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+ loss)	
Excretion	Sweating
Diuretics	
GI wound drainage	
Renal disease (Excess Na+ loss)	
Intake	Low salt diet
Severe vomiting/diarrhea (inadequate Na+ 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

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 NonAfricn Am			mL/min/1.73	>59
eGFR If Africn 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+, K+, Cl-, water
GI Tract	Absorbs fluids & electrolytes
Kidneys	Water, electrolytes; K+, Na+, Urea, and H+ ions

Sodium Imbalance - Hypernatremia

Hypernatremia is too much sodium

Causes	Excess Na+ intake
Inadequate water intake	
Excess water loss	

Hypernatremia relsults 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 - Hypernatremia (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, recieving 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 - hyperflexia, 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+/water loss/kidney failure	Fluid retention, edema
Hypokalaemia	Vomiting/diarrhea/diuretics	Dysrhythmias, weakness
Hyperkalaemia	Kidney failure/ingesting too much K+/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
pCO2	35 – 45	40
HCO3	22 – 26	24
FYI – Hematocrit normal is 3 times the hemoglobin (10-14 is normal)		

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