ACID-BASE IMBALANCE DISTURBANCES (CASE STUDIES I)

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Advanced Clinical Biochemistry I

Fall Semester

Week Five

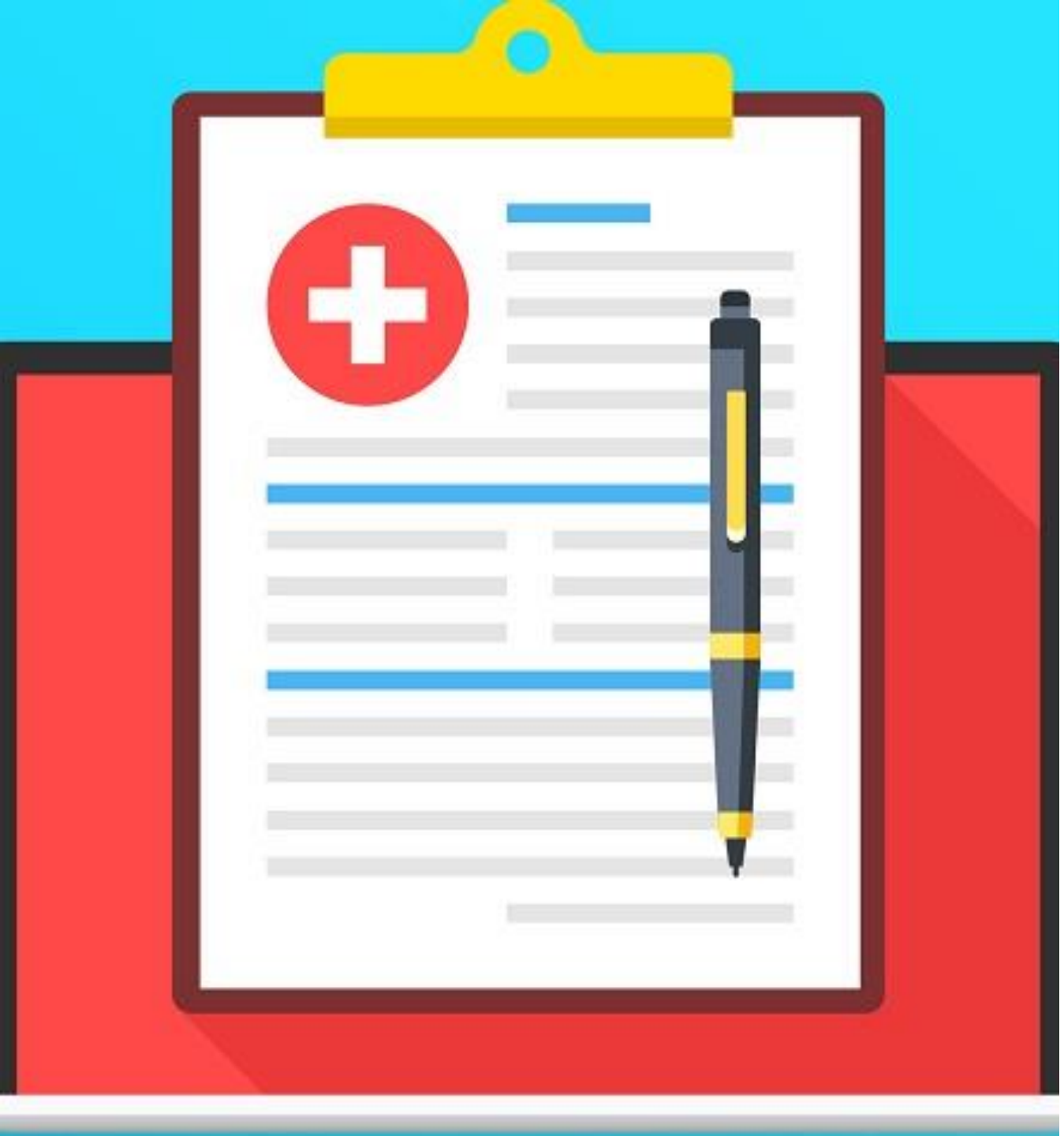
29/10/2024

Objectives

- At the end of this lab session, **students should understand:**
- What clinical case studies are all about.
- The importance and benefits of clinical case studies.
- How to use critical thinking to provide sustainable solutions to the complex case

Introduction

- Case studies have a rich history in medicine as an educational tool for clinical personnel.
- They nurture deep learning by building upon prior knowledge gained from personal experience and education to achieve optimal patient outcomes.
- Case studies capitalize upon prior knowledge through application and strengthen clinical skills.
- Simplified or made complicated, they can either reinforce or challenge the basics to expand learning.
- Case studies are appropriate for Emergency Medical Service (EMS) education because of their subject matter.
- Common complaints or fatal conditions if misdiagnosed—and frequently feature unusual presentations of a disease as a result.



Benefits of case studies

- Case studies promote critical thinking.
- Case studies depict realistic clinical scenarios.
- Case studies increase student participation and enjoyment of learning.
- Case studies are ideal for sharing new information.
- Case studies may improve clinical outcomes

Case one

- A 45-year-old female suffering from bronchial asthma was brought to an emergency in a critical state with extreme difficulty in breathing.
- The blood gas analysis revealed the following
- pH = 7.3, NR: (7.35 – 7.45)
- pCO_2 = 46 mm Hg, NR: (34 - 44 mm Hg)
- pO_2 = 55 mm Hg NR: (85 - 105 mm Hg)
- HCO_3^- = 24 meq/L, NR: (22 – 26)
- **What is your interpretation?.**

Normal Range

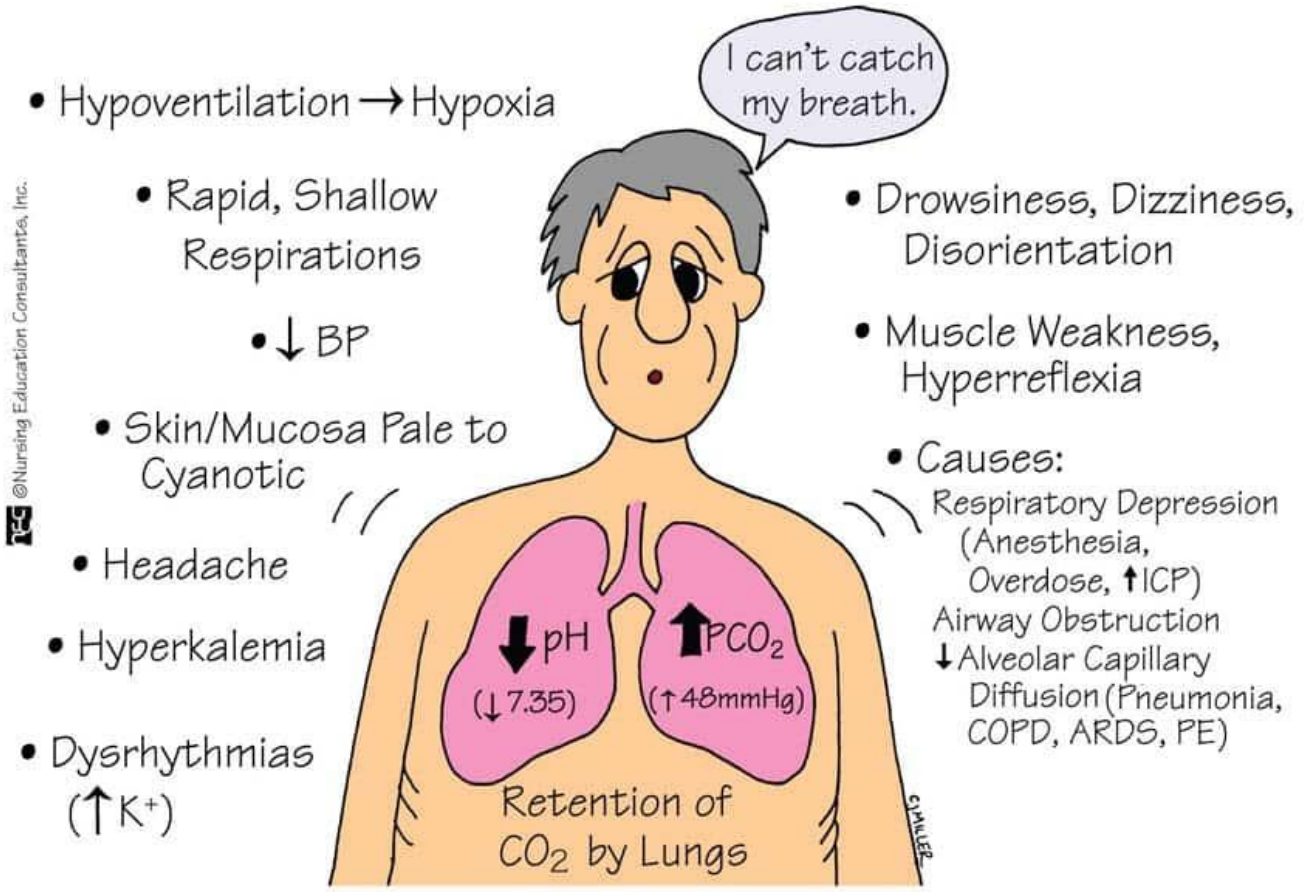
- pH = 7.35 – 7.45
- pCO_2 = 34 - 44 mm Hg
- pO_2 = 85 - 105 mm Hg
- HCO_3^- = 22 – 26 meq/L

Four Acid-Base Disorders:

Respiratory

Metabolic

↑ CO_2	Acidosis
↓ CO_2	Alkalosis
↑ HCO_3^-	Alkalosis
↓ HCO_3^-	Acidosis



Case Discussion

- Low pH – acidosis.
- Low pO_2 and high pCO_2 signify a primary respiratory problem.
- HCO_3^- = 24 (normal)
- **Thus, the patient is suffering from acute respiratory acidosis.**

Case Two

- A 4-day old girl neonate became lethargy and uninterested in breastfeeding. Physical examination revealed tachypnea (rapid breathing) with normal heartbeat and breath sounds. Initial blood chemistry values include normal glucose, sodium, potassium, chloride and bicarbonate levels.

- Blood gas values revealed a pH of 7.53, pO_2 was normal (103 mm Hg) but pCO_2 was 27 mmHg.

- **What is the probable diagnosis?**

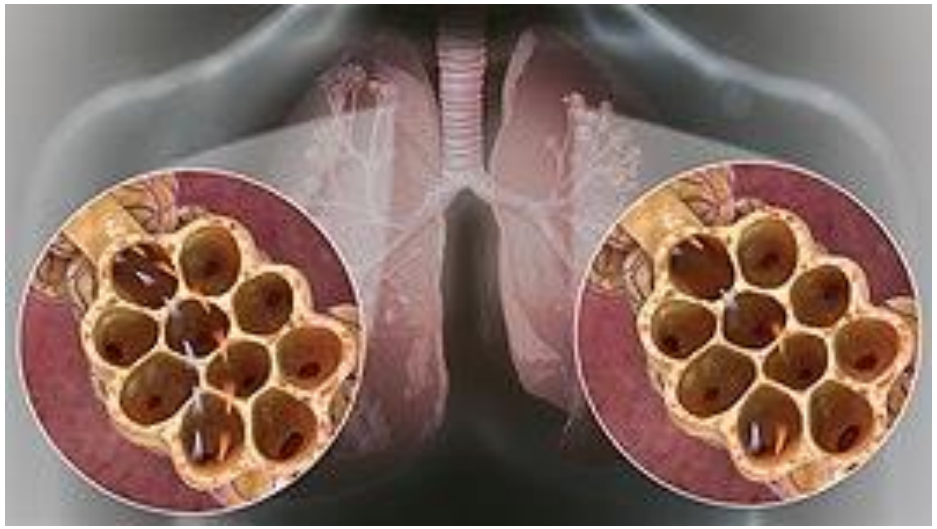
Case Discussion

- **The baby is suffering from respiratory alkalosis.**

- Tachypnea in terms of infants may be due to brain injuries and metabolic diseases that irritate the respiratory center. The increased respiratory rate moves CO2 from lung alveoli and lowers blood CO2, forcing a shift in the indicated equilibrium towards the left.

- **$CO_2 + H_2O$ <--------> H_2CO_3 <----------> $H^+ + HCO_3^-$**

- The leftward shift to replenish exhaled CO2 decreases the [H+] and increases the pH to produce alkalosis. This respiratory alkalosis is best treated by diminishing the respiratory rate to elevate the blood [CO2], force the above equilibrium to the right, elevate the [H+], and decrease the pH.



Case Three

- A new-born with tachypnea and cyanosis (bluish color) is found to have a blood pH of 7.1. Serum bicarbonate is measured as 12 mM while pCO_2 is 40 mm Hg.

- **What is the probable diagnosis?**

Case Discussion

- **Low pH and low bicarbonate indicate metabolic acidosis.**
- Since pCO_2 is normal it cannot be compensatory respiratory acidosis (if the baby had respiratory acidosis, the pCO_2 would have been elevated).
- **This is a hypoxia-related metabolic acidosis.** Hyperventilation is as compensation to metabolic acidosis.
- This condition can be treated by the administration of oxygen to improve tissue perfusion and decrease metabolic acidosis.


Comments/
Questions