

NOTES

PLEURA & PLEURAL SPACE

GENERALLY, WHAT IS IT?

PATHOLOGY & CAUSES

- Conditions that adversely affect the function of the chest wall, pleura, and lungs resulting in impaired ventilation and oxygenation
 - **Pleural effusion:** abnormal accumulation of fluid in the potential space between the visceral and parietal pleura (pleural space)
 - **Pneumothorax:** presence of air or gas in the space between the thoracic wall and the lung (pleural cavity)

COMPLICATIONS

- Mediastinal shift → impaired cardiovascular function

SIGNS & SYMPTOMS

- See individual disorders

DIAGNOSIS

DIAGNOSTIC IMAGING

Chest X-ray, CT scan, thoracic ultrasound

LAB RESULTS

- Pleural effusion
 - Analysis of pleural fluid confirms etiology

TREATMENT

SURGERY

- Pleural effusion
 - Thoracentesis
- Pneumothorax
 - Needle chest decompression, chest tube

PLEURAL EFFUSION

osms.it/pleural-effusion

PATHOLOGY & CAUSES

- Excess fluid accumulates in pleural space
- Lung expansion limited → impaired ventilation

Origin

- Hydrothorax (serous fluid), hemothorax (blood), urinotorax (urine), chylothorax/lymphatic effusion (chyle), pyothorax (pus, AKA empyema)

Pathophysiology

- Transudative pleural effusion
 - Pressure driven filtration: ↑ hydrostatic pressure/↓ oncotic pressure → force imbalance, fluid extravasation → fluid leaks across intact capillary membranes
 - Alteration in Starling forces
- Exudative pleural effusion
 - Local inflammatory processes → leaky capillaries

CAUSES

- Transudative
 - Congestive heart failure, liver cirrhosis, severe hypoalbuminemia, nephrotic syndrome, acute atelectasis, myxedema, peritoneal dialysis, Meigs syndrome, obstructive uropathy, end-stage renal disease
- Exudative
 - Infection, malignancy, trauma, pulmonary infarction, pulmonary embolism, autoimmune processes, pancreatitis, ruptured esophagus

SIGNS & SYMPTOMS

- Asymptomatic (if small)
- Pleuritic chest pain
- Dyspnea
 - Worse when lying down (orthopnea)

DIAGNOSIS

DIAGNOSTIC IMAGING

Chest X-ray

- Fluid occupies space between visceral, parietal pleural
- Area of whiteness on standard posteroanterior (PA) chest X-ray
- Blunted costophrenic angles
- Greater density than rest of lung → gravitates towards dependent regions
 - ↑ fluid on upright X-ray or lateral decubitus X-ray

Lung ultrasound

- Confirms presence of effusion and detects pleural fluid septations

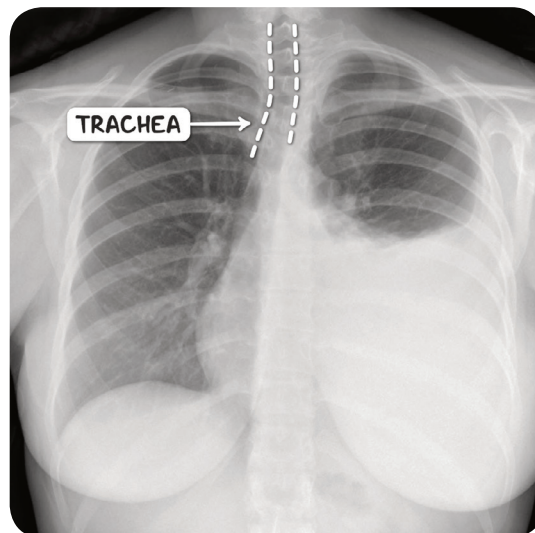


Figure 128.1 A plan chest radiograph demonstrating a large left sided pleural effusion, in this case as a consequence of metastatic melanoma. There is notable tracheal deviation.

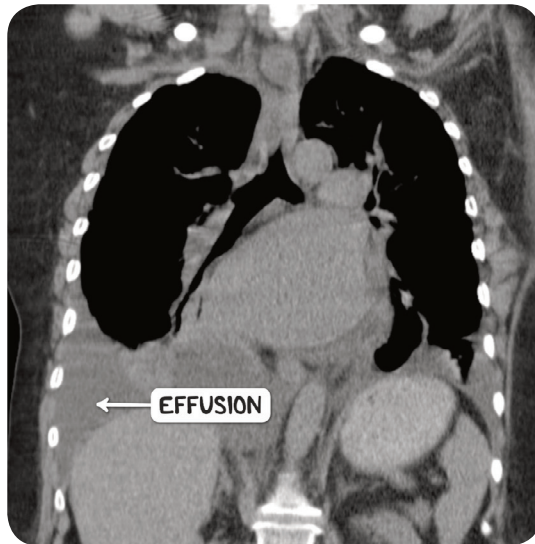


Figure 128.2 A CT scan of the chest in the coronal plane demonstrating a right sided pleural effusion.

LAB RESULTS

Thoracentesis

- Needle inserted through chest wall, 5th–8th intercostal space, midaxillary line → pleural space → withdraw fluid
- Trial diuresis for three days in heart failure before thoracentesis
- Effusion analysis
 - **Amylase:** pancreatitis, esophageal perforation, malignancy
 - **Blood:** traumatic, malignancy, pulmonary embolism with infarction, tuberculosis
 - **Cholesterol:** chylous (lymphatic fluid) vs. chyliform effusion (chyle-like fluid from chronic disease)
 - **Cytology:** malignancy, infection (reactive effusion)
 - **Differential cell count:** lymphocytic effusion in tuberculosis, cancer, lymphoma
 - **Glucose (low):** rheumatoid arthritis, tuberculosis, empyema, malignancy
 - **Microscopy, culture:** microorganisms
 - **pH:** empyema, tuberculosis, mesothelioma
 - **Protein, LDH:** transudative/exudative

- **Rheumatoid factor, antinuclear antibody, complement:** collagen vascular disease
- **Triglycerides:** chylothorax from thoracic duct leakage (trauma, cancer, lymphoma)

OTHER DIAGNOSTICS

- Medical history

Clinical examination

- ↑ fluid on affected side
 - ↓ chest expansion
 - Stony **dullness to percussion**
 - **Diminished breath sounds**
 - ↓ vocal resonance, **fremitus**
 - **Tracheal deviation** away from effusion
- If lung compressed above effusion
 - Bronchial breathing, egophony

Light's criteria

- Classification of transudative/exudative effusion
- Transudative
 - Difference between albumin in blood, pleural fluid > 1.2g/dL
- Exudative
 - Ratio of pleural fluid protein to serum protein > 0.5
 - Ratio of pleural fluid LDH to serum LDH > 0.6
 - Pleural fluid LDH > 0.6, $\frac{2}{3}$ times lab specific upper limit for serum

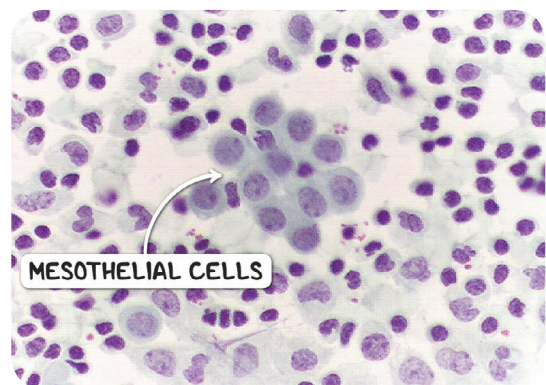


Figure 128.3 The cytological appearance of a benign pleural effusion. There are numerous bland mesothelial cells mixed with lymphocytes.

PROPERTIES OF TRANSUDATIVE & EXUDATIVE FLUIDS

	TRANSUDATE	EXUDATE
PRIMARY CAUSES	Raised hydrostatic pressure, ↓ colloid osmotic pressure	Inflammation mediated increase in vascular permeability
APPEARANCE	Clear	Cloudy
SPECIFIC GRAVITY	< 1.012	> 1.012
FLUID PROTEIN : SERUM PROTEIN	< 0.5	> 0.5
SERUM [ALBUMIN] – EFFUSION [ALBUMIN]	> 1.2g/dL	< 1.2g/dL
FLUID LDH VS. UPPER SERUM LIMIT	< 0.6 or $\frac{2}{3}$	> 0.6 or $\frac{2}{3}$

TREATMENT

SURGERY

- Therapeutic aspiration
- Insertion of intercostal drain
- Repeated effusions
 - *Surgical pleurodesis*: obliteration of pleural space; prevents fluid accumulation

OTHER INTERVENTIONS

- Supplemental oxygen
- Repeated effusions
 - *Chemical pleurodesis*: obliteration of pleural space; prevents fluid accumulation (talc, bleomycin, tetracycline/doxycycline)
- Pleural catheter
 - User-operated daily draining
- Treat underlying cause

PNEUMOTHORAX

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PATHOLOGY & CAUSES

- Abnormal collection of air in pleural cavity
- Air enters through damage to chest wall/ lung/gas-producing microorganisms
 - Positive pressure in pleural space if air enters → lung partial/complete collapse

TYPES

Primary pneumothorax

- No clear cause/no preexisting lung disease
 - Secondary to ruptured blebs (small sacs of air on lung surface)

Secondary pneumothorax

- Occurs with existing lung disease

Tension pneumothorax

- One-way valve formed by damaged tissue → air enters, can't escape → intrathoracic pressure builds up → impaired cardiac, respiratory function

Traumatic pneumothorax

- Follows physical trauma to chest (e.g. blast injury); result of medical procedure (e.g. iatrogenic pneumothorax)

RISK FACTORS

- Smoking, chronic obstructive pulmonary disease (COPD), asthma, tuberculosis
- More common in individuals who are biologically male
- Changes in atmospheric pressure
- Family history of pneumothoraces

SIGNS & SYMPTOMS

- Sharp chest pain (one-sided)
- Dyspnea
- Tachycardia
- Cyanosis
- Hypercapnia → confusion, coma
- Diminished/absence of breath sounds (affected side)
- Hyperresonance to percussion
- ↓ vocal, tactile fremitus
- Trachea displaced away from affected side
- Tension pneumothorax
 - ↓ blood pressure
 - ↓ oxygen saturation
 - Epigastric pain
 - Displaced apex beat
 - Distended neck veins

DIAGNOSIS

DIAGNOSTIC IMAGING

Chest X-ray/CT scan

- Identifies atypical collections of gas, changes in lung markings, presence of mediastinal shift and/or tracheal deviation; lucent/dark lung field, deep sulcus sign (a deep costophrenic angle)

Ultrasound

- Reverberation echoes of the pleural line, absence of lung sliding at the pleural line

OTHER DIAGNOSTICS

- Clinical history, physical examination

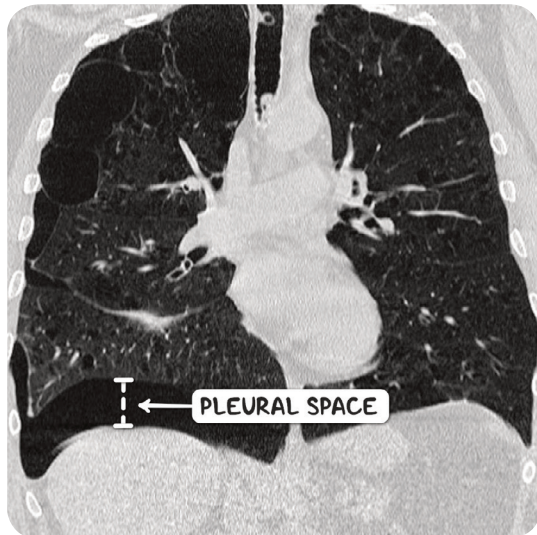


Figure 128.4 A CT scan of the chest in the coronal plane demonstrating a right-sided pneumothorax.

TREATMENT

SURGERY

Pleurodesis/pleurectomy

- Repeated pneumothoraces

Tension pneumothorax: needle chest decompression

- AKA needle thoracostomy
- Emergency procedure
- Not definitive, improves cardiopulmonary function

- Large bore intravenous catheter needle inserted into pleural space
 - *Midclavicular line*: second/third intercostal space
 - *Anterior/mid axillary line*: fifth intercostal space
 - Listen for air escaping
 - Remove needle, leave catheter in place
- May cause injury, reserve for
 - Mechanism of injury suggestive of pneumothorax
 - Clinical signs of respiratory distress, persistently low oxygen saturation despite supplemental oxygen
 - Hemodynamic instability
 - Prolonged transport time

OTHER INTERVENTIONS

- Supplemental oxygen
 - Improves rate of pneumothorax reabsorption
- Small pneumothoraces may resolve spontaneously
- If wound present, cover with dressing
 - Dressing secured on three sides to create “vent dressing”
- **Chest tube** (connected to water-seal drainage system)
 - Inserted into “safe triangle,” damage to internal organs avoided
 - Horizontal line, nipple to lateral chest wall; between latissimus dorsi, pectoralis major