Solutions to Dilutions: Veterinary Mathematics

Amanda M. Shelby, BSc, RVT, VTS (Anesthesia & Analgesia)
Gasgirl.vts@gmail.com

Understanding and confidently performing mathematic is a critical role for veterinary professionals. Within this presentation, we will review common conversions required for successful drug calculations and patient delivery. We will use clinical examples to confidently make appropriate reconstitutions, dilutions and constant rate infusions. Upon completion, participants will have the skills and mathematical processes in place to successfully and confidently make solutions and dilutions in their veterinary practices.

Common conversions:

Pounds (lb) to kilograms (kg) = 2.2 lbs to 1 kg

Grams (g) to milligrams (mg) to micrograms (mcg) = 1 g = 1000 mg = 1000 mcg

Percent (%) to milligrams per milliliter (mg/mL): 1% = 1 g/100mL = 10 mg/Ml

Liter to milliliters: 1 L = 1000ml

<u>Example: 2.5% Dextrose Solution in Patient Fluids</u>

C1= 2.5% dextrose	C2=50% dextrose stock
V1=1000 ml fluid bag	V2= unknown vol. (x ml)

(2.5%)(1000 ml) = (50%)(x ml)

X = 50 ml of 50% dextrose to add to 1000 ml bag
(remove 50 ml from bag first)

Dilutions: $C_1V_1 = C_2V_2$

Important facts to remember:

1. Units need to be the same for both concentrations and then both volumes. If you use milliliters for V1 then the V2 needs to be in milliliters. If a % is used for C1 then C2 needs to be a %.
2. V1 is the total end volume, when solving the example above, first, remove the V2, 50 ml from the 1000 ml fluid bag to make a total volume of 1000 ml 2.5% solution.

Constant Rate infusions

<u>Equation: Constant Rate Infusion</u>

$$\frac{\text{Dosage (mg/kg/h)}}{\text{Fluid rate (ml/kg/h)}} \times \text{Volume of bag (ml)} = \text{(mg) of drug to add to bag}$$

$$\frac{\text{Mg of drug to add to bag}}{\text{Concentration of drug}} = \text{volume (ml) of drug to add}$$

Important Items to Remember:

1. Always ensure you are eliminating or cross canceling units!
2. Multiple drugs can be combined (pending they are compatible). This equation should be completed for each drug you are adding.
3. Remove the volumes of the drug/s you are adding from the bag first. "Volume of bag" used in the equation should be the final total volume.
4. To deliver to the patient: Multiply the patient body weight in kilogram (kg) to the fluid rate (ml/kg/h) used in the equation = milliliters per hour (ml/h)
5. Avoid bolus from this bag. Boluses from this bag will bolus fluids as well as additives.

FInal Trick of the Trade for calculating CRIs:

If you calculate how many milligrams per hour a patient requires of a drug's as a constant rate infusion and make that an equivalent concentration as milliliter per hour would allow the CRI to run at 1 ml/h.

As an example, if a patient requires 25 mcg/hr of fentanyl, making a 25 mcg/ml solution will allow the volume to run at 1 ml/h on a syringe pump. If you require 24 hours of the infusion then you will need to make 24 ml of the 25 mcg/ml solution using the C1V1=C2V2 equation above.