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Knife to Meet You, Embedded and Endangered: A Case Report of Hemopericardium from Penetrating Chest Trauma

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Abstract **Case Report**

Penetrating chest trauma carries a high risk of life-threatening complications, requiring rapid assessment and intervention. We present a 42-year-old male with a stab wound to the sternum, complicated by a retained foreign body and hemopericardium. The injury sustained is classified grade IV - based on the American Association for the Surgery of Trauma (AAST) heart injury scale. Despite hemodynamic instability, early imaging revealed a mediastinal hematoma without active bleeding. The patient underwent emergency sternotomy for foreign body removal, preventing potential cardiac tamponade. Postoperative recovery was uneventful with minimal ventilatory and inotropic support. This case underscores the importance of early imaging, timely surgical intervention, and a multidisciplinary approach in managing penetrating cardiac injuries to improve survival and long-term outcomes.

Keywords: Penetrating chest trauma, Cardiac injury, Hemopericardium, Retained foreign body, Sternotomy.

INTRODUCTION

Penetrating chest trauma, though less common than blunt thoracic injuries, carries a significant risk of life-threatening complications, particularly when involving cardiac structures, major vessels, or the mediastinum. Both blunt and penetrating trauma can result in traumatic cardiac injury. Among those presenting with penetrating thoracic injury, cardiac injury occurs in about 6 percent [1]. Unlike blunt trauma, which may present with delayed complications, penetrating trauma often requires immediate intervention to prevent catastrophic sequelae such as cardiac tamponade, great vessel injury, or tension pneumothorax. The extent of penetrating cardiac injury is directly related to the size, speed, and trajectory of the missile or implement, which in turn influences patient outcomes. Less commonly, cardiac injury can be due to penetration into the heart from a fractured rib. The left ventricle is involved in 25 percent, and more than one chamber of the heart is involved in 30 percent [1].

Stab wounds to the precordial region pose a particularly high risk, as even a seemingly superficial injury may extend into vital thoracic structures. The presence of a foreign body embedded in the mediastinum adds another layer of complexity, necessitating careful surgical planning to prevent additional injury during extraction. Hemopericardium, even in the absence of active bleeding, can rapidly progress to tamponade, making early recognition and intervention critical.

This case highlights the importance of early imaging, surgical decision-making, and multidisciplinary collaboration in the management of penetrating cardiac injuries. We discuss the clinical presentation, diagnostic challenges, intraoperative findings, and postoperative management of a patient who sustained a stab wound to the chest, resulting in a retained foreign body within the sternum and associated hemopericardium.

CASE PRESENTATION

A 42-year-old Myanmar male was referred from a district hospital following a stab wound to the chest sustained during a domestic altercation. He arrived at the emergency department hemodynamically unstable, with borderline blood pressure 80-90/60-70 mmHg and tachycardic. A focused assessment with sonography for trauma (FAST) scan revealed a 2.3 cm pericardial effusion. CT angiography of the thorax demonstrated some key findings prior to decision for surgery which was 4.0 cm x 1.5 cm foreign body (knife tip) embedded in the sternum, with its tip located within an anterior mediastinal hematoma. A 3 cm cutaneous entry wound was noted. Anterior mediastinal hematoma measuring 1.5 x 11.9 x 14.3 cm, with no signs of active bleeding

and hemopericardium with a maximum thickness of 1.4 cm on the left side, with preserved cardiac chamber anatomy.

The patient was transferred to the cardiothoracic center for emergency sternotomy and foreign body removal under general anesthesia. Intraoperative findings confirmed a 4.3 cm x 1.5 cm knife tip embedded in the sternum. The foreign body was successfully extracted simultaneously just prior to median sternotomy. Also noted, large hematoma in the thymus bed, with active bleeding from a thymic vessel and pericardial tear with significant hemopericardium. Right atrial laceration of about 2 cm with active bleeding and was repaired with multiple 4-0 Prolene pledgeted sutures. Pericardial lavage was performed. Bilateral lung contusions with hemothorax was also noted. Postoperatively, the patient was ventilated and required hemodynamic support with minimal inotropes. He was gradually weaned off sedation and extubated on postoperative day two. He was discharged well on post op day 7 with good heart function, well expanded lung fields and satisfactory pain control.

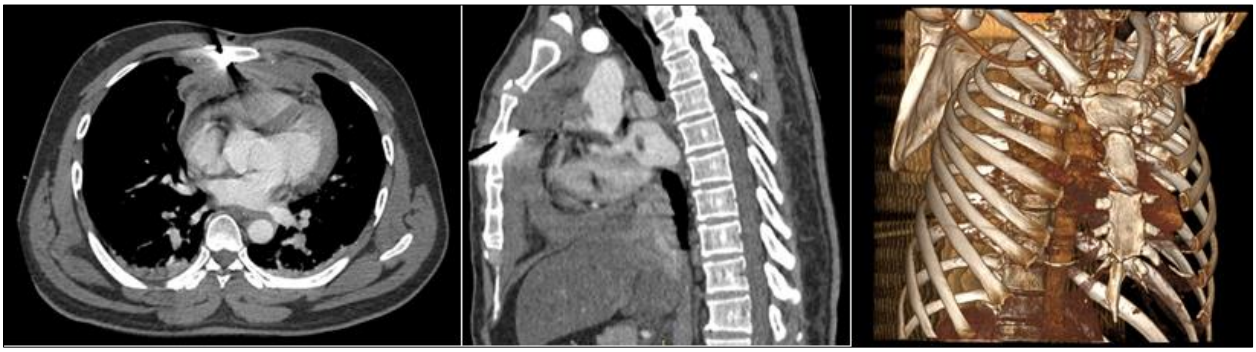

Figure 1: Multiplanar CT imaging of the thorax demonstrating penetrating cardiac injury. Axial (most left) and sagittal (centre) contrast enhanced views reveal a tract traversing the anterior chest wall into the pericardial space associated with hemopericardium. The 3D volume-rendered reconstruction (most right) highlights the trajectory of the foreign object relative to the sternum, ribs and major vascular structures

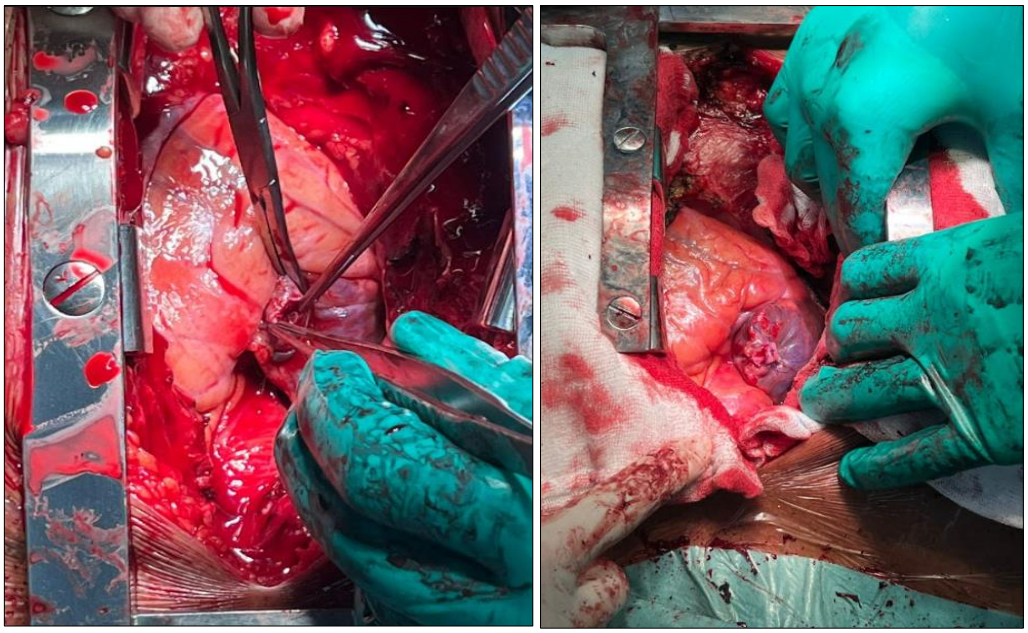

Figure 2: Intraoperative photographs illustrating the penetrating cardiac injury involving the right atrial appendage. (Left) Initial exposure reveals a linear laceration at the right atrial appendage with active bleeding. (Right) Post-repair view showing successful closure of the defect with prolene sutures

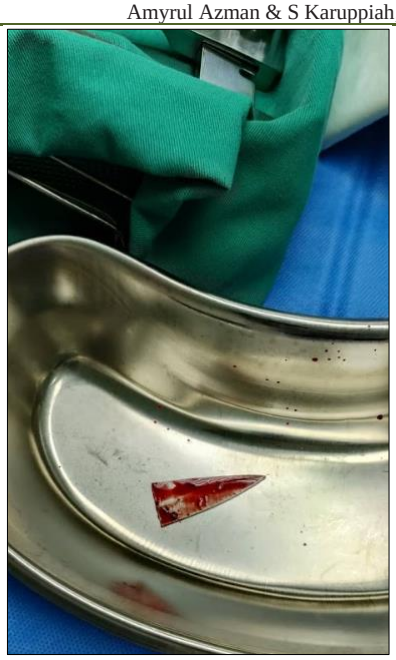

Figure 3: Intraoperative photograph showing the tip of a broken knife blade, successfully extracted from the thoracic cavity during emergency sternotomy. The metallic fragment measures approximately 4.0cm x 1.5cm, consistent with dimensions observed on preoperative imaging

DISCUSSION

Many thoracic trauma patients die after reaching the hospital as it comes to no surprise that thoracic trauma poses a significant cause of mortality; these deaths however can actually be halted with swift diagnosis and treatment. Only 15% to 30% of penetrating chest injuries and less than 10% of blunt chest injuries call for operative intervention [2]. Penetrating chest trauma, though less frequent than blunt thoracic injuries, carries a significant risk of morbidity and mortality, particularly when involving vital structures such as the heart and great vessels. The presence of a retained foreign body carries the risk of delayed complications such as infection, cardiac tamponade, and mediastinitis and may further complicate management, necessitating a strategic approach involving rapid assessment, advanced imaging, and timely surgical intervention. Early imaging, hemodynamic stabilization, and prompt surgical intervention are key to successful outcomes. Injuries that are an immediate threat to life are treated as quickly and simply as possible. Most life-threatening thoracic injuries can be treated with airway control or decompression of the chest with a needle, finger, or tube [2].

1. Diagnostic Challenges:

Early recognition of cardiac involvement is critical, as even small pericardial effusions can rapidly progress to tamponade. A cardiac injury should be suspected in cases of persistent hypotension without an identifiable source of blood loss, especially in the context of penetrating chest trauma. The classic clinical triad of muffled heart sounds, hypotension, and distended veins is not uniformly present with cardiac tamponade [2]. In this case, the initial FAST scan detected pericardial fluid accumulation, prompting further imaging. Cardiac views should be performed during FAST examination, if possible, to identify the presence of fluid in the pericardial sac, which may reflect hemopericardium. In addition to the subcostal view, a parasternal view may be helpful. FAST examination is highly accurate for identifying pericardial effusion [2]. CT angiography was instrumental in delineating the extent of the injury, identifying the foreign body's trajectory, and ruling out active bleeding. The incidental finding of an aberrant right subclavian artery also underscored the importance of detailed anatomical assessment in trauma cases. Thoracic CT is a modality that stable patients with penetrating thoracic injury should undergo as other modalities particularly FAST scan/echocardiography is operator-dependent. Hence cardiac injury due to a pneumothorax or a lack of tamponade, when the pericardium has been decompressed by blood entering the pleural cavity might be missed [3].

2. Surgical Considerations:

The urgency, approach, and technique for chest exploration depends on the hemodynamic status of the patient and mechanism of injury [3]. According to the Advanced Trauma Life Support (ATLS®) guidelines, following penetrating trauma (not blunt trauma) within 10 minutes of pulseless electrical activity (PEA). It is performed by a left anterolateral thoracotomy through the 4th intercostal space. Through this access, the therapeutic options include evacuation of the pericardium, open cardiac massage, clamping of the descending aorta (to stop distal bleeding and increase coronary and cerebral perfusion) [4].

Once the need for surgical exploration has been determined (hemorrhage, fluid in the pericardial sac, tamponade), it is important to communicate with the cardiac anesthetist and perfusionist to ensure adequate hemodynamic support, prepare for potential cardiopulmonary bypass (CPB), and coordinate intraoperative monitoring and resuscitation [2]. The decision to proceed with emergency sternotomy in this case was guided by the presence of hemopericardium and a foreign body embedded within the sternum. While some penetrating chest injuries can be managed conservatively, surgical exploration is warranted when there is suspicion of ongoing hemorrhage, cardiac injury, or foreign body retention. The sternotomy approach provided direct access to the mediastinum, facilitating safe removal of the foreign object and pericardial lavage to prevent infection and pericarditis. Access to the heart is obtained by a left anterolateral thoracotomy in emergency situations, otherwise a median sternotomy gives better access to the pericardium and great vessels if time permits. Once the mediastinum is accessed, the pericardium is opened, any clots or liquid evacuated, open cardiac massage performed and any bleeding point occluded. Atrial and ventricular lacerations are secured with direct suture and may be buttressed by Teflon strips [5].

Running 4-0 polypropylene sutures are usually used to repair atrial wounds, where the sutures are placed 5 mm beyond the edges of the wound. Due to the low pressure nature of these chambers, pledgets are not required [5]. In cases involving the coronary arteries, valve structures, or some posterior injuries, CPB may be necessary and requires a multidisciplinary approach. In the acute setting, if a controlled injury is discovered at sternotomy that cannot be accessed and CPB is available, cardiac surgery consultation is warranted. CPB may also be required for later repair in patients with valve injury or rupture, or injuries to the base of the heart identified on imaging [1].

3. Postoperative Management and Complications:

Postoperatively, the patient required ventilatory and hemodynamic support due to the physiological stress of major surgery. Early extubation is prioritized to reduce the risk of ventilator-associated pneumonia and optimize enhanced recovery after surgery. Close monitoring for potential complications, including infection, arrhythmias, and recurrent pericardial effusion, is essential. The use of prophylactic antibiotics and mucolytics aims to prevent mediastinitis and respiratory complications, given the presence of bilateral lung consolidation.

4. Multidisciplinary Approach and Prognostic Factors:

Successful management of penetrating cardiac trauma requires coordination between emergency physicians, trauma surgeons, cardiothoracic surgeons, intensive care specialists & radiologists. Prognosis is largely influenced by the severity of the initial injury, the presence of major vascular involvement, and the timeliness of surgical intervention. In this case, the absence of major vascular laceration and the rapid transfer to a specialized center contributed to a favorable outcome.

This case highlights the importance of early imaging, prompt surgical decision-making, and comprehensive postoperative care in the management of penetrating thoracic injuries. While rare, mediastinal foreign bodies pose a serious risk, reinforcing the need for a high index of suspicion and a systematic approach to trauma evaluation.

CONCLUSION

Retained foreign bodies in the mediastinum are rare but potentially fatal. Penetrating chest trauma, especially when involving the mediastinum and pericardium, requires a high index of suspicion, rapid assessment, and timely surgical intervention to prevent life-threatening complications. This case underscores the importance of early imaging, as the initial FAST scan played a crucial role in identifying pericardial fluid, prompting further evaluation with CT angiography. The presence of a retained foreign body within the sternum, coupled with hemopericardium, warranted emergency sternotomy, demonstrating that even in the absence of active bleeding, immediate surgical intervention is often necessary to prevent delayed complications such as pericarditis, infection, or tamponade.

The successful management of this patient was attributed to a multidisciplinary approach, involving emergency physicians, radiologists, cardiothoracic surgeons, and intensive care specialists. Postoperative care, including ventilatory support, hemodynamic stabilization, pain management, and infection control, was crucial in ensuring a smooth recovery. The absence of major vascular injury and the prompt decision for operative intervention contributed to a favorable outcome.

This case reinforces the need for early recognition and a structured approach to penetrating cardiac trauma, emphasizing that even small thoracic wounds can mask deeper, life-threatening injuries. As trauma management continues to evolve, advancements in imaging, surgical techniques, and critical care will further improve survival rates and long-term outcomes in patients with complex penetrating chest injuries.

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