Surgical therapy of lung cancer

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Considerations about lung cancer

- **Lung cancer's incidence and mortality in male the highest in Hungary**
- **Treatment is complex and diverse**
- **Smoking increasing the small cell lung cancer and the plano cc. incidence the most**
- **10 % of the patient is non smoker (adenocc.)**

- **In the past two decades the incidence is increasing: In 2012 410,000 new patient in Europe and 5757 in Hungary**
- **In 2012 353,000 deaths causes lung cancer, 5750 in Hungary**
- **Az operability rate: 22%**

Etiology
(primary prevention)

Smoking

➡ **In Europe at about 27% of people is smoking!**

➡ **The 85% of the patients is smoker, the heavy smokers risk is 15x higher!**

Genetic susceptibility

Air pollution

Asbestos, heavy metals, radon exposure

Lifestyle (compsumption habits, alcohol, stress)

Early detection
(secondary prevention)

Screening or not ?

YES

-30-40% is diagnostised

- more patients found in early stages

-in these patients after the operation the survival is better

NO

- one year is a long time
- to much false positive/negative
- expensive

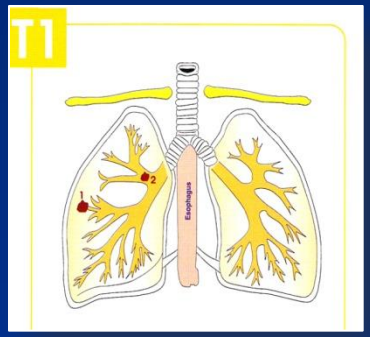
-do not decrease the all mortality
- the screening methods are insufficient (low dose CT for screening?)

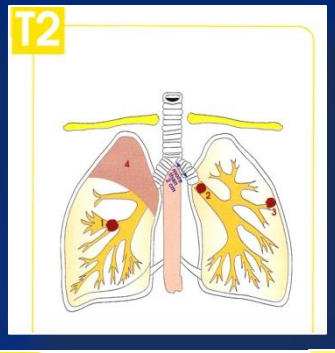
Aim of the preoperative tests

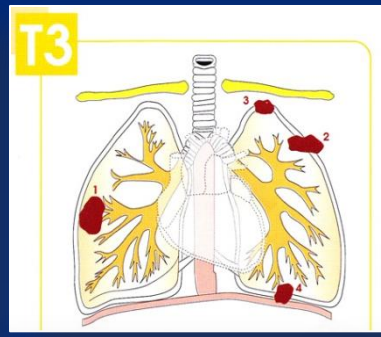
- **Detection of the tumour, localisation**
- **Extension of the tumour, situation of the nearby anatomical parts and organs,**
- **Lymph node staging,**
- **Detection of the metastases,**
- **Design of the surgical tretament,**
- **Detection of the recidives**

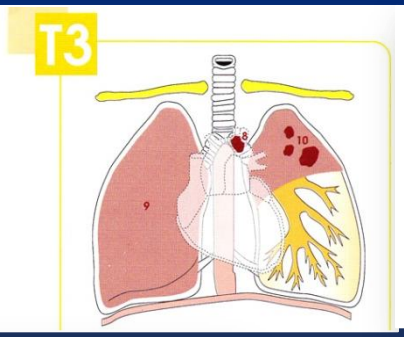
Primary lung cancer TNM system „T” stage

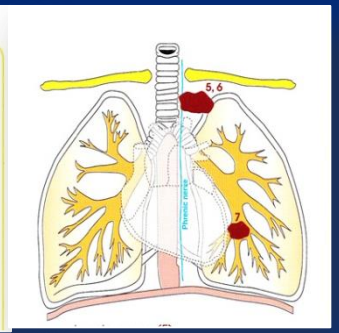
	Diam	Scopy	Atelectasis	Invasion	Nodules
T1	T1a < 2cm T1b: 2-3cm	No invasion lobar bronchus			
T2	T2a: 3-5cm T2b: 5-7cm	> 2cm to carina	Lobar atelectasis or obstructive pneumonia to hilus		
T3	> 7cm	< 2cm to carina	Whole lung	Chest wall diafragm mediast pleura pericard	Nodules in same lobe
T4		Tumor in carina		Heart great vessels trachea esophagus spine	Nodules in other ipsilateral lobes

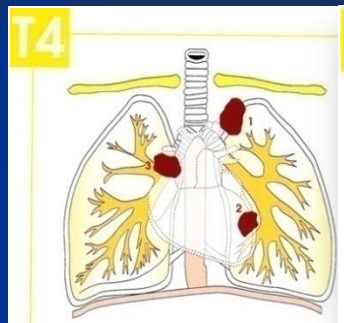


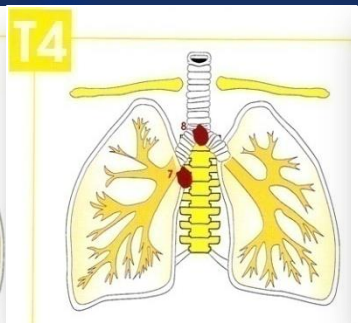


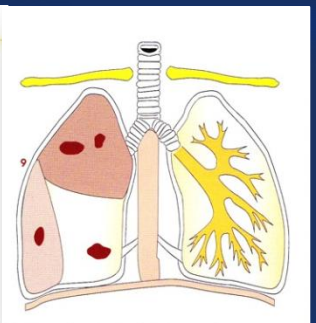




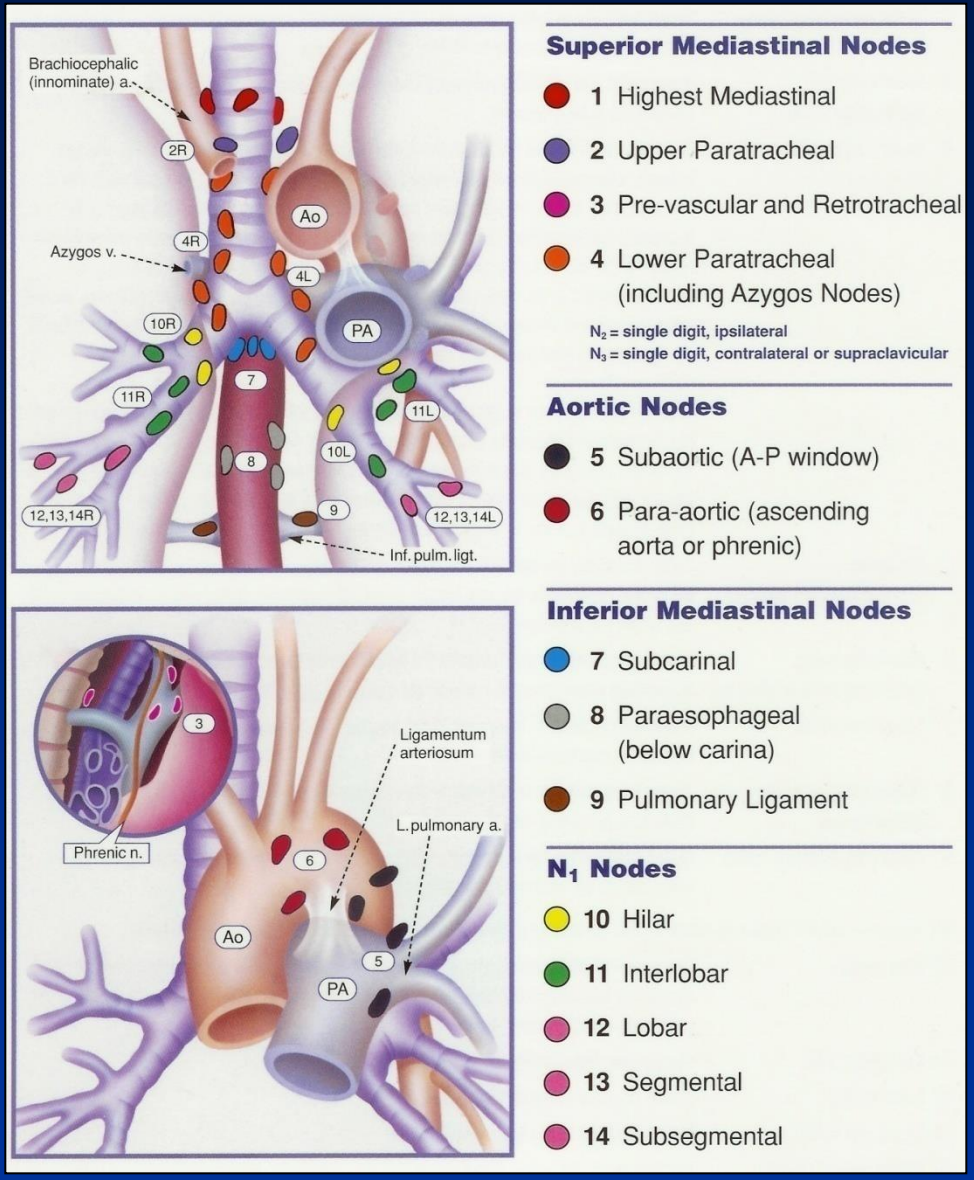


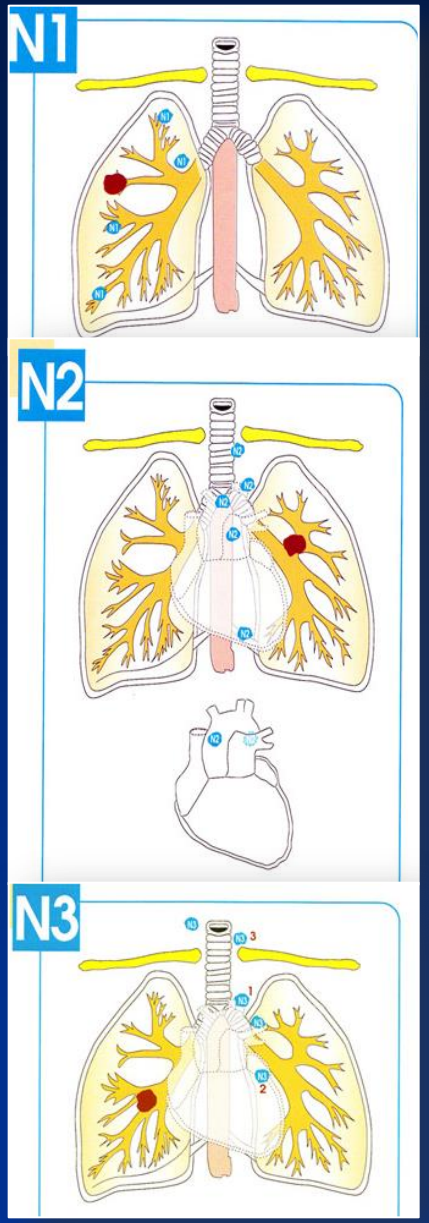






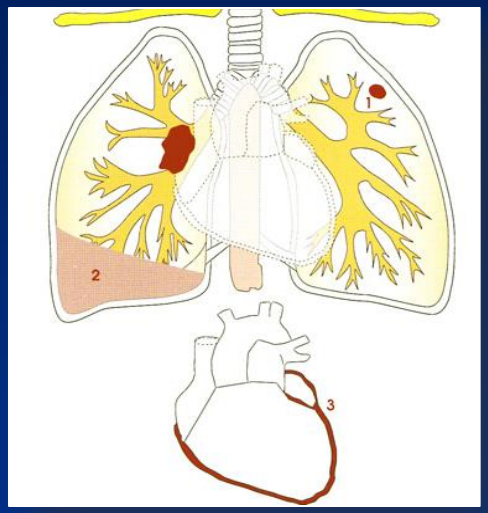
”N” stage


Brachiocephalic (innominate) a.
2R
Azygos v.
4R
Ao
4L
10R
PA
11R
7
11L
10L
8
9
12,13,14R
12,13,14L
Inf. pulm. ligt.
3
Phrenic n.
Ligamentum arteriosum
L. pulmonary a.
6
Ao
5
PA
Superior Mediastinal Nodes
1 Highest Mediastinal
2 Upper Paratracheal
3 Pre-vascular and Retrotracheal
4 Lower Paratracheal (including Azygos Nodes)
N2 = single digit, ipsilateral
N3 = single digit, contralateral or supraclavicular
Aortic Nodes
5 Subaortic (A-P window)
6 Para-aortic (ascending aorta or phrenic)
Inferior Mediastinal Nodes
7 Subcarinal
8 Paraesophageal (below carina)
9 Pulmonary Ligament
N1 Nodes
10 Hilar
11 Interlobar
12 Lobar
13 Segmental
14 Subsegmental


N1
N2
N3

”M” stage

M1a



➡ **Other side of the lung metastasis**
Pleural metastasis

M1b:

➡ **distant metastasis**
brain
bone
adrenal glands
liver

Diagnostic opportunities

anamnestic history

physical examination

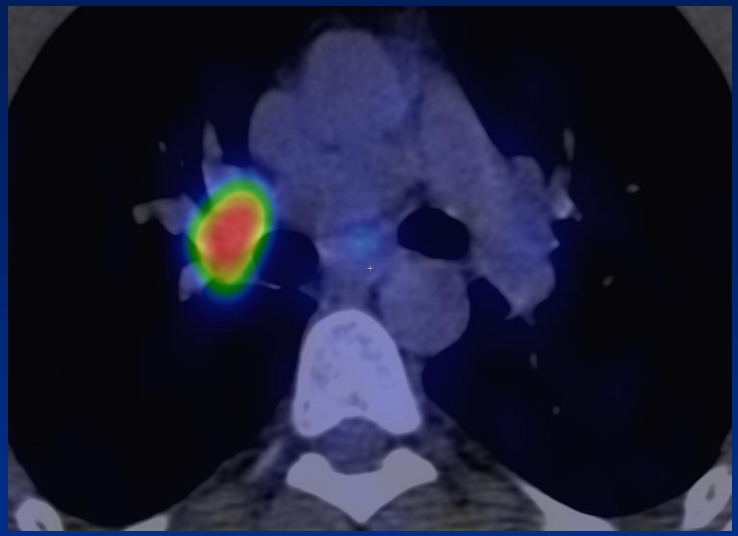
functional diagnostic:

- **spirometry**
- **arterial Astrup**
- **laboratory test**
- **bicycle ergometry test**

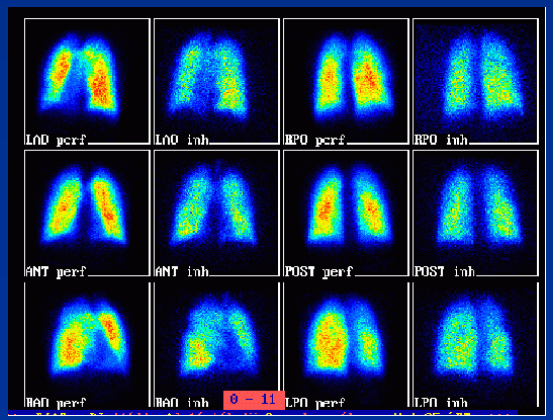
Noninvasive radiologica tests

Chest X-rays, CT scan

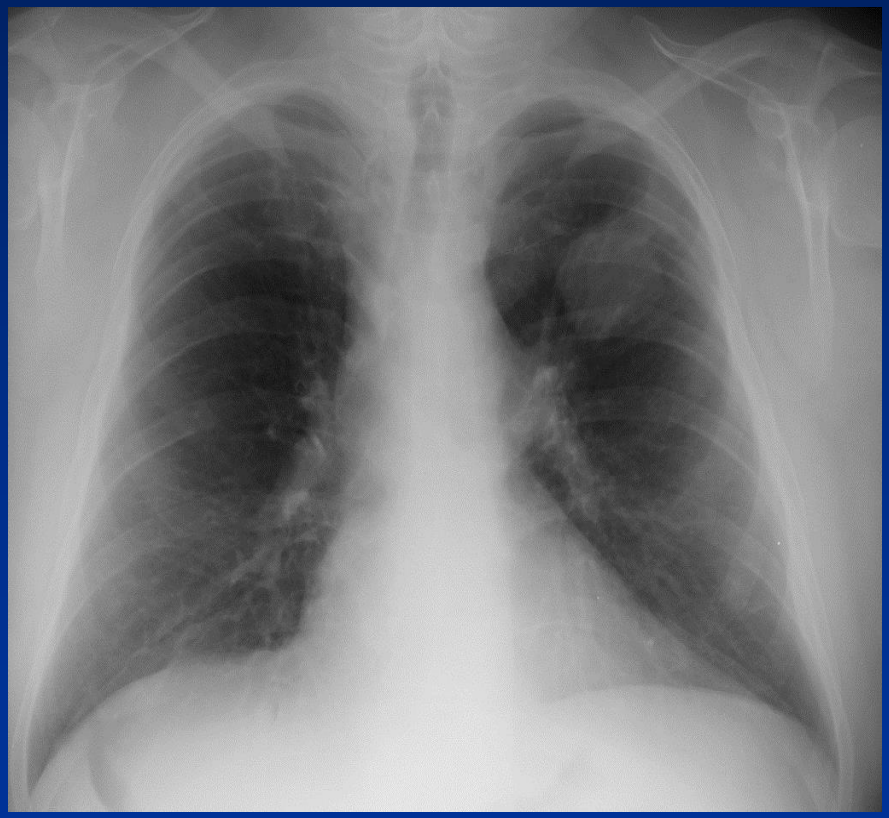
PET CT



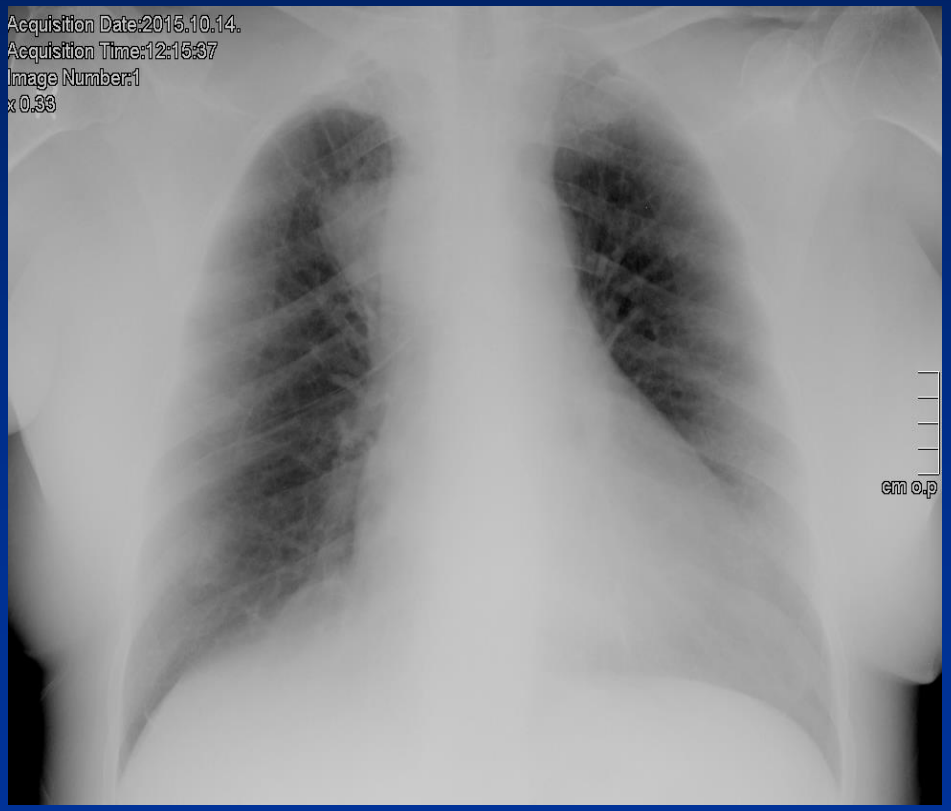
Perfusion scintigrafi

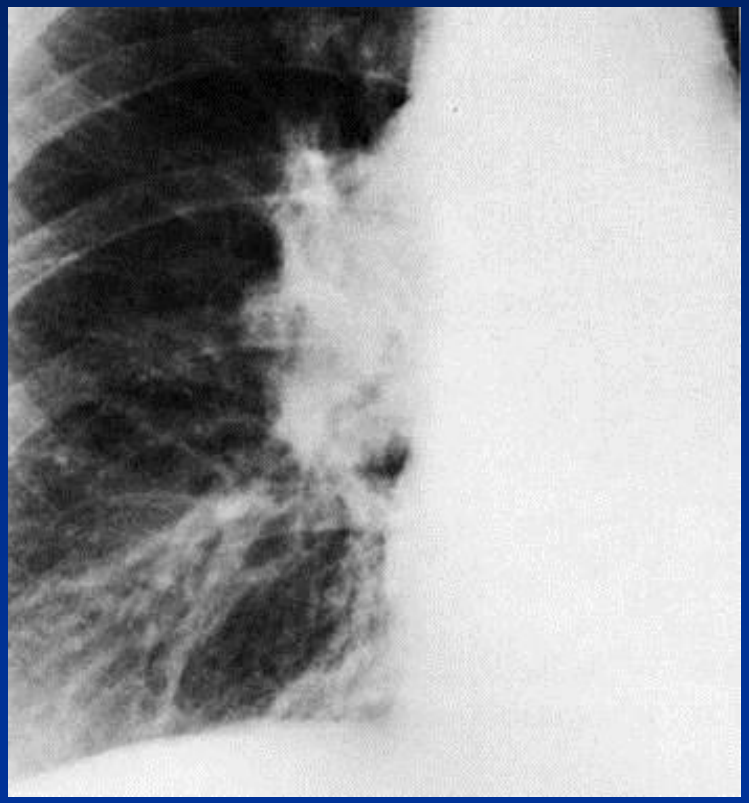


Noninvasive radiological tests

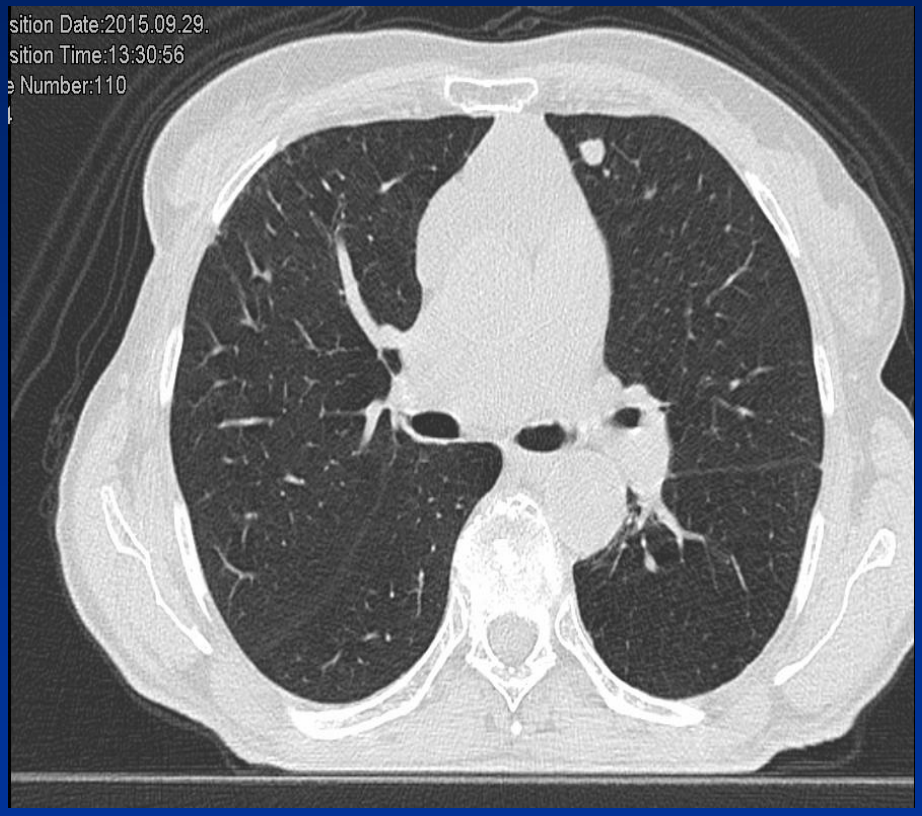


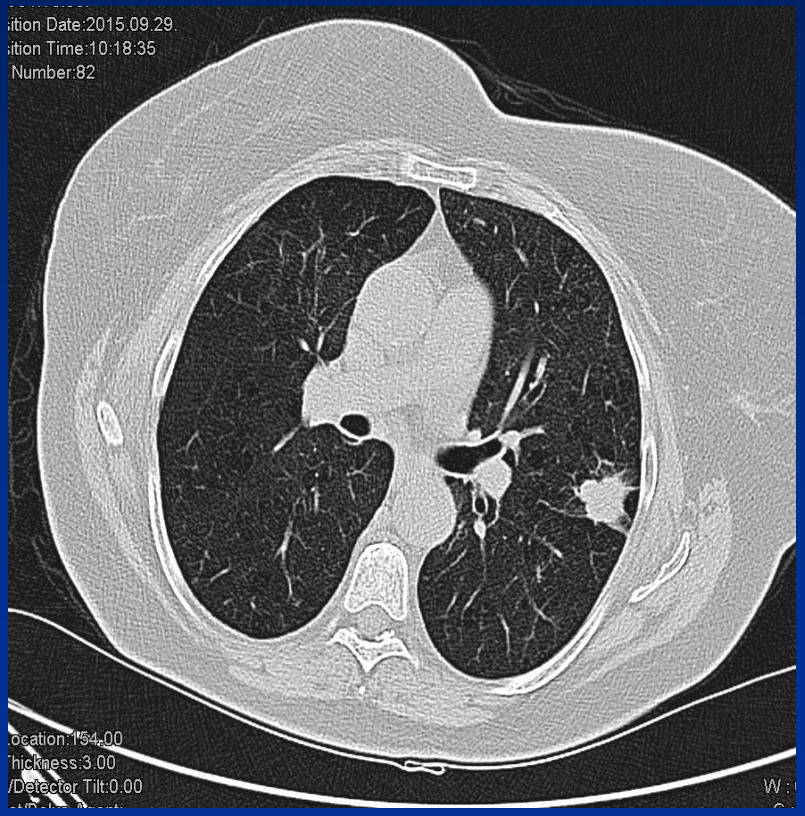
Noninvasive radiological tests



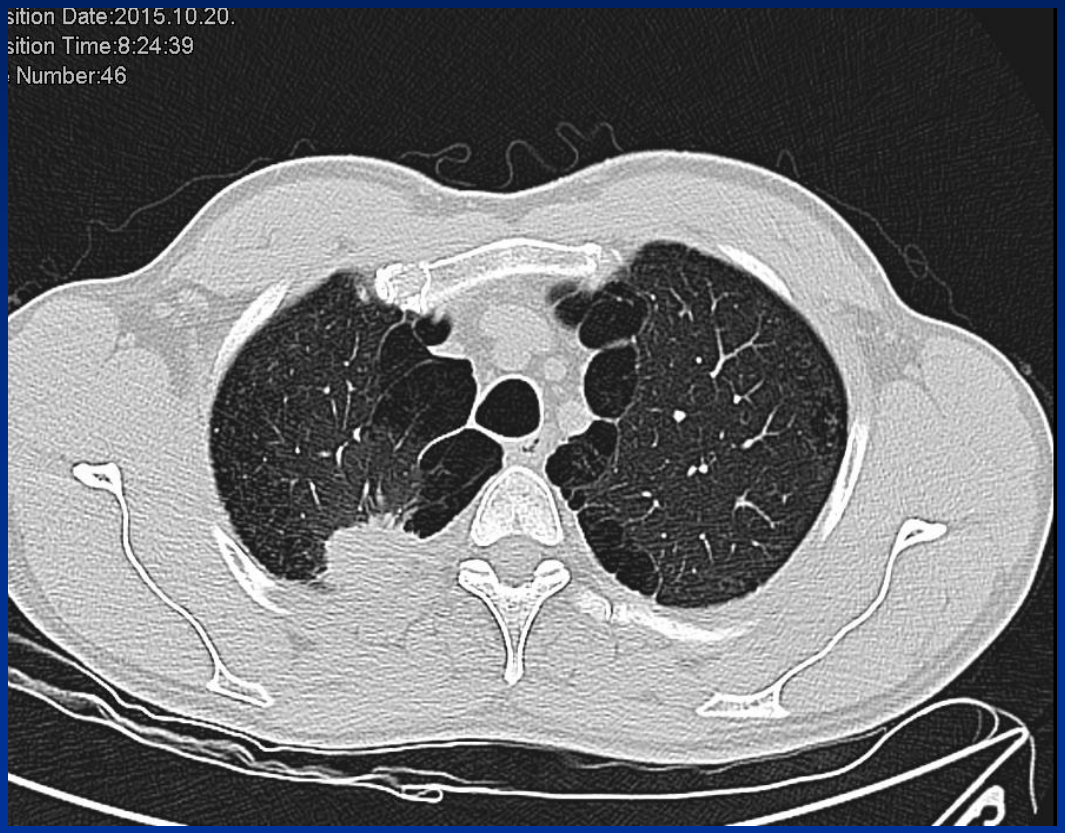


Noninvasive radilogical tests

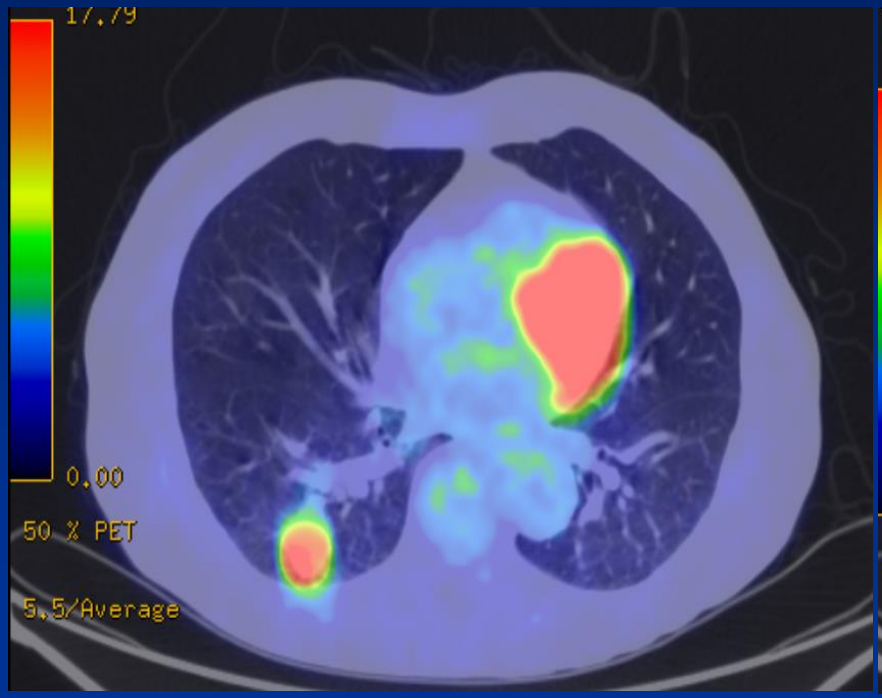


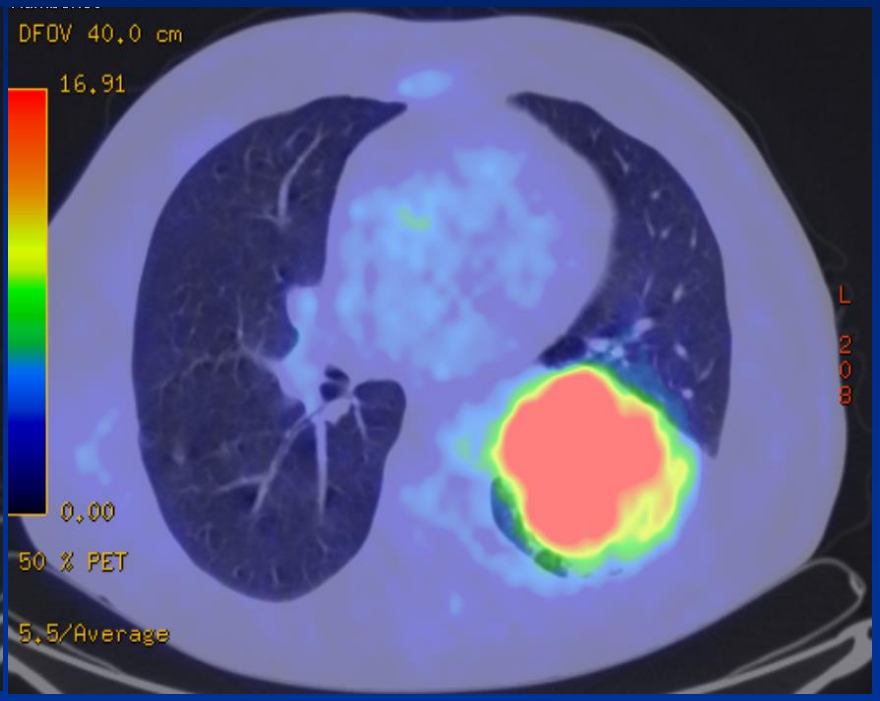


Noninvasive radiological test

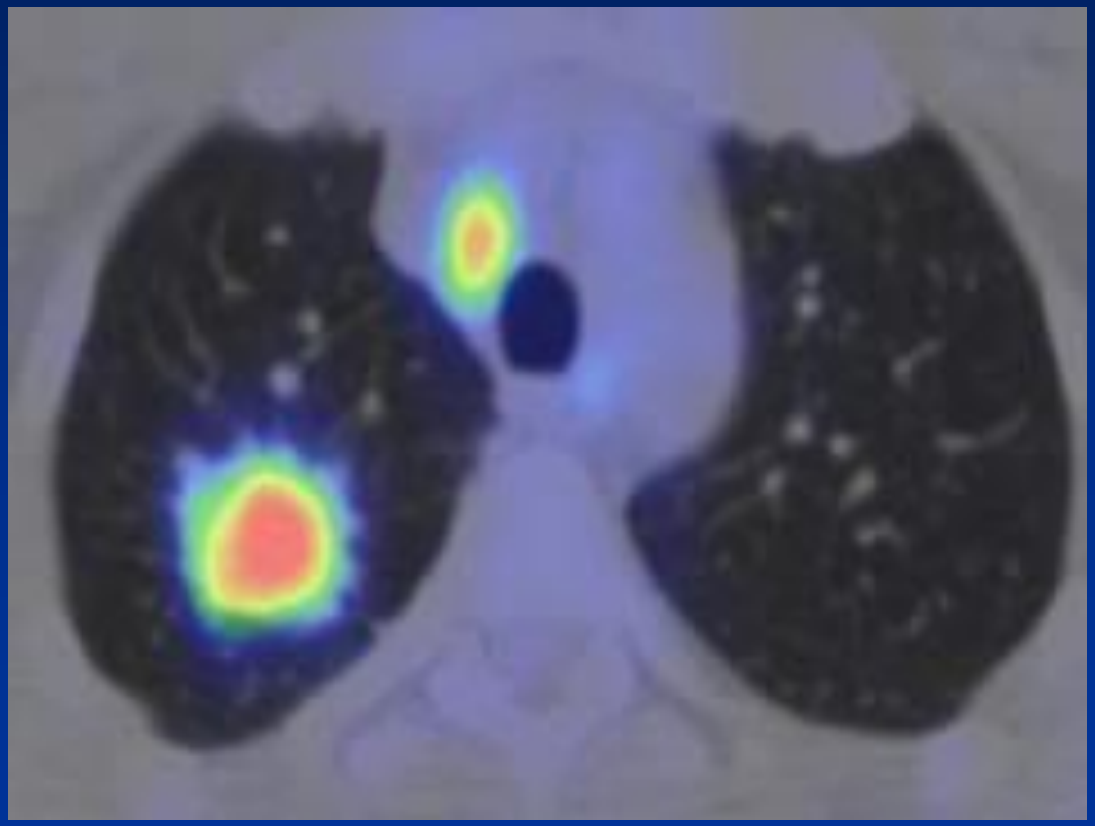


Noninvasive radiological tests



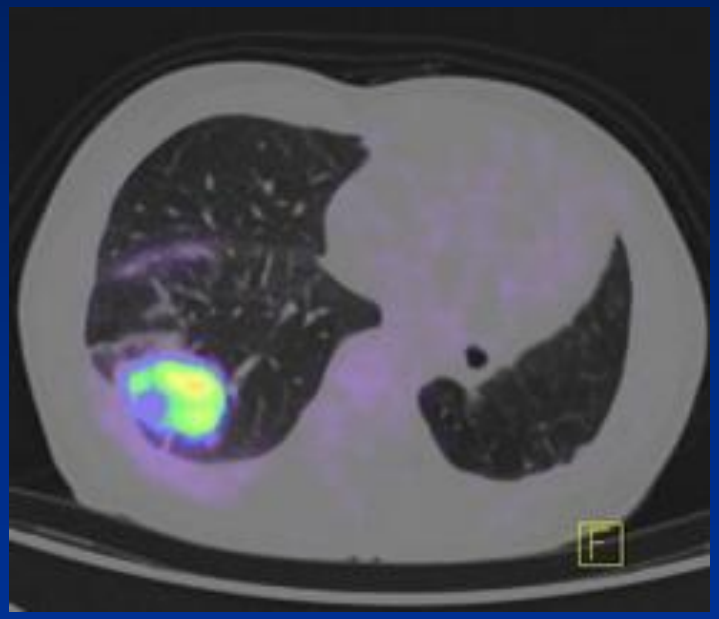


Noninvasive radiological test



PET CT- diagnostic indications

- Make the difference between malignant and benign masses, if other tests were insufficient
- Detection of the recidives
- Staging (TNM)
- Plan the optional place for biopy
- In case of unknown tumours



PET CT test

False positive

- infections,
- positive benign laesions,
- sarcoidosis

False negative

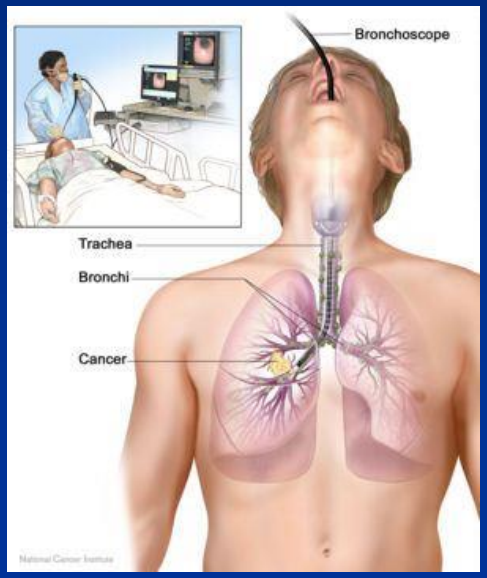
- small size,
- adenocarcinomas, BAC with mucinous features
- high blood glucose

Invasive non surgical biopsies

Bronchoscopy

Biopsies:

- brush citology / excision,
- lavage,
- TBNA



Transthoracic needle biopsy

- X-rays
- Ultrasound
- CT

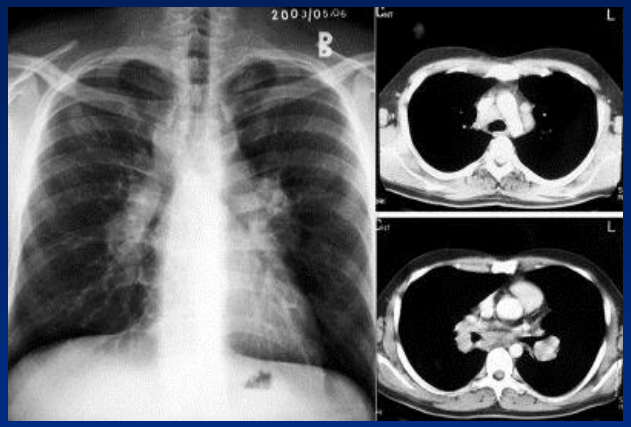
Invasive surgical biopsies

puncture / drainage (in case of pleural effusion)

Mediastinoscopy (single or extended)

-VAMLA (video assisted mediastinal lymphadenectomy),

-TEMLA (transcervical extended mediastinal lymphadenectomy



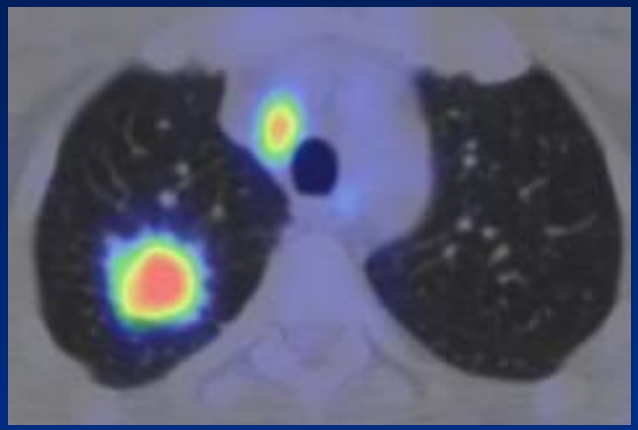
Lymph nodes:

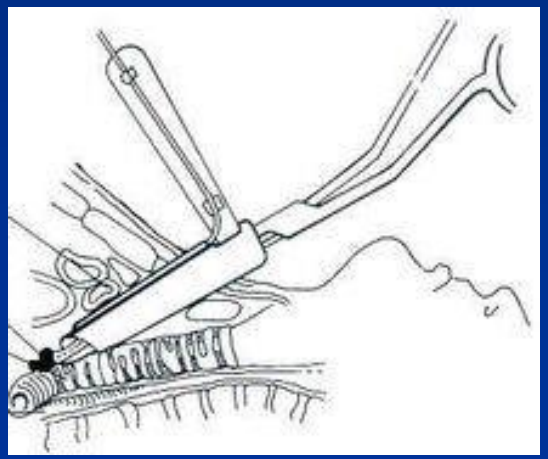
1

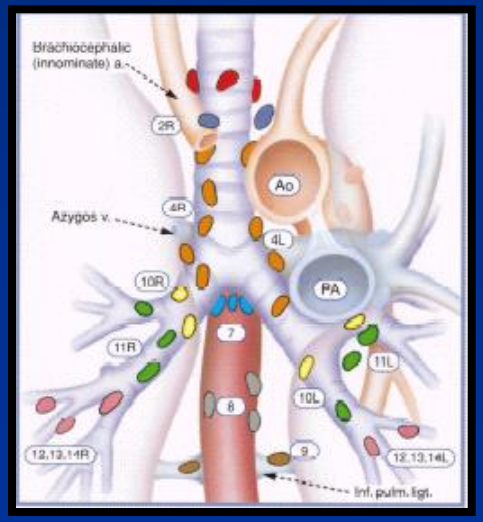
2R, #2L

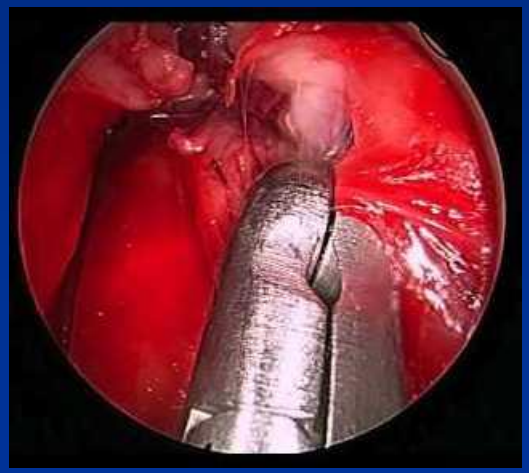
4R, #4L

7

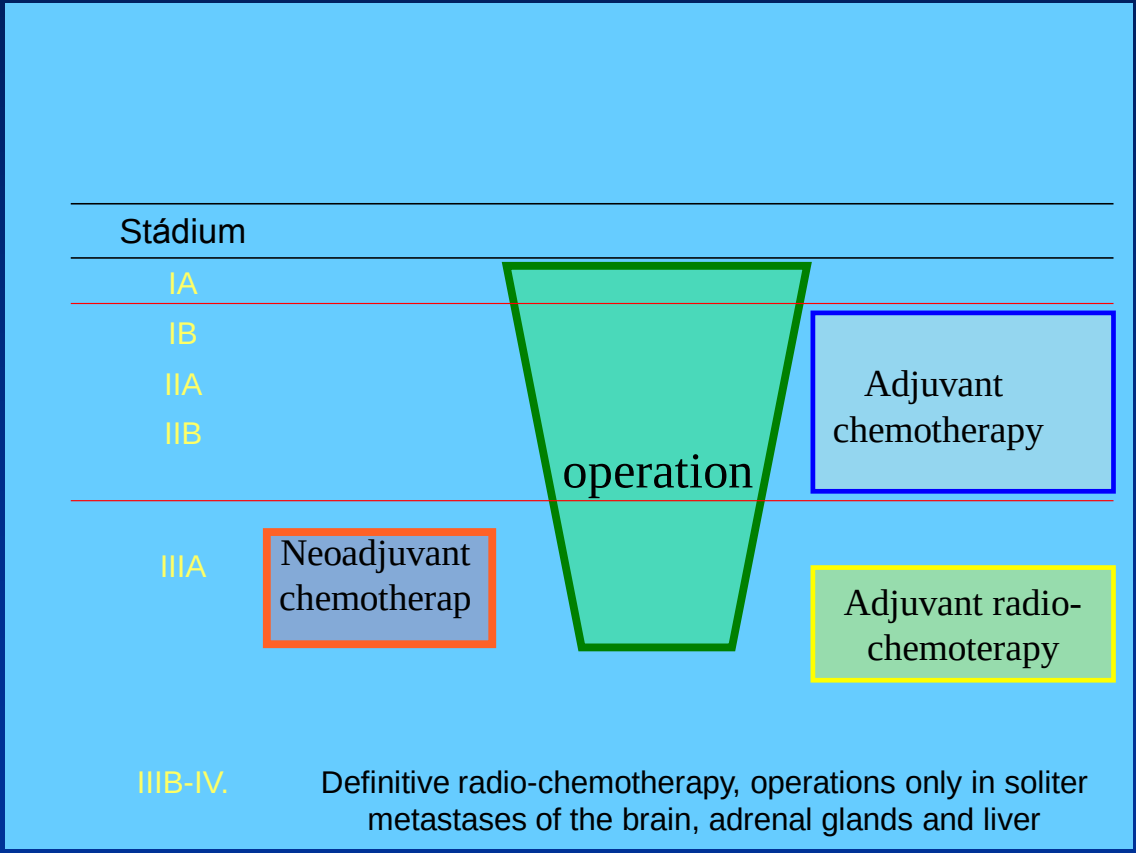








NSCLC treatment algorithm



Surgical treatment of lung cancer

- **Basis method: anatomical resection with the the nearby lymph node (segment resection lobectomy, bilobectomy , pneumonectomy)**

- **Smaller (atypical) resection is an oncological compromise solution, only use in patients with high risk comorbidity**

Type of the resections

1. Atipical resection:

wedge resection

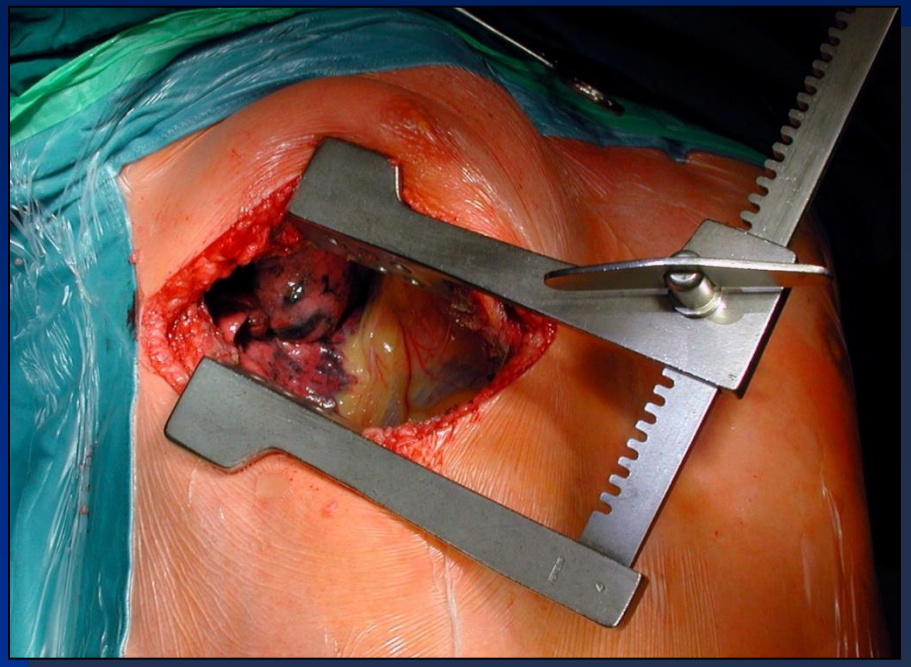
Type of the resections

2. Anatomical resections:

segmentectomy **lobectomy** **pneumonectomy**

Thoracotomy

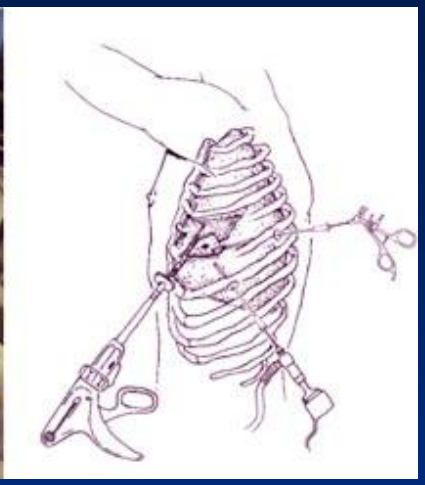
Posteolateral thoracotomy



Anterolateral thoracotomy

VIDEO LOBECTOMY

VATS
/Video assisted thoracoscopic surgery/

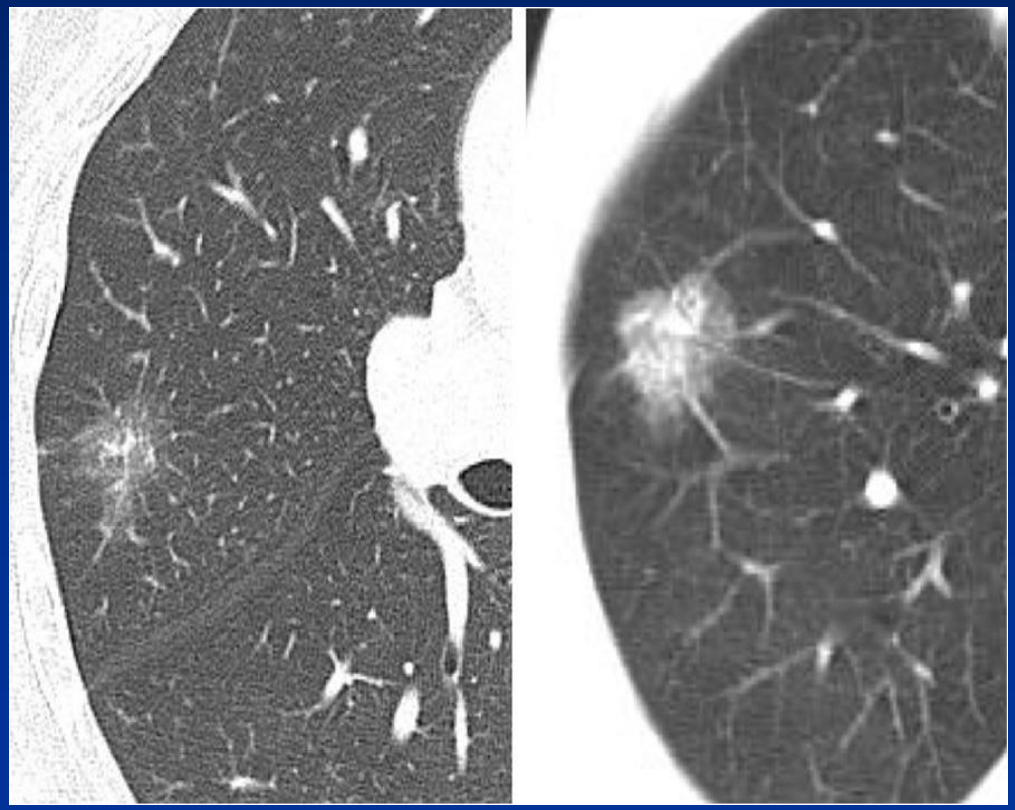


VATS lobectomia előnyei a nyitott műtétekkel szemben

- Less postoperative complications *(Paul et al.,2010)*
- Earlier hospital emission *(Scott et al.,2010)*
- Better pulmonary function*(Kaseda et al.,2000)*
- Less postoperative pain *(McKenna et al.,2006)*
- Less costs *(Burfeind et al.2010,Casali&Walker,2009)*
- Better acces for adjuvant chemotherapy *(Lee et al.,2011)*

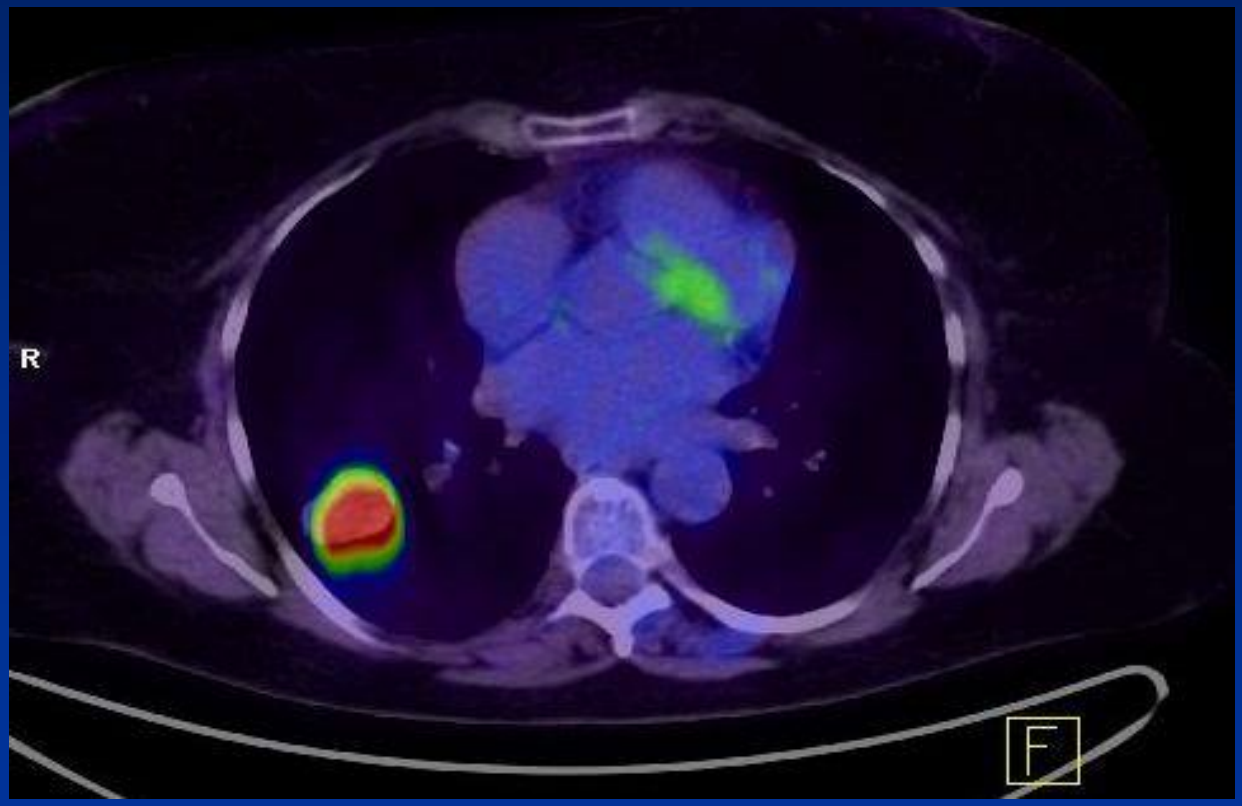
VATS lobectomy indications

- **I-II/A stadium is the optional**



VATS lobectomy indications

- Less than 6-cm tumor size



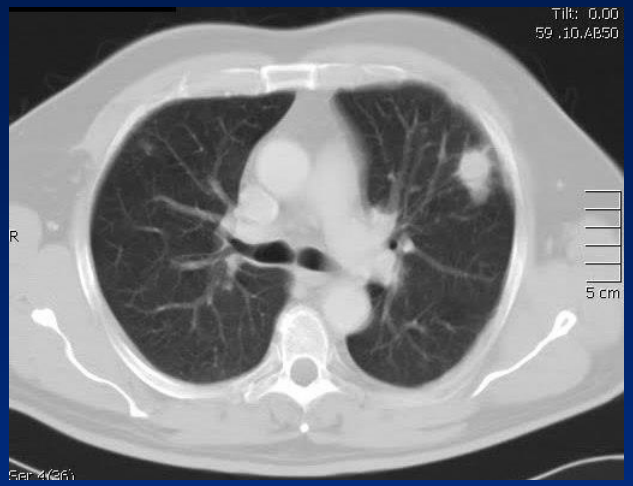
VATS lobectomy technic (I)

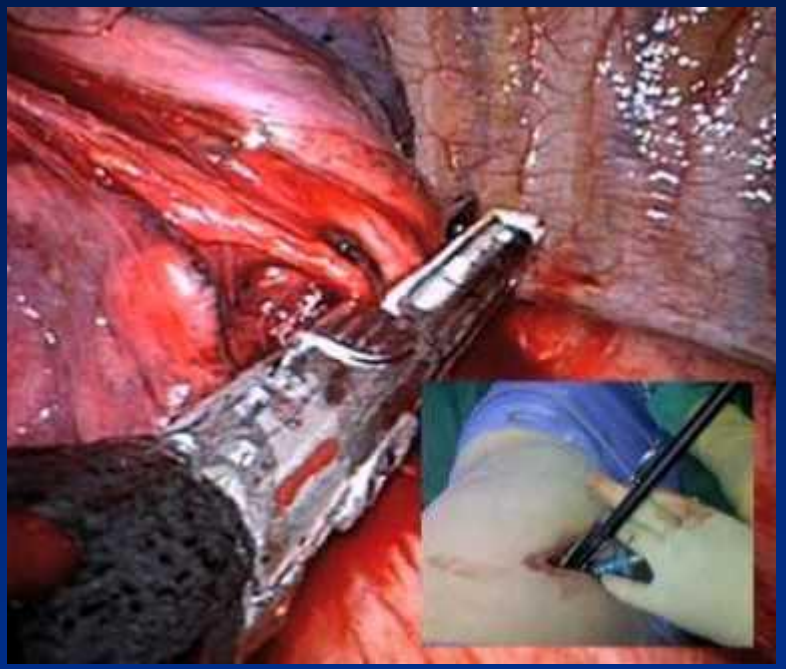
Utility 3-4 cm incision and two ports

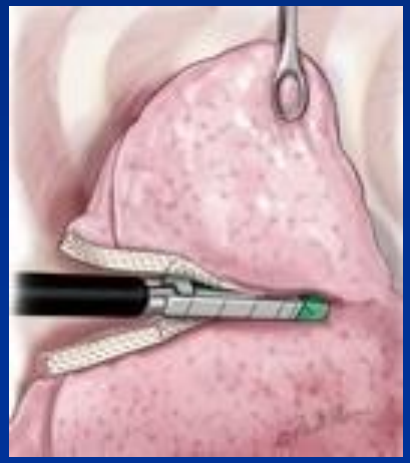
VATS lobectomy technic (II)

One 3-4 cm incision(uniportal)

VATS lung resection

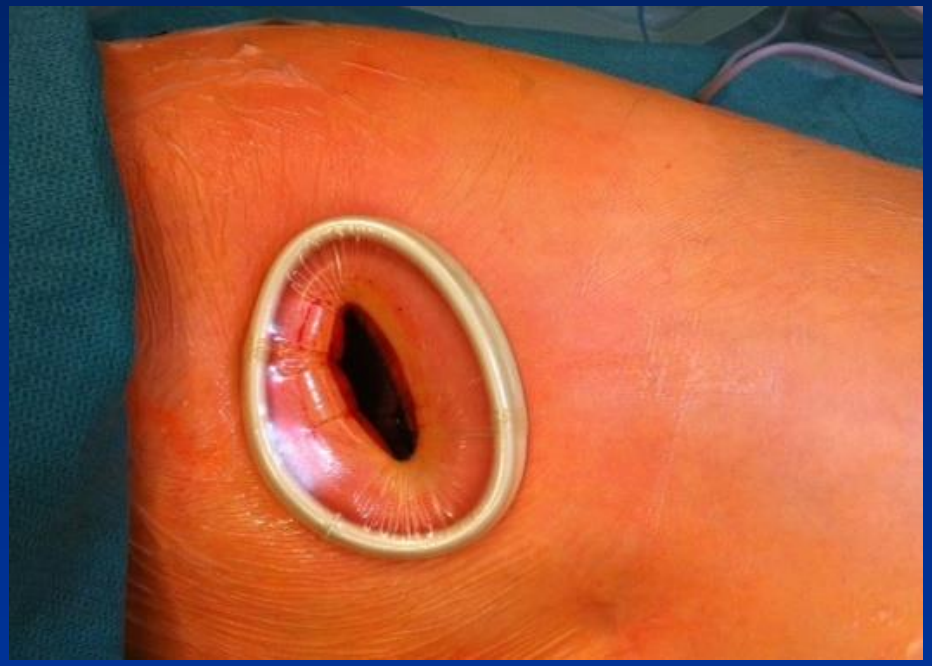






VATS lung resection

- Faster recovery and less hospital staying



1. day chest tube removing

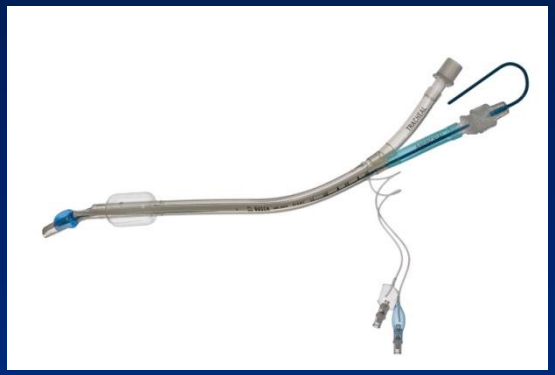
Less pain killer is needed

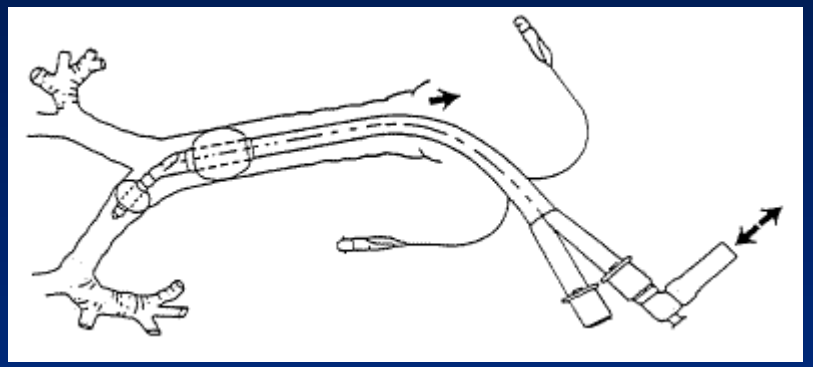
Survival

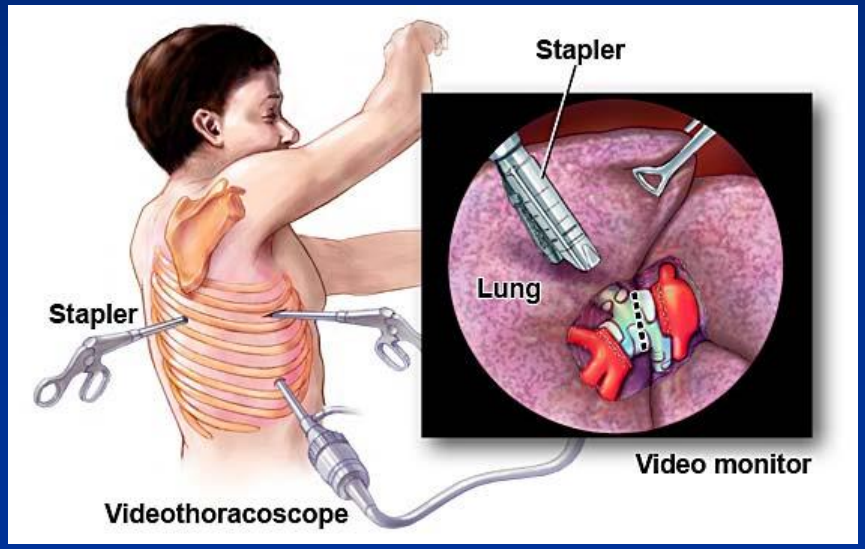
In conection of overall survival there are no differences between the open and VATS technic.

(McKenna et al.,2006, Walker et al.,2003,Yamamoto et al.,2010, Rueth&Andrade,2010)

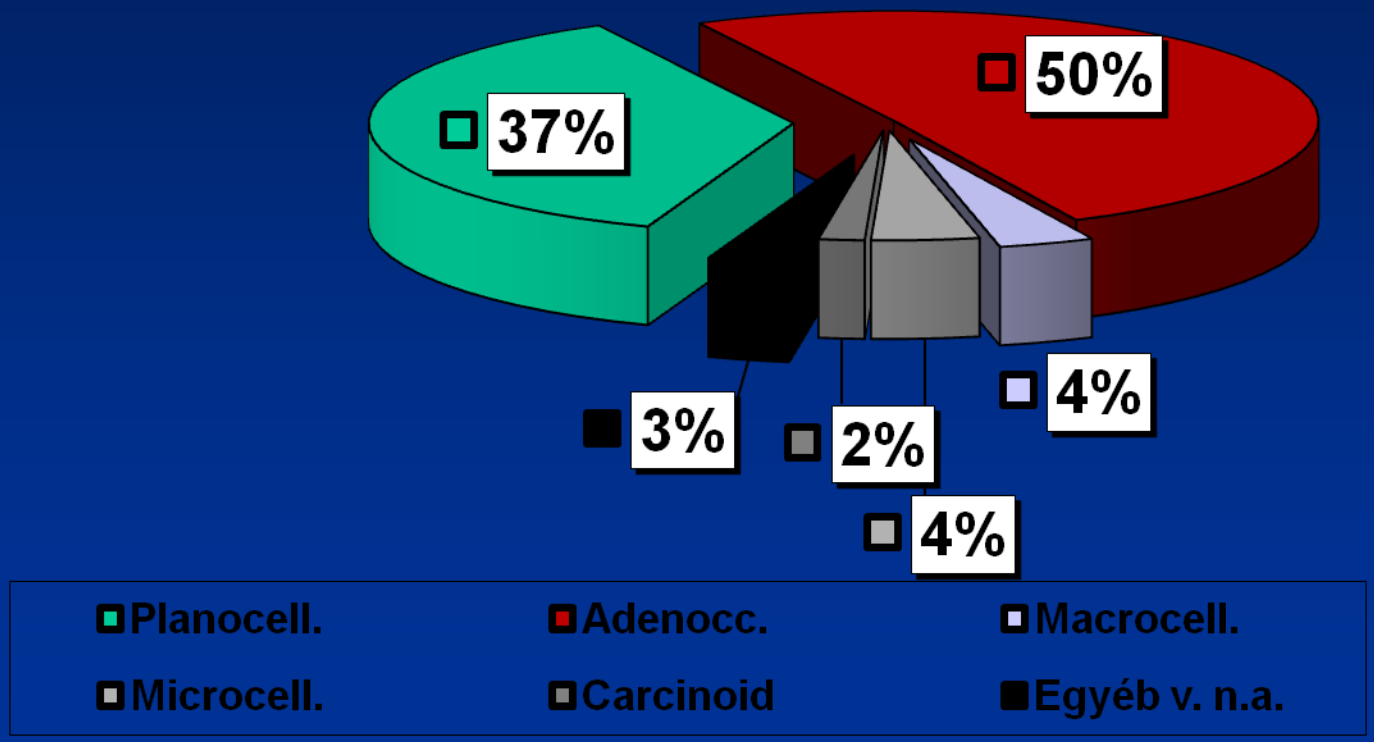
General considerations in connection of lung resection







Histology distribution among the patients who get surgical treatment



Extended resection

Involvment of the cest wall (T3):

- If its take place inside the parietal pleura: extrapleural separation is enough

- If its beyond the chest wall: an block chest wall resection

- Adjuvant radiotherapy needed only in case of incomplet resection

In case of T4 **:- carina- bifurcatio resection!**

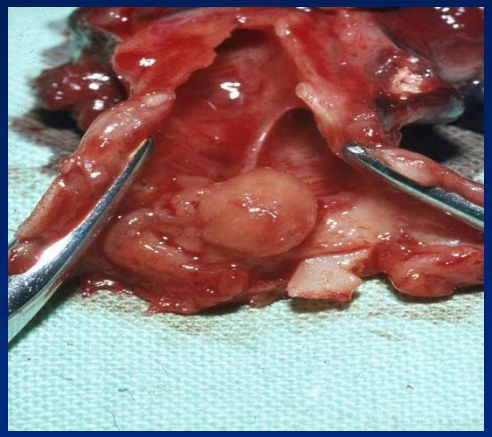
- pericardium resection!

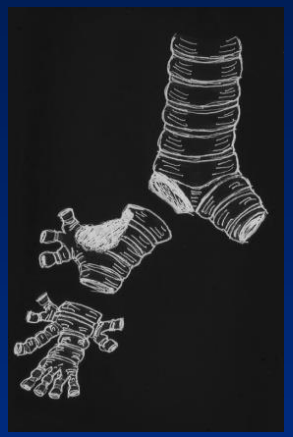
- atrial resectio

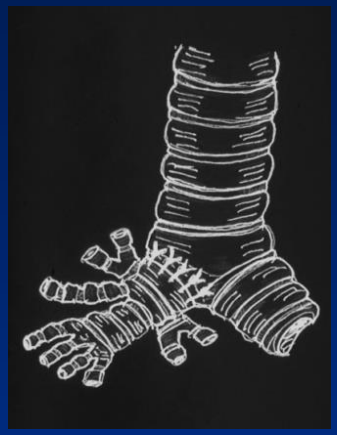
- resection of the diaphragma (!)

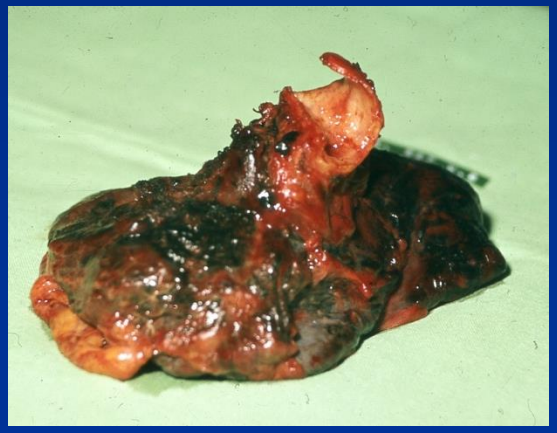
- v. cava superior, or esophagus resection

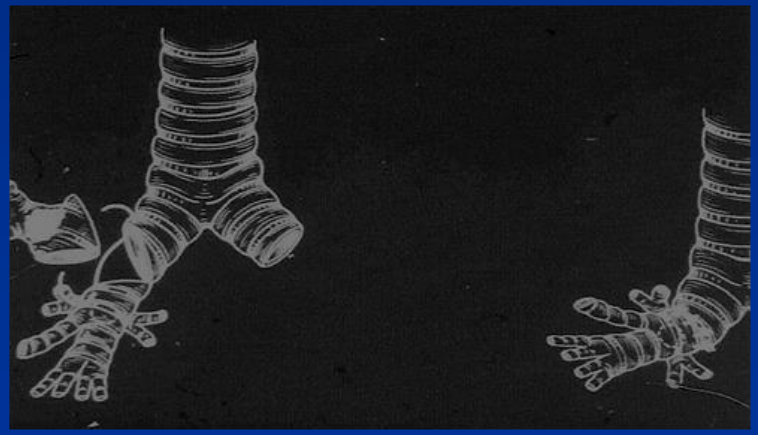
Trachea and bronchus anastomosis











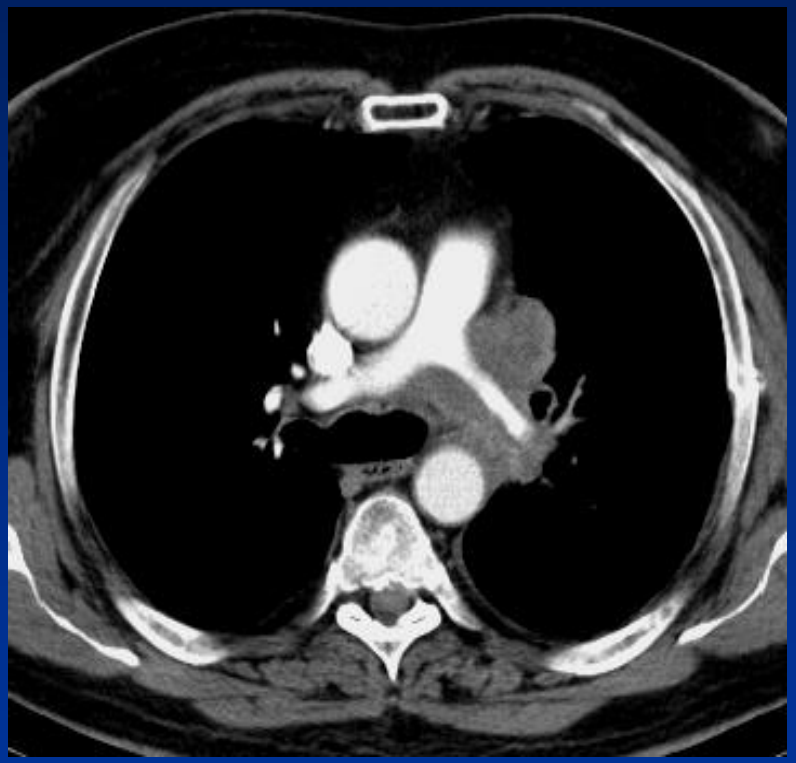
Inoperability of lung cancer

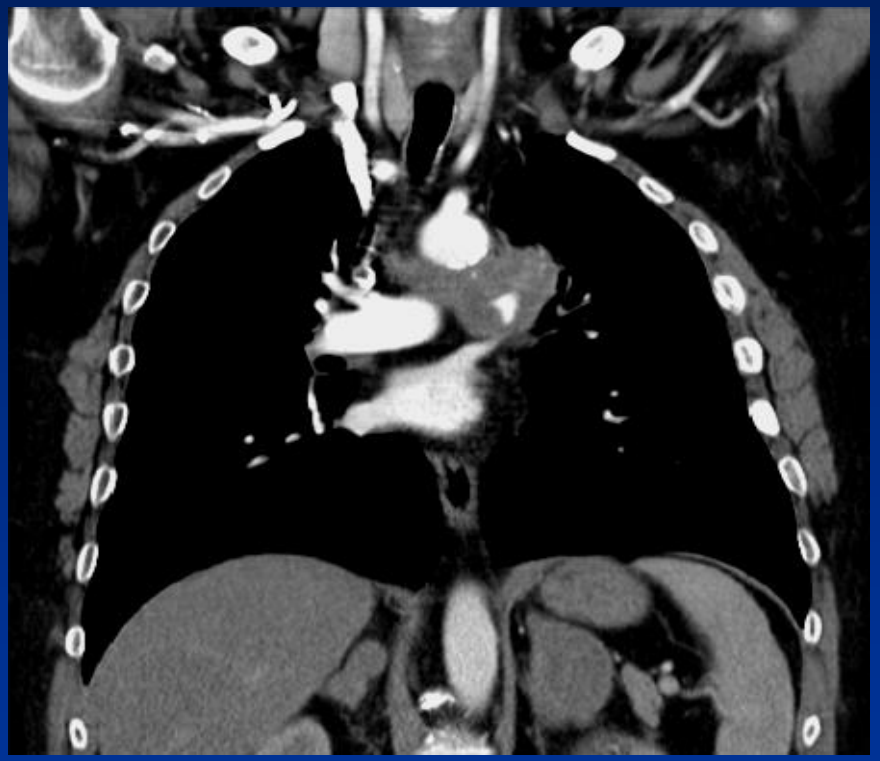
Inoperability – unresectability ?

<u>Absolutely inop.</u>:- haematogenic dissemination in the other lung
- pleuritis carcinomatosa
- N3
- distant metastases (except the following)

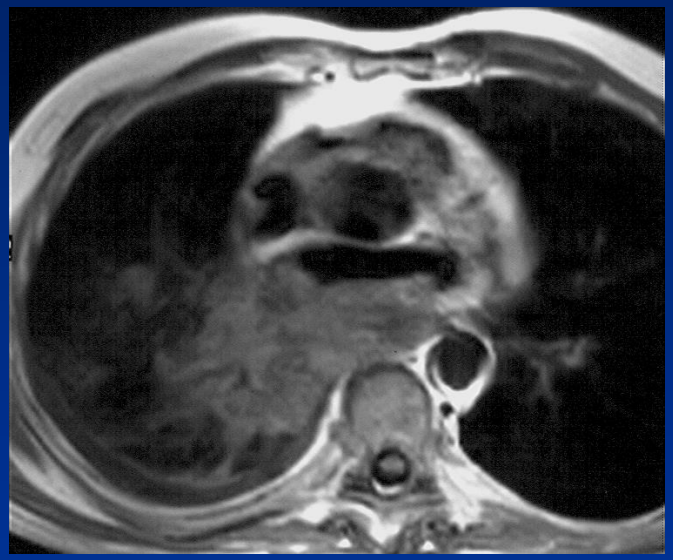
<u>Relatív inop.</u>: -n. recurrens paresis (left side N2, right side Pancoast tumour
-n. phrenicus infiltration (middle lobe or lingula tumours)
- soliter metastases (brain, ipsilateral lung, adrenal glands, liver)
-v.cava sup. involvment

Inoperability because of AP intrapericardial infiltration

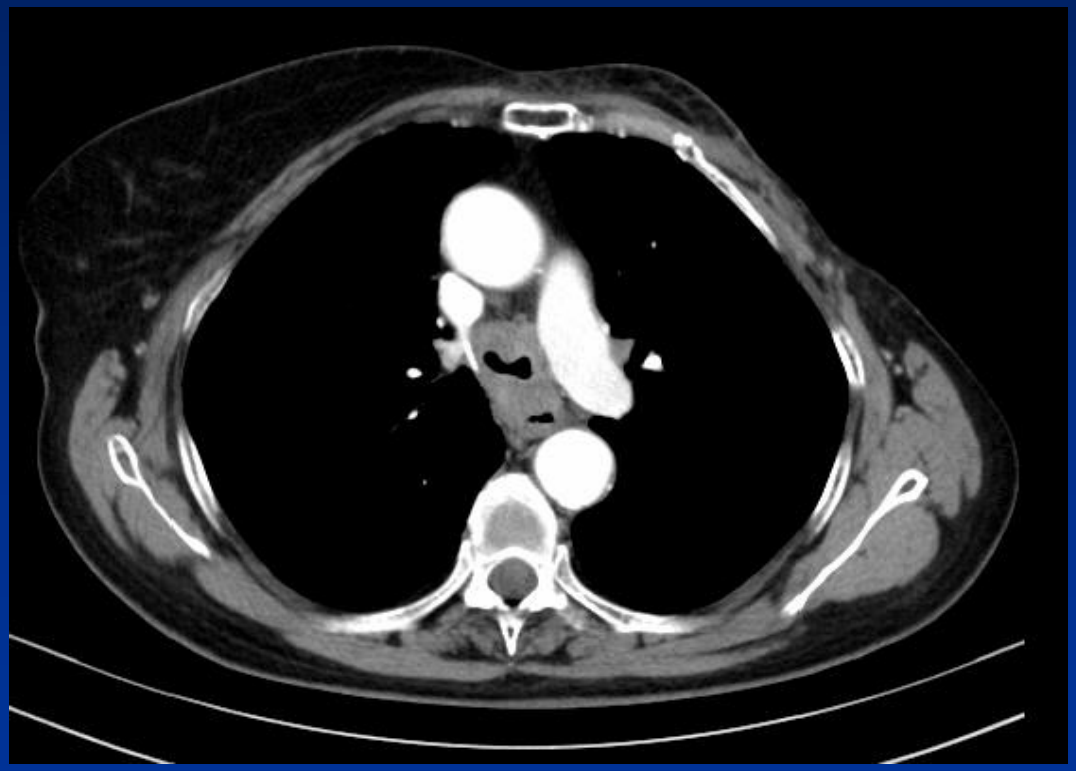




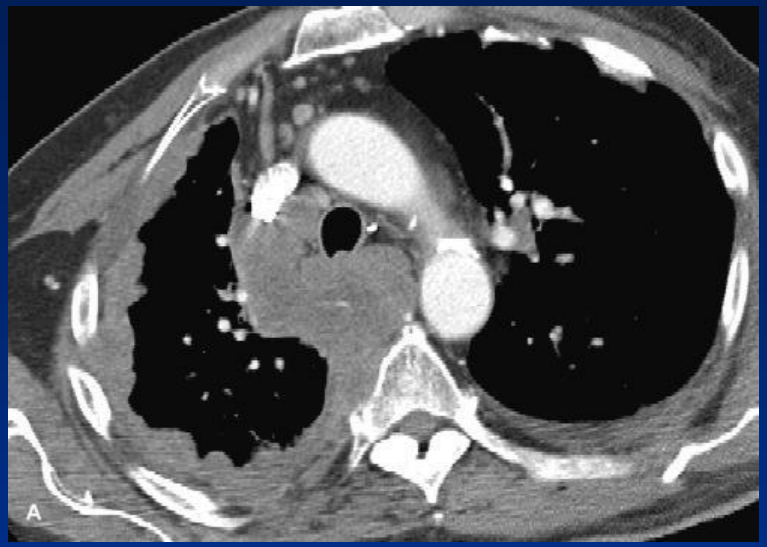
Infilitration of the left atrium

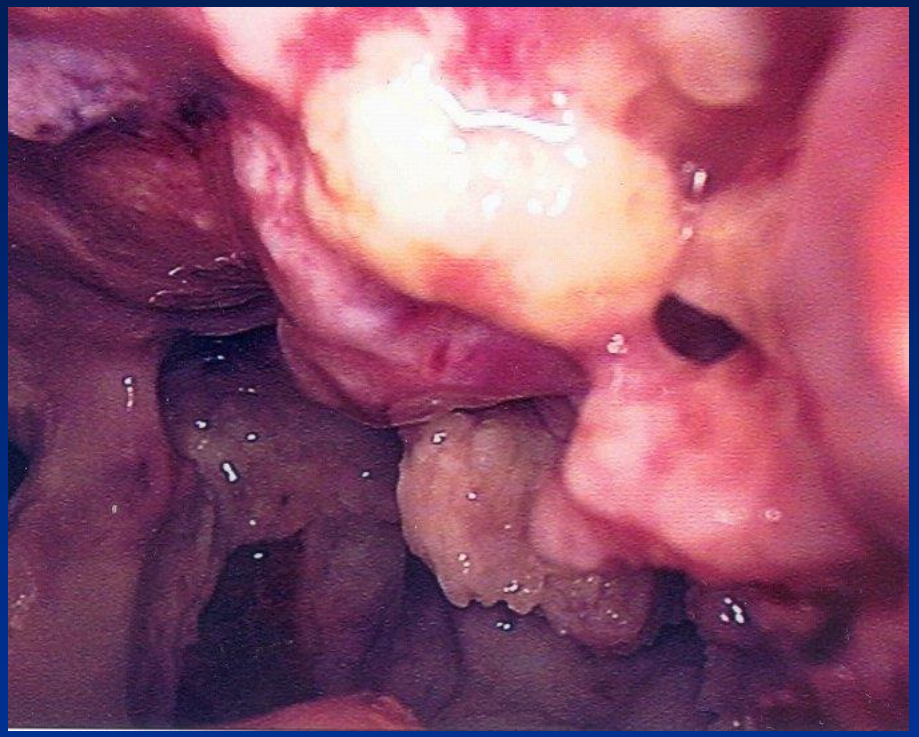


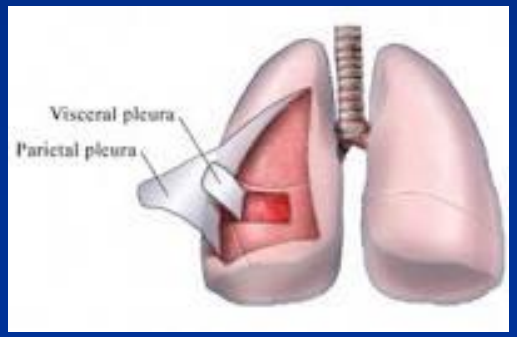
Infiltration of trachea and oesophagus



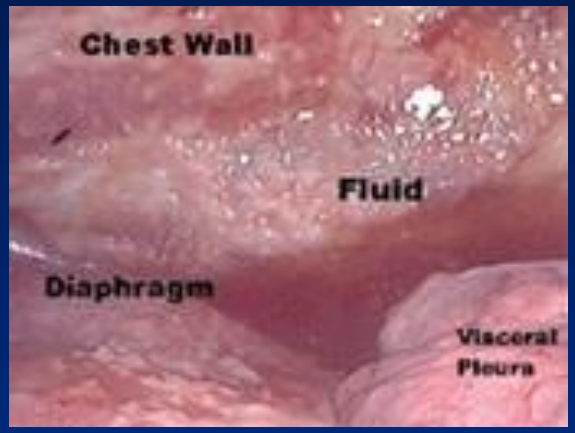
VATS pleura biopsy







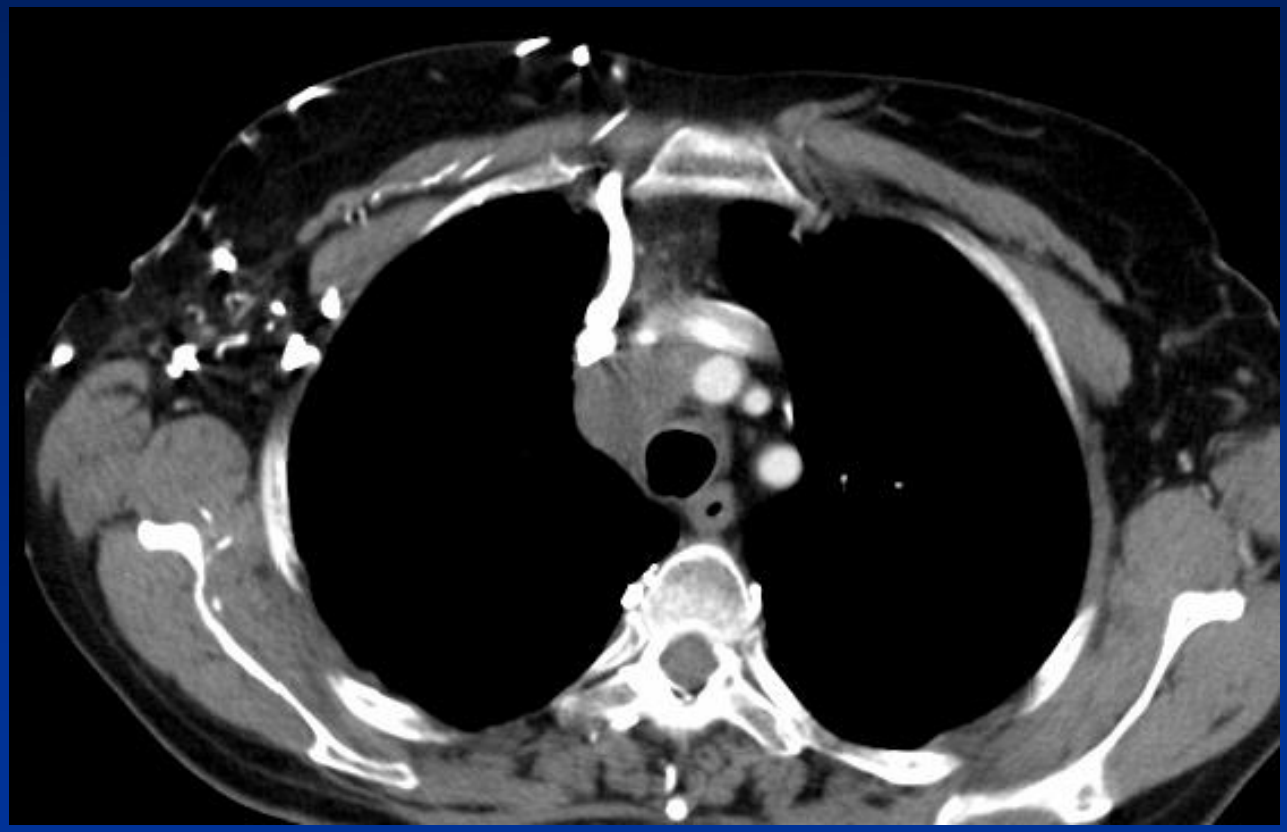
VATS pleurodesis



Treatment of the„N2 disease”

- **in cN2 suspect patients should confirm or exclude the diagnosis with histology**
- **under the operation revealed single stage N2 involvment, should make complete resection of the station !**
- ***in case of Bulky, multilevel and beyond the capsule lymp node there is no point of operation (poor survival)***
- **in case of confirmed *cN2* *neoadjuvant* chemotherapy needed and the restaging: in case of regression operation**
- **in case of residual N2 radiotherapy**
- **15-30% the 5 years survival**

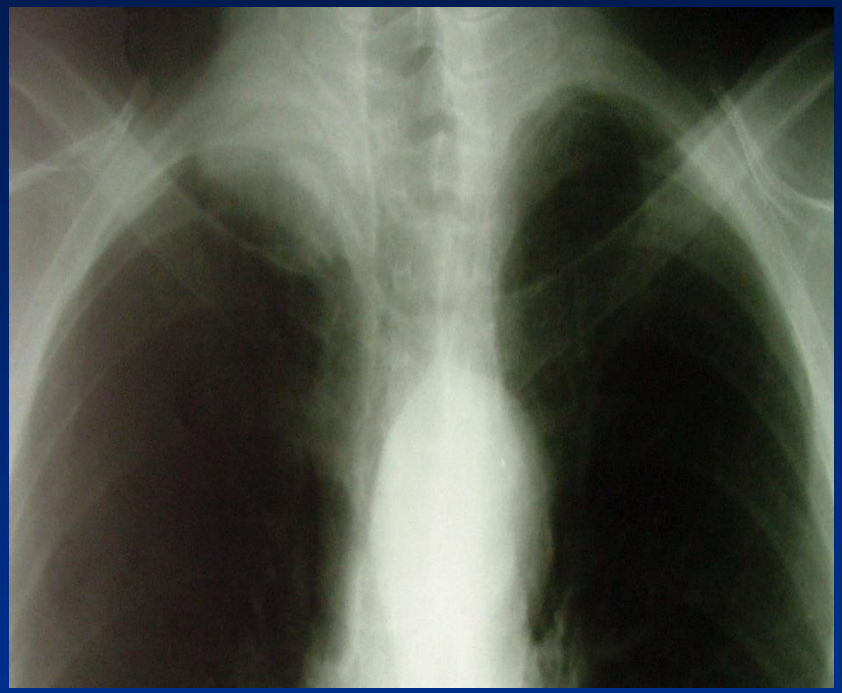
N2 stage



Pancoast tumour
(sulcus superior tumor)

- take place in the apex of the lung and growing extrapulmonary the most involving the nearby structures (rib, vertebra, plexus br., a.v. subclavia)
- shoulder pain (+Horner-triad, paresis)
- MRI !!!
- in case of N2 there is no point of operation !
- Preoperative radiotherapy, and after 3-4 weeks, operation (an block resectio)
- Postoperative radiotherapy
- 5 years overall survival is 30%

Pancoast tumour
(sulcus superior tumour)



Treatment of the local recidives

- local recidives can be in the *resection surface* (parenchyma, bronchus), or in the *regional lymph ways*

***- recidives in the lymph nodes/ways are not oncologically potential* for surgical resection!**

-re-resection is possible, but before the operation exclude the metastases

- wedge resections contains higher risks for local recidives

Adjuvant chemotherapy

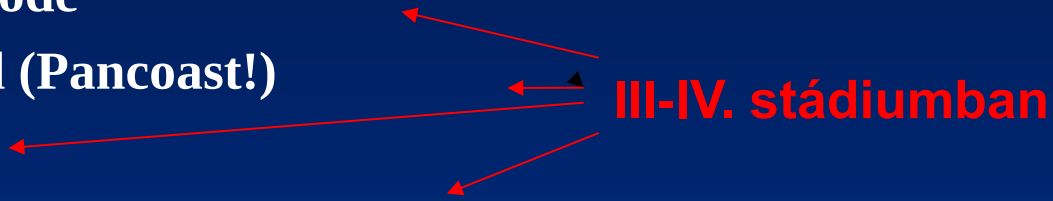
N2-mediastinal lymph node

Involvment of chest wall (Pancoast!)

T4 tumours(?)

Haematogenous dissemination

Inkomplet resection



- IA(T1N0): no need, IB(T2N0): ?, II(T1-2-3N1): need

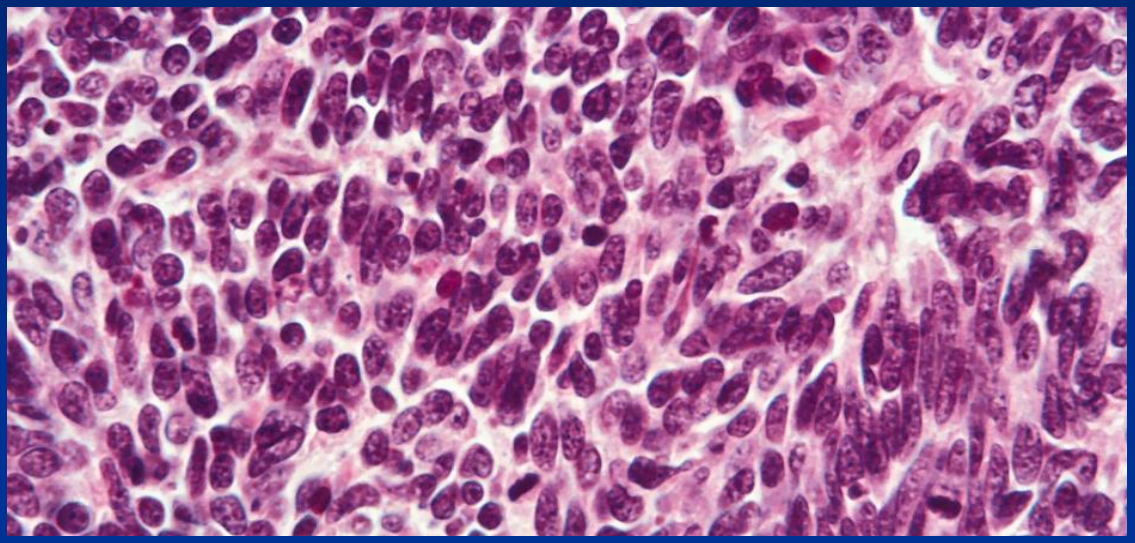
higher 5 years survival with 4-15%!

- 3-4 cycle platina based chemotherapy in 4-8 weeks after the operation.

Neoadjuvant chemo-/radiotherapy

- **Pancoast tumours**
- **N-2 diseases:**
  1. **chemotherapy**
  2. **restaging (50-70% remission)**
  3. **operation**
  4. **(adjuvant treatment)**

Surgical treatment of SCLC



General considerations

- 15-20% of the lung cancers
- in female is more common
- its place central in the lung
- high malignancy
- early metastases (brain, bone, lymph nodes, adrenal glands, liver)
- Part of the neuroendocrine tumours family
- Should difference between the carcinoid an anaplastic carcinoma

Clinical presentation

Two groups:

➡ ***Limited disease*** **(40%): tumour is localisated to the hemithorax (including ipsi-or contralateral lymph node metastases or pleural effusion)**

➡ ***Extensive disease*** **(60%): diseases exceed the hemithorax or makes distant metastases**

Surgical treatment of SCLC

- **In case of „very limited disease” = T1N0 and T2N0**
- **N1=?,**
- **N2 = there is no reason for the operation !**

- **Before the lung resection diagnostic mediastinoscopy should be performed for exclude N2 metastases**

SCLC treatment algorythm

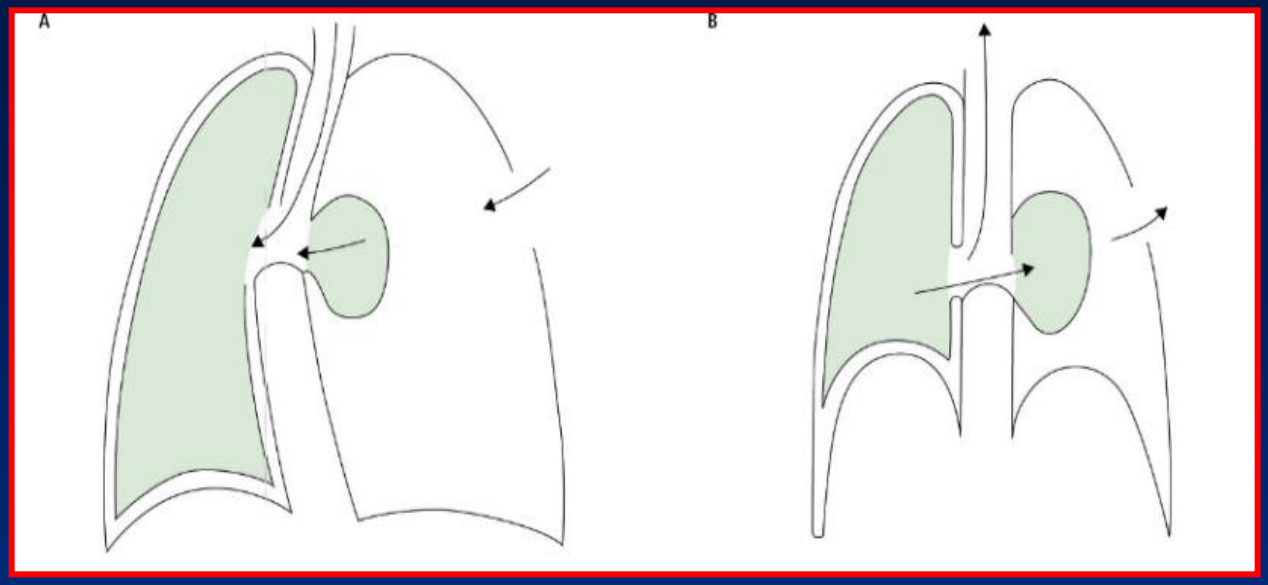
- **Confirm SCLC with biopsy**
- **Staging**
- **Patients with negative N2 disease in the chest CT should undergo mediastinoscopy**
- **OPERATION**
- **Adjuvant chemotherapy, in case of N2 involvment radiotherapy**
- **Prophilactic brain radiation**

Pneumotorax and hydrothorax

Dr. Rényi-Vámos Ferenc, Dr. Agócs László, Dr. Kocsis Ákos, Dr. Mészáros László, Dr. Török Klára, Dr. Bogyó Levente, Dr. Gieszer Balázs, Dr. Farkas Attila, Dr. Radeczky Péter, Prof. Dr. Lang György

National Institute of Oncology Thoracic Surgery Department, Semmelweis University Thoracic Surgery Clinic

PTX

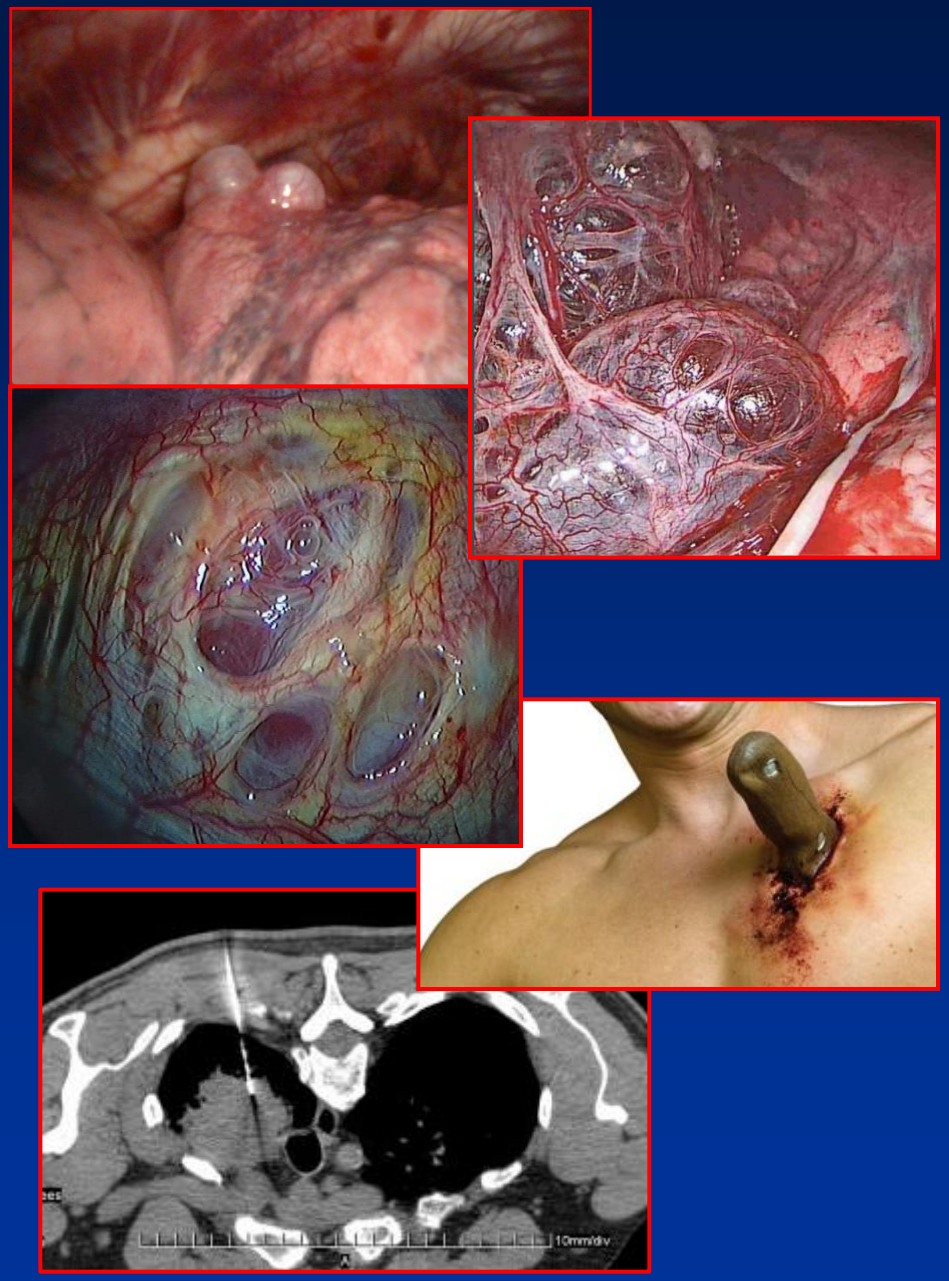


- **Basics: air penetration into pleural cavity that results :**
  - partial or total lung collapse
  - reduced ventilation surface
  - reduced respiratory muscle effectivity
  - shunt-circulation
  - mediastinal shift and reduced cardiac preload

- **Incidence:** 20-30/100.000 hab.; peaks of incidence between the ages of 20-30 and 60-70 years; 4-5 times more frequently in males;

PTX classification 1.

- **Etiology**:
  - **Spontaneous** :
    - **Primary**- rupture of subpleural bullae
    - **Sedondary** -
      - COPD
      - Cystic fibrosis
      - Oesophageal rupture
      - Marfan sy.
      - Eosinophil granuloma
      - Lung carcinoma
      - Pneumocystis carinii - AIDS
      - Metastasis - sarcoma
      - Pulmonar abcess
      - **Catamenial (endometriosis)**
      - Asthma
  - **Traumatic** : barotrauma, chest wall injury, surgery
  - **Iatrogenic** : central venous canulation, transthoracic biopsy or nerve block, transbronchial biopsy, pleural punction, abdominal surgery

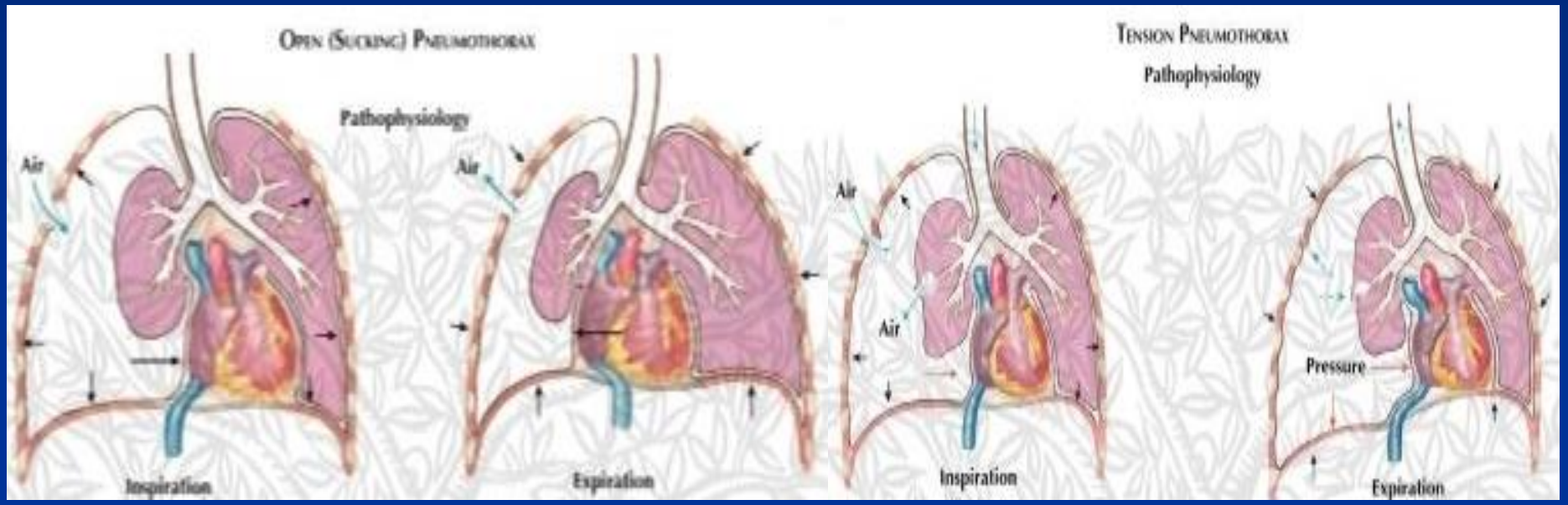


PTX classification 2.

Pathophysiology and clinical presentation:

- Closed (simple) – usually small amount of air is present without persistent air leak; spontaneous absorption in a couple of days;
- Open – persistent parenchymal or chest wall air leak after partial or total lung collapse
- Tension ptx.
- Haemoptx. – (*rupture of bullae*)
- Simultaneous bilateral ptx.

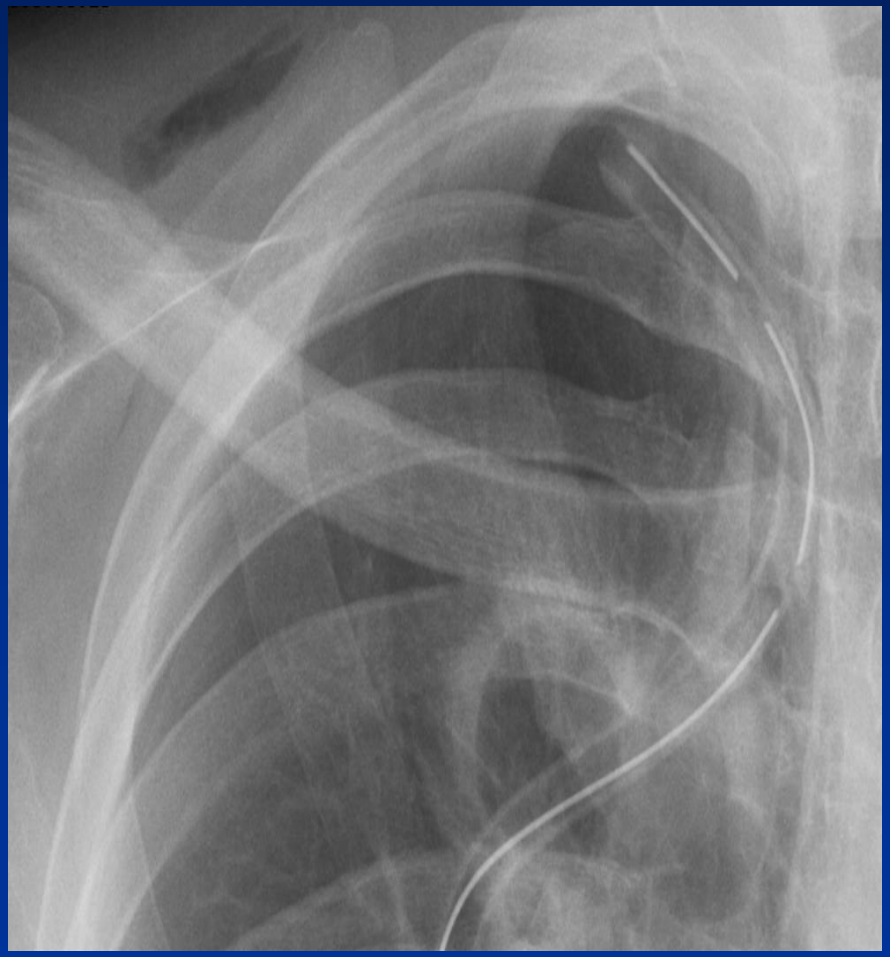
} EMERGENT THERAPY

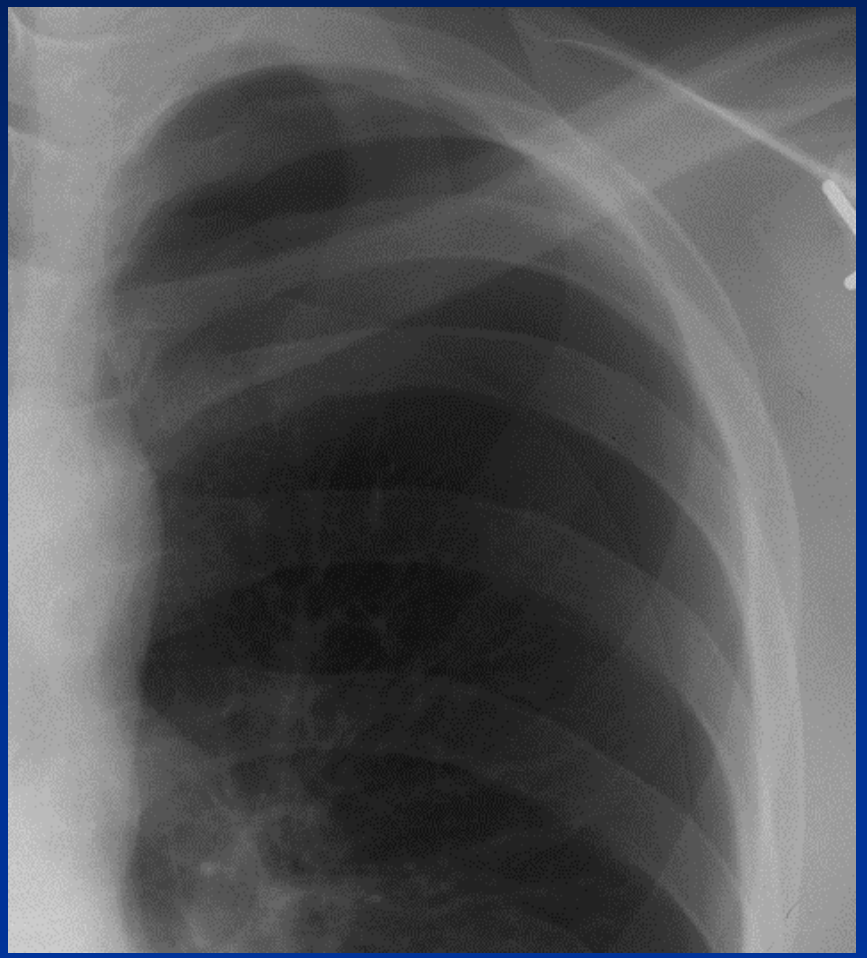


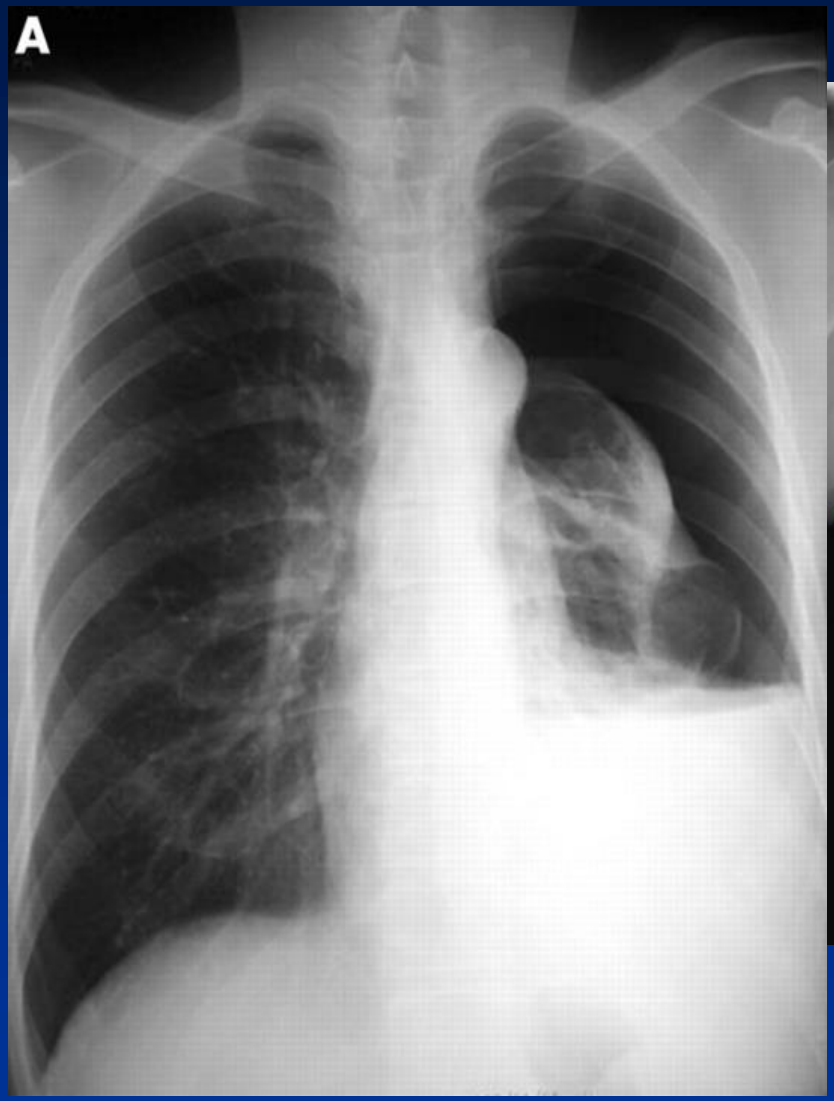
PTX classification 3.

Localization and size:

- apical, bazal, mediastinal, dorsal, ventral
- Partial or total ptx. – collapsed lung
  - Small (<2cm) or large ptx (if >2 cm)



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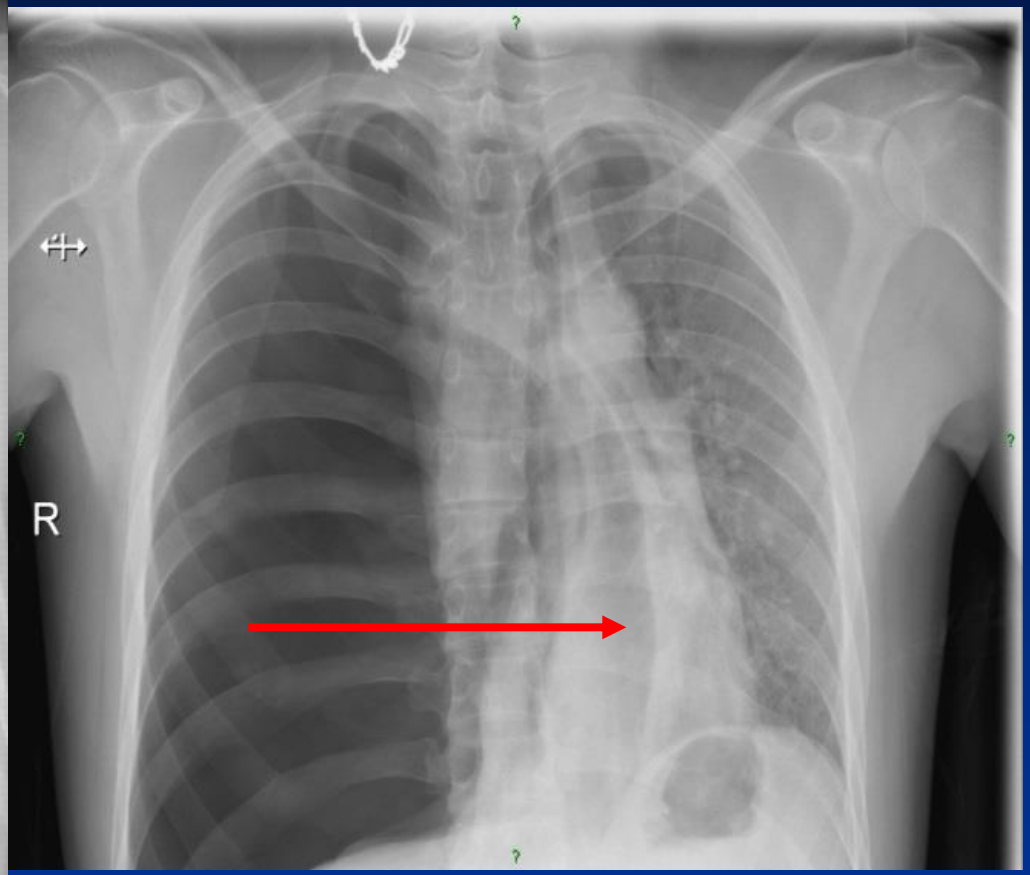
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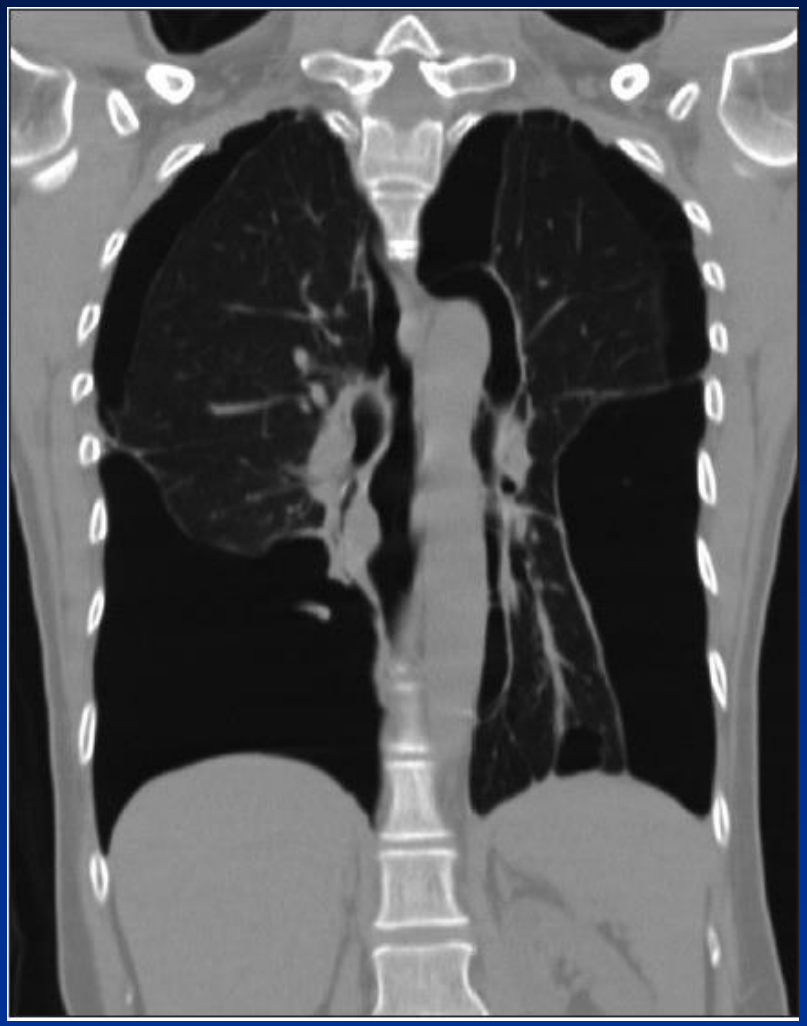


Diagnosis

- **Complains**: chest pain, dyspnoe , cough; *12% without any complain*
- **Symptoms**: attenuated respiratory murmur and tympanic resonance, diminuated phremitus;

  tension ptx results neck vein dilatation, cyanosis, CV instability, sc. emphysema - pneumomediastinum
- **Exams**:

  Chest X-Ray :
  - if mediastinal shift or/and diaphragmatic depression present – consider tension PTX
  - if air-fluid level present – consider haemoptx or seroptx.

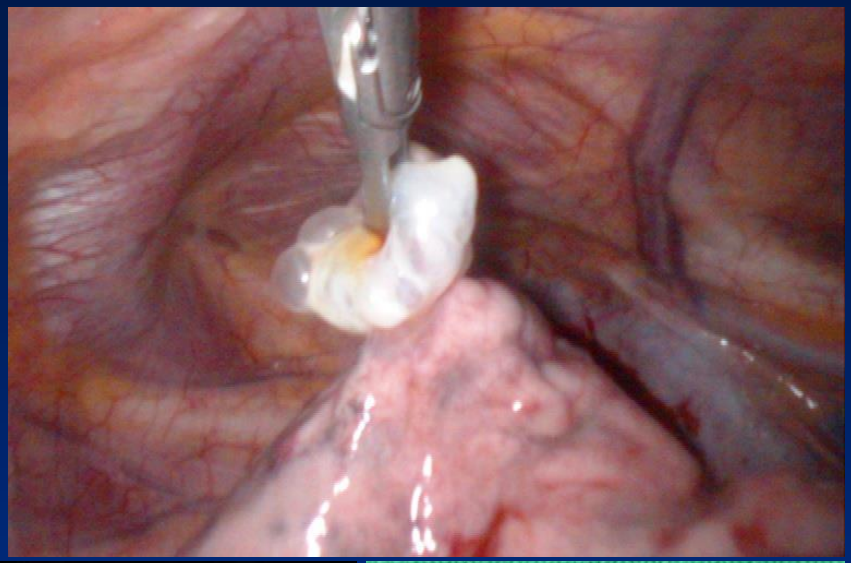
  CT : parenchymal quality, presence of bullae

  differential dg. of giant bulla or ptx. – terapeutic choice!
- **Differencial dg.**: AMI, PE, COPD exacerbation, pneumonia, hydrothorax, haemothorax
- **Complications** : prolonged air leak, subcutaneous emphysema, tension ptx – haemo ptx. with CV instability, hypoxia – respiratory failure ; sero-ptx, infection due to prolonged air leak and/or atelectasia, empyema ;

Terapy

Terapeutic choices :

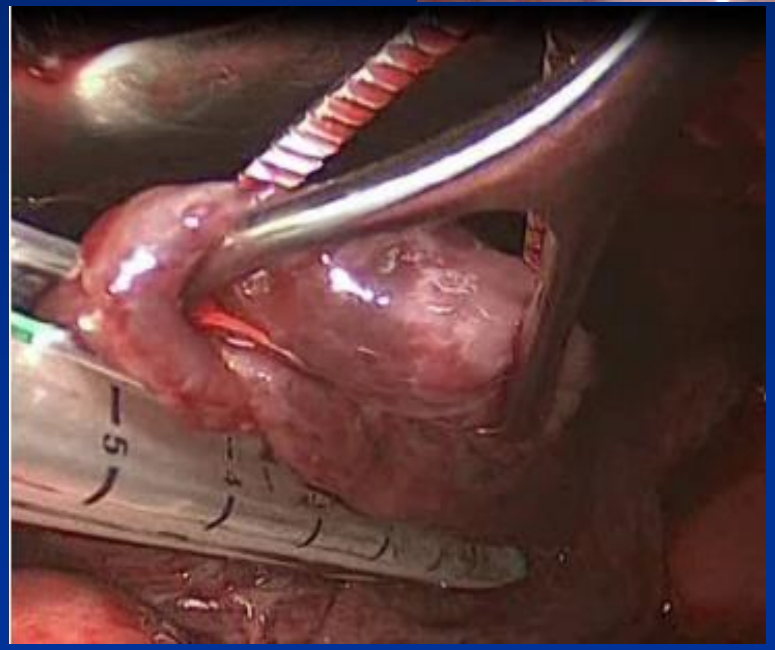
- **Conservative – bed rest and observation**
- **Needle aspiration** – high reccurence rate
- **chest drainage** – „gold standard”
- **Operative treatment : VATS or open surgery**



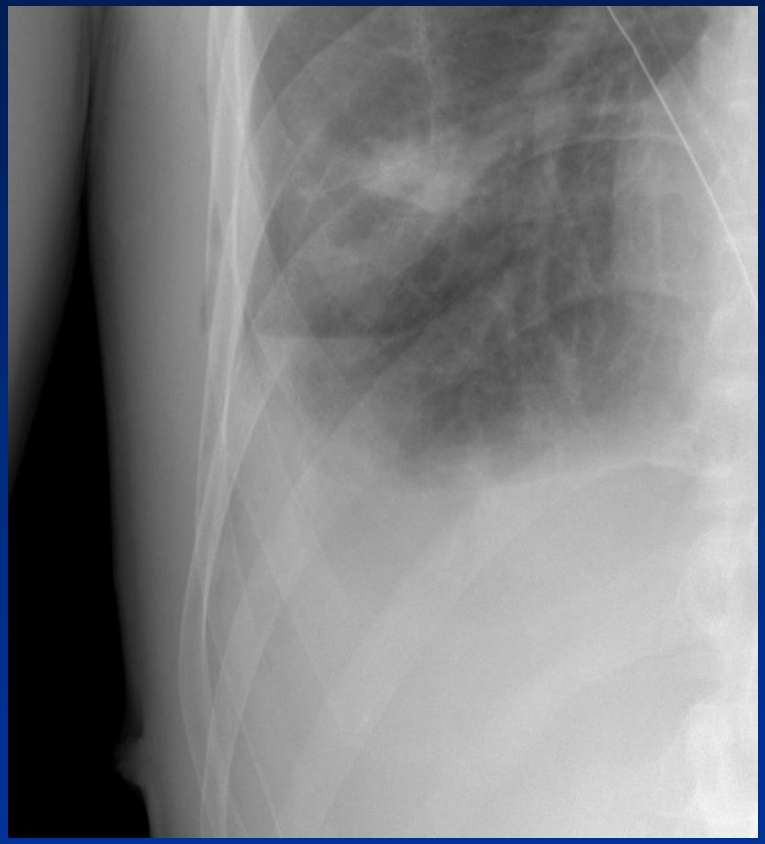
Indication of surgical therapy - usually in young patient without advanced stage underlying parenchymal desease !!!

- **First PTX and**
  - Prolonged air leak
  - Persistent lung collapse after correct chest drainage
  - bilateral ptx
  - haemo-ptx. (HTX)
  - Specific proffesion (pilot, diver, trumpeter etc.)

- **Recidivant PTX**
  - Same side reccurence
  - Isolated environement with limited acces to medical treatment
  - tension ptx
  - Presence of resectable bullae on chest CT



Pleural effusion

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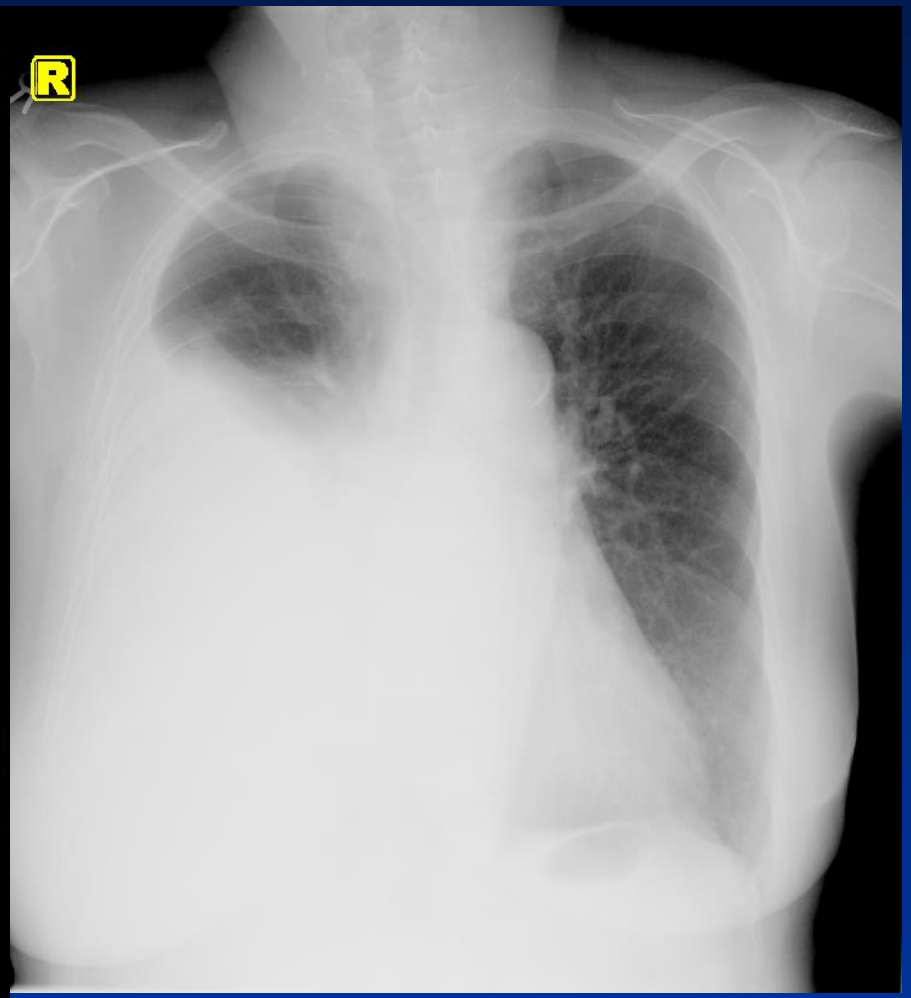
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Etiology

➢ Transudative effusion

A) Heart failure
B) Hepatic cirrhosis
C) Nephrosis sy.
D) Glomerulonephritis
E) Myxodema
F) Pulmonar artery embolism
G) Sarcoidosis

➢ Exudative effusion

A) malignancy
   1) pleural carcinosis
   2) mesothelioma pleurae

B) Inflammatory
   1) bacterial infection
   2) tuberculosis
   3) mycosis
   4) parasitic
   5) viral infection

C) Pulmonar artery embolism

D) Gastrointestinal diseases
   1) Pancreatitis
   2) Subdiaphragmatic abscess
   3) Intrahepatic abscess
   4) Oesophageal perforation
   5) diaphragmatic hernia

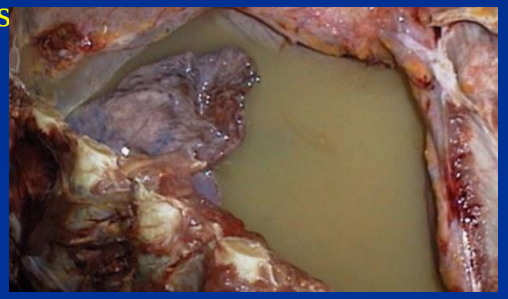
E) Autoimmune deseases
   1) Rheumatoid pleuritis
   2) SLE
   3) Wegener granulomatosis

F) Drug adverse effects

G) Miscellanous
   1) Asbestosis
   2) Irradiation

H) Haemothorax

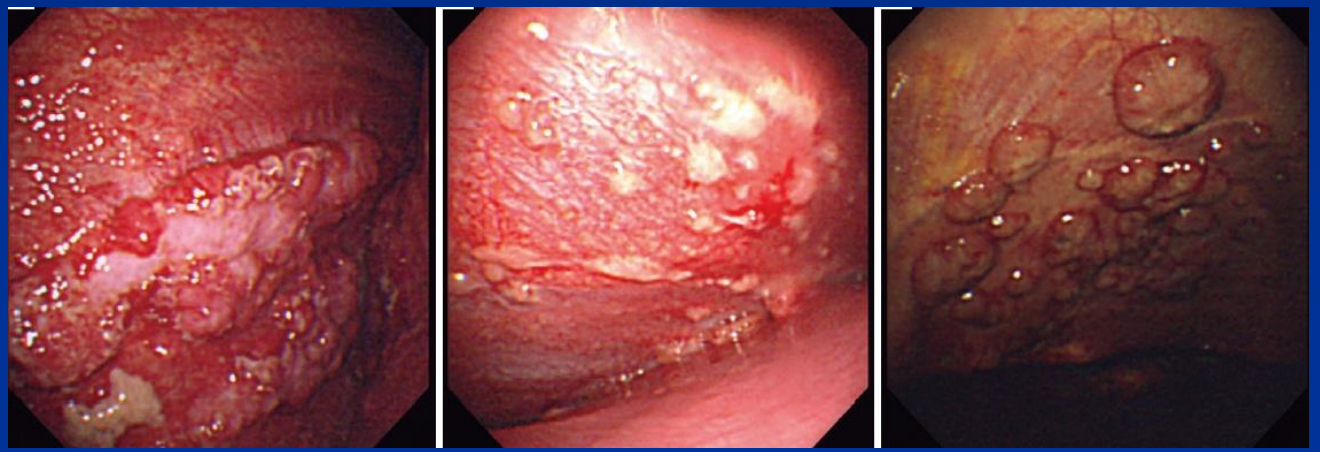
I) Chylothorax



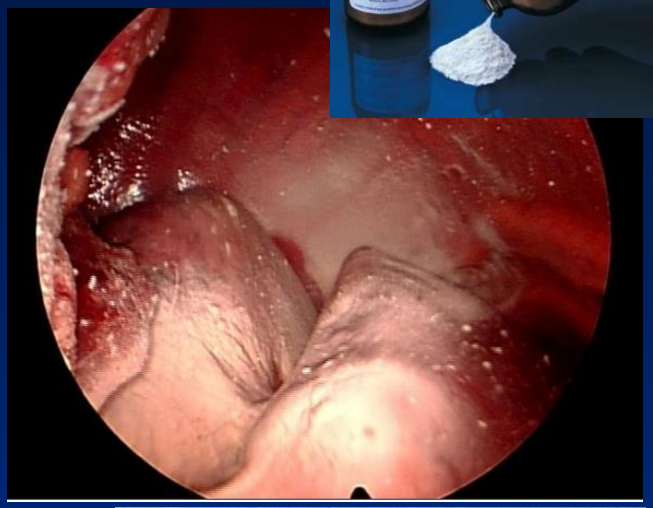
Malignant pleural effusion - MPE

- **Definition**: condition in which cancer causes directly or indirectly (post stenotic pneumonia, malignant hepatic effusion, tumor-related malnutrition) an abnormal amount of fluid to collect between pleural layers.
- **Epidemiology and prognosis** : in 15% of patient died due to malignant desease; 42% of exudative effusions are malignant
  - Median survival 6 month (worst prognosis related to lung cancer, better in ovarial cc.)

- **Etiology : Man:** lung, haematological, gastrointestinal, urological malignancies
  Woman: breast, lung, ovarial, haematological malignancies
- **Diagnosis**: symptoms - dyspnoe, chest pain, cough;
  X-Ray
  Thoracocentesis – fluid analysis; sensitivity of citology is low (60-90%) - consider only positive results
  CT – primary tumor diagnosis, staging
  Pleuroscopy - VATS sensitivity 96%; (blind pleural biopsy 40-75%)
  BRFSC



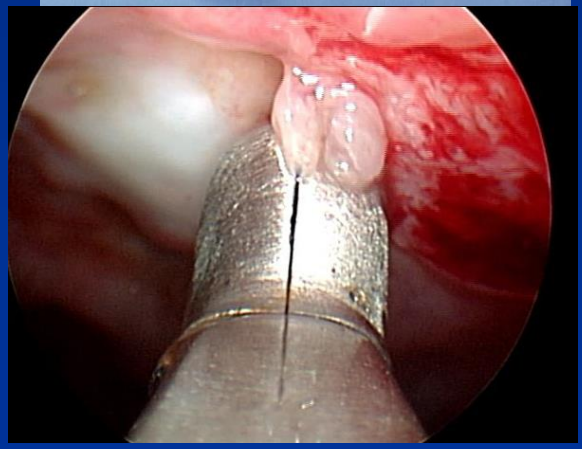
MPE - therapy



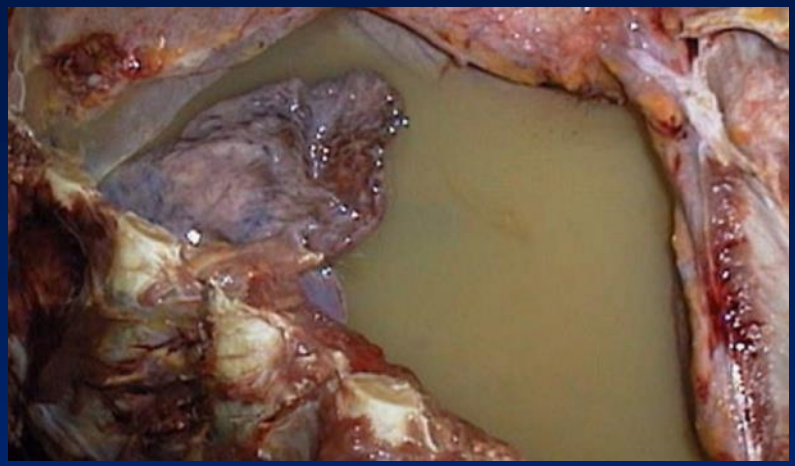
- **Repeted thoracentesis** – in poor general condition

- **Pleurodesis** – „gold standard”- large particle size *Talcum in 5g dose* –
  - **Talc slurry - instillation**
  - **Talc poudrage – insuflation** – advantages: direct vision of pleura and lung expansion, biopsy, uniform dispersion of talc
  - – complications: ARDS, heart failure due to microembolisation;
  - –Contraindication: „ trapped lung „

- **Chronic indwelling pleural catheter** (PleurX)
  - –pleurodesis failure , contraindication ;
  - – advantages: more easier , less complication
  - – 50% spontan pleurodesis rate, even in case of trapped lung !
- **Pleurectomy** –sometimes in cases when very good condition and more than 6 month expacted survival is present
  - –*Emerging therapies:* – very few evidence
    - Hipertermic intrapleural chemotherapy,
    - hipotonic ip. chemotherapy



Empyema thoracis



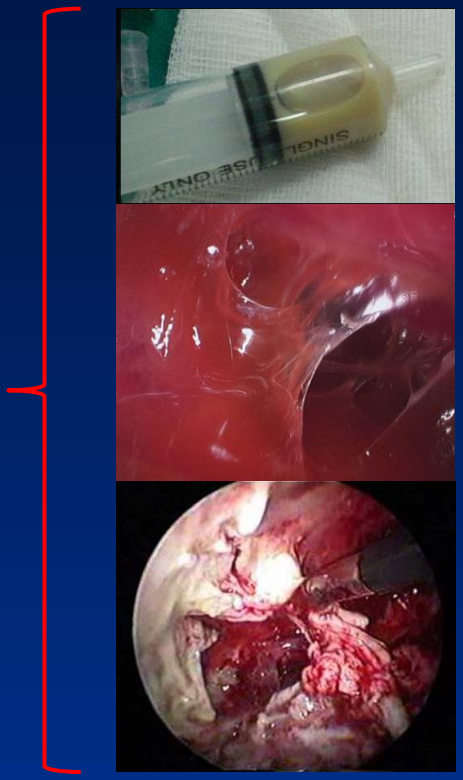
- **Definition** : purulent fluid in the pleural cavity **!**
- **Epidemiology**: in case of community-acquired pneumonia:
  - 20-50% will develop parapneumonic fluid
  - 2-5% will develop late stage empyema
- **Etiology** :
- parapneumonic 60% *(mostly in community-acquired pneumonia)*
- Iatrogenic, surgical infection 16%
- open chest injury 10%
- TBC 6%
- Pulmonar embolism 4%
- Malignant pleural effusion 2%
- aspergillosis 2%
- actinomycosis 0,3%

- ***Bacterial background*** : 50-60 % positive culture !
- In communitiy acquired pn.: Stafilooccus, Streptococcus;
- In nosocomial pn.: mostly Klebsiella, Pseudomonas and other Gram negatives

Empyema thoracis

Empyema thoracis

- **Symptoms**: cough, fever, dyspnoe, thoracic pain , septicaemia ! ...in late stages – retraction of affected hemithorax
- **Diagnosis**: - thoracocentesis indicated when fluid is more than 10 mm or septum presence on US
- Fluid sample is purulent and/or bacteriology is positive
- Fluid analysis:
  - ph < 7,00
  - glucose < 60 mg/dL
  - LDH > 1000U/l
- **Stages**:
- **Exudative –** lung expansion not affected
- **Fibrinopurulent –** lung expansion can be affected, worst stage for dacortication
- **Organised** – trapped lung, usually good for decortication

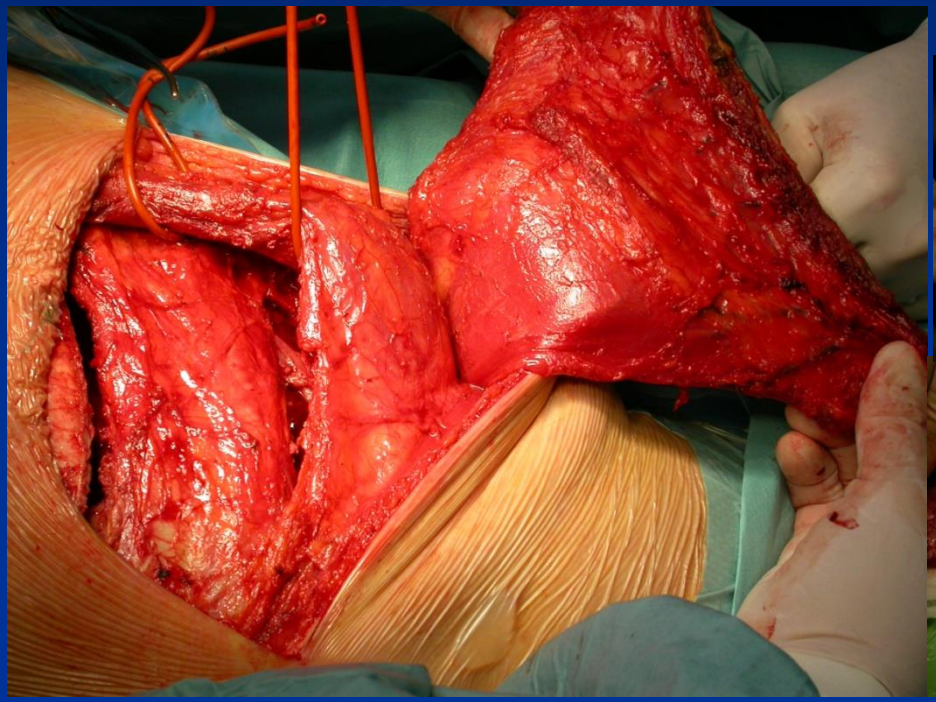


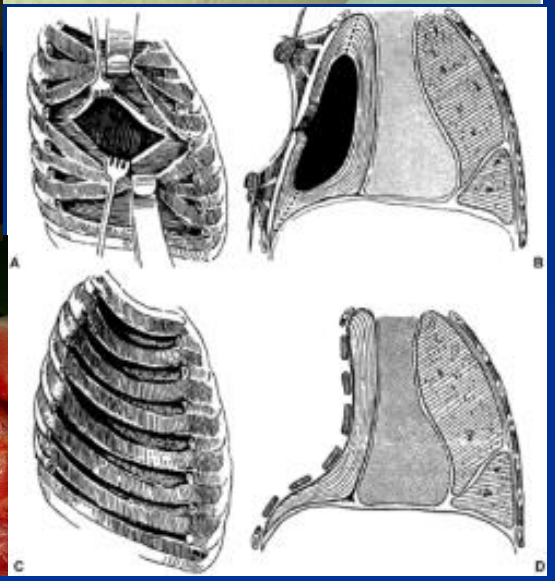
- **Complications**:
- Recurent pneumonia
- Broncho-pleural fistula
- Empyema necesitatis
- Mediastinitis
- Osteomyelitis
- Haematogen spreading – abscesses

	Stage I (exudative)	Stage II (fibrinopurulent)	Stage III (organised)
Pleura	Thin	Fibrin deposition/loculi	Thick
Fluid appearance	Clear	Opalescent	Pus
Bacteria	Sterile	Positive	Positive
pH	>7.2	<7.2	<7.2
Lactate dehydrogenase (LDH)	<500 IU	>1000 IU	>1000 IU
Glucose	>60 mg/dL	<60 mg/dL	<60 mg/dL

Empyema therapy

Antibiotics
Thoracentesis, chest tube
Fibrinolysis
VATS debridement
Decortication
Omentoplasty
Myoplasty (intrathoracic muscle transfer)
Thoracomyoplasty
Open-window thoracostomy (pleurostomy)





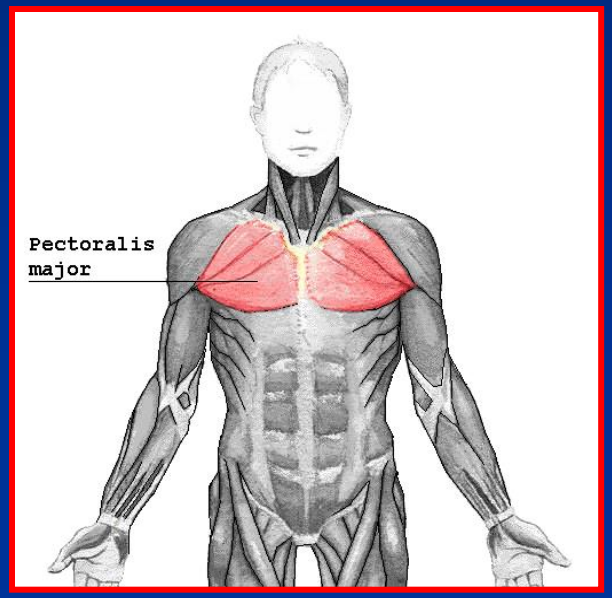
Myoplasty
(m. pectoralis, m. latissimus, m. serratus)

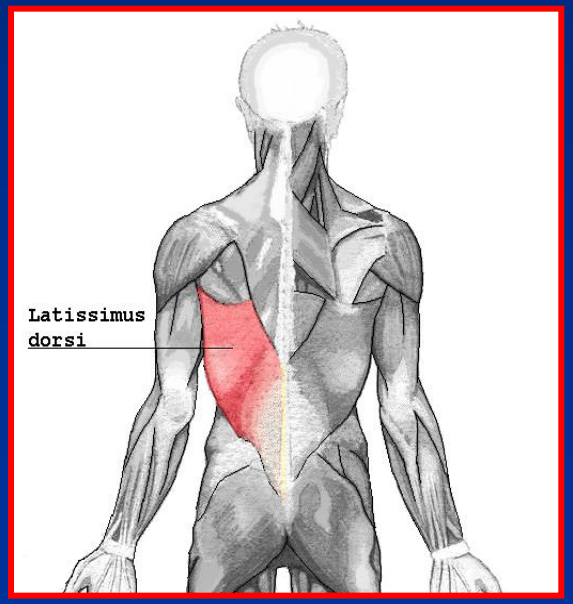
Advantages:

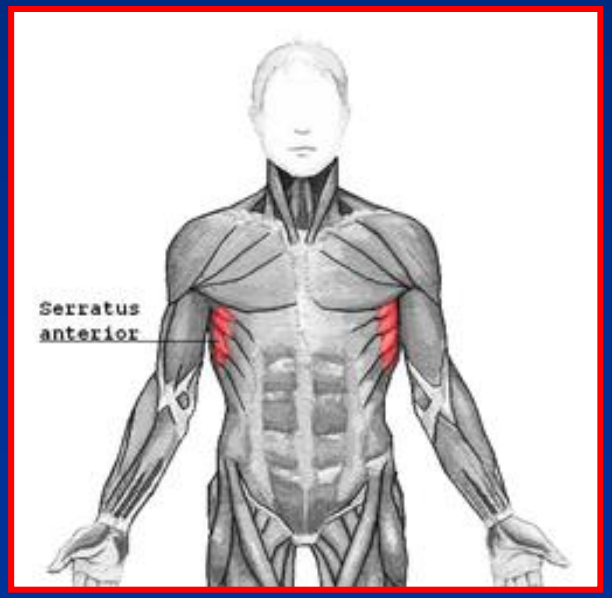
1. Easy and accessible dissection
2. Rich vascularization
3. Long muscular flap with big volumen
4. Non-worsening respiratory volumes

Disadvanteges:

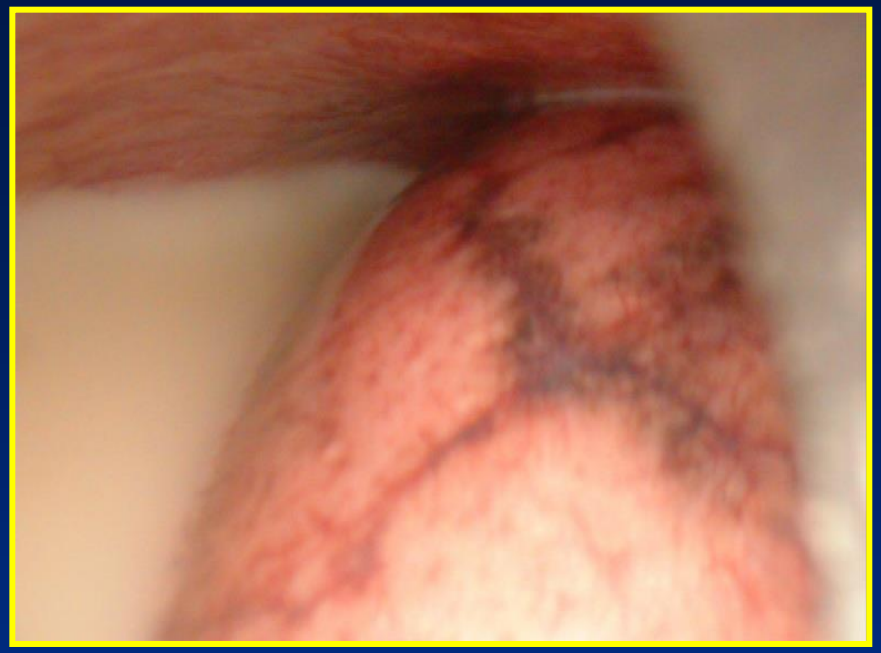
1. Require experience
2. Longer operation time







Chylothorax



- **Etiology:** damage of ductus thoracicus or other major branch
  - Congenital (perinatal injury, atresia)
  - Trauma (open or blunt trauma, operation)
  - Tumor (lymphoma, lung cancer)
  - Inflammation (tbc, filariasis other)
  - Other reason (VCS syndrome, pancreatitis)

- Treatment:
  - Conservativ therapy : carentia, total parenteral nutrition
  - Surgical therapy: thoracic drainage, VATS , open thoracic surgery (ligation, pleurectomy)
  - Irradiation
  - Chemotherapy

Thank you for your attention!