

Objectives Respiratory Regulation

- To discuss the case study scenario related to blood gas imbalance.
- To define and discuss pulmonary embolism.
- To identify the modes of breathing regulation.
- To describe the appropriate anatomical features and blood gas detectors associated with breathing regulation.

ER Scenariopatient from a house fire

Arterial Blood Gas Analysis (ABG) gives indications of dissolved gases in the blood.

PaO₂ = quantity of oxygen dissolved in the plasma (in the arterial system).

PaCO₂ = quantity of dissolved CO₂.

SO₂ = measure of percent oxyhemoglobin.

paO₂

Index of lung function.

When paO₂ is significantly less than alveolar pO₂ → indicates respiratory impairment.

Normal 80-100 mm Hg

Newborn 40-60 mm Hg

In Elderly 80 (-1 for every year over 60)

SO₂

Oxyhemoglobin percentage =

$$SO_2 = (\text{Oxyhemoglobin} / \text{Total hemoglobin}) * 100$$

This value is influenced by:

PH

Temperature 95-100% normal

Measurement is a comparison on the oxygen-hemoglobin dissociation curve.

What if SO₂ is low?

Low is below 95%

Indication that the hemoglobin is unable to react with oxygen.

May be due to CO poisoning

→ carboxyhemoglobin

Carbon monoxide competes with oxygen for binding sites on the hemoglobin, with an affinity 200 x's greater than affinity with oxygen.

Hyperbaric Therapy

Exposure to high pressure.

Oxygen can then dissolve into the blood (plasma specifically) to slowly displace the CO from the hemoglobin.

Other uses:

Decompression sickness -nitrogen narcosis

Pulmonary Embolism

Obstruction of the pulmonary artery.

Usually a blood clot. Happens most typically in post-op patients.

Symptoms:

- > Chest pain
 - > Bloody cough
 - > Tachycardia – faster than normal heart beat.
 - > Rapid & Shallow breathing (shortness of breath)
- 600,000 patients in the U.S. /yr
60,000 patients die

Respiratory Parameters during Pulmonary Embolism

Rapid pulse

BP – high

Tachypnea - Rapid breathing rate

pO₂ – Lower - hypoxemia

pCO₂ – Higher - hypercapnia

pH – More acidic

Regulation of Respiration

I. Medulla Respiratory Centers

Regulate rhythm

- 1) Dorsal respiratory group – Inspiratory
- 2) Ventral respiratory group –
Has neurons for both Relaxation & Inspiration.
More important in “forced” expiration.

Regulation of Respiration

II. Pons:

fine tuning breathing rhythm
prevents lung over-inflation

III. Cortical Controls:

conscious/voluntary control

IV. Hypothalamus:

emotions & rapid temp changes

Chemical Factors

Changes in blood chemistry.

I. Central chemoreceptors – ventrolateral medulla. Responds to CO₂ levels

II. Peripheral chemoreceptors – greater vessels in the neck. Respond to both increased pCO₂ and low pO₂ and pH.

- Aortic bodies
- Carotid bodies

For Lab next time

Answer sheets for pages 23-29.

Worksheet set with 16 blanks.

Bring data sets related to Spirometry (which we will discuss in further detail).