

Penetrating Thoracic Trauma Arising From Knife Injuries Into the Hemithorax: A Case Report

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Case report

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Abstract

Background

Trauma is associated with a high morbidity and mortality, and thoracic trauma accounts for a quarter of these deaths. This is due to the penetrating thoracic trauma that often causes serious injury to the heart and great vessels. Most penetrating thoracic wounds are caused by stabbing, which is usually caused by knives. Here, we report a patient who had penetrating thoracic trauma who was caused by a knife.

Case presentation

A 16-year-old girl was stabbed by a knife due to an accidental fall, which caused a penetrating injury in her left chest. Despite a decreased blood pressure (100/90 mmHg), the patient was conscious. The unenhanced CT at emergency clearly showed that the knife penetrated between the pericardium and the left lung without heart injury. Exploratory thoracotomy was performed in the fourth intercostal space in combination with thoracoscopy, confirmed that the knife penetrated between the pericardium and the left lung without causing any injury to the heart.

Conclusions

CT can not only clearly display foreign bodies of knives, but also accurately judge the damage of important structures such as lungs, heart and great vessels. Therefore, CT can provide information for further diagnosis and intervention.

Introduction

Trauma is associated with a high morbidity and mortality^[1]. About 5.8 million people die each year from traumatic injuries worldwide^[2], and thoracic trauma accounts for a quarter of these deaths^[3]. Thoracic trauma can be classified into the blunt and penetrating types of trauma. The penetrating thoracic trauma is life-threatening and often involves serious injury to the heart and great vessels, associated with a 90%–100% risk of death due to the occurrence of hemorrhagic shock or pericardial tamponade before the patient arrives at the hospital. Most penetrating thoracic wounds are caused by stabbing or shooting. Stabbing is usually caused by knives, followed by other sharp objects. Here, we report a patient, who had penetrating thoracic trauma.

Case Report

A 16-year-old girl was stabbed by a knife due to an accidental fall, which caused a penetrating injury in the left chest. The patient was found by her family and brought to the emergency department (ED) of Guizhou Provincial People's Hospital by ambulance. Physical examination found that the knife penetrated the thoracic cavity at a depth of ~6 cm, 1 cm proximal to the sternum in the second intercostal space. Hematoma was detected at the site of injury. Despite a decreased blood pressure (100/90 mmHg),

the patient was conscious with quite stable vital signs and a pulse rate of 90 bpm, respiratory rate of 20 bpm and oxygen saturation of 99% on room air. Murmur was bilaterally present, and slightly decreased in the left lung. The patient was free of dyspnea, cough, or hemoptysis. The complete blood count and routine biochemical tests revealed no abnormalities.

The unenhanced CT at emergency clearly showed the position of the knife. Specifically, a 24 cm long knife penetrated the left thoracic cavity at 1 cm close to the sternum in the second intercostal space. A 6-cm long blade penetrated between the pericardium and the left lung, close to the heart and large blood vessels, but did not cause injury to the heart and large blood vessels. There was hemopneumothorax in the left thoracic cavity (lung compression 20%), traumatic wet lung in the left lung and upper and lower lobes of the right lung, some soft tissue swelling in the left chest wall, Pneumatosis occurred in the subcutaneous soft tissue at the left cervical root (Fig. 1). During the examinations, the knife was prevented from moving to avoid further injury.

Given that the patient had stable vital signs and exhibited no injury to the heart and large blood vessels as revealed by CT, an exploratory thoracotomy was performed in the fourth intercostal space in combination with thoracoscopy, and the knife was removed under direct vision. The patient was so lucky that the knife penetrated between the pericardium and the left lung without causing any injury to the heart. Only slight laceration of the left upper lung lobe was noted, which was then repaired by sutures. The postoperative course was uneventful. On days 1, 4 and 5 after the operation, chest radiography showed some effusion of the left middle lower lung lobe. The chest tubes were removed on day 6 post operation. On day 13, the patient was out of danger and discharged.

Discussion

Most penetrating thoracic injuries are caused by knives, which cause tissue injury with sharp cutting edge or point. When the knife stabs into the mediastinum, it may damage important structures such as the heart, aorta, pulmonary artery, esophagus and trachea, and quickly becomes fatal^[4]. Therefore, thoracic trauma is usually associated with complications of lung contusion, cardiac tamponade, pneumomediastinum, esophageal injury, spinal cord injury, bone injury and vascular injury. Physical examination has limited use in the assessment of patients with penetrating thoracic trauma. Imaging tools play an important role in the diagnosis and classification of trauma patients^[5, 6]. Radiologists should be familiar with imaging of penetrating thoracic trauma and associated complications^[7].

CT has become the preferred method for evaluating patients with penetrating thoracic injury, which can further reveal hemodynamically stable but life-threatening injuries that are but otherwise not recognized on chest radiographs^[5]. The diagnostic rate of chest CT was 38%-81% higher than that of chest radiography. On the one hand, the most common radiographic manifestations of penetrating trauma are pneumothorax and hemothorax, both of which are highly sensitive to CT, even small amounts can be clearly displayed^[8]. On the other hand, the knife wound tracks through the lung can be well demonstrated by CT, especially when deep tissue, blood vessels or lung is suspected to be involved in the injury^[7].

Therefore, images should be examined in the bone and lung windows to precisely determine the extent of the wound and its relationship to the mediastinum. Furthermore, CT imaging of coronal and sagittal reconstructions can better describe the injury of lung, trachea, heart, great vessels, and the relationship with the knife. In addition, CT angiography (CTA) can be performed to assess active bleeding in stable patients with vascular damage^[7]. In general, CT is an optimal option for visualizing pulmonary contusion, pneumothorax, rib fractures and major vascular injuries caused by wound penetration. Moreover, CT has advantages of high accuracy, high sensitivity, high accessibility, low cost and time saving, which can provide information for further diagnosis and intervention.

The clinical manifestations of thoracic stab wounds are varied, from no intrathoracic injury to extensive injury of large vessels, even threatening life. In such cases, it is important to avoid iatrogenic injuries, especially those during transportation. Foreign bodies should be removed as soon as possible to prevent further damage to the heart^[9]. If there is a possible or a definite organ injury, liquid support should be given immediately and the patient should be moved to the operating room promptly. The general rule of treatment of penetrating trauma is to avoid deep exploration when assessing the wound site, do not take out the penetration object before accurate diagnosis, and be ready to intubate at any time to ensure the safety of the respiratory tract^[10].

Conclusions

What is lucky for the patient reported here is that there was no injury to important structures such as the heart and large blood vessels. CT can not only clearly display foreign bodies of knives, but also accurately judge the damage of important structures such as lungs, heart and great vessels, as well as abnormal gas and blood in the pleural-peritoneal cavity, mediastinum and subcutaneous tissue.

Abbreviations

CT: computed tomography

ED: emergency department

CTA: computed tomography angiography

Declarations

Availability of data and materials

Not applicable.

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Authors' Contributions

JL and XC performed and compiled the case and contributed to article writing. XZ was a major contributor in the image data. RW and XZ support and reviewed the report. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and consent to participate

The ethics committee of The Guizhou Provincial People's Hospital, approved the study.

Consent for publication

Written and informed consent was taken from the patient for publication of this case report and the associated images.

Competing interests

The authors declare that they have no competing interests.

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Figures

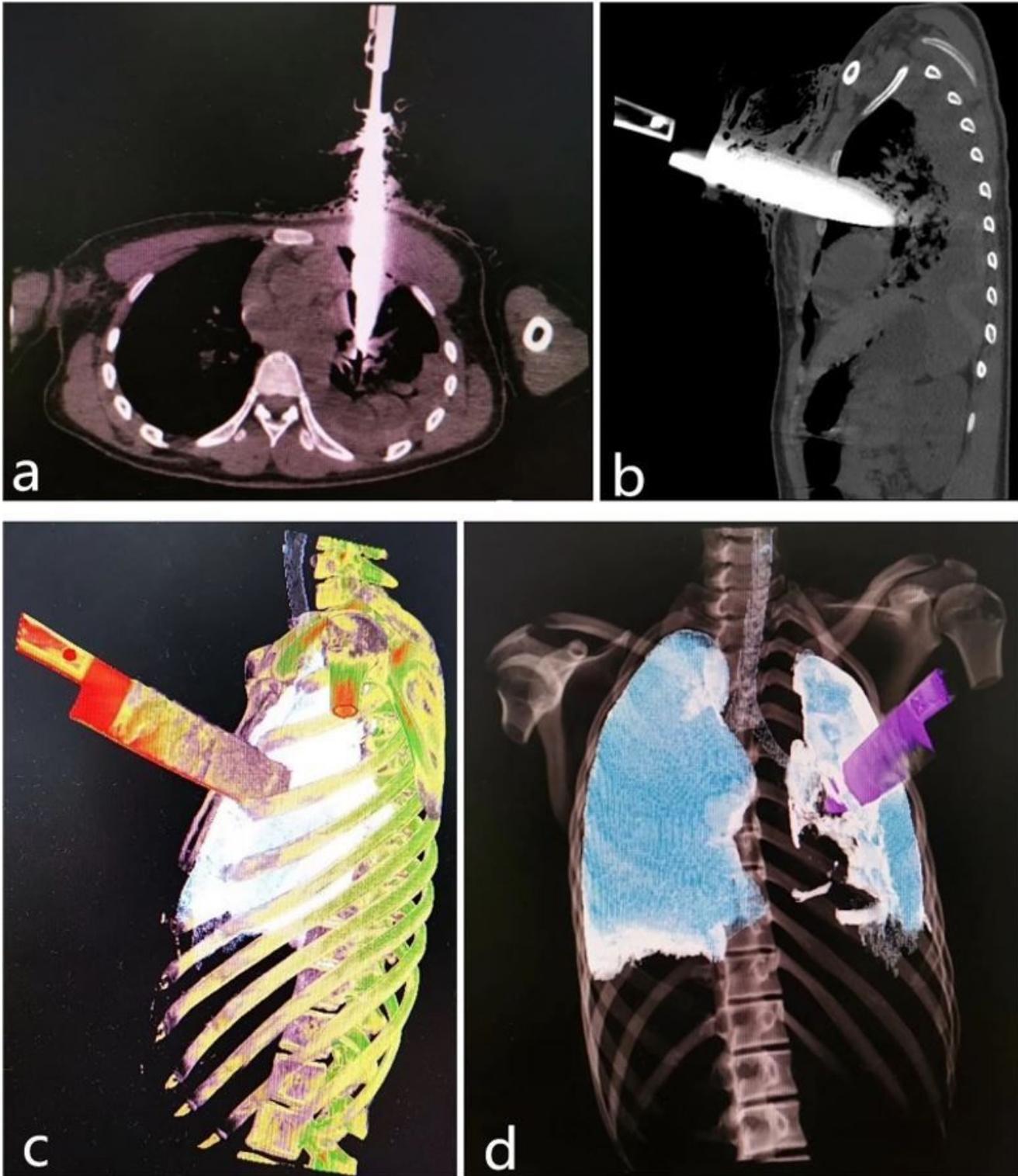


Figure 1

a. An axial computed tomography image demonstrating the trajectory of the knife. The knife penetrated between the pericardium and the left lung without heart injury, and was close to the adjacent heart and large blood vessels. b. A sagittal reconstruction CT image shows that the knife was located above the heart but without damage to the pericardium. c and d. The volume rendering technique images showed that the knife penetrated the left lung of the patient.

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