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Clinical Decision Tool Reviews

Sodium Correction for Hyperglycemia

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Abstract

In patients with hyperglycemia, serum sodium levels often appear deceptively low due to osmotic water shifts from the intracellular to extracellular compartment, causing dilutional or pseudohyponatremia. To distinguish true hyponatremia from pseudohyponatremia, clinicians apply a correction formula for serum sodium that accounts for elevated glucose levels. Traditionally, the correction factor has been 1.6 mEq/L to 2.4 mEq/L sodium increase for every 100 mg/dL rise in serum glucose. Clinicians should act on the corrected sodium level, not the unadjusted measurement, when guiding management decisions. Initial workup should also include serum osmolality to rule out an osmolality gap that may contribute to pseudohyponatremia.

Monitoring of sodium levels is essential during treatment, as levels can shift rapidly with fluid replacement and glucose control. In cases of extreme hyperglycemia, corrected sodium levels may unmask true hyponatremia, which is associated with poorer clinical outcomes and may inform prognosis. Therefore, frequent laboratory reassessment is recommended, with the interval depending on the severity of the electrolyte and glucose abnormalities. Current literature continues to support the use of sodium correction formulas, and some studies have linked the degree of corrected hyponatremia with patient mortality, underscoring its clinical relevance in managing hyperglycemic patients.

HOW TO USE

When to Use

Use in patients with elevated serum glucose who are also found to have a low serum sodium level on lab work.[1]

Pearls and Pitfalls

The classic correction factor of 1.6 mEq/L in serum sodium for every 100 mg/dL increase in serum glucose was challenged by a paper by Hillier et al. in 1999; suggesting using 2.4 mEq/L factor instead.[2]

Repeat sodium levels regularly, as sodium will shift with ongoing fluid replacement.On initial laboratory tests, check osmolality to ensure there is no osmolality gap, as this can lead to false hyponatremia (pseudohyponatremia).[3]

In extremely hyperglycemic patients, the corrected hyponatremia may reveal true hyponatremia, which can lead to worse outcomes. Therefore, ensure regular lab monitoring during fluid replacement and glucose control.

The formula assumes a uniform osmotic response across all patients, which may not be the case in certain conditions (e.g., extreme hyperglycemia, critical illness). Alternative correction factors or direct plasma osmolality assessments may provide better accuracy in some cases.

Why to Use

Some experts use the severity of corrected hyponatremia as a predictor of clinical outcome.[4] Hyperglycemia causes osmotic shifts of water from the intracellular to the extracellular space, causing a relative dilutional hyponatremia.

NEXT STEP

Advise

Act on the corrected sodium level, not the measured sodium level. Treat the underlying cause of hyperglycemia. Regularly obtain repeat lab work (frequency will depend on clinical condition and severity of abnormalities) to monitor changes.

EVIDENCE

Evidence Appraisal

Validity: The physiological basis is clear and well understood, hyperglycemia causes osmotic shifts that dilute serum sodium, and the formula has a solid theoretical foundation. However, the original derivation studies were limited, and more recent evidence suggests variability in the actual correction factor (with some studies supporting values up to 2.4 mEq/L per 100 mg/dL glucose instead of the original 1.6 mEq/L per 100 mg/dl glucose).

Reliability: Although the formula is widely cited and used, external validation has shown that the appropriate correction factor can vary depending on population (e.g., ICU patients, different severities of hyperglycemia), and there is inconsistency across studies.

Applicability: The formula is simple, quick, and helpful in distinguishing true hyponatremia from pseudohyponatremia in hyperglycemic states and is often applied in clinical practice.

Limitations and sources of error: The formula assumes a uniform osmotic response across all patients, which may not hold in certain conditions (e.g., extreme hyperglycemia, critical illness), and alternative correction factors or direct plasma osmolality assessments may provide better accuracy in some cases.

Formula

Corrected Sodium (Katz, 1973) = Measured sodium + 0.016 * (Serum glucose - 100)

Corrected Sodium (Hillier, 1999) = Measured sodium + 0.024 * (Serum glucose - 100)

Note: Serum glucose must be in mg/dL for these formulae to work.

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