Imaging of the chest

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Lung cancer (or frequently if somewhat incorrectly known as bronchogenic carcinoma) is the most common cause of cancer in men, and the 6th most frequent cancer in women worldwide. It is the leading cause of cancer mortality worldwide in both men and women and accounts for approximately 20% of all cancer deaths.

The major risk factors: cigarette smoking (90% of cases), exposition to radon, asbestos, uranium, arsenic, chromium.
Bronchial carcinoma

Neoplasm from cells of bronchial mucosa

- **Histologically:** squamous carcinoma, microcellular carcinoma, adenocarcinoma
- **Clinically:** asymptomatic in up to 50% of cases
  nonspecific image (cough, hemoptysis, weight loss, fever, pain, recurrent pneumonia)
- **Radiologically:**
  - direct symptom (tumor shadow)
  - indirect symptom (atelectasis, ventilated emphysema, pleural effusion, pneumonia)
Bronchial carcinoma

Treatment and prognosis varies not only with stage, but also with cell type. In general, surgery, chemotherapy, and radiotherapy are offered according to stage, resectability, operability, and functional status.

Non small-cell carcinoma
- operable disease (stage I to IIIA): surgery
- unresectable disease: neoadjuvant chemotherapy, radiotherapy
- advanced disease: palliative combined chemotherapy

**prognosis:** 5 year survival rates -
- local (stage I): 55-67%
- advanced (stages IIIB and IV): 1-3%

Small-cell carcinoma
- limited disease: chemoradiotherapy
- extensive disease: palliative combined chemotherapy

**prognosis:**
- limited: 5 year survival rate 15-25%
- extensive: 2 year survival 20% (with palliative combined chemotherapy and supportive care)
Lung cancer

General criteria of inoperability of lung tumours

- infiltration of main bronchi < 2 cm from carina
- mets to local lymph nodes
- mediastinal infiltration (great vessels, diaphragm, phrenic nerve, heart, vertebrae)
- chest wall infiltration
- distant metastases
Radiological diagnosis

1. CXR – suspicion of cancer, screening (???)
2. CT – diagnosis, staging
3. Bronchoscopy / biopsy – pathological diagnosis
Bronchial carcinoma in hilum

90% cases of lung cancer from main bronchus, lobar bronchus or segmental bronchus

Radiological symptoms:

- Tumor shadow in hilum
- Ventilated emphysema (X-ray – in expiration mediastinal movement towards the healthy part)
- Pneumonia (bronchi narrowing and retention of sputum)
- Fluid in pleural cavity space
- Atelectasis(complete bronchial closure, adjacent lobes – compensatory emphysema)
Hilar cancer
Hilar cancer
Hilar cancer

Lung atelectasis
Hilar cancer
Lung cancer – peripheral form

10% cases of lung cancer from a small peripheral bronchus

**Radiological symptoms:**

- Round, oval shadow, rarely irregular
- Difficult differential diagnosis (biopsy through chest wall)
- Pancoast's tumour – apex lung cancer (consolidation in apex lung, destruction of adjacent segments of ribs, infiltration of the bronchial plexus-Horner's syndrom)
Peripheral cancer
Peripheral cancer
Peripheral cancer
Peripheral cancer
Lung cancer

Differential diagnosis - metastases
Lung cancer

Differential diagnosis - AVM
Lung cancer

Differential diagnosis - tuberculosis
Lung cancer

Differential diagnosis - hamartoma
Lung cancer - metastases

Local:
- hilar lymph nodes
- paratracheal nodes

Distant:
- brain
- bones
- adrenals
Lung cancer screening is an imaging strategy that is beginning to be adopted for high-risk patients in some health systems.

Rationale: lung cancer is the most common cause of cancer death worldwide, and there is accumulating higher level evidence that a mortality benefit exists with screening of carefully selected patients.

Guidelines:
- low-dose CT (lowered kVp)
- current or former smokers with at least a 30 pack-year history of smoking
- 55-74 years of age
- no history of lung cancer

Results:
- ~20% relative reduction in lung cancer mortality
- risk reduction in lung cancer death by 3-4:1000 individuals screened
- 320 screened to save one life (mammography 1:465-601)
Metastases to the lungs

• Through lymphatic or blood vessels
• Sources: kidney, breast, bones, thyroid (and many more)
• Imaging: CXR, CT, PET

Radiological symptoms:

• Numerous round shadows in both lungs, mainly in middle and lower lobes, acute outlines, different size,
• Less often 1 round shadow located peripherally = diagn. problem
• Lymphangitis carcinomatosa: numerous v. small mets through lymph vessels, mainly from breast and stomach cancer
Metastases to the lungs

Osteosarcoma
Metastases to the lungs

Carcinosis miliaris – kidney tumour
Metastases to the lungs
Metastases to the lungs

Lymphangiosis carcinomatosa
Pneumoconiosis

- Long time inhalation of organic and inorganic dust (silicone, carbon, asbestos, talc)
- The most common silicosis
- Storing of dust in the lung and in the lymph nodes → collagen production → silicosis nodules + interstitial fibrosis
- Clinically: chronic bronchitis, shortness of breath, right ventricular heart failure
- Diagnosis: interview and radiological image
Pneumoconiosis

X-ray-the dynamic of the changes

- Reticulum image (occupation of lymphatic vessels)
- Small nodules (2-3mm) - symmetrically in the middle and lower lobes
- Lymph nodes enlargement, calcifications
- Large nodules – possible cavity

**secondary changes:** emphysema, bronchiectasis, pleural adhesions, right ventricular heart failure
Silicosis

Micronodular silicosis

Macronodular silicosis

Differentiation: sarcoidosis, miliary tuberculosis, ca miliaris
silicosis
Asbestosis
Aspergilloma

mass-like fungus balls that are typically composed of *Aspergillus fumigatus*, and is a non-invasive form of pulmonary aspergillosis

- **Clinically:** hemoptysis of varying severity

- **Radiologically:**
  - Oval or round shade with air seen between cavity wall and mycelium
  - 1-12 cm diameter
  - usual- I-II segm., less often 6 segm,
  - Mobile mycetoma in the cavity
Aspergilloma
Aspergilloma
Emphysema

Dilatation of alveoli, loss of pulmonary septum, vessels reduction

- **Emphysema in the shut-off mechanism:** in chronic bronchitis, asthma, interstitial pneumonia; bilateral
- **Compensatory emphysema:** resection, cirrhosis, atelectasis; may involve 1 lung or lobe
- **Bullous emphysema:** large, thin-walled bulla, located subpleurally, pneumothorax
- **Imaging diagnosis:** CXR, CT
Emphysema

The radiological symptoms:

• Inspiratory setting of the chest
• Horizontal course of the ribs
• Wide intercostal spaces
• Low set diaphragm
• Wide costo-phrenic angles
• Excessive clarity of the lung fields
• Reduction of vascular image
• Wide pulmonary artery
• Wide retrosternal space
Emphysema
Emphysema
Emphysema-bullae
Pulmonary embolism

- **Embolic material**: clot, fat, air

Thrombophlebitis of lower limbs veins and pelvis, clots in the heart, long immobilization

- **Clinically**: shortness of breath, pain, cough, fever, hemoptysis

- **Imaging examination**: X-ray, scintigraphy lung angio-CT,
Pleurites

• **Aetiology:** tuberculosis, infection, lung cancer or pleural cancer, trauma, infarction, subdiaphragm abscess

Dry pleurisy (fibrous): X-ray - no symptoms;

**Exudative pleurisy** (serous, purulent, haemorrhagic)

– X-ray:

• Assessment of fluid amount
• location
• Free/encapsulated
• Specifying the nature of the fluid is impossible
Pleuritis

X-ray:

• Shading of the costophrenic angle
• Shading of lower lung fields (linia Ellis - Damoiseau)
• Large amount of the fluid – shift of mediastinum to the healthy side, lowering the diaphragm, wide intercostal

USG:

• For detecting a small amount of fluid, puncture location
Exudative pleurisy
Exudative pleurisy
Exudative pleurisy
Exudative pleurisy
Pleurisy

- Encysted fluid in pleural adhesions: pleuritis interlobaris, costalis, diaphragmatica, mediastinalis. Diagnosis: X-ray and lateral image
- Pleural adhesions: shading of costophrenic angle, ten shadows over the diaphragm, shadows along the rib II, thickening of the interlobar fissures
- Fibrothorax: descent of empyema; lung with reduced volume surrounded by adhesions mantle
- Pleuritis calcarea: calcium salt deposits in thickened pleura
Exudative pleurisy

Encysted fluid
Exudative pleurisy

Encysted fluid
Pleural adhesions
Pleural adhesions
Pleuritis calcarea
Pneumothorax

• The accumulation of air between pleura parietalis and pleura visceralis

  idiopathic or traumatic (iatrogenic)

• X-ray: peripheral part of the chest without vascular image

• Tension pneumothorax – the entire lung is collapsed, mediastinum shifted to the healthy side

• Possible the occurrence of fluid. Adhesions supporting the lung → several pneumothorax chambers
Pneumothorax
Pneumothorax

massive pneumothorax with soft tissue emphysema
Pleural cancers

- primary: mesothelioma pleurae, is quite rare
- secondary: metastasis, much more frequent
- Both of them occur with exudative pleural reaction
- Basic diagnostic method – CT, differentiation of pulmonary/pleural changes
Pleural mesothelioma
Pleural mesothelioma
Cervical rib
Chest trauma

Radiological examinations:

- X-ray
- CT
- USG (diagnosis and puncture of pleural fluid and pericardium fluid)
Chest trauma

- Ribs fractures
- Pleural fluid (blood)
- Pneumothorax (tension pneumothorax)
- Lung contusion: 4 h after the trauma, foci of follicular density, recedes after 6-8 days
- Pulmonary haematoma: smooth-walled, oval shades, combined with the bronchi-cavity with fluid level, growing a few days after the trauma
- Tracheal and bronchial trauma: pneumomediastinum, subcutaneous emphysema, lung atelectasis
Chest trauma

pneumothorax and soft tissue emphysema
Chest trauma

Lung contusion
Chest trauma

Gunshot wound
Chest trauma

The condition after the removal of the upper lobe of the right lung
Chest trauma-post operation

The condition after thoracoplasty