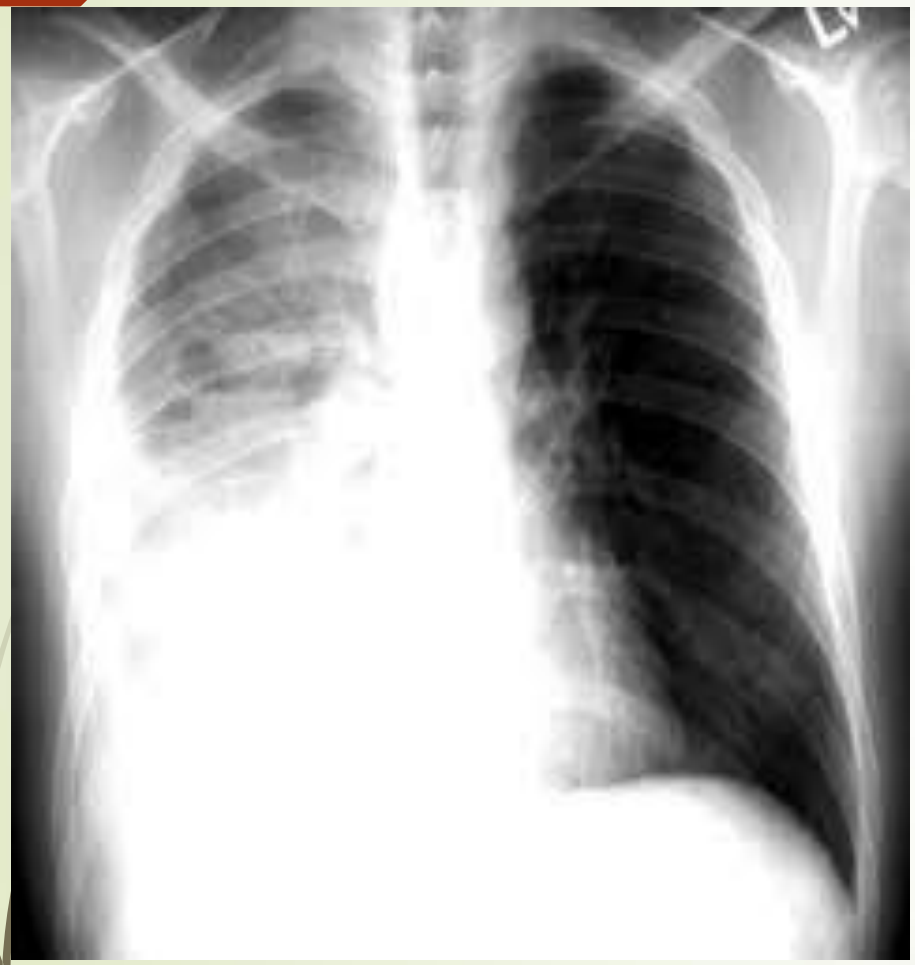
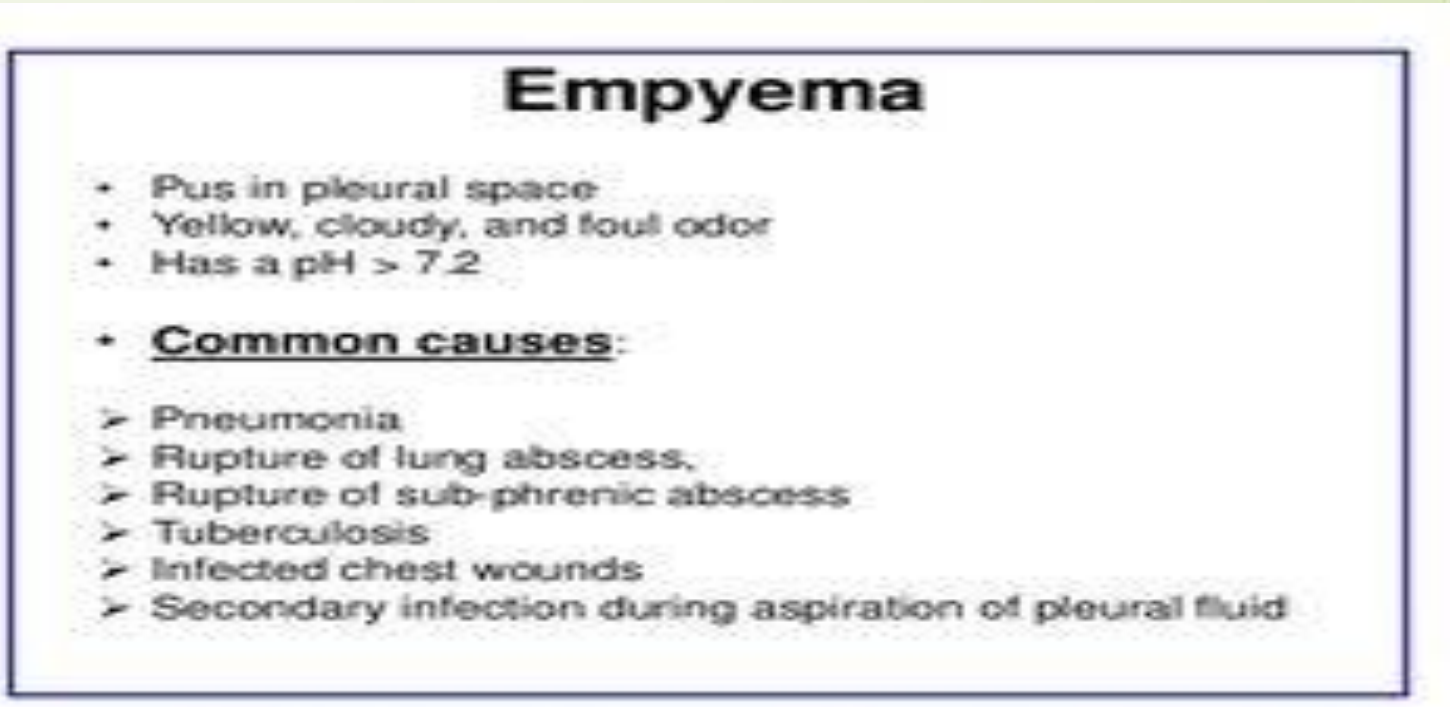


Empyema

الدُّبَيلة

Dr.MOHSEN SHAHEEN

EMPYEMA



- **Definention**: collection of **pus** in the pleural cavity.
- An infected pleural space with either **pus** or **thick purulent appearing pleural fluid** upon drainage.

Empyema → High **morbidity** and **mortality**.

20 % to **30 %** of patients in the first year after developing **Empyema**:

- Will die .
- Required further surgery.

Early intervention is **crucial** in the management of **Empyema**.

Empyema is usually associated with **pneumonia .**

- **20 %** of patients with pneumonia will develop a parapneumonic effusion that may lead to **Empyema**.
- **70 %** of patients with **Empyema** have parapneumonic effusion.

Other causes : (30 % of cases)

- Trauma.
- Post-thoracic surgery.
- Esophageal ruptures.
- Cervical infections.
- TB.

primary Empyema.

Not related to previous pneumonia or intervention.

compares **Parapneumonic Effusion** and **Empyema**.

Stages of **Parapneumonic Effusion** and **Empyema**

	Simple Parapneumonic Effusion	Complicated Parapneumonic Effusion	Empyema
Stage	Exudative	Fibrinopurulent	Organizing
Appearance	Clear or slightly turbid	Usually cloudy	Pus
pH	> **7.20**	< **7.20**	Usually not measured
Glucose	> **60** mg/dL	< **60** mg/dL	Usually not measured
LDH	< **1000** U/L	> **1000** U/L	Usually not measured
Gram Stain/ Culture	Negative		May be positive
Imaging	Small-to-moderate effusion (> **10** mm thickness but < half the size of the hemithorax) **Free-flowing effusion**	Effusion occupies > half of the hemithorax Loculated effusion Thickened pleural membrane	Locuated effusion Thickened pleural membrane

Bacteriology of Empyema may change,

Depending on if the infection is:

- **Community-acquired.**
- **Hospital-acquired.**

Comorbidities of the patients need to be taken into consideration.

MICROBIOLOGY

Community-acquired and **Hospital-acquired** pleural infections → different microbiologic patterns.

Community-acquired → predominantly:

- **Streptococcus (50 %).**
- **Anaerobes (20 %).**
- **Staphylococcus (10 %).**
- **Gram-negative bacteria.**

Gram-negative bacteria has been associated with increased comorbidities of patients with:

- **Alcohol abuse**.
- **Gastroesophageal reflux disease** (**GERD**).
- **Diabetes**.

Hospital-acquired → predominantly:

- **Methicillin-resistant Staphylococcus aureus (MRSA) (25%).**
- **Gram-negative anaerobes (20%).**
- **Pseudomonas** (more common).

Higher mortality rate .

Empyema related to trauma and surgery:

- ***S.* aureus** is also the most common agent

Anaerobic Empyema :

- ✓ When DNA amplification is implemented can be as high as **70 %.**
- ✓ In regular technics, the incidence can drop to **20 %.**

SO it is always important to cover for **Anaerobic organisms** despite negative cultures.

Fungal empyema:

- Rare.
- High mortality

The most common fungus is ***Candida***.

Epidemiology

Due to the association between **pneumonia** and **Empyema** → patients at increased risk for pneumonia will also be at higher risk for **Empyema**.

Risk factors for developing Empyema:

- Diabetes mellitus.
- Intravenous drug abuse.
- Immunosuppression.
- Gastric acid reflux.
- Alcohol abuse.

Pathophysiology

Stages of EMPYEMA

Stage I : (Exudative)

- During an inflammatory process such as pneumonia, there is an increase in fluid production in the pleural cavity.
- As the disease progresses microorganisms, usually **bacteria**, can colonize the fluid and generated an **Empyema**.
- This fluid is characterized by elevated **LDH**, **Proteins**, **Neutrophils**, and **Dead Cells**.

Stage II : (Fibrinopurulent)

A **fibrinous peel** developes on both pleural surfaces limiting lung expantion.

Stage III : (Organization)

In-growth of capillaries and fibroblast into the **fibrous peel** .

Appropriate and **early** intervention is vital to decrease complications and mortality.

History and Physical examination

Clinical history:

Similar to pneumonia:

- **Cough**.
- **Sputum production**.
- **Fever**.
- **Pleuritic-type chest pain**.

Patients with **Empyema** may have symptoms for a more extended period.

Research has shown that patients presented after a median of **15** days after the onset of symptoms.

physical examination:

- **Dullness to percussion** on the affected area.
- **Egophonia**.
- **Increase palpable fremitus**.
- **Fine crackles**.

Differential Diagnosis

- Pneumonia.
- Heart failure.
- Pulmonary infarction.
- Sequestration.

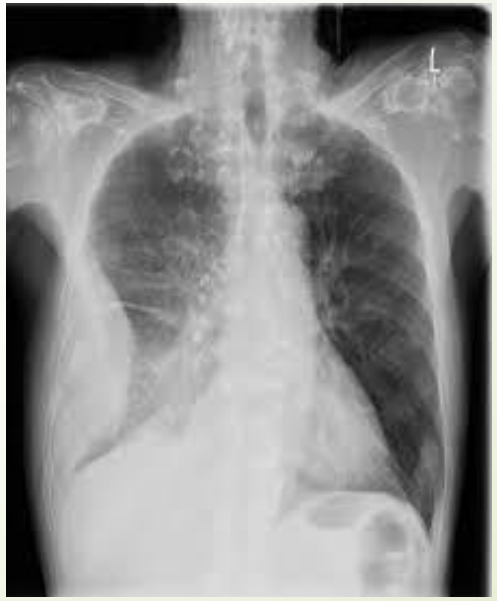
Evaluation

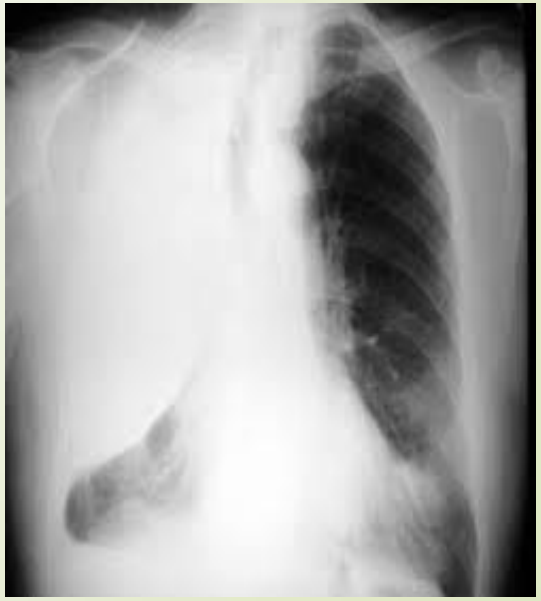
chest x-ray

The first test to confirm the presence of any pleural effusion.

Widely available and **simple** test, but it is not **100 %** sensitive.

- **75** ml in a lateral view.
- **175** ml in an anterior view.

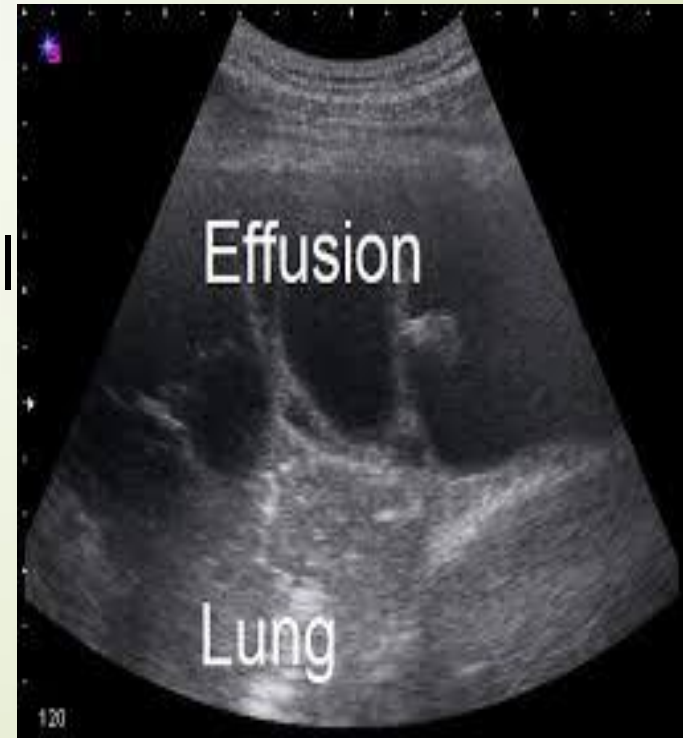




On an **x-ray**, some of the characteristics of a pleural effusion are blunted due to costodiaphragmatic angles and lungs filled with radiolucent fluid (depending on the size of the effusion).

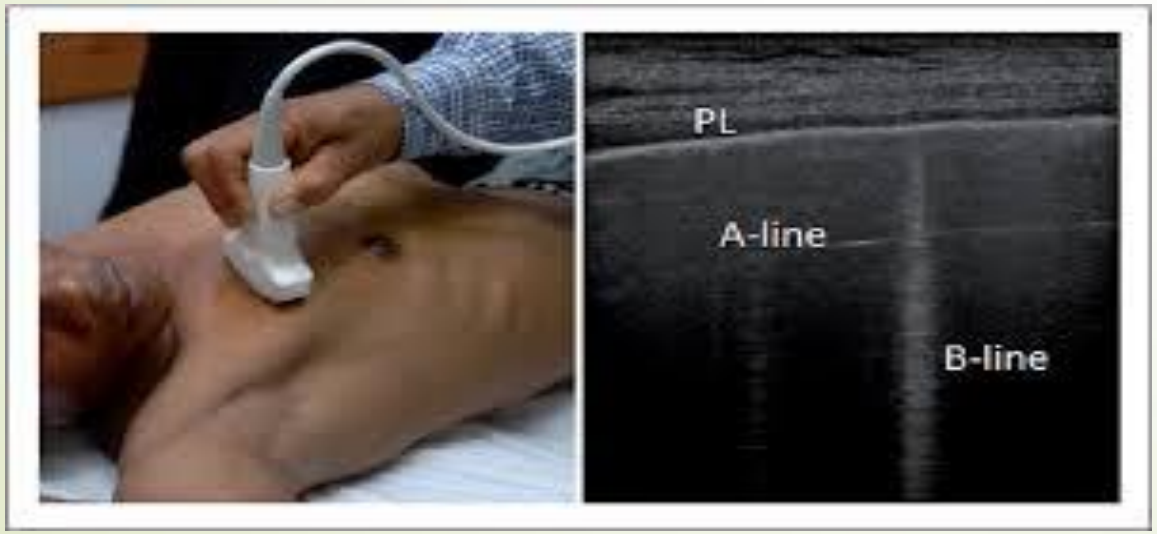
Chest ultrasound

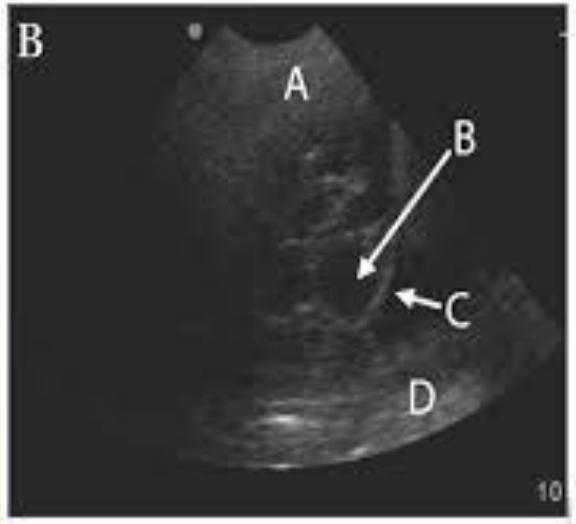
- If an effusion is suspected with the **chest x-ray**.
- It is widely available.
- It can be done at a patient's bedside.
- It is more **sensitive** at identifying pleural effusions than an **x-ray**.
- It allows differentiation between parenchyma and pleural fluid.



it also has a therapeutic use:

- Ultrasound can be useful in **guiding** a chest tube placement during **thoracentesis**.





Loculated Pleural Effusion:

A- Thoracic wall
B- Pleural fluid within a locule
C- Wall of locule
D- Lung

Empyema characteristics found with **US**:

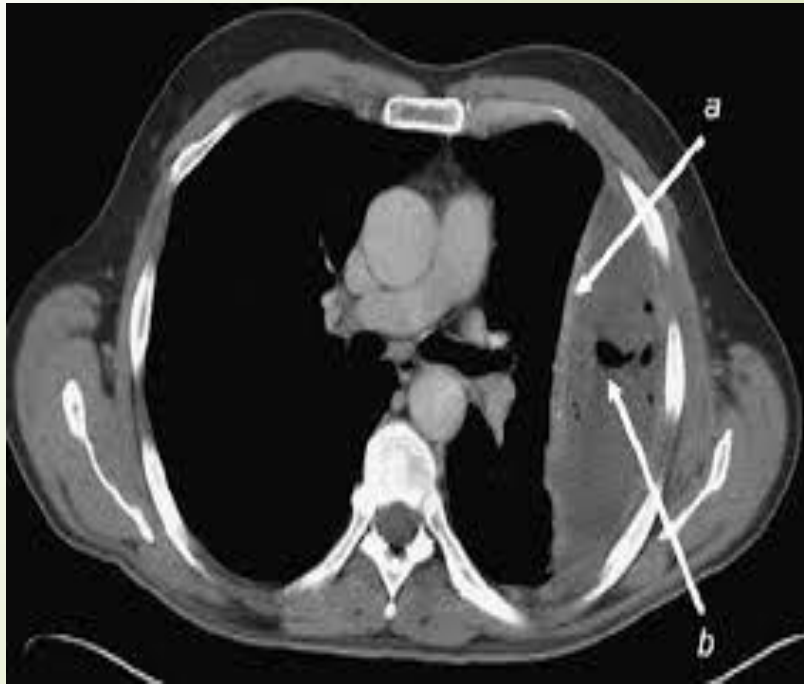
- ✓ Homogenous echogenicity.
- ✓ Anechoic effusion with hyperechoic septation.
- ✓ Pleural thickening.
- ✓ **Split pleural**, separation of the parietal, and visceral pleural by the fluid.

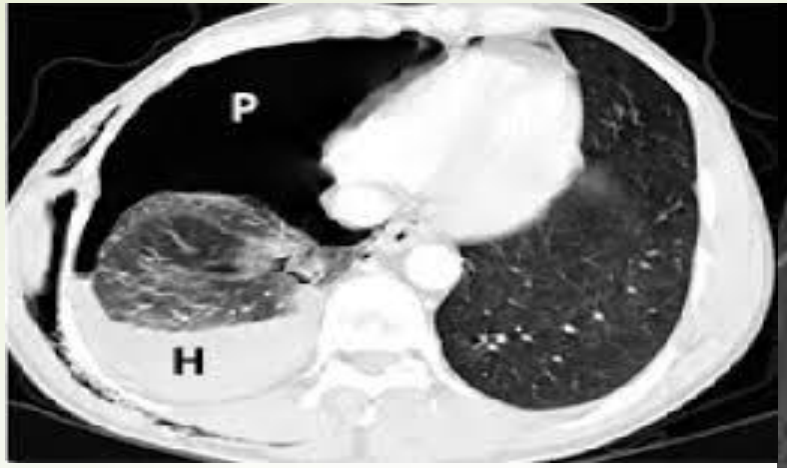
chest CT scan

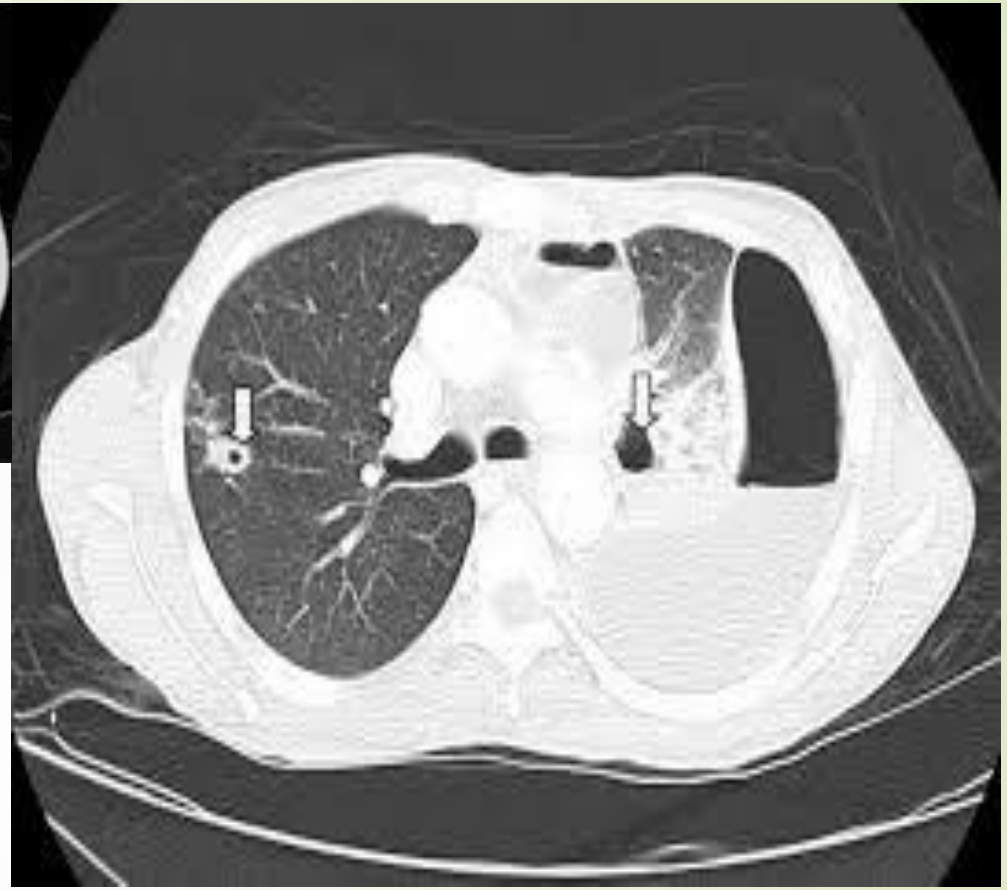
- An alternative option after **X-ray** or **US**.
- **CT scan** ideally is done with intravenous (IV) contrast to enhance the pleura.
- **CT scan** as **Diagnostic** and **Therapeutic**: **Thoracentesis** and **tube thoracotomy** can be performed under by it.

Characteristics of Empyema on CT scan:

- **Thickening** of the pleura (**80 %** to **100 %** patients).
- **Pleural enhancement**.
- **Split pleural sign**.







- **Bubbles** in the absence of tube drainage.
- **Septations**.
- Better assess **the lung parenchyma** and the **position** of a chest tube.

- ✓ After thoracentesis, the obtained fluid should be sent for **analysis** and **culture**.

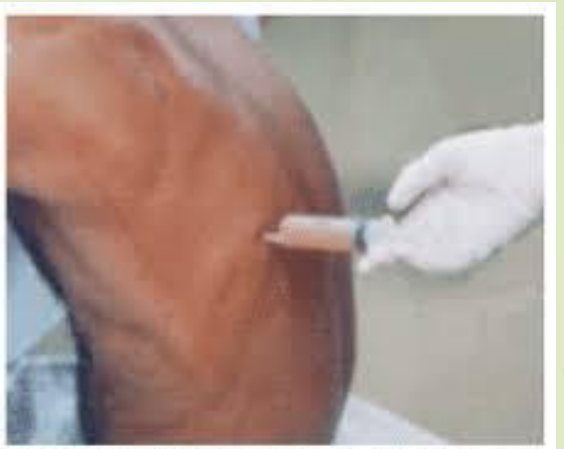


Figure 1. Diagnostic thoracocentesis producing purulent pleural fluid

- ✓ Pleural fluid cultures have poor sensitivity; this can improve if the fluid is not the only stored in sterile containers but also in blood culture bottles.
- ✓ Ideally, the culture fluids should be obtained from the thoracentesis, chest tube placements, or surgical intervention, but never from pre-existing drainages.

Pleural Effusion fluid

Tests	Transudate	Exudates (tubercular)	Exudates (Empyema)
Physical appearance	Clear	Straw coloured	Cloudy / Turbid
Microscopy	<1000 Lympho/M	>1000 Lymphocytes	>5000 PMNs Pus cells
Pleural fluid protein	< 3 gm/dl	>3 gm/dl	>3 gm/dl
Pleural fluid Protein / Serum protein	<0.5	>0.5	>0.5
Pleural fluid LDH / Serum LDH	<0.6	>0.6	>0.6
Pleural fluid pH	>7.3	<7.3	<7.2
Pleural fluid glucose	>40 mg/dl	<40 mg/dl	<40 mg/dl

TREATMENT

- Medical treatment.
- Surgical treatment.

❑ medical treatment

Empiric antibiotics tailored by microbiology, **community vs hospital** acquired.

Community-acquired Empyema:

- **Third** or **Fourth-generation Cephalosporin**.

PLUS

- **Metronidazole** or **Ampicillin** with a **Beta-lactamase inhibitor**.

Will provided good coverage

Hospital-acquired or Trauma-related, and Surgery-related Empyema

- **Vancomycin**, **Cefepime**, and **Metronidazole** or **Piperacillin-Tazobactam** is essential .

coverage of *Pseudomonas* and MRSA.

- Due to the difficulty isolating **Anaerobes**, the coverage for this organism should continue regardless of negative cultures.

- Antibiotic should be given for **2** to **6** weeks, depending on patient **response**, **source control**, and **organism**.

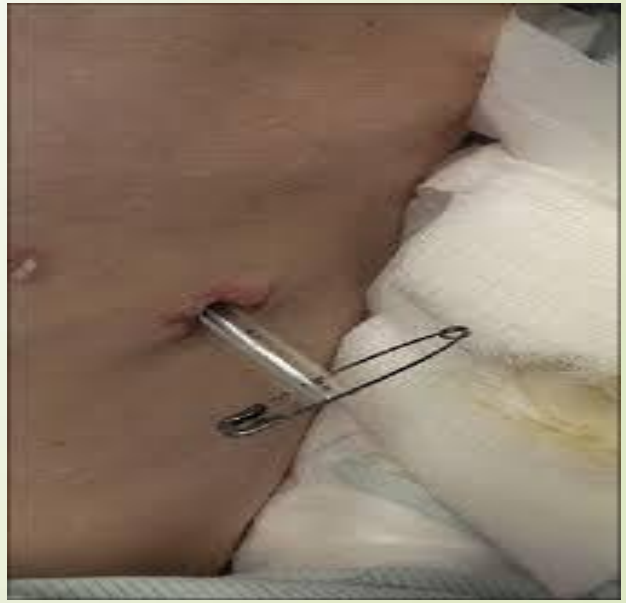
There is not a proven benefit of Intrapleural Antibiotics.

❑ Therapeutic thoracentesis

- **Tube thoracostomy** is the most common type of drainage, **bore tube <u>vs</u> smaller tubes** have not shown any difference regarding mortality and prognosis, but bigger tubes are associated with **more pain**.

- **Chest tube**, with current trend toward smaller-bore tubes (**10 –14** French catheter) for complicated parapneumonic effusions and **Empyemas**.

The position of the tube should be confirming with an X-ray or CT scan.



- Lack of clinical improvement in the first **24** hours is usually related to **tube malposition** or **blockage**.

- **Blockage** of the chest tube can be prevented with **frequent flushing**, but the necessary amount and frequency of this process is unclear.

- Any indication of a persistent fluid or other locations should be addressed with more aggressive therapy including a **larger tube**, **more tubes**, or **surgery**.

- The chest tube can usually be removed when the daily production of pleural fluid is proximal **350** ml/day or less.

- The use of **Intrapleural medication** has been around for at least **60** years.

- **Fibrinolytics** such as **Urokinase**, **Streptokinase**, and **Tissue plasminogen activator** (**TPA**).

- The isolated use of fibrinolytics, has not shown differences in **mortality** or **surgical intervention**.

- Currently, the use of intrapleural agents is **not** a standard of care.

- Some studies have shown that the combination of **Fibrinolytic** and **Mucolytic**, specifically **TPA** increases the amount of fluid drainage and the need for surgery.

- No changes in mortality have been shown.

Consider intrapleural (**TPA**) + **Deoxyribonuclease** (**DNase**) (Multicenter Intrapleural Sepsis Trial [MIST]-2)

- ✓ **MIST-1** study = Intrapleural **TPA** **vs** **placebo** in treatment of **Empyema** → **No benefits**.

- ✓ **MIST-2** study = intrapleural **TPA** + **DNase** superior to either agent alone in treatment of **Empyema** in terms of improved fluid drainage, reduced frequency of surgical referral, and **reduced duration of hospital stay**.

❑ surgical intervention

- ✓ The last resource.
- ✓ The main goal of surgical therapy in **Empyema** is the evacuation of the pus from the pleural cavity and lung expansion.

- ✓ In patients requiring surgical intervention in acute **Empyema**, (**VATS**) is the first step:

- ❑ Less invasive procedure.
- ❑ Less blood loss.
- ❑ Less pain for the patient.
- ❑ Better respiratory outcome.
- ❑ Decrease length of stay.
- ❑ Decreased 30 days mortality.

❑ open-thoracotomy

- Uncontrolled bleeding.
- Damage to a structure that cannot be repaired.
- Patient who is not able to tolerate one-lung ventilation.
- When the evacuation of the cavity or lung expansion are not achieved with **VATS**.

❑ Surgical consultation

If persistent sepsis and/or residual pleural collection despite drainage and antibiotics.

After the acute phase, some patients develop fibrosis and lung restriction that can cause dyspnea and exercise-intolerance as symptoms.

Decortication may help to alleviate these symptoms and is considered when pulmonary restriction is present **6** months after the resolution of the infection but there are still issues in a patient's quality of life.

Prognosis

RAPID score

A scoring system has been developed to assess mortality in **3** months upon presentation of patients with **Empyema**:

- **R**enal: (**kidney function**).
- **A**ge.
- **P**us: (Presence or absence).
- **I**nfection : **Hospital-acquired VS community-acquired.**
- **D**iet: Albumin levels.

BUN, serum	< 14 mg/dL (5 mmol/L) 14–23 mg/dL (5–8 mmol/L) > 23 mg/dL (8 mmol/L)	0 +1 +2
Age, years	< 50 50-70 > 70	0 +1 +2
Purulent pleural fluid	No Yes	0 +1
Infection source	**Community-acquired** **Hospital-acquired**	0 +1
Serum albumin	**≥ 2.7 g/dL (27 g/L)** **< 2.7 g/dL (27 g/L)**	**0** **+1**

Interpretation of RAPID score

RAPID Score	Risk	3-month mortality
0 – 2	Low	1.5%
3 – 4	Medium	17.8%
5 – 7	High	47.8%

THANK YOU FOR YOUR ATTENTION