

An unusual complication of chest tube thoracostomy

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ABSTRACT: This paper describes a previously unreported complication of chest tube thoracostomy: scalpel blade dislodgement within the pleural space. Techniques and complications of chest tube thoracostomy are then discussed.

RÉSUMÉ : Le présent article décrit le cas d'une complication non signalée jusqu'à présent d'un déplacement dans l'espace pleural de la lame de scalpel utilisée pour une thoracotomie. Les techniques et les complications de la thoracotomie sont ensuite discutées.

Key words: scalpel, thoracostomy, pneumothorax, complications.

Case report

An obese 67-year-old man with asthma, angina and hypertension presented to the emergency department (ED) complaining of having had a “cold” for 2 days, wheezing for 18 hours and experiencing acute shortness of breath that began 2 hours prior to presentation. On examination, he was diaphoretic and had difficulty speaking. Vital signs included a respiratory rate of 33 breaths/min, pulse of 100 beats/min and blood pressure of 224/119 mm Hg. Oxygen saturation was 88% on room air and improved to 94% with 60% mask oxygen. There was audible wheezing, a tracheal tug and intercostal recession. Peak expiratory flow rate was 100 L/min and arterial blood gas analysis revealed a pH of 7.31, a PCO_2 of 59.3 mm Hg and a PO_2 of 95.6 mm Hg.

Initial asthma treatment included nebulized and intravenous (IV) salbutamol, IV aminophylline and IV hydrocortisone. Shortly thereafter, a rightward tracheal shift was noted, and diminished air entry in the left chest confirmed the diagnosis of tension pneumothorax. A 16-g cannula was inserted into the second left intercostal space at the mid-

clavicular line; however, no air was released and the patient failed to improve. Chest tube insertion was attempted but the patient's thick chest wall made it difficult to reach the pleural space with finger dissection. A surgical consultant was called, who subsequently used a scalpel to dissect to the intercostal space, but on removing the scalpel, its blade was missing.

After the procedure was completed, a chest radiograph revealed the scalpel blade lying within the pleural cavity (Fig. 1). Under local anesthesia in the operating room, a 3-cm incision was made below the chest tube's point of entry and laparoscopic graspers were used to push the blade through the intercostal muscles from within. The blade was then dissected out through another skin incision. The patient was admitted, the chest tube was removed after 48 hours and the patient was discharged home after 6 days.

Discussion

Tension pneumothorax is a life-threatening emergency. *Advanced Trauma Life Support (ATLS)* guidelines advocate immediate needle thoracocentesis with a 5-cm cannu-

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la, followed by chest tube insertion.¹ At the recommended thoracocentesis site (the 2nd intercostal space in the mid-clavicular line), chest wall thickness ranges from 1.3 to 5.2 cm.² In obese patients, a short cannula may fail to reach the pleural space; therefore, unsuccessful needle thoracocentesis should be followed by insertion of a longer cannula or definitive chest tube placement.³

Chest tube thoracostomy is a common ED procedure and an essential treatment for patients with tension pneumothorax, but complications occur in 1% to 36% of patients.⁴⁻⁸ Early complications include tube malposition, kinking, clogging, dislodgement, subcutaneous emphysema, persistent pneumothorax and intercostal nerve, artery or vein injury.¹⁹ Direct trauma to the lung, heart, aorta, pulmonary artery or vein, oesophagus, sympathetic trunk, long thoracic nerve, phrenic nerve, thoracic duct, diaphragm, stomach, spleen, liver and hepatic vein have been also been reported.¹⁰⁻¹⁷

Lung lacerations are more common in patients with decreased pulmonary compliance¹⁸ and are also more common with the use of a trocar — a practice that should be, and has largely been, abandoned.^{4,9} Perforation of the heart or great vessels mandates immediate sternotomy or thoracotomy prior to removal of the chest tube. Tube occlusion is more likely with small calibre chest drains,¹⁹ and an occluded tube may result in persistent or recurrent tension. Tachycardia, tachypnoea, reduced breath sounds, hypoxia, hypotension, tracheal shift and lack of “swing” on respiration are indicators that an additional tube should be inserted.

Laceration of intrathoracic organs can be avoided by using

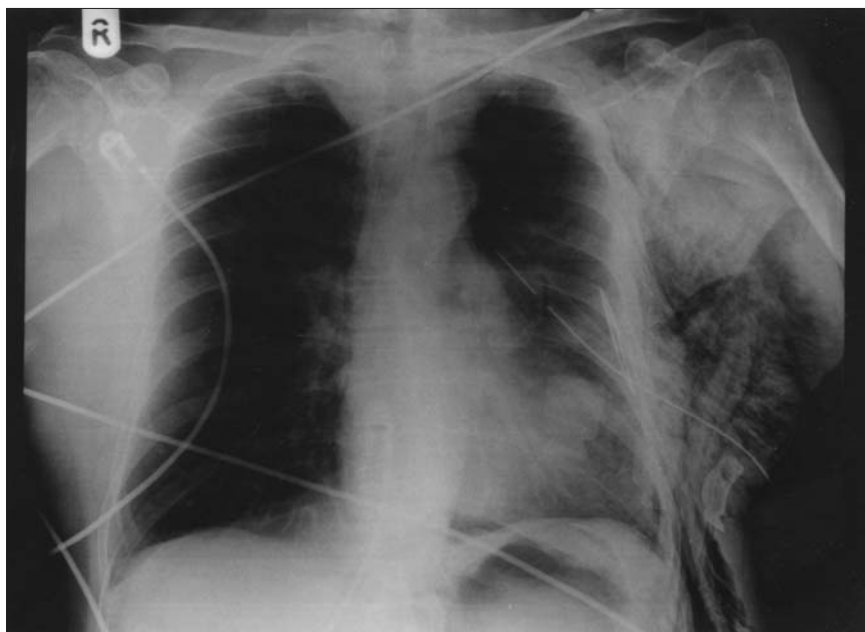


Fig. 1. Chest radiograph showing intrapleural scalpel blade within left hemi-thorax and subcutaneous emphysema.

the finger sweep technique to ensure no vital structures are adherent to the chest wall in the vicinity of the oncoming tube.¹ Laceration of abdominal organs can be prevented by using a high approach and inserting the chest tube at or above the intermammary line in the 4th or 5th intercostal space. An effective method is to place the skin incision in the 5th or 6th intercostal space, then tunnel up over the rib and insert the tube through the next higher interspace.

Many physicians are unaware that excessively high apical tube placement may cause phrenic neurapraxia and diaphragmatic paralysis. If this complication is recognized early and the tube withdrawn a few centimetres, restoration of nerve and diaphragmatic function is possible.¹⁰

Although some suggest placing tubes through the second intercostal space at the anterior mid-clavicular line, this approach is more difficult, may cause disfiguring scars and provides sub-optimal fluid drainage.¹⁷

Late complications of tube thoracostomy include persistent air leak, residual pneumothorax, pleural effusion and empyema. Empyema, the most common late complication associated with thoracostomy after blunt trauma, occurs in up to 2.4% of patients⁴ and is associated with prolonged tube placement or multiple chest tubes on the same side.⁷ Of interest, there is no evidence that the common practice of administering prophylactic antibiotics prevents empyema.

The complications described are most likely in the presence of shock, mechanical ventilation and pre-existing pleural or parenchymal lung disease. Intensive care unit (ICU) patients are especially at risk,^{4,20} and complication rates in ICU patients may be as high as 31%.²⁰ Low complication rates are reported for emergency physicians,⁵ pulmonologists⁶ and surgeons,²⁰ and chest tube placement in the ED is not associated with higher complication rates.⁵

It seems likely that, in our patient, the scalpel blade was incorrectly attached to its handle and was siphoned into the chest cavity during the procedure. The lost scalpel blade had the potential to cause significant morbidity; therefore an additional invasive procedure was performed.

Conclusion

Chest tube thoracostomy is an invasive procedure that carries potential morbidity. The complication described here could have been avoided by using a non-detachable scalpel blade or by using the

scalpel only to incise the skin, then performing blunt dissection through the intercostal muscles and pleural membrane. This and similar complications related to inadequate equipment or preparation are preventable by ensuring the availability of pre-prepared equipment trays and by adhering to procedural protocols such as those suggested in the *ATLS* guidelines. The authors believe that all physicians attempting chest tube thoracostomy should be familiar with *ATLS* guidelines and should participate in supervised training.

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