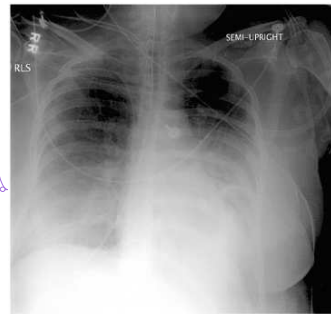


- The detection of pleural effusion or pneumothorax in the critically ill patient is often a subtle finding on clinical examination and even on chest radiography.
- A pleural effusion may not be seen on the supine chest radiograph because a diffuse alveolar infiltrate may silhouette the posterior layering of pleural fluid; the effusion may be misinterpreted by the physician as an underexposed film or attributed to objects outside the chest.
- Pneumothorax may not be detected in the supine patient because pleural air is situated anteriorly and will not produce the diagnostic visceral pleural line seen on upright radiographs.
- When a pneumothorax develops in the setting of positive-pressure ventilation, it can be a life-threatening event, and appropriate action should be taken without delay to prevent a tension pneumothorax.

Signs of pneumothorax & pleural effusion in the supine CXR

Pleural Effusion	Pneumothorax
<500 mL fluid (small)	Hyperlucency in anteromedial and subpulmonic recesses (64%)
Homogeneous density over lower lung zone	
Veil appearance to lung	Visualization of visceral pleural line (rare)
Lung markings not obliterated	Deep sulcus sign
Air bronchograms absent	Tension pneumothorax
500 to 1000 mL fluid (moderate)	Increased volume of hemithorax
Silhouetting of diaphragm	Depression of hemidiaphragm
Apical capping	Widening of intercostal spaces
1000 to 3000 mL fluid (large)	Contralateral tracheal deviation
Silhouetting of diaphragm	
(A) Contralateral mediastinal shift	
>3000 mL fluid (massive)	
Opacification of the hemithorax	
Contralateral mediastinal shift	



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A semi-upright anteroposterior chest radiograph shows bilateral alveolar infiltrates and pleural fluid veiling consistent with pleural effusions.

chest x-ray findings

- A common and often problematic diagnostic dilemma is the differentiation of an empyema from a lung abscess. Radiographic clues that are helpful in making this differentiation include the following:
  - Bronchovascular markings are displaced by an empyema and obliterated by a lung abscess.
  - An empyema crosses major lobar boundaries, whereas a lung abscess conforms to segmental or lobar boundaries.
  - An empyema forms an obtuse angle and a lung abscess forms an acute angle with the chest wall.
  - A lung abscess has a spherical shape and equal length of the air-fluid level in both frontal and lateral views, whereas the air-fluid level of an empyema is longer in one of the two projections.
  - The air-fluid level of an empyema extends to the periphery of the lung.
  - The edge of a lung abscess tends to be indistinct from the surrounding lung, whereas the edge of an empyema is sharply defined.

General

- Most critically ill patients in the ICU have poor underlying cardiopulmonary reserves and may be unable to tolerate even a minimal pneumothorax.

Iatrogenic pneumothorax:

- In nonventilated patients who sustain an iatrogenic pneumothorax after placement of a CVC, close observation and supplemental oxygen are recommended in those who have minimal symptoms and a small (<15%) pneumothorax. If a patient is more symptomatic or has a larger pneumothorax (>15%), placement of a small-bore chest tube is recommended. In the ACCP consensus statement, the distance between the chest wall and visceral pleural surface can be used in substitution of the percent of lung collapse. Based on these guidelines, observation is done for a pneumothorax of less than 3 cm and pleural drainage is required for 3 cm or greater of lung collapse.

Persistent pneumothorax:

- Pneumothorax is defined as persistent when it lasts more than 10 days, while treated uninterruptedly by tube thoracostomy with underwater seal, with or without suction.
- The most common cause of persistence is bronchopleural fistula; other causes include formation of fibrinous peel over the lung, pleural adhesions, bronchial or pulmonary tear due to trauma, and bronchial obstruction.
- The possibility of obstruction mandates bronchoscopy to rule out mucus plugs, tumor, or a foreign body. Extraction of the foreign body or aspiration of bronchial secretions will nearly always result in immediate expansion of the lung.
- Other causes of persistence are best sought by inspection of the pleura at thoracoscopy.

management of pneumothoraces in intensive care

pleural disease

general

- Pleural disease as a primary reason for admission to the ICU is relatively uncommon.
- These instances include unilateral or bilateral large pleural effusions causing respiratory failure, hemothorax requiring intensive monitoring for rate of bleeding and hemodynamic status, empyema with associated sepsis, and secondary spontaneous pneumothorax causing respiratory insufficiency and tension physiology.
- Pleural complications of diseases and procedures performed in the ICU are common and may even be overlooked in the critically ill patient; they are often overshadowed by the major presenting illness that is the reason for admission to the ICU.

causes of pleural effusion

Medical ICU	Surgical ICU
Atelectasis	Atelectasis
Congestive heart failure	Congestive heart failure
Pneumonia	Duropleural fistula
Hypoalbuminemia	Pneumonia
Pancreatitis	Pancreatitis
ARDS	Hypoalbuminemia
Pulmonary embolism	Coronary artery bypass surgery
Hepatic hydrothorax	ARDS
Esophageal sclerotherapy	Pulmonary embolism
Postmyocardial infarction	Esophageal rupture
Iatrogenic	Hemothorax
	Chylothorax
	Abdominal surgery
	Iatrogenic

causes of pneumothorax

Spontaneous	Iatrogenic
<b>Primary</b>	Barotrauma
No clinical lung disease	Mechanical ventilation
<b>Secondary</b>	Procedure-related
Clinical presence of lung disease	Central venous catheter placement
Airway diseases	Thoracentesis
COPD	Endotracheal intubation
Status asthmaticus	Tracheostomy
Cystic fibrosis	Cardiopulmonary resuscitation
Interstitial lung diseases	Bronchoscopy
Langerhans' cell histiocytosis	Nasogastric tube placement
Usual interstitial pneumonitis	<b>Trauma</b>
Stage IV sarcoidosis	Blunt chest trauma
Pulmonary Infections	Penetrating chest trauma
<i>Pneumocystis carinii</i>	Rib fractures
Necrotizing pneumonia	Esophageal rupture
Tuberculosis	Tracheobronchial injuries
Lung abscess	
Diffuse alveolar damage	
ARDS	