

Acid-base abnormalities

(March 2022)

Rationale

Abnormally high or low hydrogen ion concentration—acidemia and alkalemia, respectively—is encountered relatively frequently, particularly in hospital-based practice. Acidemia may be caused by an underlying life-threatening condition. Several acid-base abnormalities can coexist in a single patient.

Causal Conditions

(list not exhaustive)

- Metabolic acidosis
 - a. High anion gap
 - Increased acid production
 - a. Exogenous (e.g., methanol)
 - b. Endogenous (e.g., ketoacidosis)
 - Decreased renal acid excretion (e.g., kidney injury)
 - b. Normal anion gap
 - Gastrointestinal bicarbonate loss (e.g., diarrhea)
 - Renal bicarbonate loss (e.g., renal tubular acidosis, interstitial nephritis)
- Metabolic alkalosis
 - a. Expanded effective arterial blood volume (e.g., mineralocorticoid excess)
 - b. Contracted effective arterial blood volume

- Gastrointestinal loss (e.g., vomiting)
- Renal loss (e.g., diuretics)
- c. Exogenous ingestion
- Respiratory acidosis
 - a. Neuromuscular causes (e.g., medications, illicit drugs, neuromuscular disease)
 - b. Pulmonary causes of decreased alveolar ventilation (e.g., severe asthma exacerbation with impending respiratory failure)
 - c. Kyphoscoliosis
 - d. Hypoventilation (e.g., due to obesity)
- Respiratory alkalosis
 - a. Hypoxemia with tachypnea
 - b. Metabolic (e.g., hepatic failure)
 - c. Cardiopulmonary disorders (e.g., pneumonia, embolism)
 - d. Central nervous system disorders (e.g., subarachnoid hemorrhage)
 - e. Drugs (e.g., salicylate)
 - f. Miscellaneous (e.g., fever, pain, pregnancy)

Key Objectives

Given a patient with an acid-base abnormality, the candidate will diagnose the cause, severity, and complications and will initiate an appropriate management plan, particularly when dealing with a high anion gap metabolic acidosis.

Enabling Objectives

Given a patient with an acid-base abnormality, the candidate will

- through efficient and focused data gathering, diagnose the cause of acidemia or alkalemia expeditiously;
- list and interpret critical clinical and laboratory findings that are key in the processes of exclusion, differentiation, and diagnosis, including those derived from

- a. an accurate arterial blood gas (ABG) analysis; and
 - b. complementary investigations for acidemia or alkalemia aimed at identifying the primary abnormality and the adequacy of the associated secondary compensation; and
- construct an effective initial management plan for acidemia or alkalemia, including
 - a. describing general supportive measures;
 - b. describing management for specific acid-base disorders; and
 - c. determining whether the patient needs to be referred for consultation.