

The Value of Osmolality Testing

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Abstract

Measured osmolality is a great initial screening tool when evaluating patients with metabolic acidosis, ingestions with various alcohols and alcohol-derivatives, common intoxications, and disorders of plasma sodium. It helps narrow down the differential diagnoses for these conditions in a cost- and time-effective manner. Hospitals and health systems can include measured osmolality in clinical pathways for these conditions to help reduce cost of care and improve quality of care.

Description

Some common conditions patients present with in emergency rooms, hospital wards, and ICU's are ingestions with various alcohols and alcohol-derivatives, common intoxicants, metabolic acidosis, and electrolyte disorders like hypo- and hypernatremia. The differential diagnosis for each of these conditions – namely the list of possible causative agents – can be long, and involve several dozen possibilities.

Consider metabolic acidosis, for instance; the list of possible causes (called “differential diagnosis”) can be over one hundred. It is highly expensive to test the lab analyte for each possible cause. Additionally, such a process of elimination would be time-consuming, cost-ineffective, and probably clinically unhelpful. What is needed in such situations are one or two tests that can help narrow the differential diagnosis to a manageable list – which can then be tested in a more cost-effective and time-efficient manner.

One such test is measured osmolality. This can help narrow the differential diagnoses for the following conditions:

1. Ingestions with various alcohols and alcohol-derivatives (e.g., methanol, ethanol, ethylene glycol, propylene glycol, isopropyl alcohol)
2. Common intoxicants like toluene, salicylates, ethylene glycol, propofol, isopropyl alcohol; as also iatrogenic overdosing with mannitol, sorbitol, and glycine (commonly used during surgical procedures like neurosurgery and TURP)
3. Metabolic acidosis – especially of the high anion gap variety (HAGMA for short)
4. Electrolyte disorders like hypo- and hypernatremia

The measurement of plasma osmolality helps to calculate the “Osmolal Gap”. Combining the use of the Anion Gap and the Osmolal Gap helps narrow the list of differential diagnosis for HAGMA from a hundred plus, to less than a dozen (see Figure 1). This leads to significant cost savings and a quicker and proper diagnosis, and eliminates the patient spending days in an ICU bed waiting for results of several dozen tests. From a cost-analysis point of view, just one or two patient stays in ICU can cost as much as the cost of the instrument that measures osmolality (osmometer) – approximately USD 40-50K.

Measurement of the plasma osmolality is also crucial to making the correct diagnosis in patients with Hyponatremia (see Figure 2). The possibilities are completely different -



and so is the proper treatment – depending on whether osmolality is low, normal, or high. It would be very easy to make the wrong diagnosis if the osmolality were not measured or not available, and thereby end up giving the wrong treatment to the patient. Not only would that be potentially harmful to the patient; but also very expensive, given that some of the medications now available to treat SIADH (one of the causes of hyponatremia) cost literally USD 500-1000 per day! Just one or two misdiagnosed patients can cost the hospital system as much as the price of the osmometer! *This is not counting the possible costs arising from litigation for malpractice* by misdiagnosis and improper treatment. Similar logic applies for patients with Hypernatremia.

The use of osmolality and Osmolal Gap as a screening test for certain defined conditions – like the ones enumerated above – can lead to the construction of clinical pathways – like the ones enumerated above – can lead to the construction of clinical pathways. These pathways would be akin to the workup of patients suspected of having pulmonary embolism, for instance, whereby the D-dimer and the V/Q scan help both in making the proper diagnosis, as well as guide the proper therapy. Another example would be the clinical pathway for DVT, using the D-dimer and Duplex ultrasound. The osmolality could be used similarly, incorporated into a clinical pathway or algorithm, in patients suspected to have the four broad conditions enumerated above. Quick and proper diagnosis helps decide whether the patient needs to be admitted to the hospital; if so, to which type of bed (ICU versus ward); and thereafter help decide what appropriate therapy to provide; etc. The actual construct of the pathway would likely depend on the specific site at which the testing is being done (ER, ICU, ward, clinic, etc).

It is obvious that such pathways will yield benefits in terms of bed utilization; and thereby can help reduce the cost of care and improve the quality of care. The cost savings would accrue at the level of the patient, the hospital, the hospital system, the insurer, and eventually the health care system.

HIGH Osmolal Gap (OG)

OG = Measured osm - Calculated osm

Normal OG = 10; if OG > 25, suspect presence of ingestion

Use to narrow the differential diagnosis

HIGH OSMOLAL GAP

With HAGMA

Methanol
Ethylene glycol
Ethanol
Lactic acidosis
Ketoacidosis

Without HAGMA

Isopropyl alcohol
Mannitol
Sorbitol
Glycine
Maltose

**glycine, sorbitol, mannitol
used for transurethral
resection of prostate or
bladder tumor

Figure 1: Osmolal Gap can help narrow the Differential Diagnosis of HAGMA

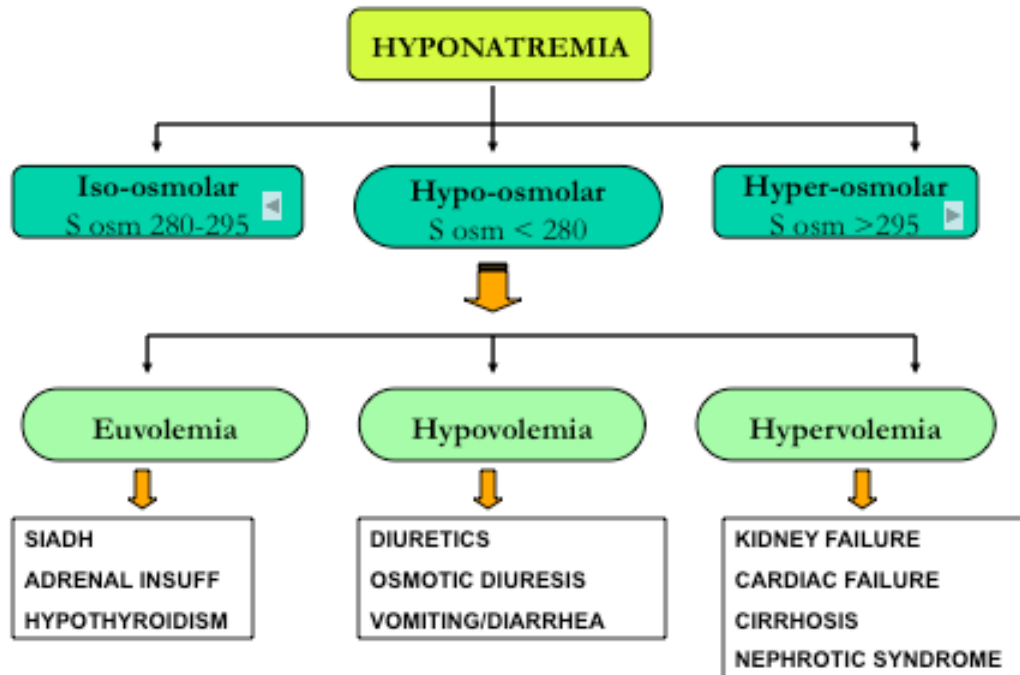


Figure 2: Differential Diagnosis of HYPONATREMIA