A 20-year-old man with hemopneumothorax caused by penetrating thoracic trauma: a case report

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ABSTRACT

Background: 20–25% of trauma-related deaths are caused by thoracic injuries, which also contribute to 25–50% of patient deaths. An increasing number of critically injured but potentially salvageable patients are reporting to trauma centers as a result of the rising occurrence of penetrating chest injuries and the advancements in prehospital and perioperative care. Up to 80% of patients with penetrating chest injuries can be treated conservatively; in other situations, a stenotomy/thoracotomy (3%) or tube thoracostomy (18%) may be required. This case report aims to present a case of hemopneumothorax as a consequence of penetrating thoracic trauma.

Case presentation: A 20-year-old male patient referred to Dr. Soetomo General Hospital a tertiary referral hospital massive hemopneumothorax dextra post water seal drainage to be underwent surgical resuscitation by open thoracotomy procedure then right internal mammary ligation and pericardial repair surgery. Patient’s condition steadily improved after the operation. Chest penetrating thoracic trauma caused by applying a mechanical force directly and abruptly to a focused location can cause penetrating injuries. By stretching and crushing tissue, a knife or projectile causes damage, which is often limited to the tissues in the route of penetration. The Patient with significant chest injuries needs to be managed with adequate analgesics and chest physiotherapy.

Conclusion: Clear treatment algorithms and uniform assessment in chest penetrating trauma are essential for effective management. A substantial number of patients can be saved by conducting the primary survey and beginning with interventions that can save patient lives.

Keywords: hemopneumothorax, penetrating, thoracic, trauma.


INTRODUCTION

Thoracic trauma is often found in approximately 25% of multi-trauma sufferers who have a thoracic trauma component. 90% of sufferers with thoracic trauma can be treated with simple actions by doctors at the hospital (or paramedics in the field), therefore only 10% require surgery.1–3 Thoracic trauma contributed to a significant proportion cause of mortality. Most patients die after arriving at the hospital and many of these deaths could have been prevented by improving diagnostic and therapeutic capabilities. Less than 10% of blunt thoracic trauma and only 15 – 30% of penetrating thoracic trauma require thoracotomy.4,5 Although penetrating trauma is less prevalent, it can nevertheless pose a serious risk to life. The mechanism of injury must be understood because there are differences in management. Furthermore, the examination and intervention will be determined by the directionality of penetration. Early identification is essential to survival since, depending on the penetrating injuries, rapid surgical intervention may be required. It is important to evaluate the penetrating damage as well.6–8

Prompt care is necessary in cases of immediate, life-threatening injuries. Examples of this include emergency tube thoracostomy for massive pneumothorax and first hemothorax therapy. Enough drainage is essential in hemothorax situations to avoid retained hemothorax. Video-assisted thoracoscopic surgery may be necessary to treat empyema resulting from retained hemothorax. Most thoracic trauma cases can be treated without surgery. 15% of patients need surgical care, therefore when surgery is necessary, it should not be delayed.1,3–2 Thoracic trauma is associated with morbidity and mortality because it can affect circulation, respiration, or both. As with pulmonary contusions, respiratory impairment can result from direct injury to the airway or lungs, or via interference with the breathing mechanics as in the case of rib fractures.9,10 Reduced pulmonary compliance and the emergence of a ventilation-perfusion mismatch are the frequent results. Hypoventilation and hypoxia ensue, potentially requiring intubation. When there is severe blood loss, a reduced venous return, or direct heart damage, circulation becomes compromised.6

When severe or penetrating trauma occurs, intrathoracic bleeding most often appears as hemothorax; a large hemothorax can result in hemodynamic shock and hypotension. The increasing prevalence of penetrating thoracic trauma associated with increasing warfare, improvements in
hospital health services and perioperative care have resulted in an increase in the number of patients identified.\textsuperscript{1,2} An interdisciplinary team of a trauma surgeon, thoracic surgeon, pulmonologist, pain specialist, heart surgeon, respiratory therapist, and intensive care unit (ICU) nurses typically manages penetrating trauma. Timely diagnosis, treatment, and resuscitation are essential for lowering morbidity and death rates.\textsuperscript{3,4} This case report aims to present a 20-year-old man with hemopneumothorax caused by penetrating thoracic trauma.

**CASE PRESENTATION**

A 20-year-old male patient was referred to the Emergency Unit, Soetoemo General Hospital from Sidoarjo General Hospital, East Java, Indonesia with massive hemopneumothorax dextra post water seal drainage (WSD). The patient has a history of respiratory distress, respiratory rate 30-35 times per minute, decreased left breath sounds, stab wound from a knife in the right chest, peripheral saturation 90\% with an O\(_2\) mask of 6 lpm. Pale wet cold perfusion, pulse 100 beats per minute, blood pressure 90/60 mmHg, E4V5M6 consciousness, isochore round pupil. At Sidoarjo General Hospital the patient received ringer lactate 1500 cc therapy, WSD installation, intravenous injection, namely: tranexamic acid 500 mg, ketorolac 30 mg, ceftriaxone 1 gr, anti-tetanus serum 1 ampoule. From the WSD initial, 50 mL of blood came out, it was decided to observe first, resulting in a drain production of 600 mL. Patient's condition when referred: airway was free; breathing 30 times/minute asymmetrical right left visible 5 cm wound on anterior thorax, chest tube inserted; circulation: capillary refill time >2, blood pressure 82/56 mmHg, pulse 140 times per minute, WSD production 200 cc/30 minutes. Blood function test results within normal limits. The patient was still on O\(_2\) 6 lpm then resuscitated with 500 mL 0.9\% NaCl crystalloid fluid, 500 mL gelofusine colloid, 350 mL whole blood transfusion, then an open thoracotomy was performed for surgical resuscitation.

The hemodynamic condition during 4 hours 25 minutes of operation was stable with oxygen saturation of 90-100\%, resulting in rupture of the right internal mammary artery, rupture of the costochondral junction IV right, rupture of the right pericardium with myocardial laceration without bleeding, while the lungs and diaphragm were intact. The patient underwent right internal mammary ligation and pericardial repair. Blood function test results were within normal limits, however, hemoglobin dropped below normal to 10.5 mg/dL post-operatively therefore transfusion of 400 mL fresh frozen plasma and 350 mL whole blood were done. Hemoglobin dropped again to 7.2 mg/dL hence the patient received a transfusion of 1 kolf of whole blood and 1 kolf of packed red cells until the hemoglobin reached normal range. The patient condition in the observation room is stable with O\(_2\) installed with a pressure control ventilation (PCV) ventilator mode. For three days in the observation room, airway conditions were free, spontaneous breathing, respiration rate 16 times per minute symmetrically right and left, oxygen saturation 98-99\%; circulation with a pulse rate of 105 times/minute, blood pressure 109/66 mmHg. The patient continued to receive O\(_2\) simple mask therapy 6 lpm, slight head up position, oral and personal hygiene, respiratory physiotherapy, RD5 infusion 500 mL/24 hours, metamizole 3 x 1 gr intravenously, tramadol drip 3 x 100 mg intravenously.

**DISCUSSION**

Thoracic trauma affects the thorax cavity causing damage to the thorax wall or the contents of the thorax cavity caused by sharp objects or blunt objects and can cause acute thoracic emergencies. Thoracic trauma or chest injury can cause wall damage in the chest, lungs, heart, large blood vessels and surrounding organs including the viscera consists of various large internal organs in the chest cavity.\textsuperscript{5} Sharp thoracic trauma caused by the occurrence of discontinuity of the thorax wall (laceration) directly due to the cause of trauma. Especially due to sharp objects (knife, glass, etc.) or bullets. The mechanism of injury in sharp thoracic trauma can be categorized as low, medium, or high energy trauma. Low-energy injuries include stabblings (e.g., knife wounds), which disrupt only the penetrated structure. Medium energy injuries include bullet wounds from most types of handguns and pellet guns and are characterized by much less severe tissue damage when compared with wounds caused by high energy injuries. Wounds resulting from high-energy injuries include gunshot wounds from rifles and wounds from military weapons.\textsuperscript{7,8}

The amount of tissue damage is directly related to the amount of energy exchanged between the penetrating object and the body part. The density of the tissue involved and the frontal area of the penetrating object are important factors that determine the rate of energy loss. Energy exchange produces permanent cavities in the tissue. This part of the

The cavity is the result of tissue damage due to the passage of the projectile. Projectiles with high speeds can cause the same severity of injury as knife penetration, but unlike knives, injuries caused by bullet penetration can damage structures adjacent to the bullet's path. This is because it is caused by the formation of tissue cavities and by producing tissue shock waves that can increase in area. The severity of the internal injury that occurs depends on the organ that has been affected and how vital that organ is. Knives usually cause less injury because they are low-energy projectiles. Stab wounds caused by knives are limited to the area where penetration occurs. Wounds caused by knife stabs are usually tolerable, even if the puncture is in the heart area, they can usually be saved with maximum medical treatment.

Management principles of thoracic trauma consists of primary survey, vital function resuscitation, detailed secondary survey and definitive treatment. Hypoxia is a very serious problem in thoracic trauma, early intervention needs to be done to prevent and correct it. Trauma that is life threatening must be treated immediately as quickly and simply as possible. Most cases of life-threatening thoracic trauma are treated by controlling the airway or inserting a chest tube or decompressing the thorax with a needle. Secondary surveys require a trauma history and high awareness of specific traumas. Closed heart massage for cardiac arrest or pulseless electrical activity (PEA) is less effective than chest compression for cardiac arrest or pulseless electrical activity (PEA) is less effective than chest compression.

After repair of the hemothorax, the drain is maintained for a minimum of 48-72 hours after installation. The patient must be mobilized and receive adequate respiratory physiotherapy.

There are two approaches that are often used for thoracotomy, namely anterolateral and posterolateral approaches. With the anterolateral approach, good access can be obtained to see both upper lobes, right middle lobe and anterior hila. Can also be extended across from the sternum to other parts of the thorax (clamshell incision). This approach is the best approach for unilateral lung transplantation. Posterior pleural exposure is more limited. The posterolateral approach is currently still the best approach. This approach not only provides maximum access to the lungs, hilum, middle and posterior mediastinum, endo thoracic trachea and endo thoracic esophagus, but is also safe for pulmonary vascular control during lung resection. This approach also allows wide access to all areas of the hemithorax. Potential disadvantages that may occur if this approach is used are pain, which can interfere with the breathing mechanism due to interference with the respiratory muscles and reduced mobility of the chest wall. In the critically ill patients who have severe chest wall damage or require massive transfusions, a ventilator should be considered. After extubation, pulmonary toilet and pain control are important to prevent complications such as atelectasis or pneumonia. Furthermore, chest tubes are maintained, where observation and recording of their quantity and quality are carried out. If pulmonary trauma is obtained or resection of lung tissue is performed during surgery, the chest tube will be maintained until there is no further air leak and the lungs are fully developed as can be seen from the chest radiograph. Drainage should be done at less than 100 ml in 24 hours. Furthermore, antibiotics are still given for up to 48 hours postoperatively until the culture results come. Antibiotic selection is highly procedure-specific and based on the bacteria likely to be the source of the potential infection therefore the use of prophylactic antibiotics in patients with chest trauma decreases the incidence of posttraumatic empyema and pneumonia.

CONCLUSION

Most penetrating thoracic trauma can be treated with simple tube drainage thoracostomy. However, the selection of patients requiring thoracotomy is not always easy and there is much controversy regarding the indications for surgery observation.

CONFLICT OF INTEREST

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ETHICAL CLEARANCE

The authors have secured informed consent from the patient regarding this study.

AUTHOR CONTRIBUTION

All of the authors equally contributed to the study.

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