PLEURAL EFFUSION

Definition: Accumulation of fluid in the pleural space that exceeds the physiological amounts (10 – 20ml).

<table>
<thead>
<tr>
<th>Epidemiology</th>
<th>Causes of pleural effusion</th>
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<tbody>
<tr>
<td></td>
<td>Transudative</td>
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<tr>
<td>Infection</td>
<td>Liver cirrhosis.</td>
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<tr>
<td>Malignant</td>
<td>CHF.</td>
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<tr>
<td>CHF</td>
<td>Nephrotic syndrome.</td>
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<tr>
<td>PE</td>
<td>P.E.</td>
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<tr>
<td>Idiopathic</td>
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Differentiation of transudates and exudates (Light's Criteria)

<table>
<thead>
<tr>
<th>Transudates</th>
<th>Pleural Fluid</th>
<th>Exudates</th>
</tr>
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<tbody>
<tr>
<td>&lt; 0.5</td>
<td>Pleural/serum Protein</td>
<td>&gt; 0.5</td>
</tr>
<tr>
<td>&lt; 0.6</td>
<td>Pleural/serum LDH</td>
<td>&gt; 0.6</td>
</tr>
<tr>
<td>&lt; 2/3 the upper limit for serum</td>
<td>Pleural LDH</td>
<td>&gt;2/3 the upper limit for serum</td>
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Transudative Causes

- Liver Cirrhosis & Nephrotic Syndrome: Hypoalbuminemia, ↑ hydrostatic pressure of pleural capillaries
  - Transudate: Rt HF → ↑ syst. veins pressure → ↑ hydrostatic pressure of the capillary → ↑ formation, ↓ drainage.
  - Exudates: Pulmonary Infarction, Altered permeability of pleural membranes, ↑ capillary permeability & vascular disruption.

Exudative Causes

1) Para pneumonic effusions:
   - Altered permeability of pleural membrane.
   - Activation of mesothelial cells and neutrophils.
   - Protein-rich fluid enters the pleura.
   - Exudative → organizing.

2) Malignant pleural effusions:
   - Malignant cells → pleural surface → autocrine growth factors and angiogenesis.
   - ↑ vascular permeability, angiogenesis.
   - Lymphatic obstruction.

3) Pancreatitis:
   - Direct contact with diaphragm.
   - Pancreatitis ascites → diaphragm defects.

4) Rupture esophagus:
   Acute mediastinitis pleural inflammation.

5) Collagen dis & immunological dis.
   Inflammation of the pleural membrane → ↑ permeability.

6) Uremia:
   - CHF. - ↑ infection.
   - Association SLE. - P.E
   - Pleurisy.

7) Para malignant pleural effusions:
   - Local effects of the tumor:
     - Lymphatic obst.
     - SVC obst.
     - Bronchial obst with pneumonia or atelectasis.
   - Systemic effect of the tumor:
     - PE: hypercoagulable state.
     - Hypoalbuminemia.
   - Complication of therapy:
     i. Radiation:
        - Early → Pleuritis.
        - Late → fibrosis of mediastinum.
     ii. Chemotherapy

8) Chylothorax:
   - Rupture of thoracic duct or impairment of thoracic lymphatic flow.
   - Chyle leakage from:
     - Thoracic duct or its tributaries.
     - Extravasation from lymphatics.
     - Chyle ascites → diaphragm defects.
   - Pseudochylothorax: Cholesterol-rich from degenerated pleural cells of chronic effusion.
Diagnosis of Pleural Effusion

1) Clinical manifestations

<table>
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<tr>
<th>Symptoms</th>
<th>General</th>
<th>Signs</th>
<th>Local</th>
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<tbody>
<tr>
<td>15% asympto!</td>
<td>RR, HR (N or ↑)</td>
<td>Pleural friction rub.</td>
<td></td>
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<tr>
<td>Chest pain.</td>
<td>Congested neck vein, S3 gallop, peripheral edema.</td>
<td>&gt; 300 ml → detected on clinical exam.</td>
<td></td>
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<tr>
<td>Dyspnea.</td>
<td>Thrombophlebitis → PE.</td>
<td>Stony dullness.</td>
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<tr>
<td>Dry cough.</td>
<td>LN → neoplasm.</td>
<td>Massive eff → displace mediastinum.</td>
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<tr>
<td>Others</td>
<td>HSM, ascites (liver disease).</td>
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2) Radiological

<table>
<thead>
<tr>
<th>Chest x-ray</th>
<th>Ultrasound</th>
<th>CT scan</th>
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<tr>
<td>1) Costophrenic angle:</td>
<td>Echo-free space between chest wall and lung parenchyma.</td>
<td>Useful in: Parenchymal lung disease, lung hidden behind pleural effusion, mediast LN.</td>
</tr>
<tr>
<td>o &lt; 200 → lateral decubitus view.</td>
<td>10-50 ml.</td>
<td>Pleural fibrosis – nodules (thickened pleura with irregular nodular internal border → mesothelioma)</td>
</tr>
<tr>
<td>o 200 ml → lateral view.</td>
<td>Loculated pleural effusion.</td>
<td>Other studies: PE: Spiral CT.</td>
</tr>
<tr>
<td>o 300 – 600 → P.A view.</td>
<td>Optimal point for thoracocentesis.</td>
<td></td>
</tr>
<tr>
<td>2) Subpulmonic effusion.</td>
<td>↑ yield of pleural biopsy.</td>
<td></td>
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<tr>
<td>3) Encysted effusion.</td>
<td></td>
<td></td>
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<tr>
<td>4) Fissural effusion.</td>
<td></td>
<td></td>
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<tr>
<td>5) Consolidation, tumor mass or pleural calcifications.</td>
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Right lateral decubitus view of a pleural effusion.

Interlobar effusion

Asbestos-related Pleural Plaques

Pleural Calcification

MESOTHELIOMA
3) Pleural fluid analysis

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<tr>
<th>Gross picture</th>
<th>Microscopic features</th>
<th>Differential:</th>
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<td>• Transudate: clear – pale with only a yellow tint.</td>
<td>• Total WBCs: 1000/cmm3 roughly diff between transudate and exudates.</td>
<td>• PMNL – acute condition (pneumonia, PE).</td>
</tr>
<tr>
<td>• Exudates: deep yellow, turbid, cloudy.</td>
<td>• WBCs &gt; 10,000 → empyema, para-pneumonic eff.</td>
<td>• Lymphocytes → TB or malignancy.</td>
</tr>
<tr>
<td>• Empyema: opaque and viscous.</td>
<td></td>
<td>• Eosinophils (&gt; 10%) benign inflam lesion.</td>
</tr>
<tr>
<td>• Amoebic liver abscess → brown .</td>
<td></td>
<td>1) PE</td>
</tr>
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<td>• Anaerobic infection → Putrid.</td>
<td></td>
<td>2) Pneumonia → good prognostic sign</td>
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<td>• Haemorrhagic effusion → traumatic, PE, Tumor, TB, blood disease.</td>
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**Biochemical analysis**

1) **pH:**
- Normally more alk.
- Transudate: pH 7.30 to 7.40.
- Exudate pH < 7.30.
- Useful in tube decision.

2) **Specific gravity:** Trans < 1016, exudates >.

3) **Proteins:**
   - Exudate: -total P fluid / total serum > 0.5.
   - total P fluid > 3 g/dl.
   - Parapneum. 3.5 g/dl – 6 g/dl.

4) **Glucose:**
- Normally = plasma level.
- < 60 mg/dl: TB
- < 40 mg/dl in para-pneumonia → ICT.

**Enzymes**

a) **LDH:**
- Pl fluid LDH > 200 → exudates.
- Pl fluid LDH / serum LDH > 0.6 exudate
- LDH > 1000 U/L → parapneumonic & Rhd.

b) **Amylase** ↑ in:
- Pancreatitis. (↑ pancreatic amylase).
- Pancreatic pseudocyst with pl fistula (↑ pancreatic amylase).

c) **ADA** ↑ in:
- All TB patients.
- Most empyema.

**Culture and bacteriological examination:**
- Gram stain – ZN stain positive only in 25%
- Culture for bacterial (aerobic, anaerobic), mycobacteria and fungi.

**Cytological examination:**
- Mesothelial cells absent in TB & parapneumonic effusion.
- Malignant cells.
- Diagnostic sensitivity 62 – 90%.

**Pleural biopsy (closed needle biopsy)**
- If pleural cytology fails to diagnose Pl.Eff.
- Abram’s or Cope’s needle.
- In malignant pl effusion yield 40 – 50%, TB → 80%.
- 2nd biopsy ↑ positive by 10 – 40%.
- Treatment of Pleural Effusion

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**Immunologic studies:**
- Tests for collagen vasc disease:
  - Pleural fluid:
    - LE cells → SLE
    - Rhd fact → ↑ Rhd.

**Tumor markers**

**Medical thoracoscopy**
- The gold standard for diagnosis of Pl.Eff.
- After pl cyto –ve ± pl biopsy –ve
- Diagnostic yield 97-100%.