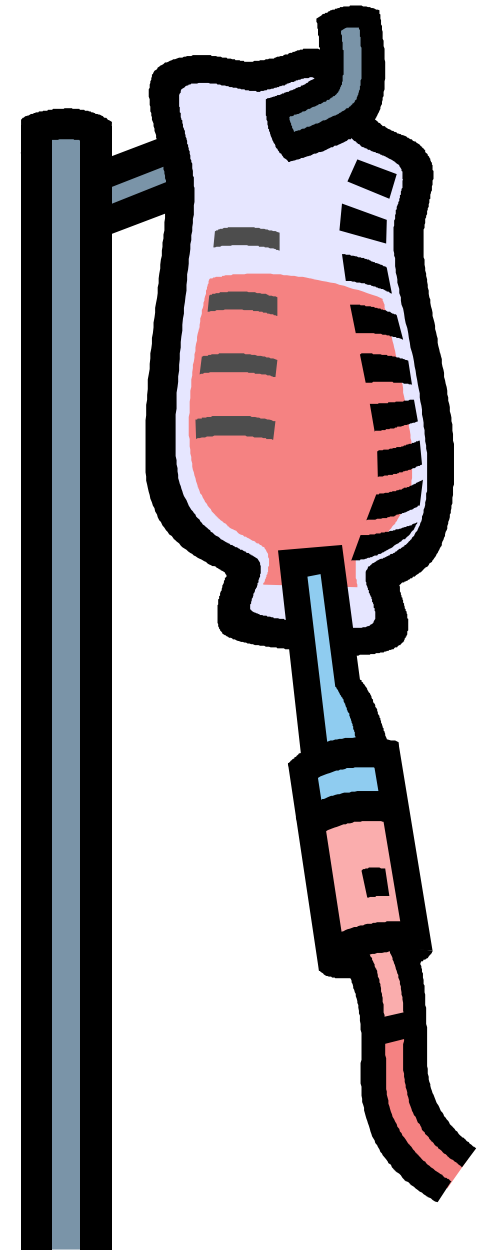


Electrolyte Imbalances

Dr Sameena Ghayur
Shifa College of Medicine
sameena.ghayur@yahoo.com



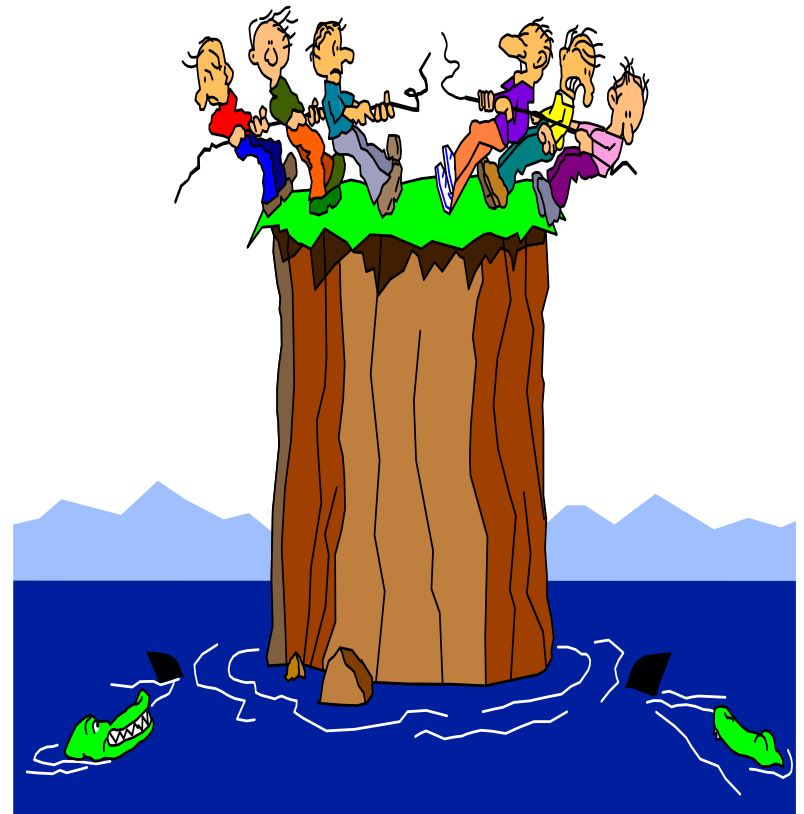
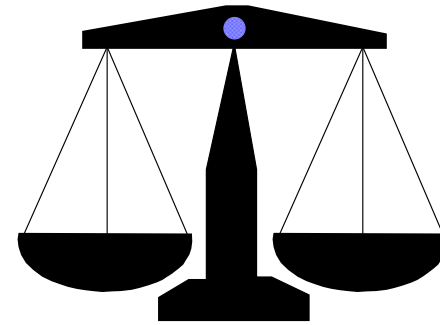
Major Electrolytes

- Electrolytes
 - Na^+ , K^+ , Ca^{++} , Mg^+ = cations
 - HCO^{-3} , Cl^- , PO^{-4} = anions
- ICF = K^+
- ECF = Na^+
 - osmosis
 - osmolarity
 - capillary dynamics



Electrolyte Balance

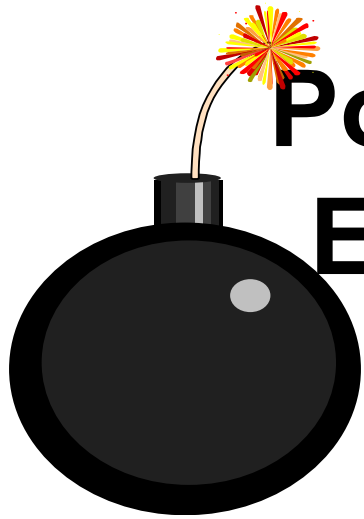
- Physiological role of electrolytes
 - Maintaining **electroneutrality** in fluid compartments
 - Mediating **enzyme reactions**
 - Altering cell membrane **permeability**
 - Regulating **muscle contraction** and relaxation
 - Regulating **nerve impulse transmission**
 - Influencing **blood clotting** time



Conditions Suggesting Electrolyte Imbalance

- Abnormal vital signs or altered mental status
- Prolonged illness or chronic disease
- Renal /Gastrointestinal /disease or malnutrition
- Diabetes and other endocrinopathies
- Cancer
- Alcohol/drug abuse
- Chronic lung disease

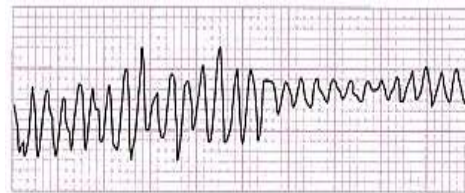




Potential Consequences of Electrolyte Abnormalities

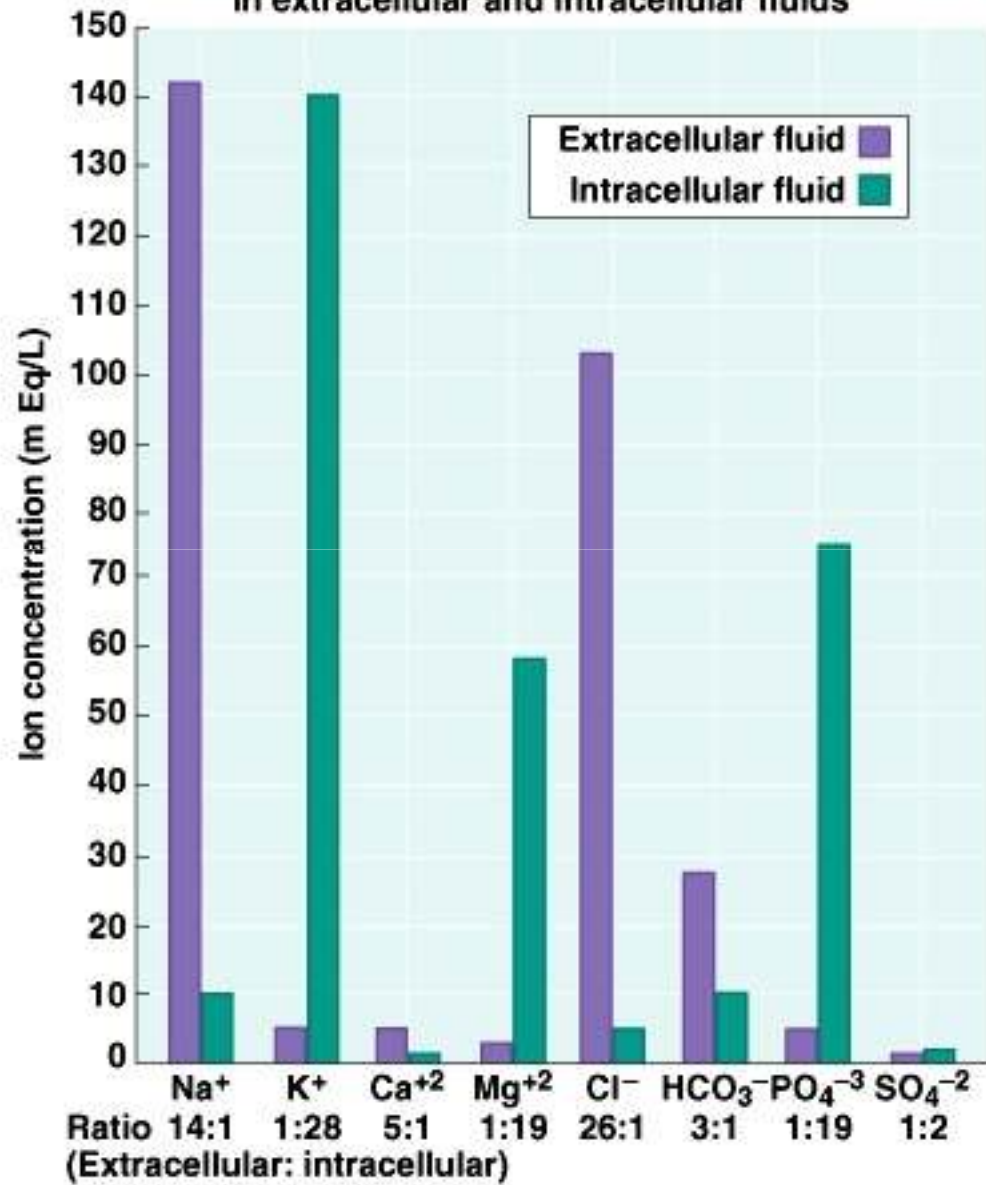


- May produce **critical illness**
- May lead to **arrhythmias**, pulseless **cardiac arrest**:
 - VT/VF
 - Asystole
 - PEA
- May make resuscitation impossible unless treated



Ventricular Fibrillation

Relative concentrations and ratios of ions in extracellular and intracellular fluids








Regulation of Sodium

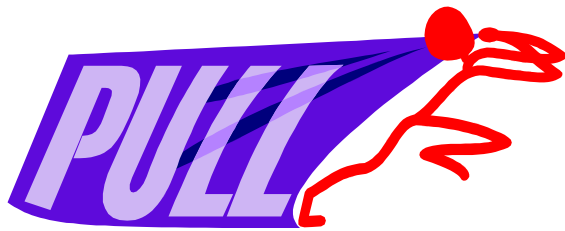


- Renal tubule reabsorption affected by hormones:
 - Aldosterone
 - Renin/angiotensin
 - Atrial Natriuretic Peptide (ANP)

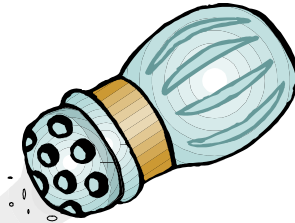
Hyponatremia: < 135 mEq/L



FUNCTION OF Na ⁺ :	CAUSE:	S&S:	TREATMENT:
<ul style="list-style-type: none"> •Determinant of plasma OSMOLALITY •Water balance helps maintain and its distribution •Conduction of nerve impulses & muscle fiber transmission through the SODIUM & POTASSIUM PUMP 	<ul style="list-style-type: none"> •Fictitious •Diuretics •GI fluid loss •Diaphoresis  <ul style="list-style-type: none"> •Hypotonic tube feedings/ IV sol •Water retention (Cirrhosis. CCF, Nephrotic) 	<ul style="list-style-type: none"> •Anorexia/ N&V •Weakness •Lethargy •Confusion •Muscle cramps •Twitching/Seizures   <p><small>©OriginalArtist Reproduction rights obtainable from www.CartoonStock.com</small></p> <p><small>search ID: 494912</small></p>	<ul style="list-style-type: none"> •Restrict fluids (safest) •Very slow administration of hypertonic saline solution (3% NaCl) •Medications that decrease Na⁺: <ul style="list-style-type: none"> •-diuretics •-lithium

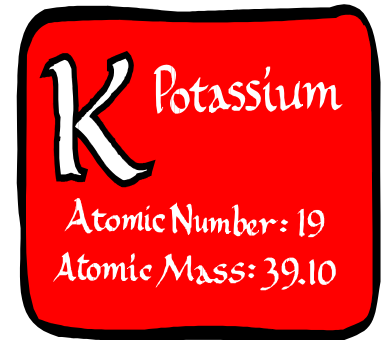


Hypernatremia: > 145 mEq/L



FUNCTION OF Na ⁺ :	CAUSE:	S&S:	TREATMENT:
	<p>Water deprivation</p> <ul style="list-style-type: none">•Diabetes insipidus•Osmotic diuresis•Heatstroke•Diarrhea/vomiting•Renal failure•Cushing's syndrome <p>Salt gain</p> <ul style="list-style-type: none">•Hypertonic tube Feeding/ salt ingestion	<ul style="list-style-type: none">•Thirst•Hyperpyrexia•Hallucinations•Lethargy•Irritability•Seizures	<p>TREATMENT:</p> <ul style="list-style-type: none">•Restrict sodium from diet•Increase water intake•Medication that increase Na⁺:<ul style="list-style-type: none">• prednisone

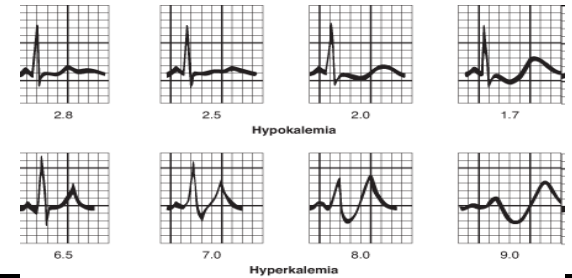
Regulation of Potassium



- Through kidney
 - Aldosterone
 - Insulin

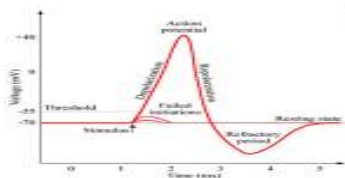


Hypokalemia: < 3.5 mEq/L



FUNCTION OF K⁺:

- **Action potential** of excitable cells of muscles, neurons, & other tissues
- Extracellular K⁺ helps control **cardiac rate, rhythm, conduction of nerve impulses, skeletal muscle contraction,** function of smooth muscles, endocrine tissue



CAUSE:

- **Diuretics**
- **Diarrhea**
- Vomiting
- Gastric suction
- Steroids
- **Hyperaldostoni sm**
- Amphotericin b
- Bulimia
- **Cushing's syndrome**

S&S:

- Fatigue/Anorexia/N&V
- Muscle weakness/Reduced GI motility/
- Paresthesia
- **Dysrhythmias/Flat T wave on EKG**
- Anxiety/Confusion
- **Leg cramps**

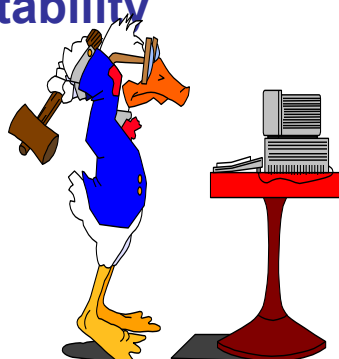


TREATMENT:

- Administer K⁺ IV or orally
- IV given drip over at least 60 minutes
- Encourage food high in K⁺
- *Medications that decrease K⁺:
 - laxative/enemas
 - steroids
 - Beta2 agonists
 - digoxin
 - insulin & glucose
 - diuretics
 - some antibiotics

Hyperkalemia: > 5.0 mEq/L




FUNCTION OF K ⁺ :	CAUSE:	S&S:	TREATMENT:
	<ul style="list-style-type: none">• Hemolyzed serum sample• Oliguria• Acidosis/ Renal failure• Addison's disease• K⁺ sparing diuretics• GI bleeding• Insulin deficiency• Heparin therapy	<ul style="list-style-type: none">• Muscle weakness/ twitching• Bradycardia/Dysrhythmias/• Tall, peaked T waves & widened QRS• Flaccid paralysis• Intestinal colic/ Increase GI motility• Irritability 	<ul style="list-style-type: none">• Stop medication with K⁺• Administer dextrose 50% with regular insulin• Administer kayexalate• Monitor EKG• Administer calcium gluconate• Medications that increase K⁺:<ul style="list-style-type: none">-ACE inhibitors-heparin--NSAID

MANAGEMENT OF SEVERE ACUTE HYPERKALAEMIA ($K^+ > 7\text{mmol/L}$)

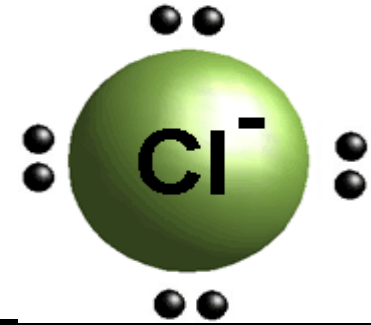
- Identify and treat cause
- 10 – 20 mL intravenous 10% calcium chloride over 10 min in patients with ECG abnormalities
 - (reduced risk of ventricular fibrillation)
- 50 mL 50% dextrose plus 10 units short acting insulin over 2-3min
- Monitor plasma glucose and K^+ over next 30-60 min)
- Regular Salbutamol nebulizers
- Consider oral or rectal calcium
- Resonium (ion exchange resin), although this is more effective for non-acute hyperkalaemia.
- Haemodialysis for persistent hyperkalemia



Hypocholeremia: < 95 mEq/L

Cl Chlorine
Atomic Number: 17
Atomic Mass: 35.45

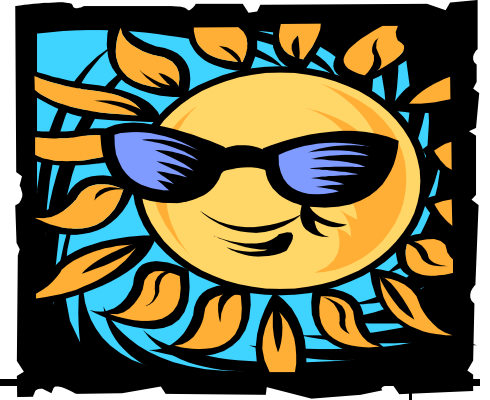
FUNCTION OF Cl-:	CAUSES:	S&S:	TREATMENT:
<ul style="list-style-type: none"> •Formation of salts (sodium chloride or potassium chloride) •Helps maintaining cellular integrity with sodium - balance between intracellular and extra cellular fluids in the body •Helps control osmotic pressure 	<ul style="list-style-type: none"> •Metabolic alkalosis/Ingestion of alkaline substances) •Hypokalemia •Chronic respiratory acidosis •Prolonged vomiting/Prolonged GI suction/Prolonged diarrhea •Burns/Heat exhaustion •Addison's •SIADH 	<ul style="list-style-type: none"> •Slow, shallow respirations •Muscle tremors/ twitching •Hypotension 	<p>Administer salt tablets or increase chloride in diet</p>

Hyperchloremia: > 105 mEq/L



FUNCTION OF Cl⁻:	CAUSES: <ul style="list-style-type: none">•Metabolic acidosis•Salicylate overdose•Increase k⁺ /na⁺•Renal disorder•Adrenocortical hormone production•Head trauma•Profuse perspiration 	S&S: <ul style="list-style-type: none">•Deep rapid respirations•Weakness•Lethargy•Stupor•unconscious 	TREATMENT: <ul style="list-style-type: none">•Stop Cl⁻ supplements•Administer diuretics•0.45% NaCl
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Euvolemic State:




<p>DESCRIPTION:</p> <ul style="list-style-type: none">• Decrease in fluids in both the intravascular and interstitial space.• Normal serum osmolality (275-295)• Use of Na⁺ free solutions that result in dilution of extracellular space.	<p>CLINICAL PRESENTATION:</p> <ul style="list-style-type: none">• SIADH• Hypothyroidism• Psychiatric disorders• Medications	<p>TREATMENT:</p> <ul style="list-style-type: none">• Water restriction• Increase dietary salt• Treat SIADH• Correct underlying cause	<p>CC S:</p> <p>1</p>
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Hypervolemic State



DESCRIPTION:	CLINICAL PRESENTATION:	TREATMENT:	COMMENTS:
<ul style="list-style-type: none">• Hyperglycemic states that pulls water from cells• Fluid loss from extracellular space greater than solute loss leading to increase serum osmolality > 295.	<ul style="list-style-type: none">• CHF• Cirrhosis• Nephrotic syndrome• Renal failure	<ul style="list-style-type: none">• Water restriction• Loop diuretic• Restrict dietary salt• Treat underlying cause  An illustration of a person in a pink long-sleeved shirt and blue pants, holding a yellow box to their mouth and drinking. The background is light green.	

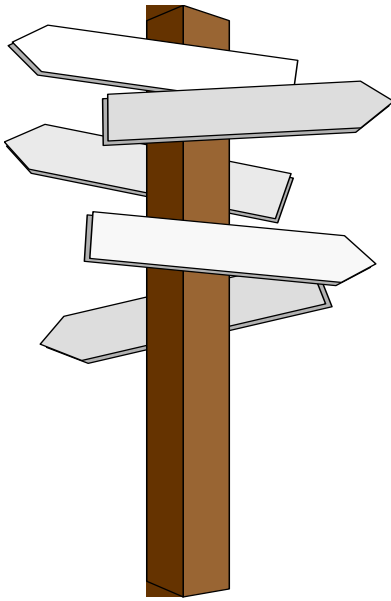
Hypovolemic State:



DESCRIPTION:	CLINICAL PRESENTATION	TREATMENT:	COMMENTS:
<ul style="list-style-type: none">•Glucose in isotonic solution oxidized leading to cellular swelling.•Loss of solute from extracellular space greater than excess of water resulting in decrease serum osmolality (< 275)	<ul style="list-style-type: none">•GI fluid loss•Diuretics•Adrenal insufficiency•Burns•Sweating•Hypotonic•Dehydration	<ul style="list-style-type: none">•IV Normal Saline to correct the extracellular fluid deficit*Increase daily salt intake*Hypertonic saline solution to increase Na⁺ levels	

Replacement of fluids and electrolytes

- Types of IV fluids
- Isotonic
- Hypertonic
- Hypotonic



IV complications

- Infiltration
 - IVF enter SQ space
- Phlebitis
 - vein inflammation
 - S/S: pain, redness, warmth
- Fluid overload
 - Fluids given too rapidly
- Bleeding

