Acid - Base III

Acid Base Abnormalities

K pp. 116-131
C pp 48-52
B pp 290-292

Objectives

Upon completion of this lecture, the learner should be able to:

- Discuss various clinical examples of uncompensated and compensated Respiratory Acidosis and Alkalosis, and Metabolic Acidosis and Alkalosis.
- Explain typical blood gas abnormalities that are associated with the above abnormalities.
- Discuss precautions in using $NaHCO_3$ routinely in management of most acid - base disorders

Respiratory Acidosis

$H^+ + HCO_3^- \simeq H_2CO_3 \simeq H_2O + CO_2$

Acidosis

- $pCO_2 > 45$
- hypoxia (usually, but not always)
- may be life threatening

Clinical Presentation

Signs: distress (increased WOB)
depression
O_2 sat. may be misleading

Respiratory Acidosis

Causes

- Acute (pCO_2 > 40 ; HCO_3: normal)
  - pneumonia
  - asthma
  - spontaneous pneumothorax
  - drug overdose
  - CNS disease
  - trauma ; including chest wall pain
  - flash pulmonary edema

Respiratory Acidosis

Causes

- Chronic (pCO_2 > 40 ; HCO_3 : high)
  - COPD
  - CHF
  - other chronic lung disease
    - TB
    - pleural disease

Respiratory Alkalosis

$H^+ + HCO_3^- \simeq H_2CO_3 \simeq H_2O + CO_2$

Alkalosis

- pCO_2 < 35

Clinical Presentation

Sx. anxious; dizziness; paresthesias
chest wall pain; carpal-pedal spasm

Signs: distress (increased WOB)

Respiratory Alkalosis

Causes

- Acute (pCO_2 < 40 ; HCO_3: normal)
  - hypoxia
    - P Em.
    - asthma
  - fever
  - sympathomimetic - drugs

Respiratory Alkalosis

Causes

- Chronic (pCO_2 < 40 ; HCO_3: low)
  - progesterone ; pregnancy
  - chronic aspirin toxicity
  - sympathomimetic - hyperthyroidism

Metabolic Alkalosis

$H^+ + HCO_3^- \simeq H_2CO_3 \simeq H_2O + CO_2$

Metabolic acid - base status

- reflected by : HCO_3^- level
- normal HCO_3^- : 24 - 28 [25]
  - HCO_3^- > 28 ; Metabolic Alkalosis

Acute uncompensated (minutes)

- pCO_2 : 40

Compensation is ineffective

- pCO_2 : cannot increase much above 40 without causing hypoxia

Metabolic Alkalosis

Causes
- Non-acute (pCO_2 ~ 40 ; HCO_3: high)
  - – Excessive diuresis / hypokalemia
  - – Excessive NG suction (of HCl)

Treatment
- NS rehydration
- IV KCl (20 mEq/1000 mL NS / hr)

Metabolic Acidosis

.

$H^+ + HCO_3^- \simeq H_2CO_3 \simeq H_2O + CO_2$

Metabolic acid - base status
- reflected by : HCO_3^- level
- normal HCO_3^- : 24 - 28 [25]
  - HCO_3^- < 24 : Metabolic Acidosis

Acute uncompensated (minutes)
- pCO_2 : 40

Compensating
- pCO_2 : < 40

Metabolic Acidosis

Clinical Features
- Sx.: N, V, abd. pain, ALOC
- Signs:
  - increased HR, T°
  - acute and uncompensated (minutes)
    +/- increase in RR
  - compensating
    increase in RR (Kussmaul)
  - shock signs

Metabolic Acidosis

Causes (high anion gap - C. p. 51)

A MUDPILES

- **A** lcohol
- **M** ethanol
- **U** remia (acute + chronic renal failure)
- **D** KA
- **P** oisonings (TCA, cyanide)
- **I** ron and INH (anti-TB isoniazide)
- **L** actic acidosis
- **E** thylene glycol
- **S** alicylates and starvation

Metabolic Acidosis Treatment

$CO_2M_3E\ BI_{NS}G$

Specific Tx.:

- Toxicology
- Sepsis
- DKA

Consider $NaHCO_3$ (controversial) 1 mEq / kg IV

- DKA: pH < 7.1 and HCO3 < 8 [and $pCO_2 < 20$]
- Assure adequate ventilation

Metabolic Acidosis Treatment

$NaHCO_3$ precautions / reasons not to use routinely

- No improved survival
- No improved defibrillation
- Paradoxical intracellular acidosis

  $H^+ + HCO_3^- \simeq H_2CO_3 \simeq H_2O + CO_2$
- Hypernatremia
- Hyperosmolality
- Metabolic alkalosis

Metabolic Acidosis Treatment

Reasons not to use $NaHCO_3$ routinely (cont.)

- Causes metabolic alkalosis
  - Difficult to reverse
    - without compromising A/B (O_2)
  - Inactivates catecholamines
  - Shifts O_2 dissociation curve
    - harder to off-load O_2 from Hb into tissues
  - Hypokalemia
    - arrhythmias

Summary

We have discussed :

- Clinical examples of and treatments of various uncompensated and compensated
  respiratory acidosis and alkalosis,
  and metabolic acidosis and alkalosis.
- Typical blood gas abnormalities that are associated with the above abnormalities.
- Precautions in using $NaHCO_3$ routinely in management of most acid - base disorders