Evaluation of the chest
Part II.

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SZEGEDI TUDOMÁNYEGYETEM
ÁOK, RADIOLÓGIAI KLINIKA,
SZEGED
ANATOMY

• parenchyma:
  – alveoloacinar system, pulmonary arteries and veins
• interstitium:
  – connective tissues and lymphatic vessels
  – bronchial arteries and veins
• bronchi
• mediastinum
• pleura
Parenchymal diseases

- congenital abnormalities
- air content disorders
- circulatory disorders
- inflammations
- hypersensitive processes
- degenerative diseases
- tumors
Congenital abnormalities

- right pulmonary artery agenesis
Increased air content

- emphysema
  - compensatory
  - destructive
- bullous
- tissue absence (pneumo-cyst)
compensatory emphysema
centrilobular emphysema

Causative agents: smoking, industrial smoke, ultra fine powder
chronic emphysema

barrel chest, diaphragm inversion
• it can be congenital, or may be associated with emphysema or fibrosis
Decreased air content

- Air access impeded:
  - Bronchial stenosis, foreign body, fluid aspiration
- Air is crowded out from the alveoli:
  - Inflammatory exudate, fluid stasis, blood
- Tissue proliferation in alveoli:
  - carcinoma alveolocellulare
Obstructive atelectasis

trachea-tube in too deep position
Fleischner’s atelectasis

it is reflective, induced by peritonitis, or severe peritoneal shock
carcinoma alveolocellulare

it is more or less sharp edged, without involvement of the bronchi
Circulatory disorders

• circulating blood volume:
  – decreases (hypovascularisation)
  – increases (hypervascularisation)

• blood flow:
  – stop (embolism, infarction)
  – gets out: hemoptysis, pulmonary hemorrhage

• elevated blood pressure:
  – arterial side: pulmonary hypertension
  – vein side: pulmonary congestion
Circulating blood volume

- In left to right shunt, more blood enter the lungs than it should,
in right to left shunt less or mixed blood enter the lungs
Blood flow

angiographic and CT-image of pulmonary embolism
pulmonary infarction

Single and multiple necrosis
Pulmonary hemorrhage

- Blood enters the airways from the bronchial arteries, if the tumorous or tuberculotic wall of the blood vessel is ulcerated.
pulmonary hypertension

suddenly narrowing central vessels
pulmonary venous congestion

redistribution + interstitial edema
Inflammations

- Penetrating the alveoloacinar system:
  - lobar pneumonia
- Penetrating the bronchial system:
  - bronchopneumonia
- Penetrating the interstitium:
  - atypic pneumonia, pneumonitis
Lobar pneumonia

- It has a spotty look, but it respects the borders of the lobes
- more lobes can be affected at the same time or one after the other
- air bronchogram is present
Bronchopneumonia

- It is frequent, with a fast changing pattern, and comes with hilar adenomegaly
- It has a non-confluent, focal-spotty structured shadow
Pulmonary abscess

basket-like shadow forms after suppuration
Interstitial pneumonia

- The infection can be transmitted by animals (ornithosis, bird flu)
- It frequently comes with slight, striped infiltration
- Clinical and radiological findings are not always in accordance
Interstitial pneumonia

- Frequently spreads as an epidemic (Spanish flu, SARS)
- Its severe, hemorrhagic types quickly lead to death
Pneumonias

- In the developed Western countries, infectious diseases became the 3rd most frequent cause of death again,
- in the United States, 15% more deaths occur due to pneumonia as it used to be 20 years before.
Pulmonary tuberculosis

- People with poor quality of life (homeless, alcoholic, Indian or ethnic, moved from the East)
- The number of multiresistant infections increases
- Starts insidiously → screening
- Its diverse types are less and less typical
primary complex

peripheral focus + hilar lymphadenomegaly connected by inflamed lymphatic vessels
caverna

- open tbc: thin puss is excreted by coughing through the bronchi

- droplet infection
miliary tuberculosis

- haematogenic
- disseminates to other organs as well
Hypersensitive diseases

- They are remarkably diverse in look, but they are generally bilateral
- Exogenic causes:
  - Allergy-inducing or irritative effect of the inhalation of organic or non-organic materials
- Endogenic causes:
  - Immunologic or rheumatoid diseases, materials entering the circulation, e.g. medicines
Hypersensitive pneumonia

- It forms during taking medicines, and doesn’t respond to antibiotics
- inflammatory process, mostly spreads around the blood vessels
Boeck’s sarcoid

- Generally comes with bilateral, symmetric hilar lymphadenomegaly, or skin symptoms
- It rarely affects the lungs or rarely it is only present in the lungs
Pulmonary fibrosis

- The untreated or incurable hypersensitive inflammations may turn into fibrosis
- This may lead to the destruction of the pulmonary tissue in a lethal extent
Degenerative diseases

• Lung tissue:
  – emphysema, dystrophia
• interstitium:
  – fibrosis
• bronchi:
  – COPD, brochiectasis
• Expiration is partly inhibited due to chronic inflammation and scarring of the bronchioli caused by long-lasting irritation or smoking

• Lung tissue is destructed, respiratory functions worsen

*/ COPD: chronic obstructive pulmonary disease*
COPD

- Due to the destruction, ventilation is inhibited in some areas
- Destructed areas will be larger and larger
- X-ray image cannot follow up the process (He$^3$ MR)
• Abundant excretion gathers in the dilated bronchi, mostly in the lower lobes
• This excretion discharges by coughing time to time, mostly in the mornings
Bronchiectasis

- CT-scan shows thickened and dilated bronchi
- Lung tissue destructs, scars, its air content decreases
Excretion stasis in bronchi

- It can occur mainly in heavy smokers, they can cough up thick mucus effect of nicotine during only.
- Without nicotine the mucus plug occludes bronchi causing atelectasis.
Tumors

- benign:
  - hamartoma, chondroma

- semimalignant:
  - alveolar cell carcinoma, bronchial adenoma

- malignant:
  - bronchial carcinoma, fibrosarcoma
Benign tumors

- well differentiated cells, even growing in every direction → round or lobulated
- non-invasive → with sharp edge
- calcification: central, rough, pop-corn like
chondroma, hamartoma

It is growing real slow (previous X-rays are important)
Semimalignant tumors

- bronchial adenoma:
  hystologically benign, but does metastasise
- alveolar cell carcinoma:
  spreading from one alveolus to another,
  it is malignant histologically, but does not metastasise
bronchial adenoma

it narrows the bronchus or even occludes it (virtual bronchogram)
Malignant tumors

- poorly differentiated cells, growing unevenly in different directions → irregular, spiculated
- infiltrative growing → blurred contours
- calcification: eccentric, slight
- Does metastasise
bronchial carcinoma

spiculated, hilar mass (chest x-ray and CT)
bronchial carcinoma

the „early” carcinoma can also easily be too late
bronchial carcinoma

recurring pneumonia:

- smoking men over 40 years of age
- Recurring pneumonia at the same location

it is the sign of a bronchial carcinoma at that location!
The solitary nodule is always suspicious to be a tumor!
bronchial carcinoma

the PET-CT signs the increased glucose metabolism of the tumorous tissue
Numerous sharp edged, round nodules of different size formed in the lungs; their size (developed in different time) and number is increasing from the apex to the diaphragm.
Diseases of the mediastinum

- dislocation („shift”)
- mediastinitis
- mediastinal emphysema
- haemomediastinum
- hernias
- tumors
mediastinal dislocation

atelectasis of a lobe  haemorrhagia
Mediastinal tumors

- anterior mediastinum: struma, thymus
- middle mediastinum: lymphatic structures, metastases
- posterior mediastinum: neurogenic tumors
intrathoracal struma

Inducing stridorous breath and dysphagia
thymoma

quite common, but it is only rarely associated with myasthenia gravis
Middle mediastinal tumor

arterial and bronchial compression caused by malignant lymphoma
Posterior mediastinum

neurogenic tumor (MR-images)
Pleural diseases

- pneumothorax
- pleural effusion (transudate)
- pleuritis (exsudate)
- empyema thoracis
- pleural callus
- mesothelioma
- metastatic lesions
pleural transssudate

concave border, compressed, air-less lower lobes
pleural exsudate

pulmonary abscess with inflammatory pleural exsudate
mesothelioma

often late consequence of azbest-inspiration
pleural metastasis

It is common in breast cancer, can produce lots of fluid
Diaphragm

- **High position of diaphragm**: X-ray (physiologic on the right side, sub pulmonal fluid)
- **abnormal diaphragm movement**: fluoroscopy
- **rupture**: chest X-ray + abdominal US + upper passage examination, CT
- **diaphragm herniation**: mainly in new born
Traumatic diaphragm rupture

standing

prone position
Diaphragm

- traumatic rupture (CT-examination i.v. and oral contrast administration)