

### Electrolytes

Electrolytes are chemicals dissolved in body fluids and are commonly measured in mEq and include: salts, acids, bases, and some proteins

A natriuretic peptide is a peptide which includes natriuresis - the secretion of sodium by the kidneys

Atrial natriuretic peptide (ANP) or atrial natriuretic factor (ANF) is a natriuretic peptide hormone secreted from the cardiac atria - the main function of ANP is causing a reduction in expanded extracellular fluid (ECF) volume by increasing renal sodium excretion

#### Electrolytes are regulated by:

Normal organ & gland function

Intake, output

Acid-base balance

Hormones

Cell integrity

### Electrolytes

#### Sodium

Major extracellular electrolyte

Controls & regulates water balance

Where sodium goes, water follows

#### Potassium

Major intracellular electrolyte

Helps maintain intracellular water balance

Transmit nerve impulses to muscles and contract skeletal and smooth muscles (e.g., cardiac)

### Sodium Imbalance - Hyponatremia

Water excess or loss of sodium

#### Causes

*Dilution*

Polydipsia

Freshwater drowning

ADH

CHF (Excess Na<sup>+</sup> loss)

*Excretion*

Sweating

Diuretics

GI wound drainage

Renal disease (Excess Na<sup>+</sup> loss)

*Intake*

Low salt diet

Severe vomiting/diarrhea (inadequate Na<sup>+</sup> intake to balance loss)

#### Signs & Symptoms

### Sodium Imbalance - Hyponatremia (cont)

*S*tupor/coma

*A*norexia, nausea & vomiting

*L*ethargy

*T*endon reflexes decreased

*L*imp muscles (weakness)

*O*rthostatic hypertension

*S*eizures/headaches

*S*tomach cramping

#### What can you do?

3% normal saline

If caused by fluid excess, will need fluid restriction

Usually can't be fixed by adding sodium to the diet

**Don't forget! Sodium must be replaced slowly!**

### Potassium Imbalance - Hypokalemia

#### Causes

Vomiting

NG suction

Diarrhea

Medications (diuretics, laxatives, insulin)

#### Signs & symptoms

Dysrhythmias

Weakness

Low BP

Weak pulse

Muscle weakness and paralysis

Diuresis

#### What can you do?

Cardiac monitor

Foods high in potassium

Potassium IV (only if good urine output)

Keep patient safe from falls



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Published 5th March, 2022.  
Last updated 5th March, 2022.  
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### Basic Metabolic Panel/Urea & Electrolytes example

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL
Comp. Metabolic Panel (14)				
Glucose, Serum			mg/dL	65-99
BUN			mg/dL	6-24
Creatinine, Serum			mg/dL	0.76-1.27
eGFR If NonAfrican Am			mL/min/1.73	>59
eGFR If African Am			mL/min/1.73	>59
BUN/Creatinine Ratio				9-20
Sodium, Serum			mmol/L	134 - 144
Potassium, Serum			mmol/L	3.5-5.2
Chloride, Serum			mmol/L	97-108
Carbon Dioxide, Total			mmol/L	20-32
Calcium, Serum			mg/dL	8.7-10.2
Protein, Total, Serum			g/dL	6.0-8.5
Albumin, Serum			g/dL	3.5-5.5
Globulin, Total			g/dL	1.5-4.5
A/G Ratio				1.1-2.5
Bilirubin, Total			mg/dL	0.0-1.2
Alkaline Phosphatase, S			IU/L	25-150
AST (SGOT)			IU/L	0-40
ALT (SGPT)			IU/L	0-55

### Organs & glands associated with F&E balance

#### Lungs & Liver

#### Heart

**Sweat glands** Excrete Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, water

**GI Tract** Absorbs fluids & electrolytes

**Kidneys** Water, electrolytes; K<sup>+</sup>, Na<sup>+</sup>, Urea, and H<sup>+</sup> ions

### Sodium Imbalance - Hypermnatremia

Hypermnatremia is too much sodium

**Causes** Excess Na<sup>+</sup> intake

Inadequate water intake

Excess water loss

Hypermnatremia results in fluid shift from ICF to ECF (water follows sodium)

**Signs & symptoms** F = Fever (low grade, flushed skin)

**R** - Restless (irritable)

**I** - Increased fluid retention and increased BP

**E** - Edema (peripheral & pitting)

**D** - Decreased urine output, dry mouth

**What can you do?** Treat the underlying cause

Diuretics

### Sodium Imbalance - Hypermnatremia (cont)

Sodium must be reduced slowly to avoid swelling in the brain, causing seizures

### Potassium Imbalance - Hyperkalemia

Very dangerous

#### Causes

Kidney failure (most common)

Use of salt or potassium supplements, receiving old blood (not very common anymore)

Cell destruction, Acidosis, hypoxia

Exercise, catabolic state

Use of potassium-sparing diuretics

Can get false high results if specimen not handled properly

#### Symptoms

**M**uscle weakness

**U**rine, oliguria, anuria

**R**espiratory distress

**D**ecreased cardiac contractability

**E**CG changes

**R**eflexes - hyperreflexia, or areflexia

#### What can you do?

Cardiac monitor

Lasix if kidneys are functioning

Stop potassium in IV fluids

Have patient avoid foods high in potassium

Dialysis if severe

### Recap

#### Hyponatremia

**Hypernatremia** Eating too much Na<sup>+</sup>/water loss/kidney failure Fluid retention, edema

**Hypokalaemia** Vomiting/diarrhea/diuretics Dysrhythmias, weakness

**Hyperkalaemia** Kidney failure/ingesting too much K<sup>+</sup>/acidosis Stops cardiac function/ECG changes

### Magic 4 of electrolyte lab values

Electrolyte	Range	Magic 4
Potassium	3.5 – 5.5	4
Chloride	98 – 106	104
Sodium	135 – 145	140
pH	7.35 – 7.45	7.4
pCO <sub>2</sub>	35 – 45	40
HCO <sub>3</sub>	22 – 26	24
FYI – Hematocrit normal is 3 times the hemoglobin (10-14 is normal)		

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Published 5th March, 2022.  
Last updated 5th March, 2022.  
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