5.17: Multi-Step Calculations

Sometimes multi-step calculations are required, especially for medications used in critical care. There are many different ways to solve multi-step calculations, so it is important to select a method that works for you that is consistently accurate. Let’s practice a multi-step calculation for a medication supplied in mg/mL but is prescribed based on micrograms (mcg) per kilogram (kg) per minute, and the patient’s weight is provided in pounds.

Practice Problem: Multi-Step Calculations

Patient Information:

Name: Ideen Hanson, DOB: 09/29/19xx, Allergies: NKDA, Weight: 180 lbs

Diagnosis: Hypertension

Prescription: Begin initial infusion of Nipride at 0.5 mcg/kg/min

Medication Supplied: See Figure \(\PageIndex{1}\) for the drug label of the medication supplied.
Problem: What rate (in mL/hr) should the nurse set the pump to begin the infusion?

1. Set up the goal units to solve for, which is mL/hr.

\[
\text{\textit{\(\frac{mL}{hr}\)}}
\]

2. Review the problem. The prescription is based on mcg/kg/min. Having three elements can create confusion when setting up the equation using dimensional analysis, so it can be easier to eliminate one element by doing some preliminary steps. First convert the patient weight to kilograms (kg) by dividing 180 pounds/2.2 = 81.8181 kg. Now multiplying the micrograms (mcg) ordered by weight in kg to determine the amount of medication to administer per minute: 81.8181 x 0.5 mcg = 40.9090 mcg/minute. Use this information as you set up your problem.

3. Start by identifying the unit you are solving for, which is mL/hour. Then set up the first fraction. Match the numerator to mL. Look to the problem for information related to mL. On the drug label, we see that 50 mg of Nipride is supplied in 250 mL of D5W. Plug in 250 in the numerator, and then 50 mg in the denominator:

\[
\text{\textit{\(\frac{mL}{hr}\)}} = \frac{250 \text{ mL}}{50 \text{ mg}}
\]

4. Set up the second fraction with the intent to cross off mg by placing 1 mg in the numerator. Based on the known equivalency that 1000 mcg are equal to 1 mg, place 1000 mcg in the denominator:

\[
\text{\textit{\(\frac{mL}{hr}\)}} = \frac{250 \text{ mL}}{50 \text{ mg}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}}
\]

5. Cross off mg diagonally. Set up the third equation with the intent to cross off mcg by placing it in the numerator. Plug in the information previously calculated, which was 40.9090 mcg/minute:

\[
\text{\textit{\(\frac{mL}{hr}\)}} = \frac{250 \text{ mL}}{50 \text{ mg}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{40.9090 \text{ mcg}}{1 \text{ min}}
\]

6. Cross off mcg diagonally. Set up the fourth fraction with the intent to cross off minutes. Based on the known
equivalency of 60 minutes in 1 hour, plug in 60 in the numerator and 1 hour in the denominator:

\[
mL = \frac{250 \text{ mL}}{50 \text{ mg}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{40.9090 \text{ mcg}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hour}} = 12.2727
\]

7. Cross off min diagonally. Review the equation to ensure the goal unit has been met. It has been met, so multiply across the numerators and the denominators, and then divide the final fraction:

\[
\frac{mL}{Hr} = \frac{250 \text{ mL}}{50 \text{ mg}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{40.9090 \text{ mcg}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hour}} = 12.2727
\]

8. Depending on the agency policy and available pump settings, round to 12.27 mL/hour.

**Video Reviews of Multiple-Step Calculations that Commonly Occur with Heparin and Dopamine drips:**

Heparin Drip

[2]
1. "Nipride Label" by Jody Myhre-Oechsle, Chippewa Valley Technical College, Open RN is licensed under CC BY 4.0.

2. RegisteredNurseRN. (2018, July 26). Heparin drip calculation practice problems for nurses | Dosage calculations nursing. [Video]. YouTube. All rights reserved. Video used with permission. https://youtu.be/10y4gRdnCy8

3. RegisteredNurseRN. (2019, February 8). Dopamine IV drip calculation & nursing considerations pharmacology implications. [Video]. YouTube. All rights reserved. Video used with permission. https://youtu.be/R2XMro13dD0