**A Case of severe hyponatramia**

A 61 year old woman attended her GP with dizziness, feeling unwell and somewhat confused.

The biochemistry results were:

Date 06/07/16 22/12/15 25/08/15 04/08/15  
Time 15:00 11:00 12:00 11:00   
Lab ID 452616159 Units Reference 472132225 472322716 472289287  
  
Status Fasting   
Sodium 104 mmol/L (135-145) 135 131 133 Potassium 5.0 mmol/L (3.5-5.5) 5.4 4.9 4.2  
Chloride 66 mmol/L (95-110) 97 94 94  
Bicarbonate 18 mmol/L (20-32) 23 22 24   
Urea 3.9 mmol/L (3.0-8.5) 7.8 5.9 5.7  
Creatinine 61 umol/L (45-85) 75 53 55  
eGFR >90 ml/min (>59) 74 >90 >90  
Uric Acid 0.25 mmol/L (0.15-0.40) 0.27 0.20 0.29  
Calcium 2.39 mmol/L (2.15-2.55) 2.69 2.60 2.57  
Corr. Cal. 2.29 mmol/L (2.15-2.55) 2.56 2.54 2.49  
Phosphate 0.91 mmol/L (0.7-1.5) 1.28 1.34 1.45  
Bili.Total 15 umol/L (3-15) 7 6 6  
ALP 125 U/L (30-115) 110 132 138  
GGT 403 U/L (5-35) 291 139 198  
LDH 107 U/L (120-250) 124 168 159  
AST 44 U/L (10-35) 24 21 35  
ALT 45 U/L (5-30) 34 36 63  
Protein 76 g/L (63-80) 79 74 77  
Albumin 45 g/L (33-44) 46 43 44  
Globulin 31 g/L (26-41) 33 31 33  
Cholesterol 2.4 mmol/L (3.5-5.5) 4.2 3.6 3.1  
Fast. Gl. 9.2 mmol/L (3.6-5.4)   
  
Medication: thyroxine, frusemide, Coveram (ACE Inhibitor and Ca channel blocker) for hypertension.

Na result was below critical limits therefore was communicated to the doctor, who subsequently arranged the patient to be hospitalised.

Measured osmolality was 220 mOsm/L.

**Sodium Homeostasis**Na is tightly regulated by the actions of aldosterone, and by the balance of water in the body via antidiuretic hormone, and to a lesser extent by natriuretic peptides. Na is gained from dietary sources and losses are via urine and sweat. In colonic diarrhoea, Na losses may exceed intake leading to hyponatraemia. Generally in Western society, Na intake is far in excess to requirement and the concentration within the body is regulated by urinary excretion. However if intakes fall then Na is conserved by reducing urinary losses. This is achieved via aldosterone, which increases reabsorption of Na in the kidneys.

Hypertension is managed using diuretics (which increases urinary losses of Na, dragging water with it) that results in a lower volume therefore lower blood pressure. ACE inhibitors (angiotensin- converting enzyme inhibitors) are used to reduce the secretion of aldosterone, thereby reduce the Na reabsorbed in the kidneys, which also reduces the blood volume and therefore pressure.

It is likely that the combined actions of frusemide and the ACE inhibitor resulted in the hyponatraemia. There may have been other contributing factors such as fluid retention and dilution due to cardiac failure.

When investigating low Na, pre-analytical, and analytical issues should be considered. Most important in the clinical setting is the evaluation of the patient’s hydration status. Na may be low due to water retention, which excess hydration or Na may be low with normal ECF volume. In some cases Na may be low with dehydration. ECF volume is maintained by osmotically active particles, Na being the main electrolyte. Others are glucose and urea. Other exogenous substances can exert an osmotic pressure within the ECF.

Osmolality can be calculated using various formulae.

Calculated osmolarity = (1.86 x [Na+]) + glucose + urea + 9

**Calculated osmolarity = ( 2 x [Na+] ) + glucose + urea + 9**

* An **osmole** is the amount of a substance that yields, in ideal solution, that number of particles ([Avogadro’s number](http://www.anaesthesiamcq.com/FluidBook/fl2_3.php)) that would depress the freezing point of the solvent by 1.86K
* **Osmolality** of a solution is the number of osmoles of solute per kilogram of solvent.
* **Osmolarity** of a solution is the number of osmoles of solute per litre of solution.

The number 9 in the formula accounts for unmeasured osmotically active substances such as alcohol.

**IF there are exogenous osmotically active particles present such as ethanol, the formula can be modified :**

**Calculated osmolarity = ( 2 x [Na+] ) + glucose + urea + ethanol**

**The osmolar gap =** is the difference between the measured and calculated osmolalities. This gap is considered to be about 10 in healthy people. A wider gap indicates unmeasured exogenous osmolar substances.