

Updated Review of Serum Anion Gap

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Abstract

The serum Anion Gap calculator evaluates states of metabolic acidosis, and distinguishes between anion gap metabolic acidosis states and non-anion gap metabolic acidosis.

I. HOW TO USE

When to Use

Use to determine if a patient's metabolic acidosis also has an elevated anion gap.

Pearls / Pitfalls

The value for a "normal" anion gap assumes that the unmeasured proteins that have charges (e.g. immunoglobulins with positive charges and albumin with a negative charge) and contribute to this gap are also within reference ranges.

Patients with lower levels of albumin or elevated immunoglobulins may have a lower anion gap at baseline which may obscure the recognition of an increased anion gap in the setting of acidosis.

Why Use

Acidosis with increased anion gaps has a distinct differential diagnosis as compared with non-gap acidosis.

II. NEXT STEPS

Advice

In cases of hypoalbuminemia or hyperalbuminemia, the corrected anion gap result may be more accurate.

If no albumin is entered, or if albumin is within the normal range, no correction is necessary.

Anion Gap Metabolic Acidosis: MUDPILERS

- Methanol
- Uremia
- Diabetic ketoacidosis/alcoholic ketoacidosis
- Paraldehyde
- Isoniazid
- Lactic acidosis
- Ethanol/ethylene glycol
- Rhabdomyolysis/renal failure
- Salicylates

Non-Anion Gap Acidosis: HARDUPS

- Hyperalimentation
- Acetazolamide
- Renal tubular acidosis
- Diarrhea
- Uretero-pelvic shunt
- Post-hypocapnia
- Spironolactone

Acute Respiratory Acidosis (Chronic Respiratory Acidosis due to chronic obstructive pulmonary disease, restrictive lung disease, or any hypoventilation state.

- CNS depression (drugs/CVA)
- Airway obstruction
- Pneumonia
- Pulmonary edema
- Hemo/pneumothorax
- Myopathy

Metabolic Alkalosis: CLEVER PD

- Contraction
- Licorice
- Endocrine causes (Conn's, Cushing's, or Bartter's syndromes)
- Vomiting
- Excess alkali
- Refeeding alkalosis
- Post-hypercapnia
- Diuretics

Respiratory Alkalosis: CHAMPS (think speed up breathing)

- CNS (central nervous system) disease
- Hypoxia
- Anxiety
- Mechanical ventilators
- Progesterone
- Salicylates/sepsis

Management

Management of an anion gap acidosis is directed at reversing the underlying cause and varies based on etiology.

III. EVIDENCE

Formula

Key formula include:

- Anion Gap = $\text{Na} - (\text{Cl} + \text{HCO}_3^-)$ or Anion gap, mEq/L = sodium, mEq/L - (chloride, mEq/L + bicarbonate, mEq/L)
- Delta Gap = the patient's Anion Gap - the "normal" anion gap (considered to be 10 to 12)
- Albumin corrected anion gap, mEq/L = anion gap + $[2.5 \times (4 - \text{albumin, g/dL})]$
- Albumin corrected delta gap, mEq/L = albumin corrected anion gap - "normal" anion gap (considered to be 10 to 12)

e. Delta ratio = delta anion gap / (24 - bicarbonate, mEq/L)

f. Albumin corrected delta ratio = albumin corrected delta gap / (24 - bicarbonate, mEq/L)

Facts & Figures

Interpretation

The delta ratio is the ratio of the amount of additional anion in a body over the amount of additional H⁺. The volume of distribution of the anion and its excretion affects this ratio. Organic acids that have a greater distribution may have lower anion gaps as compared to inorganic acids where the volume of distribution may be restricted to the extracellular compartment.

Delta ratio	Suggests...
< 0.4:	Pure normal anion gap acidosis
0.4–0.8:	Mixed high and normal anion gap acidosis
0.8–2.0	Pure high anion gap acidosis
> 2.0	High anion gap acidosis with pre-existing metabolic alkalosis

Literature

Original/Primary

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Validation

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