

EVALUATION AND TREATMENT WARFARE CHEST INJURIES

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Received date: 10 September 2022

Revised date: 30 September 2022

Accepted date: 20 October 2022

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ABSTRACT

Background: Chest injuries constitute a major cause of morbidity, with a significant impact on global health. **Objective:** The aim of this study was to determine the demographics, clinical manifestations, management, and outcome of thoracic injuries during the conflict. **Patients and Methods:** An Observational Cross Sectional Study was conducted for the period six years (May 2015 – May 2021) at Tishreen University Hospital in Lattakia-Syria. The study included all patients admitted with thoracic injuries resulting from warfare trauma. **Results:** A total of 180 patients, 169 males (93.9%) and 11 females (6.1%) with a mean age 27.3 ± 5.2 years were included in the study. The peak age group was 20-40 years (81.7%), shrapnel fragments represented the most frequent mechanism of injury (60.6%), followed by gunshot (30%) and closed trauma (9.4%). Chest injury was isolated in 36.7% with presence of other combined organs injuries in 63.7%. Pulmonary contusion represented the most common isolated injury which found in 65 cases (36.1%), and the accompanied abdominal injuries were observed in 51 cases (44.7%). Management of injuries was performed by chest tube thoracostomy in 70.6% of the cases and thoracotomy in 29.4%. The number of the performed surgical procedures was 77 procedures, which were more frequent in the case of pulmonary laceration on average 13.9% of the total number of patients, and in presence of gunshot or shrapnel on average 12.8%. Duration of hospitalization was longer in patients who underwent thoracotomy and extrathoracic surgery (37 day), with higher rate of mortality (18.75%). **Conclusion:** Chest war injuries carry a high morbidity and mortality with enormous demands on the available limited financial resource, so that prompt and efficient management is considered crucial to improve the outcome.

KEYWORDS: Chest injuries, warfare, morbidity.

INTRODUCTION

Armed conflict in Syria has contributed to an excess in morbidity and mortality since it started, and limited data are available on the humanitarian and health consequences of the war. Chest war injuries account for 15% of all war injuries and are the common cause of death at the battlefield.^[1] Chest injuries during armed conflict might result from blunt, blast, or penetrating trauma to chest.^[2] Blunt trauma can cause damage to organs by increasing intrathoracic pressure without disrupting integrity of the tissue such as falls.^[3] Penetrating trauma is mostly attributed to violence with high mortality than blunt trauma. It is more common in men and the injury results from gunshots or stab wound.^[3] The clinical presentation of patients depends on mechanism of injury and the injured organ, which

varies widely and ranges from superficial soft tissue wounds, fractures of chest wall to intrathoracic organ damage.^[4] In addition to, concomitant abdominal injuries can occur and range from 10% to 40%. Chest radiography and computed tomography (CT) scan are the imaging modalities most often used in evaluation patients with chest trauma.^[5] Emergency surgical repair is still considered a technical challenge with high morbidity and mortality rates in spite of a considerable progress in the last decades in the management of the chest injuries.^[6] The objective of this review was to: 1- investigate causes, characteristics, and patterns of the chest injuries, 2- to determine the outcome of injuries and management.

PATIENTS AND METHODS: This is an Observational Cross Sectional Study of a group of

patients attending emergency department at Tishreen University Hospital in Lattakia-Syria during six years (May 2015 – May 2021). The inclusion criteria were: patients with a traumatic chest injuries during war period, males or females of all ages. All patients were assessed initially in the emergency room with a primary survey following the Advanced Trauma and Life Support guidelines (ATLS). Demographic characteristics, mechanism, type of the injury, and associated organ injuries were recorded. Chest X ray, computed tomography (CT) scan of the chest, or both were performed to diagnose the injury. Patients were divided into three groups according to the age: <20(15), 20-40(147), >40(18). Patients were referred to the thoracic department, conservative treatment was performed for all patients, and surgery indicated when conservative treatment was insufficient.

Ethical approval: All patients were provided a complete and clear informed consent after discussion about the purpose of the study. This study was performed following the Declaration of Helsinki.

Statistical Analysis Statistical analysis was performed by using IBM SPSS version 20. Basic Descriptive statistics included means, standard deviations (SD), median, Frequency and percentages.

RESULTS

The study included a group of 180 patients with a wartime chest trauma. The baseline characteristics of patients were as shown in Table (1). Age ranged from 6 to 60 years, with a mean age of 27.3 ± 5.2 years. Males represented 93.9% of the study sample and female 6.1% with a sex ratio (male: female) was 15.4:1. Patients were divided according to age into three groups: <20 year (8.3%), 20-40 (81.7%), and >40 (10%). CT scan was the most frequently used diagnostic modality in 107 patients (59.4%), CXR was performed in 85 patients (47.2%); some patients underwent the two procedures, whereas others underwent emergency surgery without any diagnostic test. Most injuries to the thoracic cavity resulted from shrapnel in 109 cases (60.6%), gunshot in 54 cases (30%), and blunt trauma in 17 cases (9.4%).

Table 1: Demographic characteristics of the study population.

Variable	Result
Age (years)	27.3±5.2
Age groups (n %)	
<20	15(8.3%)
20-40	147(81.7%)
>40	18(10%)
Sex	
Male	169(93.9%)
Female	11(6.1%)
Radiological diagnostic procedures	
CXR	85(47.2%)
CT scan	107(59.4%)
Etiology of injury	
Shrapnel fragments	109(60.6%)
Gunshot	54(30%)
Closed trauma	17(9.4%)

As shown in table (2), chest injuries presented as an isolated injury in 66 cases (36.7%) or as part of multitude of injuries in 114 cases (63.3%). Pulmonary contusion represented the most frequent thoracic injury which occurred in 65 cases (36.1%), followed by pneumothorax in 49 cases (27.2%), pulmonary laceration in 31 cases (17.2%), and rib fractures in 23 cases (12.8%). Other rare observed injuries were: intercostal vessels rupture in 4 cases (2.2%), diaphragmatic rupture in 3 cases (1.7%), and azygos vein rupture in 1 case (0.5%), with presence of multiple chest injuries in 77 cases (42.8%). Abdominal injuries were the most common associated organ injuries which occurred in 51 cases (44.7%), followed by extremities injuries in 40 cases (35.1%), head and neck injuries in 15 cases (13.1%), with presence of multiple extrathoracic injuries in 8 cases (7.1%).

Table 2: Distribution of the study population according to the characteristics of the injury.

Variable	Result
Type of chest injury	
Isolated	66(36.7%)
Combined with other organ injuries	114(63.3%)
Isolated chest injury	
Pulmonary contusion	65(36.1%)
Pneumothorax / hemothorax	49(27.2%)
Pulmonary laceration	31(17.2%)
Rib fractures	23(12.8%)
Intercostal vessels rupture	4(2.2%)
Diaphragmatic rupture	3(1.7%)
Azygos vein rupture	1(0.5%)
Multiple injuries	77(42.8%)
Associated injuries	
Abdominal injuries	51(44.7%)
Extremity injuries	40(35.1%)
Head and neck injuries	15(13.1%)
Combined injuries	8(7.1%)

Of the patients, 127 (70.6%) underwent chest drainage, and 53 (29.4%) underwent thoracotomy. The number of surgical procedures reaches to 77 procedures, which varies according to the type of injury. Patients with flail thoracic segment were subjected to internal pneumatic stabilization repeated two times on average 1.1%. Traumatic rupture of intercostal vessels was controlled with ligation of vessel which repeated 13 times on average 7.2%, and vein ligation was used for repairing

rupture of azygos vein. Wedge resection with closure was performed for pulmonary laceration repeated 25 times on an average 13.9%. Diaphragmatic rupture was managed by direct closure, which repeated 3 times (1.7%), and removal of gunshot or shrapnel was repeated 23 times on average 12.8%. Lung decortication was used for treatment hemothorax with empyema which repeated 10 times (5.6%).

Table 3: Management of thoracic trauma complications.

Type of injury	Management	Number of surgical procedures Percentage of total patients/thoracotomy patients
Flail chest	Stabilization of the flail segment	2(1.1%)/3.8%
Intercostal vessels rupture	Blood vessel ligation	13(7.2%)/24.5%
Azygos vein rupture	Vein ligation	1(0.5%)/1.9%
Pulmonary laceration	Closure /wedge resection	25(13.9%)/47.2%
Diaphragmatic rupture	Direct suture	3(1.7%)/5.7%
Presence of gunshot or shrapnel	Removal of foreign body	23(12.8%)/43.4%
Hemothorax / Empyema	Lung decortication	10(5.6%)/18.9%

As shown in table (4), hospital stay of patients varied according the surgical procedure method; 6 days' chest drainage, 13 days in thoracotomy, 21 days in chest drainage with extrathoracic surgery, and 37 days in thoracotomy with extrathoracic surgery. The high rate of

mortality was in patients who underwent thoracotomy with extrathoracic surgery in 3 cases (18.7%), followed by chest drainage with extrathoracic surgery in 7 cases (8.6%), and thoracotomy in cases (8.1%).

Table 4: Morbidity and mortality according to the surgical procedure.

Variable	Result			
	Chest drainage (46)	Thoracotomy (37)	Chest drainage with extrathoracic surgery (81)	Thoracotomy with extrathoracic surgery (16)
Duration of hospitalization (day)	6	13	21	37
Mortality	0(0%)	3(8.1%)	7 (8.6%)	3(18.75%)

DISCUSSION

Thoracic trauma remains an issue for health services due to life threatening conditions resulting from the

complexity of thoracic injuries and the associated respiratory and other organs failure. The result of the current study revealed that majority of patients were

males in the age group 20 -40 years, and shrapnel fragments represented the most frequent mechanism for injury. Injury of chest was isolated in one-third of the cases and pulmonary contusion was the most frequent type, with presence of combined injuries in other organs in approximately two-third of the cases and abdominal injuries represented the most frequent type. Chest injuries were managed by chest drainage in approximately three quarters of the patients, and the number of the surgical procedures varied according to the complications, in which the high rate of procedure was in the case of pulmonary laceration and presence of gunshot. Longer hospitalization with higher rate of mortality was observed in patients who treated with thoracotomy and extrathoracic surgery. Various studies have provided evidence for prevalence, management, and outcome of warfare thoracic injuries. Zakharia (1985) found in a study conducted in 1992 casualties with thoracic battle wounds in Lebanon that 97 percent of the wounds were penetrating, and isolated chest injuries were identified in 42.8%.

Patients were managed by thoracotomy in 71% and tube thoracostomy in 29%.^[7]

Proper et al (2010) demonstrated in a study conducted in 1660 patients with sustained thoracic injury that blast mechanism was the most prominent mode of injury (45.8%) followed by penetrating injury (40%), and blunt mode (14%).

Lung contusion represented the most prevalent injury (31.8%), followed by hemothorax (19.4%), rib fractures (13.2%) in which flail chest injury was present in 0.7%, with a mortality rate was 12%. Tube thoracotomy was the most common performed procedure.^[8]

Ivey et al (2012) showed in a study conducted in 23797 wounded military personnel that thoracic injuries occurred on average 8.6% with mean age 26±6.6 years. Penetrating trauma was the most mechanism of injury, pulmonary contusion and pneumothorax were the most common injuries. Tube thoracostomy was performed in 47% which was the sole therapeutic intervention in 84% of the patients with penetrating fragmentation.^[9] Keneally et al (2013) found in a study conducted in patients with injuries from military operations in Iraq and Afghanistan that prevalence of chest injuries was 10%, and penetrating injuries were the most common etiology of injury. Pulmonary contusion represented the most common thoracic injury.^[10]

Eshan et al (2014) demonstrated in a study conducted in 182 patients with thoracic injury that pulmonary contusions were the most observed isolated chest injury with mortality rate was 4.9%.^[11] In summary, early diagnosis and management of thoracic injuries is considered crucial to improve outcome and avoid serious complication of chest injury.

Competing of Interests

All the authors do not have any possible conflicts of interest.

Funding Not applicable Author contributions

All authors performed the measurements and wrote the article. Literature review was done by Mohammad Ahmad Shaaban, and all authors performed analytic calculations and performed the numerical simulations.

ACKNOWLEDGEMENTS

We wish to thank all doctors in the department of thoracic surgery.

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