CASE REPORT
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Thoracic gunshot injury with minimal pericardium disruption: a case report

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ABSTRACT

Introduction: Thoracic gunshot injury was associated with various presentation and fatality portrait. In this case report, authors will presented a case of thoracic gunshot injury with minimal pericardium disruption.
Case Report: A 26-year old Indonesian male was admitted to Sanglah General Hospital with a single gunshot wound at the left anterior chest as high as the 6th intercostal space without any exit wound. Given the stable hemodynamic, the chest computed tomographic scan was done and confirmed that the bullet was located at the inferior border of the left ventricle with minimal hemopericardium. An explorative sternotomy was done with fluoroscopy guidance. The bullet, overlying the inferior border of the pericardium, was removed successfully. Then, the pericardium was repaired. The patient was extubated and monitored at the surgical ward. There was no eventful complication after the surgery.
Discussion: The extend of gunshot wound injury to the chest depends on various factors such as the material of the bullet, mechanism of injury, velocity, and the associated structures that the bullet passed through. Emergency thoracotomy must be done in unstable patient, but for the stable patient, further radiology confirmation should be carried out for better way of exploration.
Conclusion: Successful management of thoracic gunshot injury depends on identification of danger signs, proper resuscitative measures and timely intervention.

Keywords: thoracic trauma, gunshot injury, fluoroscopy, sternotomy.
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INTRODUCTION

A gunshot wound is physical trauma caused by a bullet from a firearm. Damage from a gunshot wound varies widely based on the bullet, velocity, mass, entry point, trajectory, and affected anatomy. Gunshot wounds can be particularly devastating compared to other penetrating injuries because the trajectory and fragmentation of bullets can be unpredictable after entry. Moreover, gunshot wounds typically involve a large degree of nearby tissue disruption and destruction caused by the physical effects of the projectile, correlated with the bullet's velocity.[1]

The immediate damaging effect of a gunshot wound is typically severe bleeding with the potential for hypovolemic shock, a condition characterized by inadequate delivery of oxygen to vital organs. Devastating effects can result when a bullet strikes a vital organ such as the heart, lungs, or liver, or damages a component of the central nervous system, such as the spinal cord or brain.[2,3]

Gunshots to the chest can thus cause severe bleeding, respiratory compromise, cardiac injury, esophageal injury, and nervous system injury. Projectile injuries to the heart can cause a wide variety of cardiac injuries, including myocardial contusion, damage to the interventricular septum, laceration of the coronary arteries, and free-wall rupture.[4,5]

The initial workup, as outlined in the Workup section, is particularly important with gunshot wounds to the chest due to the high risk of direct injury to the organs. The need for expeditious evaluation modalities, including plain radiographs, sub-xiphoid window, echocardiography, and CT scans, will be considered according to the patient's hemodynamic stability. In a stable patient, CT is the best imaging modality as it is fast and provides high sensitivity and specificity in identifying and characterizing traumatic injuries.

Immediate management of these patients is crucial, and the proper decision regarding the surgical removal of a retained bullet is of utmost importance for the survival of these patients.[4] After addressing the fatality of thoracic gunshot injury, we will present a case of thoracic gunshot injury with minimal pericardial disruption.

CASE REPORT

A 26-year-old male patient was referred from Karangasem Hospital with a history of a gunshot injury to the left side of the chest, 4 hours prior. The patient complained of pain in the left chest and reported no history of severe respiratory distress, abnormal sounds during respiration, active bleeding, or loss of consciousness. Upon admission, the pulse rate was 86, blood pressure was 110/70, room air SpO2 was 98%, and the respiratory rate was 18/min. A small circular wound with charred margins was found above the 6th rib, just right of the sternal border. No exit wound was found (Figure 1A). On auscultation, there were no diminished breath sounds in either lung, and heart sounds were clearly audible without any

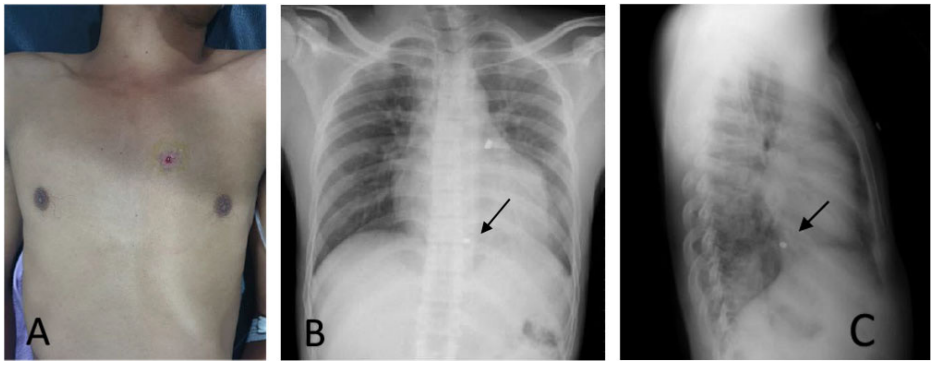

Figure 1. A. 26-year-old man with gunshot wound to the left side of the chest. B. anteroposterior supine radiograph of the chest demonstrates a bullet fragments (arrow), and increased opacity in the medial lower left hemithorax. C. lateral chest radiograph.

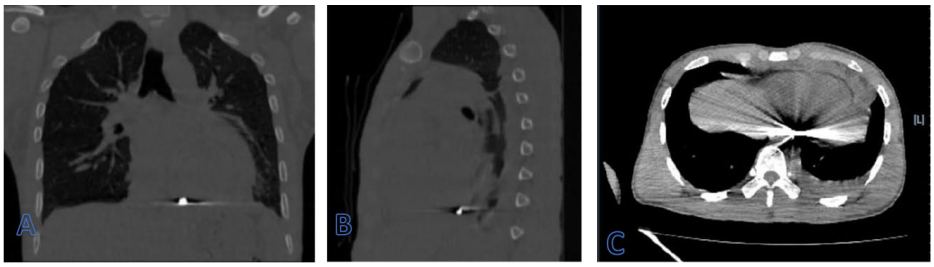

Figure 2. A and B. CT Scan toraks with contras showed bullet on the posterior border of the left ventricle. 2C. left hematothorax and minimal hemopericardium (arrow).

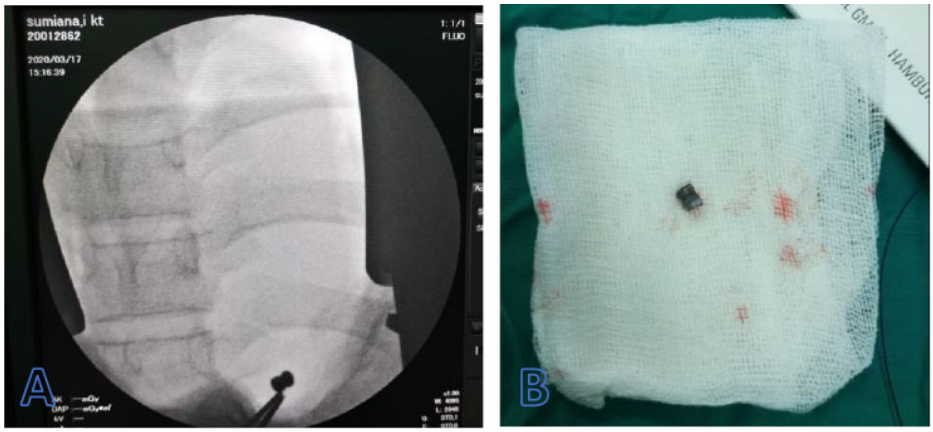

Figure 3. A. Fluoroscopic localisation of bullet. B. The bullet after extraction.

murmurs. An electrocardiogram showed a mild circumferential pericardial effusion (the largest diameter was 0.6 cm) with an ejection fraction of 53%. A supine anteroposterior chest radiograph (Figure 1B) and lateral chest radiograph (Figure 1C) showed bullet fragments and increased opacity in the lower left hemithorax.

A computed tomographic scan with contras of the chest confirmed the present of a bullet on the posterior border of the left ventricle (Figure 2A, B) consistent with hematothorax and minimal hemopericardium (Figure 2C).

Pasien admitted for surgery and the chest was opened via sternotomy. Pre operative bullet position was assessed by C-Arm radiography fluoroscopy (Figure 3A). Bullet had entered the left hemithorax without causing significant hematothorax and penetrated the pericardium. Bullet was found in the posterior border of left ventricle and immediately extracted (Figure 3B). The pericardium was repaired and the thorax drain was inserted.

Patien admitted to the ICU for 2 days and transferred to ward for 2 days. The thorax drain was removed 4 days after surgery. Patien went home without complications.

DISCUSSION

Thoracic gunshot injuries may present in a variety of ways, and the treatment plan varies accordingly. The risk of injury to the heart, major blood vessels, and lungs should be evaluated in every patient. The clinical presentation of a penetrating cardiac injury depends on several factors, such as the type of object, size of the wound, structures damaged, the presence of pericardial tamponade, and associated non-cardiac injuries. The fatality rate after cardiac gunshot injuries is around 80%, depending on the mechanism of injury.[1,2]

A brief history is critical and is usually provided by the pre-hospital personnel. This history should include the mechanism of injury, the time elapsed since the injury, vital signs, and the neurological status at the scene, as well as any changes during transport. If the patient is lifeless on arrival or critically unstable with imminent cardiac arrest, the patient requires an Emergency Room resuscitative thoracotomy without any prior investigations. If the patient is relatively stable, or hypotension can be easily corrected with intravenous fluids, the patient should undergo further evaluation to identify any contained vascular injuries, aerodigestive and diaphragmatic injuries, and other life-threatening conditions.[3]

In our case, the patient was referred from Karangasem Hospital with a history of a gunshot injury to the left side of the chest, occurring 4 hours before admission to the Emergency Room. The patient arrived with stable hemodynamics and no history of severe respiratory distress, abnormal sounds during respiration, active bleeding, or loss of consciousness. The patient had a single gunshot wound on the left anterior chest at the level of the 6th intercostal space, without any exit wound. The patient was evaluated for more detailed and organ-specific information, including chest radiograph, hemodynamic monitoring, electrocardiography, and most importantly, a CT scan.

Gunshot injuries caused by the projectile can affect both the permanent cavity, the damaged tissues along the path followed by the projectile, as well as the temporary cavity—the tissue surrounding the permanent cavity that is subject to temporary forces, including

radial acceleration, shear, stretch, and compression. While the forces causing the temporary cavity act for a brief period, the results can be longstanding.[4]

Firearms have been classified into three major types according to their muzzle velocity and bullet caliber: low-velocity (<350 m/s), medium-velocity (350–600 m/s), and high-velocity (>600 m/s). Handguns (except for magnums) are low-velocity, shotguns and magnum handguns are medium-velocity, while high-velocity weapons are usually rifles. Gunshot wounds in civilians are typically inflicted with low-velocity or medium-velocity firearms. The muzzle energy is considered to decrease significantly beyond 45 m for most handgun bullets. Unfortunately, most civilian gunshot wounds are inflicted from an average of 10 m. The nose contour and the mass of the bullet are important for maintaining its velocity and energy during flight.[5]

In our case, the patient sustained a gunshot injury from 2 meters above his left side of the chest without any exit wound found. The bullet caliber was 4.5 mm with a flat-nosed shot from an air rifle. Air rifles are low-velocity firearms, and flat-nosed bullets create clean, round holes. Because no exit wound was found, the energy was transferred from the bullet to the tissue.[5]

In the stable patient where hypotension can be easily corrected with intravenous fluids, further evaluation should be carried out to identify contained vascular injuries, aerodigestive and diaphragmatic injuries, and other life-threatening conditions. Further investigations include chest radiograph, hemodynamic monitoring, electrocardiography, and most importantly, a CT scan for more detailed, organ-specific information.[4]

In our case, the electrocardiogram showed a mild circumferential pericardial effusion with an ejection fraction of 53%. The supine anteroposterior and lateral chest radiographs showed bullet fragments and increased opacity in the lower left hemithorax. A computed tomographic scan with contrast of the chest confirmed the presence of a bullet on the posterior border of the left ventricle, consistent with hematothorax and minimal hemopericardium.[3]

Emergency thoracotomy must be performed in unstable patients. However, for stable patients, further radiological confirmation should be carried out for a better exploration strategy. In our patient, the chest was opened via sternotomy. The preoperative bullet position was assessed by C-arm radiographic fluoroscopy. The bullet had entered the left hemithorax without causing significant hematothorax and had penetrated the pericardium. The bullet was found in the posterior border of the left ventricle and was immediately extracted. The pericardium was repaired, and a thoracic drain was inserted.[2]

CONCLUSION

This case highlights the importance of timely and thorough evaluation in patients with thoracic gunshot injuries. While gunshot wounds to the chest can present with a range of complications, including damage to vital organs such as the heart, lungs, and blood vessels, prompt diagnosis and management are crucial for improving patient outcomes. In this case, the use of advanced imaging techniques, including CT scans and radiography, played a key role in identifying the extent of the injury and guiding the surgical approach. Despite the significant trauma caused by the gunshot wound, the patient's stable hemodynamics and timely surgical intervention contributed to a favorable outcome. This case underscores the importance of careful assessment, rapid intervention, and appropriate management in patients with penetrating chest trauma, particularly in regions with limited access to standard treatment options. Further research and attention to pre-hospital care and early resuscitation strategies could help optimize outcomes for these patients.

ETHICAL CONSIDERATIONS

The authors stated that this article corresponds to the hospital research protocol and the inform consent has been obtained from the patient.

DECLARATION OF CONFLICTING INTERESTS

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AUTHOR CONTRIBUTIONS

All authors contributed to data gathering, analysis, drafting, and revising and approving the article regarding this research to be published.

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