
Observation	34 (34)	34 (61.8)	0 (0)	-	-
Chest tube insertion	21 (21)	21 (38.2)	0 (0)		
Transfer to the operation room for the management of scapular fracture (%)	10 (10)	6 (10.9)	4 (8.9)	0.034	0.741
Open reduction internal fixation Ligament/tendon repair	8 (8)	4 (7.2)	4 (8.9)	0.054	0.756
	2 (2)	2 (3.6)	0 (0)	0.183	0.201
Other procedures (%)	22 (25)	15 (27.3)	7 (15.6)		
Arm cast	2 (2)	1 (1.8)	1 (2.2)		
Arm slab	3 (3)	2 (3.6)	1 (2.2)	0.036	0.939
Arm sling	15 (15)	11 (20)	4 (8.9)		
Close reduction	2 (2)	1 (1.8)	1 (2.2)		
Duration of hospitalization (day) (mean±SD)	7.90±4.94	7.47±5.71	8.34±4.0	-0.108	0.284
ICU admission (%)	8 (7.4)	8 (14.6)	0 (0)	0.267	0.007*
Duration of ICU admission (mean±SD)	8.24±7.32	8.24±7.32	-	-	-
Outcome (%)					
Discharge	100 (100)	55 (100)	45 (100)	-	-
Death	0 (0)	0 (0)	0 (0)		

* Statistically significant

Totally, 55 (55%) participants had lung injuries (P=0.158), and most of the causes of scapular fracture were due to car-motorcycle accidents (30%) and car overturning (27%). Furthermore, lung contusion (31%) and hemothorax (30%) were the most types of lung injuries. None of the patients had single pneumothorax; in addition, 18% of the cases had clavicle fracture, and 43% of the patients had no other accompanied injuries

The mean±SD duration of hospitalization was estimated at 4.94±7.90 days. Most of the patients (32%) were hospitalized for only one day. Chest tubes were inserted for 21 (38.2%) patients with lung injuries. Totally, 10% of the cases were transferred to the operating room due to scapula fracture, and the most common procedure was open reduction internal fixation (8%). All patients survived and were discharged from the hospital. Our results showed that the mean age (OR=-0.207, P=0.039) and ICU admission rate (OR=0.267, P=0.007) were statistically different in patients with and without lung injuries. Other variables were not statistically different in both groups.

Discussion

In the present study, 55% of the patients with scapula fractures had lung injuries, especially lung contusion and hemothorax. Therefore, it is important for emergency physicians to consider lung injuries after observing them in patients with scapula fractures. Fractures of clavicles and ribs, as well as shoulder girdle injuries, were also the most common injuries. However, the results of a study by Salimi et al. in Tehran showed that the prevalence of head, face, and brain injuries, followed by the shoulders and long bones, was higher in these patients. Dislocations, rib fractures, hemothorax, and pelvic fractures were the rest of the injuries (5). The results of a study by Hornez et al. in the US showed that the most common injuries were rib fractures, various lung injuries, head injuries, pneumothorax, spinal fractures, clavicle fractures, upper and lower limb fractures, followed by abdominal injuries, pelvic fractures, and facial fractures, skull fractures, humerus fractures, radius and ulna bones, and then nerve injuries to the upper body (9).

The current study showed that the mean age of the patients with scapula fractures and lung injuries was higher than that in patients without lung injuries. Salimi et al. revealed that the mean age of the patients with scapula fractures was 35.95 years (5). Hornez et al. and Akaraborworn et al. achieved the mean ages of 41.36 and 37.98 years (6, 9), respectively, which was almost similar to the results of the present study. Moreover, the results of this study showed that most of the patients with or without lung injuries were male, and this difference was statistically significant. This result was in line with the results of studies conducted by Salimi et al. and Hornez et al. (5, 9).

In the present study, the most common mechanisms of injuries leading to scapula fracture were car-motorcycle accidents and car overturns. In a study conducted by Armstrong and Spuy J, the most common mechanism of injuries was motorcycle crashes (10). Car-person accidents accounted for only 17% of injuries, which was similar to the results of a study by Salimi et al. (14%) (5). Mock et al. showed that injuries from agricultural work

were the most important causes of scapula fractures, which was not consistent with the results of the present study (11).

In the recent study, the mean±SD duration of hospitalization in traumatic patients with scapula fracture was 7.90±4.94 days, which was not significantly different in patients with and without lung injuries. However, the hospitalization duration was determined at 10.31 days in a study conducted by Hornez et al. (9).

In the present study, all of the patients admitted to the ICU had lung injuries, indicating that the injuries were more severe in these patients. The length of ICU stay in this study was significantly longer in patients with lung injuries. Similar to our results, the mean length of the ICU stay was 8.25±7.32 days in a study by Salimi et al. (5).

On the other hand, in the present study, there was no statistically significant difference between the two groups regarding the vital signs. The mean Glasgow Coma Scale (GCS) was obtained above 14 in both groups. In a study by Hornez et al., the GCS of the patients with scapula fracture was determined at 12.9 (9). Furthermore, transfer rates to the operating room and hospital interventions were higher in the patients with lung injuries. Cole et al. showed that patients with scapular fractures did not require surgery, and mere close observation was sufficient for their improvement (2).

Since the studied place is a center for traumatic patients in the south of Iran, the results of the present study are expected to be largely generalizable. However, due to the lack of a regular classification of papers in archives, defects in HIS, and the removal of a collection of relevant radiological images in the PACS system, 250 people who had scapular fractures during the study were excluded. Therefore, studies with larger sample sizes are recommended to find injuries associated with scapula fractures.

Although scapula fracture was not significantly associated with lung injuries, the incidence of 55% of lung injuries in patients with scapula fracture is clinically significant. In addition, the presence of other accompanying injuries in patients with scapula fractures indicates the importance of scapula fractures. On the other hand, since the CT scan of the patients showed injuries that could not be identified in a simple graph, in the clinical approach, it is recommended that the emergency physicians do CT scans in patients with scapula fractures to evaluate concomitant injuries, including lung injuries.

Najmeh Zarei Jelyani, MD[1]
Ali Reza Torabi Jahromi[1]
Razieh Sadat Mousavi-Roknabadi, MD[1,2]
Saeid Esmaeilian, MD[3]
Pourya Medhati[1]

1 Emergency Medicine Department, School of Medicine, Shiraz University of Medical Sciences, Shiraz, IR Iran
2 Emergency Medicine Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
3 Radiology Department, School of Medicine, Shiraz University of Medical Sciences, Shiraz, IR Iran

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