ToxTidbits

Maryland Poison Center
UNIVERSITY OF MARYLAND SCHOOL OF PHARMACY

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The Maryland Poison Center's Monthly Update: News, Advances, Information

Osmol Gap and Poison Exposures

Osmol gap can be a useful laboratory value to help evaluate a possible toxic exposure; but only if calculated and interpreted correctly. Osmotic activity refers to the concentration gradient of solutes across a membrane. In the body, those solutes are electrolytes, proteins, sugars, and lipids. A normal human serum osmolality ranges from 275 to 295 mOsm/kg, but it varies between individuals and among laboratories. Exogenous substances in the blood, such as toxic alcohols and glycols, and certain conditions like chronic kidney disease, can add osmoles, resulting in higher osmolality.

An osmol gap may reveal additional osmoles due to a toxic exposure. To calculate the gap, osmoles must be determined two different ways. Osmolality is determined using an osmometer that yields a measured value. Additionally, osmolarity is calculated based upon the primary solutes that make up the expected osmolarity of the blood - sodium, glucose, and urea. In patients who have consumed ethanol, blood ethanol level is included as an expected osmol in the calculation. The osmol gap is the difference between the measured and calculated osmoles. It can normally range from -14 to +10 depending on an individual's baseline. If the measured osmolality is higher than the calculated "expected" osmolarity (i.e. a "high osmol gap"), it can indicate the presence of an extra solute, such as methanol or ethylene glycol. This is useful for determining whether a patient has a significant exposure, and can be trended to provide guidance on clinical management while waiting for methanol or ethylene glycol levels to return (usually a send-out lab).

A = Measured osmolality = All osmotically active solutes in blood

B = Calculated osmolarity = Expected osmotically active solutes in blood

$$Calculated\ Osmolarity\ \left(\frac{mOsm}{L}\right) = 2Na + \frac{Gluc}{18} + \frac{BUN}{2.8} + \frac{Ethanol}{4.6}$$

Use CHEM7 and serum ethanol; Units: Na^+ (mmol/L); Gluc, BUN, and ethanol (mg/dL)

A-B = Osmol gap: Unmeasured ("unknown") remaining solute in blood

$$Plasma\ osmolal\ gap = \left[\begin{matrix}measured\\osmolality\end{matrix}\right] - \left[\begin{matrix}calculated\\osmolarity\end{matrix}\right]$$

A and B must be from same sample

Caution should be used during osmol gap interpretation. A normal or small osmol gap cannot completely exclude a toxic alcohol (e.g. ethylene glycol, methanol) ingestion. The osmol gap decreases as the alcohols are metabolized to toxic organic acids (formate and oxalate), which increases the anion gap due to metabolic acidosis from accumulating organic acids. In addition, the calculation is dependent upon normal baseline osmolality, which varies and frequently is unknown. Significantly elevated gaps (>30) are suggestive of toxic alcohols because other disorders usually do not cause such marked elevations. However, use of osmol gap does not take the place of obtaining serum concentrations of the suspected alcohols.

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CAUSES OF ELEVATED OSMOL GAP	
Methanol	Chronic kidney disease
Ethylene glycol	Pseudohyponatremia
Isopropanol	Lactic acidosis
Ethanol	Ketoacidosis
Propylene glycol	Sick cell syndrome
Mannitol	
Sorbitol	

Did you know?

Basic metabolic panel and measured osmolality must be determined from the same blood sample.

More helpful tips:

- The calculated value reports osmolarity (given in mOsm/L), whereas the osmometer reports measured osmolality (mOsm/kg). However, they are considered equivalent at physiologic conditions.
- Osmol gap is not sensitive or specific for toxic alcohols and should be taken into context of the patient's history and chief complaint.
- Regional poison centers can assist in the interpretation of osmol gap in the context of a suspected alcohol exposure and provide guidance in clinical management.

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