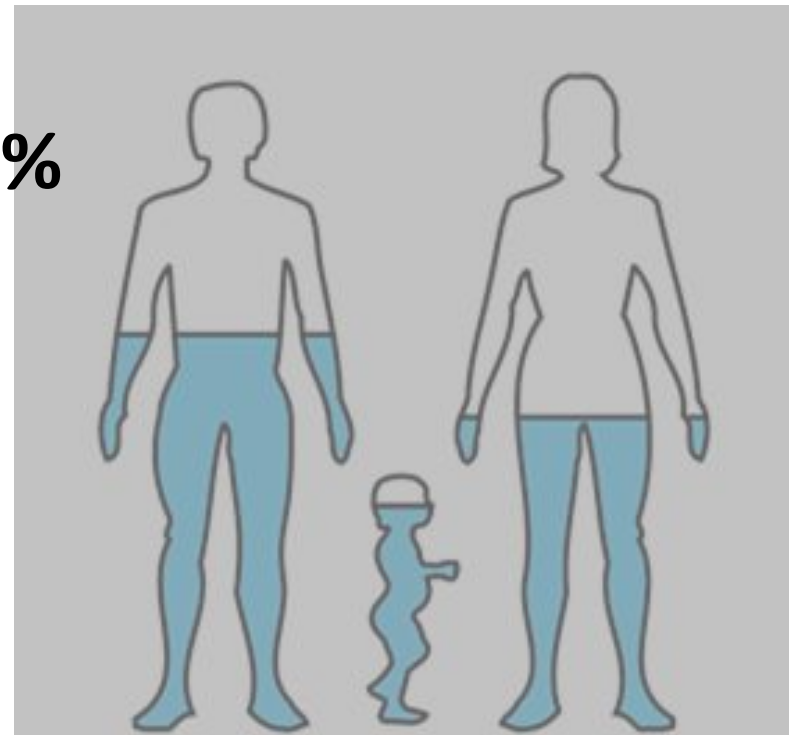


Why are fluids so Important?

Our Bodies are mostly water:

- **Adults 60%**
- **Infants & Elderly 70-80%**



- **Intracellular compartment:**

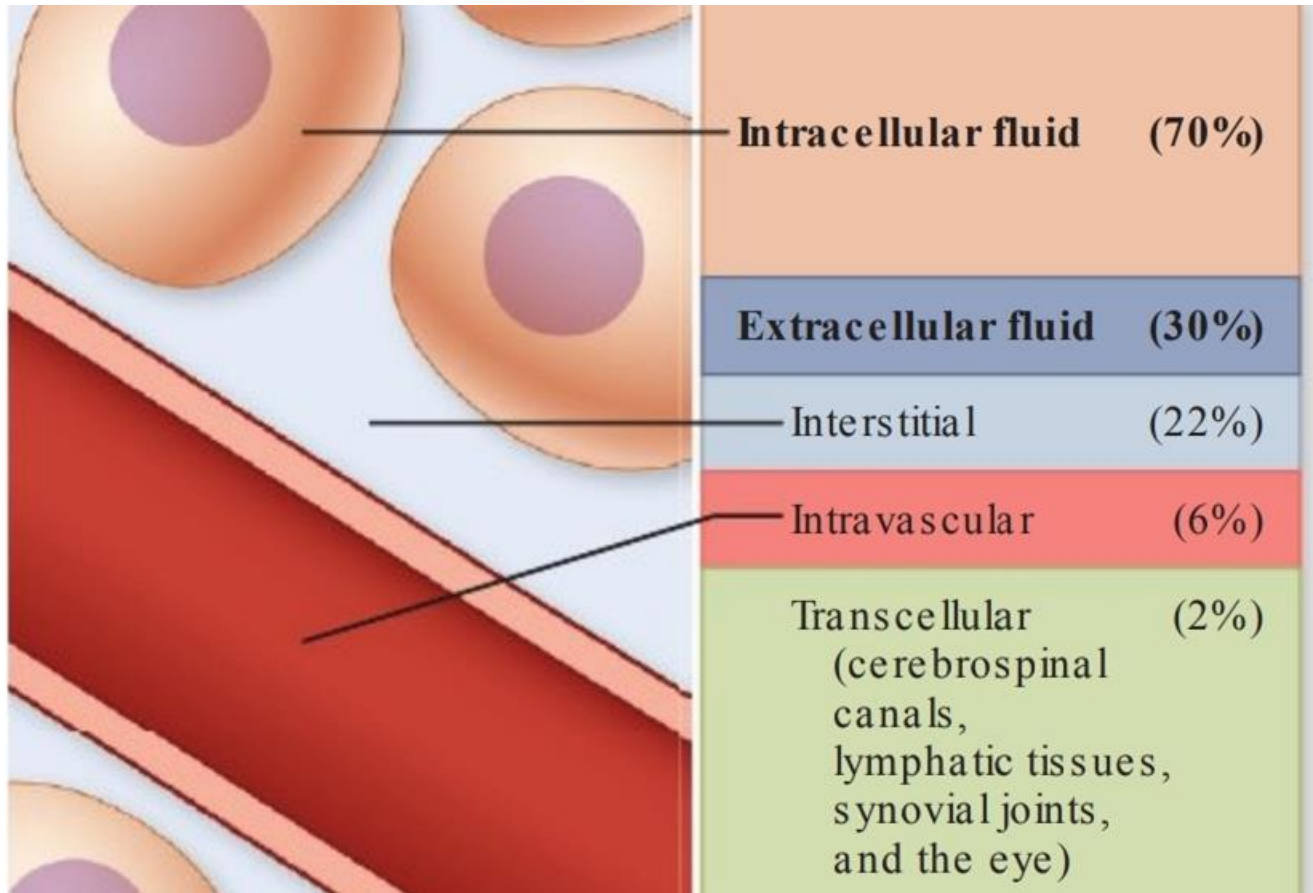
Fluid inside cells

- **Extracellular compartment:**

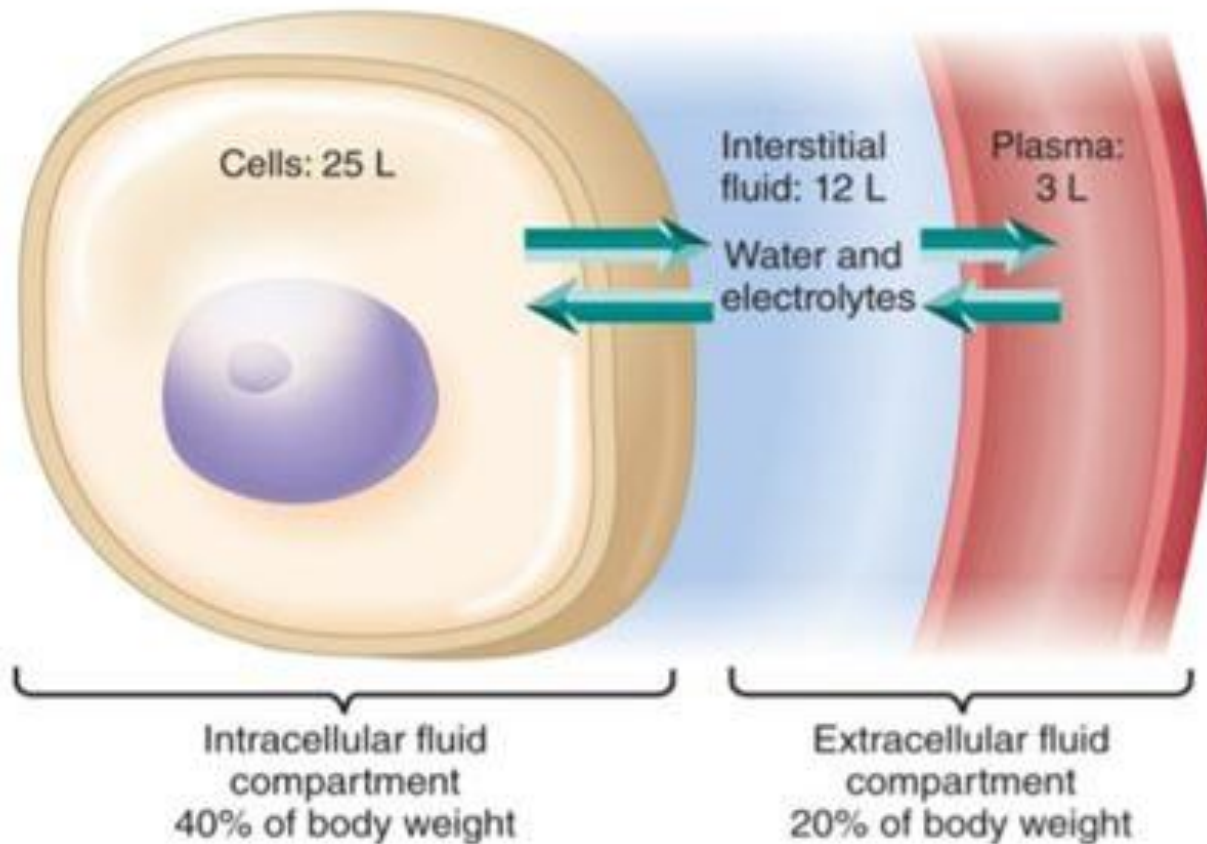
Fluid outside cells

- **Intravascular compartment:** Fluid inside vessels
- **Interstitial compartment:** Fluid between cells

Fluid Distribution



Fluid Distribution



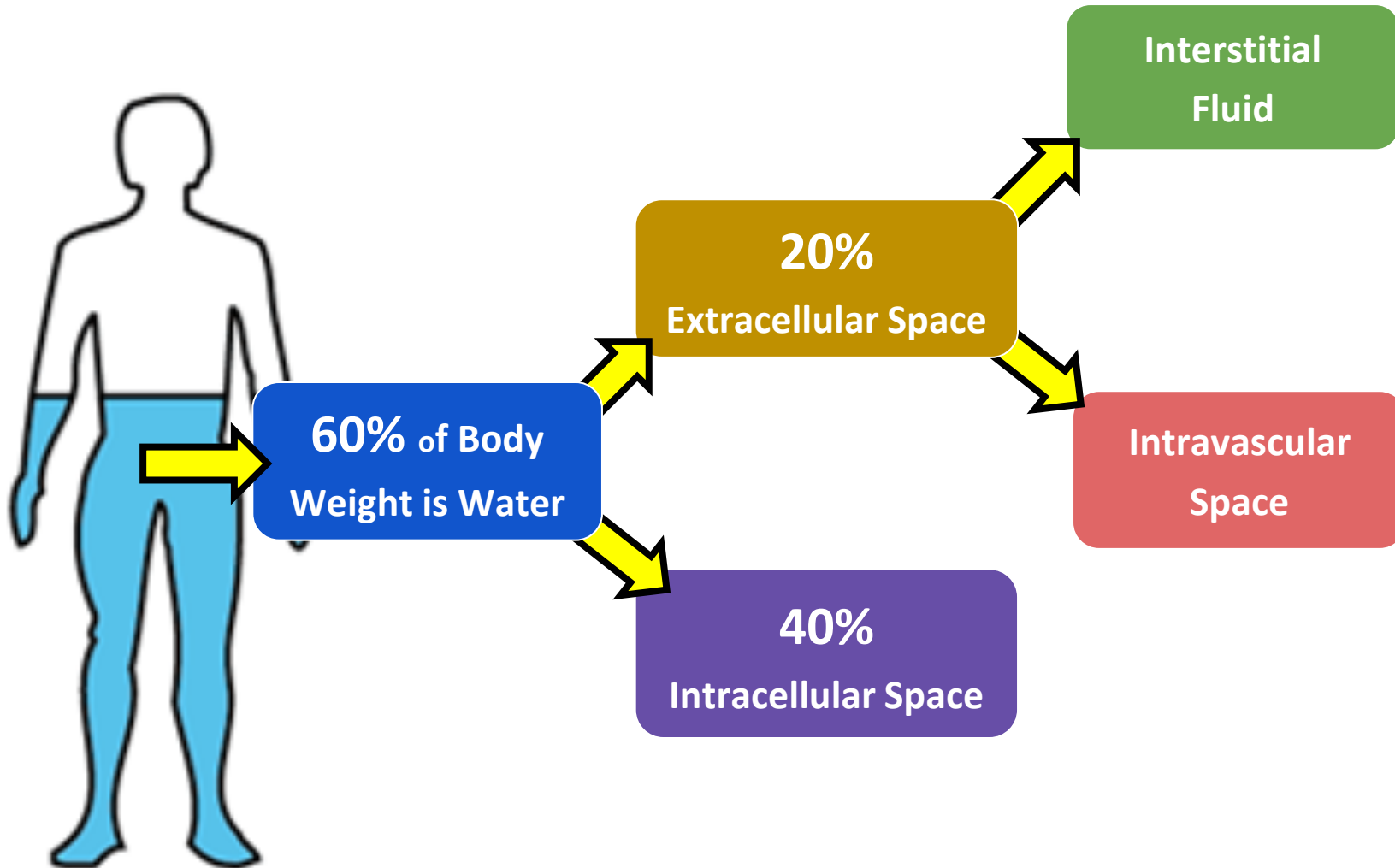
- **Third spacing** is the accumulation of trapped extracellular fluid in a body space (*actual or potential*) as a result of disease or injury.

Edema

- Accumulation of fluid in the interstitial space.
- Generalized edema is also known as Anasarca.



Think 60-40-20



3 Ways to Get Fluids Into the Body

Oral

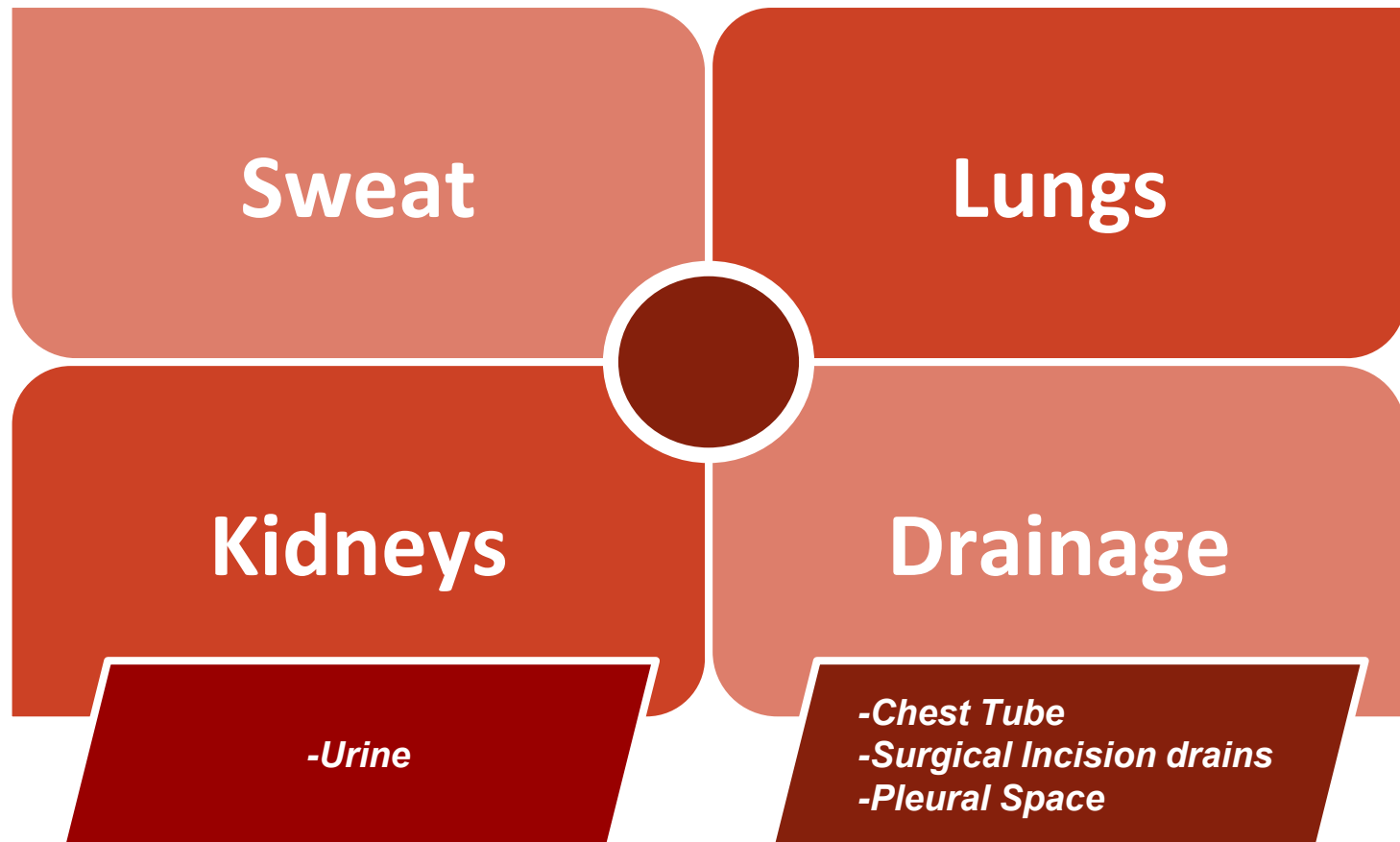
(Drink Fluids)

IV Therapy

GUT

(Via NG or OG Tube)

Ways Fluid gets OUT of the Body



Hypervolemia

- Also known as Fluid Volume Excess (FVE)
- *Definition:* Too much fluid in the vascular space.
- What are the causes?
 - *Heart Failure*
 - *Renal Failure*
 - *Sodium Excess*

Fluid Volume Excess(FVE)

- Overhydration or fluid overload is fluid volume excess.
- Fluid intake or fluid retention exceeds the fluid needs of the body.
- **The goal of treatment is to restore fluid balance,** if present compensate for electrolyte imbalance and eliminate or control underlying cause of the overload.

Fluid Volume Excess(FVE)

- **Isotonic** overhydration results from excessive fluid in the extracellular fluid compartment. It causes circulatory overload and interstitial edema.
- When severe or when it occurs in a client with poor cardiac function, heart failure and pulmonary edema can result.

- **Hypertonic** overhydration is rare and is caused by excessive sodium intake.
-
- **Hypotonic** overhydration is also known as water intoxication. Electrolyte imbalance occur as a result of dilution

Heart is WEAK:

- Cardiac Output
- Kidney Perfusion
- Urinary Output
- Fluid remains in the vascular space.

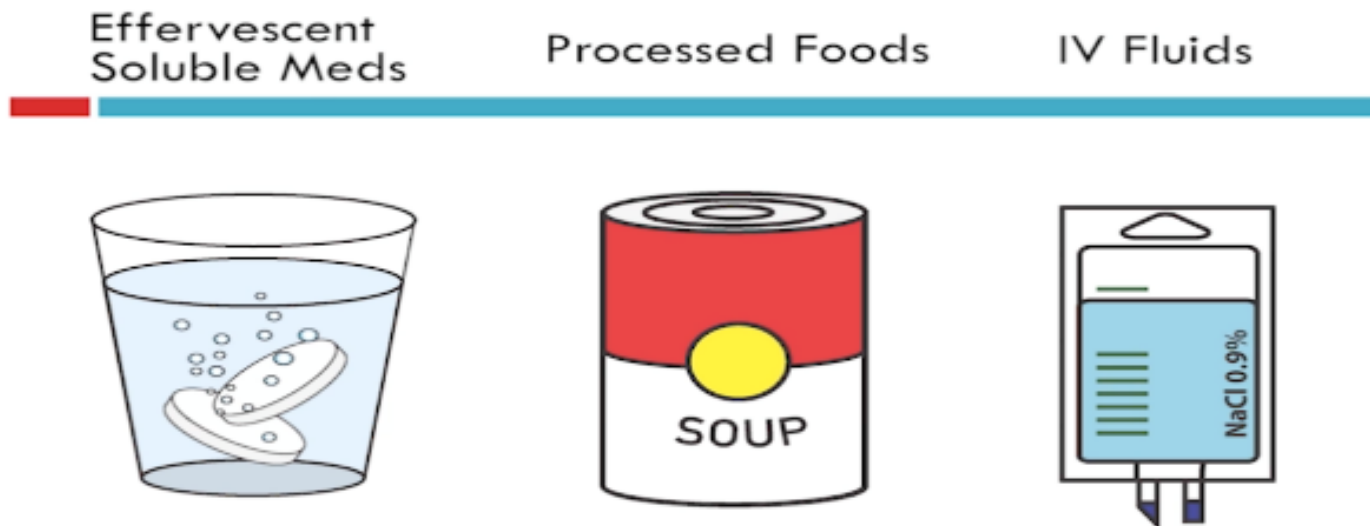
Renal Failure

- If kidneys aren't working, are they going to be putting out anything? NO
- Where is all the fluid going to stay?

Sodium Excess

Water Retention. Where?

- Example:



Hormonal Regulation of FV

- **Aldosterone** (Steroid, mineralocorticoid)



- Blood volume gets low Aldosterone secretion increases retain sodium and water blood volume goes up

Aldosterone:

- ***Too much*** aldosterone
(RETAIN TOO MUCH SODIUM AND WATER):
 - ***Cushing Syndrome***
 - ***Hyperaldosteronism***
- ***Too little*** aldosterone
(LOSE SODIUM AND WATER)
 - ***Addison's Disease***

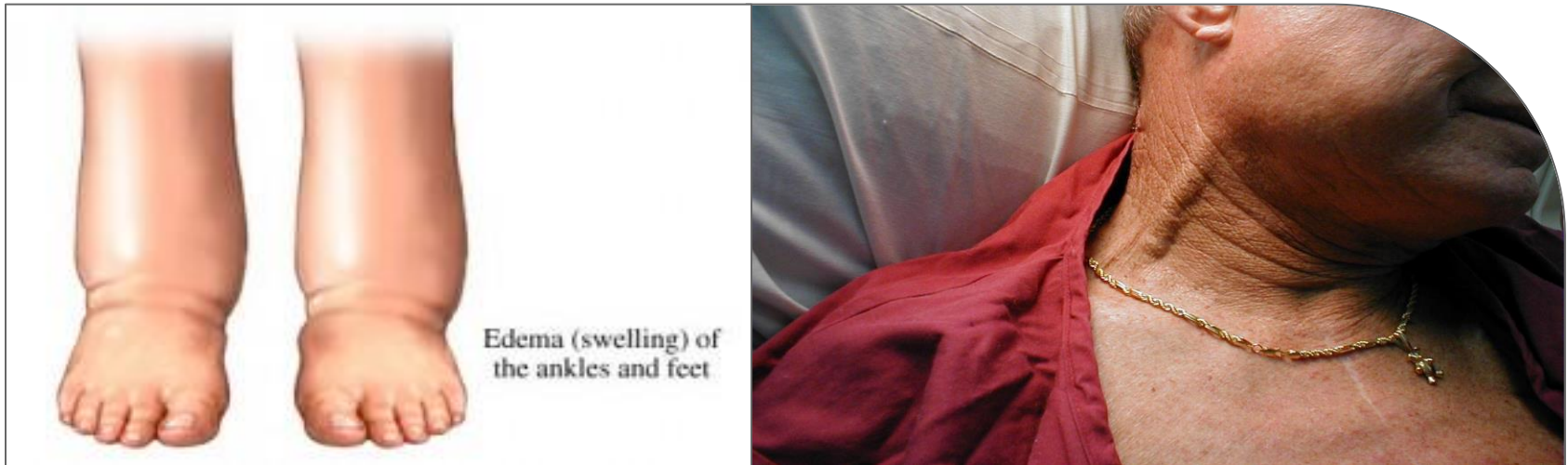
Lab Values

Hematocrit	Sodium	Urine Specific Gravity
Men 40-54% Women 38-47%	135-145mEq/L	1.002-1.030

Antidiuretic Hormone (ADH):

- It's found in the pituitary gland.
- Where is the pituitary gland located?
- What kinds of injuries will affect the ADH?
- Another name for antidiuretic hormone (ADH) is vasopressin (Pitressin®).
- The drug vasopressin (Pitressin®) or desmopressin acetate (DDAVP®) may be utilized as an ADH replacement in diabetes insipidus.

Signs and Symptoms of FVE



Signs and Symptoms of FVE

- **The Central Venous Pressure (CVP)**
 - measured in the right atrium
 - More volume, more pressure

- **Lungs sounds**
 - Wet (Rales)

- **Polyuria**
 - Kidneys trying to help your diuresis

- **Pulse**
 - Goes up
 - Heart wants the fluid to go forward, to prevent water going into the lungs.

Signs and Symptoms of FVE

- **Pulse:** ↑ UP

More Volume, More Pressure

- **Weight:** ↑ UP fast
 - *Not fat, fluid.*

Fluid Volume Excess (FVE)

Treatment:

- Low sodium
- Restrict fluid
- I & O
- Daily Weight
- Diuretics
- Bed rest
- Focused physical assessment
- IVFs slowly to the elderly and the very young

- **Hypovolemia** is also known as *Isotonic dehydration*.
- This is the ***most common*** type of dehydration. It results in inadequate tissue perfusion and decreased circulating blood volume.

Fluid Volume Deficit (FVD)

- When water loss exceeds electrolyte loss is known as hypertonic dehydration.
- The fluid moves from the intracellular compartment into the plasma and interstitial fluid spaces causing the cell walls to swell.

Fluid Volume Deficit (FVD)

- **Hypotonic dehydration** is when electrolyte loss exceeds water loss.
- The fluid moves from the plasma and interstitial spaces into the cells, causing a plasma volume deficit and causing the cell to swell.

Fluid Volume Deficit (FVD)

- Also known as **HYPOVOLEMIA**
- Deficit = Shock
- Causes:
 - Loss of fluids from anywhere
 - Third Spacing
 - Burns
 - Ascites
 - Diseases with polyuria (Diabetes)
 - *THINK SHOCK FIRST -> RENAL FAILURE*

Fluid Volume Deficit (FVD)

Signs and Symptoms

- | | |
|--|--|
| • Weight: ↓ DOWN | • Respirations: INCREASE |
| • Decreased skin turgor | • CVP: ↓ DOWN |
| • Decreased urine output | • Peripheral veins/neck veins vasoconstrict |
| • BP: ↓ DOWN
<i>*Less Volume, Less Pressure*</i> | • Urine specific gravity: UP
<i>*Concentrated numbers go UP, Dilute makes numbers go DOWN*</i> |
| • Pulse: ↑ UP | • Cool Extremities |

Treatment:

- Prevent further loss
- Replace Volume
- Safety precautions
- Monitor cardiovascular, gastrointestinal, renal, neurological, respiratory status.

Fluid Volume Deficit (FVD)

Goal:

- Restore fluid volume
- Replace electrolytes
- Eliminate cause

IV Fluids

Hypotonic Solution	Isotonic Solutions	Hypertonic Solutions
– D2.5%W – 0.5% NS – 0.33%NS	– Normal Saline 0.9% – Ringer Lactate – D5W – D5 1/4 NS	– D10%W – 3%, 5% NS – D5LR – D5.5NS – D5%NS – TPN – Albumin • Electrolytes + (Isotonic or Hypotonic Solution) = Hypertonic Solution

- Plasma expanders also known as Colloid solutions pull fluid for the interstitial compartment into the vascular compartment. Used to treat hypovolemia as seen in severe hemorrhage.
- **Examples:** Dextran and Human Albumin.

TIPS

- **I**sotonic
 - “Stay where **I** put it!”
- hyp **O**tonic
 - “Go **O**ut of the vessel.”
- hyp **E**rtonic
 - “**E**nter the vessel.”

Magnesium & Calcium:

Hypermagnesemia

Causes

- Renal Failure
- Antacids

S&S

- Flushing
- Warmth
- Mg makes you sedative

Treatment

- Ventilator
- Dialysis
- Calcium gluconate
- Safety precautions

Hypercalcemia

Hypercalcemia

Causes	S&S	Treatment
- Hyperparathyroidism: too much PTH - Thiazides - Immobilization	- Brittle bones - Kidney stones	- Move! - Fluids to prevent kidney stones - Ca has an inverse relationship with phosphorus, so we add PROTEIN to the diet. - Steroids - Safety Precautions - Must have Vitamin D to use Ca. - Medications that decrease serum Ca

Causes

- Diarrhea
- Alcoholism
- Alcohol suppresses ADH & it's hypertonic
 - Not eating
 - Drinking

Treatment:

- Give some Mg
- Check kidney function (before and during IV Mg).
- Seizure precautions
- Eat Magnesium
- If your client reports flushing and sweating when you start IV Mg, ASSUME THE WORST and **STOP** IV Mg.

Hypocalcemia

Causes

- Hypoparathyroidism
- Radical neck
- Thyroidectomy

Treatment:

- Vitamin D
- Phosphate binders sevelamer hydrochloride (Renagel®) calcium acetate (PhosLo®)
- IV Ca (GIVE SLOWLY) and always make sure client is on a heart monitor.
- **Foods high in magnesium:** spinach, mustard greens, summer squash, broccoli, halibut, turnip greens, pumpkin seeds, peppermint, cucumber, green beans, celery, kale, sunflower seeds, sesame seeds and flax seeds

Hypomagnesaemia & Hypocalcemia

Treatment:

- DTRs : UP
- Muscle Tone rigid tight
- Arrhythmias
- Seizure
- Stridor/laryngospasm
- + Chvostek's – tap cheek (“C” is for Cheek)
- + Trousseau's – pump up BP cuff.
- Mind Changes
- Swallowing Problems
 - **IF YOU WANT TO GET Mg & Ca questions right, THINK MUSCLES FIRST!**

- The sodium level in your blood is totally dependent on how much water you have in the blood.

NORMAL LAB VALUES:

– 135 -145 mEq/L (135 -145 mmol/L)

Hypernatremia

= Dehydration

Hypernatremia		
Causes	S&S	Treatment
– Hyperventilation – Heat stroke – DIABETES INSIPIDUS	– Dry Mouth – Thirsty – Swollen tongue	– Restrict sodium – Dilute client with fluids – Daily weights – I & O – Lab work

Hyponatremia

= Dilution

Hyponatremia		
Causes	S&S	Treatment
– Drinking H₂O for fluid replacement (vomiting, sweating) – Psychogenic polydipsia – D5W (sugar & water) – SIADH	– Headache – Seizure – Coma	– Na – NO water – If having neuro problems: need hypertonic saline • Means “packed with particles” • 3% NS or 5% NS

Potassium

- Excreted by the **kidneys**
 - If the kidneys are not working well, the serum potassium will go **up**.

NORMAL LAB VALUES:

- 3.5-5.0 mEq/L (3.5-5.0 mmol/L)

Hyperkalemia

Hyperkalemia

Causes

- Kidney trouble
- Spironolactone (Aldactone®)

S&S

- Begins with muscle twitching
- Then proceeds to muscle weakness
- Then flaccid paralysis

Treatment

- Dialysis- Kidneys aren't working
- Calcium gluconate decreases arrhythmias
- Glucose and insulin
- Sodium polystyrene sulfonate (Kayexalate®)

Hypokalemia

Hypokalemia

Causes

- Vomiting
- NG suction
- Diuretics
- Not eating

S&S

- Muscle cramps
- Muscle weakness

- **ECG changes with hyperkalemia:** bradycardia, tall and peaked T waves, prolonged PR intervals, flat or absent P waves, and widened QRS, conduction blocks, and ventricular fibrillation.
-
- **ECG changes with hypokalemia:** U waves, PVCs, and ventricular tachycardia.

Treatment:

- Give potassium (K).
- Spironolactone (Aldactone®) makes the client retain K.
- Ingest more potassium.
- **Foods high in potassium:** spinach, fennel, kale, mustard greens, brussels sprouts, broccoli, eggplant, cantaloupe, tomatoes, parsley, cucumber, bell pepper, apricots, ginger root, strawberries, avocado, banana, tuna, halibut, cauliflower, kiwi, oranges, lima beans, potatoes (white or sweet), and cabbage.

Miscellaneous Information

- Upset GI = Major problem with oral potassium.
- Assess urinary output (UO) before/during IV potassium.
- Always put IV potassium on a pump.
- Mix well!
- Never give potassium IV push!
- Burns during infusion.

1) The nurse is preparing to care for a client with a potassium deficit. The nurse reviews the client's record and determines that the client is at risk for developing the potassium deficit because of which situation?

- a.** Sustained tissue damage
- b.** Requires nasogastric suction
- c.** Has a history of Addison's disease
- d.** Uric acid level of 9.4 mg/dL (559 μ mol/L)

b. Requires nasogastric suction

- **Rationale:** The normal serum potassium level is 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L). A potassium deficit is known as hypokalemia.
- Potassium-rich gastrointestinal fluids are lost through gastrointestinal suction, placing the client at risk for hypokalemia.
- The client with tissue damage or Addison's disease and the client with hyperuricemia are at risk for hyperkalemia.
- The normal uric acid level for a female is 2.7 to 7.3 mg/dL (0.16 to 0.43 mmol/L) and for a male is 4.0 to 8.5 mg/dL (0.24 to 0.51 mmol/L). Hyperuricemia is a cause of hyperkalemia.

2) Potassium chloride intravenously is prescribed for a client with hypokalemia. Which actions should the nurse take to plan for preparation and administration of the potassium? Select all that apply.

- a) Obtain an intravenous (IV) infusion pump.
- b) Monitor urine output during administration.
- c) Prepare the medication for bolus administration.
- d) Monitor the IV site for signs of infiltration or phlebitis.
- e) Ensure that the medication is diluted in the appropriate volume of fluid.
- f) Ensure that the bag is labeled so that it reads the volume of potassium in the solution.

Rationale:

- Potassium chloride administered intravenously must always be diluted in IV fluid and infused via an infusion pump.
- Potassium chloride is never given by bolus (IV push). Giving potassium chloride by IV push can result in cardiac arrest. The nurse should ensure that the potassium is diluted in the appropriate amount of diluent or fluid.

Rationale Cont.

- The IV bag containing the potassium chloride should always be labeled with the volume of potassium it contains. The IV site is monitored closely because potassium chloride is irritating to the veins and there is risk of phlebitis.
- In addition, the nurse should monitor for infiltration and contacts the health care provider output is less than 30 mL/hour.

- Test-Taking Strategy: Focus on the subject, the preparation and administration of potassium chloride intravenously.
- Think about this procedure and the effects of potassium. Note the word bolus in option 3 to assist in eliminating this option.
- Review: The precautions with intravenously administered potassium
- Analyzing Client Needs, Nursing Process and Implementation Pharmacology—Cardiovascular Medications Priority Concepts

- 4)** Which client is at risk for the development of a sodium level at 130 mEq/L (130 mmol/L)?
- a.** The client who is taking diuretics
 - b.** The client with hyperaldosteronism
 - c.** The client with Cushing's syndrome
 - d.** The client who is taking corticosteroids

a. The client who is taking diuretics

- **Rationale:** The normal serum potassium level is 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L). A potassium deficit is known as hypokalemia.
- Potassium-rich gastrointestinal fluids are lost through gastrointestinal suction, placing the client at risk for hypokalemia.
- The client with tissue damage or Addison's disease and the client with hyperuricemia are at risk for hyperkalemia.
- The normal uric acid level for a female is 2.7 to 7.3 mg/dL (0.16 to 0.43 mmol/L) and for a male is 4.0 to 8.5 mg/dL (0.24 to 0.51 mmol/L). Hyperuricemia is a cause of hyperkalemia.

Rationale:

- The normal serum sodium level is 135 to 145 mEq/L (135 to 145 mmol/L). A serum sodium level of 130 mEq/L (130 mmol/L) indicates hyponatremia.
- Hyponatremia can occur in the client taking diuretics. The client taking corticosteroids and the client with hyperaldosteronism or Cushing's syndrome are at risk for hypernatremia.

4) The nurse is assigned to care for a group of clients. On review of the clients' medical records, the nurse determines that which client is most likely at risk for a fluid volume deficit?

- a) A client with an ileostomy
- b) A client with heart failure
- c) A client on long-term corticosteroid therapy
- d) A client receiving frequent wound irrigations

a. A client with an ileostomy

- **Rationale:** A fluid volume deficit occurs when the fluid intake is not sufficient to meet the fluid needs of the body.
- Causes of a fluid volume deficit include vomiting, diarrhea, conditions that cause increased respirations or increased urinary output, insufficient intravenous fluid replacement, draining fistulas, and the presence of an ileostomy or colostomy.
- A client with heart failure or on long-term corticosteroid therapy or a client receiving frequent wound irrigations is most at risk for fluid volume excess.

5) The nurse is assessing a client with a suspected diagnosis of hypocalcemia. Which clinical manifestation would the nurse expect to note in the client?

- a) Twitching
- b) Hypoactive bowel sounds
- c) Negative Trousseau's sign
- d) Hypoactive deep tendon reflexes

a. Twitching

- **Rationale:** The normal serum calcium level is 9 to 10.5 mg/dL (2.25 to 2.75 mmol/L). A serum calcium level lower than 9 mg/dL (2.25 mmol/L) indicates hypocalcemia.
- Signs of hypocalcemia include paresthesia followed by numbness, hyperactive deep tendon reflexes, and a positive Trousseau's or Chvostek's sign.
- Additional signs of hypocalcemia include: increased neuromuscular excitability, muscle cramps, twitching, tetany, seizures, irritability, and anxiety. Gastrointestinal symptoms include increased gastric motility, hyperactive bowel sounds, abdominal cramping, and diarrhea.

Questions?

