Respiratory System

A. Functions

1.

2.

3.

4.

5.

B. Anatomy of the Respiratory System

1. Nose/Nasal Cavity

A) Functions

1)

2)

3) Warm and moisten incoming air

4)

5) Location of

B) Has external and internal components

C) External components

1)

2)

3)

4)

D) Internal components

1) – divided into 2 sections by the nasal septum

a) Roof is composed of

b) Floor is composed of the

c) Each side is further divided into sections by the

i) These cause air to swirl causing particles to become trapped in mucus

2) – openings between the nasal cavity and pharynx

2. Pharynx – throat

A) Composed of 3 regions

1)

a)

b) Normally serves as a passageway for

c) Blocked by

2)

a) Lies posterior to oral cavity – from soft palate to tip of the upright epiglottis

b) Passageway for both

3)

a) Lies posterior to the upright epiglottis and extends to esophagus/trachea

b) Passageway for both

3. – voice box

A) Extends from

B) Main functions

1)

2) Acts as a switching mechanism to route food and air down correct paths

3) Location of the – speech

4) Initiation of the reflex – caused when something other than air enters

the trachea

C) Composed of nine pieces of cartilage

1) Largest piece is the – causes protrusion = laryngeal

prominence (Adam’s apple)

2) – blocks trachea during swallowing

3) 3 paired cartilages –

4) Cricoid cartilage is the inferior-most piece

D) – opening between the vocal folds within the larynx

4. – windpipe

A) Extends from

B) Is ciliated and produces mucus to help trap particles in inspired air

C) – rings of cartilage that provide strength and

support

5. The Respiratory Tree –

A)

1) Initial branches of the trachea

B)

C)

D) Continues branching (up to 23 times)

E) – 1mm diameter

1) Continue to branch and get smaller

F) – < 0.5m

6. The Respiratory Zone –

A) (contain alveoli)

B) Alveolar sacs –

C)

1) Actual site of

2) About 300 million per lung

3) Coated in

a)

b) Reduces surface tension of the water in the alveoli and prevents the alveoli

from collapsing upon themselves

C. Respiration – Breathing, Exchange, Transport

1. Inspiration (Inhalation)

A) Result of a pressure difference between:

1)

2)

B) – the pressure exerted by a gas varies inversely to its volume

C) Mechanism

1)

2. Expiration (Exhalation)

A) Normal/restful (tidal) expiration

B) Exercise or forced expiration

1)

3. Gas exchange (O2 & CO2)

A) Dictated by – the total pressure exerted by a mixture

of gases is the sum of the pressures exerted independently by each gas in the mixture

1)

B) A partial pressure difference is necessary at all locations where gases are

exchanged

1)

2)

C) pO2 is **lowest** in the and increases as you move **up** the respiration pathway

D) pCO2 is **highest** in the and decreases as you move **up** the respiration pathway

E) Rate of gas exchange is affected by:

1)

2)

3)

4)

4. Transport of Gases

A) O2 transport

1) 2 main forms

a) – 1.5%

b) (Hb) – 98.5%

i) Hb + O2 = HbO2 (oxyhemoglobin)

2) The RBC’s affinity for O2 is affected by:

a) – decreased pH causes decreased affinity

b) – increased pCO2 causes decreased affinity

c) – increased temp causes decreased affinity

B) CO2 transport – 3 basic forms

1) – 7%

2) – 23%

a) Hb + CO2 = HbCO2 (carbaminohemoglobin)

3) – 70%

a) Forms in

i) HCO3- leaves the RBC

ii) – Cl- moves into RBC

iii) H+ binds with hemoglobin

b) Process reverses in the lungs

i) HCO3- enters the RBC

ii) H+ breaks from hemoglobin and binds with HCO3-

iii) Reverse chloride shift – Cl- moves out of the RBC

5. Control of Respiration

A) Respiratory Center – located within the

1) respiratory group (DRG) – dominant group

a) Stimulates the

i) Sets the tidal (restful) breathing rhythm (eupnea)

(a)

(b)

b) Integrates input from peripheral stretch and chemoreceptors

i) Stimulates the VRG when ventilation demands increase

2) respiratory group (VRG)

a) Stimulates the accessory inspiratory and expiratory muscles (

) when necessary

3)

a) Helps coordinate transition from

b) It stimulates the DRG to initiate inspiration during both restful and forceful

breathing

4)

a) Helps coordinate transition from

b) It inhibits the apneustic center to promote restful or forceful expiration as

needed

c) Along with the apneustic center, it helps modify and fine-tune breathing

during activities such as speaking, singing, sleeping, and exercising

B) The respiratory center is influenced by:

1)

2)

3)

4)

a) Detect CO2 &H+ in the blood

5)

a) Detect O2, CO2 &H+ in the blood

6. Respiratory Air Volumes

A) Respiratory Volumes

1) volume (TV) – the amount of air inhaled or exhaled with each

breath under resting conditions

2) Inspiratory reserve volume (IRV) – the amount of air that can be forcefully

inhaled after a normal tidal volume inhalation

3) Expiratory reserve volume (ERV) – the amount of air that can be forcefully

exhaled after a normal tidal volume exhalation

4) volume (RV) – amount of air remaining in the lungs after a

forced exhalation

5) volume (DSV) – amount of air in the respiratory

pathway not involved in gas exchange

B) Respiratory capacities

1) Total lung capacity (TLC) – the sum of all respiratory volumes.

2) capacity (VC) – the total amount of exchangeable air

7. Breathing Patterns

A) – normal breathing

B) – transient cessation of breathing

C) – difficult, labored, or painful breathing

1) Often indicates lung infection/injury

F) Hyperventilation

1) Can result in

G) Hypoventilation

1) Can result in

8. Respiratory Disorders

A) Sinusitis – inflamed sinuses from a nasal cavity infection

B) Laryngitis – inflammation of the vocal cords

C) Pharyngitis (strep throat) – inflammation of the pharynx; caused by *Streptococcus*

bacteria

D) Pleurisy – inflammation of the pleural membranes

E) Pneumothorax – air in the intrapleural spaces

F) Atelectasis – lung collapse

G) Carbon Monoxide Poisoning – CO binds with Hb in place of O2

H) Pneumonia – infectious inflammation of the lungs (usually bacterial but can also be

viral or fungal)

I) Emphysema – permanent enlargement of the alveoli due to destruction of the

alveolar walls

J) Chronic bronchitis – inhaled irritants lead to chronic excessive mucus production as

well as inflammation and fibrosis of the mucosa

K) Asthma – bronchoconstriction prevents airflow into the alveoli

L) Tuberculosis – an infectious disease caused by the bacterium *Mycobacterium*

*tuberculosis* resulting in fibroid masses in the lungs

M) Cystic Fibrosis – genetic disorder that causes an increase in mucus production

resulting in clogged respiratory passages

N) Infant Respiratory Distress Syndrome (IRDS) – alveoli collapse between breaths

causing labored breathing and sometimes inadequate respiration

1) Usually seen in premature infants