*** Please note that all normal ranges for blood tests will depend on the lab performing the test.
The normal values listed in this book are to be used as references only.**

I. FLUID VOLUME EXCESS: HYPERVOLEMIA

Define: too much volume in the _____

A. Causes:

1. **CHF:** heart is_____, CO_____, decreased_____ perfusion, UO_____
   *the volume stays in the _____

2. **RF:** Kidneys aren't_____

3. **Alkaseltzer**
   Fleets enemas
   IVF with Na
   } All 3 have a lot of _____

4. **Aldosterone (steroid, mineralocorticoid):**

   -Where does aldosterone live?

   -Normal action: when blood volume gets low (vomiting, blood loss, etc.)
   →aldosterone secretion increases→ **retain Na/water**→ blood volume _____

   ** Diseases with too much aldosterone:
   1._____
   2._____

   **Disease with too little aldosterone:
   1._____

Normal Urinary Output:
1ml/kg/hr

Good Rule: Call the MD if the UO is < 30ml/hr

A client feels the "urge" to void when the bladder has approximately 250-300 ml of urine in it

5. ADH (Anti-diuretic Hormone):

-Normally makes you retain or diurese?

-Retain? _____

2 ADH Problems	
Too Much	**Not Enough**
Retain	Lose (diurese)
Fluid Volume _____	Fluid Volume _____
SIADH Syndrome of Inappropriate ADH Secretion (TOO MANY _____ TOO MUCH _____)	DI Diabetes Insipidus
Urine	Urine
Blood	Blood

*Concentrated makes #'s go up
*Dilute makes #'s go down
} Urine specific gravity, sodium, and hematocrit

ADH lives in pituitary; key words to make you think potential ADH problem: craniotomy, head injury, sinus surgery, transphenoidal hypophysectomy or any condition that could lead to increased ICP there is a risk of an ADH problem.

Trans-_____, sphenoid_____, hypophysis_____,ectomy_____

*Another name for anti-diuretic hormone (ADH) is Vasopressin (Pitressin®). The drug Vasopressin (Pitressin®) or Desmopressin Acetate (DDAVP®) may be utilized as an ADH replacement in diabetes insipidus.

B. S/S:

-Distended neck veins/peripheral veins: vessels are_____

-Peripheral edema, third spacing: vessels can't hold anymore so they start to _____

-CVP: measured where _____; number goes_____
More_____....More_____

CVP:
Central Venous Pressure
Normal: 2-6 mmHg

*CVP checked per MD orders… usually every 4 hours

The ideal location of the catheter tip is within the superior vena cava (SVC), so that it is close, but not inside, the right atrium. It reflects pressure readings in the right atrium.

-Lung sounds:

-Polyuria: kidneys trying to help you_____

-Pulse: _____; your heart only wants fluid to go_____

-If the fluid doesn't go forward it's going to go_____into the_____

-BP: _____ move volume.....more_____

-Weight: _____ any acute gain or loss isn't fat-it's fluid

C. Tx :

Fluid Retention… Think heart problems FIRST

-Low Na diet

-Diuretics:

-Loop: Example: _____
-Bumetanide (Bumex®) may be given when Furosemide (Lasix®) doesn't work.

-Hydrochlorothiazide (Thiazide®)

-Watch lab work with all diuretics
-Dehydration and electrolyte problems

-K+ sparing: Example: _____

-Bed rest induces_____
-in general, when you are supine you perfuse your kidneys more because you have more cardiac output

-Physical Assessment

-Give IVF's slowly to elderly

TESTING STRATEGY
ANYTIME YOU SEE ASSESSMENT OR EVALUATION ON THE NCLEX®, YOU SHOULD BE LOOKING FOR THE PRESENCE OR ABSENCE OF THE PERTINENT SIGNS AND SYMPTOMS

II. FLUID VOLUME DEFICIT: HYPOVOLEMIA

Big Time Deficit=Shock

A. Causes:

1. **Loss of fluids from anywhere**
   Examples: Thoracentesis, paracentesis, vomiting, diarrhea, hemorrhage

2. **Third spacing** (Definition: When fluid is in a place that does you no good)

   -burns

   -ascites

3. **Diseases with polyuria**

   -Polyuria → Oliguria → Anuria

Polyuria-usually the client will have a total urinary output of over 2000ml in 24 hours
Oliguria-total urinary output between 100 ml and 400ml in 24 hours
Anuria-Total urinary output of less than 100 ml in 24 hours

B. S/S:

-Weight

-Decreased skin turgor

-Dry mucous membranes

-Decreased Urine Output
-kidneys either aren't being_____ or they are trying to _____

-BP? _____ (less_____, less_____)

-Pulse? _____, heart is trying to pump what little is left around

-CVP? _____ (less volume, less _____)

-Peripheral Veins/Neck veins

-Cool Extremities (peripheral _____in an effort to shunt blood to _____ _____)

-Urine Specific Gravity _____, if putting out any urine at all it will be _____

C. Tx:

-Mild Deficit:

-Severe Deficit:

III. Quickie IV Fluid Lecture

A. Isotonic Solutions: Go in the vascular space and stays there!

-Examples of isotonic solutions: _____, _____, _____

> Although D5W is considered an isotonic solution due to the osmolarity… it is not used often for clients that need a large amount of vascular volume replaced. This is because when D5W is initially administered it is isotonic; however, it does metabolize into free water and is no longer isotonic. An example of when this solution is used is when a patient has hypernatremia.

B. Hypotonic Solutions: Go in the vascular space, hang out a little while and rehydrate, but they do not stay in the vascular space.....If they stayed in the vascular space they wouldn't be hypotonic.....they would be _____. These solutions go in and hang out and rehydrate, then they move into the cell and the cell burns the remainder up in cellular metabolism. They are hydrating solutions, but they won't drive your pressure up because they do not stay in the vascular space.

-Hypotonic Solution:

- Causes a fluid shift from the vascular space into the cells. A solution that will cause water to enter the cell, which could induce swelling or lysis of the cell.
- Examples: D2.5 W, ½ NaCl, 0.33% NaCl, tap water

C. Hypertonic Solutions:

- Volume expander and solution that draws fluids into the vascular space. Draws water out of the cell.
- Examples: $D_{10}W$, 3% NaCl, 5% NaCl, D_5 LR, D5 ½ Na, D_5 NaCl, TPN, Albumin.

Quick Tips for IV Solutions

Isotonic Solutions
"Stay where **I** put it!"

Hyp**o**tonic Solutions
"Go **O**ut of the vessel"

Hyp**e**rtonic Solutions
"**E**nter the Vessel"

Normal Lab Values
Mg: 1.2-2.1 mEq/L
Calcium: 9.0-10.5 mg/dl

IV. MAGNESIUM AND CALCIUM

Fact: Magnesium is excreted by **kidneys** and it can be lost other ways, too (GI tract)

Hypermagnesemia

A. Causes:
-Renal Failure

-Antacids

B. S/S:

-Flushing
-Warmth
-Mg makes you_____

C. Tx:
-Ventilator

-Dialysis

-Calcium gluconate
*Calcium gluconate inactivates magnesium- they inactivate each other

**Calcium gluconate is administered IVP very slowly (Max rate: 1.5-2 ml/min)

Hypercalcemia

A. Causes:
-Hyperparathyroidism: too much

-Thiazides (retain _____)

-Immobilization (you have to bear weight to keep Ca in the _____).

B. S/S:

-bones are brittle
-kidney stones
*majority made of calcium

C. Tx:
-Move!

-Fluids!

-Phospho Soda® & Fleets® Enema
-both have phosphorous
-Ca has inverse relationship with _____.
-When you drive Phos up, Ca goes _____.

-Steroids

-Add what to diet?

-Safety Precautions

-Must have Vitamin ___ to use Ca.

-Calcitonin _____ serum Ca

S/S
DTR's
Muscle Tone
Arrhythmias
LOC
Pulse
Respirations

When your serum calcium gets low parathormone (PTH) kicks in and pulls Ca from the _____ and puts in the blood....therefore, the serum calcium goes ___.

HINT: If you want to get Mg & Ca questions right, think muscles 1st.

* the signs and symptoms listed above in the box are common in a client with hypermagnesemia and hypercalcemia*

Normal Lab Values
Mg: 1.2-2.1 mEq/L
Calcium: 9.0-10.5 mg/dl

Hypomagnesemia

A. Causes:
- -Diarrhea - lots of Mg in intestines
- -Alcoholism
- -alcohol suppresses ADH & it's hypertonic
- -not eating
- -drinking

Hypocalcemia

A. Causes:
- -Hypoparathyroidism
- -Radical Neck
- -Thyroidectomy

} Not Enough _____.

HINT: If you want to get Mg & Ca questions right, think muscles 1st.

B. S/S:

Muscle Tone

Could my client have a seizure? _____

Stridor/laryngospasm - airway is a _____

+Chvostek's - tap cheek ("C" is for Cheek)

+Trousseau's - pump up BP cuff

Arrhythmias - heart is a _____

DTR's

Mind Changes

Swallowing Probs - esophagus is a _____

these signs and symptoms are common in a client with hypomagnesium or hypocalcemia

C. Tx:
- -Give some Mg
- -Check _____function (before and during IV Mg)
- -NCLEX® scenario answers:
  - A. call the doctor
  - B. decrease the infusion
  - C. Stop the infusion
  - D. Reassess in 15 min.
- -Seizure Precautions
- -Eat Magnesium

C. Tx:
- -Vit D
- -Sevelamer hydrochloride (Renagel®)
- -Calcium Acetate (PhosLo ®)
- -Calcium Carbonate (Os-Cal ®)

Aluminum Hydroxide Gel (Amphojel ®) is another phosphorus binding drug that is used however; don't give it to renal clients because they can't get rid of the aluminum and will get TOXIC!

- -IV Ca (GIVE SLOWLY)

Always make sure client is on a _____ _____

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

What do you do if your client begins to c/o flushing and sweating when you start IV Mg?

Normal Lab Values
Sodium: 135-145 mEq/L

V. SODIUM

Your Na level in your blood is totally dependent on how much **water** you have in your body.

Hypernatremia=Dehydration

Too much Na; not enough water

A. Causes:

-hyperventilation

-heat stroke

-DI

B. S/S:

-Dry mouth

-Thirsty - already dehydrated by the time you're thirsty

-Swollen tongue

C. Tx:

-Restrict _____.

-Dilute client with IV fluids

-Diluting makes serum Na go _____

-Daily weights
-I & O

} If you've got a Na problem you've got a _____ problem.

-Lab work

Case in Point: Feeding tube clients - tend to get _____

Hyponatremia=Dilution

Too much water; not enough Na

A. Causes:

-vomiting or sweating then drinking H_2O for fluid replacement
-this only replaces the water and dilutes the blood

-psychogenic polydypsia
-loves to drink _____

-D_5W (sugar & water)

-SIADH

B. S/S:

-headache

-seizure

-coma

Neuro changes

Brain doesn't like it when Na's messed up

this sign and symptom is common in a client with hypernatremia or hyponatremia

C. Tx:

-Client needs_____

-Client doesn't need _____.

-If having neuro probs: needs hypertonic saline
-means "packed with particles"

-3% NS or 5% NS

Normal Lab Values
Potassium: 3.5-5.0 mEq/L

VI. POTASSIUM

-Excreted by **kidneys**

-Kidneys not working well, the serum potassium will go _____

Hyperkalemia

A. Causes:
-kidney troubles

-aldactone - makes you retain _____.

B. S/S:
-Begins with muscle twitching
-Then proceeds to weakness,
-Then flaccid paralysis

C. Tx:
-Dialysis - Kidneys aren't working

-Calcium gluconate
decreases _____

-Glucose and insulin
-Insulin carries _____ & _____
into the cell
-Any time you give IV insulin worry about
_____&_____

-Sodium Polystyrene Sulfonate (Kayexalate®)
-given for hyperkalemia
-exchanges Na for K+ in the GI tract

Hypokalemia

A. Causes:
-vomiting

We have lots of K+ in our stomach

-NG suction

-diuretics

-not eating

B. S/S:
-Muscle Cramps & weakness

Life- Threatening Arrhythmias

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

C. Tx:
-Give K+!

-Aldactone

-Eat K+ (See box at bottom of pg)

Sodium and Potassium have an
_____
relationship

Foods high in potassium: spinach, fennel, kale, mustard greens, Brussel 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.

D. Miscellaneous Information:

-Major problem with PO K+?

-Assess UO before/during IV K+.

-Always put IV K+ on a _____.

-Mix well!

-Never give IV K+ _____!

-Burns during infusion?

-Is it okay to add to a bag that's already up and running?

Be sure not to confuse potassium (K+) with Vitamin K…