Intravenous Solutions and Equipment
Intravenous Solutions and Equipment: Objectives

After reviewing this chapter, you should be able to:

1. Identify common IV (intravenous) solutions and abbreviations.
2. Calculate the amount of specific components in IV solutions.
3. Define the following terms associated with IV therapy: peripheral line, central line, primary line, secondary line, saline/heparin locks, IV piggyback (IVPB), and IV push.
Intravenous Solutions and Equipment: Objectives (Cont.)

4. Differentiate among various devices used to administer IV solutions such as PCA (patient-controlled anesthesia) pumps, syringe pumps, and volumetric pumps.

5. Identify best practices that prevent IV administration errors and ensure client safety.

6. Identify how technology related to IV therapy can enhance client safety.
Background: Intravenous Fluids

- IV therapy—fluids, blood, and blood products, nutrients, as well as medications administered via a vein
- RAPID acting
- Replacement fluids:
  - Vomiting, diarrhea, or hemorrhage
- Maintenance fluids:
  - Sustain normal levels of fluids and electrolytes
Background: Intravenous Fluids (Cont.)

SAFETY ALERT!

Nurse is responsible for administering IVF to the correct client at the right rate and monitoring response. Too rapid an infusion or inappropriate infusions can result in reactions that range from mild to fatal!
IV Delivery Methods

- Continuous IV Infusions
  - Replace/maintain fluids and electrolytes
  - Flows continuously until changed

- Intermittent IV Infusions
  - Use IV piggy back (IVPB) or IV push (IVP)
  - Administer medications and supplemental fluids
  - Intermittent peripheral infusion devices (saline/heparin locks) maintain venous access without the need for continuous infusion
IV Fluids Solution Strength

- Several types
- Bottles and bags (bags most common)
- Highly individualized
- Abbreviations used to write orders; letters indicate compounds, numbers indicate strength
  - NS = Normal saline
  - D5W = Dextrose 5% in water
  - RL or LR = Ringer lactate or lactated Ringer solution
  - KCl = Potassium chloride additive—in mEq per L
### BOX 21-1 Abbreviations for Common IV Solutions

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>NS</td>
<td>Sodium chloride 0.9%</td>
</tr>
<tr>
<td>$\frac{1}{2}$ NS</td>
<td>Sodium chloride 0.45%</td>
</tr>
<tr>
<td>D5W or 5% D/W</td>
<td>Dextrose 5% in water</td>
</tr>
<tr>
<td>D5RL</td>
<td>Dextrose 5% and lactated Ringer (Ringer lactate)</td>
</tr>
<tr>
<td>RL or RLS</td>
<td>Lactated Ringer solution (electrolytes)</td>
</tr>
<tr>
<td>D5NS</td>
<td>Dextrose 5% in sodium chloride</td>
</tr>
<tr>
<td>D5 and $\frac{1}{2}$ NS (0.45%)</td>
<td>Dextrose 5% in 0.45% sodium chloride</td>
</tr>
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**Note:** IV bags are labeled as sodium chloride but frequently referred to as normal saline (NS).
Figure 21-2 Lactated Ringer’s and 5% dextrose (D5LR).
D5 ½ NS

Figure 21-3 5% Dextrose in 0.9% sodium chloride.
Documentation of IV Fluids

- Charted on Intake and Output (I&O), and in some facilities on medication record (MAR) or electronic record

![Sample of charting IV fluids on I&O record.](image)

**Figure 21-8** Sample of charting IV fluids on I&O record.
IV Orders

Prescriber orders must specify:
1. Name of the IV solution
2. Name of the medication to be added (if any)
3. Amount (volume) to be administered
4. Time period during which the IV is to infuse
IV Solution Additives

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When adding potassium to an IV:

- Check compatibility and dilute well
- Monitor client during infusion because rapid infusion of potassium can cause DEATH
- Check IV site frequently. Medication is irritating
- Administer using an infusion control device
- NEVER administer via IV push
- DO NOT add potassium to an IV bag that is already infusing
Calculating Percentage of Solute in IV Fluids

- Solution strength in percentage = grams of solute in 100 mL of fluid
- Example: D5W or 5% dextrose in water = 5 g dextrose per 100 mL

**Problem 1**
- How many grams of dextrose in 500 mL of D5W?

**Problem 2**
- How many grams of NaCl are in 1,000 mL of NS?
Problem 1: Ratio and Proportion

\[
\frac{5 \text{ g}}{100 \text{ mL}} = \frac{x \text{ g}}{500 \text{ mL}}
\]

\[
\frac{100x}{100} = \frac{500(5)}{100}
\]

\[
x = 25 \text{ g}
\]
Problem 2: Dimensional Analysis

\[ x \text{ g} = \frac{0.9 \text{ g}}{100 \text{ mL}} \times \frac{1,000 \text{ mL}}{1} \]

\[ x = 9 \text{ g NaCl} \]
Mr. Flint is a 63-year-old male who presents to the emergency department with chest pain and shortness of breath on exertion. His vital signs are stable at this time. The physician on duty orders an electrocardiogram, 1 L NS IV to run at 100 mL/hr, lab work, and cardiac monitoring. You know that in 3 hours, 300 mL will have infused. How many mg NaCl will be left in the bag?
Case Study 5 (Cont.)

Answer:

6,300 mg NaCl left in 700 mL
Intravenous nutritional support
  - Peripheral or central line (subclavian or PICC)
- Glucose, amino acids, fats, vitamins, and minerals
  - Called TPN (total parenteral nutrition)
- Solutions greater than 4% must be given via central line
  - Hypertonicity of higher concentrations causes phlebitis
- Always adhere to facility protocols
Administration of Blood and Blood Products

- Refer to nursing reference books for protocols governing infusion
- Flow rates and infusion time are applicable
- Commonly infused via “Y” blood set with specified drop factor
  - One spike to blood
  - One spike to NS
- Tubing has an in-line filter
Figure 21-9 Setup for blood administration. (From Harkreader H, Hogan MA: Fundamentals of nursing: caring and clinical judgment, ed 3, St. Louis, 2007, Saunders.)
Administration of IV Fluids

- Sterile IV solution
  - Injection port on bag

- Sterile IV administration set
  - Drip chamber with specific drop size (varies) and injection spike
  - Tubing with injection ports
  - Roll clamp or pump adapter
  - Needle adapter end for connection to cannulation device
Figure 21-10 Intravenous infusion set. (From Clayton BD, Willihnganz M: Basic pharmacology for nurse, ed 16, St Louis, 2013, Mosby.)
IV Sites and Lines

- Sites—peripheral or central
  - Peripherals in hand, forearm, scalp, and rarely leg
  - Central are subclavian, Broviac, Schon, PICC
- Primary line
  - Carries main IV solution; is continuous
  - May have additives such as potassium or vitamins
- Secondary Line
  - Usually connected to primary (variety of systems)
  - Contains solutions of smaller volume with medications
  - Usually intermittent (IVPB)
Figure 21-11 Intermittent IV medication administration can be accomplished with the use of IV piggyback. A, Piggyback. B, Tandem. (From Harkreader H, Hogan MA: Fundamentals of nursing: caring and clinical judgment, ed 3, St. Louis, 2007, Saunders.)
Saline and Heparin Locks

- Intermittent delivery devices in a vein
  - Names: medlock, saline lock, heplocks
- Saline or heparin is injected into port regularly to prevent clotting
- Schedule and type are institution specific
- Administer after infusion of medications in site
SAFETY ALERT!

Heparin is a high-alert medication that comes in many dosage strengths. The concentration for a heparin lock flush is 10 units per mL or 100 units per mL. The average heparin flush dosage is 10 units and never exceeds 100 units. Always check the concentration carefully.
Figure 21-16 A, Needless infusion system. B, Connection into an injection port. (From Potter PA, Perry AG, Stockert P, Hall A: Fundamentals of nursing, ed 8, St Louis, 2013, Mosby.)
Electronic Devices

- Machine-specific tubing—diverse functions!
- Electronic volumetric pumps
  - Infuse fluids in vein under pressure
  - Deliver mL per hour
- Syringe pumps
  - Deliver medications or fluids via a syringe
  - Used in pediatrics, obstetrics, and intensive care
Electronic Devices

- Patient-controlled analgesia
  - Allows self-administration of pain medication and/or a continuous “basal” rate of medication

- “Smart” pumps
  - Programmable pumps with safety features to help prevent med errors
  - Customized software with reference library of medications
  - Safe range of infusion rates
Figure 21-17 A, Dual-channel infusion pump. B, Alaris® System. (A, From Potter PA, Perry AG, Stockert PA, Hall A: Fundamentals of nursing, ed 8, St Louis, 2013, Mosby. B, From CareFusion.)
Case Study 5

A 20-gauge IV is placed in Mr. Flint’s right forearm. You prime the tubing and begin to infuse the NS at the prescribed rate using an IV pump. This IV is a:

a) Central line
b) Secondary line
c) Peripheral line
Case Study 5 (Cont.)

Answer:

c) Peripheral line