Respiratory System

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Functions

• Ventilation
• Exchange of gases

• Two major zones
  - Conduction zone
  - Respiratory zone
Nasal cavity
Hard palate
Nostril
Pharynx
Larynx
Choana
Soft palate
Epiglottis
Glottis
Esophagus
Left lung
Left primary bronchus
Secondary bronchus
Tertiary bronchus
Trachea
Right lung
Pleural cavity
Two zones

- Conducting zone
  - Fxt: get air in and out of the lungs
    - Nose
    - Pharynx
    - Trachea
    - Larynx
    - Bronchi
    - Bronchioles

- Respiratory zone
  - Fxt: exchange of gases
    - Respiratory bronchioles
    - Alveoli
Conducting zone

Number of branches
(1)
(2)
Bronchial tree

Trachea
Primary bronchus

Respiratory zone

Terminal bronchiole

Respiratory bronchioles (500,000)

Alveolar sacs (8 million)

Terminal bronchioles

Alveolus
The Conducting Zone

- nose and nasal passages
  - bordered exteriorly with external nares
  - Bilateral cavities lined with mucus membranes
  - contain olfactory epithelium
  - warm and moisten incoming air
  - sense of smell
Nose and nasal passages

- **Concha**
  - 3 sets of bones
  - increase the surface area of the nasal cavities

- **Septum and bridge**
  - composed of hyaline cartilage

- **Choanae**
  - internal nares
  - posterior passages to nasopharynx
Deviated septum

- Most septa not perfectly straight
- Degree of deviation determines effect
- Could cause breathing difficulties, speech difficulties, and contribute to snoring and sleep apnea
- Treatment: surgical correction
Nose and palate

- External nares
- Nasal cavity
- Nasal septum
- Olfactory receptors
- Nasal conchae
- Paranasal sinuses
- Separation from oral cavity
  - Hard palate
  - Soft palate
Cleft palate

- Congenital deformity
  - Unknown cause
  - 1/1000 live births: most common congenital abnormality

- Effects:
  - Speech production
  - Dentition
  - Feeding
  - Facial development

- Surgical correction
Cleft palate

Lack of medial fusion of bones forming palate.
Pharynx

- **Nasopharynx**
  - posterior to nasal cavities
- **Oropharynx**
  - posterior to oral cavity
- **Laryngopharynx**
  - posterior/superior to the larynx
Paranasal sinuses

• large cavities that equalize air pressure between the head and atmosphere

• 4 sets
  - Frontal
  - Maxillary
  - Ethmoidal
  - Sphenoidal
larynx

- voice box
- superior most aspect of the trachea
- supported by several cartilages
  - thyroid
  - cricoid
  - arytenoid and corniculate (move during speech)
Larynx

- Epiglottis
  - elastic cartilage that closes when you swallow
- Glottis
  - opening between vocal cords
- vocal folds (vocal cords)
  - cords of fibrous CT
  - vibrate during speech
- vestibular folds (false vocal cords)
- laryngeal muscles involved in speech and swallowing
trachea

• windpipe
• C-ring cartilage
  - hyaline cartilage rings
  - 16-20
  - Prevents collapse of tube
• trachealis muscle
  - Smooth muscle support for C-rings
  - Closes the circle of C ring by forming bridge
  - Helps adjust air flow to lungs
(a) Transverse section of the trachea in relation to the esophagus
tracheostomy
Bronchial tree

- 1° bronchi
  - 1st branches off trachea
- 2° bronchi
  - 1 per lobe of lung
- 3° bronchi
  - branch off secondary bronchioles
- Terminal
- respiratory bronchioles
- eventually give rise to alveolar ducts
Gradual changes in the bronchial tree

- decrease in diameter
- decrease in hyaline cartilage support
- decrease in smooth muscle
- a gradual thinning of epithelium
- in larger bronchioles
  - hyaline cartilage in plates
  - smooth muscle still present
- Airways closed during inflammation of mucous membranes, as in asthma
  - sometimes aggravated by “bronchiolespasm”
Fig. 8.12. Lung lobes and the bronchial tree (crude schematic, redrawn from Guyton).
The Respiratory Zone

- pleura: protective membranes surrounding lungs, in elastic tension against thoracic wall
- lungs:
  - lobes:
  - Rt. has 3
  - Lt. has 2 and has a notch to leave room for the heart
Alveoli

- number: ~300,000,000
- size (individual) ~ 60-100 microns diameter
- surface area (collective)=1500 square feet
- type I alveolar cells
  - simple squamous epithelium
- type II alveolar cells
  - septal cells
  - secrete surfactant
Asthma

• Difficulty breathing due to narrowing of the passageways from nose to lungs
• Many causes
• Rx includes:
  - Bronchodilators
  - Steroidal anti-inflammatories
  - Leukotriene inhibitors
Cystic fibrosis

- Genetic disorder effecting lungs and digestive tract
- Overproduction of mucus impairs breathing by clogging lungs and digestion by obstructing entry of pancreatic enzymes into the small intestines
- Life expectancy = 30-40yo