

Computed tomography of the thorax with 3D reconstruction in penetrating chest injury

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SUMMARY

Penetrating chest wounds is less common but more deadly than blunt trauma. Majority of penetrating chest trauma can be managed conservatively with observation and simple thoracotomy. This case report highlights a bizarre occupational hazard causing a penetrating chest injury and the option of non-invasive management with the aid of computed tomography with 3D reconstruction.

KEY WORDS:

Stab, penetrating chest trauma, thoracic injury, CT Thorax, 3D reconstruction

INTRODUCTION

Penetrating thoracic injury, although less common than blunt thoracic injury, has higher mortality rates. The incidence is generally higher in war torn countries. It is relatively uncommon in Malaysia and as such, a delay in identifying the life-threatening complications may be catastrophic. This case report highlights the role of computed tomography (CT) thorax with 3D reconstruction in managing penetrating chest trauma.

CASE REPORT

A 15-year-old boy, with no comorbidity, was referred after falling onto a metal spear used for harvesting palm oil fruits. It penetrated his left axilla and exited through the right supraclavicular fossa. He denied any loss of consciousness, had no weakness involving his upper limbs, no shortness of breath and was not pale.

Clinically, he was conscious and coherent with no signs of respiratory distress or neurological deficit. He was haemodynamically stable. Chest auscultation revealed equal breath sounds bilaterally with no subcutaneous emphysema, and heart sounds were clearly heard. Chest roentgenogram demonstrated the spear penetrating the left first intercostal space and exiting at the right supraclavicular fossa (Figure 1). There was no pneumothorax or pleural effusion present. No signs of tracheal injury was seen when he was electively intubated.

A CT neck and thorax (Figure 2) suggested the spear entered between the clavicle and first rib on the left side, sparing the thorax, anterior to the oesophagus and other structures in the

mediastinum, and exiting superior to the right clavicle on the right side. There was no pneumothorax; and no lung, oesophageal or tracheal injury.

In view of the clinical condition of the patient and CT findings, the metal rod was removed in the operating theatre through the exit wound. Both wounds were debrided and packed with povidone-iodine soaked ribbon gauze. He was monitored in the intensive care unit and was extubated six hours after removal of the rod. He was discharged home the next day.

DISCUSSION

The severity of penetrating thoracic injuries varies from patients who present haemodynamically stable, to patients who are haemodynamically unstable and require an emergency department thoracotomy. The mortality risk is determined from the amount of blood lost and the severity of organs injured.¹

The most common injuries due to a penetrating wound within the thoracic cavity are intercostal artery injury, rib fractures, pneumothorax, pulmonary contusion, haemothorax or pulmonary laceration. This can present six to 24 hours after the initial insult. Delayed complications such as abscesses or bronchopleural fistula can also manifest from penetrating chest injury.¹ If the heart is involved, injury to the right ventricle is more common and haemorrhage leading to shock can occur. Mortality is higher if there are multiple chambers of the heart involved.¹ Injury to the great vessels usually results in death prior to arrival to an Emergency Department. Tracheal injury can occur but partial injuries may present with its complications later on such as tracheoesophageal fistula, mediastinitis or empyema.

A study in 2001, deduced that the majority of penetrating chest trauma cases can be managed conservatively. Initial assessment was done using the Advanced Trauma Life Support guidelines and injury was graded using the injury severity score, chest abbreviated injury scale and the specific thoracic injury based on the lung injury scale score. Indications for open surgery are initial chest tube output of more than 1000 ml or continued output of 250 ml/hour for three consecutive hours, haemodynamic instability, massive haemothorax associated with shock, pericardial tamponade,

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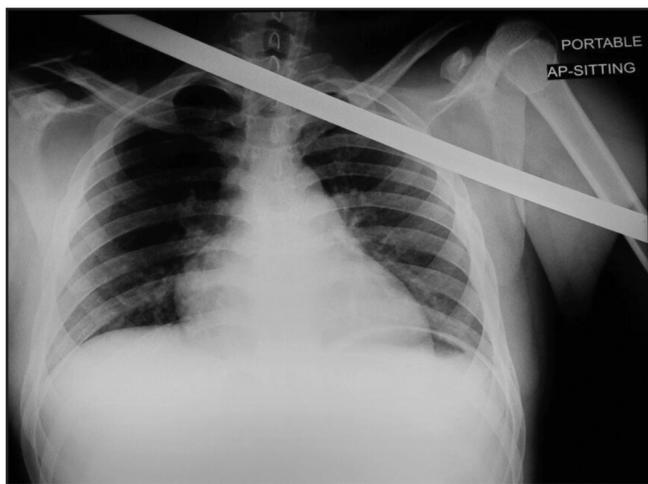


Fig. 1: Plain chest x-ray showing the spear in-situ.

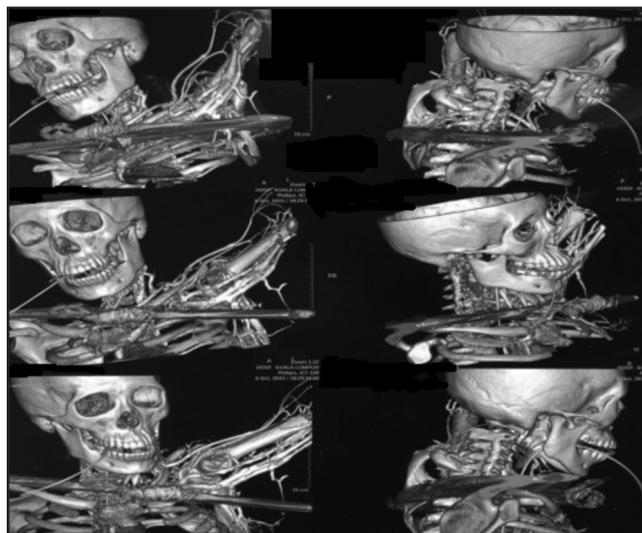


Fig. 2: Computed tomography image with 3D reconstruction showing the spear in-situ.

massive air leak or radiographic evidence of a large haemothorax.² Most penetrating chest injuries can be treated using tube thoracostomy.

With the advent of video assisted thoracic surgery (VATS), patient selection is crucial as a clinically stable patient may become unstable and necessitate open thoracotomy. VATS has a role in managing lung trauma complications or may be used as an alternative modality for evaluation of isolated diaphragm injuries due to stab wounds.²

Studies have shown better results when performing thoracotomies in the operating room due to the availability of proper instruments and trained staff. Removal of the foreign body under general anaesthesia in the operating theatre provides a controlled environment should there be a need for invasive surgery to manage possible complications.³

Thoracic injuries can also present with long term sequelae which may cause significant problems. Haemothorax is the most common pleural space problem and can develop in 5-30% of patients up to 14 days post trauma, and may subsequently result in empyema thoracis.⁴ Other sequelae such as fibrothorax, tracheobronchial injury and diaphragmatic rupture may occur months to years after the initial insult. Early thoracoscopic intervention has proven to be superior to tube thoracostomy in managing these sequelae and should be considered in left sided stab wounds of the lower chest.⁴ Nonetheless, delayed manifestations will continue to present an interesting problem for thoracic surgeons, and will require surgical intervention and treatment when they arise.⁴

The use of CT thorax with 3D reconstruction in evaluating penetrating chest injuries minimises unnecessary procedures such as angiography, echocardiography and oesophagoscopy, and its associated risks.⁵ However, it must be emphasized that it is an option which can be used only in stable patients to identify the trajectory of the penetrating object. Using this imaging modality to assess the sequelae of the thoracic or vascular injuries negates the use of invasive procedures such as a thoracotomy or VATS.

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