Fluid Resuscitation

Pea Ridge Fire Department

EMS refresher

Ensuring Safe Medication Administration

- Ensure medications are administered accurately and safely.
  - Use standing orders or online medical direction.
  - Avoid human factors that cause errors.
  - Follow the 10 rights of medication administration.

Ensuring Safe Medication Administration

- Use a tool to verify:
  - Dose
  - Drug name
  - Route
  - Rate of administration
  - Indication for administration
  - Contraindications
  - Drug concentration
  - Volume to be administered

Ensuring Safe Medication Administration

- Document:
  - Dose administered
  - Name of medication
  - Route
  - Rate
  - Time of administration
  - Who administered the drug
  - Patient’s response

Body Fluid Composition

- The human body is composed mostly of water.
  - Provides environment necessary for life
  - Body maintains balance between intake and output of fluids and electrolytes.
    - Injured or ill body may be unable to maintain homeostasis.

Abnormal States of Fluid and Electrolyte Balance

- Dehydration
  - Inadequate total systemic fluid volume
  - Signs and symptoms:
    - Decreased level of consciousness
    - Postural hypotension
    - Tachypnea
    - Dry mucous membranes
    - Decreased urine output
    - Tachycardia
    - Poor skin turgor
    - Flushed, dry skin

Abnormal States of Fluid and Electrolyte Balance

- Dehydration (cont'd)
  - Causes:
    - Diarrhea
    - Vomiting
    - Gastrointestinal drainage
    - Infections
    - Metabolic disorders
    - Hemorrhage
    - Environmental emergencies
    - High-caffeine diet
    - Insufficient fluid intake

Abnormal States of Fluid and Electrolyte Balance

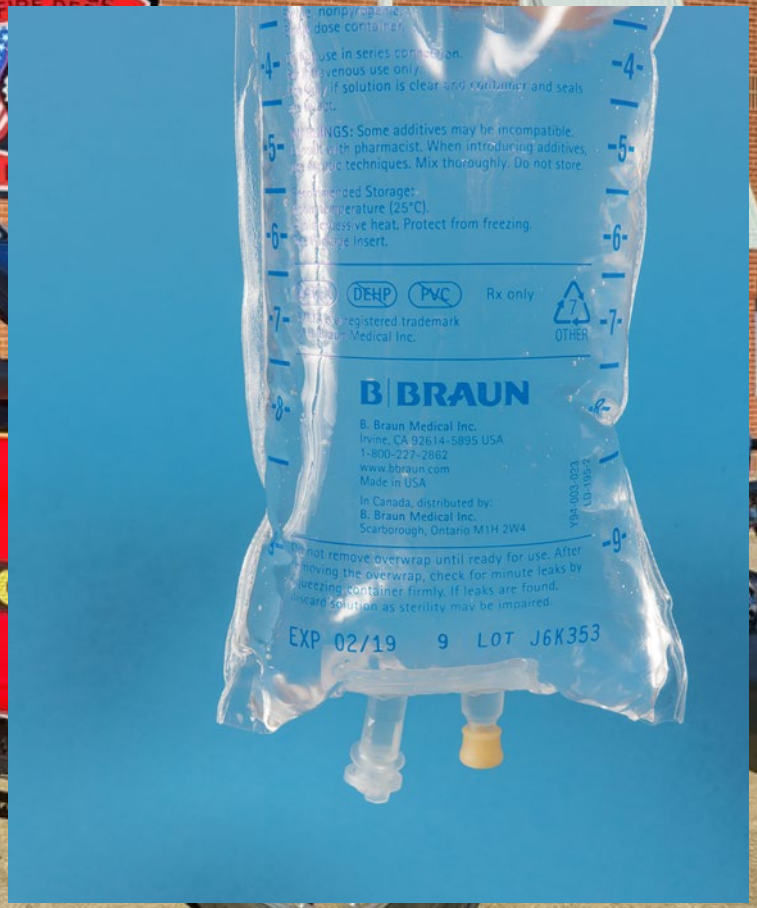
- Overhydration
  - Occurs when the body's systemic fluid volume increases.

Abnormal States of Fluid and Electrolyte Balance

- Overhydration
  - Signs and symptoms:
    - Shortness of breath
    - Puffy eyelids, edema
    - Polyuria
    - Moist crackles (rales)
    - Acute weight gain
  - Causes:
    - Unmonitored IVs (pediatrics)
    - Kidney failure
    - Water intoxication in endurance sports
    - Prolonged hypoventilation

IV Fluid Composition

- Each bag of IV solution is individually sterilized.
  - Altering IV concentration can move water into or out of fluid compartment.



IV Fluid Composition

- Operation of electrolytes
  - A patient's electrolytes can become altered from:
    - Excessive vomiting
    - Diarrhea
    - Dietary issues
    - Medications
    - Blood loss, or a variety of other injuries

Types of IV Solutions

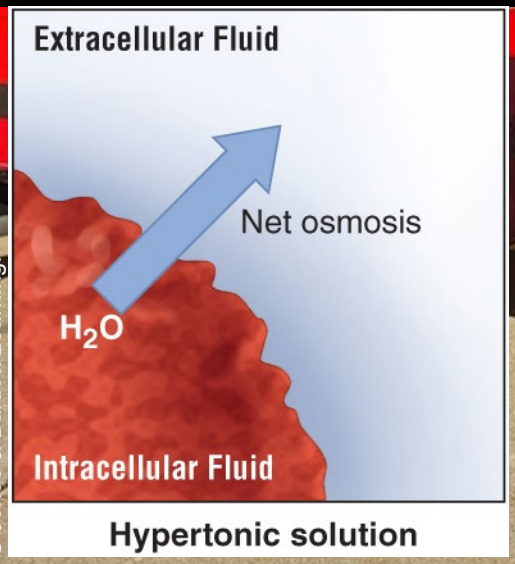
- Crystalloid solutions
  - Dissolved crystals in water
  - Can cross membranes and alter fluid levels
  - 3-to-1 replacement rule
  - Cannot carry oxygen
  - Boluses should be given to maintain perfusion, not to raise blood pressure.

Types of IV Solutions

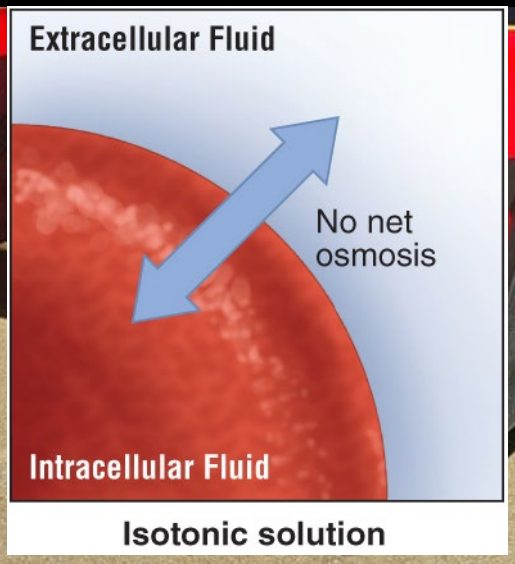
- Colloid solutions
  - Contain molecules that are too large to pass out of capillary membranes
  - Molecules remain in the vascular compartment.
  - High osmolarity
  - Could cause dramatic fluid shifts
  - Short duration of action

Types of IV Solutions

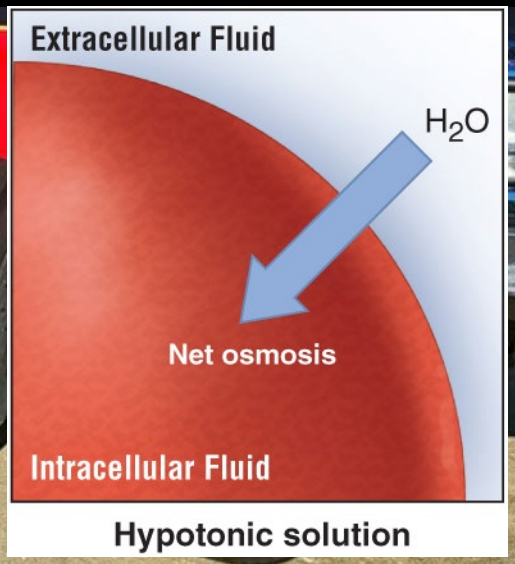
- IV solutions are categorized by their tonicity.
  - Isotonic
  - Hypertonic
  - Hypotonic



Hypertonic solution



Isotonic solution



Hypotonic solution

Types of IV Solutions

- Isotonic solutions
  - Examples:
    - Lactated Ringer's (LR) solution
    - D_5W, 5% dextrose in water

Types of IV Solutions

- Hypotonic solutions
  - Hydrate the cells while depleting the vascular compartment
  - Can cause sudden fluid shift from intravascular space to the cells

Types of IV Solutions

- Hypertonic solution
  - Pulls fluid from intracellular and intestinal compartments to intravascular compartment
  - Help stabilize blood pressure, increase urine output, and reduce edema
  - Careful monitoring to avoid fluid overloading

Types of IV Solutions

- Oxygen-carrying solutions
  - Whole blood is the best replacement for lost blood.
  - Synthetic blood substitutes are being researched.

Techniques and Administration

- IV therapy involves cannulation of a vein with a catheter.
  - Peripheral vein cannulation involves cannulating veins of the periphery.
  - Keep the IV equipment sterile!

Techniques and Administration

- Assembling your equipment
  - Gather and prepare in advance
    - Elastic tourniquet
    - Cleaning wipe or solution
    - Gauze
    - Tape or adhesive bandage
    - Appropriate size IV catheter
    - IV administration set

Techniques and Administration

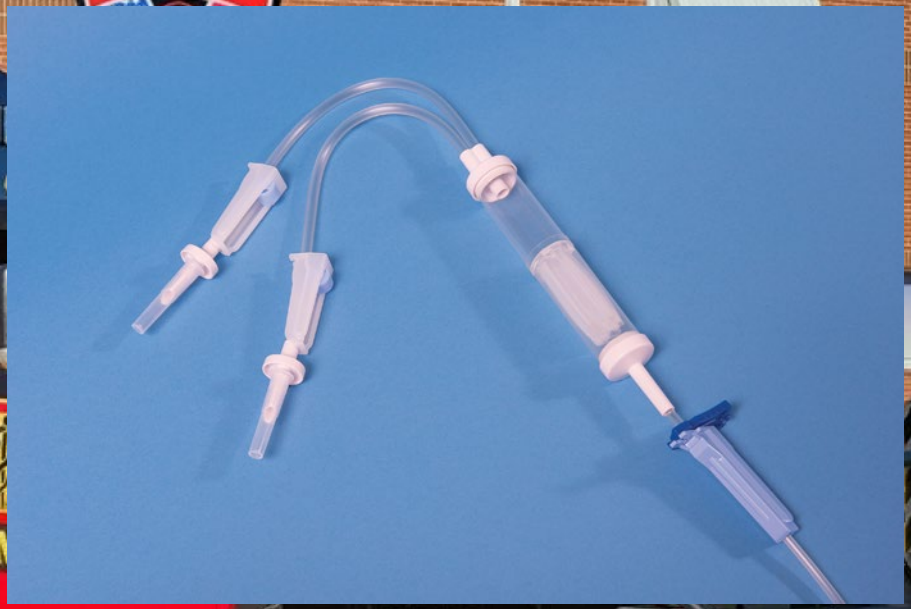
- Choosing an IV solution
  - Usually limited to normal saline and LR solution
  - IV solution bags must be used within 24 hours once opened.
  - IV bags come in different fluid volumes.

Techniques and Administration

- Choosing an administration set
  - Must be used once piercing spike is exposed
  - Two sizes
    - Microdrip set: 60 gtt/mL
    - Macrodrip set: 10 or 15 gtt/mL

Techniques and Administration

- Preparing an administration set
  - Verify the expiration date and check the solution.
- Other administration sets
  - Blood tubing
  - Volutrol

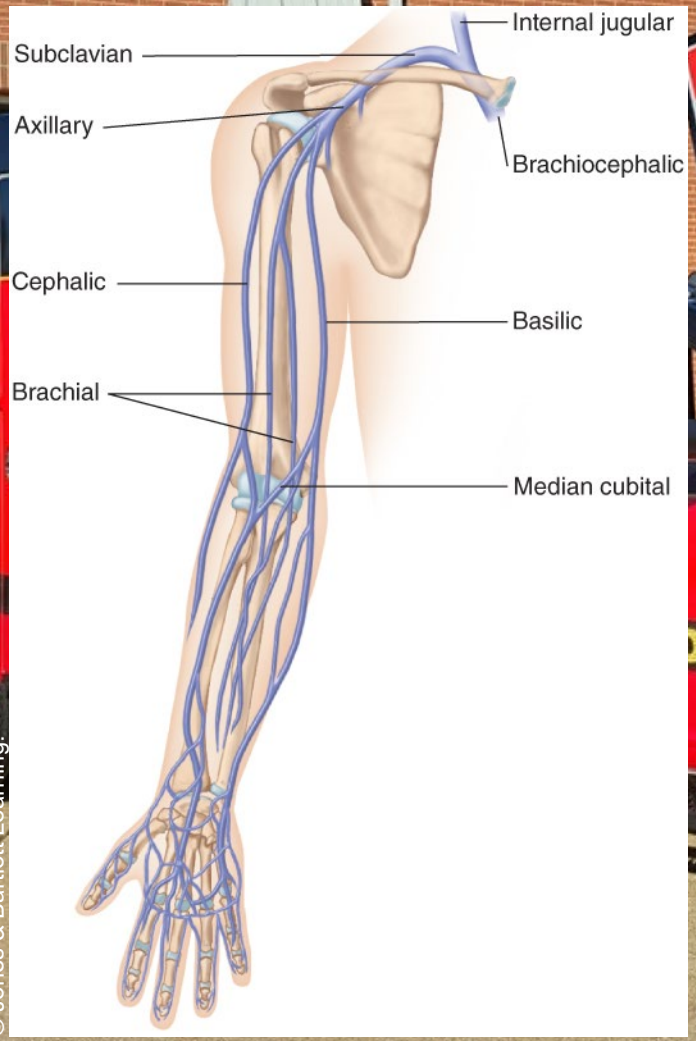


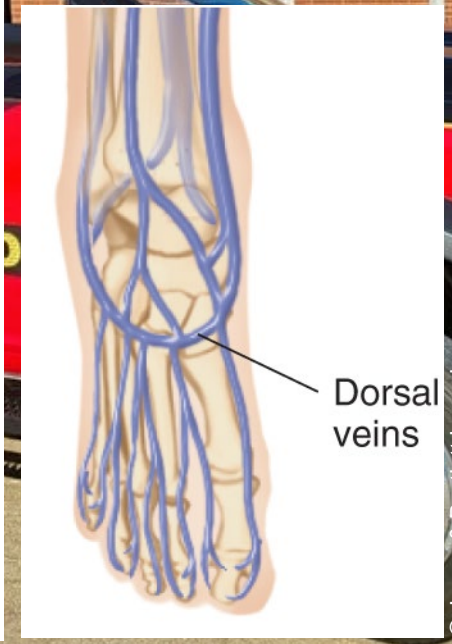
Techniques and Administration

- Choosing an IV site
  - Avoid areas that contain valves and bifurcations.
  - Locate vein that looks straightest, firm, round, and springs when palpated.
  - Limit IV access to distal areas of extremities.

Courtesy of Rhonda Hunt.

Techniques and Administration





Medication Administration

- Understand how medications affect the human body before administering them.
  - Become familiar with:
    - Mechanism of action
    - Indications
    - Contraindications
    - Side effects
    - Routes of administration
    - Pediatric and adult doses
    - Antidotes

Mathematical Principles Used in Pharmacology

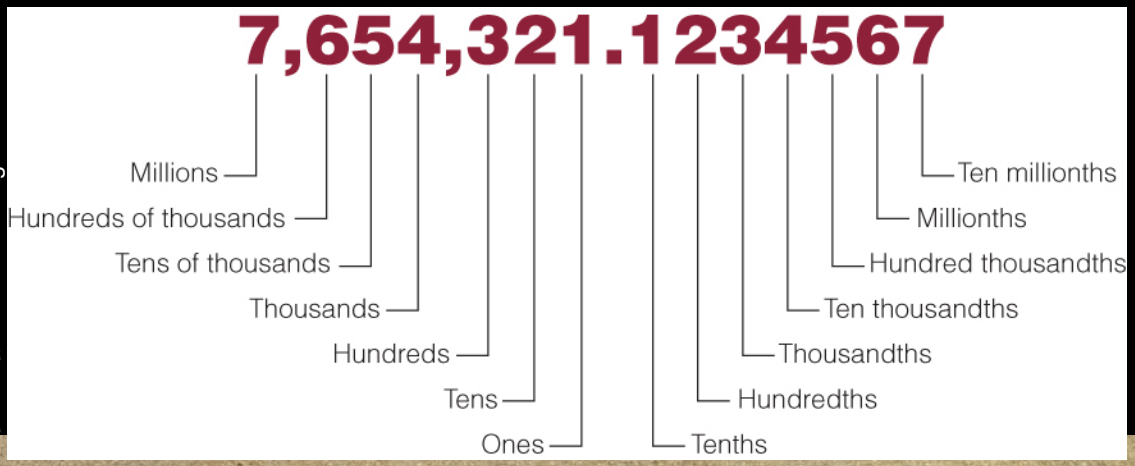
- Mathematics review
  - Fractions represent a portion of a whole number.
  - Decimals distinguish numbers that are greater than zero from numbers that are smaller than zero.

Mathematical Principles Used in Pharmacology

- Mathematics review (cont'd)
  - Dividing or multiplying by 10:
    - When dividing, move decimal point to the left.
    - When multiplying, move decimal point to the right.
  - Percentages are part of 100 and use the % symbol.

Mathematical Principles Used in Pharmacology

- The metric system
  - Based on multiples of ten
  - Measures length, volume, weight
    - Meter (m): Length
    - Liter (L): Volume
    - Gram (g): Weight



Mathematical Principles Used in Pharmacology

- The metric system (cont'd)
  - Prefixes demonstrate the fraction of the base being used.

Table 14-5 Units of Measurement

Volume		Numeric Value	Concentration	
Abbreviation	Unit		Abbreviation	Unit
kL	Kiloliter	1,000	kg	Kilogram
L	Liter	1	g	Gram
mL	Milliliter	0.001	mg	Milligram
mcL	Microliter	0.000001	mcg	Microgram

Table 14-6 Symbols Used in the Metric System

Unit	Symbol
Weight (smallest to largest)	
Microgram	mcg
Milligram	mg
Gram	g (or gm)
Kilogram	kg
Volume (smallest to largest)	
Milliliter	mL
Deciliter	dL
Liter	L

Mathematical Principles Used in Pharmacology

- Drugs are supplied and packaged in a variety of weights and volumes.
  - You will be required to convert weights to volumes and vice versa

Table 14-7 Metric Units

Unit	Equivalent
Weight (smallest to largest)	
1 mcg	0.001 mg
1 mg	1,000 mcg
1 g	1,000 mg
1 kg	1,000 g
Volume (smallest to largest)	
1 mL	1 cc*
100 mL	1 dL
1,000 mL	1 L

*Cubic centimeters (cc) is a unit also used to represent milliliters (mL); therefore, 1 cc is the same as 1 mL (1 cc = 1 mL).

Mathematical Principles Used in Pharmacology

- Volume conversion
  - Prehospital setting uses two measurements of volume: Milliliters and liters.
    - mL to L: Divide smaller volume by 1,000
    - L to mL: Multiply L by 1,000

Mathematical Principles Used in Pharmacology

- Weight conversion
  - Large unit to small: Multiply large by 1,000
  - Small unit to large: Divide large by 1,000

Mathematical Principles Used in Pharmacology

- Converting pounds to kilograms
  - Two formulas:
    - Divide the patient's weight in pounds by 2.2.
    - Divide the patient's weight in pounds by 2 and subtract 10% of that number.

Mathematical Principles Used in Pharmacology

- Temperature conversion
  - To convert Fahrenheit to Celsius:
    - Subtract 32 then multiply by 0.555 (5/9).
  - To convert Celsius to Fahrenheit:
    - Multiply by 1.8 (9/5) then add 32.

Calculating Medication Doses

- Desired dose: Amount of drug ordered by the physician
  - Expressed as standard dose or specific number of micrograms, milligrams, or grams

Calculating Medication Doses

- Drug concentrations: Total weight of the drug contained in a specific amount of volume
  - Volume on hand: Volume of solution that the drug is contained in
  - Weight of drug present in 1 mL = concentration

Calculating Medication Doses

- Volume to be administered
  - Desired dose (mg)/Concentration of drug on hand (mg/mL) = Volume to be administered

Weight-Based Drugs

- Medication doses are based on patient's weight in kilograms.
- Add one step to the formula: Convert the patient's weight in pounds to kilograms

Calculating Fluid Infusion Rates

- Adjust flow rate based on patient's condition
  - To calculate the flow rate:

$$\frac{\text{Volume to be infused} \times \frac{\text{gtt}}{\text{mL}} \text{ of administration set}}{\text{total time of infusion in minutes}} = \text{gtt/min}$$

Calculating the Dose and Rate for a Medication Infusion

- Non-weight-based medication infusion
  - Use the same formula to calculate a drug dose.
  - Then calculate the desired dose to be administered continuously:

$$\frac{\text{mL per minute} \times \text{drops per milliliter}}{\text{total times in minutes}} = \text{continuous infustion rate}$$

Calculating the Dose and Rate for a Medication Infusion

- Weight-based medication infusions
  - Use the previously discussed formula.
    - Factor in the patient's weight in kilograms

IV Bolus Medication Administration

- Drugs go directly into the circulatory system.
  - Direct injection of drugs with a needle and syringe into IV line
    - Needleless systems now available.
  - A bolus is a single dose given by the IV route.
    - Small or large quantity of a drug
    - Delivered rapidly or slowly

IV Bolus Medication Administration

- To administer medication through a saline lock:
  - Determine the need for the medication.
  - Obtain a history.
  - Follow standing orders/contact medical control.
  - Check the medication.
  - Explain the procedure to the patient.

IV Bolus Medication Administration

- To administer medication through a saline lock (cont'd):
  - Assemble equipment and draw up medication.
  - Cleanse the injection port or remove the cap.
  - Insert the needle into the port or screw the syringe onto the port.
  - Pull back on the plunger and observe for blood.
  - Place needle and syringe into a sharps container.

IV Bolus Medication Administration

- To administer medication through a saline lock (cont'd):
  - Clean the port; insert the needle with the flush.
  - Flush and place needle in sharps container.
  - Store any unused medication properly.
  - Monitor the patient and document findings.

IV Bolus Medication Administration

- Adding medication to IV bag
  - Check fluid in the IV bag.
  - Check name and concentration.
  - Compute volume to be added, and draw up in syringe.
  - Cleanse the injection port.
  - Inject medication.
  - Withdraw and dispose of needle

IV Bolus Medication Administration

- Adding medication to IV bag (cont'd)
  - Agitate bag.
  - Label the IV bag with the:
    - Name of the medication added
    - Amount added
    - Concentration in the IV bag
    - Date and time
    - Your name
  - Attach IV administration set and prepare bag.

Thank you

Please continue to the next section