

HEMOTHORAX FOLLOWING PENETRATING THORACIC INJURY (GUNSHOT WOUND) IN GERIATRIC PATIENT: A CASE REPORT AND EMERGENCY MANAGEMENT

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ABSTRACT

Introduction: Penetrating chest trauma is highly lethal. Studies have reported up to 60% mortality depending on the mechanism of injury. While penetrating chest trauma is less common than blunt trauma, it can be more deadly. High-velocity gunshot injury resulting in penetrating thoracic trauma in geriatric patients poses a significant challenge for the traumatic surgeon. Hemothorax is usually a consequence of penetrating chest trauma. It can be caused by intercostal arterial bleeding, especially the posterior part. Initial treatment, including chest tube drainage insertion, is needed to avoid lung compression and to assess future treatment needed.

Purpose: To report the patient survival from massive hemothorax caused by penetrating Thoracic injury caused by an air rifle, treated by chest tube insertion and posterolateral thoracotomy to take out the bullet several days after.

Case Report: 70-year male patient came to the Emergency Room (ER) Adihusada Hospital Surabaya with a penetrating chest injury caused by an air rifle on the right side of the chest. The patient had chest pain, shortness of breath, and hypoxia. By inserting a chest tube, emergency management was done by a general surgeon due to the massive right hemothorax. An immediate chest tube insertion was needed to overcome the patient's breathing problem to assess the future treatment needed. Chest X-ray and CT-Scan was done immediately after the patient's hemodynamic were stable. Three days after hospitalizing, the Cardiothoracic and vascular surgeon performed posterolateral thoracotomy to take the bullet out of the chest.

Conclusion: Seven days postoperatively, the patient was discharged from the hospital without any complications and stable hemodynamic. The patient went to the outpatient department for follow-up one week after.

Keywords: Chest injury, penetrating chest injury, gunshot injury, hemothorax

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INTRODUCTION

The thoracic injury has become one of the most common reasons patient comes to the emergency department. Thoracic trauma accounts for up to 40% of trauma-related death.^{1,2} Thoracic trauma is divided into two categories blunt chest trauma and penetrating chest trauma. Blunt chest trauma is more common than penetrating trauma. The most common cause of blunt chest trauma is a vehicle accident; other causes include falls, act of violence, and blast injury. Higher morbidity in blunt trauma caused by vehicle accident is associated with high speed and lack of seat belt use.³

Gunshots and stabbing dominate the majority cause of penetrating trauma. Despite higher incidence, less than 10% of patients suffering blunt trauma to the thorax require surgical intervention, whereas 15% to 30% of patients sustaining penetrating chest injury need surgical intervention. Penetrating chest trauma is associated with a higher mortality rate.⁴ Among causes of penetrating thoracic injury, gunshot thoracic injury is the most fatal form of chest injury, leading to many morbidities. The risk of gunshot thoracic injury are heart penetration, blood vessel rupture, and lung injury that should be evaluated immediately, and any intervention, including surgical intervention, should never be delayed.⁵ Most penetrating injuries to the thoracic cavity can be managed by a simple procedure such as chest tube insertion;

however, 15% of patients need definitive surgical repair.⁶

An elderly patient with thoracic trauma poses a significant challenge to a trauma surgeon. The challenge starts from diagnosing phase, preoperative phase, operative phase, and post-operative phase. Diagnoses can be delayed, and they do not tolerate complications as well as a young person. Delayed diagnosis can be caused by misleading criteria that are usually used for the general population.^{7,8}

Hemothorax is common after thoracic injury, especially penetrating one. It can be caused by various sources of bleeding, such as disruption of the lung, pulmonary vascular hemorrhage, bronchial vessel bleeding, or injury to the intercostal vessels—most patients with stable hemodynamic penetrating hemothorax treated with chest tube insertion. However, patients who have persistent bleeding (>250ml/hr for 2-4 hr) after chest tube insertion need a thoracotomy as bleeding control.^{9,10}

CASE REPORT

A 76-year-old male came to the emergency department of Adihusada Hospital Surabaya with shortness of breath after a penetrating chest injury caused by a gunshot injury. The patient was conscious, with a heart rate of 120 beats per minute, blood pressure of 140/90 mmHg, respiratory rate of 32 breaths per minute, body temperature was

36,9 oC, and peripheral saturation oxygen was 86% room air.

The physical examination was done immediately following the Advance Trauma Life Support (ATLS) protocol. From the physical examination, the patient's airway was fine. There was no partial nor complete obstruction of the airway. The patient's breathing was not fine. He had hypoxia, flared nostrils, and excessive use of accessory muscles. The chest examination revealed a gunshot wound with the entry point from the posterior part of the chest. The chest expansion was not normal, with asymmetry on the right side. Chest percussion revealed a dull sound on the right side, showed a fluid-filled on the right chest. From the patient's vital signs, it can be concluded that the patient was in Class I Hypovolemia Shock. On

neurological examination, there were no motoric or sensory problems. There was no problem with exposure. For an adjunct to the primary survey, a chest radiograph was performed as a diagnostic tool. The chest radiograph showed massive fluid accumulation on the right side of the chest, suggesting hemothorax (Figure A-B). A foreign body with high opacity also identified a place in the posterior mediastinum through anterior-posterior position and lateral position chest x-ray. An immediate Chest tube insertion using a large-bore (24 F) tube through the fifth intercostal space in the midaxillary line done immediately by the general surgeon. After chest tube insertion was done, around 500 ml of blood was collected.

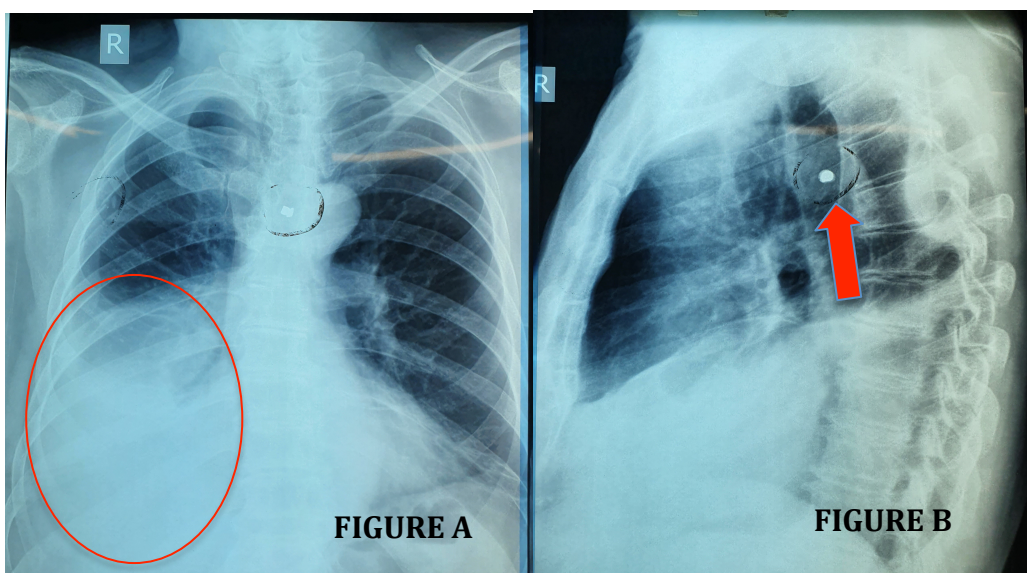


Figure 1. **A** Anterior-posterior chest x-ray in the picture showed a massive fluid accumulation on the right side of the chest, suggested hemothorax (red circle mark). **Figure B** Lateral chest x-ray in the image showed a foreign body in the posterior mediastinum (red arrow mark)

Follow-up in 3 days showed there was only 50 ml blood left, and a chest tube was removed. Chest Ct-Scan was done to evaluate bullet position before thoracotomy. Chest Ct-Scan result showed a foreign body with size 7,482 mm x 6,626 mm in posterior mediastinum behind the aortic arch in front of the thoracic vertebrae corpus 4 (T4) - thoracic vertebrae corpus 5 (T5) (Figure 2.1-2.3). There was also moderate hemothorax with a volume of around 200 cc—thoracotomy with posterolateral approach was done with C-arm as guidance for bullet position during operation. The advantages of using this

procedure are: achieving maximum exposure to intrathoracic organs for almost all thoracic surgery procedures and beneficial when used in reoperation and complex procedures. The operation is done carefully to prevent the rupture of the aortic arch. A bullet with a size of 5 mm (Figure 2.4-2.5) was extracted successfully from the chest, and the patient hemodynamic was stable. Seven days postoperatively, the patient was discharged from the hospital without any complications and stable hemodynamic. The patient went to the outpatient department for follow-up one week after.

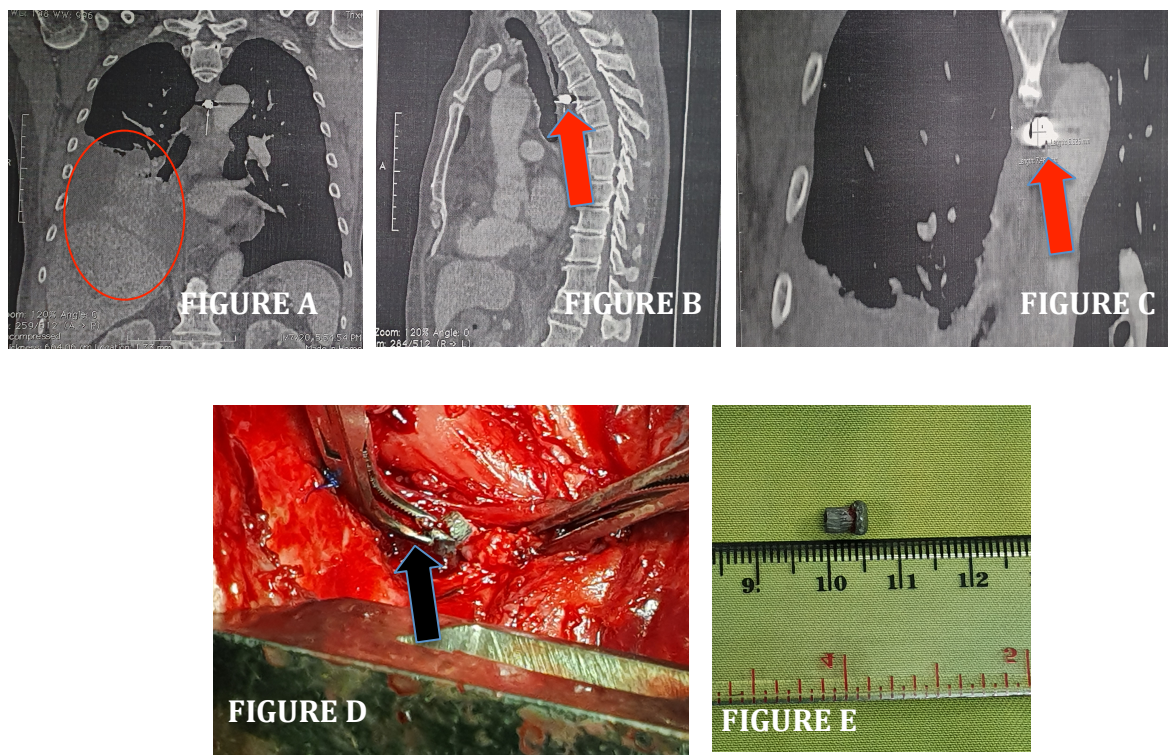


Figure 2. A Chest CT-Scan showed a fluid accumulation on the right chest (red circle mark). **Figure B** Lateral chest CT-Scan showed a foreign body behind the aortic arch. In front of corpus vertebrae thoracic 4 (T4) - thoracic 5 (T5) (red arrow mark) **Figure C** A bullet with size 7,482 mm x 6,626 mm. (red arrow mark) **Figure D** A bullet extracted from the chest (black arrow mark). **Figure E** The 5 mm-sized bullet.

DISCUSSION

The geriatric population is the fastest-growing age group nowadays, and trauma to this population accounts for significant admission to the hospital. In Indonesia, based on Badan Pusat Statistik (BPS) data, geriatric has reached 25 million in numbers or 9.60% of the total population.¹¹ Chest trauma in geriatric patients poses a significant challenge to the traumatic surgeon. In chest trauma, age is one of the significant predictors in mortality and morbidity numbers. Standard triage criteria used for the general population may be misleading in the elderly.⁷ Diagnoses can be delayed, and they do not tolerate complications as well as their younger counterparts. anatomical and physiological changes caused by the degenerative process lead to increased morbidity and mortality in the elderly, around 28%.¹² McMahon DJ et al. showed that every one-year addition on a patient with age over 65 years old, the possibility to die after trauma increase by more than 6%.¹³ Geriatric patients with comorbidities and decreased sensitivity of several drugs also posed a challenge in resuscitation. The majority of geriatric patients presenting to hospital after receiving trauma are caused by blunt trauma, however a small but significant percentage sustains penetrating trauma.¹⁴⁻¹⁵ Some studies showed that outcomes after trauma in geriatric are worse than in younger age. The study by Roth

et al. showed that following penetrating trauma, the older patient had a more prolonged ICU and hospital stays compared to their younger counterparts.¹⁶ The study by Nagy et al. in 85 elderly patients compared to 85 young patients with penetrating trauma also showed that elderly sustaining penetrating trauma arriving alive to the hospital is as likely to survive as younger patients but have more comorbidities, as well as longer ICU and hospital stays.¹⁷ The mortality rate in penetrating trauma remains constant until the age of 55 and increasing after that, according to the study by Ottochian et al.¹⁸

Hemothorax is one of the most frequent consequences of thoracic trauma. Intrapleural and extrapleural injuries can cause it. Hemothorax can be diagnosed in patients receiving chest trauma with unstable hemodynamic. On physical examination, chest percussion revealed a dull sound on the involved side and showed a fluid-filled chest. Auscultation may indicate a decrease in broncho-pulmonary sound. The chest radiograph showed massive fluid accumulation on the involved side of the chest, suggesting hemothorax. In supine condition, hemothorax on chest radiograph reveals a cloudy view that is hard to assess. Some studies reveal the amount of blood volume estimated in thoracic cavities in cloudy chest x-ray counted from intercostal space. One intercostal space can contain

around 200-250 cc blood volume. Blood that enters the pleural cavity is exposed to the motion of the diaphragm, lungs, and other intrathoracic structures. Fluid accumulation in the chest cavity can inhibit lung expansion. In this case, the patient had cyanosis that probably caused by lung compression by hemothorax.⁹

Treatments of hemothorax are based on its severity. It depends on the accumulation of fluid volume on the chest involved. Surabaya standard divided hemothorax into three classifications:

1. Mild hemothorax with 300 cc fluid
2. Moderate hemothorax with 300-800 fluid
3. Massive hemothorax with >800 cc fluid

Treatment for mild hemothorax is conservative or thoracentesis, while moderate hemothorax using chest tube insertion and WSD as a treatment. Thoracotomy exploration is indicated for hemothorax with fluid volume > 800 cc.¹⁹ In this case, the patient had 500 cc fluid, classified as moderate hemothorax, which needs a chest tube and WSD. Establishing a correct diagnosis remains the most important thing before chest tube insertion. The best timing for chest tube insertion in the thoracic trauma case is based on clinical signs and symptoms and associated injuries. Good skill in the physical examination is needed. Chest examination included inspection, palpation, percussion, and auscultation that has high

sensitivity and specificity (90% and 98%, respectively).² A repeated examination is important. Chest radiography can be performed rapidly. CT Scan might also be useful, but it only can be done on stable hemodynamic patient. There are two main sites of chest tube insertion: 1) The ventral approach on the 2nd – 3rd intercostal space on the mid-clavicular line (Monaldi); 2) Lateral approach on the 4th – 6th intercostal space on anterior axillary line (Bulau).^{20,21}

A study by Huber-Wagner et al. revealed that there were no differences in both techniques.²² Although operators usually preferred the Bulau approach, both techniques were considered safe and effective in chest trauma situations.

Thoracic foreign bodies are classified into three types: type-I (Aspiration), type II (Trauma or accident, type III (Iatrogenic). Type II thoracic traumas may occur after a laceration or an injury by the gun explosion.²³ Complications associated with metallic foreign bodies in the thoracic cavity such as hemothorax, pneumothorax, obstructive pneumonitis, and atelectasis. Calcific fibrothorax results of previous hemothorax can occur in the delayed phase. Chronic empyema can arise if there is a foreign body in the pleural cavity. There are some indications in bullet removal of thoracic trauma, including intra-articular missile, abscess or sepsis, migrating or embolizing missile, lead poisoning, and exploration. A thoracotomy procedure can do bullet removal

in the thoracic cavity. Thoracotomy procedure indicated in some conditions such as hemothorax (>1500 mL initial blood loss, bleeding >250 mL/h), pneumomediastinum associated with tracheal, bronchial, and esophageal injuries.^{24–26} In this case, the cardiothoracic surgeon chooses to remove the bullet from the chest, considering the patient's age, which belongs to the geriatric population that has a higher risk of infection caused by a foreign body (bullet).

CONCLUSION

Penetrating chest injury, especially in geriatric, that is caused by high-velocity gunshot injury, poses a significant challenge for the surgeon. Removal of the bullet in the chest is recommended in geriatric patients to prevent further infection. A good physical examination is needed in chest trauma cases in the elderly, including inspection, palpation, percussion, and auscultation. If hemothorax is diagnosed, the treatment must depend on its severity. From the Surabaya standard, an immediate chest tube should be inserted in moderate hemothorax. The chest tube can be inserted in Monaldi or Buleu. In this case, seven days postoperatively, the patient was discharged from the hospital without any complications and stable hemodynamic. The patient went to the outpatient department for follow-up one week after.

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