SELF-TEST 1 Calculation of Drip Rates

Calculate the drip rate for the following IV orders given in milliliters per hour or drops per minute. Answers are given at the end of the chapter. Round to the nearest whole number. Determine if microdrip or macrodrip tubing is better.

1. Order: 150 mL D5WNS IV q8h
   Available: infusion pump
2. Order: 250 mL D5W; run at 25 mL/hour
   Available: infusion pump
3. Order: 1000 mL D5NS; run 100 mL/hour
   Available: macrodrip (20 gtt/mL); microdrip (60 gtt/mL)
4. Order: 180 mL D5½NS 12 NOON–6 PM
   Available: macrodrip (10 gtt/mL); microdrip (60 gtt/mL)
5. Order 1000 mL D5W 0.45NS IV 4 PM–12 MIDNIGHT
   Available: macrodrip (15 gtt/mL); microdrip (60 gtt/mL)
6. Order: 250 mL D5W IV q8h
   Available: infusion pump
7. Order: 500 mL NS IV over 2 hours
   Available: infusion pump
8. Order: 1000 mL D5NS IV 4 AM–4 PM
   Available: macrodrip (15 gtt/mL); microdrip (60 gtt/mL)
9. Order: 1000 mL D5W 0.45 NS IV; run 150 mL/hour
   Available: macrodrip (10 gtt/mL); microdrip (60 gtt/mL)
10. Order: 150 mL 0.9 NS IV; over 1 hour
    Available: macrodrip (20 gtt/mL); microdrip (60 gtt/mL)

Determining Hours an IV Will Run

Knowing how to calculate approximately how long an IV will last helps you to know when to prepare the next IV, or to be aware if the IV is infusing too fast or too slow.

$$\frac{\text{Number of milliliters ordered}}{\text{Number of milliliters per hour}} = \text{Number of hours to run}$$

EXAMPLE Order: 500 mL NS IV; infuse at 75 mL/hour

$$\frac{\text{Number of mL}}{\text{Number of mL/hour}} = \text{Hours}$$

$$\frac{500 \text{ mL}}{75 \text{ mL/hour}} = 75\overline{)500.00} \quad 6.67 \text{ (Round to 6.7 hours)}$$

$$\begin{array}{r} 450 \\ \hline 500 \\ 450 \\ \hline 500 \end{array}$$

EXAMPLE Order: 500 mL D5W IV at 50 mL/hour

$$\frac{\text{Number of mL}}{\text{Number of mL/hour}} = \text{Hours}$$

$$\frac{500 \text{ mL}}{50 \text{ mL}} = 10 \text{ hours}$$

The IV will last 10 hours.

Start the infusion at 10 AM. When will the IV infusion be complete?

10 AM + 10 hours = 8 PM

The infusion will be complete at 8 PM.

SELF-TEST 2 IV Infusions—Hours

Calculate the hours that the following IV orders will run. Answers are given at the end of this chapter. Round your answer to the nearest tenths then convert to hours and minutes if applicable.

1. Order: 250 mL D5½NS IV at 30 mL/hour
2. Order: 500 mL LR IV run at 60 mL/hour
3. Order: 1000 mL D5NS IV 4 PM–2 AM
4. Order: 1000 mL D5W IV KVO 24 hours
5. Order: 500 mL D5½NS at 70 mL/hour
6. Order: 500 mL D5W IV at 50 mL/hour
7. Order: 1000 mL LR IV over 10 hours
   Start the IV at 9 AM. When will it be finished?
8. Order: 250 mL NS IV at 100 mL/hour
   Start the IV at 1 PM. When will it be finished?
9. Order: 1000 mL NS IV 12 NOON–6 PM
10. Order: 500 mL NS IV over 5 hours

Assessment

Many factors may interfere with the drip rate. When you are not using an infusion pump, gravity will cause the IV to vary from its starting rate; you will need to observe and assess the infusion and IV site frequently. You'll need to monitor other conditions as well. As the amount of fluid decreases in the IV bag, pressure changes occur—and they, too, may affect the rate. The client's movements can kink the tube and shut off the flow; they can change the position of the needle or catheter in the vein. The needle can become lodged against the side of the blood vessel, thereby altering the flow, or it may be forced out of the vessel, allowing fluid to enter the tissues (infiltration). (Signs of possible infiltration are swelling, pain, coolness, or pallor at the insertion site. If you notice any of these signs, discontinue the IV and start a new one at another insertion site.)

Infusion pumps have a system that alarms or "beeps" to alert you when the rate cannot be maintained or when the infusion is nearly finished. Be sure to check the infusion pump frequently, and know how to troubleshoot the various alarms.

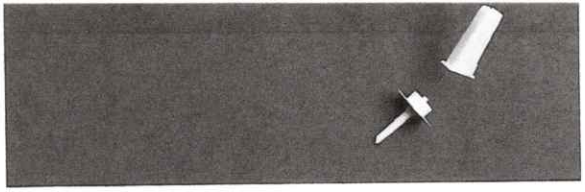

FIGURE 6-7 A Buretrol is an IV delivery system with tubing and a chamber that can hold 150 mL delivered as microdrip (1 mL = 60 drops). (This device is sometimes referred to as a Volutrol.) The top of the Buretrol has a port so that a reservoir of fluid can be added. The Buretrol is a volume control because no more than 150 mL can be infused at one time.

SELF-TEST 3 IV Infusion Rates

Calculate how much medication is needed (if applicable) and the infusion rate for the following orders. Answers are given at the end of the chapter. Round the infusion rate to the nearest whole number.

1. Order: 500 mL D5W IV with vitamin C 500 mg at 60 mL/hour
   Available: ampule of vitamin C labeled 500 mg/2 mL; microdrip tubing at 60 gtt/mL
2. Order: 250 mg hydrocortisone sodium succinate (Solu-Cortef) in 1000 mL D5W
   8 AM–12 MIDNIGHT
   Available: vial of hydrocortisone sodium succinate labeled 250 mg dilute with 2 mL sterile water to yield 250 mg in 2 mL; microdrip tubing
3. Order: aminophylline 250 mg in 250 mL D5W IV; run 50 mL/hour
   Available: infusion pump, vial of aminophylline labeled 500 mg/10 mL
4. Order: 250 mL D5½NS with KCl 10 mEq IV 12 NOON–6 PM
   Available: microdrip tubing, vial of potassium chloride labeled 20 mEq/10 mL

MEDICATIONS FOR INTERMITTENT IV ADMINISTRATION

Some IV medications are administered not continuously but only intermittently, such as every 4, 6, or 8 hours. This route is termed *intravenous piggyback* or IVPB (Fig. 6-8). The term admixture refers to the premixed IVPB.

Most of these drugs are prepared in powder form. The manufacturer specifies the type and amount of diluent needed to reconstitute the drug; later, you, the nurse, connect the IVPB (containing the reconstituted drug) by IV tubing to the main IV line. Some IVPB medications come premixed from the manufacturer. For other medications, the institutional pharmacy may reconstitute and prepare IVPB solutions in a sterile environment using a laminar flow hood. This procedure saves nursing time, because when you are ready to administer the drugs, they have already been prepared, labeled, and screened for incompatibilities. Nevertheless, the nurse still bears considerable responsibility: You must check the diluent and volume. You must also check the dose and the expiration date of the reconstituted solution; note whether the IVPB should be refrigerated before use or whether it can remain at room temperature until hung. Finally, you must calculate the drip rate and record this information on the IVPB label before hanging the bag.

The healthcare provider may write a detailed order, such as "Vancomycin 0.5 g IVPB in 100 mL D5W over 1 hour." More often, however, the healthcare provider writes only the drug, route, and time interval, relying on you to research the manufacturer's directions for the amount and type of

SELF-TEST 4 IVPB Drip Rates

Solve these drip rates for IVPB problems. Calculate how much medication is needed (if applicable). Answers are given at the end of this chapter. Round your infusion rate to the nearest whole number.

1. Order: acyclovir (Zovirax) 500 mg IVPB q8h
   Supply: 500 mg powder
   Package directions: Reconstitute with 100 mL/D5W. Use a reconstitution device. Infuse over 1 hour/once a day.
   Available: macrodrip tubing at 10 gtt/mL

2. Order: ceftazidime (Ceptaz) 1 g IVPB q12h
   Supply: 1 g powder
   Package directions: Reconstitute with 50 mL D5W. Use a reconstitution device. Infuse over 15–30 minutes. Use 30 minutes.
   Available: macrodrip tubing at 10 gtt/mL

3. Order: cefotaxime (Claforan) 1 g IVPB q6h
   Supply: 1 g powder
   Package directions: Reconstitute with 50 mL D5W. Use a reconstitution device. Infuse over 15–30 minutes. Use 30 minutes.
   Available: macrodrip tubing at 10 gtt/mL

4. Order: ampicillin (Omnipen) 500 mg IV q6h
   Supply: Reconstitute with 4.5 mL sterile water to yield 2 g in 5 mL.
   Package directions: Add to 50 mL D5W. Infuse over 15–30 minutes. Use 30 minutes.
   Available: microdrip tubing at 60 gtt/mL

5. Order: tobramycin (Nebcin) 50 mg IV q8h
   Supply: Reconstitute with 2 mL sterile water to yield 80 mg in 2 mL.
   Package directions: Add to 100 mL/D5W. Infuse over 60 minutes.
   Available: macrodrip tubing at 15 gtt/mL

6. Order: ticarcillin (Timentin) 500 mg IV q6h
   Supply: Reconstitute in 4.5 mL sterile water to yield 1 g in 5 mL.
   Package directions: Add to 50 mL/D5W. Infuse in 30 minutes.
   Available: macrodrip tubing at 15 gtt/mL

AMBULATORY INFUSION DEVICE

An ambulatory infusion device such as the one pictured in Figure 6-10 is used when a client is receiving long-term antibiotic or other infusion therapy. The device is filled with the medication, and a vacuum within the container infuses the medication over a specific time frame when the device is

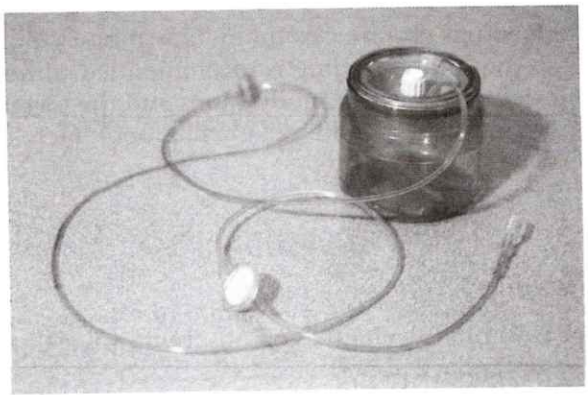

FIGURE 6-10 Ambulatory infusion device.

Solve these problems stating how much of the feeding and how much water to add. Answers are at the end of the chapter.

1. Prepare ¾ strength Isocal. Total volume is 275 mL. How much Isocal is to be mixed with how much water?
2. Prepare 75 mL of 75% Magnacal. How much Magnacal is to be mixed with how much water?
3. Prepare ½ strength Osmolite. Total volume is 100 mL. How much Osmolite is to be mixed with how much water?
4. Prepare ¼ strength Ensure. Total volume is 85 mL. How much Ensure is to be mixed with how much water?
5. Prepare 25% Renalcal. Total volume is 400 mL. How much Renalcal is to be mixed with how much water?
6. Prepare 50% Suplena. Total volume is 400 mL. How much Suplena is to be mixed with how much water?

Recording Intake

Keep an accurate account of parenteral intake as well as liquids taken orally and/or enterally (e.g., tube feedings). Each institution provides a type of flow sheet (paper or computer) to record fluid input over a specified period of time. Usually, when an IVPB is infusing, the primary IV stops infusing. After the IVPB is completed, the primary IV flow rate begins again. (Refer to Fig. 6-8.)

EXAMPLE

The primary IV is infusing at 50 mL/hour. For 12 hours, the IV intake would be 600 mL (12 hours × 50 mL = 600 mL). If you administer an IVPB of 100 mL once during the 12 hours and infuse the IVPB at 100 mL/hour, then your IV intake would be as follows:

11 hours × 50 mL of primary IV (550 mL) plus 1 hour of 100 mL IVPB, to equal 650 mL IV intake for 12 hours.

An IV infusion pump can keep track of all fluids infused over a specific amount of time. Usually there is a screen titled "volume infused" that shows this value.

SKIP Self Test 5

SELF-TEST 6 Fluid Intake

Answer the following questions regarding fluid intake. Answers are given at the end of this chapter.

1. A total of 900 mL of an IV solution is to infuse at 100 mL/hour. If it is 9 AM when the infusion starts, at what time will it be completed?
2. A client is receiving an antibiotic IVPB in 75 mL q6h to run over 1 hour plus a maintenance IV of 125 mL/hour. What is the 24-hour intake parenterally?
3. An IV of 1000 mL D5NS is infusing at 10 microdrips/minute. What is the parenteral intake for 8 hours?
4. A doctor orders 500 mL with aminophylline 0.5 g to infuse at 50 mL/hour. How many milligrams will the client receive each hour? (Hint: Take fluid and divide by amount of drug (conversion: 0.5 g=500 mg) so, 500 mL/500 mg=1 mg per mL.)

SELF-TEST 6 Fluid Intake (*continued*)

5. A total of 20,000 units of heparin is added to 500 mL D5W, and the order is to infuse IV at 30 mL/hour. How many hours will the IV run?
6. A client is receiving an antibiotic IVPB in 50 mL q8h to run over 1 hour plus a maintenance IV of 100 mL/hour. What is the 24-hour intake parenterally?
7. A total of 500 mL of an IV solution is to infuse at 50 mL/hour. If it is 6 AM when the infusion starts, at what time is it completed?
8. An IV of D5W 1000 mL is infusing at 125 mL/hour. How many hours will the IV run?
9. A client is receiving an antibiotic IVPB in 250 mL q6h. What is the 24-hour intake parenterally?
10. A physician orders 100 units regular insulin in 100 mL to infuse at 10 mL/hour. How many units will the client receive each hour? (See question 4 for help in solving.)

SELF-TEST 7 IV Drip Rates

Solve these problems related to IV and IVPB drip rates. Answers are given at the end of the chapter. Round the infusion/drip rate to the nearest whole number.

1. Order: 1500 mL D5W 8 AM–8 PM
   Available: macrodrip tubing (10 gtt/mL)
   What is the drip rate?

2. Order: 250 mL D5½NS IV KVO (give over 12 hours)
   Available: microdrip tubing
   What is the drip rate?

3. Order: 150 mL D5½NS IV; run 20 mL/hour
   Available: infusion pump
   a. What is the drip rate?
   b. How long will the IV last?

4. Order: 1000 mL D5NS with 15 mEq KCl IV; run 100 mL/hour
   Available: macrotubing (20 gtt/mL) and microdrip
   a. How many hours will this run?
   b. How many milliliters of KCl will you add to the IV if KCl comes in a vial labeled 40 mEq/20 mL?
   c. What is the drip rate?
   d. What size tubing will you use?

5. Order: aminophylline 1 g in 500 mL D5W IV at 75 mL/hour
   Available: vial of aminophylline 1 g in 10 mL; infusion pump
   a. How many milliliters of aminophylline should be added to the IV?
   b. What is the drip rate?

6. Order: amikacin (Amikin) 0.4 g IVPB q8h
   Supply: 2-mL vial labeled 250 mg/mL
   Package directions: 100 mL/D5W 30 minutes
   Available: macrodrip tubing 10 gtt/mL
   a. How many milliliters of amikacin (Amikin) should be added to the IV?
   b. What is the drip rate?

(*continued*)

SELF-TEST 7 IV Drip Rates (*continued*)

7. Order: 500 mL D5½NS IV q8h
   Available: microdrip tubing
   What is the drip rate?

8. Order: 1000 mL D5W IV q24h
   Available: macrodrip tubing (15 gtt/mL)
   What is the drip rate?

9. Order: Heparin 25,000 units in 250 mL NS at 20 mL/hour
   How long will the IV last?

10. Order: 500 mL NS over 4 hours
    Available: macrodrip tubing (20 gtt/mL)
    What is the drip rate?

SELF-TEST 8 IV Problems

Solve these problems related to IV and IVPB drip rates. Answers are given at the end of this chapter. For drip rates, round to the nearest whole number.

1. Order: aqueous penicillin G 1 milliunit in 100 mL D5W IVPB q6h over 40 minutes (macrodrip tubing at 10 gtt/mL) (milliunits = million units)
   Supply: vial labeled 5 million units of powder. Directions say to inject 18 mL sterile water for injection to yield 5 milliunits / 20 mL solution. Reconstituted solution is stable for 1 week.

   a. How would you prepare the penicillin?
   b. What solution will you make?
   c. What amount of penicillin solution should be placed into the bag of 100 mL D5W?
   d. What is the drip rate for the IVPB?

2. A total of 1000 mL of an IV solution is to infuse at 100 mL/hour. If the infusion starts at 8 AM, at what time will it be completed?

3. Order: gentamicin (Garamycin) 60 mg IVPB in 50 mL D5W over 30 minutes using macrodrip (20 gtt/mL)
   Supply: vial of gentamicin (Garamycin) 40 mg/mL; 50-mL bag of D5W; order is correct

   a. How many milliliters of gentamicin (Garamycin) will you add to the 50-mL bag of D5W?
   b. What is the drip rate for the IVPB?

4. Calculate the drip rate for 1500 mL D5½NS to run 12 hours by macrodrip (10 gtt/mL).

5. Intralipid, 500 mL q6h, is ordered for a client together with a primary IV that is infusing at 80 mL/hour. Calculate the 24-hour parenteral intake. (Total will be amount of lipids plus primary IV amount.)

6. Order: 1000 mL D5W with 20 mEq KCl and 500 mg of vitamin C at 50 mL/hour. No infusion pump is available.
   a. Approximately how many hours will the IV run?
   b. What is the drip rate? (Macrodrip 10 gtt/mL; microdrip 60 gtt/mL)
   c. What size tubing will you use?