Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/19958
DOI URL: http://dx.doi.org/10.21474/IJAR01/19958

*RESEARCH ARTICLE*

# MANAGEMENT OF SEVERE BALLISTIC THORACIC TRAUMA: A CASE REPORT AND REVIEW OF CURRENT PRACTICES

**Grine Ali[1], Belghiti Amine[1], Bhiris Mohamed[2], Najout Hamza[1], Mounir Khalil[1], Jaafari Abdelhamid[1] and Balkhi Hicham[1]**

1. Surjical Intensive Care Unit, Department of Anesthesia and Critical Care, Mohammed V Military Teaching Hospital, Rabat, Morocco.
2. Thoracic surgery Department, Mohammed V Military Teaching Hospital, Rabat, Morocco.

## *Manuscript Info*

***Manuscript History***
Received: 17 September 2024
Final Accepted: 27 October 2024
Published: November 2024

## *Abstract*

Ballistic thoracic trauma represents a severe medical emergency, characterized by high rates of morbidity and mortality. These injuries typically occur in the context of interpersonal violence or firearm-related accidents and are associated with significant damage to thoracic structures, including the lungs, major blood vessels, and mediastinum. Effective management of such trauma relies on the rapid recognition of clinical signs, followed by prompt interventions to prevent potentially fatal complications such as massive hemothorax or respiratory distress. This case report describes the management of a 22-year-old man who sustained severe ballistic thoracic trauma. Upon admission, the patient presented with a massive hemothorax, mediastinal shift, and signs of acute respiratory decompensation. Following initial evaluation and partial stabilization, an emergency intervention consisting of thoracic drainage was performed on-site, leading to a rapid improvement in the patient's clinical condition. The objective of this work is to highlight the importance of on-site interventions in the management of severe thoracic injuries, emphasizing the challenges faced in resource-limited settings and reviewing current recommendations for the management of ballistic thoracic trauma.



## Introduction:-

Thoracic trauma, particularly ballistic injuries, represents a major cause of trauma-related mortality worldwide. According to the World Health Organization (WHO), firearm injuries account for approximately 250,000 deaths annually on a global scale, with thoracic trauma constituting up to 20% of these fatalities [1]. In hospital settings, ballistic thoracic injuries are implicated in 30% of trauma-related deaths, primarily due to massive hemorrhage and acute respiratory failure [2,3].

These injuries result from the high kinetic energy transfer, causing significant damage to thoracic structures such as the lungs, major blood vessels, and the mediastinum [4]. In addition to the direct damage caused by the projectile, secondary injuries often arise from shockwaves and cavitation, which amplify tissue destruction [5]. Rapid initial management, including early diagnosis and emergency therapeutic interventions, is crucial for improving patient outcomes.

**Corresponding Author:- Grine Ali**
Address:- Surjical Intensive Care Unit, Department of Anesthesia and Critical Care, Mohammed V Military Teaching Hospital, Rabat, Morocco.

**Case Presentation**

A 22-year-old man with no prior medical history was admitted to the emergency department with severe ballistic thoracic trauma and hemorrhagic shock. Upon arrival, his Glasgow Coma Scale score was 11/15, with a blood pressure of 85/45 mmHg, heart rate of 150 bpm, respiratory rate of 24 breaths per minute, and oxygen saturation of 80% on 15 L/min of oxygen. Physical examination revealed an entry wound in the left parasternal region (figure1) and an exit wound at the same axial level dorsally, accompanied by significant bleeding. Auscultation revealed diminished breath sounds over the left hemithorax.

Initial laboratory results showed a hemoglobin level of 8 g/dL, platelet count of 241,000/$mm^3$, and prothrombin time of 51%. The patient was immediately transfused with two units of packed red blood cells and administered one gram of tranexamic acid, resulting in partial improvement of hemodynamic parameters. He was subsequently intubated urgently to manage respiratory distress. A rapid pulmonary ultrasound revealed a large heterogeneous pleural effusion prior to an angio-CT, which confirmed a massive hemothorax with left lung collapse (figure 2,3).

Following the CT results, a chest tube was placed, immediately evacuating 1.3 liters of blood, followed by an additional 300 mL over the next two hours (figure 4). This intervention resulted in a notable improvement in respiratory status, with oxygen saturation increasing to 97% on $FiO_2$ 60%, and hemodynamic stabilization with a blood pressure of 120/70 mmHg and a heart rate of 100 bpm.

The subsequent clinical course was favorable, marked by progressive re-expansion of the left lung toward the thoracic wall (figure 5) and complete stabilization of respiratory and hemodynamic parameters. The patient was extubated on the seventh day and continued his recovery without major complications. He was later transferred to the thoracic surgery department for further specialized care and potential definitive surgical exploration.

## Discussion:-

Ballistic thoracic trauma represents a significant cause of mortality in trauma care, particularly due to the vascular and pulmonary injuries associated with such wounds. These injuries result from the high kinetic energy transferred to the tissues by the projectile, causing direct damage, shockwaves, and cavitation effects [3]. Managing these injuries poses a challenge, especially in resource-limited settings where infrastructure and surgical expertise may be lacking.

In our case, a 22-year-old man presented with a massive hemothorax and lung collapse secondary to a ballistic thoracic injury. Initial stabilization involved resuscitation with blood products and administration of tranexamic acid, in accordance with the recommendations of the CRASH-2 Trial, which demonstrated that early use of this agent significantly reduces hemorrhagic mortality [6]. Rapid intubation and emergency thoracic drainage resulted in immediate improvement in respiratory and hemodynamic status, highlighting the crucial role of on-site interventions.

Current guidelines, such as those published by Advanced Trauma Life Support (ATLS), emphasize the importance of early interventions, particularly thoracic drainage in cases of hemothorax or tension pneumothorax [7]. Massive hemothorax, as observed in this case, leads to lung compression and mediastinal shift, compromising venous return and cardiac perfusion. In this context, emergency thoracic drainage is a life-saving intervention, restoring hemodynamic and respiratory stability [4]. In our case, the immediate evacuation of 1.3 liters of blood resulted in rapid improvement in oxygen saturation and hemodynamic stabilization.

In many resource-limited environments, challenges include delays in patient transfer, limited access to advanced imaging, and insufficiently trained personnel to perform invasive interventions [2]. The ability to perform procedures such as on-site thoracic drainage, as demonstrated in our case, is essential for improving clinical outcomes. Training local teams in basic trauma techniques, combined with appropriate equipment, can significantly reduce mortality [8].

Recent advances in trauma care offer new tools to improve initial management. The use of point-of-care ultrasound (POCUS) to rapidly identify hemothorax or pneumothorax is now commonly recommended [9]. Furthermore, the principles of "damage control" resuscitation, which aim to temporarily stabilize patients before definitive surgery, have proven effective in reducing mortality [10]. In our case, these principles were applied through rapid resuscitation, effective thoracic drainage, and referral to a thoracic surgery department for further care.

The literature strongly supports the importance of rapid and effective management of ballistic thoracic trauma. Systematic application of current recommendations, such as protocol-driven resuscitation, on-site interventions, and the use of modern diagnostic tools, can significantly reduce morbidity and mortality [11]. However, it is essential to adapt these protocols to local contexts, taking into account resource constraints.

**Figure 1:-** Image showing the entry wound of the firearm projectile.

**Figure 2:-** Chest angio-CT: mediastinal window: massive hemopneumothorax.

**Figure 3:-** Chest angio-CT: parenchymal window: massive hemopneumothorax.

**Figure 4:-** Patient's chest drainage.

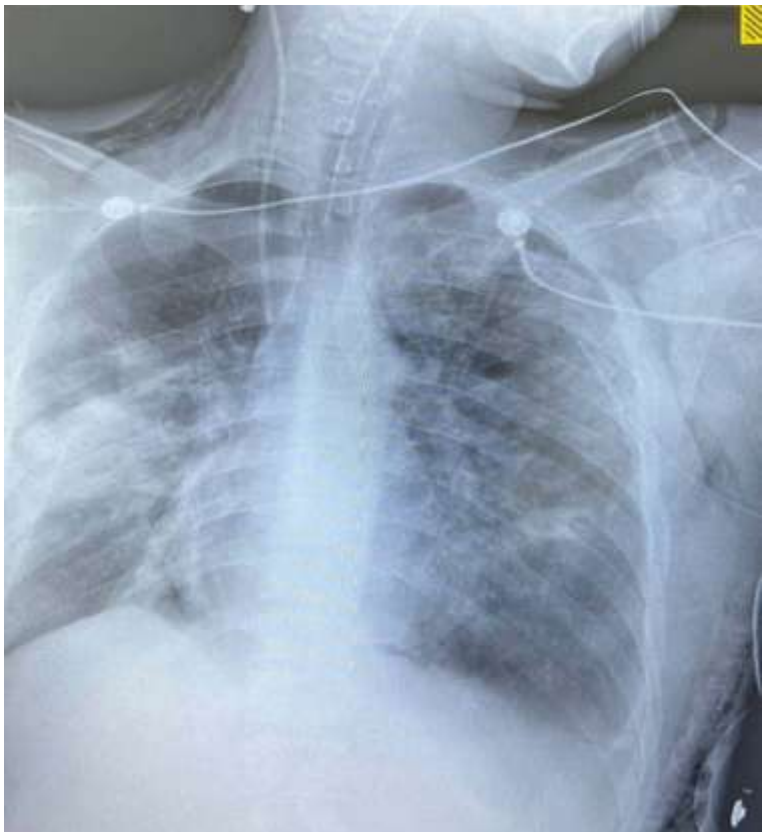

**Figure 5:-** Chest X-ray: lung re-expansion against the thoracic wall.

## Conclusion:-

Our case highlights the critical impact of on-site interventions, particularly in resource-limited settings, in stabilizing severe thoracic injuries. Complementing modern resuscitation principles, the application of basic techniques such as thoracic drainage remains a cornerstone in the management of ballistic thoracic trauma. Appropriate training of local teams and the adoption of modern technologies, such as point-of-care ultrasound, should be priorities to improve survival in these contexts.

## References:-

1. World Health Organization. Global status report on violence prevention 2014. WHO; 2014.
2. Lecky FE, et al. "Epidemiology of trauma: Global patterns and trends." Ann Surg. 2019;270(6):980-989.
3. Sharma OP. "Ballistic injuries to the chest: A review of modern management principles." Chest. 2010;137(3):672-679.
4. de Moya MA, et al. "Thoracic trauma: Review and update on trauma life support." J Trauma Acute Care Surg. 2014;76(6):1435-1442.
5. Peitzman AB, et al. The Trauma Manual: Trauma and Acute Care Surgery. 5th ed. Lippincott Williams & Wilkins; 2018.
6. CRASH-2 Trial Collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients: A randomized trial. Lancet. 2010;376(9734):23-32.
7. American College of Surgeons. Advanced Trauma Life Support (ATLS) Student Course Manual. 10th ed. Chicago: ACS; 2018.
8. Hunt PA, et al. Thoracic trauma: The deadly dozen. Emerg Med Clin North Am. 2004;22(1):65-77.
9. Gohil R, et al. Point-of-care ultrasound in trauma resuscitation. Emerg Med J. 2016;33(7):525-531.
10. Holcomb JB, et al. Damage control resuscitation: Directly addressing the early coagulopathy of trauma. J Trauma. 2007;62(2):307-310.
11. Ivatury RR, et al. Thoracic trauma: Diagnostic and therapeutic approaches. J Trauma Acute Care Surg. 2005;59(3):654-667.