Chapter 11

Parenteral Dosage of Drugs
Parenteral

• Route of administration other than gastrointestinal
  – Intramuscular (IM)
  – Subcutaneous (SC)
  – Intradermal (ID)
  – IV
Parenteral

- Most medications prepared in liquid form and packaged in dose vials
  - Ampules or prefilled syringes
- Injectable drugs measured in syringes
Injectable Solutions

- **IM maximum dosage:**
  - Average 150 lb adult = 3 mL
    - Maximum for deltoid site = 2 mL
  - Children age 6 to 12 years = 2 mL
  - Children birth to age 5 years = 1 mL
Solving Parenteral Dosage Problems

• Apply same three steps used when calculating oral dosages
Remember

1. Convert
   – All units of measurement must be in same system and all units must be in same size

2. Think
   – Estimate logical amount
Remember

3. Calculate
   - Set up ratio between dosage on hand and desired dosage

\[
\frac{\text{Dosage on hand}}{\text{Amount on hand}} = \frac{\text{Dosage desired}}{X \text{ Amount desired}}
\]
Rules

• Parenteral dosages
  – Round amount to be administered to tenths if amount greater than 1 mL
    • Measure in 3 mL syringe
  – Measure amounts less than 1 mL rounded to hundredths and all amounts less than 0.5 mL in 1 mL syringe
Rules

• Parenteral dosages
  – Amounts of 0.5 mL to 1 mL calculated in tenths can be accurately measured in either 1 mL or 3 mL syringe
Example One

- Order: Cleocin 150 mg IM every 12 h
- Available: Cleocin 300 mg per 2 mL
- How many mL are needed for each dose?
Example One

1. Convert
   - No conversion necessary

2. Think
   - Estimate giving less than 2 mL
     • Actually want to give 150 mg, which is half of 300 mg and half of 2 mL, or 1 mL
   - Calculate to double-check estimate
Example One

3. Calculate

\[
\frac{\text{Dosage on hand}}{\text{Amount on hand}} = \frac{\text{Dosage desired}}{\text{X Amount desired}}
\]
Example One

3. Calculate

Cross-multiply

\[
\frac{300 \text{ mg}}{2 \text{ mL}} \times \frac{150 \text{ mg}}{X \text{ mL}}
\]

\[
300 \times X = 150 \times 2
\]

Simplify

\[
\frac{300 \times X}{300} = \frac{300}{300}
\]

\[
X = 1 \text{ mL}
\]
Example One

• 1 mL needs to be given intramuscularly every 12 hours
• Select 3 mL syringe
• Measure 1 mL of Cleocin 300 mg per 2 mL from vial
Example Two

• Order: Robinul 150 mcg IM stat
• Available: Robinul 0.2 mg per mL
• How many mL are needed for each dose?
Example Two

1. Convert
   - Equivalent: 1 mg = 1,000 mcg
   - 0.2 mg = 0.200. = 200 mcg
Example Two

2. Think
   - Give less than 1 mL but more than 0.5 mL
     - Avoid being fooled into thinking 0.2 mg is less than 150 mcg
       - 0.2 mg is more than 150 mcg
       - 0.2 mg = 200 mcg
3. Calculate

Cross-multiply $\frac{200 \text{ mcg}}{1 \text{ mL}} \times \frac{150 \text{ mcg}}{X \text{ mL}}$

$200 \times X = 150$

Simplify $\frac{200 \times X}{200} = \frac{150}{200}$

$X = 0.75 \text{ mL}$
Example Two

- 0.75 mL of Robinul needs to be given immediately
- Select 1 mL syringe
- Measure 0.75 mL of Robinul 0.2 mg per mL
- May need to change needles
  - Due to IM injection
Guidelines for Syringe Selection

• Standard doses more than 1 mL
  – Round to tenths and measure in 3 mL syringe
  – 3 mL syringe calibrated to 0.1 mL increments
    • 1.53 mL rounded to 1.5 mL
    • Drawn up in 3 mL syringe
Guidelines for Syringe Selection

- Small (less than 1 mL), critical care, or children’s doses
  - Round to hundredths and measure in 1 mL syringe
  - 1 mL syringe calibrated in 0.01 mL increments
    - 0.257 mL rounded to 0.26 mL
    - Drawn up in 1 mL syringe
Guidelines for Syringe Selection

• Amounts of 0.5 to 1 mL calculated in tenths
  – Can be accurately measured in either 1 mL or 3 mL syringe
Insulin

- Supply dosage of insulin is 100 units per mL
- Abbreviated on label as U-100
- Syringe must also be U-100
Insulin

• Also available as 500 units per mL
  – U-500
  – Used only in special circumstances
  – Use extreme caution when administering
    • Accidental overdose may result in irreversible insulin shock or death

• U-500 insulin syringe not available
  – Use 1 mL syringe
Insulin

• Critical to be accurate
• Nurses must understand and correctly interpret insulin order and label
• Must select correct syringe
## Insulin Action and Times

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting (lispro, aspart, glulisine)</td>
<td>5 to 15 minutes</td>
<td>45 to 75 minutes</td>
<td>2 to 4 hours</td>
</tr>
<tr>
<td>Short-acting (regular)</td>
<td>30 minutes</td>
<td>2 to 4 hours</td>
<td>5 to 8 hours</td>
</tr>
<tr>
<td>Intermediate-acting (NPH)</td>
<td>2 hours</td>
<td>6 to 10 hours</td>
<td>18 to 24 hours</td>
</tr>
<tr>
<td>Long-acting (detemir, glargine)</td>
<td>2 hours</td>
<td>–</td>
<td>Up to 24 hours</td>
</tr>
</tbody>
</table>
Premixed Combination Insulin

• Combination of short-acting and intermediate-acting insulin mixed in one vial
• Read label carefully to understand each type of insulin and concentration included in combination
Interpreting the Insulin Order

• Order must include:
  – Brand-name, generic name, and action time
  – Supply dosage (concentration) and number of units
  – Route of administration and time frequency

• Example:
  – Novolin N NPH U-100 insulin 24 units, SC, 30 minutes before breakfast daily
Insulin Sliding Scale

• **Purpose:**
  – To cover or correct elevation in patient’s blood glucose level

• **Order:**
  – Humulin R U-100 insulin SC based on glucose reading at 1600
## Insulin Sliding Scale

<table>
<thead>
<tr>
<th>Insulin Dose</th>
<th>Glucose Reading*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No coverage</td>
<td>Glucose less than 160</td>
</tr>
<tr>
<td>2 units</td>
<td>160 to 220</td>
</tr>
<tr>
<td>4 units</td>
<td>221 to 280</td>
</tr>
<tr>
<td>6 units</td>
<td>281 to 340</td>
</tr>
<tr>
<td>8 units</td>
<td>341 to 400</td>
</tr>
</tbody>
</table>

*If greater than 400, hold insulin and call MD stat

- If glucose is 250, how many units of Humulin R U-100 insulin should be administered?
Rules for Measuring Insulin in an Insulin Syringe

• Measure U-100 insulin in U-100 insulin syringe only
  – Use U-100 insulin syringes only to measure U-100 insulin
• Measure U-500 insulin in 1 mL syringe
• Two nurses must check insulin dosage before administration to patient
Measuring U-500 Insulin in a 1 mL Syringe

• Order: Humulin R U-500 regular insulin 280 units SC stat
• Available: Humulin R U-500 regular insulin
• How many mL are needed?
Measuring U-500 Insulin in a 1 mL Syringe

1. Convert
   - Recall that U-500 equals 500 units per mL

2. Think
   - There are 500 units in 1 mL
     - 280 units is slightly more than half
   - Estimate giving a little more than 0.5 mL
   - Calculate to determine exact amount
3. Calculate

Cross-multiply: \[
\begin{array}{c}
500 \text{ units} \\
1 \text{ mL}
\end{array} \times \begin{array}{c}
280 \text{ units} \\
X \text{ mL}
\end{array}
\]

\[500 \times X = 280\]

Simplify: \[
\begin{array}{c}
500 \\
500
\end{array} \times \begin{array}{c}
X \\
500
\end{array}
\]

\[X = \frac{280}{500}\]

\[X = 0.56 \text{ mL}\]
Measuring U-500 Insulin in a 1 mL Syringe

- 0.56 mL needs to be given immediately
- Draw up 0.56 mL of Humulin R U-500 regular insulin in 1 mL syringe
Combination Insulin Dosing

• Two types of insulin prescribed to be administered at same time
  – Usually rapid- or short-acting and intermediate-acting insulin ordered for same time
Combination Insulin Dosing

- If compatible, both insulins can be drawn up into same syringe
  - Check manufacturer recommendation
  - Long-acting insulins cannot be mixed in syringe with another insulin
    - E.g., detemir, glargine
Combination Insulin Dosing

• Example order:
  – Novolin N NPH U-100 insulin 40 units and Novolin R U-100 insulin 12 units SC before breakfast daily

• First determine total number of units needed and choose correct insulin syringe
  – 40 + 12 = total of 52 units
  – Need standard U-100 insulin syringe
Preparing Combination Insulin Dose

• Follow clear-to-cloudy rule
  – Draw up clear insulin (regular) first
  – Then draw up cloudy (NPH) insulin
    • Roll vial of cloudy insulin in hands to mix before beginning procedure
Procedure for Combining Two Insulins in the Same Syringe

1. Draw back and inject 40 units of air into NPH insulin vial
   - Withdraw needle

2. Draw back and inject 12 units of air into regular insulin vial
   - Leave needle in vial
Procedure for Combining Two Insulins in the Same Syringe

3. Turn vial of U-100 regular insulin up-side-down and draw out insulin to 12-unit mark
4. Insert needle into NPH insulin vial and withdraw insulin to 52-unit mark
Insulin: Avoiding Errors

• Check dosage with two nurses
• When combination dosages prepared, two nurses must verify each process step