Pathology of the respiratory tract, part I
<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Pathological basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum</td>
<td></td>
</tr>
<tr>
<td>• clear or mucoid</td>
<td>Excess secretion from bronchial mucous glands in, for example, asthma and chronic bronchitis</td>
</tr>
<tr>
<td>• purulent</td>
<td>Inflammatory exudate from respiratory tract infection</td>
</tr>
<tr>
<td>• with blood</td>
<td>Extravasation of red cells due to cardiac failure, pulmonary infarction or ulceration of respiratory mucosa (e.g. by tumour)</td>
</tr>
<tr>
<td>Cough</td>
<td>Physiological reflex response to presence of mucus, exudate, tumour or foreign material</td>
</tr>
<tr>
<td>Wheezing</td>
<td></td>
</tr>
<tr>
<td>• on inspiration</td>
<td>Narrowing of larynx, trachea or proximal bronchi (e.g. by tumour)</td>
</tr>
<tr>
<td>• on expiration</td>
<td>Distal bronchial narrowing (e.g. asthma)</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>Decreased oxygen in the blood from impaired alveolar gas exchange, left heart failure or anaemia</td>
</tr>
<tr>
<td>Cyanosis</td>
<td>Increased non-oxygenated haemoglobin, e.g. circulatory bypassing of lungs in congenital heart diseases or impaired alveolar gas exchange</td>
</tr>
<tr>
<td>Pleuritic pain</td>
<td>Iritation of the pleura due to pulmonary inflammation, infarction or tumour</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td></td>
</tr>
<tr>
<td>• transudate</td>
<td>Cardiac failure</td>
</tr>
<tr>
<td>(low protein)</td>
<td>Hypoalbuminaemia (e.g. cirrhosis, nephrotic syndrome)</td>
</tr>
<tr>
<td>• exudate</td>
<td>Pleural inflammation</td>
</tr>
<tr>
<td>(high protein)</td>
<td>Tumour</td>
</tr>
<tr>
<td>Clubbing</td>
<td>Often accompanies carcinoma of lung and pulmonary fibrosis, as well as, less commonly, cirrhosis and chronic inflammatory bowel disease</td>
</tr>
<tr>
<td>Weight loss</td>
<td>Protein catabolic state induced by chronic inflammatory disease (e.g. tuberculosis) or tumours</td>
</tr>
<tr>
<td>Auscultation signs</td>
<td></td>
</tr>
<tr>
<td>• crackles</td>
<td>Sudden inspirational opening of small airways resisted by fluid or fibrosis</td>
</tr>
<tr>
<td>• wheezes</td>
<td>Generalised or localised airway narrowing</td>
</tr>
<tr>
<td>• pleural rub</td>
<td>Pleural surface roughened by exudate</td>
</tr>
<tr>
<td>Percussion signs</td>
<td></td>
</tr>
<tr>
<td>• dullness</td>
<td>Solidification of lung by exudate (pneumonia) or fibrosis</td>
</tr>
<tr>
<td>• hyper-resonance</td>
<td>Pleural effusion</td>
</tr>
<tr>
<td></td>
<td>Increased gas content of thorax due to pneumothorax or emphysema</td>
</tr>
<tr>
<td>Aetiological factor</td>
<td>Disease</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Genetic</td>
<td>Cystic fibrosis</td>
</tr>
<tr>
<td></td>
<td>$\alpha_1$-Antitrypsin deficiency</td>
</tr>
<tr>
<td></td>
<td>Some asthma</td>
</tr>
<tr>
<td>Environmental</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Lung cancer</td>
</tr>
<tr>
<td></td>
<td>Chronic bronchitis and emphysema</td>
</tr>
<tr>
<td></td>
<td>Susceptibility to infection</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Chronic bronchitis</td>
</tr>
<tr>
<td></td>
<td>Susceptibility to infection</td>
</tr>
<tr>
<td>Occupation</td>
<td>Pneumoconiosis</td>
</tr>
<tr>
<td></td>
<td>Asbestosis, mesothelioma and lung cancer</td>
</tr>
<tr>
<td>Infection</td>
<td>Influenza</td>
</tr>
<tr>
<td></td>
<td>Measles</td>
</tr>
<tr>
<td></td>
<td>Bacterial pneumonias</td>
</tr>
<tr>
<td></td>
<td>Tuberculosis</td>
</tr>
</tbody>
</table>
Nasal cavity, paranasal sinuses, nasopharynx

Inflammation

1. acute rhinitis (common cold, running nose), sinusitis, rhinosinusitis, nazopharyngitis (rhinoviruses, adenoviruses, para-influenza viruses, coronaviruses, coxackieviruses, Haemophilus influenzae)

2. allergic rhinitis = hay fever (type I and III hypersensitivity reaction)

3. chronic rhinosinusitis (recurrent infections, allergy, cystic fibrosis, septal deviation, trauma, Kartagener’s syndrome, immunosuppression, alveolitis
   forms: atrophic
   hypertrophic (nasal polyps)
   sinusitis – swollen mucosa may block drainage orifice → abscess → osteomyelitis, meningitis, cerebral abscess
Nasal cavity, paranasal sinuses, nasopharynx

4. **Wegener granulomatosis** (autoimmune vasculitis cANCA+) – ulcerations

5. **Specific inflammations** (TBC, syphilis, rhinoscleroma)

6. **Mykoses** – a) **non-invasive** (immunocompetent persons)
   - allergy, mycetoma
   - Aspergillus, Bipolaris, Alternaria, Curvularia
   b) **invasive** (immunocompromised persons)
   - necroses, bleeding, neurologic defect
   - Mukormycosis
Nasal cavity, paranasal sinuses,
Nasal polyp
Nasal polyp
Rhinoscleroma

(Klebsiella rhinoscleromatis)
Nasal cavity, paranasal sinuses, nasopharynx

Non – tumorous lesions
Paranasal mucocele
Respiratory epithelial adenomatoid hamartoma
Nasal cavity, paranasal sinuses, nasopharynx

Tumors

Benign epithelial

1. **papilloma** (Schneiderian)
   a) exophytic form
   (50% HPV - 6,11, in 25% recurrence, minimal risk of carcinoma)
   b) inverted form (in 10% risk of squamous cell carcinoma)

2. **adenoma**
Nasal cavity, paranasal sinuses, nasopharynx

Tumors

Benign mezenchymal and a neuroectodermal

• Juvenile angiofibroma (males, 10-20 yrs)
• Hemangioma
• Myxoma
• Leiomyoma
• Schwannoma, meningioma
Angiofibroma

- Locally aggressive tumor in the back of the nasal cavity. It most commonly affects adolescent males.
- Symptomology:
  - Frequent chronic epistaxis
  - Nasal obstruction and rhinorrhea
  - Conductive hearing loss from eustachian-tube obstruction
  - Diplopia, which occurs secondary to erosion into the cranial cavity and pressure on the optic chiasma
  - Rarely anosmia, recurrent otitis media, and eye pain
Nasal cavity, paranasal sinuses, nasopharynx

Malignant tumors

1) Carcinomas – squamous cell
   – adenocarcinoma
   – nasopharyngeal carcinoma =
     (malignant lymphoepithelioma, EBV infection)

2) Others
   Olfaktoric neuroblastoma
   Malignant melanoma, lymphomas
Larynx

- epiglottis
- vestibule of the larynx
- hyoid bone
- thyroid cart.
- vocal ligament
- cricoid cart.
- vaginal fold
- thyroarytenoid muscle
- infraglottic space
- trachea

Superior View
- Transverse and oblique arytenoid muscle
- Cricoid cartilage
- Vocal process of Arytenoid cartilage
- Vocalis muscle
- Thyroid cartilage
- Thyroarytenoid muscle
- Vocal ligament
Angioneurotic oedema (Quincke’s oedema, acute non-infectious)
a) Hereditary (mutations C1 inhibitor protein)
b) Non-hereditary (allergy, similar to urticaria)
!Medical emergency, as airway obstruction and suffocation!
Larynx

Reinke‘s oedema

- polypoid degeneration (swelling) of the vocal folds due to fluid collection, bilateral
- low-pitched voice, dysphonia
- smoking, hormonal changes such as hypothyroidism, chronic voice abuse, allergy
- more frequent in females
Larynx

Inflammations

- **Epiglottitis:**
  life threatening, especially kids, Haemophilus influenzas type B.
  Epiglottis becomes inflamed → airway obstruction → inspiratory stridor a cyanosis

- **Acute laryngitis:** mostly viral etiology (para-influenza, influenza)

- Allergic laryngitis

- **Chronic laryngitis** (atrophic, hypertrophic , often leukoplakia)

- **Ulceroflegmonous laryngotracheitis**

- **Pseudomembranous laryngotracheitis** (diphteria, influenza, scarlet fever)

  separation of pseudomembranes → laryngeal obstruction, ulceration, scars, deformities
Epiglottitis
Pseudomembranous tracheolaryngitis
Pseudotumors and benign laryngeal tumors

- **laryngeal (singer’s) nodes**: usually solitary polypoid lesion on vocal cords, fibrous stroma covered by squamous epithelium

- **laryngeal cysts**: usually incidental findings

- **squamous cell papilloma (juvenile, adult)**: often HPV etiology, may be multiple- papillomatosis, rarely malignant transformation
node

papilloma
Laryngeal cyst
Larynx

**Malignant tumors**

**Mostly epithelial**

- **Precurzor lesions (SIN – squamous intraepithelial neoplasia)**
  - smoking, alcohol, HPV, nutrition deficiency of vitamins, asbestos workers

- **Squamous cell carcinoma**
  - males over 40 yrs

4 types according topographic localisation and prognosis
Laryngeal carcinoma

1) **glottic ca (50%)**: most frequent, limited to one or both vocal cords, late metastases to lymph nodes, good prognosis, radiotherapy or voice saving surgery is usually curative

2) **transglottic ca**: true and false cords, more aggressive, metastases, total laryngectomy

3) **supraglottic ca (30-40%)**: in the ventricle, false vocal cords and epiglottis, not true cords, metastasis are more common than in glotic tu, voice saving surgery is often possible

4) **infraglottic ca (5%)**: bellow true cords, common meta, total laryngectomy
Histological types
• Squamous cell ca
• Verrucous (large, locally destructive, good prognosis)
• Basaloid ca
• Adenosquamous ca

Less frequent tumors: adenocarcinomas of minor salivary gland type, sarcomas, melanoma
Trachea

Congenital anomalies

- *Tracheoesophageal fistula*: rare, possibility of aspiration
- *Tracheoesophageal fistula with oesophageal atresia*: more common and serious

Others

- *trauma* (iatrogenic-tracheostomy, strictures)
- *compression* (goiter)
- *foreign bodies* (large pieces of food – Miami Beach syndrome)
- *tumors*: very rare, muco-epidermoid carcinomas, adenoid-cystic carcinomas
Bronchi

Congenital anomalies
• *bronchial atresia*: rare, upper lobe

Inflammations
Acute bronchitis mostly as a complications of upper resp. pathway
Cough, dyspnea, tachypnoea, sputum
Usually viral
Forms: catarrhal, suppurative, pseudomembranous
Aetiology: *Viruses: adenoviruses*, *influenza v.*, *RSV* (respiratory syncytial virus):
    *morbilli* – bronchial obliteration and bronchiectasis
• *Bacterias: Hemophilus influenzae, H. pertuisis, Streptococcus pneumonie*
• *Fungi: Aspergillus, Candida* (*imunosupression*)

Bronchiolitis
often with bronchopneumonia, usualy viral (influenza, adenoviruses, RSV, adenoviruses)
Brochiolitis obliterans – viruses, toxic fumes (DAD), aspiration, pulmonary fibrosis
Acute bronchitis usually results from an infection such as a cold or flu.
COPD - Chronic obstructive pulmonary disease

- Chronic bronchitis
- Emphysema
- Bronchiectasis
- (Mukoviscidosis)

Hypoxaemia, hypercapnia and cyanosis (Blue bloaters) X pink puffers (hyperventilation, relatively normal gas profile)
Cor pulmonale
Chronic bronchitis

Productive cough (with sputum) for 3 month in 2 consecutive years
Aetiology: smoking, air pollution (urban dwellers X rural dwellers), dusty occupations, age, sinusitis,
Features: mucus hypersecretion with bronchial mucous gland hypertrophy
Complications: Bronchiectasis, emphysema (centrilobular), squamous cell metaplasia
Chronic bronchitis
Chronic bronchitis

With chronic bronchitis, the lining may stay inflamed and the cilia may not function.
Emphysema

Enlargement of alveolar airspaces with destruction of elastin in walls
imbalance between elastin synthesis and catabolism

Aetiology: Smoking
  - Chronic bronchitis
  - alfa1 antitrypsin deficiency
  - Scarring, fibrosis

Types: Centrilobular (smoking
  - Panlobular (alfa1 antitrypsin deficiency)
  - Localised (paraseptal, advanced pleura – scarring, fibrosis)
  - Irregular (scarring)
  - Bullous (over 10 mm) – spontaneous pneumothorax
  - Interstitial (traumatic rupture)
  - Senile (aging lungs)

Clinical features: dyspnoe, cough, tachypnoe, barrel chest, overventilation, weight loss
Interstitial emphysema
Bullous emphysema
Bronchiectasis

- Results from bronchial obstruction with distal infection and scarring or severe infection alone
- Chronic suppurative infection
- Secondary inflammatory changes lead to further destruction of airways
- **Complications** – pneumonia, lung abscess, empyema, septicaemis, metastatic abscess, mycetoma, AA amyloidosis, cor pulmonale

**Aetiology:**
- **Congenital** (Kartagener’s sy, mucoviscidosis)
- **Acquired** (morbilli, pertussis)

Saccular
Varicose
Cylindrical
Bronchiectasis
Bronchiectasis
Atelectasis

— the collapse or closure of alveoli resulting in reduced or absent gas exchange. It may affect part or all of one lung.

Atelectasis:
• newborns (immature, lack of surfactant)
• bronchial obstruction (foreign body, secretion, lymph node, tumor – middle lobe syndrome)
• compression (hydrothorax, pneumothorax, ascites)