

Osmolality of serum and urine

Prepared by :
Mona AL-Harbi

The Osmolality test

✓ Is account of the number of particles in fluid samle (Serum , urine)

Objectives of the test:

- It is ordered to help evaluate the body's water balance
- to help investigate low sodium levels (hyponatremia),
- to detect the presence of toxins such as methanol and ethylene glycol, and to monitor osmotically active drugtherapies such as mannitol

Serum Osmolality

Objectives:

[1] primarily ordered to investigate hyponatremia.

[2] Osmotic Gap [or called osmolal gap] (OG)

Hyponatremia

***Causes:**

- may be due to sodium loss through the urine or due to increased fluid in the bloodstream
- Increased fluid may be due to drinking excessive amounts of water, water retention,

Acute Hyponatremia:

Exp. In Marathon runners drinking large quantities of water in a short period of time. In a few cases, this has led to the death of the runner.

Chronic Hyponatremia:

People who chronically drink excessive amounts of water, by choice or due to a psychological condition,

Osmotic Gap (OG)

OG = measured serum osmolality - calculated serum osmolality

Calculated serum osmolality = $2 \times [\text{Na mmole/L}] + [\text{glucose mmole/L}] + [\text{BUN mmol/L}] + [\text{ethanol mmol/L}]$



Calculated serum osmolality = $2 \times [\text{Na mmole/L}] + [\text{glucose} / 18] + [\text{BUN} / 2.8] + [\text{ethanol} / 3.8]$

{ this equation use to convert the mg/dl to mmol/L }

The normal range of OG < 10mOsm/kg

Objective:

Used as screening tool to identify toxins

There are 4 main Causes will lead to increase OG

1-Sugar [monnitol]

2-lipid

3-protein

4-alcohol[ethanol , methanol]

Urine Osmolality

Objectives:

➤ It is used to help evaluate the body's water balance and to investigate increased and decreased urine output.

{Increased urine output may be due to increased fluid intake, lack of appropriate amounts of ADH, or due to diabetes, with increased glucose levels leading to increased urine output.

Decreased urine output may be due to a variety of causes including decreased blood flow to the kidneys, an appropriate response to dehydration, or damage to tubular cells in the kidneys. }

➤ urine osmotic gap is calculated and used to help evaluate the kidney's ability to excrete acid and reabsorb bicarbonate,(kidney function)

➤ to detect the presence of osmotically active molecules,

Expected values for osmolality

- Expected serum osmolality assumes that sodium salts (chloride and bicarbonate), glucose, and urea nitrogen are the primary solutes in the serum. A difference from the expected and actual serum osmolality values is the osmolality gap. The gap reflects an expected solute composition abnormality or the addition of an unexpected solute such as alcohol,
- serum osmolality: 282 - 295 mOsm/kg water;
- Urine osmolality: can range from 50 - 1400 mOsm/kg water,, After an overnight fast, the urine osmolality should be at least 3 times the serum osmolality.
 - After 12-14 hours of restricted fluid intake, urine osmolality should be > 850mOsm/Kg

Osmometer

is a device for measuring the osotic strength of a solution, colloid, or compound.

There are several different techniques employed in osmometer.

1. **Vapor Pressure Osmometers** –determine the concentration of osmotically active particles that reduce the vapor pressure of the solution
2. **Freezing Point Osmometers** –determine the osmotic strength of solution by utilizing freezing point depression
3. **Membrane Osmometers** –measure the osmotic pressure of a solution separated by a semi-permeable membrane.

