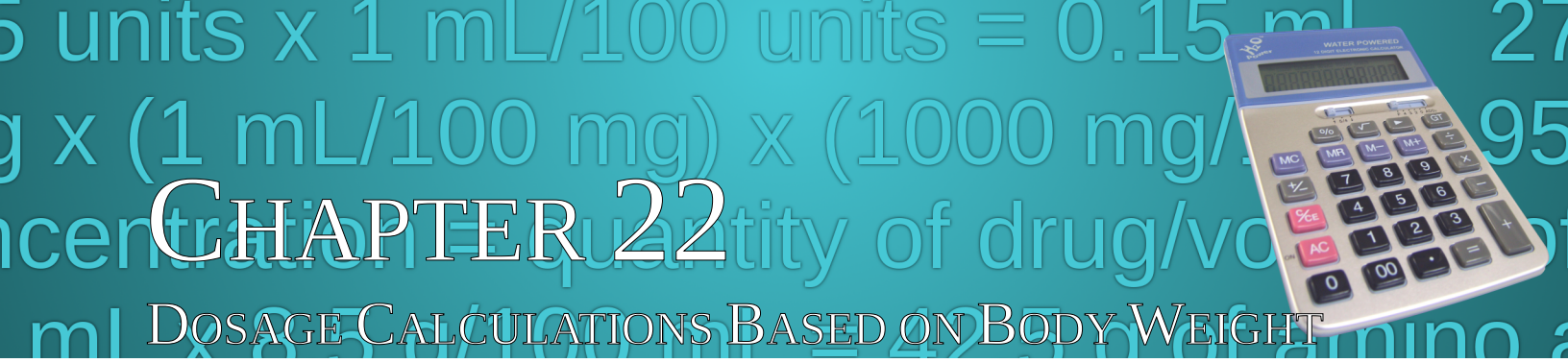


Chapter 22

Dosage Calculations Based on Body Weight

If we follow the logic that 454 graham crackers equal a pound cake, does that mean that 2.2 pound cakes would make a kilo cake?
--A really bad attempt at humor from this book's author.

As we initially introduced the concept of medication doses based on body weight back in chapter 10, we will review a little before diving straight into this concept. Many drugs need to be calculated based on body weight. Some of the drugs where you will see this most often include chemotherapy, steroids, antibiotics, heparinoids, and drugs for pediatric and geriatric patients.

The specific ideas included in this chapter are:

- medication dosages in weight of drug,
- medication dosages in volume of drug, and
- verifying the appropriateness of a dosage when a drug dosage is based on body weight.

If a medication dose is to be based on a body weight, it will usually be requested in mg/kg of body weight. Sometimes a time element will be included as well. Typically, the time element will be kept with the body weight when performing dimensional analysis. A useful idea to keep in mind is always consider what labels you want to end up with in order to help you set up your factor label problems correctly. Let's look at some example problems.

Examples

1) Gentamicin is ordered 5 mg/kg/day divided into 3 equal doses for a patient with a serious infection who weighs 231 pounds. How many mg of gentamicin should the patient receive for each dose?

$$\frac{5\text{ mg}}{\text{kg day}} \times \frac{1\text{ day}}{3\text{ doses}} \times \frac{1\text{ kg}}{2.2\text{ pounds}} \times \frac{231\text{ pounds}}{1} = \mathbf{175\,mg/dose}$$

So the patient will need 175 mg of gentamicin in each dose. Some things to notice include kg and day being paired together in the dimensional analysis. It is also noteworthy that the question itself was about how many mg of gentamicin were needed in each dose, allowing you to know that your final answer should yield mg per dose.

2) A physician orders a 120 mcg/kg dose of vinblastine for a patient with testicular cancer. The drug is available in a 10 mg vial that you reconstitute with 10 mL of bacteriostatic saline to achieve a concentration of 1 mg/mL. If the patient weighs 176 pounds, how many mL are required for a dose?

$$\frac{\text{mL}}{1\,\text{mg}} \times \frac{1\,\text{mg}}{1000\,\text{mcg}} \times \frac{120\,\text{mcg}}{\text{kg}} \times \frac{1\,\text{kg}}{2.2\,\text{pounds}} \times \frac{176\,\text{pounds}}{1} = \textbf{9.6 mL of vinblastine}$$

Something to be careful about when reading a problem is the potential for excess information. The fact that the vial contains 10 mg and that it was reconstituted with 10 mL did not matter for doing the math.

3) A 3-day old neonate weighing 7 pounds 11 ounces is ordered tobramycin 10 mg IM q12h. The recommended dosage of tobramycin for an infant is 2 mg/kg/dose IM q12h. Is 10 mg the appropriate dose for the neonate?

First, to simplify things, we will want to convert the infant's weigh all into pounds.

$$\frac{11\,\text{oz}}{1} \times \frac{1\,\text{pound}}{16\,\text{oz}} = 0.6875\,\text{pounds}$$

$$7\,\text{pounds} + 0.6875\,\text{pounds} = 7.6875\,\text{pounds}$$

Now we can determine the normal dose.

$$\frac{2\,\text{mg}}{\text{kg dose}} \times \frac{1\,\text{kg}}{2.2\,\text{pounds}} \times \frac{7.6875\,\text{pounds}}{1} = \textbf{7 mg / dose}$$

So, the recommended dose would only be 7 mg per dose, which is less than what was originally written for by the physician.

Now that the example problems have allowed us to review some concepts, attempt the practice problems below.

Practice Problems

1) Ceftazidime is ordered for a 44 pound patient with meningitis at a dosage of 50 mg/kg every 8 hours. The drug when reconstituted has a concentration of 100 mg/mL. How many mL of the reconstituted solution will be required for each dose?

2) Sulfamethoxazole and trimethoprim is a combination antibiotic commonly used for enteritis, p. carinii pneumonia, and urinary tract infections. When treating enteritis, the pediatric dosage range is 8 to 10 mg/kg/day (based on trimethoprim) in 2 to 4 divided doses every 6, 8, or 12 hours for 5 days by IV infusion.

   a) If a physician orders 50 mg of this antibiotic every 12 hours for a patient weighing 25 pounds, is this within the suggested dosing guidelines?

b) If this antibiotic has a concentration of sulfamethoxazole 80 mg/mL and trimethoprim 16 mg/mL, how many milliliters of solution will you need for each dose?

3) A 115 pound patient is life flighted to your hospital after an accident resulting in a spinal cord injury. She received a bolus dose of methylprednisolone while en route to the hospital, but now requires a continuous infusion of methylprednisolone at a rate of 5.4 mg/kg/hr for 23 hours. How many grams of methylprednisolone will need to be placed in her continuous infusion?

1) 10 mL 2-a) Yes, this dose is within the acceptable range. 2-b) 3.125 mL 3) 6.5 g of methylprednisolone

Now that you've attempted the practice problems you are ready for the worksheets.

Worksheet 22-1

Name:

Date:

Solve the following problems.

1) A 66 pound pediatric patient is to receive cefuroxime 25 mg/kg q8h. How many mg per dose should this patient receive?

2) Ceftazidime is ordered for a 55 pound patient with meningitis at a dosage of 50 mg/kg every 8 hours. The drug when reconstituted has a concentration of 100 mg/mL. How many mL of the reconstituted solution will be required for each dose?

3) A physician orders cyclophosphamide 5 mg/kg in 50 mL of D5W to be administered twice a week for a 75 kg patient. If a 500 mg vial of cyclophosphamide is reconstituted with 25 mL of SWFI to obtain a concentration of 20 mg/mL, how many milliliters of the reconstituted solution will need to be added to the D5W bag?

4) A patient weighing 198 pounds is to receive 2.5 mg/kg/day of oral cyclophospamide. If cyclophosphamide is available in the pharmacy as 25 mg/tablet, how many tablets will he need?

5) A 4 pound 8 ounce neonate is to receive IV vancomycin 10 mg/kg q8h. How many milligrams of vancomycin should the neonate receive in each dose?

6) A 156 pound patient with an HIV infection is to receive IV zidovudine 1 mg/kg in 50 mL D5W minibags q4h atc. How many milligrams of zidovudine will the patient receive each day?

7) A physician orders a dose of vincristine, based on the patient's body weight, as 30 mcg/kg. The maximum dose of vincristine is capped at 2 mg, so if your calculated dose exceeds that it is automatically reduced to 2 mg. Look at the vial pictured below to obtain the concentration. If the patient weighs 143 pounds, how many mL are needed for a dose? Mark the syringe appropriately for the dose.

8) A pediatric patient with an upper respiratory tract infection weighing 44 pounds is receiving ampicillin 12.5 mg/kg in 50 mL of D5W q6h.

   a) How many milligrams will the patient receive for each dose?

   b) What is the total daily dose?

   c) If a 10 gram bulk vial is to be reconstituted with 35 mL of SWFI and contains 5 mL of powder volume, how many milliliters of this reconstituted solution will need to be added to each minibag?

9) Calculate both the loading dose and the maintenance dose of gentamicin for a 230 pound patient with pelvic inflammatory disease.

   a) If the loading dose is 2 mg/kg IV, how many mg of gentamicin will the patient need for their loading dose?

   b) If the maintenance dose is 1.5 mg/kg IV q8h, how many mg of gentamicin will the patient need for a single maintenance dose?

   c) If the gentamicin stocked in the pharmacy comes in a 30 mL MDV with a concentration of 40 mg/mL, how many milliliters of gentamicin will be required for both the loading dose and each maintenance dose?

10) Your pharmacy stocks a 10% immune globulin solution. The order for a 55 pound patient with primary immunodeficiency is 500 mg/kg every 4 weeks. How many mL of 10% immune globulin will need to be infused on this patient for each dose?

11) A medication order for a patient weighing 190 pounds requests amphotericin B 0.25 mg/kg in 1000 mL of D5W. Amphotericin B comes as a 50 mg lyophylized powder that gets reconstituted with 10 mL of SWFI and has negligible powder volume. How many milliliters of the reconstituted solution should be added to the 1 L bag?

12) A neonate weighing 4000 g is ordered tobramycin 10 mg IM q12h. The recommended dosage of tobramycin for an infant is 2.5 mg/kg/dose IM q12h.

a) Is 10 mg the appropriate dose for the neonate?

b) Looking at the vial, how many mL of solution are needed?

c) Appropriately mark the syringe for how much should be dispensed.

13) Sulfamethoxazole and trimethoprim is a combination antibiotic commonly used for enteritis, p. carinii pneumonia, and urinary tract infections. When treating p. carinii pneumonia the pediatric dosage range is 15 to 20 mg/kg/day (based on trimethoprim) in 3 or 4 divided doses every 6 or 8 hours for 14 days by IV infusion.

a) If a physician orders 75 mg of this antibiotic every 8 hours for a patient weighing 25 pounds, is this within the suggested dosing guidelines?

b) If this antibiotic has a concentration of sulfamethoxazole 80 mg/mL and trimethoprim 16 mg/mL, how many milliliters of solution will you need for each dose?

14) A 240 pound patient is admitted to the hospital due to herpes genitalis. The physician orders acyclovir 5 mg/kg in 100 mL of NS q8h. Acyclovir is available in 1 gram vials that get reconstituted with 20 mL of SWFI (powder volume is considered negligible). How many mL of the reconstituted acyclovir will you add to each 100 mL bag?

15) A pediatrician orders penicillin V potassium oral suspension 20,000 units/kg/dose q8h for 10 days for a patient weighing 66 pounds. Penicillin V potassium has a concentration of 250 mg/tsp and 1 mg of penicillin V potassium is equal to 1600 units of penicillin V potassium.

a) How many milliliters of this suspension will need to be used for each dose?

b) How much should be dispensed to cover all 10 days?

16) A 209 pound patient is rushed to the emergency room after a terrible car accident and requires the spinal cord protocol for two methylprednisolone infusions.

a) First, you need to make a bolus dose of 30 mg/kg in 50 mL of NS. How many mg of methylprednisolone will you need to make the bolus dose? (The bolus dose will be infused over 1 hour)

b) If methylprednisolone comes in a double chamber vial with a concentration of 1 g/8 mL, how many mL will you need to add to the 50 mL bag of NS?

c) After the bolus dose is infused, you need to prepare a continuous infusion of methylprednisolone at a rate of 5.4 mg/kg/hr for 23 hours. How many mg of methylprednisolone will you need to make the continuous infusion?

d) The continuous infusion is to be administered with normal saline as the diluent. If the final bag has to have an exact volume of 1000 mL, how many mL methylprednisolone will be needed since it comes in a double chamber vial with a concentration of 1 g/8 mL, and how many mL of NS will be needed?

Worksheet 22-2

Name:

Date:

Solve the following problems.

1) Enoxaparin 1 mg/kg SQ q12h is ordered for a 176 pound patient. How many mg of enoxaparin should the patient receive for each dose?

2) The usual dosage of dalteparin for patients with cancer and symptomatic venous thromboembolism for the first 30 days of treatment is 200 units/kg total body weight subcutaneously once daily. The maximum dose is 18,000 units subcutaneously once a day. How many units would be the recommended dose for each of the following body weights:

   a) 110 pounds

   b) 138 pounds

   c) 165 pounds

   d) 193 pounds

   e) 220 pounds

3) A 190 pound patient is receiving dopamine at 5 mcg/kg/min. If the physician does not titrate the dose up, how long should a 500 mL premixed bag of dopamine last if it has a concentration of 0.8 mg/mL?

4) A 231 pound patient is receiving dobutamine at 10 mcg/kg/min. If the dose remains the same,

how long should a 250 mL premixed bag of dobutamine last if it has a concentration of 1 mg/mL?

5) A five year old pediatric patient weighing 42 pounds with a severe infection is ordered cefotaxime 90 mg/kg/day by IV infusion in 6 equally divided doses every 4 hours in 50 mL of NS.

   a) How many mg of cefotaxime should this patient receive daily?

   b) How many mg will this patient receive for each dose?

   c) If a bulk 10 g vial of cefotaxime is reconstituted with 95 mL of SWFI and has 5 mL of powder volume, how many mL of the reconstituted solution will be shot into each minibag for the patient dose?

6) A pediatric patient weighing 20 kg with a severe skin infection that has probable penicillin resistance is ordered a combination of ampicillin and sulbactam 300 mg/kg/day (ampicillin 200 mg/sulbactam 100 mg) by IV infusion in 4 equally divided doses every 6 hours in 50 mL of NS.

   a) How many mg of ampicillin and sulbactam should this patient receive daily?

   b) How many mg will this patient receive for each dose?

   c) If a bulk 15 g vial of ampicillin and sulbactam (10 grams ampicillin and 5 grams sulbactam) is reconstituted with 32 mL of SWFI and has 8 mL of powder volume, how many mL of the reconstituted solution will be shot into each minibag for the patient dose?

7) The initial dosing guidelines for fluorouracil for a carcinoma of the stomach is 12 mg/kg once daily by IV bolus for 4 successive days. The daily dose should not exceed 800 mg. If no toxicity is observed, 6 mg/kg should be given on days 6, 8, 10, and 12 unless toxicity occurs. No therapy is given on days 5, 7, 9, and 11. Therapy is to be discontinued at the end of day 12, even if no toxicity has become apparent. If a 150 pound patient is receiving fluorouracil to treat a

stomach carcinoma, what would be the recommended doses for each of the first 12 days?

a) Day 1

b) Day 2

c) Day 3

d) Day 4

e) Day 5

f) Day 6

g) Day 7

h) Day 8

i) Day 9

j) Day 10

k) Day 11

l) Day 12

8) Based on the information in the previous problem and looking at the vial pictured to the right, how many milliliters of fluorouracil will the patient require each day?

a) Day 1

b) Day 2

c) Day 3

d) Day 4

e) Day 5

f) Day 6

g) Day 7

h) Day 8

i) Day 9

j) Day 10

k) Day 11

l) Day 12

9) A 250 pound patient with Crohn's disease is ordered infliximab 5 mg/kg. How many mg of infliximab will the patient receive?

10) A one year old child that has been deemed as high risk for RSV is to receive palivizumab 15 mg/kg monthly throughout RSV season. If the child's body weight is 22 pounds when scheduled to receive his first dose, how many mg will the first dose be?

11) The initial oral dosage of tacrolimus after a heart transplant is 0.075 mg/kg/day administered in 2 divided doses (every 12 hours). A 180 pound patient is ordered oral tacrolimus 6 hours after completion of a heart transplant.

a) What would the recommended dose be for this patient?

b) Since tacrolimus is available in 0.5 mg, 1 mg, and 5 mg capsules, what combination of capsules makes the most sense to dispense for this patient for each dose?

12) A 154 pound patient with a systemic fungal infection is to receive amphotericin B lipid complex 5 mg/kg /day.

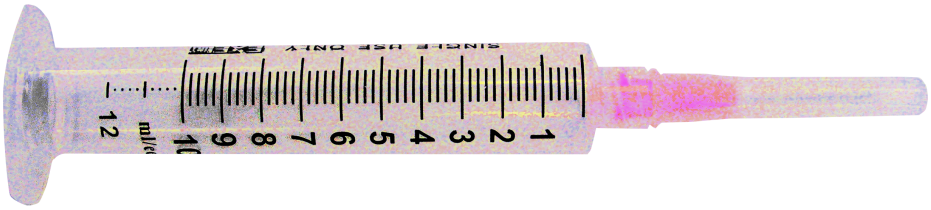
a) How many mg of amphotericin B lipid complex should this patient receive on a daily basis?

b) Amphotericin B lipid complex comes with a concentration of 5 mg/mL. How many mL of this stock solution is needed?

c) An IV bag of amphotericin B lipid complex should be diluted out with D5W till the amphotericin B lipid complex reaches a final concentration of 1 mg/mL. How many mL of D5W are needed for this IV?

13) A 4 pound 8 ounce neonate with a severe infection is ordered a continuous infusion of penicillin g potassium at a rate of 4,000 units/kg/hr. The nursing unit wants to hang a new bag every 12 hours. How many units of penicillin g potassium should be in each bag?

14) A physician orders potassium chloride 0.6 mEq/kg/day divided into 4 doses each in 100 mL of NS for an 198 pound patient suffering from hypokalemia. How many mL should be added to each IV bag based on the concentration listed on the vial? Mark the correct dose on the syringe below.



15) A 121 pound patient received 2 grams of a medication that should have been dosed at 50 mg/kg. Was the patient underdosed, correctly dosed or overdosed?

16) If a 147 pound patient were to receive an initial dose of 200 mg of fluconazole po followed by 3 mg/kg bid for 7 days, then how many 100 mg fluconazole tablets will the patient need to cover their course of therapy?

17) Phenytoin is a commonly used anticonvulsant. The dosage range for pediatric patients is 4 to 8 mg/kg/day in 2 to 3 divided doses when taken orally.

    a) If a physician orders 25 mg of phenytoin suspension every 12 hours for a patient weighing 25 pounds, is this within the suggested dosing guidelines?

    b) If phenytoin oral suspension has a concentration of 125 mg/5 mL, how many milliliters of phenytoin suspension will be needed for each dose?

18) The loading dose of indomethacin is 0.2 mg/kg IV for neonates with patent ductus arteriosus.

    a) What would be the loading dose for a neonate weighing 5 pounds 8 ounces?

    b) If a 1 mg vial of indomethacin is reconstituted to a final volume of 2 mL, how many mL will the loading dose be?

19) When treating hospital acquired pneumonia with vancomycin, the American Thoracic Society guidelines recommend 15 mg/kg every 12 hours in adults with healthy renal function. Assuming heathy renal function, what would be the appropriate dose for each of the following body weights?

    a) 110 pounds

    b) 165 pounds

c) 220 pounds

20) A 176 pound patient is rushed to the emergency room after a motorcycle accident and requires the spinal cord protocol for two methylprednisolone infusions.

a) First, you need to make a bolus dose of 30 mg/kg in 50 mL of NS. How many mg of methylprednisolone will you need to make the bolus dose? (The bolus dose will be infused over 1 hour)

b) If methylprednisolone comes in a double chamber vial with a concentration of 1 g/8 mL, how many mL will you need to add to the 50 mL bag of NS?

c) After the bolus dose is infused, you need to prepare a continuous infusion of methylprednisolone at a rate of 5.4 mg/kg/hr for 23 hours. How many mg of methylprednisolone will you need to make the continuous infusion?

d) The continuous infusion is to be administered with normal saline as the diluent. If the final bag has to have an exact volume of 1000 mL, how many mL methylprednisolone will be needed since it comes in a double chamber vial with a concentration of 1 g/8 mL, and how many mL of NS will be needed?