Treatment of pleural empyema

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I have no conflicts of interest to report

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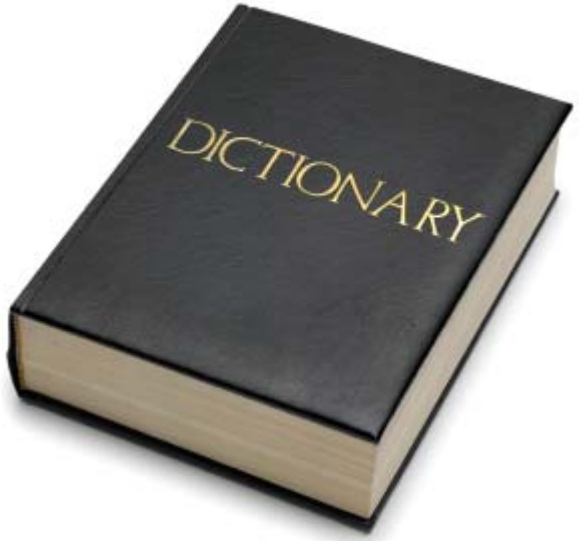
DEFINITIONS



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Parapneumonic effusion is any pleural effusion associated with a suppurative parenchymal lung disease

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SIMPLE Parapneumonic Effusion is an uninfected, free-flowing fluid collection

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COMPLICATED Parapneumonic Effusion is an early infected fluid collection, prone to develop loculations by fibrinous septations

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Thoracic EMPYEMA is a collection of frank PUS within the pleural space

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Pleural infection: 80,000 cases/year UK and USA

High associated morbidity and mortality:

20% pts with empyema die

20% pts with empyema require surgery

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The incidence of empyema continues to growth with an estimated 65,000 pts affected/year, and an annual cost of 500 million $ per year

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Pleural infection most commonly occurs in paediatric and elderly population

RISK FACTORS:

(same for pneumonia)

diabetes mellitus

immunosuppression

corticosteriod use

gastro-oesophageal reflux

alcohol

intravenous drug abuse

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Physiology of the pleura

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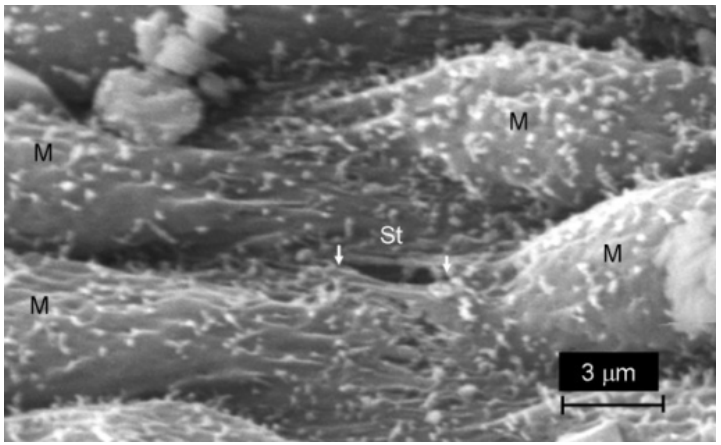
In health:

Pleural fluid volume < 1 ml

(film ~ 10 μm between visceral and parietal)



It contains:

proteins at the same concentration
of the *interstitial fluid*
small number of cells
(mesothelial cells, lymphocytes, macrophages)
LDH *(lactate dehydrogenase)*
pH: ~7.6

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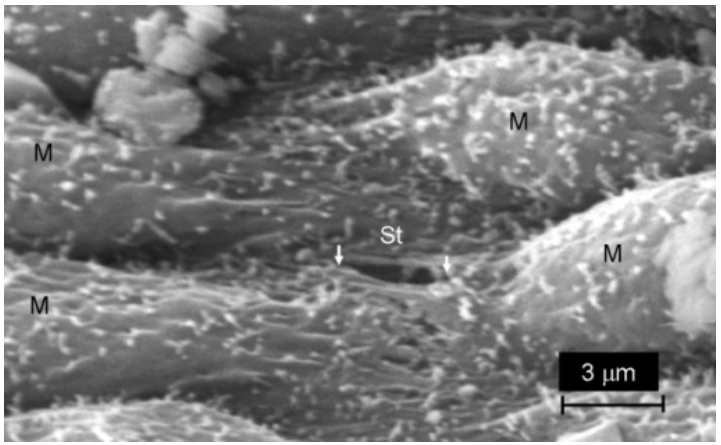
In health:



Normal Pleural Fluid values

Volume:	0.1 to 0.2 ml/kg
Cells per mm3:	1000 to 5000
Mesothelial cells:	3% to 70%
Monocytes:	35% to 70%
Lymphocytes:	2% to 30%
Protein:	1-2 g/dl
Albumin:	50% to 70%
Glucose:	similar to plasma levels
LDH:	<50% plasma level
pH:	~7.6

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1962:
The American Thoracic Society

3 stages:

exudative stage *(acute)*
fibrinopurulent stage
organized stage with scar tissue
(pleural peel) formation *(chronic)*

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They are not sharply defined, but represent a *continuum spectrum*

Table 1
Stages of empyema

Stage	Phase	Characteristics	Status of Lung Parenchyma	Treatment
I	Exudative (Acute)	Pleural membrane thickening Fibrin deposition Presence of exudative fluid	Compliant Reexpansion possible with evacuation of fluid	Thoracentesis Closed-tube thoracostomy
II	Fibrinopurulent	Extensive fibrin deposition Pleural fluid becomes turbid or purulent Presence of loculated empyema	Partial compliance Lung entrapment due to fibrin deposition	Closed-tube thoracostomy with fibrinolytics Thoracoscopy Thoracotomy
III	Organized (Chronic)	Fibroblast in growth Thickened pus Granulation tissue replacement of the pleural space	No compliance Lung completely entrapped by fibrous peel	Thoracotomy (decortication) Open drainage (Eloesser) Open thoracostomy

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The transition through the 3 phases occurs over a 3 to 6 week period

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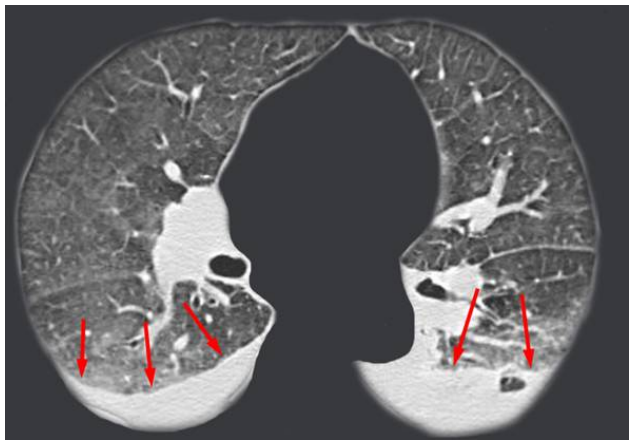
1° stage: exudate



increased capillary vascular permeability

proinflammatory cytokines production

(IL-8; TNFα)

facilitate fluid entry into pleural cavity

(free-flowing exudate, normal pH, no bacteria, ↓LDH ↓ glucose)

Antibiotics usually control the disease

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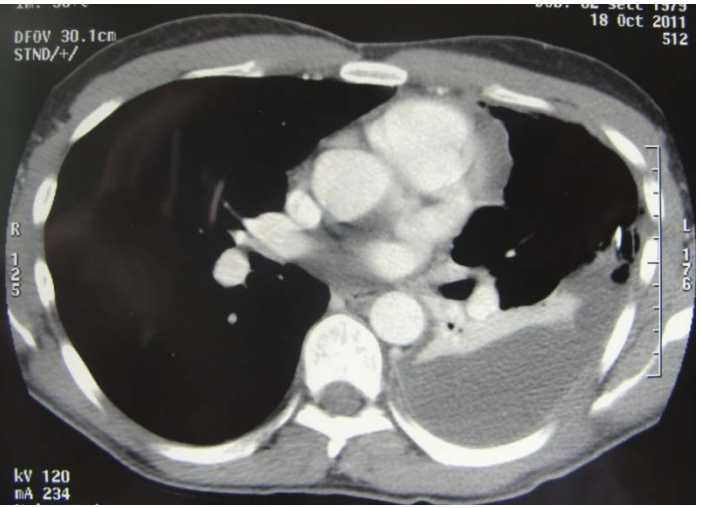

If appropriate medical treatment is not started (or delayed)…
progression to fibrinopurulent stage

Bacterial invasion
Increased fluid accumulation
Fibrin deposition
Septa development
(pH<7.20; glucose<2.2 mmol/l;
LDH> 1000U/l; WBC> 5000mm^3)

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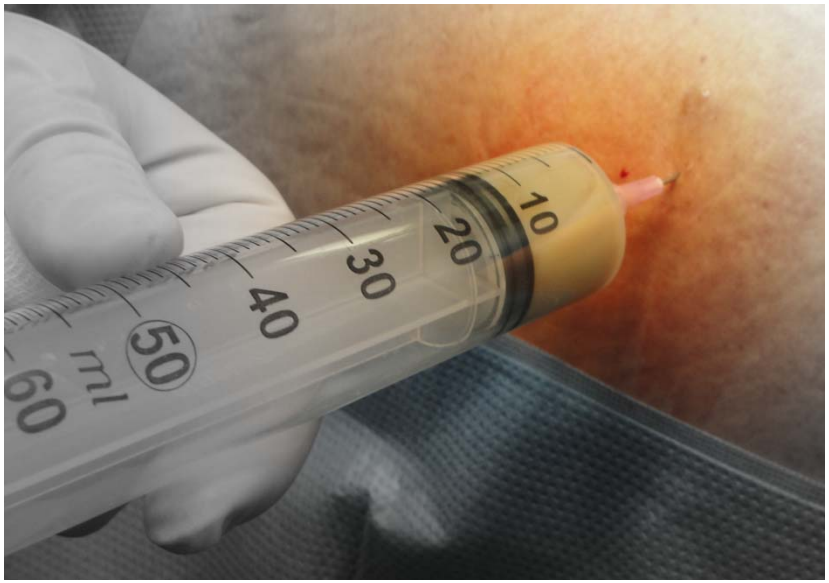

If not drained, increased amount of bacteria appears and the fluid becomes frankly purulent, giving rise to a true EMPYEMA

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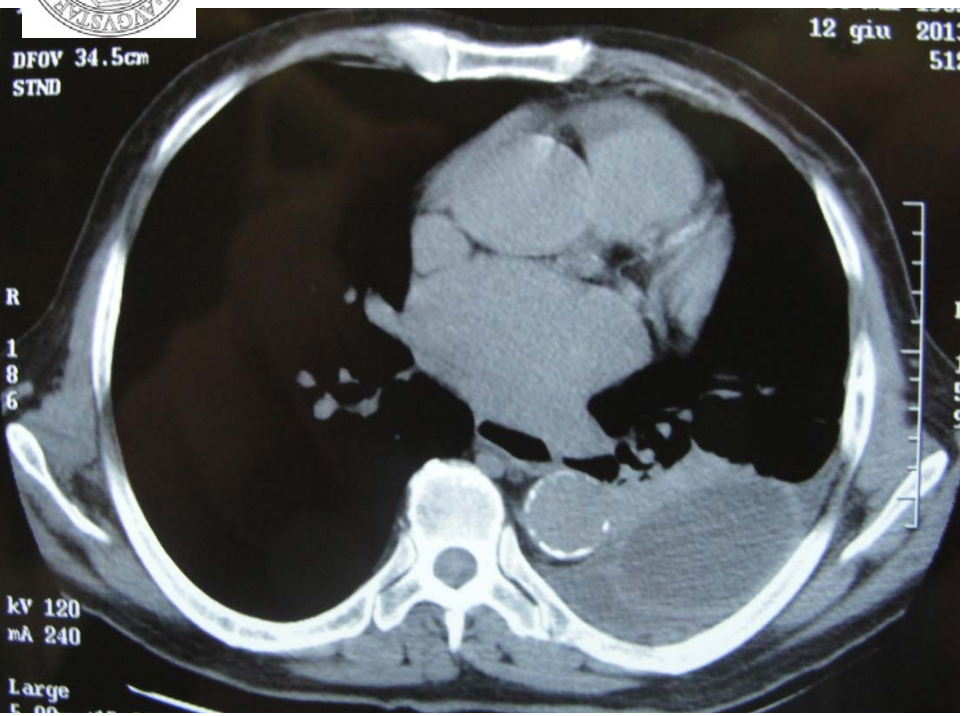

Loculations prevent the extension of the infectious process to the whole pleura but make its evacuation by non-surgical means progressively difficult

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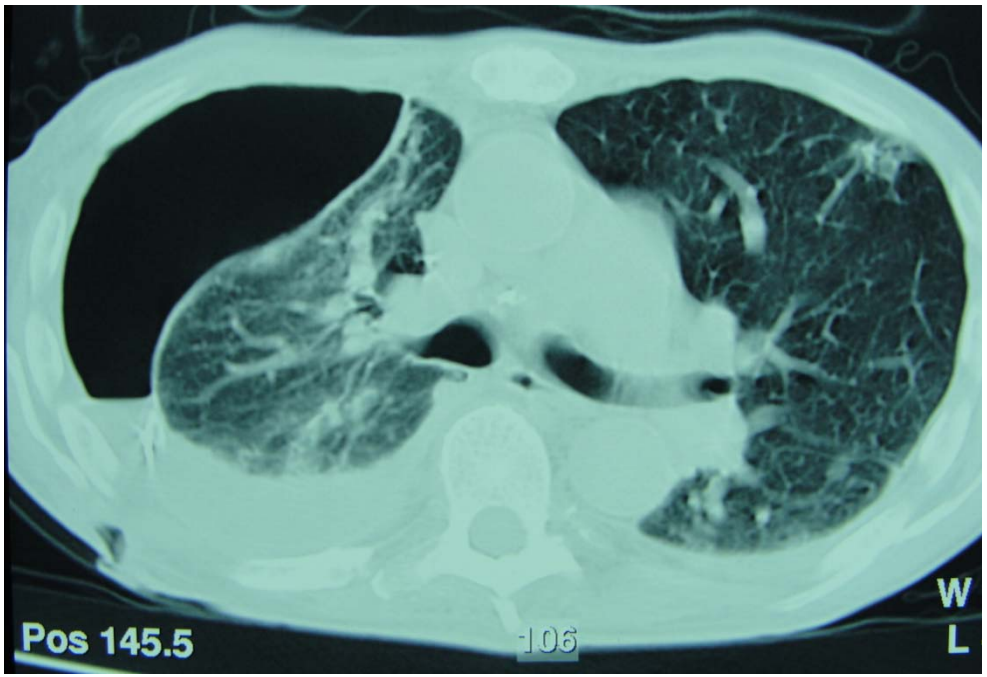

Stage 3:

fibroblast migrate in the pleural cavity and produce an inelastic membrane (pleural peel or cortex) and entrapp the lung rendering it functionless

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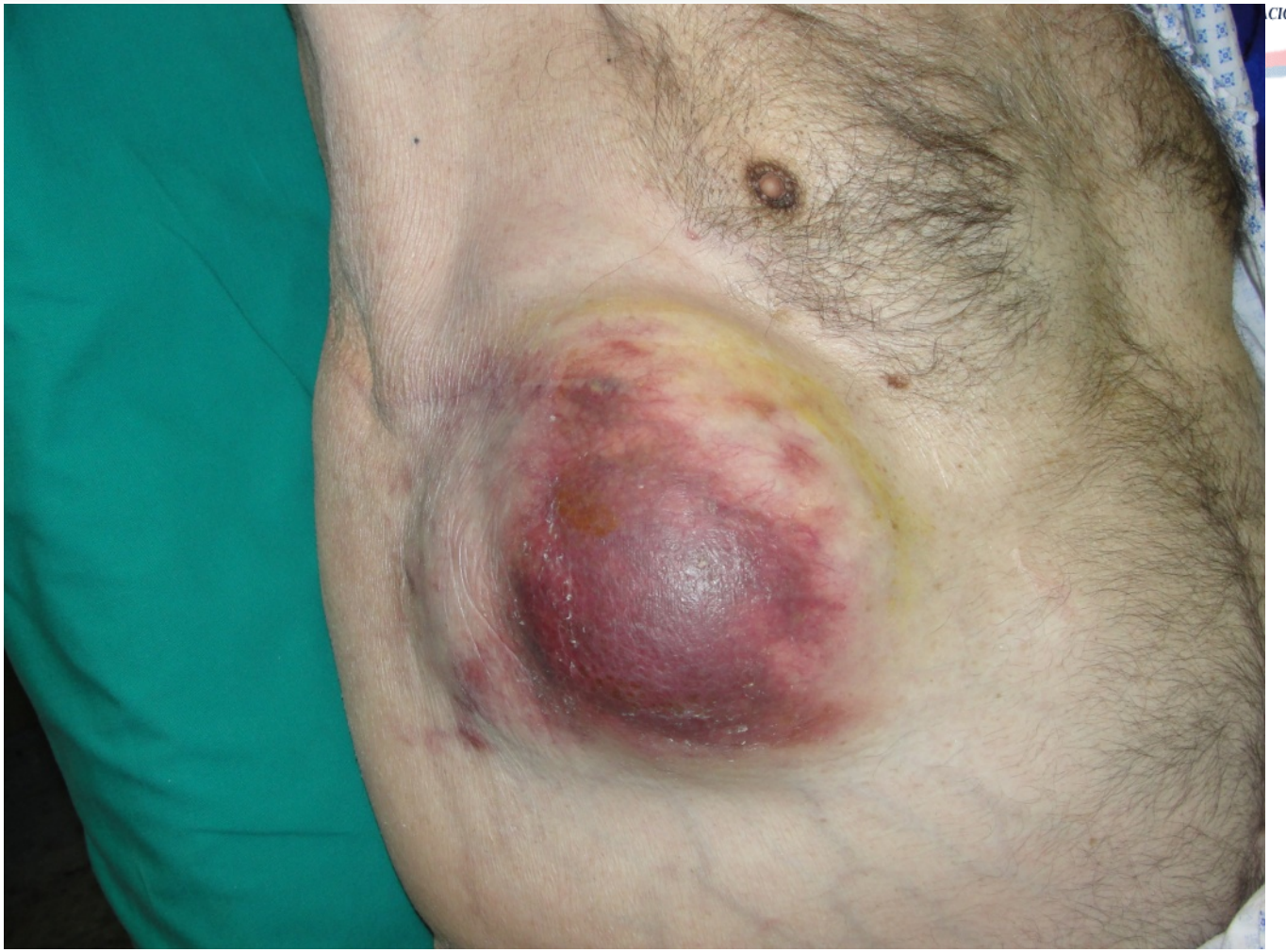

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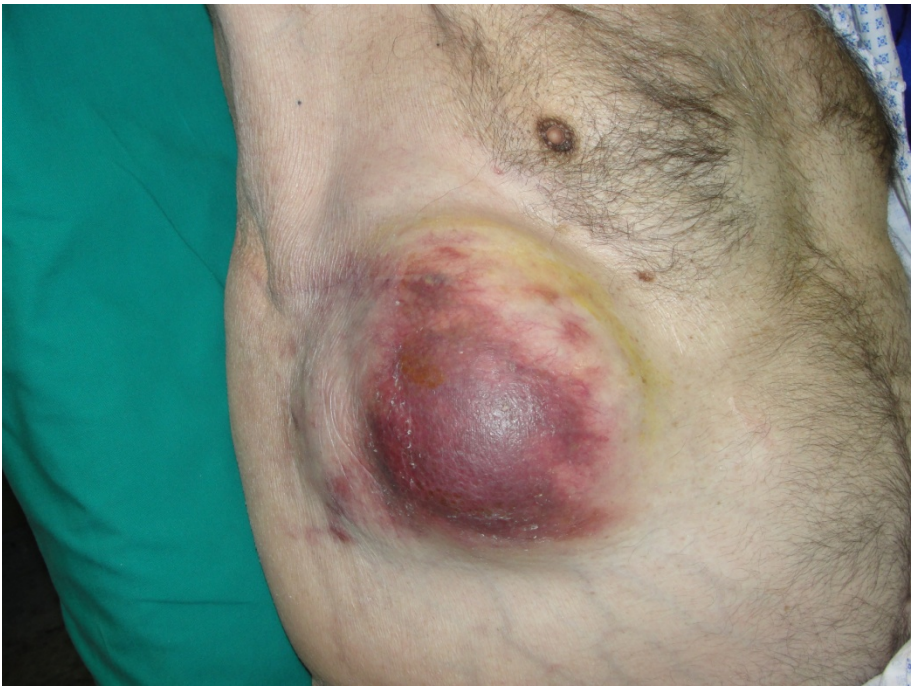

Causes of Thoracic Empyema

Parapneumonic Effusions:	40% to 60%
Post-thoracotomy:	20%
Post-traumatic:	4% to 10%
Idiopathic:	9%
Other causes:	5% to 10%

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Pleural empyema bacteriology

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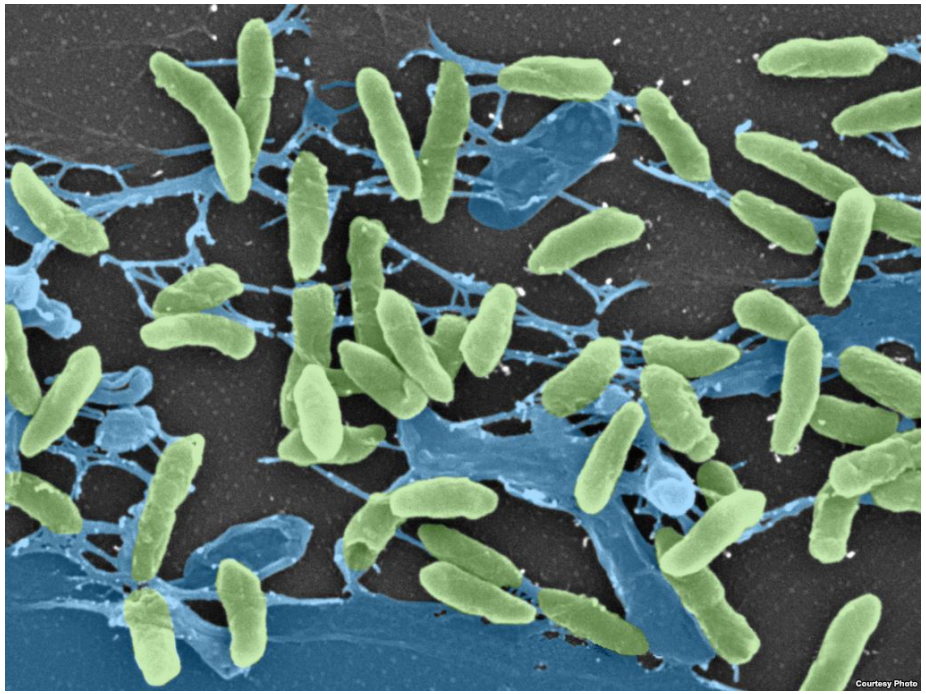

Pathogens isolated have significantly changed since the introduction of antibiotic therapy in the 1940s

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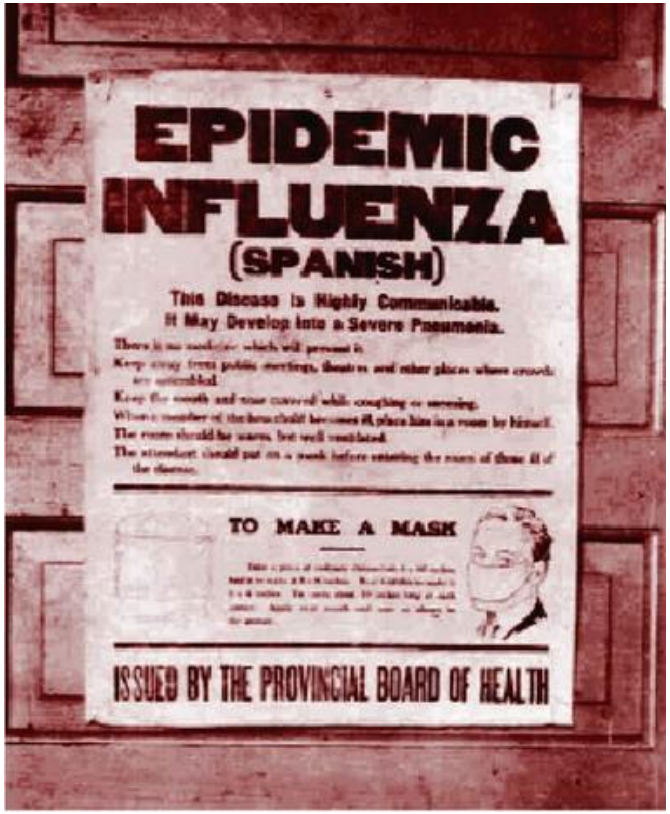
1917-1919

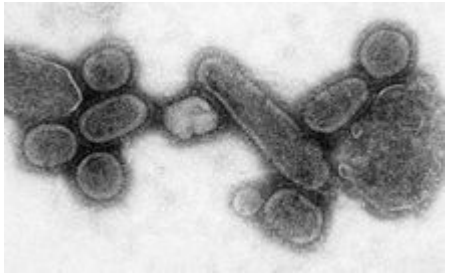
Empyema Commission Recommendations:

adequate pus drainage

proper nutritional support

pleural space obliteration





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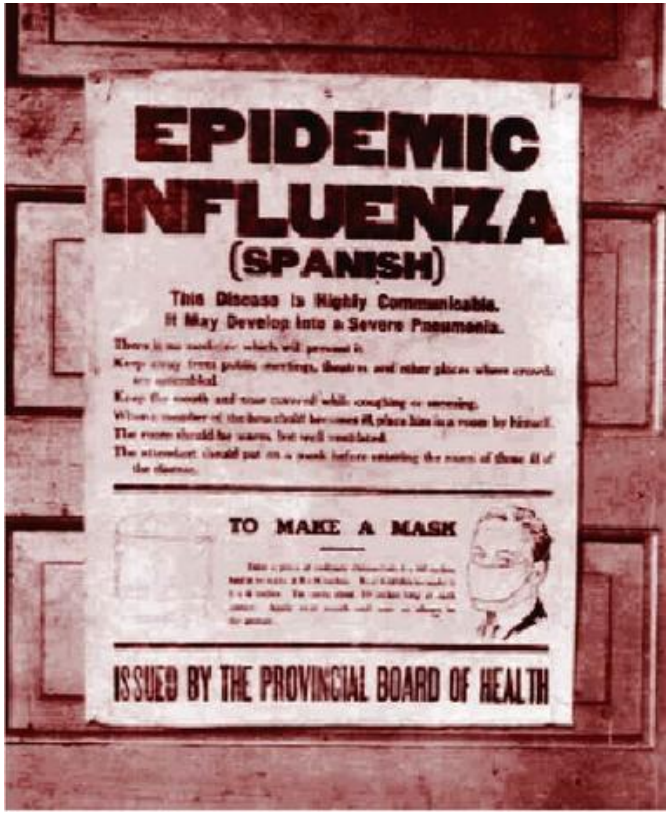
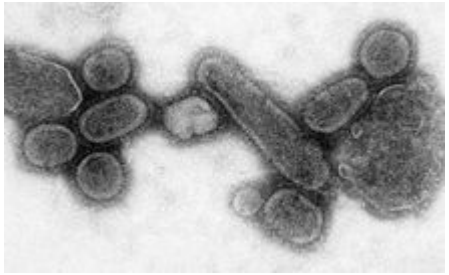
1917-1919
Empyema Commission Recommendations:



mortality reduced to 4.3%
in the later stage of the epidemic



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Before antibiotics:

60%-70%: *Streptococcus Pneumoniae*
(now < 10%)

After antibiotics:

1950's: *Staphylococcus Aureus*

Now: *anaerobic infections*
Gram-negative organisms

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	Common organisms
Community-acquired	*Streptococcus* spp. (~52%)
	► *S milleri*
	► *S pneumoniae*
	► *S intermedius*
	Staphylococcus aureus (11%)
	Gram-negative aerobes (9%)
	► Enterobacteriaceae
	► *Escherichia coli*
	Anaerobes (20%)
	► *Fusobacterium* spp.
	► *Bacteroides* spp.
	► *Peptostreptococcus* spp.
	► Mixed
Hospital-acquired	Staphylococci
	► Meticillin-resistant *S aureus* (MRSA) (25%)
	► *S aureus* (10%)
	Gram-negative aerobes (17%)
	► *E coli*
	► *Pseudomonas aeruginosa*
	► *Klebsiella* spp.
	Anaerobes (8%)

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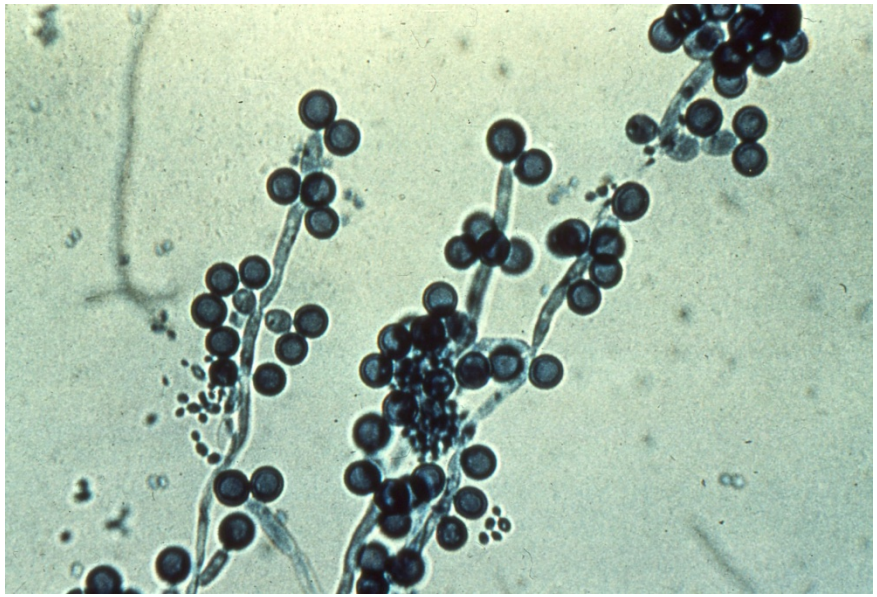

Fungal empyema is very rare
(<1% of all empyemas)

Candida species is the
commonest responsible
(usually in immunosuppressed pts)

High mortality (> 70%)

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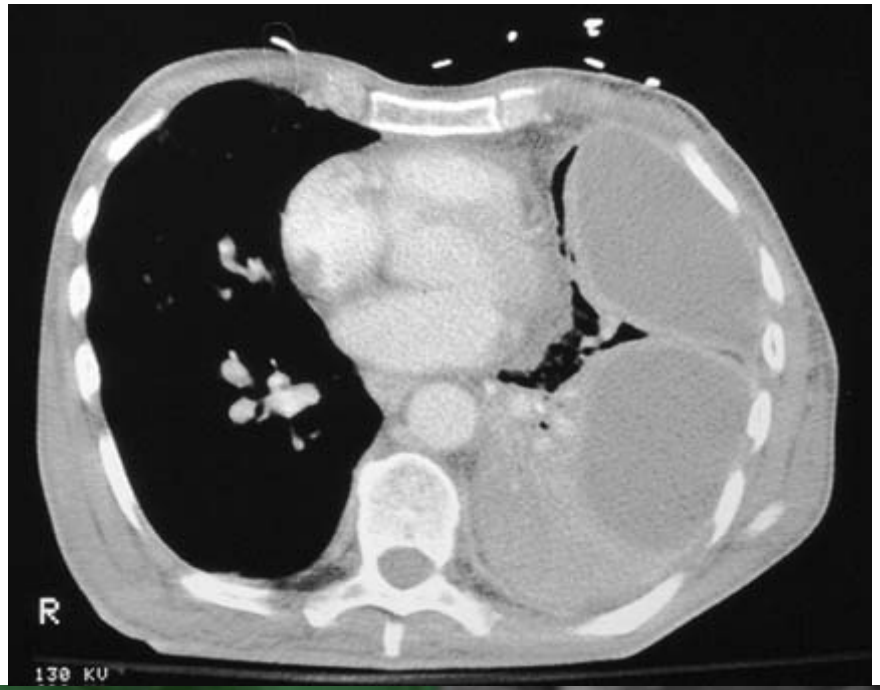
MANAGEMENT



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General rules

The *sine qua non* of empyema management is:

early

adequate

dependent drainage

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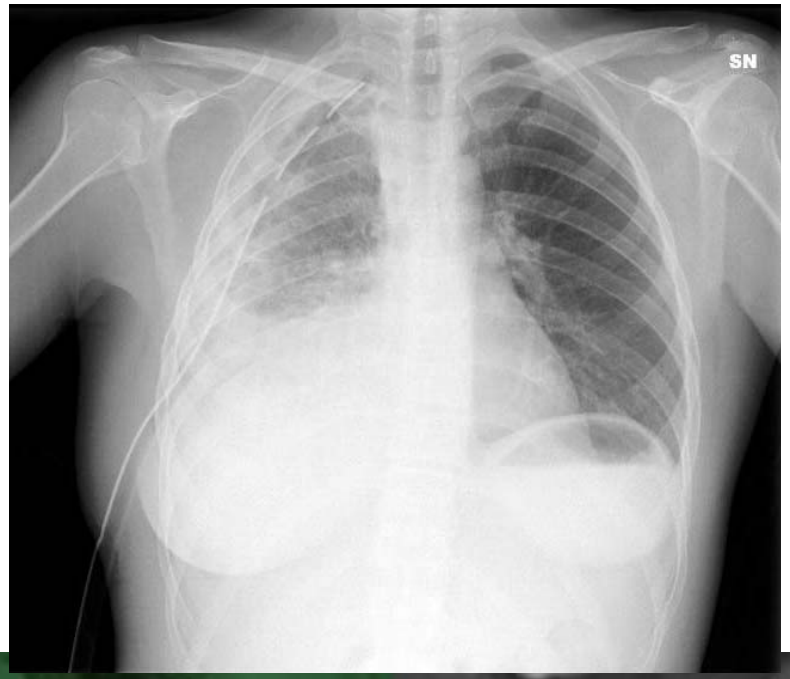
Pleural empyema management depends on the stage at which it's diagnosed



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Diagnostic challenge

To distinguish pleural effusions that will respond to antibiotic therapy ALONE from those that need chest drainage or surgery

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Stage 1 disease

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Stage 1

Antibiotics

Pleural effusion drainage

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Antibiotics

An early and appropriate antibiotic treatment for the pneumonia minimizes the development of parapneumonic effusions and aborts the progression to complicated effusions or empyema

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Antibiotics

Simple parapneum. effusions no longer than that indicated for the underlying pneumonia

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Antibiotics

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β-lactam antibiotics:

Amoxicillin/Clavulanate

Ticarcillin/Clavulanate

Piperacillin/Tazobactam

Ampicilin/Sulbactam

Quinolones

Imipem

Meropenem

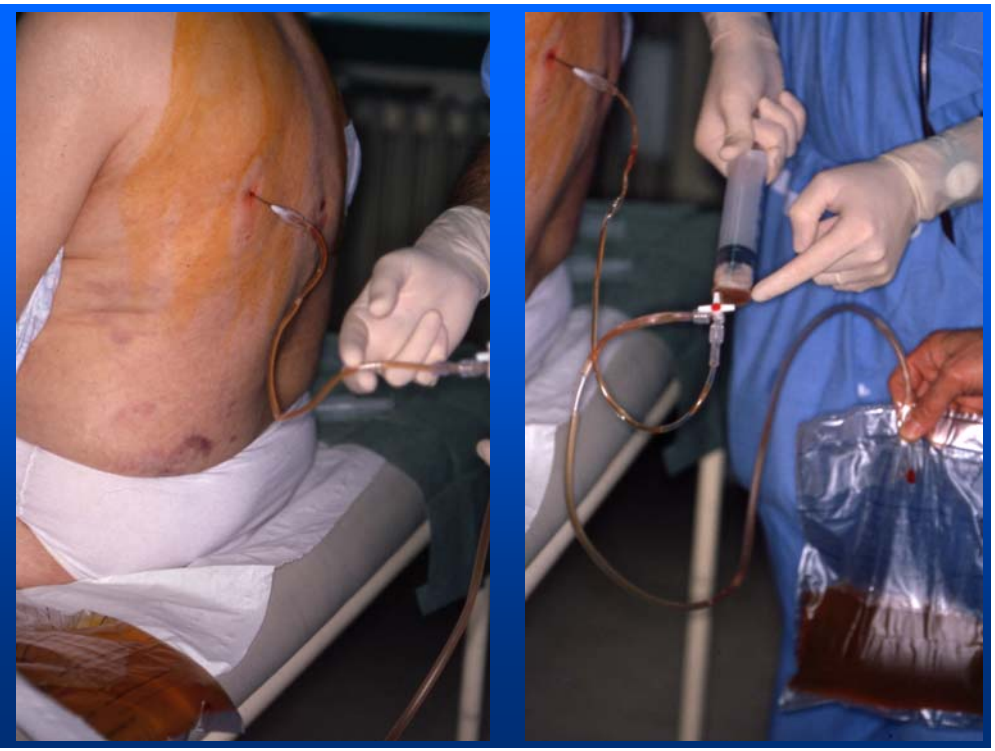
Diagnosis and Management of Parapneumonic Effusions and Empyema

Steve A. Sahn

Division of Pulmonary, Critical Care, Allergy, and Sleep Medicine, Medical University of South Carolina, Charleston

Approximately 1 million patients develop parapneumonic effusions (PPEs) annually in the United States. The outcome of these effusions is related to the interval between the onset of clinical symptoms and presentation to the physician, comorbidities, and timely management. Early antibiotic treatment usually prevents the development of a PPE and its progression to a complicated PPE and empyema. Pleural fluid analysis provides diagnostic information and guides therapy. If the PPE is small to moderate in size, free-flowing, and nonpurulent (pH, >7.30), it is highly likely that antibiotic treatment alone will be effective. Prolonged pneumonia symptoms before evaluation, pleural fluid with a pH <7.20, and loculated pleural fluid suggest the need for pleural space drainage. The presence of pus (empyema) aspirated from the pleural space always requires drainage. Fibrinolytics are most likely to be effective during the early fibrinolytic stage and may make surgical drainage unnecessary. If pleural space drainage is ineffective, video-assisted thoracic surgery should be performed without delay.

Effusions drainage



Thoracentesis is usually sufficient to drain simple and limited pleural effusions without bacterial infiltration

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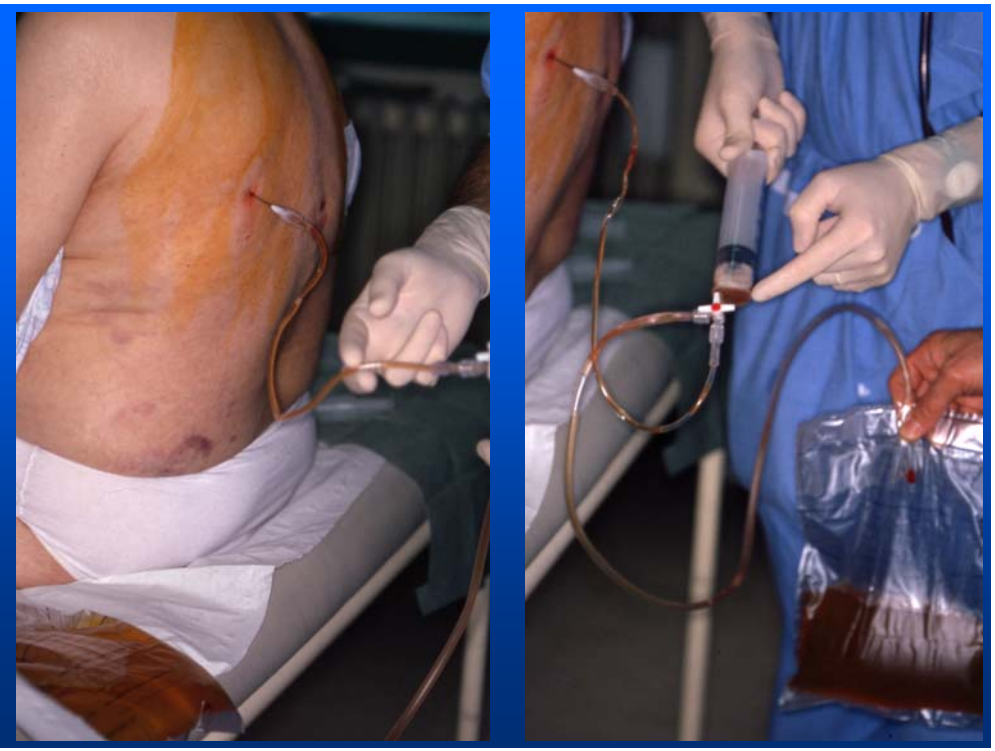
Effusions drainage



>25% culture-positive parapneumonic effusions in the Stage 1 may respond to thoracentesis

Pneumonia caused by *Staphylococcus aureus* are less like to respond because of early loculations

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Stage 2 disease

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Stage 2

Antibiotics

Chest tube drainage

VATS

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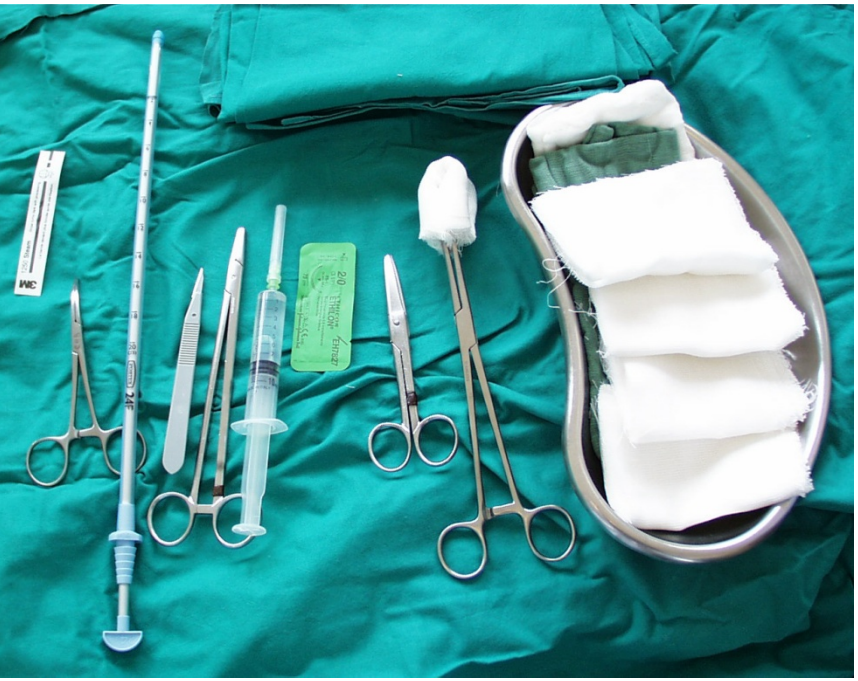
Chest tube placement



Decision is based on:

- pleural fluid characteristics
- absence of multiple loculations

- frank pus
- bacteria on pleural fluid Gram's stain
- pleural glucose < 40 mg/dl
- LDH > 1000 IU
- pH < 7.10

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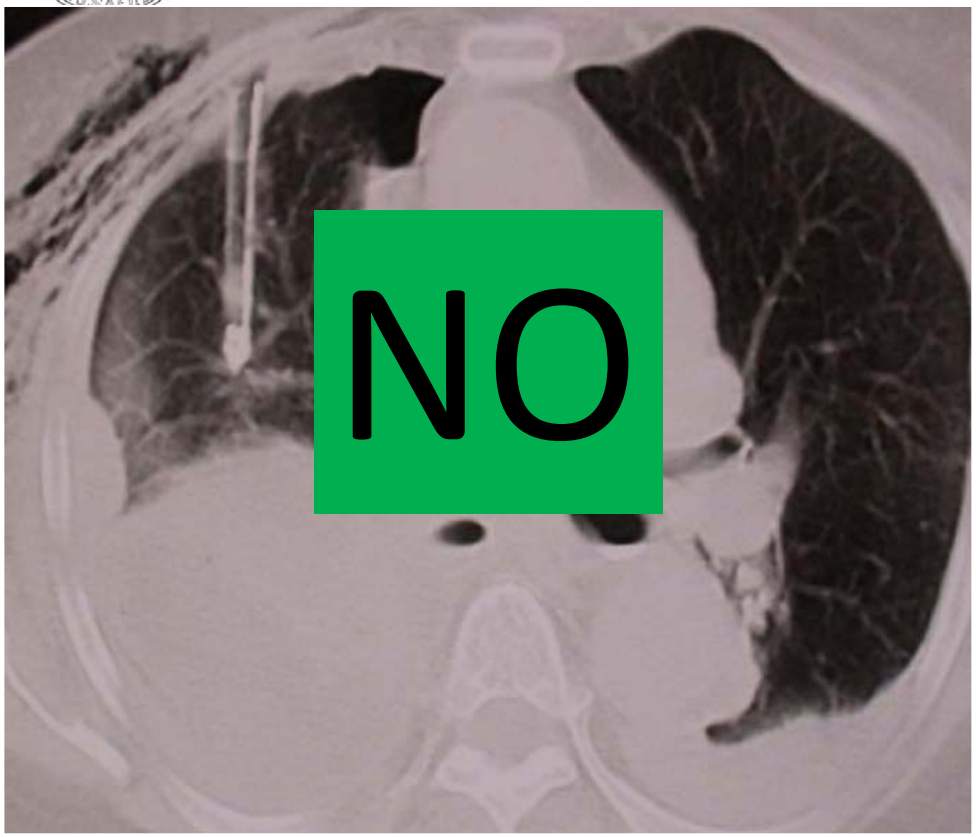

Chest tube placement

Chest tube MUST be placed at the most dependent level and MUST enter the fluid collection

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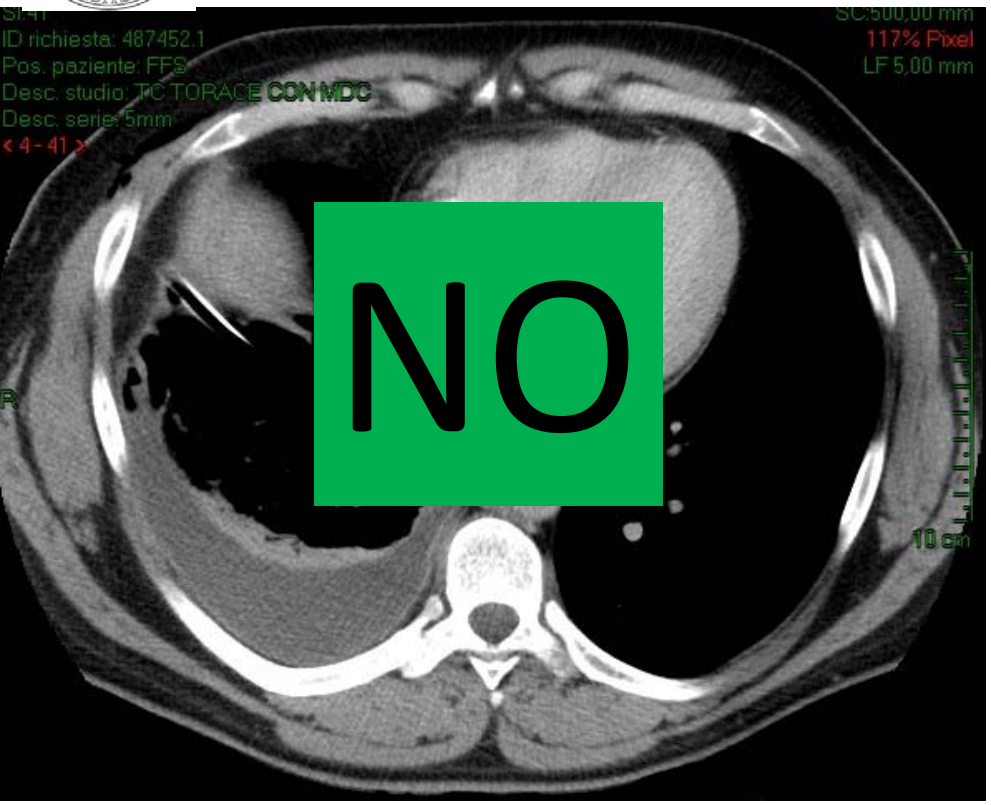

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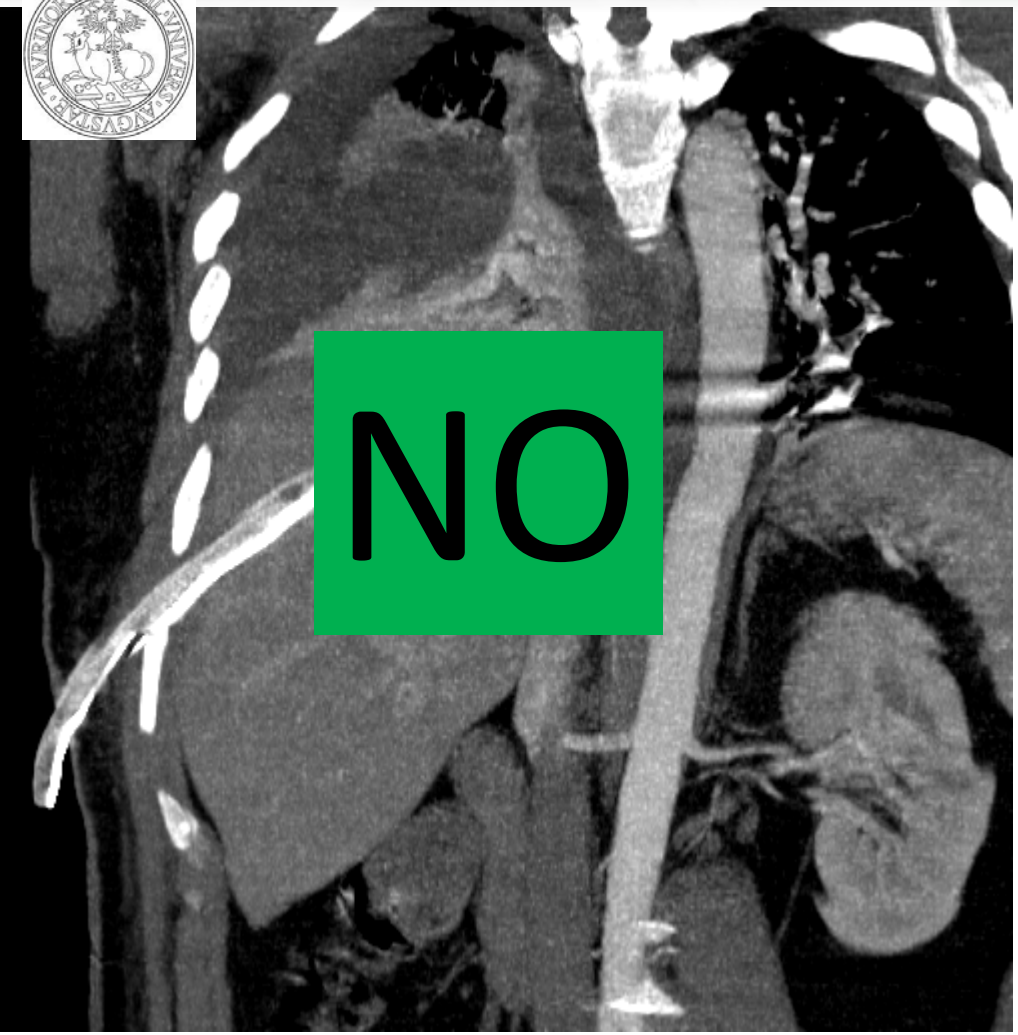

ATTENTION!!!!!

Don’t place the drain too much below, to avoid severe injuries…

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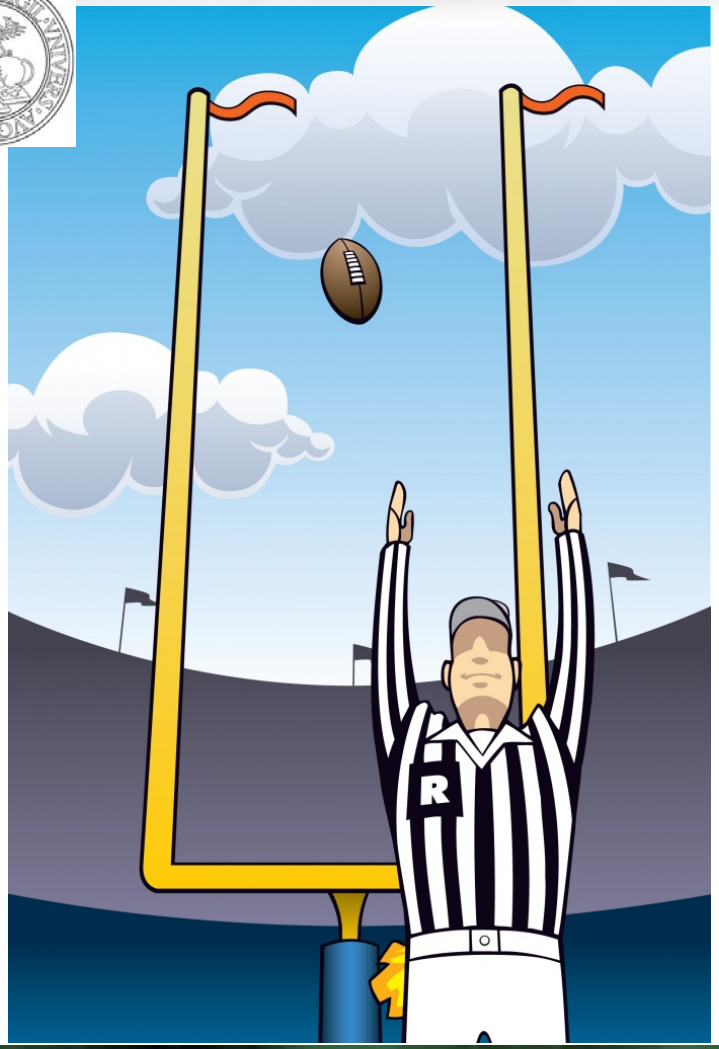

Chest tube placement

Success rates may vary between 6% and 78%

To be successful the drainage should be reserved for patients with exudative
early fibrinopurulent effusions

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Chest tube placement

Success rates deteriorate to
35% - 39% in case of true empyema

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Which drainage?

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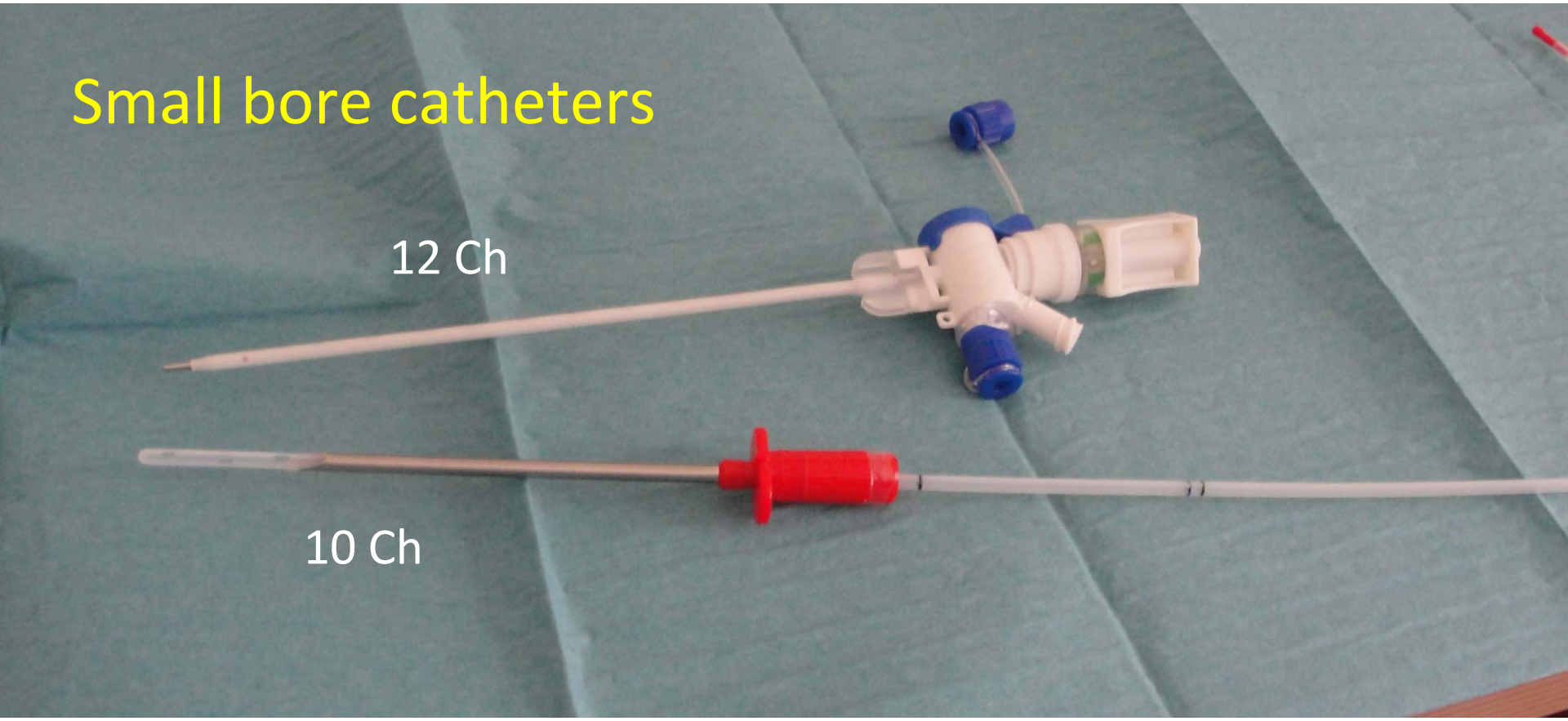
Small bore catheters



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Which drainage?

Traditionally, closed chest tube drainage of pus with large bore drains is done without radiological guidance

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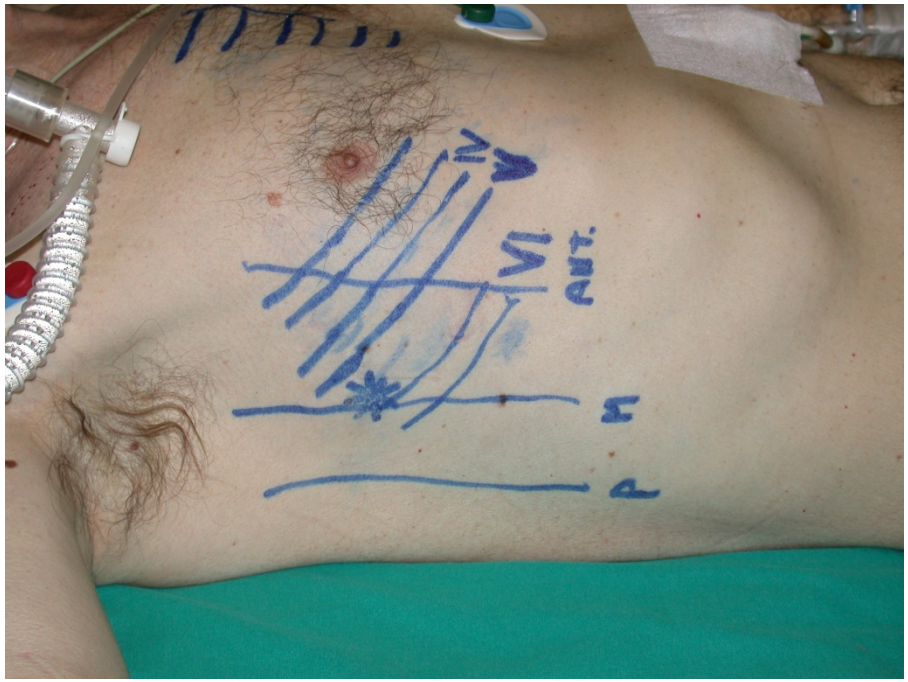
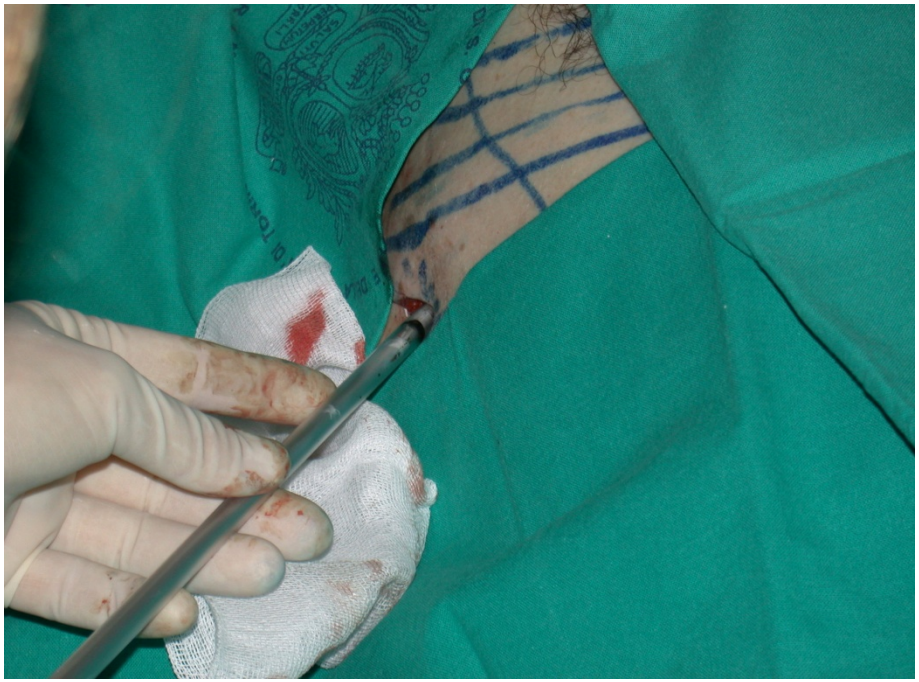
Large bore drains





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Which drainage?

Small bore catheters (10 – 14 Ch) have been employed

Easier and less traumatic to insert

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Which drainage?

Chest drain insertion
(especially small bore one)
is recommended
to be performed under image guidance

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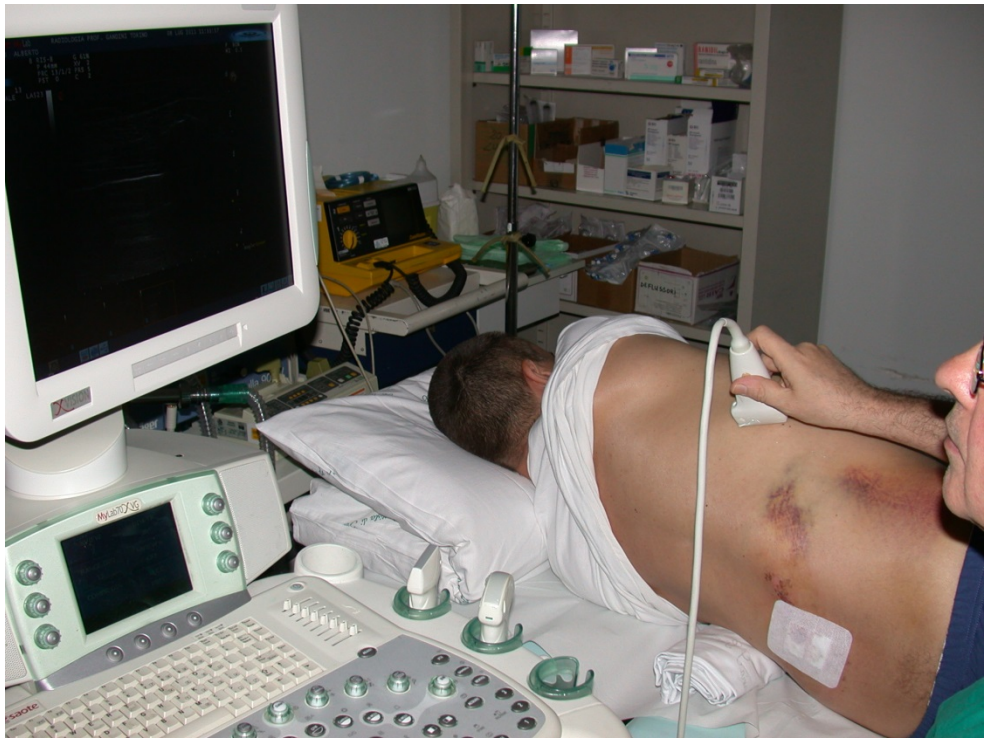

Drainage placement under ultrasonographic guidance

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Under CT guidance (multiloculated effusions)

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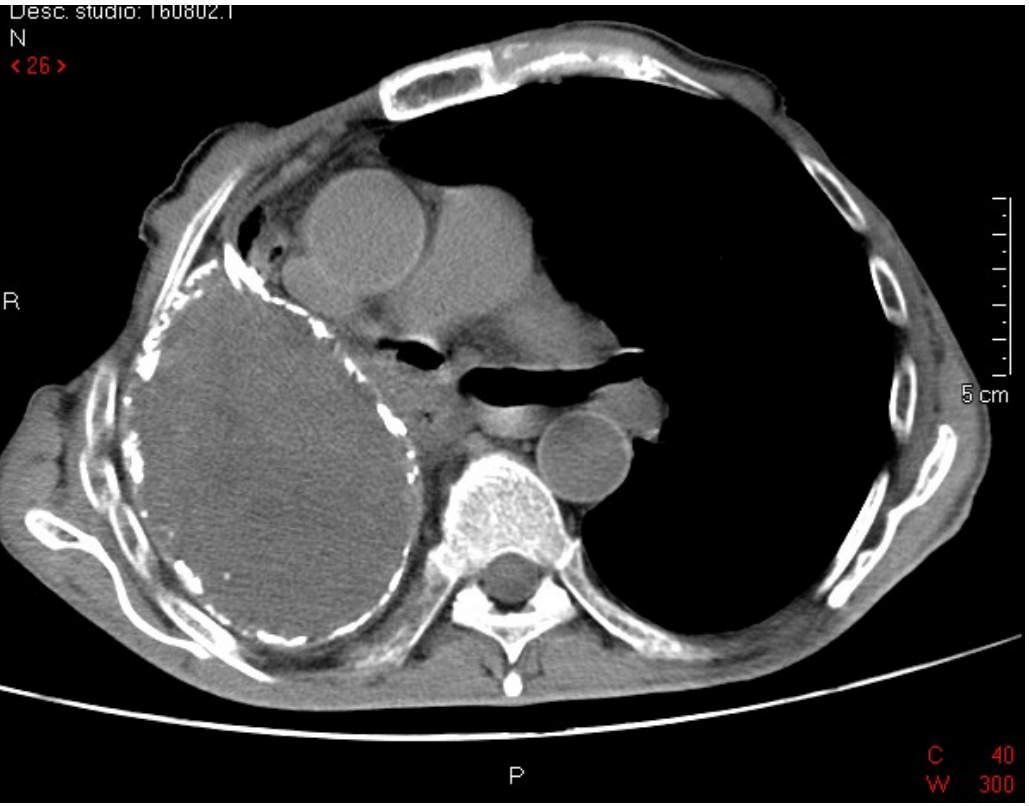
Which drainage?



Chest tube should be chosen according to the parapneumonic radiologic appearance…

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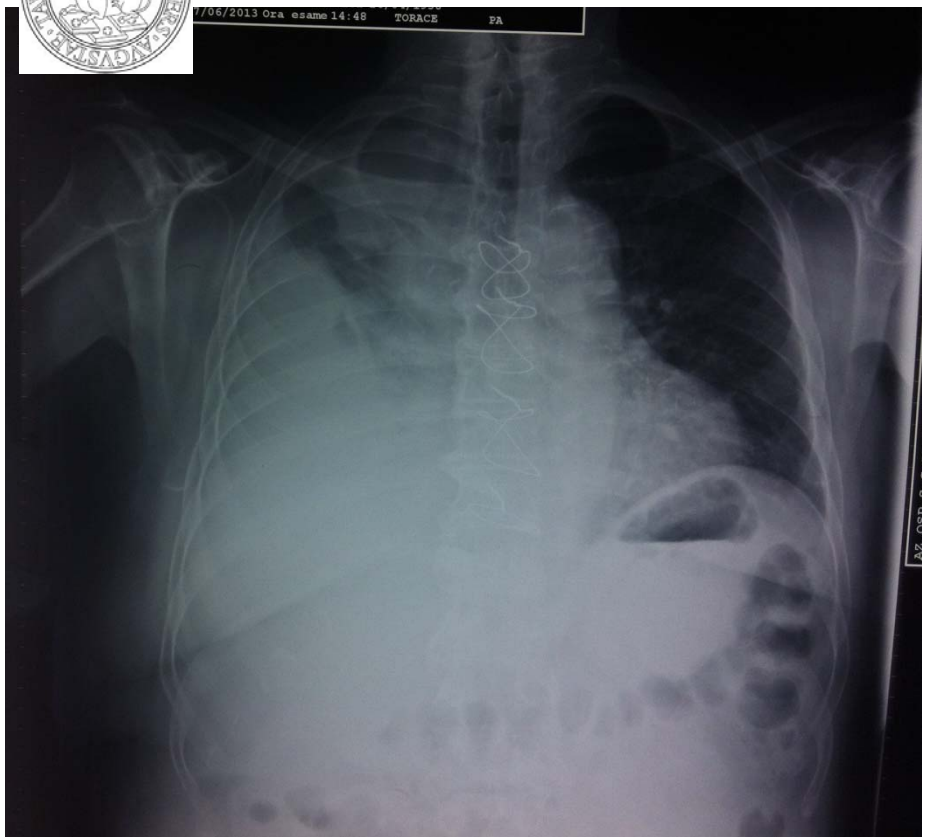

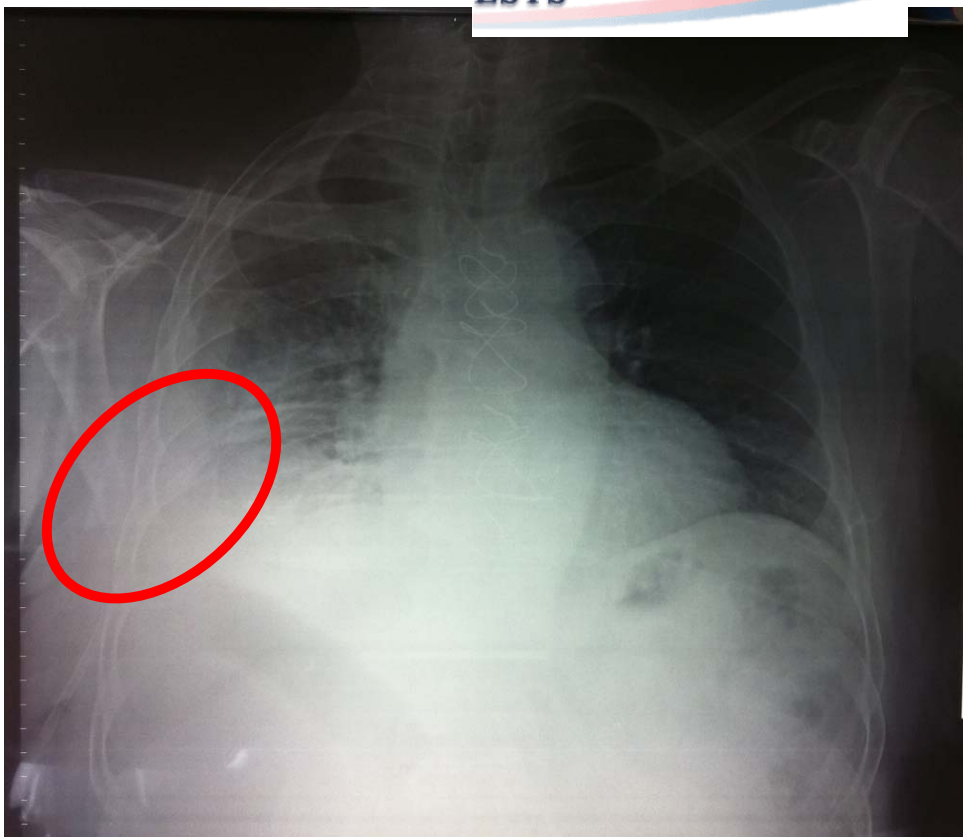

before

after

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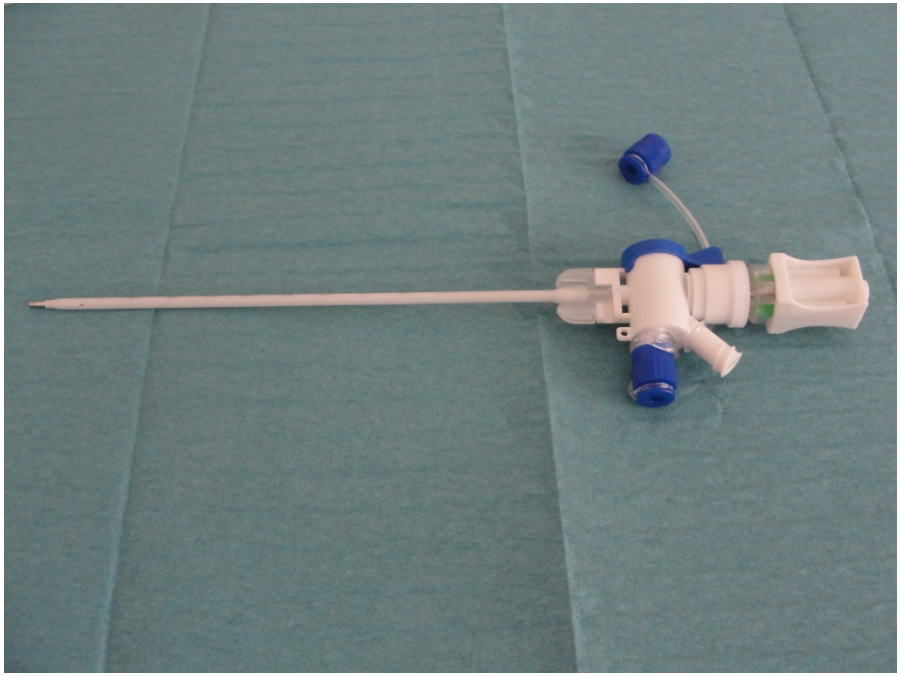
Small bore drains



Reported success rates up to 83% - 87%

Drains are better tolerated by the patients, but they're more prone to obstruction by fibrinous debris

Resolution tends to be slower with chest duration:7-26 days

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Despite proper positioning and aggressive drainage management, small bore chest tube may fail if it is repeatedly occluded by debris

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Which drainage?

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BTS guidelines

Management of pleural infection in adults: British Thoracic Society pleural disease guideline 2010

Helen E Davies,[1,2] Robert J O Davies,[1] Christopher W H Davies,[2] on behalf of the BTS Pleural Disease Guideline Group

[1]Oxford Centre for Respiratory Medicine, Churchill Hospital Site, Oxford Radcliffe Hospital, Oxford, UK
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INTRODUCTION

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This article presents the results of a peer-reviewed systematic literature review combined with expert opinion of the preferred management

to *Streptococcus pneumoniae* which now only accounts for approximately 10% of culture-positive cases.[6] The prevalence of *Staphylococcus aureus* rose and the development of staphylococcal resistance in the 1950s increased complications and mortality.[7 8] More recently, the reported prevalence of anaerobic infections[7 9 10] and Gram-negative organisms[9 10] has risen. Use of intrapleural fibrinolytic therapy was first suggested in 1949[11] but the impure agents available caused adverse reactions. Most recently, early use of video-assisted thoracoscopic surgical (VATS) techniques has been introduced.[12]

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Which drainage?

There's no clear consensus about the optimal chest drain size…

Surgeons tend to use large bore ones to avoid their blockage

ACCP and BTS guidelines recommend 10-14 Ch drains, since they're atraumatic and better tolerated by the patients compared to large bore ones

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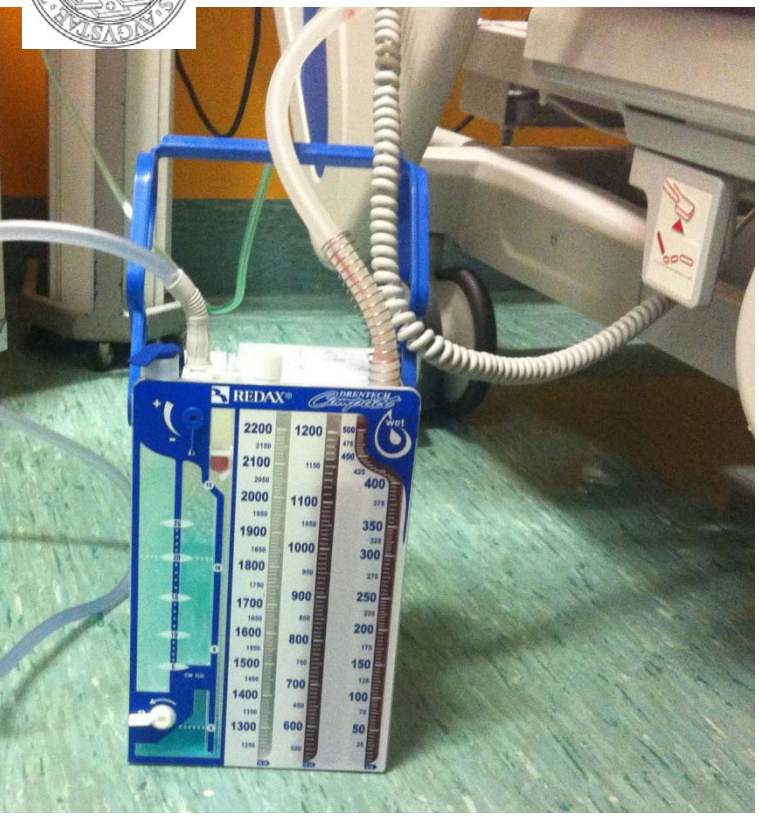

Following insertion, a pleural suction system (usually -20 cm H_2O) is used to facilitate pleural apposition

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Predicting Factors for Outcome of Tube Thoracostomy in Complicated Parapneumonic Effusion or Empyema*

Hsu-Chia Huang, MD; Han-Yu Chang, MD; Chang-Wen Chen, MD; Cheng-Hung Lee, MD; and Tzuen-Ren Hsiue, MD

Study objectives: To determine the predicting factors for outcome of tube thoracostomy in patients with complicated parapneumonic effusion (CPE) or empyema.
Design and settings: Retrospective chart review over a 55-month period at a tertiary referred medical center.
Patients and measurements: The medical charts of patients with empyema or CPE were reviewed. Data including age, gender, clinical symptoms, important underlying diseases, leukocyte count, duration of preadmission symptoms, interval from first procedure to second procedure, the time from first procedure to discharge (recovery time), the amount of effusion drained, administration of intrapleural streptokinase, chest tube size and position, loculation of pleural effusion, and characteristics and culture results of pleural effusion were recorded and compared between groups of patients with successful and failed outcome of tube thoracostomy drainage.
Results: One hundred twenty-one patients were selected for study. One hundred of these patients had received tube thoracostomy drainage with 53 successful outcomes and 47 failed outcomes of chest tube drainage. Nineteen patients received decortication directly, and the other two received antibiotics alone. Univariate analysis showed that pleural effusion leukocyte count, effusion amount, and loculation of pleural effusion were significantly related to the outcome of chest tube drainage. Multiple logistic regression analysis demonstrated that loculation and pleural effusion leukocyte count ≤ 6,400/μL were the only independent predicting factors related to failure of tube thoracostomy drainage.
Conclusions: Loculation and pleural effusion leukocyte count ≤ 6,400/μL were independent predicting factors of poor outcome of tube thoracostomy drainage. These results suggest that if the initial attempt at chest tube drainage fails, early surgical intervention should be considered in good surgical candidates with loculated empyema or pleural effusion with leukocyte count ≤ 6,400/μL.
(CHEST 1999; 115:751–756)

Key words: complicated parapneumonic effusion; empyema; predicting factors; tube thoracostomy

Abbreviations: AROC = area under the receiver operating characteristic curve; CI = confidence interval; CPE = complicated parapneumonic effusion; D24 = the volume of pleural effusion drained from the chest tube within the first 24 h; LDH = lactate dehydrogenase; PMN = polymorphonuclear leukocyte; TNF = tumor necrosis factor

Retrospective review of 100 pts managed by tube thoracostomy:

53%: resolution without other interventions

Independent predictors of failure:
loculated empyema
pleural fluid leukocyte < 6400μg/l

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Intrapleural instillation of fibrinolytic agents have been advocated in case of failure of resolution with chest tube placement

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Table 2
Randomized clinical trials investigating intrapleural fibrinolytic therapy for empyema

Author	Number of Patients	Success (%)	Complications (%)
Bouros et al[10]	Streptokinase group = 25 Urokinase group = 25	Streptokinase group = 92 Urokinase group = 92	28 developed elevation in temperature
Davies et al[11]	Streptokinase group = 12 Control = 12	Streptokinase group = 100 Control = 83	None
Tuncozgur et al[12]	Urokinase group = 25 Control = 24	Urokinase group = 71 Control = 40	None
Diacon et al[13]	Streptokinase group = 22 Control = 22	Streptokinase group = 82 Control = 48	None
Maskell et al[14]	Streptokinase group = 208 Control = 222	Streptokinase group = 69 Control = 73	7 (chest pain, fever)
Misthos et al[15]	Streptokinase group = 57 Control = 70	Streptokinase group = 88 Control = 67	None

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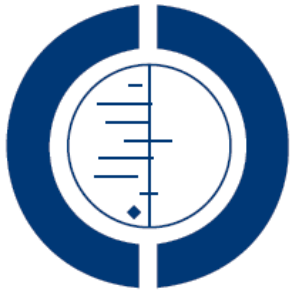
Surgical versus non-surgical management of pleural empyema (Review)

Coote N, Kay ES



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2009, Issue 3

http://www.thecochranelibrary.com

Fibrinolytic therapy reduced the need for surgery when compared with chest tube placement alone

(RR 0.63; 95% CI: 0.46-0.86)

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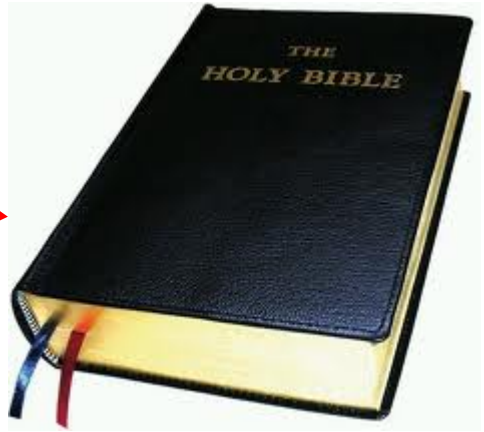
This article presents the results of a peer-reviewed systematic literature review combined with expert opinion of the preferred management to *Streptococcus pneumoniae* which now only accounts for approximately 10% of culture-positive cases.[6] The prevalence of *Staphylococcus aureus* rose and the development of staphylococcal resistance in the 1950s increased complications and mortality.[7 8] More recently, the reported prevalence of anaerobic infections[7 9 10] and Gram-negative organisms[9 10] has risen. Use of intrapleural fibrinolytic therapy was first suggested in 1949[11] but the impure agents available caused adverse reactions. Most recently, early use of video-assisted thoracoscopic surgical (VATS) techniques has been introduced.[12]

Current evidence does not support the routine use of intrapleural fibrinolytic agents



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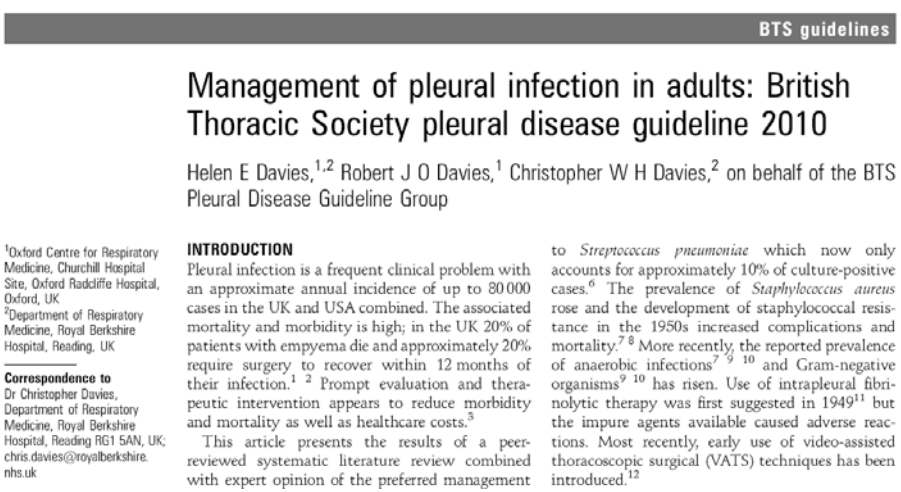
Fibrinolytic therapy



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Physical decompression of multiloculated pleural collections causing dyspnoea or resp. failure when surgery is not immediately feasible or at high risk

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Acute Hypoxemic Respiratory Failure Following Intrapleural Thrombolytic Therapy for Hemothorax*

Michael D. Frye, M.D., F.C.C.P.; Mikell Jarratt, M.D.; and Steven A. Sahn, M.D., F.C.C.P.

Intrapleural instillation of thrombolytic agents has been useful in the treatment of hemothorax when thoracostomy tube drainage is unsuccessful. We present a patient who developed acute hypoxemic respiratory failure following the intrapleural instillation of both streptokinase and urokinase 24 h apart. Hypoxemia most likely resulted from a direct effect of the products of fibrinolysis on the pulmonary circulation.

(Chest 1994; 105:1595-96)

CO=cardiac output; FDP=fibrin degradation products; PAP=pulmonary artery pressure; PCWP=pulmonary capillary wedge pressure

Complications of the therapeutic use of intrapleural thrombolytic agents are infrequent. Although intravascular administration has been associated with adult respiratory distress syndrome (ARDS) in two patients,[1,2] intrapleural instillation has not been previously reported to lead to pulmonary complications. We recently observed a patient who developed two episodes of severe hypoxemia related to the instillation of two different thrombolytic agents.

Report of ARDS in a patient who received both urokinase and streptokinase for empyema

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Surgery

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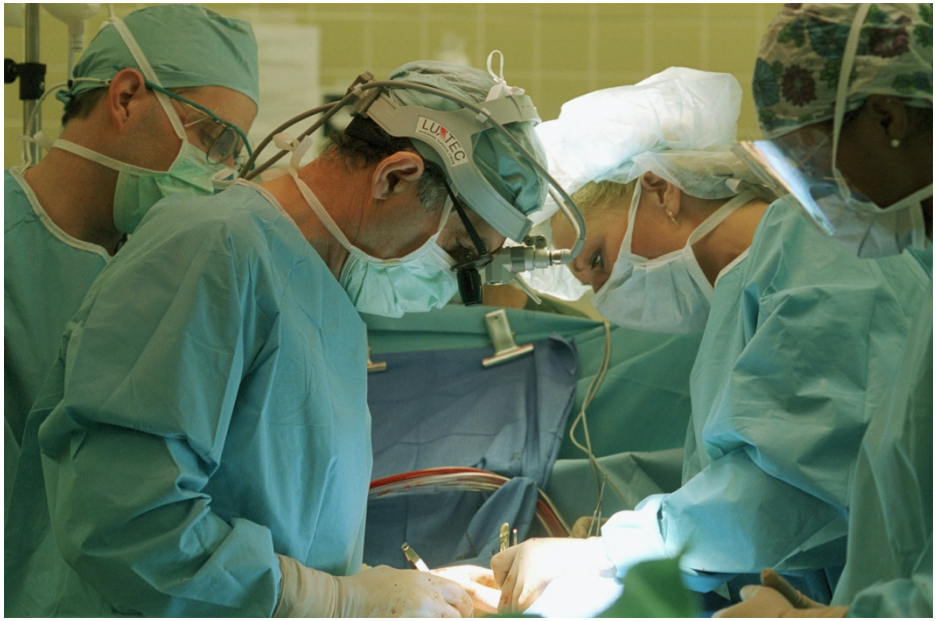

Most patients require surgery to promote drainage because of the presence of viscous pleural fluid or multiple loculations

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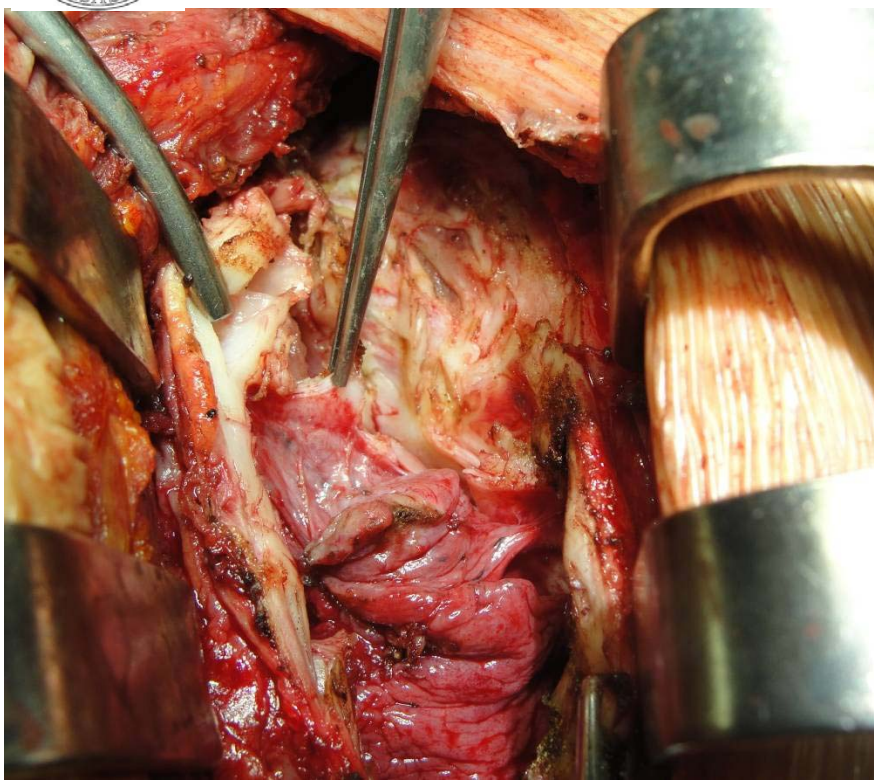

Delay in elective drainage may allow the creation of pleural peel, prolong the hospital stay and increase hospital costs

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Indications to surgical drainage:

- Extent of loculations
- Patient's operability
- Lung capability to re-expand
- Possible BPF

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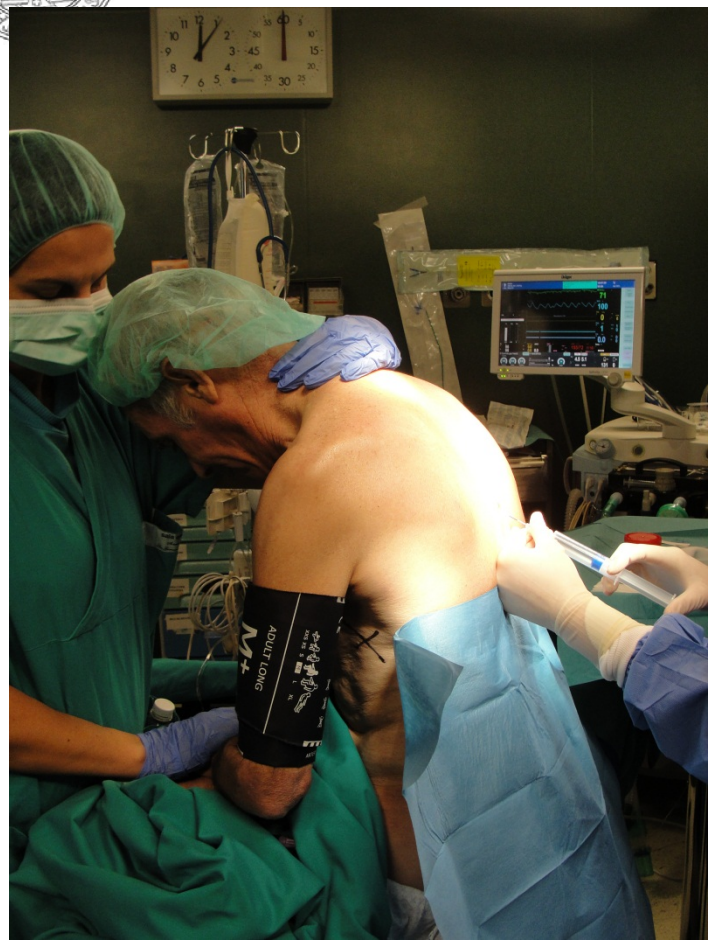
Tips & Tricks:



Double lumen tracheal ventilation

(fundamental for VATS and thoractomy; also in case of BPF)

Postoperative pain control

(epidural analgesia)

Early pts deambulation

(portable suction devices)

Low weigh heparin subcutaneously

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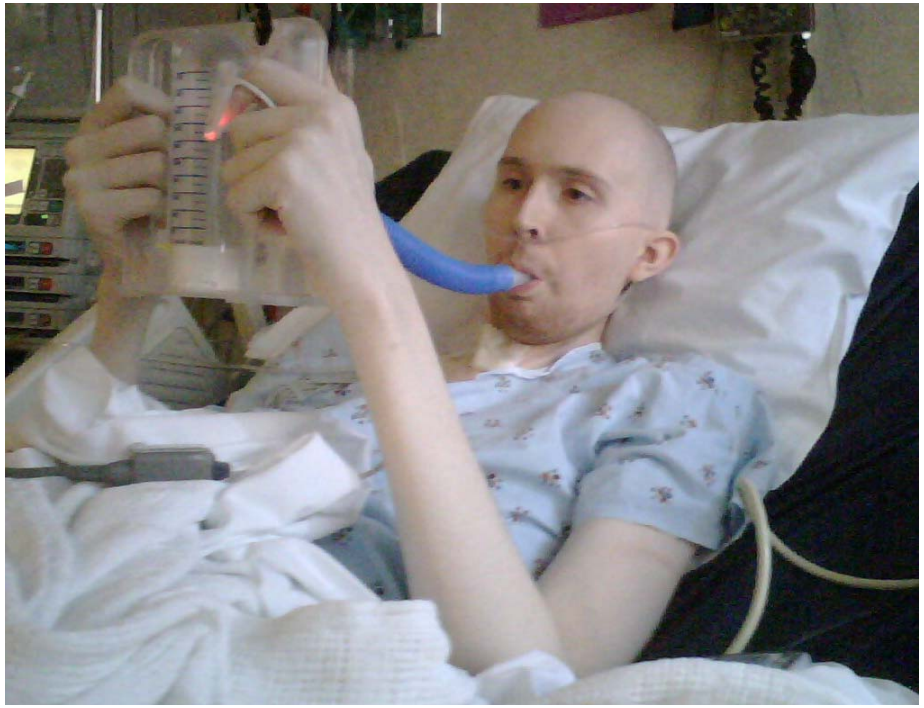
Tips & Tricks:



Aggressive chest physioterapy
and incentive spirometry
to allow:

deep breath
cough
secretion removal
lung re-expansion

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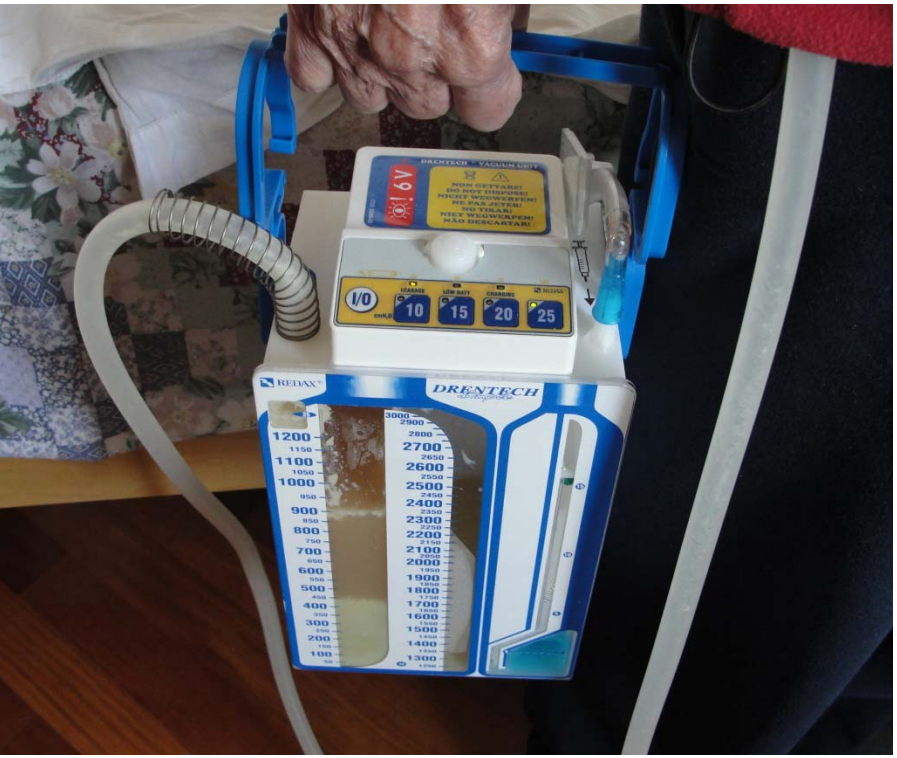
Suggestions:



Portable suction devices allow an early hospital discharge and patient can be safely managed at home

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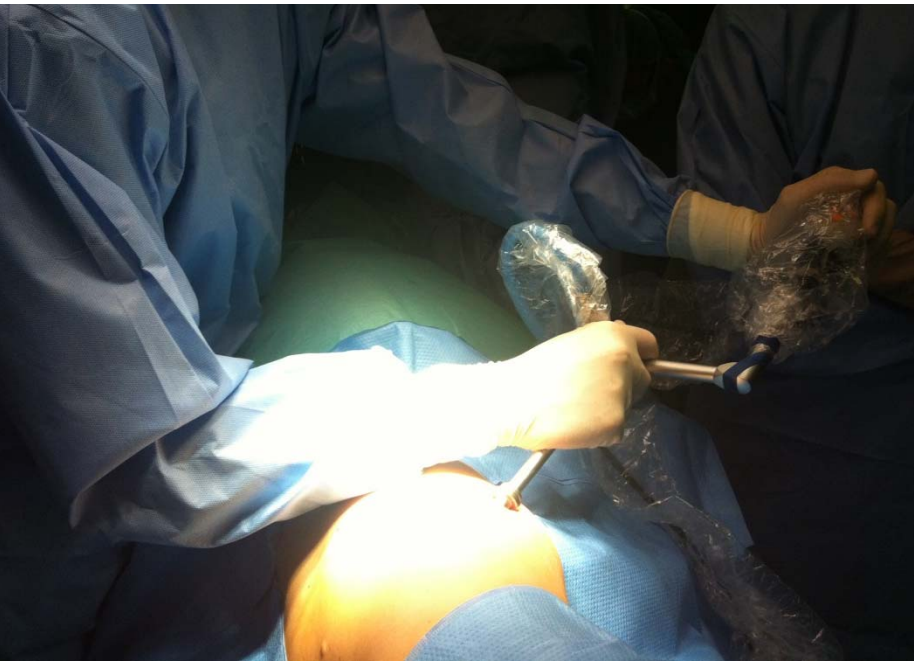

VATS is useful during the fibrinopurulent stage of empyema

Breakdown of all loculations, drainage of the gelatinous exudate, removal of fibrin and thin peels from the visceral pleura, allowing complete lung re-expansion

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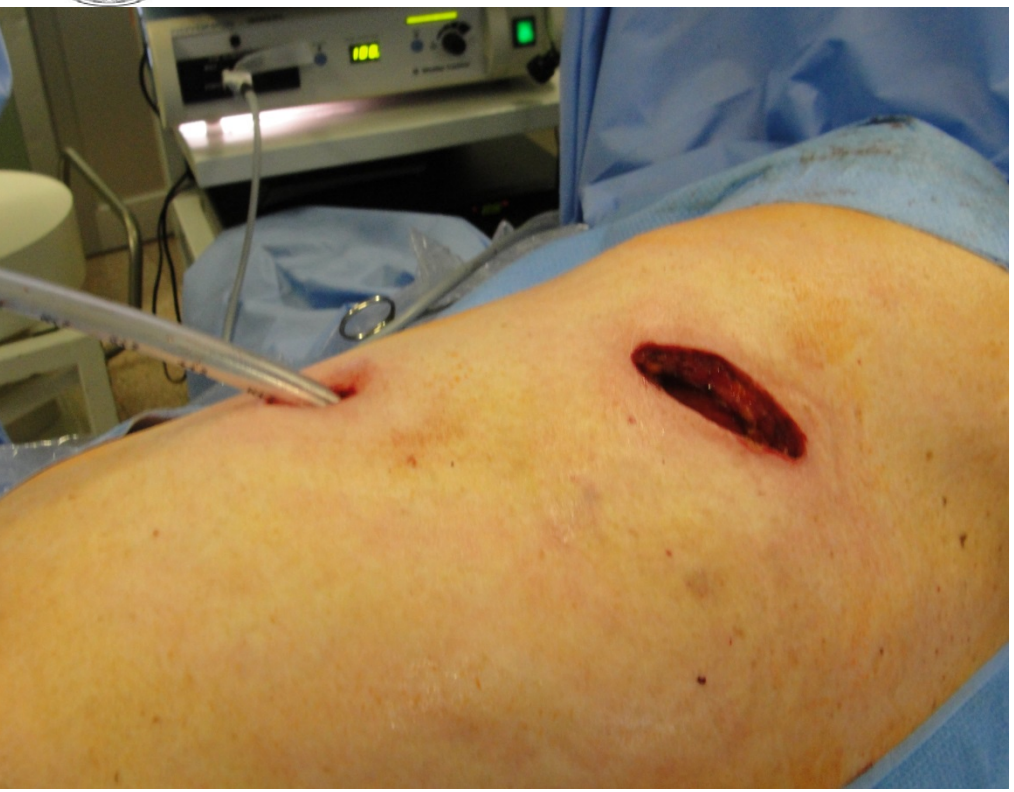

Small "utility" mini-thoracotomy is sometimes needed to achieve a complete lung re-expansion

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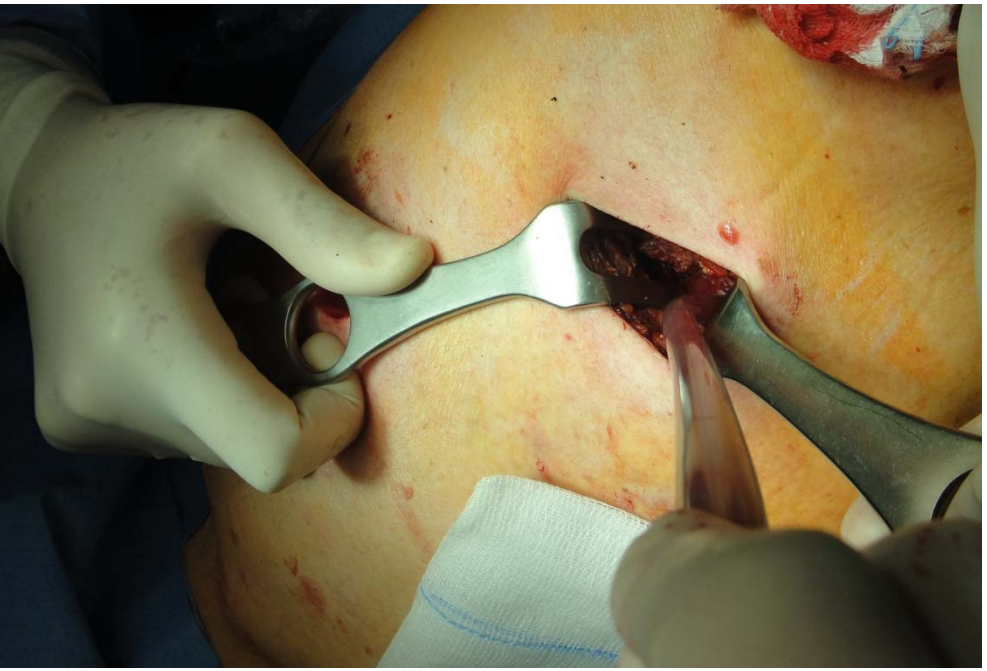

Through the mini-thoracotomy a correct loculation debridment is feasible and may be more effective

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Stage 3 disease

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Stage 3

Thoracotomy

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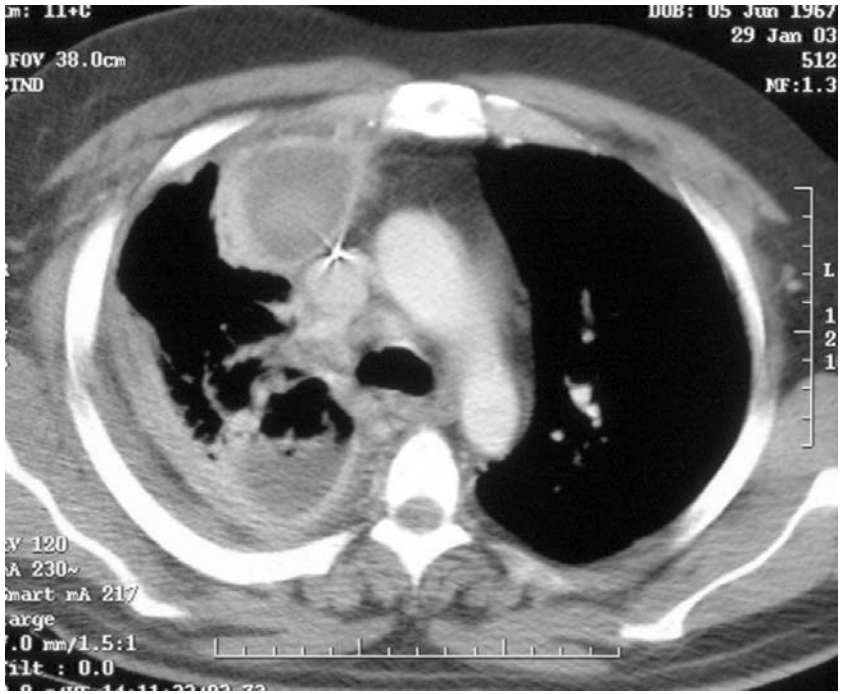

Early thoracotomy for pleural space infection evacuation is usually performed in the initial phase of the organizing stage (Stage 3)

Pleural surfaces are covered by an amorphous gelatinous fluid, but a true fibrous peel has not yet formed

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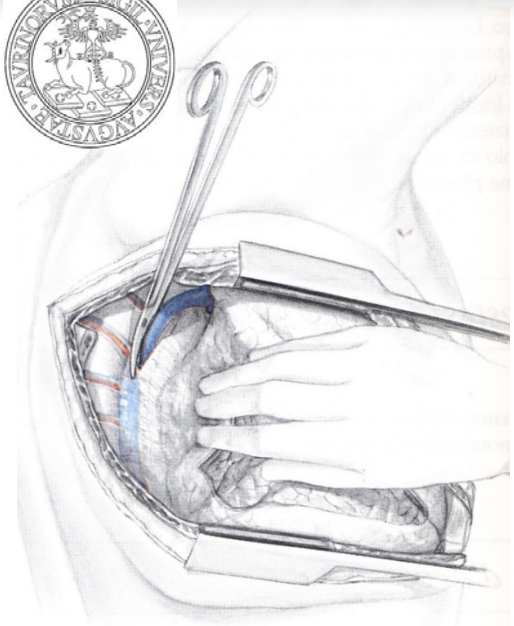

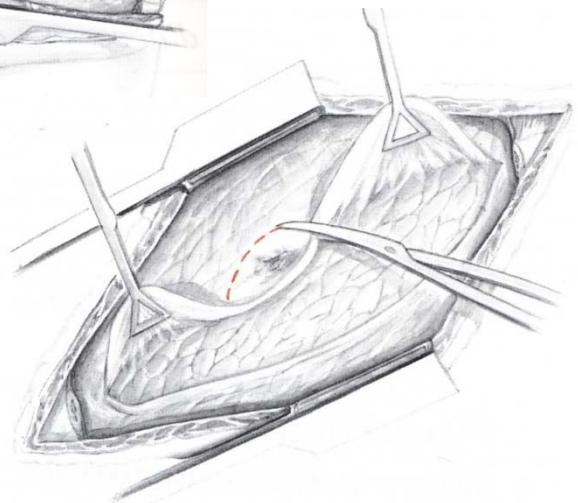

Blunt finger dissection to disrupt the septations and allow access to the entire pleural space

Total elimination of fibrin membranes from the lung, diaphragm and parietal pleura

Facilitate immediate and full lung re-expansion

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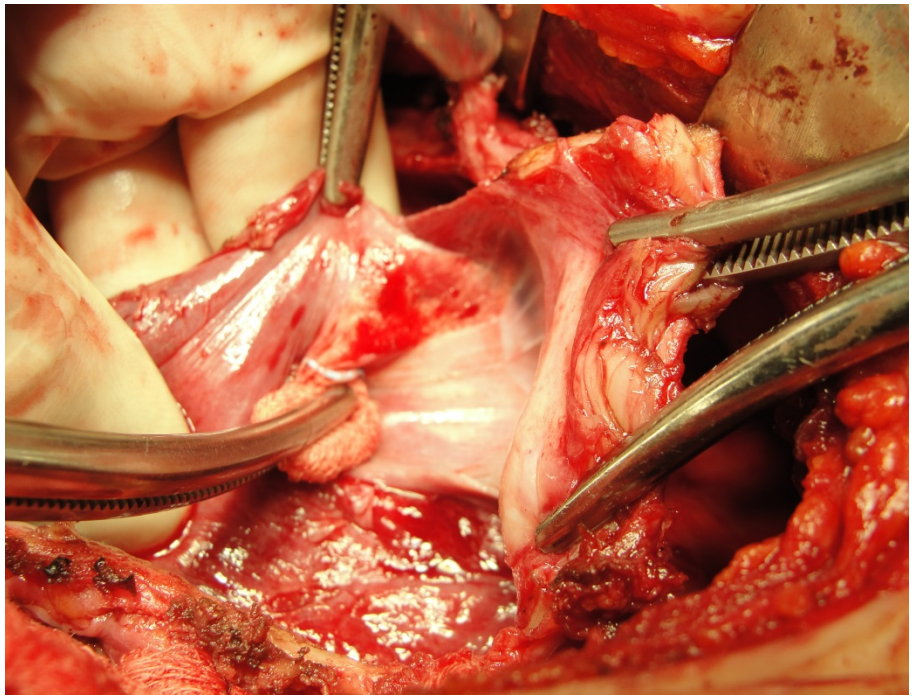

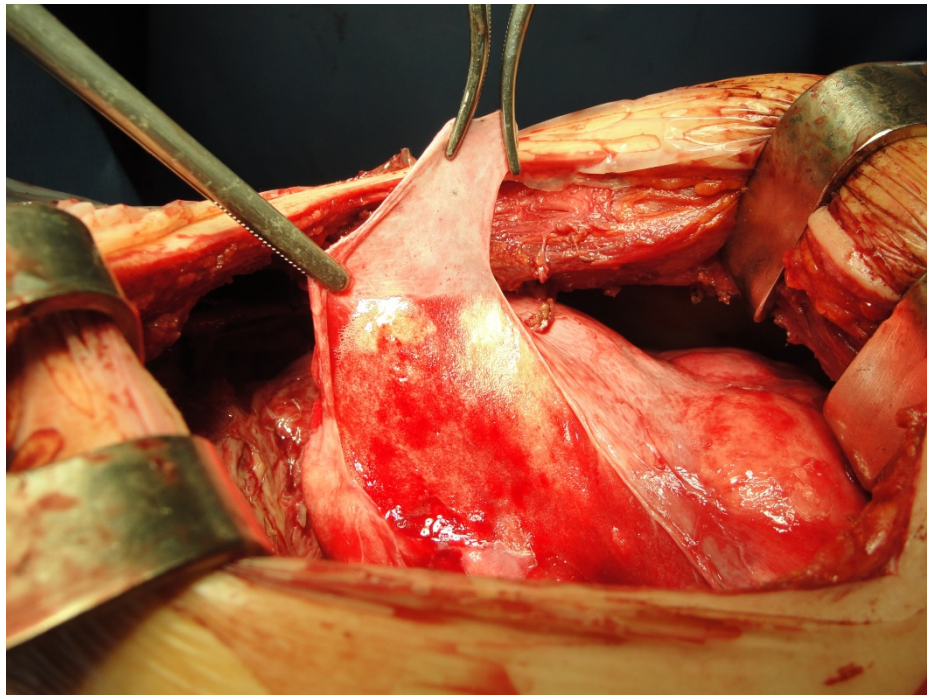

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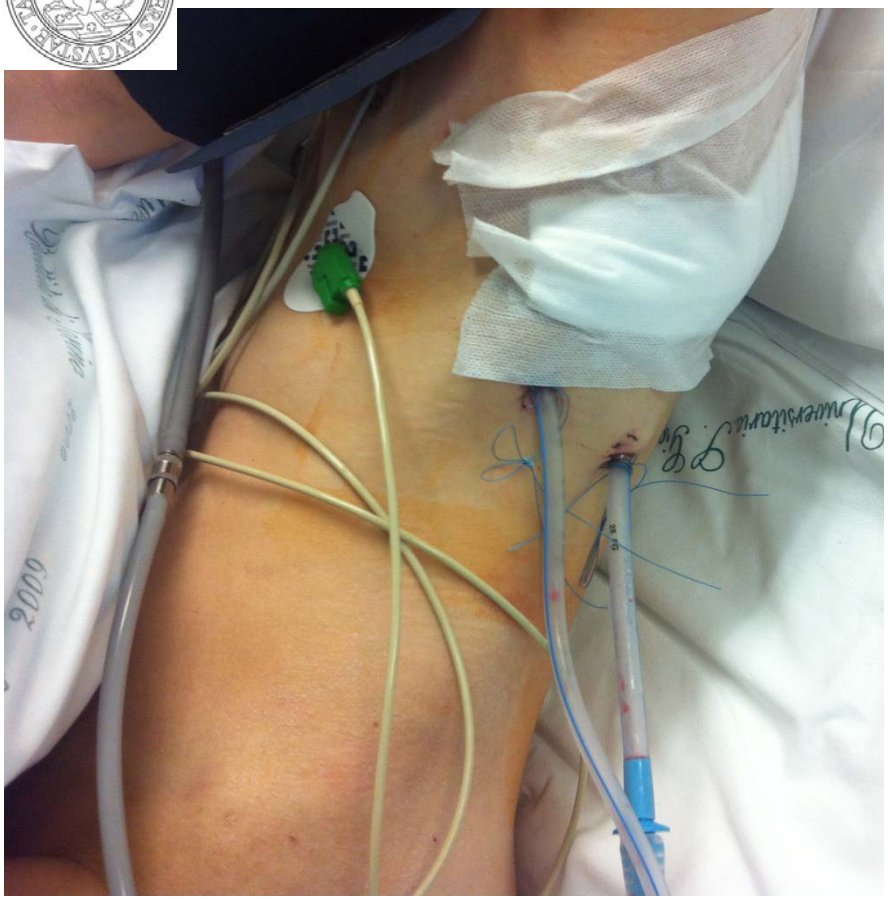

2 large bore chest drainages are placed at the end of intervention, one anteriorly, one posteriorly

Additional chest drains may be used to drain small inaccessible pleural areas

Drainages must be placed under suction (-20 cm H_2O)

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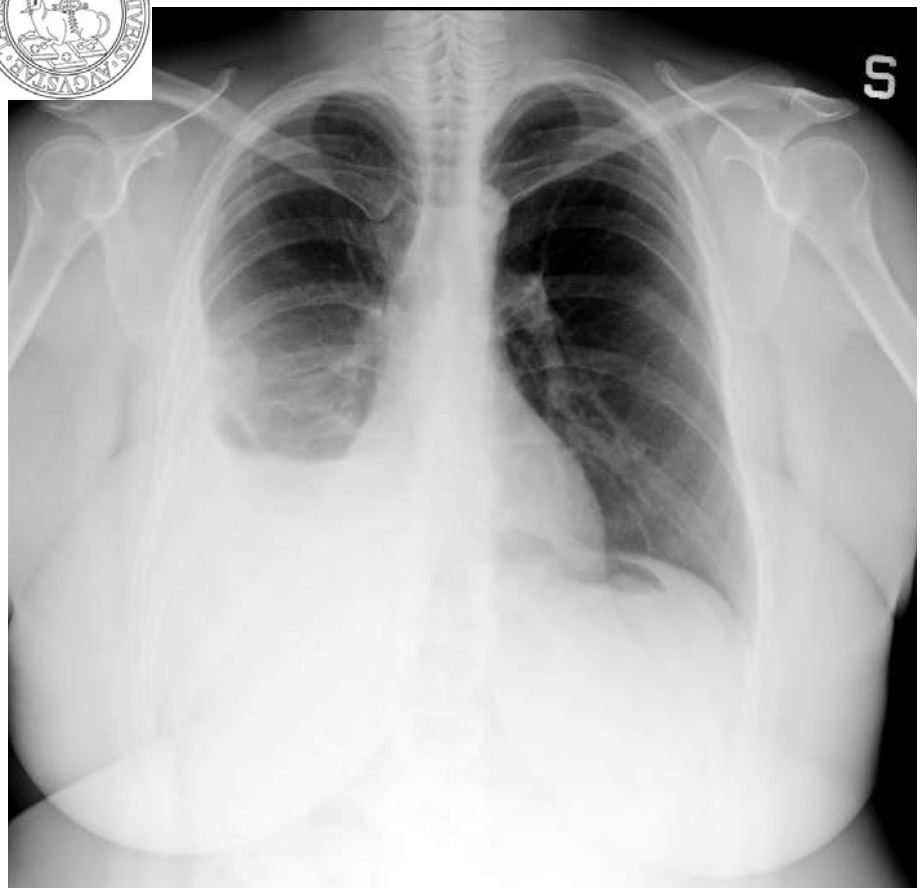
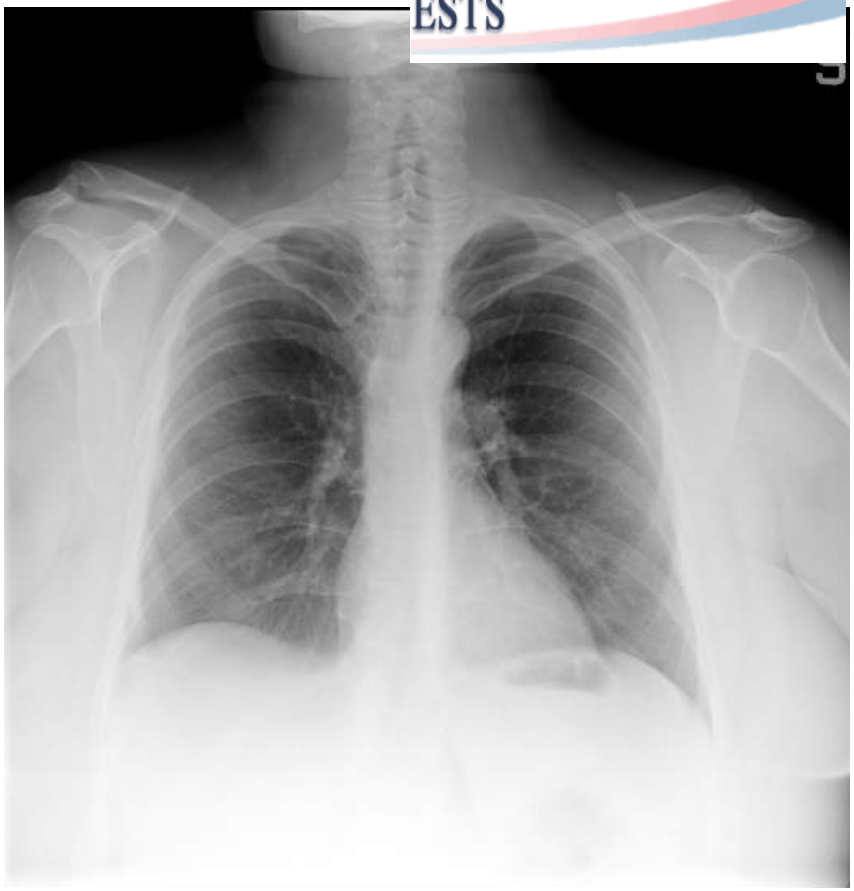


before



after

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Chronic empyema

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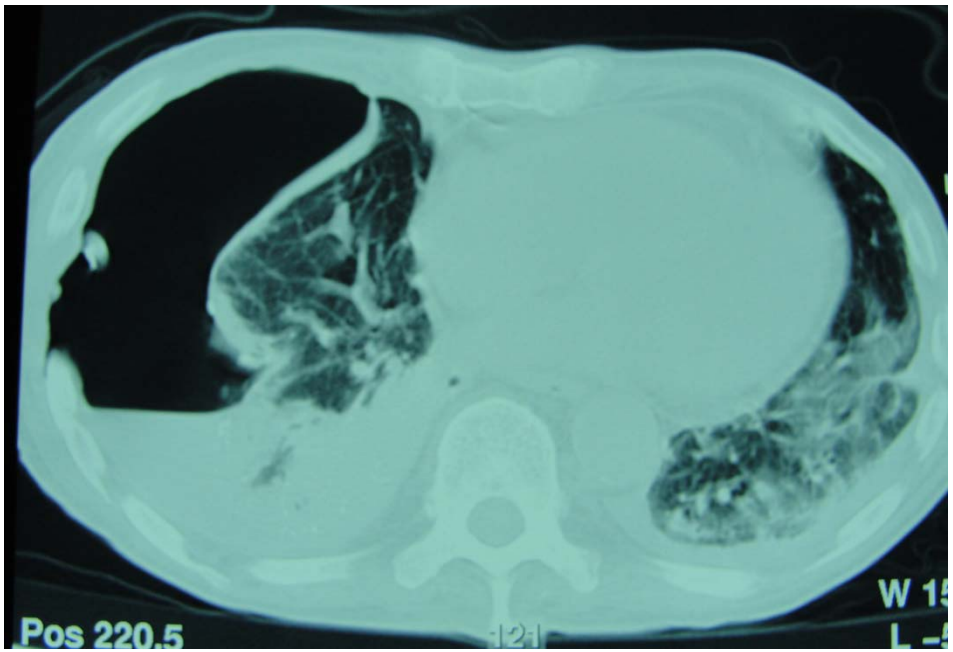

In a chronic empyema the presence of dense pleural peel makes impossible the lung re-expansion

The lung is entrapped and the pleural space obliteration is impossible

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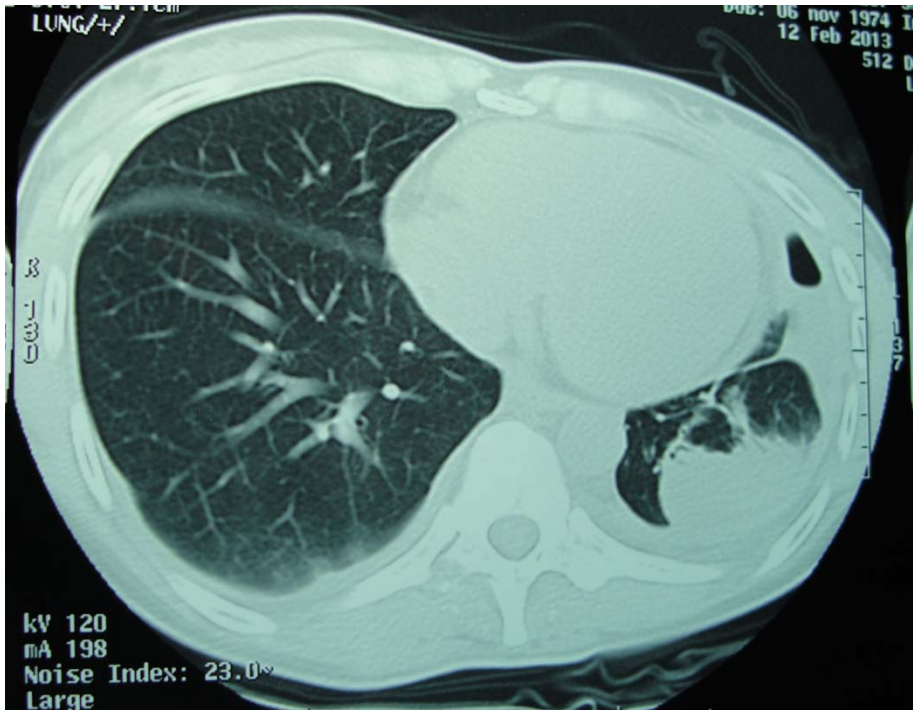

The result of a chronic empyema is frequently a fibrothorax

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Causes of Chronic Empyema

Delay in diagnosis

Inadequate drainage in acute stage

Continuing reinfection (bronchopleural fistula)

Retained haemothorax

Specific infections (i.e.: tuberculosis or fungal infection)

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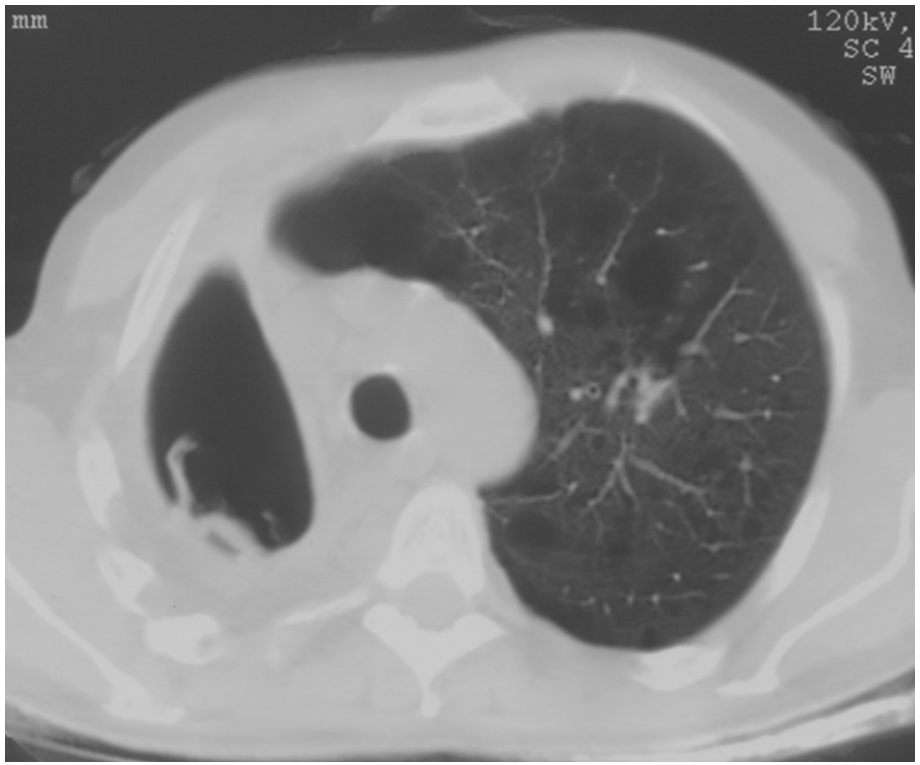

In an acceptable surgical candidate decortication remains the procedure of choice

An alternative is rib resection and large bore chest tube placement

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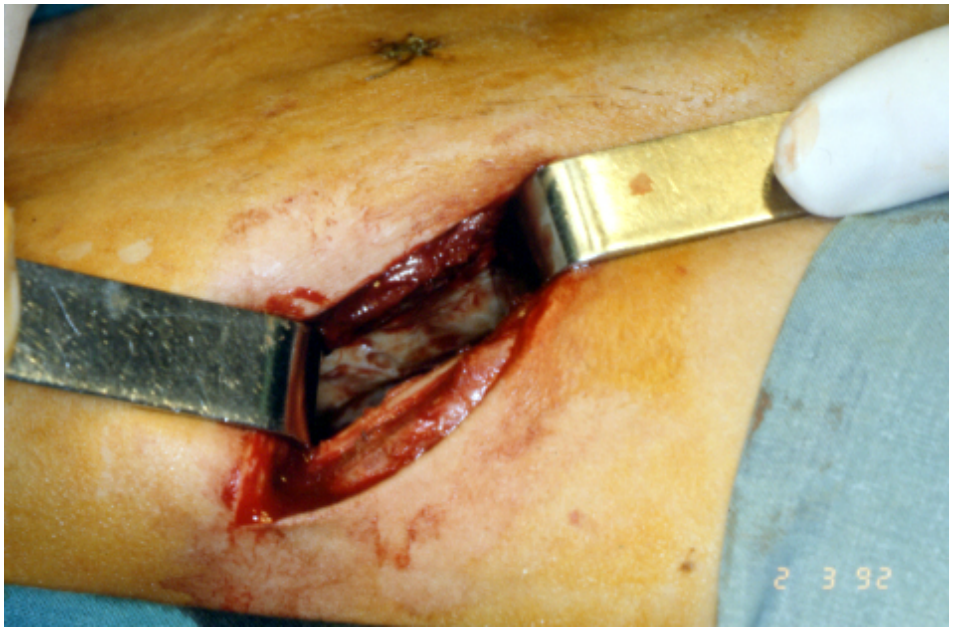
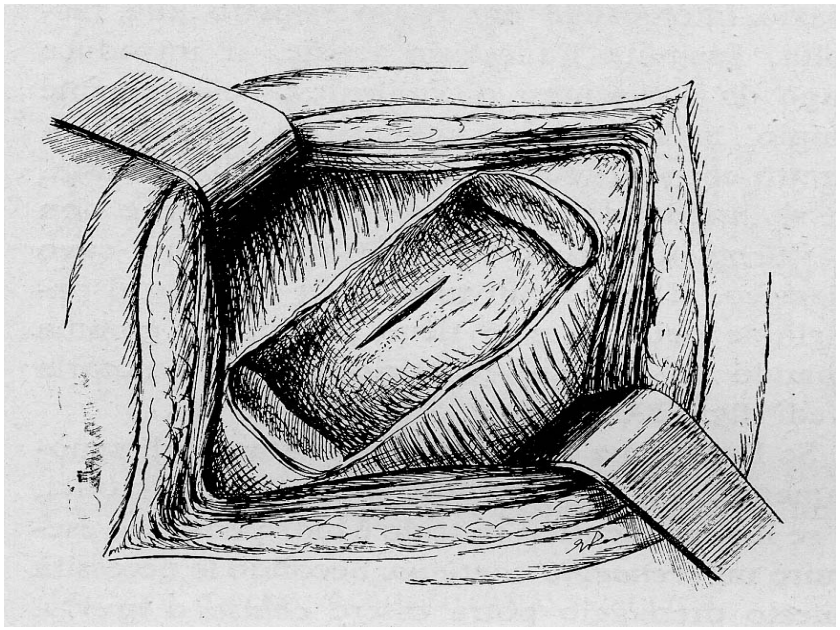
Rib resection and drainage





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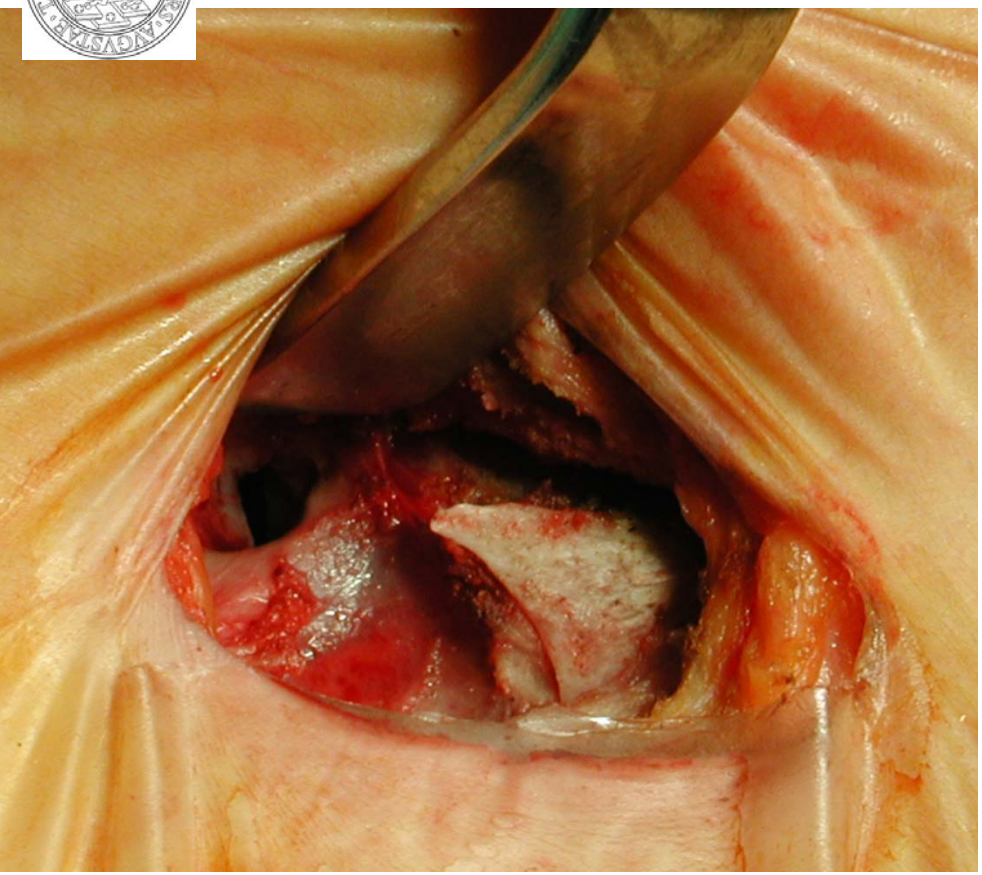

The tube may be slowly retracted over the course of weeks or months, while the infected space heals behind it

The patient may be managed also as outpatients, with a close surveillance

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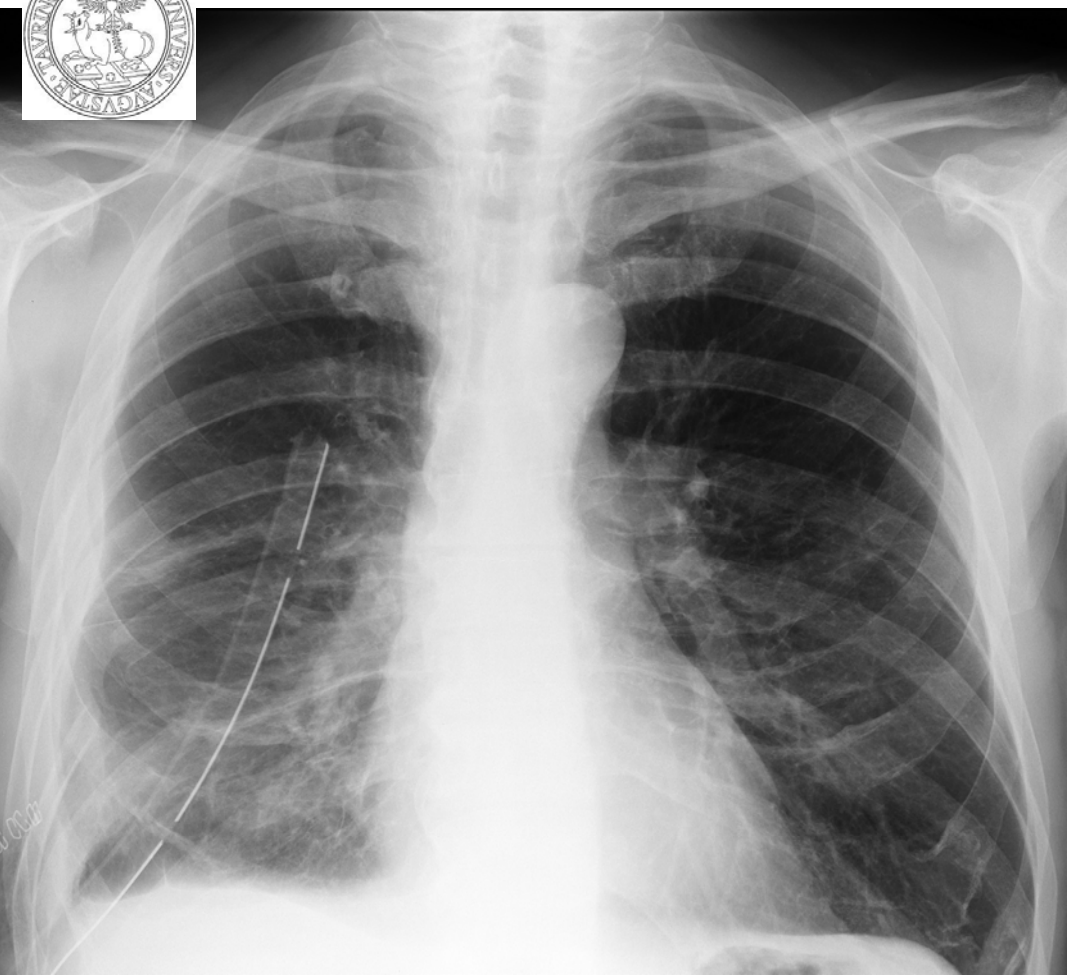

Postoperative chest X-ray

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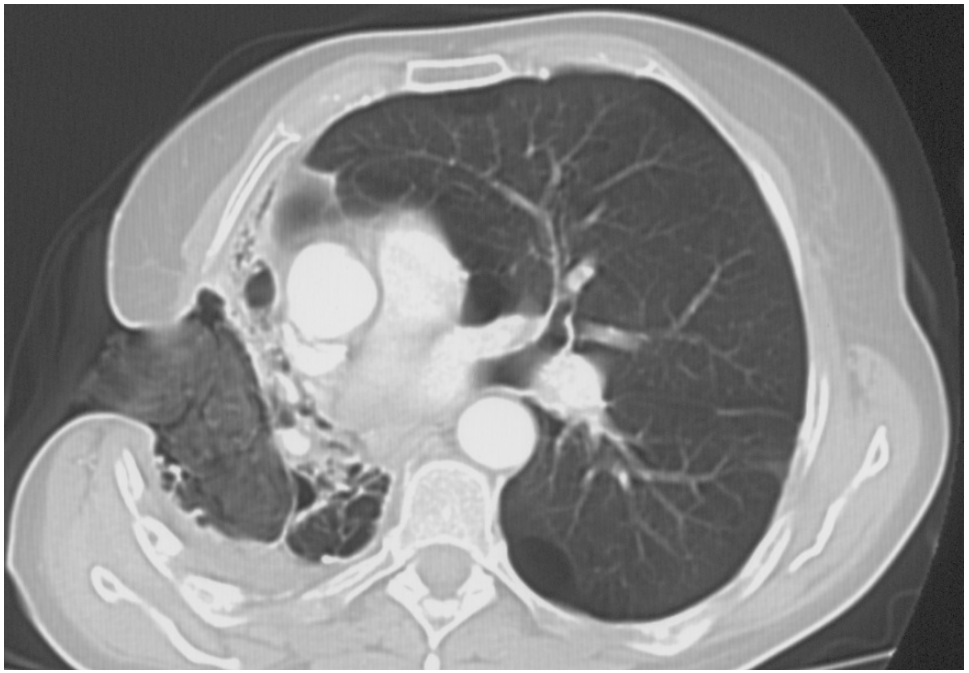

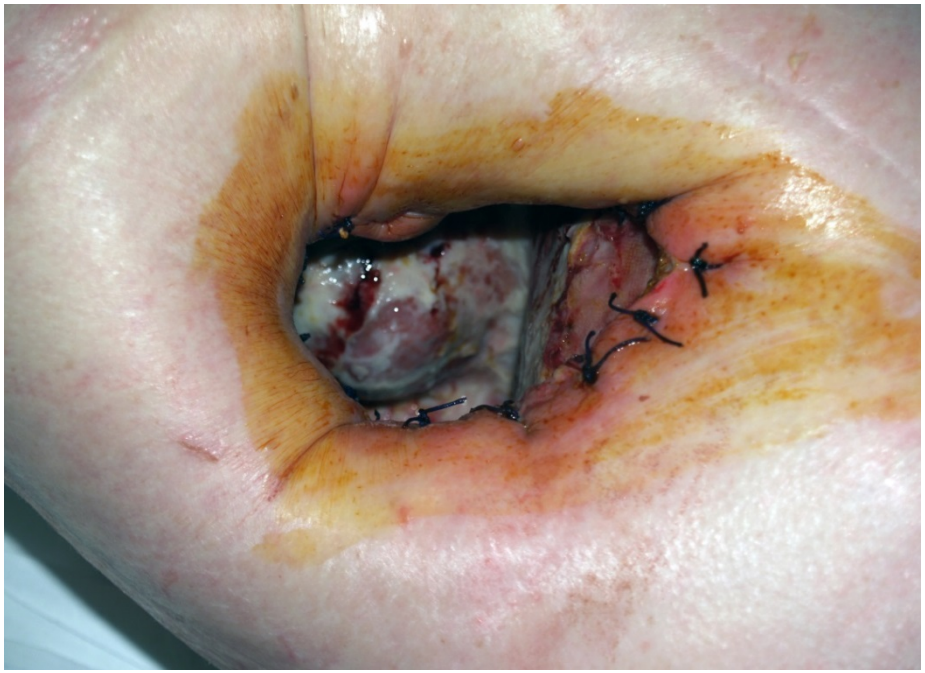

Open window

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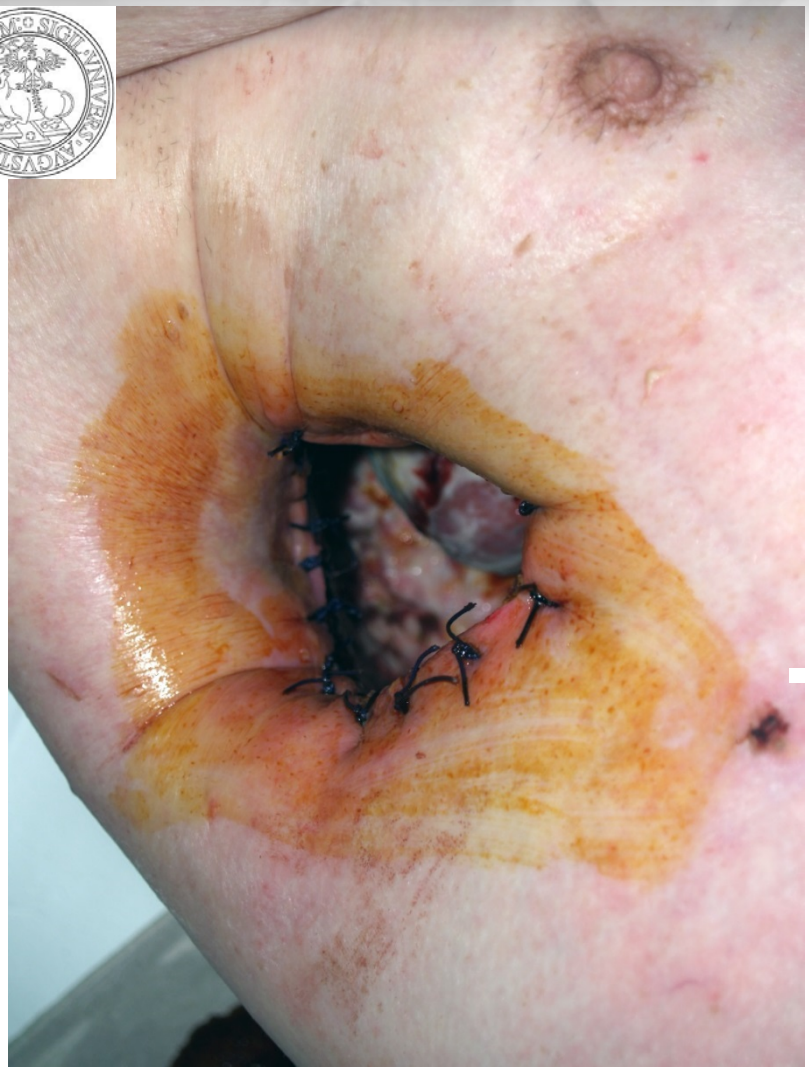

Open window is the treatment of choice in case of debilitated patient with chronic empyema

It's imperative to place the window at the inferior aspect of the cavity and to make the chest wall opening large enough to accomodate one's fist

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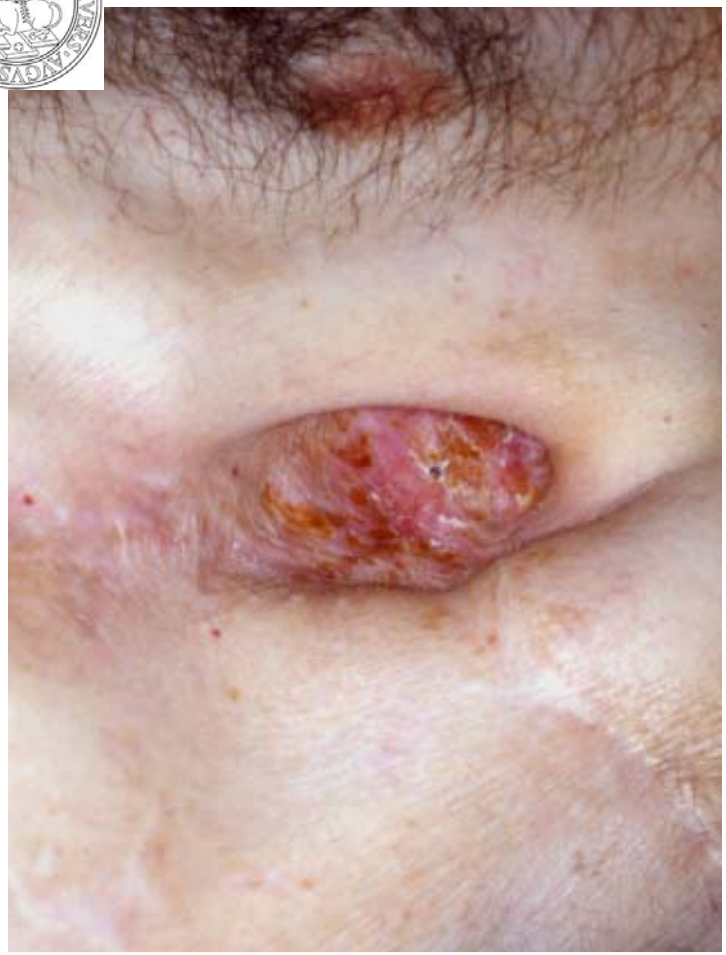

ATTENTION!!!

Open window thoracostomy tends to close spontaneously

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Special issue:

Postpneumonectomy empyema

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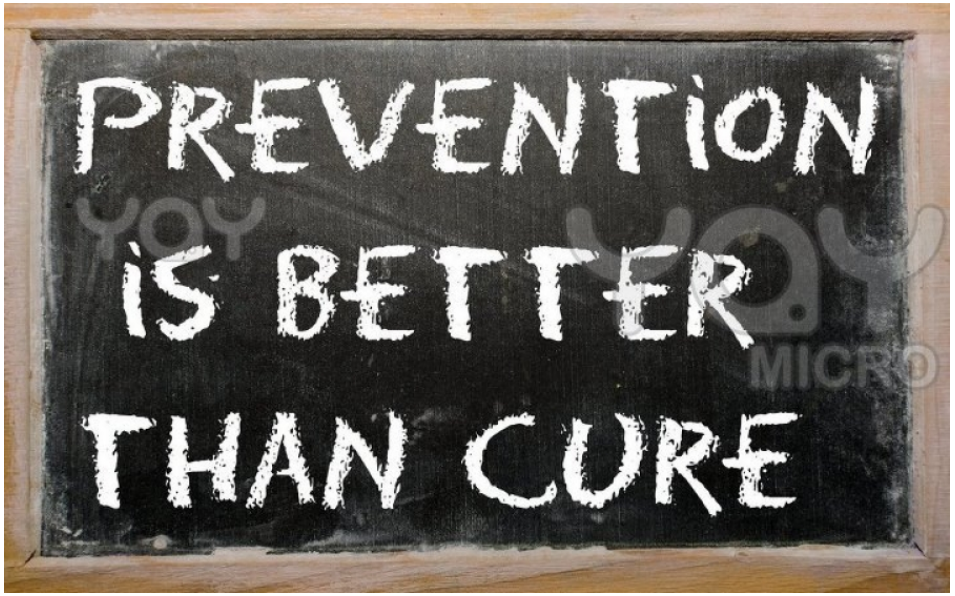
Prevention



Treat the bronchial stump with respect

Avoid devascularization
Avoid excessive lenght
Cover the stump with pleura or pericardium or muscle if preop. RT/CT has been done

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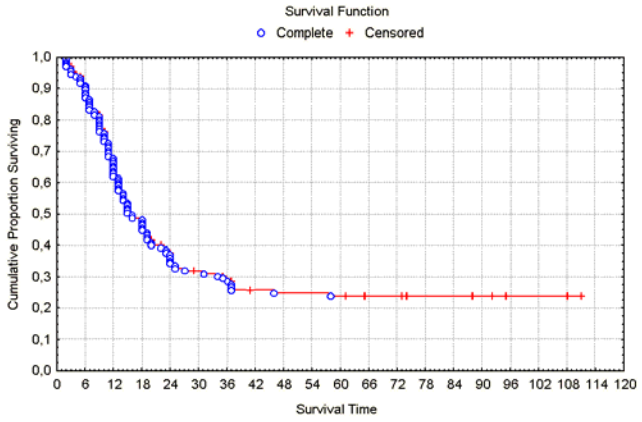
Incidence



The overall BPF incidence is estimated to be between 1.6% and 2.7%, and 2/3 of these patients received induction chemo/radiotherapy

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Symptoms

Early BPF occurs within few days or up to 1 – 2 weeks after a pneumonectomy

frothy pink sputum
air fluid level on chest X-ray
persistent low-grade fever
persistent clinical complaints

Bronchoscopy confirm the suspect of BPF

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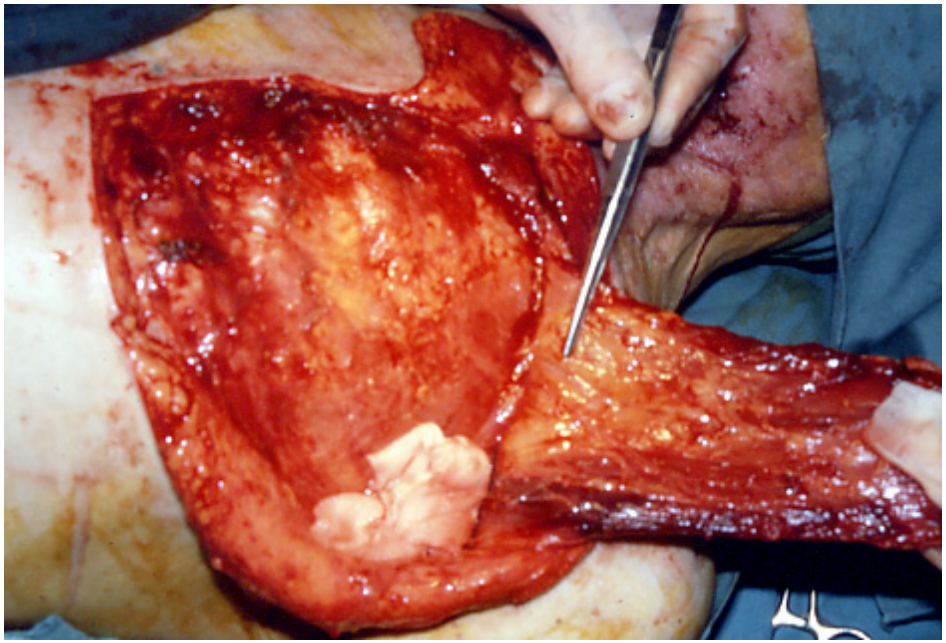
Treatment goals:



Secure close the bronchial stump
obliterate the empyema cavity

Immediate re-exploration with stump closure and reinforcement with a pedicled muscle flap *(intercostal, latissimus dorsi, serratus anterior, pectoralis major)* and pleural space drainage *(Clagett & Geraci procedure)*

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Predictors of Successful Closure of Open Window Thoracostomy for Postpneumonectomy Empyema

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Division of General Thoracic Surgery, "E. Morelli" Regional Hospital, Sondalo, Division of General Thoracic Surgery, Humanitas Gavazzeni Hospital, Bergamo, and Division of General Thoracic Surgery, National Cancer Institute, Pascale Foundation, Naples, Italy

Background. Although the open window thoracostomy (OWT) represents the ideal method for drainage of postpneumonectomy empyema (PPE), several controversies exist concerning its closure.

Methods. Between January 1993 and December 2003, an OWT was created in 31 patients (29 male and 2 female) with PPE. The median age was 61 years (range, 32 to 76). In 26 patients (84%) a bronchial stump fistula developed. The OWT closure was correlated with characteristics of PPE and the timing of OWT.

Results. In 15 patients (48%), the OWT could be closed by obliteration of pleural cavity with antibiotic solution (3 patients) or intrathoracic muscle transposition (12 patients). A successful closure was observed in 13 of the 15 patients (87%). All patients closed by Clagett's procedure remained empyema free. Recurrent cancer (n = 4), poor functional status (n = 3), refusal of further operation (n = 2), and persistent tuberculous empyema (n = 2) were common causes of failure of OWT closure. Univariate analysis revealed that the timing of empyema development after surgery ($p = 0.02$) and the timing of OWT ($p = 0.03$) were significant predictors of thoracostomy closure.

Conclusions. Late onset of PPE and immediate OWT creation are significant predictors of OWT closure. Smaller dimensions of the pleural cavity appeared to increase the likelihood of closure. When the pleural cavity shows healthy granulation tissue and no bronchopleural fistula, the Clagett's procedure is safe and effective to obliterate the pleural cavity. Obliteration by muscle flap transposition can be reserved for patients with persistent or recurrent bronchopleural fistula.

(Ann Thorac Surg 2006;82:288–92)

Massera and Coll advocated an early open window thoracostomy for BPF

Late BPF presentation and early open window procedure were independent predictors of successful BPF management

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Chest tube management

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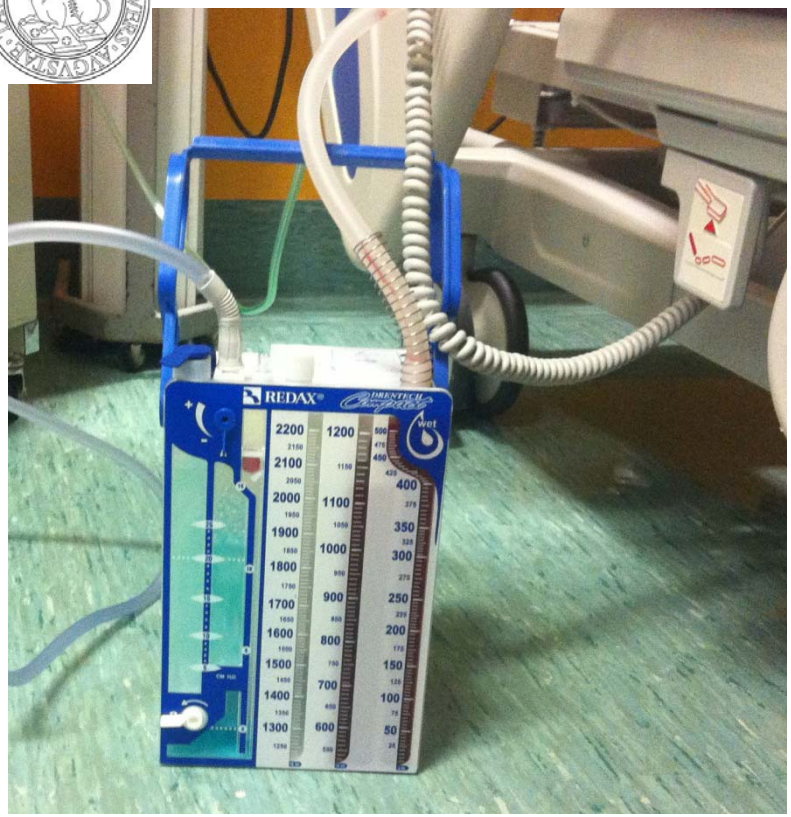

One or two chest tubes are placed at the end of surgery and left under suction (-20 cm H_2O)

They can be removed when there are:

no signs of infection
no more pus
no more than 100 ml-150 ml /24 h
no air leaks

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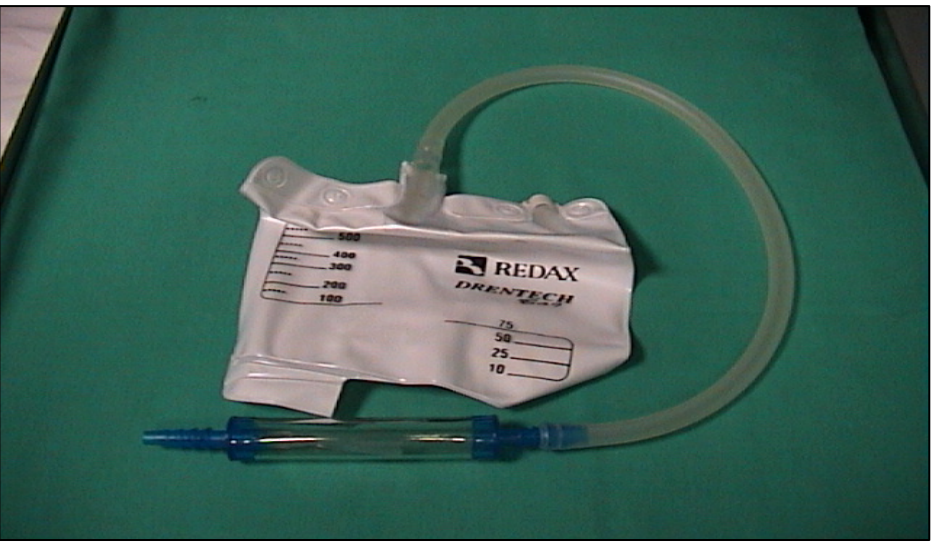

In case of persistent serous fluid, the drain may be connected with an Heimlich valve, making the patient able to walk and to be discharged from the hospital

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Be careful not to remove too soon the drains….

Fast-track surgery does not exist in case of pleural empyema

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Conclusions

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Early intervention of pleural space infection is the key to prevent chronic empyema

The advent of VATS made it possible to treat stage I and stage II empyema with significantly less morbidity

Management of chronic empyema remains a major challenge in Thoracic Surgery

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EMPYEMA NEEDS TO BE TREATED AND MANAGED URGENTLY, TO AVOID THESE CONSEQUENCES…

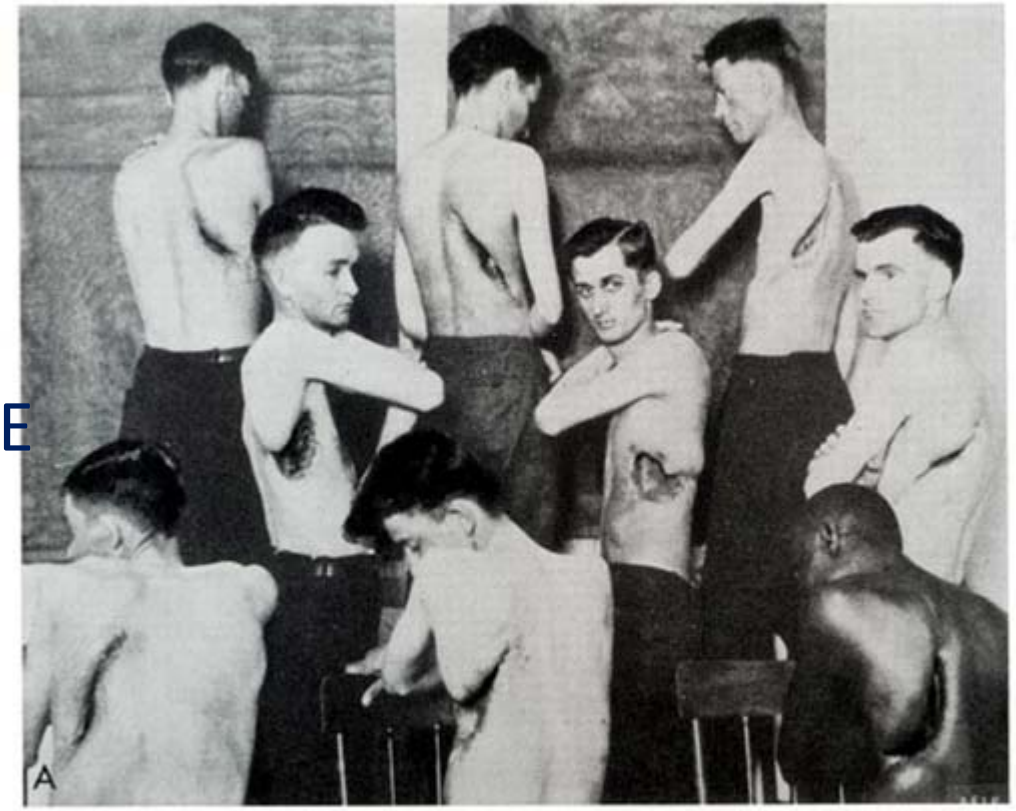

FIGURE 109.—Comparative results of management of empyema in World Wars I and II. A. Typical patients with chronic empyema in Zone of Interior hospitals in World War I (2).

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Thank you very much for your attention…

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