



7-1-2024

Section: Thoracic and cardiovascular surgery

Management of Penetrating Chest Trauma Retrospective Study

Bahaa Abdelgawad Hassan El khonezy

Cardiothoracic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

AlSayed Basiony Moghazy Aboulyazid

General Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohamed Sharaf Alsaied Alfiky

Cardiothoracic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Omar Mohamed Abdellah SuLtan

Cardiothoracic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt,
doc0omar@gmail.com

Follow this and additional works at: <https://aimj.researchcommons.org/journal>



Part of the [Medical Sciences Commons](#), [Obstetrics and Gynecology Commons](#), and the [Surgery Commons](#)

How to Cite This Article

El khonezy, Bahaa Abdelgawad Hassan; Aboulyazid, AlSayed Basiony Moghazy; Alfiky, Mohamed Sharaf Alsaied; and SuLtan, Omar Mohamed Abdellah (2024) "Management of Penetrating Chest Trauma Retrospective Study," *Al-Azhar International Medical Journal*: Vol. 5: Iss. 6, Article 19.

DOI: <https://doi.org/10.58675/2682-339X.2479>

This Original Article is brought to you for free and open access by Al-Azhar International Medical Journal. It has been accepted for inclusion in Al-Azhar International Medical Journal by an authorized editor of Al-Azhar International Medical Journal. For more information, please contact dryasserhelmy@gmail.com.

Management of Penetrating Chest Trauma Retrospective Study

Bahaa A. H. El khonezy^a, AlSayed B. M. Aboulyazid^b, Mohamed S. A. Alfiky^a,
Omar M. A. Sultan^{a,*}

^a Department of Cardiothoracic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

^b Department of General Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: As a primary cause of mortality from civilian trauma, chest injuries remain a significant challenge in trauma surgery. The majority of thoracic trauma deaths happen after an individual has arrived at the hospital, which is a concerning disparity given the established action strategies for the treatment of these injuries.

Aim and objectives: To explain how individuals who have penetrating chest injuries are evaluated and Examine the various ways that acute chest trauma patients present, are managed, and fare in populations with varying age ranges.

Subjects and methods: In this retrospective analysis, 155 patients with penetrating chest trauma who visited the AL-Azhar University Hospital "Bab El Sheria" emergency room between 2021 and 2023 are included.

Result: In terms of the nature of the difficulties that arise, this procedure can be regarded as the most suitable course of treatment for chest injuries.

Conclusion: The primary demographic at the highest risk for this particular injury is men between the ages of 20 and 40. Stabbing incidents are the predominant cause of penetrating chest injuries.

Keywords: Penetrating Chest Trauma; Chest trauma

1. Introduction

Each year, trauma claims the lives of 150,000 Americans. It is the leading cause of mortality among those under the age of 40. 25% of fatalities are directly attributed to thoracic injuries, with a significant number of these incidents taking place in the prehospital environment.¹

The documented adult survival rate following cardiopulmonary resuscitation (CPR) in trauma centers varies from 0% to 23%, as reported by multiple authors. The survival rate among the pediatric population ranges from 1.5% to 25%.²

Over the past twenty years, there has been a global rise in the occurrence of civilian gunshot injuries and resulting deaths. Additionally, there are significant variations in these rates between different areas and countries. Firearm injuries typically arise from acts of assault or homicide in lower-income countries, while in higher-income ones, they are predominantly associated with suicides.³

In recent times, there has been a significant rise in the incidence of violence and armed

robbery across the entire country. The number of armed robbery cases has increased twelvefold, from 233 incidents in 2010 to nearly 3,000 cases in 2012. Similarly, the number of annual killings has surpassed two thousand, whereas previously, it was less than a thousand per year.⁴

Most thoracic injuries that require surgical intervention are caused by penetrating methods of injury, such as gunshot wounds (GSW), stab wounds (SW), and shotgun wounds (SGW). Blunt thoracic injuries that require surgical intervention are very rare, although their occurrence has been gradually increasing from 3% before 1994 to 12% in recent years. This increase is primarily due to motor vehicle collisions.⁵

Gunshot wounds are the primary cause of penetrating injuries that require surgical treatment, making up 33% to 80% of cases. Stab wounds, on the other hand, comprise 17% to 67% of all these injuries. Less common occurrences, among them impalement and shotgun wounds, are reported in approximately 1% to 5% of instances.⁶

Accepted 21 June 2024.

Available online 31 June 2024

* Corresponding author at: Cardiothoracic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt. E-mail address: docOomar@gmail.com (O. M. A. Sultan).

<https://doi.org/10.58675/2682-339X.2479>

2682-339X/© 2024 The author. Published by Al-Azhar University, Faculty of Medicine. This is an open access article under the CC BY-SA 4.0 license (<https://creativecommons.org/licenses/by-sa/4.0/>).

This study provides a comprehensive analysis of the assessment of individuals who have had penetrating chest injuries. It aims to investigate the various ways in which these injuries manifest, the approaches taken in their treatment, and the resulting results in populations of varying age groups.

2. Patients and methods

This retrospective study included a cohort of 155 patients who experienced penetrating chest trauma and sought medical attention at the Emergency Department of AL-Azhar University Hospital "Bab El Sheria" between 2021 and 2023.

All patients received treatment based on the Advanced Trauma Life Support standards in the emergency room. They were then monitored in the Cardiothoracic Surgery room or the ICU, depending on their diagnosed injuries, treatments, and results.

This retrospective study includes any patients of different ages and sexes coming to the Emergency room with penetrating chest injuries and any patients with other injuries in other systems, with the exclusion of any patients coming with blunt chest trauma.

All patients received treatment based on the Advanced Trauma Life Support standards in the emergency department. Depending on their diagnosed injuries, treatments, and results, they were then either monitored in the Cardiothoracic Surgical Department or admitted to the ICU.

Every trauma patient was examined and evaluated using ATLS guidelines, which provide a common language and approach to the initial evaluation of the trauma patient. These guidelines emphasize the ABCDE approach to trauma evaluation.

After evaluation of patients concerning ATLS guidelines, the airway, circulation, breathing, neurologic disabilities, and entire body deformities or any penetrating injuries were assessed and controlled. The first trauma survey was performed to recognize and manage any life-threatening injury that required urgent intervention as a life-saving measure. In contrast, the second was performed to evaluate trauma patients, involving a complete history and physical examination. The material included details about injuries that have the potential to be life-threatening, such as cardiac contusion, pulmonary contusion, tracheobronchial disruption, and esophageal disruption.

The majority of these disorders are associated with chest trauma, such as tension pneumothorax, pericardial tamponade, open pneumothorax, massive hemothorax, and flail chest. Fortunately, most of these conditions can be ruled out through clinical examination, which

ensures quick detection and prompt therapy.

Once the initial assessment is over, resuscitation measures are firmly in place, and the vital signs are returning to normal, the secondary evaluation can commence. The secondary survey involves a comprehensive assessment of the trauma patient, encompassing a thorough examination of the entire body and a detailed review of the patient's medical history. This includes the reassessment of all vital signs. A comprehensive examination of every region of the body is necessary.

The secondary survey will yield data regarding injuries that have the potential to be life-threatening, such as pulmonary contusion, cardiac contusion, tracheobronchial disruption, and esophageal disruption.

Tension pneumothorax:

When a tension pneumothorax was clinically suspected, and there was evidence of cardiorespiratory compromise, needle decompression was performed without waiting for imaging, and intercostal catheter placement was then started for good. The clinical diagnosis of bilateral pneumothorax was challenging. Bilateral tube thoracotomies are advised when there is suspicion or confirmation by imaging modalities such as ultrasonography or X-ray.

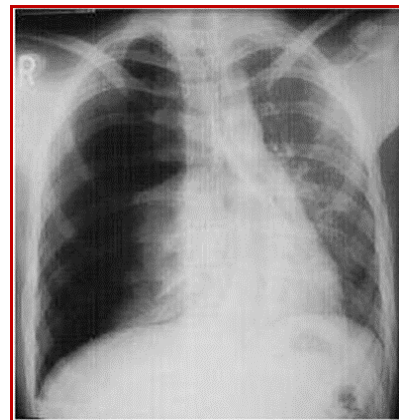


Figure 1. CXR, Rt tension pneumothorax preoperative.

Massive hemothorax

A hemothorax is often diagnosed on a chest radiograph once a significant amount of blood, usually around 200-300 mL, has accumulated in the pleural space. Massive haemothorax is the accumulation of a substantial volume of blood (usually above 1 liter) in the pleural cavity. Death is caused by hemorrhagic shock and subsequent cardiovascular impairment resulting from the blockage of venous blood flow, together with respiratory impairment. Diagnostic procedures used to confirm the presence of haemothorax include chest X-ray (CXR), computed tomography (CT) scan, and ultrasound. The recommended course of action is the prompt insertion of a large-bore intercostal catheter.

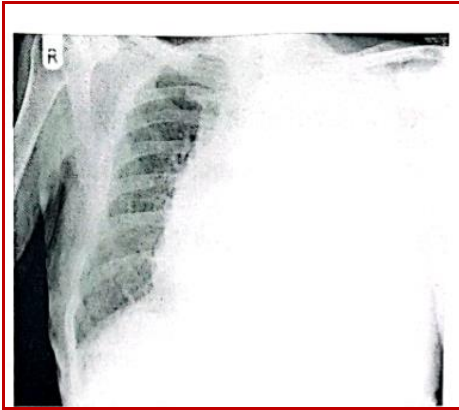


Figure 2. CXR; Lt massive hemothorax preoperative.

Cardiac injuries and Pericardial tamponade

Pericardial tamponade occurs when as little as 50 ml of fluid accumulates in the pericardial space. This leads to a decrease in venous return and consequent failure of blood transport to the left ventricle. Patients who arrive at the hospital prior to experiencing cardiac arrest typically have a higher likelihood of survival.

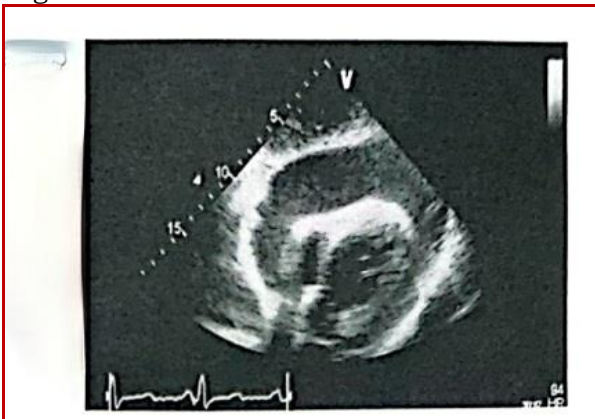


Figure 3. Pericardial effusion by echocardiography preoperative.

Patients who are in stable condition and have heart wounds can be treated with sternotomy or thoracotomy. To rapidly reduce bleeding, finger occlusion sutures must be used. Instances where inflow obstruction and cardiopulmonary bypass are required are infrequent. Myocardial repair should be carried out using interrupted sutures with pledgets, following a horizontal mattress technique. Ligation is typically performed on distal coronary lesions, but proximal damage may necessitate bypass grafts. Typically, intracardiac shunts or valvular damage in surviving patients are mild and do not necessitate immediate correction. It is necessary to extract foreign objects from the chambers of the heart on the left side.

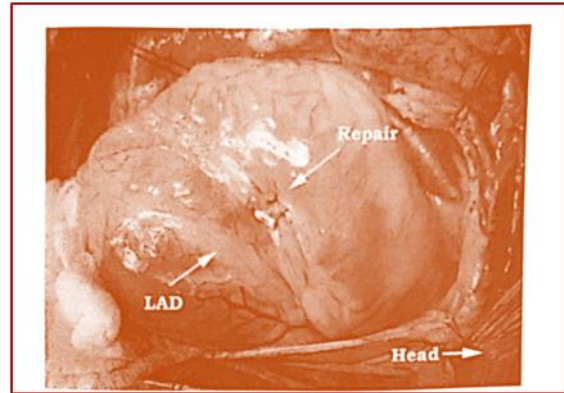


Figure 4. Repair of cardiac injury by transverse mattress pledged sutures intraoperative.

Diaphragmatic injury

Trauma surgeons currently utilize laparoscopy and thoracoscopy for diagnostic and therapeutic purposes. The diaphragmatic ruptures may be repaired using either minimally invasive techniques or the traditional open approach. An open exploration may be performed via the thoracic or abdominal routes. When acute injuries occur, such as polytrauma, nasogastric and thoracostomy tubes may be inserted if necessary.

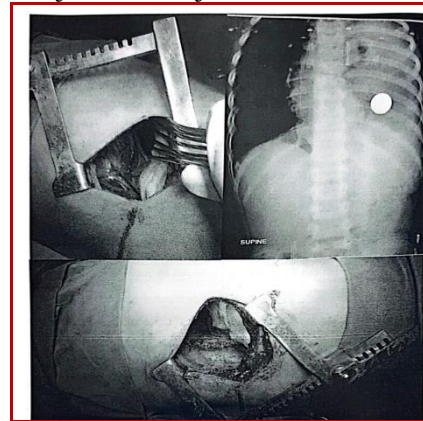


Figure 5. Iatrogenic diaphragmatic injury, managed by primary suturing intraoperative.

Statistical analysis

The data were inputted into the computer and analyzed using the IBM SPSS software package, version 20.0. IBM Corp is located in Armonk, NY. Quantitative data were represented using numerical values and percentages. The Kolmogorov-Smirnov test was employed to confirm the normality of the distribution. The quantitative data were characterized using the range (minimum and maximum values), mean, standard deviation, median, and interquartile range (IQR). The significance of the acquired results was assessed using a significance level of 5%.

3. Results

Table 1. The distribution of the analyzed cases based on demographic data.

SUBJECTS (N=155)		
AGE		
RANGE.	22-68	
MEAN±SD.	39.73±12.96	
SEX		
FEMALE	38	24.5
MALE	117	75.5

Data are presented as frequency (%) unless otherwise mentioned, SD:Standard deviation

The mean age of the studied cases was 39.73 (±12.96 SD) with range (22-68) and among the studied cases there were 38 (24.5%) female and 117 (75.5%) male.

Table 2. The patients under study are categorized based on the cause of the trauma.

SUBJECTS (N=155)		
ASSAULT/VIOLENCE	No.	%
ROAD AND MOTOR CAR TRAFFIC ACCIDENT	75	48.4
WORK RELATED	37	23.9
OTHERS	35	22.6
	8	5.2

Data are presented as frequency (%) unless otherwise mentioned

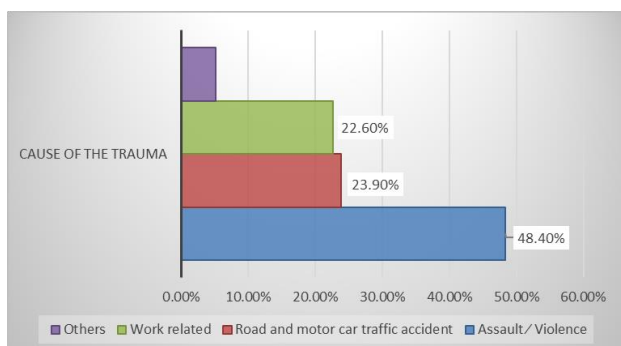


Figure 6. The distribution of the patients under study is categorized based on the cause of the trauma.

There were 75 (48.4%) assault/violence, 37 (23.9%) with road and motor car traffic accident, 35 (22.6%) work related and 8 (5.2%) other causes.

Table 3. The distribution of the cases under study is categorized based on the type of chest injuries

SUBJECTS (N=155)		
TYPE OF CHEST INJURIES	No.	%
PNEUMOTHORAX	48	31.0%
HEMOTHORAX	32	20.6%
HEMOPNEUMOTHORAX	70	45.2%
TRACHEOBRONCHIAL	0	0.0%
CARDIAC	3	1.9%
DIAPHRAGM	1	0.6%
MAJOR VESSELS	1	0.6%
ESOPHAGUS	0	0.0%

Data are presented as frequency (%) unless otherwise mentioned

There were 48(31.0%) with pneumothorax, 32(20.6%) with hemothorax, 70(45.2%) with hemopneumothorax, 0 (0.0%) with tracheobronchial, 3(1.9%) with cardiac, 1(0.6%) with diaphragm, 1(0.6%) with major vessels, 0(0.0%) with esophagus.

Table 4. Classification of the examined cases based on related injuries.

SUBJECTS (N=155)		
ASSOCIATED INJURIES	No.	%
PELVIC FRACTURES	8	5.2
INTERNAL HEMORRHAGE	25	16.1
LIMB FRACTURES	52	33.5
SKULL INJURY	72	46.5

Data are presented as frequency (%) unless otherwise mentioned

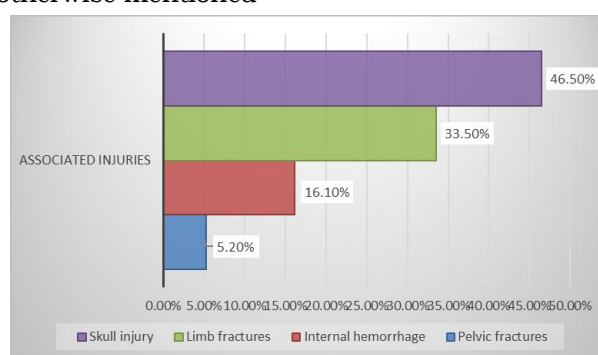


Figure 7. Classification of the examined cases based on related injuries

There were 8 (5.2%) with pelvic fractures, 25 (16.1%) with internal hemorrhage, 52 (33.5%) with limb fractures and 72 (46.5%) with skull injury.

Table 5. The examples under study are categorized based on their management.

SUBJECTS (N=155)		
MANAGEMENT	No.	%
CHEST TUBE	116	74.8
CONSERVATIVE	34	21.9
SURGICAL	5	3.2

Data are presented as frequency (%) unless otherwise mentioned

There were 116 (74.8%) had chest tube, 34 (21.9%) had conservative management and 5 (3.2%) had surgical management.

Table 6. The instances under study are categorized based on their outcome.

SUBJECTS (N = 155)		
OUTCOME	No.	%
CURED	122	78.7
COMPLICATED	33	21.3

Data are presented as frequency (%) unless otherwise mentioned

There were 122 (78.7%) cured, 33 (21.3%) complicated and no case died.

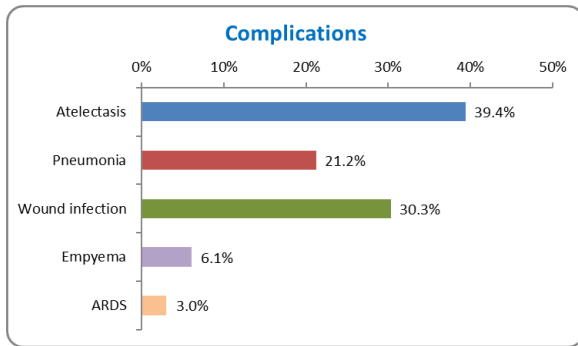


Figure 8. Classification of examined cases based on complications

According to type of complications among the studied cases there were 78(50.3%) with atelectasis, 15(9.7%) with pneumonia, 37(23.9%) with wound infection, 20(12.9%) with empyema, 5(3.2%) with ARDS

4. Discussion

In the current study, according to the cause of the trauma among the studied cases, there were 75 (48.4%) assault/violence, 37 (23.9%) with road and motor car traffic accidents, 35 (22.6%) work-related and 8 (5.2%) other causes.

This partially comes in accordance with the study of Thomas & Ogunleye,⁷ A study was undertaken with 168 cases of penetrating chest injury. Out of these cases, 49 patients (29.2%) experienced minor chest injuries that only affected the chest wall. The patients comprised 142 males and 26 females, with a ratio of 5.5 to 1. The age range spanned from 4 to 66 years. Out of the total injuries, 101 were caused by gunshot wounds, and 67 were caused by other means. Out of all the injuries sustained during the armed robbery, 77 of them (76.2%) were caused by gunshots. Out of the non-gunshot injuries, car accidents accounted for 46 cases, which constituted 68.7% of the total. However, individuals who experienced gunshot injuries received the highest severity scores.

In the current study, according to the type of chest injury, among the studied cases, 48(31.0%) had pneumothorax, 32(20.6%) had hemothorax, 70(45.2%) had hemopneumothorax, 0(0.0%) had tracheobronchial, 3(1.9%) had cardiac, 1(0.6%) had diaphragm, 1(0.6%) had major vessels, and 0(0.0%) had esophagus.

In a study by Heus et al.⁸ Over nine years, a comprehensive analysis was conducted on a total of 159 individuals who suffered from penetrating chest injuries. Out of the overall sample size of 159 individuals, 89% (n=141) were male and 11% (n=18) were female. The average age was 35 years, with a range of 14 to 75. The majority of penetrating chest injuries, specifically 73% (n=116), were attributed to stabbings,

whereas 21% (n=34) were caused by gunfire. The predominant causes were primarily work-related injuries. The types and sites of the injury were determined through the use of physical examination, diagnostic imaging, and exploratory operation. Cardiac damage was observed in ten patients, accounting for 6.3% of the total. Pneumothorax was the prevailing injury, affecting 24.5% (n=39) of the entire patient population. The incidence of hemopneumothorax and hemothorax was lower, with rates of 13.2% (n=21) and 14.5% (n=23), respectively. Two patients experienced bilateral pneumothorax.

In the current study, according to associated injuries among the studied cases, there were 8 (5.2%) with pelvic fractures, 25 (16.1%) with internal hemorrhage, 52 (33.5%) with limb fractures, and 72 (46.5%) with skull injury.

In a study by Heus et al.⁸ Over nine years, a comprehensive analysis was conducted on a total of 159 individuals who suffered from penetrating chest injuries. Thirteen patients, accounting for 8.2% of the total, exhibited diaphragmatic damage. Eleven patients (7%) exhibited rib fractures, with an average of 1.3 fractures per patient. Additional forms of damage include pneumomediastinum. The median Injury Severity Score (ISS) for all patients was 12, with a range of 1 to 50.

In the current study, according to management, among the studied cases, 116 (74.8%) had chest tubes, 34 (21.9%) had conservative management, and 5 (3.2%) had surgical management.

This finding aligns with the research undertaken by Thomas and Ogunleye⁷ which examined 168 cases of penetrating chest injury. Out of these cases, 49 patients (29.2%) experienced minor chest injuries that merely entered the chest wall. Thoracotomy was performed in 27 cases, accounting for 16.1% of the total. Chest tube insertion alone was sufficient for managing 124 patients, or 73.8% of the total.

In a study by Heus et al.⁸ Over nine years, a comprehensive analysis was conducted on a total of 159 individuals who suffered from penetrating chest injuries. Out of the overall sample size of 159 individuals, 89% (n=141) were male and 11% (n=18) were female. The average age was 35 years, with a range of 14 to 75. The majority of penetrating chest injuries, specifically 73% (n=116), were attributed to stabbings, whereas 21% (n=34) were caused by gunfire. The predominant causes were primarily work-related injuries. The majority of patients can be treated with conservative management. A total of 78 cases, accounting for nearly half of the sample, underwent treatment with chest tube drainage. In contrast, surgical intervention was conducted in 24% (n=38) of the whole patient population.

In the current study, according to the outcome of the studied cases, there were 122 (78.7%) cured, 30 (19.4%) complicated, and 3 (1.9%) died. All of them died due to cardiac arrest.

The investigation carried out by Seamon et al.,⁹ The fatality rate in the study we conducted on penetrating chest injuries was lower (25%) compared to the previous study, which mostly focused on patients who had no pulse. In their study, examined the clinical outcomes of thoracic trauma patients in the intensive care unit over ten years. They reported a mortality rate of 25.1%, which was somewhat lower than the mortality rate observed in our study. It is worth noting that their analysis included patients with blunt trauma, which may have influenced the overall mortality rate.

Comparative data from other hospitals in the city indicate a mortality rate of less than 7%; however, at their institution, the mortality rate is significantly lower, specifically 3% Alam et al.¹⁰ The six cases exhibited mortality due to various causes, such as multiorgan failure, sepsis, severe bleeding, and cardiorespiratory failure.

Our study showed a decreased fatality rate (1.9%) compared to the previously mentioned studies despite the presence of intrathoracic penetrating trauma. This can be attributed to the early presentation of the surviving patients following the trauma.

4. Conclusion

The presence of a highly specialized trauma team, highly skilled personnel, and improvements in instrumentation, especially endoscopic surgical techniques, together with appropriate pre-hospital care, fully equipped ambulances, and rapid patient transfer to the hospital are essential factors to improve the outcome of penetrating chest trauma patients and improve both mortality and morbidity. Fortunately, most penetrating chest injuries can be managed non-operatively, both rapidly and by tube thoracostomy, with no mortality in our cases that coming to the Emergency Department of AL-Azhar University Hospital "Bab El Sheria. Concerning the specific complications that arise, this procedure can be regarded as the most suitable therapy for chest traumas. Accidents and penetrating chest injuries are directly proportional to violence and riots, so to decrease the occurrence of penetrating chest trauma, higher social security is needed.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Shields, TW. General thoracic surgery. Lippincott Williams & Wilkins. 2005 :Vol.1.
2. Guitron, J., Huffman, L. C., Howington, J. A., LoCicero, J. Blunt and penetrating injuries of the chest wall, pleura, and lungs. General Thoracic Surgery. Wolters Kluwer Health Adis (ESP) 2011. p. 2376-2410.
3. Saad, S.; Salama, K.; Moghazy, A. Incidence, topography, types of firearm injuries before and after the revolution of the 25th of January 2011: a hospital-based study. International Surgery Journal.2016;3(3): p.1193-1198.
4. YAZICI, Ü.; YAZICIOĞLU, A.; AYDIN, E., et al. "Penetrating chest injuries: analysis of 99 cases. Turkish Journal of Medical Sciences.2012;42(6):1082-5.
5. Petrone P, Asensio JA. Surgical management of penetrating pulmonary injuries. Scand J Trauma Resusc Emerg Med. 2009;17:8.
6. Heitzman, ER. The mediastinum: radiologic correlations with anatomy and pathology. Springer Science & Business Media. 2012;eBook. Doi : 10.1007/978-3-642-73301-7
7. Thomas MO, Ogunleye EO. Penetrating chest trauma in Nigeria. Asian Cardiovasc Thorac Ann. 2005;13(2):103-106.
8. Heus C, Mellema JJ, Giannakopoulos GF, Zuidema WP. Outcome of penetrating chest injuries in an urban level I trauma center in the Netherlands. Eur J Trauma Emerg Surg. 2019;45(3):461-465.
9. Seamon MJ, Haut ER, Van Arendonk K, et al. An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg. 2015;79(1):159-173.
10. Alam, SN.; Jawaid, M.; Malik, KA. Chest Trauma Management: Good outcomes possible in a general surgical unit. Pak J Med Sci.2009;25(2):217-221.