Division of respiratory system

- Upper respiratory tract:
  - external nose
  - nasal cavity & paranasal sinuses
  - pharynx
- Lower respiratory tract:
  - larynx
  - trachea (windpipe)
  - bronchi (down to respiratory bronchioli)
  - lungs
- Significance: ENT vs. pneumology
  URTI vs. pneumonia
Nasal passages and paranasal sinuses
Nasal cavity and paranasal sinuses

- Common colds are common
- Spatial relationships (syntopies) are important for spread of infection
- Complications: meningitis, teeth, orbit, mediootitis, mastoiditis, sinusitis…
Nasal cavity and paranasal sinuses

• Why do we have them (other than to keep ENT doctors in business)
• Maxillary, frontal, sphenoidal, ethmoidal
• Surface projections, visible and X-ray examination - sinusitis
Surface projection of pasanasal sinuses
Frontal CT
Postnatal growth of paranasal sinuses (pneumatization)
Histology of airways

Taken from and see more in: Junquiera’s Histology!
The Pharynx - crossing of breathing and swallowing pathways
Laryngeal cartilages

Thyroid cartilage – left + right lamina, superior + inferior notch, superior + inferior horn, oblique line, cricoid articular surface

Cricoid cartilage - arch, lamina, arytenoid + cricoid articular surface

Arytenoid cartilage - base, apex, muscular + vocal process, cricoid articular surface,

Epiglottis, Cuneiform + Corniculate + Triticeal cartilages
The Larynx - muscles

Anterior  posterior  lateral
The Larynx - development
The Larynx - sagittal view
The Larynx - vocal cord movements

anterior

posterior
The Larynx - frontal view
The Larynx - examination (laryngoscopy)

indirect
direct
The Trachea - cross section
Histology of the Trachea

- Epithelium (cylindrical with cilia and goblet cells)
- Connective tissue
- Glands in lamina propria
- Hyaline cartilage covered by perichondrium
- Smooth (trachealis) muscle
The trachea and segmental bronchi

Starts at C6
Bifurcation at Th4-5
Length: 13 cm
Diameter: 2.5 cm
Coniotomy and tracheotomy
Coniotomy and tracheotomy

- **Coniotomy**
- **Superior tracheotomy**
- **Inferior tracheotomy**
Syntopy of the cervical part of trachea
Blood supply

- Nasal cavity - ethmoidal and sphenopalatine artery
- Larynx - superior and inferior laryngeal artery
- Trachea - branches from thyroid arteries or thoracic aorta
Innervation

• Nasal cavity - I, V1, V2; parasympathetic fibers from VII
• Larynx - superior and recurrent laryngeal nerve (from X)
• Trachea - X, cervical sympathetics
Lymphatic drainage
The Lungs & Pleura - projections
Borders of Lungs & Pleura
Borders of Lungs & Pleura
The Lungs & Pleura - projections
Pleural recesses

- Costodiphragmatic recess - accumulation of fluids
- recessus phrenicomediatinalis
- recessus costomediastinalis
The Pleural Cavity
Pneumothorax

- Penetration of the pleural cavity equalizes pressure
- This results in the collapse of the affected lung
- Could be classified as open, closed, or tension
- Treatment is by drainage that facilitates air resorption
Pneumothorax - X-ray
The lungs
The lungs
Syntopies of the trachea and main bronchi
The bronchopulmonary segments
Histology of the Bronchi

- Epithelium (cylindrical with cilia and goblet cells)
- Connective tissue
- Glands in lamina propria
- Hyaline cartilage (discontinuous)
- Smooth muscle
Histology of the Bronchi
Bronchography
Blood supply & innervation

- Pulmonary artery and branches - functional
- *Rr. bronchiales* from thoracic aorta or intercostal arteries - nutritive
- Pulmonary vein, anastomoses
- Parasympathetic: left and right vagus
- Sympathetic: inferior and middle cervical ganglia, rami from the first four thoracic ganglia; almost no pain (only parietal pleura via intercostal nerves)
Lymphatic drainage
Right Lung

Superior lobe:  (1) apical, (2) posterior, (3) anterior

Middle lobe:  (4) lateral, (5) medial

Inferior lobe:  (6) superior (apical), (7) medial basal, (8) anterior basal, (9) lateral basal, (10) posterior basal
**Left Lung**

Superior lobe:  (1) apical, (2) posterior, (3) anterior, (4) superior lingular, (5) inferior lingular

Inferior lobe:  (6) superior (apical), (7) medial basal, (8) anterior basal, (9) lateral basal, (10) posterior basal
The Bronchioli

- No cartilage, just smooth muscle => bronchocostriction in asthma!
The Lung Lobes - projections
Terminal bronchioli and Clara cells

a

b
Histology of lung tissue - respiratory bronchioli, alveolar ducts, alveoli
Branching ~23 bifurcations, 300-400 mil alveoli
surface area: 40-80 sq. m., air-blood barrier 0.2-0.5 µm
Alveolar wall: Capillaries, type I & II alveolar cells, macrophages
The muscles of respiration

Diaphragma (C3-C5)
Intercostal mm. - bucket handle action
Accessory respiratory muscles
Mechanism of breathing

- Piston & syringe
Respiratory movements of the diaphragm
Abdominal press

• Simultaneous contraction of diaphragm and abdominal muscles

• Increased abdominal pressure useful during miction, defecation, parturition

• If the pelvic diaphragm is contracted as well, supports the lumbar spine (muscular corset)
Pleural cavity
Parietal pleura
Costal part
Mediastinal part
Diaphragmatic part
Pleural cupula (dome)
Pleural recesses:
costodiaphragmatic
costomediastinal
phrenicomediastinal
Pulmonary lig.
bronchopericardial
membrane
Mediastinum
Superior, Inferior –
anteerior, middle,
posterior
The Pleura
Lined by mesothelium (M) secreting pleural fluid (WHY this is NOT an epithelium?)
The connective tissue is rich in both collagen and elastic fibers and contains both blood vessels (V) and lymphatics (L).
Mediastinum  interpleural space)
superius, inferius – anterius, medium, posterius
Mediastinum

Space in thorax between the left and right pleural cavities, filled by vessels, organs, fatty tissue

Borders:
- cranial – apertura thoracis superior
- caudal – diaphragm
- ventral – sternum and ribs
- dorsal – vertebral column
Posterior mediastinum

- esophagus
- n. vagus dexter et sinister (plexus oesophageus)
- Aortic arch (end)
- aorta thoracica
- ductus thoracicus
- v. azygos
- v hemiazygos et hemiazygos accessoria
- truncus sympathetic dexter et sinister
- Lymph nodes
Anterior mediastinum

Anterior superior mediastinum
- thymus
- Venous layer – vv. brachiocephalicae, v. cava sup., plexus thyroideus impar
- Arterial layer – aortic arch and its branches
- Trachea, bronchi, recurrent laryngeal nerve

Anterior inferior (middle) mediastinum
- Heart in pericardium
- n. phrenicus
What is that?
The thymus

- Lympho-epithelial organ
- Primary lymphatic organ
- Left and right lobe
- Lobules, cortex & medulla
- (accessory lobules)
- Fibrous capsule
- Proportionally large at birth (12-14g)
- With ageing undergoes involution and replacement by fatty tissue
- Residues still discernible at the old age (watch out during dissections when opening the chest cavity!)
Located in the superior mediastinum behind the sternum 30-40 g

- Involution after puberty
- Replaced by fat after 50 years
- Possible site of thymoma (cancer from white blood cells)
Development of the thymus
Development of thymus

- ventral process of the 3rd branchial pouch
- mediocaudal descensus
- endodermal proliferation
- stem cell colonization in the 10th week /lymphocytes derived from blood island, liver, bone marrow
- ingrowth of the mesenchymal septa (fibrous tissue)
Residual thymus tissue after standard thymectomy, based upon 50 clinico-anatomical studies.
THORACIC AORTA
SUPERIOR VENA CAVA

• Formed by the confluence of the brachiocephalic veins
• tributaries:
  – v. thyroidea inf.
  – v. vertebralis
  - v. intercostalis suprema, intercosalis sup. sin.
• v. azygos
• v. thoracica interna
• Visceral branches of the mediastinal organs
Cranial tributaries of the superior vena cava
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