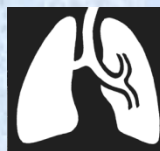


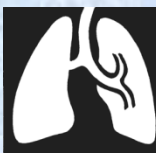
Pneumothorax Haemoptysis

Libor Fila



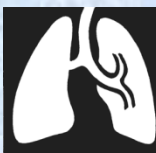
Emergencies in pulmonology

- Pneumothorax
- Haemoptysis
- Foreign body aspiration
- Acute severe asthma
- ARDS



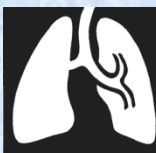
Pneumothorax (PNO)

- The presence of air in the pleural cavity
- Communication through the chest wall, the bronchial tree or the gastrointestinal system
- Accompanied with a partial or complete collapse of the lung



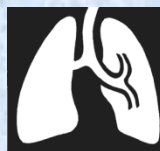
PNO: pleural cavity

- Virtual space between the visceral and parietal pleura
- Physiologically, negative pressure from -3 to -7 cm H₂O, due to the elastic properties of the lung and the chest wall and absorptive properties of the basal pleura
- Negative pressure keeps lung expanded: in case of loss of negative pressure the lung collapses towards the hilus due to its elastic fibers



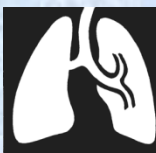
Pathophysiological types of PNO

- Closed PNO: communication is closed
- Open PNO: communication persists
- Tension PNO: communication opens in inspirium and closes in expirium; the air accumulates in the pleural cavity



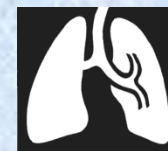
Consequences of PNO

- According to the extent of collapse of lung and to the state of lung parenchyma
- Ventilation is limited in the collapsed lung, there is decreased ventilation/perfusion ratio
- Total lung collapse lead to right-to-left shunt
- The patient is hypoxemic, usually without hypercapnia because of compensatory hyperventilation of contralateral lung



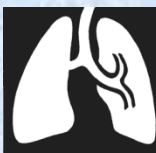
Consequences of PNO /2

- Closed PNO: stable condition
- Open PNO: pendulum-like movement of mediastinum and air between lungs (with increasing dead space) following respiratory movements
- Tension PNO: lead to mediastinal shift to contralateral side with compression of unaffected lung and worsening of venous return



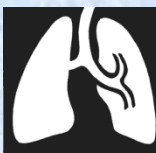
Clinical classification of PNO

- Primary spontaneous PNO: with no known underlying lung disease
- Secondary spontaneous PNO: in the terrain of lung disease
- Traumatic PNO: after blunt or penetrating chest injury
- Iatrogenic PNO: as consequence of medical procedure
- Catamenial PNO: during menstruation



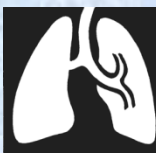
Primary spontaneous PNO

- In asthenic individuals in the second and third decade of life
- 5x more frequently occurs in men, often recurs
- The risk increases with smoking (22x in men, 9x in women)
- On the basis of apical bullae and "blebs" (subpleural air spaces)
- Rupture occurs at changes in barometric pressure (diving, traveling by plane), as well as when sneezing and coughing or there is no apparent cause



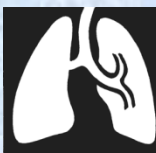
Secondary spontaneous PNO

- As a complications of underlying lung disease
- Maximum incidence in the fifth, sixth and seventh decade of life
- Chronic lung diseases: COPD, AB, IPF, sarcoidosis, LAM, PLCH, CF, ...
- Acute pulmonary diseases: cavitary necrotising pneumonias (staphylococcus, klebsiella) and pneumocystis pneumonias in AIDS patients
- Extrapulmonary disease: eg. esophageal cancer



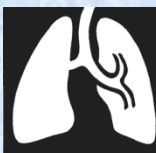
Traumatic PNO

- In chest injuries
- External PNO: communication through the chest wall (penetrating trauma: stabbing and gunshot wounds)
- Internal PNO: communication with the alveolar space (blunt trauma: car accidents, falls, injuries by the blast wave or lightning)
- At the same time may be present: hemothorax, rib fractures, contusions or lacerations of the lung and rupture of trachea and large bronchi



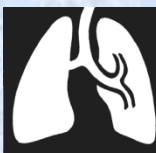
Iatrogenic PNO

- Thoracocentesis (for fluidothorax)
- Transparietal biopsy of lung or pleura
- Transbronchial (cryo-)biopsy of lung
- Cannulation of superior caval vein
- Curative PNO for TB
- Barotrauma during mechanical ventilation
- Injury after indirect heart massage (CPR)
- Injections against upper back pain
- Acupuncture (points LU 1 and BL 13)



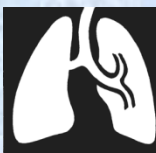
Catamenial PNO

- Recurrent PNO during the onset of menstruation
- Up to 30% of primary spontaneous PNO in women, usually in the third and fourth decade of life
- The causes are not clear
- Sometimes is present endometriosis (ectopic occurrence of uterine mucosa in lungs or in pleural cavity)
- Sometimes accompanied with catamenial hemoptysis or catamenial hemothorax



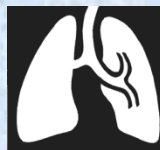
PIE, pneumomediastinum and subcutaneous emphysema

- Pulmonary interstitial emphysema (PIE): rupture of alveoli into the pulmonary interstitium, spreading of air along bronchi and vessels to the lung hilum
- Pneumomediastinum: the presence of air in the mediastinum, in case of PIE or as consequence of diseases of the esophagus; PNO occurs in the event of rupture mediastinal pleura, spreading of air to the upper thoracic outlet is also possible
- Subcutaneous emphysema: the presence of air in soft tissues of chest wall, neck and head, as a consequence of pneumomediastinum or dysfunction of chest tube



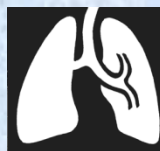
Symptoms of PNO

- May be asymptomatic
- Usually stinging pain, cough, breathlessness, collapse in case of circulatory failure
- Physical examination: hyperresonant percussion, weakened or inaudible vesicular breathing
- Confirmation on chest X-ray (beware of skinfolds in bedridden patients)
- Can be also evaluated using artifacts analysis on chest ultrasound
- Sometimes is required chest CT for confirmation (eg. in large bullae in COPD)



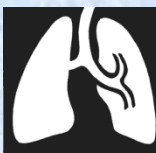
Treatment of PNO

- Open PNO: covering the wound
- Tension PNO: urgent puncture
- Small PNO: observation, oxygen
- Significant PNO: needle aspiration or chest tube (water seal or active suctioning)
- Recurrent PNO: thoracoscopy, solving of possible lung defect, pleural abrasion
- VTS intolerable cases: autohaemopleurodesis



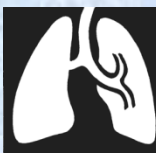
PNO: practical notes

- Insert chest tube in every PNO in patients on mechanical ventilation (risk of tension PNO !)
- Never clamp chest tube without supervision, eg. for transport (risk of tension PNO !)
- In case of unsuccessful attempt on one side, never insert central venous catheter in superior caval vein on contralateral side without previous chest X-ray (risk of bilateral PNO !)
- In case of atelectasis, never insert central venous catheter in superior caval vein on contralateral side (risk of PNO !)



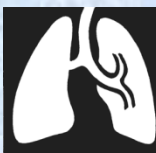
Haemoptysis

- It's a **symptom** of an underlying disease !
- Haemoptysis: coughing up blood
- Haemoptoe: spitting up blood
- Epistaxis: bleeding from nose
- Haematemesis: vomiting blood
- Differentiate: bleeding from upper airways or upper parts of digestive system
- May be problematic: vomiting of swallowed blood for airways vs. coughing up aspirated blood from upper airways or digestive system



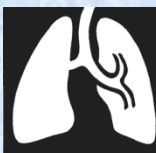
Quantification of haemoptysis

- The amount of blood is usually overestimated
- Blood streaking in sputum: small amount of blood in sputum
- Common way of quantification: number of coffee or soup spoons in certain period
- Massive haemoptysis: life-threatening, various criteria (> 500 mL/day or > 200 mL daily for several consecutive days)
- Risk of suffocation (not exsanguination) !



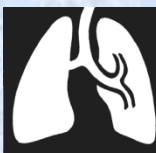
Sources of haemoptysis

- Bronchial arteries: 75-90% of cases
- Systemic non-bronchial arteries: 5-20%
- Branches of pulmonary artery: only 5%
- Large BE: up to 7% of cardiac output !



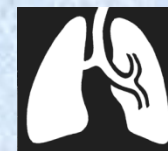
Causes of haemoptysis

| | |
|---------------------|---|
| Common (≥5%) | Lung cancer 25%, cryptogenic 20%, BE 18%, bronchitis 13%, pneumonia 5%, TB 5% |
| Rare (1-4 %) | Other tumors, mycetoma, lung abscess, pulmonary embolism, lung mycobacteriosis, left heart failure, chest injuries, iatrogenic (bronchoscopy, biopsy, right heart catheterization, insertion of chest tube) |
| Very rare (<1 %) | Mycoses and parasitoses, foreign body, amyloidosis, sarcoidosis, A-V malformation, LAM, mitral valve stenosis, endometriosis, bronchovascular fistula, DAH, lung sequestration, drug toxicities |



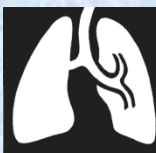
DAH: diffuse alveolar haemorrhage

- Around 70% of cases have haemoptysis
- Alveolar involvement with hypoxemic RI
- Vasculitis and immunopathologic conditions (Wegener's granulomatosis, Goodpasture syndrome, MPA, SLE...)
- Other causes: ARDS, cocaine abuse, post irradiation lesion, uremia, thrombocytopenia, coagulopathy, congestive heart failure, bone marrow transplantation ...
- BAL: last portion is most hemorrhagic



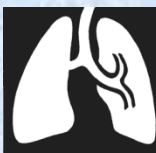
Massive haemoptysis

- 5% of cases of haemoptysis; 20% mortality
- Lung cancer
- BE
- TB
- Mycetoma
- Lung abscess
- A-V malformation
- Bronchovascular fistula



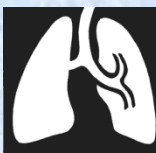
Haemoptysis in lung cancer

- The first symptom in 7-10% of cases of lung cancer
- In 20-30% of lung cancer patients in the course of disease
- 3 % of cases of lung cancer died on terminal massive haemoptysis (involvement of large vessels in mediastinum)



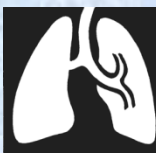
Haemoptysis in TB

- TB was most frequent cause of haemoptysis in the past
- Posttuberculous BE and TB caverna are the causes of heamoptysis
- Up to 5% of patients with TB caverna have Rasmussen's aneurysm (dilated branch of pulmonary artery in caverna) with risk of massive (terminal) haemoptysis



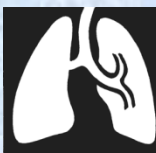
Approach to patient

- ? source of bleeding (? upper airways, ? digestive system)
- Blood count, coagulation, ANCA, chest X-ray:
? blood losses, ? coagulopathy, ? vasculitis,
? localization of side of bleeding
- Chest CT (AG) : localization of side of bleeding, cavitation, BE, (pulmonary embolism)
- Bronchoscopy, bronchial arteriography: diagnostic and therapeutic procedures



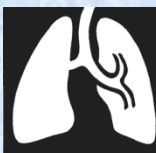
Treatment of haemoptysis

- Bedrest, position on the affected side, ice packs
- Treatment of the underlying disease
- Correction of coagulopathy, antifibrinolytics
- Correction hypertension
- Vasopressin and its analogues
- Antitussives, sedatives
- Immunosuppression or plasmapheresis in vasculitis



Treatment of massive haemoptysis

- Urgent chest CT, (\pm bronchoscopy), bronchial arteriography with therapeutic embolization
- Frequently is required intubation (selective intubation of non-bleeding lung)
- Bronchoscopic intervention: lavage with iced saline, administration of epinephrine or vasopressin, laser, balloon tamponade (Fogarty catheter)
- Surgeon: ligation of bronchial arteries in lung hilum, resection of bleeding site (usually lobectomy)



Therapeutic embolisation

