**Pleural empyema**
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Pleural empyema (pyothorax) is a purulent infection in the pleural space. Pyopneumothorax – purulent effusion plus air in the pleural space.

**Diagnostic criteria of pleural empyema:**
- purulent pleural effusion
- positive Gram stain
- positive pleural fluid culture

Complicated pleural effusion:
- exudate pH < 7.0
- glucose < 2.2 mmol/l

**Causes of pleural empyema**
- Pneumonia
- Chest trauma
- Thoracic operations
- Thoracentesis, pleural drainage
- Esophageal perforation
- Mediastinitis
- Subphrenic abscess

**Microbiology of pleural empyema**
- Bacteria
  - aerobes (streptococci, staphylococci)
  - anaerobes
- Mycobacteria (tuberculous empyema)
- Fungi
- Parasites (endemic)
  - amoebiasis, echinococcosis, paragonimiasis

**Risk factors of pleural empyema**
- Alcohol abuse
- Diabetes
- Bad oral hygiene
- Aspiration (GERD, seizures)
- Immune deficiency (HIV)

**Causes of pleural empyema**

<table>
<thead>
<tr>
<th>Condition</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>22</td>
<td>47.8</td>
</tr>
<tr>
<td>Bilateral pneumonia</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Necrotizing pneumonia</td>
<td>6</td>
<td>13.0</td>
</tr>
<tr>
<td>Bilateral necrotizing pneumonia</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td>Blunt chest trauma</td>
<td>5</td>
<td>10.9</td>
</tr>
<tr>
<td>Penetrating stab wound of the chest</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td>Gunshot chest wound</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Thoracotomy and lung resection</td>
<td>3</td>
<td>6.5</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>6.5</td>
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<tr>
<td>TOTAL:</td>
<td>46</td>
<td>100</td>
</tr>
</tbody>
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*(Laisaar et al. Eesti Arst 1997)*
Development of parapneumonic empyema:
dry pleurisy
I - exudative stage
II - fibrinopurulent stage
III - organizing stage
Duration of stages may vary and evolution from one stage to another is continuous process, therefore it is sometimes difficult to establish the exact stage of the disease

Symptomatology of pleural empyema
- Fever, chills, sweating
- Chest pain
- Cough with purulent sputum
- Dyspnea
- Weakness, loss of appetite

Bronchopleural fistula
- Cough with large amount of purulent sputum

Pleurocutaneous fistula
- Usually in case of postoperative pleural empyema
- Purulent discharge from the surgical chest wound

Diagnostics of pleural empyema
- Radiological examinations
  - X-ray
  - Ultrasound
  - CT
- Thoracentesis
  - Pus in pleural cavity
  - Low pH and glucose

Figure 1. Posteroanterior and lateral chest X-ray of a patient with left-sided pleural empyema
Figure 2. Chest CT of a patient with right-sided multiloculated pleural empyema.

**Treatment of pleural empyema**

**Aim of the treatment:**
- evacuate all purulent effusion from the pleural space
- achieve full re-expansion of the lung (no residual space)

**Treatment steps of pleural empyema:**
- Antibacterial therapy
- Pleural drainage
  - Multiple chest tubes if necessary
  - Ultrasound or CT guided pleural drainage
- Intrapleural fibrinolytic therapy
  - Streptokinase, urokinase, alteplase
  - Repeated instillations if necessary
- Surgical treatment

**Intrapleural fibrinolytic therapy**
- 250,000 units of streptokinase is diluted in 100 ml saline solution
- Administered intrapleurally through the chest tube
- Chest tube clamped for 3 hours
- Streptokinase is administered once daily

**Response to therapy is evaluated by:**
- amount of discharge from the chest tube
- serial radiological investigations
- clinical recovery of the patient

**Surgical treatment of pleural empyema**

**Indications:**
- multiloculated empyema
- bronchopleural fistula
- esophageal perforation
o infected residual pleural space
o extensive pleural thickening
o septic state due to empyema despite of pleural drainage and AB therapy
o foreign body causing pleural empyema
o clotted/suppurated hemothorax

Video-assisted thoracoscopic treatment of pleural empyema
  o adhesiolysis
  o debridement
  o drainage

Thoracotomy for pleural empyema
  o lung decortication and parietal pleurectomy
  o empyemectomy
  o lung resection when needed ⇔ pleuropneumonectomy

Treatment of postoperative empyema
  o Thoracoplasty
  o Myoplasty, omentoplasty
  o Open-window thoracostomy

Summary:
  o Pleural empyema has several different causes
  o Microbiological diagnosis is very important to give proper therapy
  o Early treatment gives better results and allows to use less invasive treatment methods
  o Multiloculated pleural effusion or stage III empyema is indication for surgical treatment