Cheatography

Respiratory System NPB 101 Cheat Sheet

by lydiap34 via cheatography.com/213368/cs/46429/

general anatomy

pharynx	common passage for lungs and stomach
larynx	voice box at entry of trachea
trachea	tube for air to go into the lungs
bronchi	division of trachea into two main branches
bronch-ioles	small branches of respiratory airway
alveoli	small, thin-walled sacs where gas exchange takes place
conducting zone	top of trachea to respiratory bronchioles
respiratory zone	where gas exchange occurs
pleural sacs	pair of thin, fluid filled membranes that enclose the lungs
pleural cavity	space between pair of membranes
pleurae	two flattened, closed sacs with pleural fluid- form serosa

Respiratory Mechanics

Pressure Gradient

air moves from high to low pressure; respir-atory pressure relative to atmospheric

Inspiration

diaphragm and external intercostal muscles contract- increase dimensions of thoracic cavity

Passive Expiration

inspiratory muscles relax- ribs, sternum, diaphragm return to resting position

Active Expiration

abdominal and internal intercostal muscles contract- reduce size of thoracic cavity

Determinants of Lung Compliance

Respiratory Mechanics (cont)

stretchability of lung tissue (elastin) and alveolar surface tension

Surfactant

reduces cohesive forces on alveolar surface- lowers surface tension- secreted by type II alveolar cells

Opposing Forces Acting on Lung

Forces Keeping Alveoli Open

transmural pressure gradient

pulmonary surfactant- opposes alveolar surface tension

Forces Promoting Alveolar Collapse

elasticity of stretched elastin fibers in connective tissue

alveolar surface tension

4 Important Factors for Ventilation

1. Atmospheric

2. Intra-Alveolar

lower during respiration bc thoracic wall expands

boyle's law- at constant temp the pressure of a gas varies inversely with its volume

3. Intrapleural Pressure

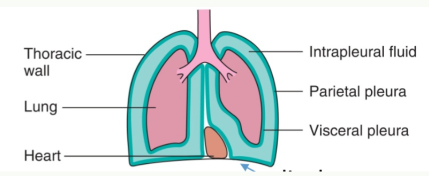
chest wall pulls out, lungs pull in, small vacuum forms causing negative pressure inside pleural cavity

always less than intra-alveolar

4. Transmural Pressure Gradient

pushes out on lungs, stretching them to fill larger thoracic cavity

Anatomy



Gas Exchange

exchange of O_2 and CO_2 between external environment and tissues

gas movement by passive diffusion (high to low pressure)

exchange across pulmonary and systemic capillaries

partial pressure of water vapor in lungs -> alveolar PO_2 < atmospheric PO_2

Factors That Influence Rate of Gas Exchange

partial pressure gradients of O_2 & CO_2	direct relationship
	major determinant of rate
surface area of alveolar-cap-illary membrane	direct relationship
	constant under resting conditions
	increase during exercise; decrease with pathological conditions
thickness of alveolar-cap-illary membrane	inverse relationship
	usually constant; increase with pathol-ogical conditions
diffusion constant	direct relationship
	CO_2 20x greater than O_2

Gas Transport

process of O_2 & CO_2 transportation between systemic tissues and lungs

Two Forms of O_2 Transport

dissolved in blood (1.5%) & chemically bound to hemoglobin (98.5%)

Hemoglobin

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Gas Transport (cont)

soluble cytoplasmic protein in erythrocytes- reversibly binds 4 molecules of O2

Oxygen Storage

hemoglobin stores O2 without affecting partial pressure gradient

Hemoglobin Saturation

proportional to PO2 of blood; follows S-shaped "oxygen hemoglobin dissociation curve"

Partial Pressures and Functions

Partial Pressure Gradients

from difference in partial pressures between two areas; gas moves from area of high partial pressure to low

Partial Pressures of CO2 and O2 are Different

higher solubility of CO2 compensates for smaller gradient; allows for approx equal exchange rates of O2 and CO2

Alveolar PO2 < Atmospheric PO2

due to partial pressure of water vapor in the lungs, and mixing of inspired air with residual alveolar air

Systemic PCO2 Higher in the Tissues

due to production of CO2 during oxidative metabolism

Respiratory Conditions

Pneumothorax

condition occurring when air is allowed to enter plural cavity

transmural pressure gradient is lost

lungs collapse, thoracic wall expands

Newborn Respiratory Distress Syndrome (RDS)

condition occurring when lungs are not fully developed and lack surfactant

affects premature infants, typically born before 32 weeks

Pleurisy

Respiratory Conditions (cont)

infection or inflammation of pleura- often from pneumonia

Ventilation

pulmonary

volume of air breathed in/out per min

alveolar

volume of air exchanged between atmosphere and alveoli per min

Lung Volume

Spirometer

device for measuring the volume of air breathed in and out

Tidal Volume

volume of air inhaled and exhaled during a single normal breath

Residual Volume

The volume of air that remains in the lungs and airways even after a maximal exhalation

Total Lung Capacity

maximum volume of air that the lungs can hold

Anatomical Dead Space

volume of air not involved in gas exchange- approx 150 ml in healthy adults

Factors Affecting Hemoglobin

Promote Unloading of O2 from Hemoglobin at Tissues

a. low: partial pressure of O2

b. high: partial pressure of CO2

c. low: pH

d. high: temperature

Promote Uploading of O2 From Hemoglobin at Lungs

a. high: partial pressure of O2

b. low: partial pressure of CO2

c. high: pH

d. low: temperature

Carbon Dioxide Transport

Dissolved in Blood (10%)

Chemically Bound to Hemoglobin (30%)

haldane effect- increased carrying capacity of CO2 on hemoglobin when hemoglobin gives up oxygen

-tissue- reduced Hb has greater affinity for CO2, facilitates transport of CO2 out of tissue

-lungs- promotes CO2 unloading, facilitates release of CO2 from blood into alveoli

Bicarbonate HCO3 (60%)

CO2 converted into HCO3 within red blood cells by carbonic anhydrase

Control of Respiration

Neural Control	Effects of hypoventilation and hyperventilation
Respiratory Centers	located in pons & medulla
	establish rhythmic firing pattern to drive motor neurons in spinal cord to stimulate skeletal inspiratory muscles
Central Chemoreceptors	located near respiratory centers in medulla
	respond to change in arterial PCO2 by increasing activity and ventilation rate