Section 6: Parenteral Route Administration

Parenteral administration includes all forms of drugs administered via a syringe, needle, or catheter into body tissues or fluids.

INTRADERMAL OR INTRACUTANEOUS INJECTIONS
These injections are made into the outer layer of skin (dermis) and produce local effects. The techniques are used mainly for local anesthesia and sensitivity tests, such as allergy panels and tuberculin tests. The inner aspect of the forearm is the most common site for intradermal injections because it gives good visualization of the response to test media. The upper aspect of the chest or the back of the client can also be used.

Interventions
1. Wash hands. Apply gloves.
2. Select a tuberculin-type syringe with a 26–27 gauge needle ½- to 5/8- in long.
3. Cleanse selected injection site with alcohol; use a circular motion, moving outward from the projected insertion site. Allow skin to air dry.
4. Stretch skin taut and insert needle with the bevel up at a 10–15 degree angle until the bevel is just under the outer layer of skin (needle should be visible through the skin).
5. Inject fluid slowly, usually 0.5 mL or less.
6. Withdraw the needle after a small blister or wheal forms from the solution just below the skin surface.
7. Apply gentle pressure but do not rub the site.
8. After the injection, observe for local reaction such as redness or swelling.
9. If a blister or wheal does not appear, or if the site bleeds after the needle is removed, the needle may have been too far below the skin layers and test results will be invalid.
10. Circle and date test sites to facilitate interpretation of results.
11. Instruct client that in 24–48 hours (depending on test) a licensed nurse or physician must evaluate the response and record results.
12. Remember no recapping of needles after administering a parenteral drug. Use retractable or safety shielded needles.

INTRASYNOVIAL AND INTRA-ARTICULAR INJECTIONS
Intrasynovial and intra-articular injections are used for the relief of joint pain or the local application of medication. Be aware that local discomfort is usually intensified for several hours before the palliative effect sets in and may persist for 24–48 hours. The procedure is performed by the provider, using sterile technique. In the event that there is fluid accumulation, the provider may elect to remove some fluid first to analyze before attaching another syringe to administer medication. Avoid excessive use of the joint because medication can mask pain initially.
INTRATHECAL INJECTIONS
This technique has also been referred to as intraspinal, subdural, subarachnoid, or lumbar injection. Intrathecal (into a sheath) permits direct administration of medication (or anesthesia) into the subarachnoid space of the spinal cord. Assist the client into the position indicated and desired by the provider for safe administration. After the procedure, instruct the client to lie flat for several hours and take fluids to help replace spinal fluid loss and associated spinal headaches. If the client gets a headache that does not respond to usual therapy, and is severe and prolonged, a blood patch may be indicated. This involves removing approximately 10 mL of the client’s blood from a peripheral vein and then injecting it into the epidural space. The blood then clots and seals off the leaking area and the client should gain immediate relief. Although some nurses do not administer drugs via this route (NPs, APNs, and CRNAs can with proper instruction), they may be responsible for filling the drug reservoirs of an intraspinal delivery system, and are responsible for assisting in the relief of any headache and for reporting any changes or problems to the provider.

HYPODERMOCLYSIS AND CLYSIS
Although not commonly used anymore, hypodermoclysis or clysis is the subcutaneous infusion of isotonic solutions. This technique is used primarily in clients who require parenteral fluids but whose condition or veins do not permit intravenous (IV) infusion. It is also used in clients for palliative care or when hospitalization is not a desired by clients or families.

Interventions/Procedure
1. Use an intramuscular (IM) 20–22 gauge needle 1 ½ inches long for children, and a 19 gauge 2 ½ –3 inch needle for adults.
2. Wash hands. Prepare site. Apply gloves.
3. Insert the needle into areas of loose connective tissue, such as the upper thighs, under the breast, or in the scapular region of the back.
4. Fluid is administered slowly to prevent overdistention of tissues.
5. If tissues become indurated, clamp fluid off to allow for absorption. Restart after the tissue becomes more elastic.
6. Hyaluronidase (Wydase), an enzyme that breaks down the main constituents of intracellular connective tissue, is sometimes added to the solution so that the fluid will be absorbed more rapidly and cause less discomfort.
7. Upon completion, remove the needle and apply pressure; apply a dry sterile dressing to prevent fluid leakage.

SUBCUTANEOUS AND INTRAMUSCULAR INJECTIONS
Medications administered subcutaneously should be limited to those that are highly soluble, low in volume, and nonirritating. Repeated subcutaneous injections of irritating drugs can result in tissue atrophy, the formation of sterile abscesses, and necrotic tissue. Intramuscular injections permit larger doses (2-3 mL in adult; 1 mL in child) of more irritating drugs. These injections are made through the skin and subcutaneous (SC) fat into muscular tissue. The SC route is appropriate for small doses (0.5–1 mL) of water-
soluble drugs. The IM route permits larger volumes (1–5 mL) of more irritating drugs to be administered and produces a more rapid systemic response than the SC route.

Interventions
1. Always use sterile technique; wash hands, apply gloves, and assist client to a comfortable position to prevent strain on the muscle.
2. Select proper gauge and length of needle: consider age, weight, condition of client, and physical properties of medication to be administered.
3. Palpate site and choose a site that is not tender and where tissue does not become firm on palpation.
4. Alternate sites of injection and chart according to facility guidelines.
5. Cleanse site with alcohol using a circular motion moving outward from intended injection site.
6. For SC injections, pick up tissue in selected area and hold firmly until the needle has been inserted at a 45 degree angle.
7. Not all subcutaneous injections can be given at a 45 degree angle. Heparin and low molecular weight heparin products should be given at a 90-degree angle.
8. It is not necessary to aspirate for a subcutaneous injection. Never aspirate with heparin or heparin products.
9. Do not introduce any air into the syringe or injection.

Geriatric Administration
If administering to older adult clients that have little SC tissue, spreading the skin may prove more effective. Geriatric clients have decreased tissue elasticity, muscle mass, and often are less active. As a consequence, when IM and SC injections are administered, medication may ooze from the site, resulting in poor absorption.
1. Look for and use fat pads on the abdomen, the outer surface of the upper arm, and the anterior surface of the thigh for SC injections in this population.
2. Use upper, outer quadrant of the buttocks or a ventrogluteal site for IM injections.
3. Rotate injection sites. To ensure rotation, mark the site of the last injection on the client’s record.
4. For an IM injection, stretch the skin taut if the client is in a normal state of nutrition. If the client is emaciated, pinch the tissue to form a muscle bundle to ensure that the medication is injected into the muscle. Insert the needle at a 90-degree angle.
5. Leave at least 1/4–1/2 inch of needle from the hub to prevent complete disappearance in case of breakage. Should the needle break, mark the site and immediately report the incident.

Z-Track Administration
1. If a Z-track injection is recommended by the drug manufacturer (i.e., iron injections) include a small bubble of air in the syringe (0.2–0.3 mL) after drawing up the medication. The air bubble will help to expel all medication from the needle so that irritating solutions will not leak into the tissues as the needle is withdrawn, or leak out of the injection site.
2. Insert the needle quickly (like a dart) to minimize pain. After insertion, aspirate to ensure that the needle is not in a blood vessel. If blood returns into the syringe, withdraw the needle and discard the medication and injection set. Prepare another dose using new sterile equipment and select another site to start the injection procedure all over again.

3. Administer medication slowly to allow for absorption.

4. Count to ten slowly (10 seconds), then remove the needle quickly while pressing down at the point of insertion with a sterile sponge to prevent bleeding.

5. Apply an adhesive bandage as needed.

6. Do not massage the area after a Z-track injection, especially with certain drugs, such as penicillin G benzathine, where absorption should be slow.

7. Some irritating drugs (e.g., iron dextran) can be ordered and administered by the Z-track method. This involves placing a clean needle on the syringe after drawing up the medication.

8. Displace the skin, subcutaneous tissue, and fat laterally.

9. Cleanse the injection site with alcohol before inserting the needle into muscle tissue. After injecting the medication, wait 10 seconds and then release the tissue while withdrawing the needle. When working with geriatric clients, use the Z-track method to facilitate sealing. Cleanse skin from any medication that has oozed to the surface to prevent localized irritation.

10. Check expiration dates regularly.

11. Evaluate the client shortly after administration for any reactions and chart the effects and the effectiveness of the administered drug.

**SUBCUTANEOUS INFUSIONS/PUMPS**

These infusions are generally reserved for chemotherapeutic drugs, opioids, deferoxamine mesylate, or insulin. The route permits certain drugs to be administered generally via a microprogrammable infusion pump over a specified period of time. Clients are taught the appropriate techniques for self-administration of medications at home. Insulin infusion pumps for the control of diabetes are most frequently used. Detailed written guidelines are given to the client to take home once mastery of the procedure is demonstrated. Extra batteries and a phone number to call for help are a necessity at the time of discharge. Two support persons should be taught by the provider to prevent interruption of therapy.

**INTRAVENOUS INJECTIONS**

**(DIRECT OR VIA CONTINUOUS INFUSION)**

This route is chosen when an immediate effect is desired or if the drug cannot be injected because its absorption is inhibited (e.g., dopamine HCl), the size of dose needed for a therapeutic response (e.g., cefoxitin), the potential for tissue damage (e.g., norepinephrine), no other route is available (e.g., coma, GI bleed, ulcers), or circulation is impaired (e.g., cardiac arrest).
Responsibilities for IV therapy vary according to the facility.
1. Follow the appropriate written policies and practices of your employing facility.
2. Many facilities use an IV team to ensure quality control in the area of client care related to comfort, safety, cost, and infection control.
3. The pharmacy department usually prepares unit dose medications that can be reconstituted at the time of administration. The following nursing considerations are generally applied for IV therapy.

**Interventions/Procedures**
1. Review facility policy concerning procedure for venipuncture and the list of approved solutions and drugs for nurse administration (on the nursing unit, in the ICU, in the ER, in specialty areas) because these may differ.
2. Before administering unfamiliar medications, review the drug pharmacology and check facility policy to ascertain which drugs a nurse can add to an IV ordered by a provider, or administer. If unfamiliar with a particular drug, check the drug, use, dose, contraindications, and side effects.
3. Check IV administration set package to determine the drop factor (number of drops/mL or cc/min). For buretrol, volutrol, or pediatrol administration, dilute as required and regulate the flow according to the recommended rate so that the medication will not damage tissue, yet will be absorbed before loss of potency occurs. A volumetric infusion pump should be utilized with continuous infusion.
4. Assess client and position for comfort while explaining the procedure. Locate appropriate vein.
5. If area to be injected is hairy, clip hair to prevent adhesive tape from causing discomfort during removal (do not shave the area; shaving can contribute to infection).
6. To obtain maximum use of arm veins, start a saline lock (with extension tubing attached) in non-dominant hand vein, unless contraindicated, so that site changes can gradually be move up the arm.
7. Insertion must be performed using aseptic technique. Check with the client regarding allergies. Then prepare the site with antiseptic solutions in kit applied in circular outward motions.
8. Permit area to air dry. Apply disposable gloves before inserting catheter.
9. Insert catheter or steel winged needle (butterfly), bevel up, into the vein until flashback of blood is noted; remove inside retractable needle and tourniquet.
10. Stabilize catheter with tape and dress site according to facility policy.
11. Attach to infusion or heparin lock and flush, whichever is ordered.
12. If administering continuous infusions attach additional bottles, bags, or pumps as ordered, documenting and labeling appropriately.
13. IV fluid should be 18–24 inches above the peripheral infusion site unless on a pump.
14. Highly acidic, alkaline, or hypertonic fluids should be administered through large veins (e.g., subclavian) to facilitate adequate dilution.
15. Maintain rate of flow as ordered; check every 30 min, or more often if client is restless and moves the limb where the IV is inserted.
16. Periodically count flow rate even if an infusion pump is in use.
17. Check amount of fluid administered at least hourly and maintain accurate I&O record.
18. Flush IV as required based on the type of catheter used, medication administered, and equipment used.
19. When medication is added, record the name of the drug, dosage, date and time of addition, and your signature on a label to be attached to the bottle, bag, or volutrol container. If already done by the pharmacy, check orders and the bag for accuracy.
20. Indicate on the client’s record that the drug has been administered, noting response or any adverse side effects or the need to stop or interrupt the infusion and why.
21. If flow stops, check that the tubing is not kinked or occluded by the position of the client. Reposition extremity to establish flow.
22. Assess for correct placement of catheter in the vein and for the absence of extravasation of fluid if the IV rate slows despite clamp or pump adjustment, if the site of injection becomes pale or edematous, or if the client complains of pain.
23. Remind client to report any “strange feelings” such as lightheadedness, difficulty breathing, or increased site pain.
24. Use one of three methods to assess for correct placement of the catheter in the vein:
   a. Lower the container below the level of the vein. If blood flows back into the tubing, most often it is in the vein. If blood returns slowly, it may have partially slipped out of the vein. If blood does not return, most likely it is not in the vein. This procedure is not recommended when the IV contains a vesicant or drug that can cause necrotic damage to the tissue.
   b. Observe the site frequently for swelling, erythema, or pain and instruct client to report any of these signs or symptoms.
   c. Aspirate on catheter device or saline lock utilizing a saline flush solution. Observe for blood and flush with saline. Observe for any swelling, coolness, or reported pain. Follow the saline flush procedure per facility policy, usually every 8-12 hour shift for peripheral lines.
25. Prevent air embolism by adding an additional container of solution before the old container completely empties; check that all connections are tight, position the extremity receiving infusion below the level of the heart to prevent negative pressure, venous collapse, and sucking air into tubing; position clamp of infusion pump regulating the flow no lower than 4 inches above the level of the heart to prevent formation of negative pressure in the tubing below; allow tubing to fall below the level of the extremity to help prevent air from entering the vein if the infusion bottle empties before the IV is discontinued; make sure pump alarms are set on.
26. Signs and symptoms (S&S) of air embolism: respiratory distress, cyanosis, hypotension, weak pulse, elevated central venous pressure (CVP), and loss of consciousness.
27. If air embolism occurs, stop infusion and notify provider. Position client on left side and administer oxygen and other supportive measures.
28. Prevent “speed shock” by checking the rate of flow frequently and observing for side effects associated with the drug being administered. This occurs when a drug is given too quickly resulting in toxic plasma drug levels.

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29. Geriatric clients tend to have decreased cardiac efficiency. There is increased danger of circulatory overload during IV therapy. Monitor for rise in BP, rapid respirations, coughing, and shortness of breath.

30. Assess for S&S of thrombophlebitis, such as pain, tenderness, and redness along the path of the vein. Those receiving IV infusions for more than 24 hr are especially susceptible to phlebitis. Alcohol, hypertonic solutions with carbohydrate above 10%, and solutions with high alkaline or acid pH cause phlebitis more frequently.

31. If S&S of phlebitis appear, restart IV in another limb and apply warm soaks to elevated phlebitic area for 20 min 3 or 4 times each day.

32. Do not flush a clogged IV. The flow might have been stopped by an embolus that should not be moved into the circulation. If an attempt to aspirate the clot with a syringe is unsuccessful, remove IV and restart therapy in another area.

33. Schedule incompatible medications to be administered at different times; flush lines thoroughly between therapies.

34. Remove IV when ordered. Clamp off tubing before removing IV to prevent extravasation into SC tissues. Press down with a sterile sponge at site of needle or plastic catheter while removing to prevent bleeding. Apply bandage to site to prevent bleeding and infection.

35. Chart I&O and record all fluids and medications administered.

36. Assess site, and perform dressing and tubing changes according to facility policy.

CENTRAL VENOUS ADMINISTRATION

Short-Term Infusion Therapy

Central venous infusion is the administration of fluids through a catheter into a central vein. Three general types of catheters are available: over-the-needle, through-the-needle, and the catheter over the guidewire (most commonly used). The short-term catheters consist of single- or multiple-lumen catheters of PVC or polyurethane. The sites of insertion include internal jugular vein, external jugular vein, subclavian vein, cephalic vein, basilic vein, and the femoral vein.

Intervention/Procedure

1. Review goals of therapy and provider explanation to client. Clarify any questions or concerns as needed.

2. Ensure that there is a signed consent form for the procedure.

3. Assemble all necessary equipment and assist provider with catheter insertion unless IV team performs function).
   a. Place the client in a Trendelenburg position to raise venous pressure and reduce risk of embolism.
   b. Insert a rolled towel lengthwise under the client’s upper mid-back to make the subclavian vein more prominent through venous distension.
   c. Turn the client’s head away from the insertion site and drape the insertion area to prevent airborne contamination.
   d. Instruct the client to bear down (Valsalva’s maneuver) when the needle is inserted to prevent air from entering the vein.
   e. Assist the provider with gown and gloves for the procedure.
Once the site is prepped and the catheter inserted and sutured, assist with site dressing. Date, time, and initial as per facility policy.

4. Run the isotonic solution at keep open rate until x-ray verifies catheter position.

5. Control sepsis by the following:
   a. Use sterile technique with dressing changes following facility policy and procedure.
   b. Frequently assess dressing and if it is loose, soiled, or wet, change it immediately.
   c. Assess skin site at catheter insertion site, and document findings. Report any leaking, increased swelling, drainage, or erythema at site.
   d. Change infusion tubing and filters every 24–48 hr as per facility policy. Tape all connections to prevent the introduction of air. Remove catheter as soon as condition permits.

6. Refrigerate total parenteral nutrition (TPN) solutions and discard all outdated TPN solutions.

7. Observe solution for clouding, growth, or particulate matter. If contamination is observed, notify the pharmacy, hang a new bag or bottle, and send contaminated one for culture.

8. Use 10% dextrose/water if bag or bottle of TPN must be removed and another is not available.

9. Assess the client’s temperature every 4 hr for elevations.

10. Report any chills or fever or other evidence of sepsis. Replace bottle or bag and tubing and send equipment for culture. Further tests such as blood, urine, sputum cultures, chest x-ray (CXR), and client exam may need to be done to locate foci of infection.

11. If undetermined and fever continues for 12–24 hr, assist with removal of catheter and, if indicated, assist with insertion on the other side. Send removed catheter tip for culture.

12. Maintain the rate of flow.
   a. Use an electronic infusion device if at all possible.
   b. Use an infusion pump when a 0.22 micron filter is used. The flow with a 0.45 micron filter will continue by gravity drip so that an infusion pump is not essential with this filter size.
   c. Count drip rate periodically to ensure that pump is accurate.
   d. Calculate and maintain a uniform flow rate for 24 hr unless condition precludes it.

13. Check for kinks and position tube meticulously.

14. Tape all connections to prevent introduction of air.

15. Assess for:
   a. Evidence of pneumothorax as manifested by chest pain, dyspnea, cyanosis, diminished breath sounds, and abnormal CXR
   b. S&S of fluid overload by prominence of neck, arm, and hand veins, elevated CVP, lassitude, headache, nausea, twitching, hypertension, mental fuzziness, somnolence and seizures
   c. Infiltration by noting pain and swelling in shoulder, neck, or face, and x-ray confirmation of displacement of catheter
d. Improperly placed, slipped, or broken catheter, or a leak at the tubing union, which may present as a wet dressing

e. Catheter blockage by noting occlusion alarms on pump, inability to administer medication and flush, and inability to withdraw blood. Do not forcibly try to flush a blocked catheter; notify provider.

f. Evidence of infection such as chills, fever, purulent exudate, elevated WBCs

16. Decrease incidence of infections by following strict aseptic technique and ensure that others do as well, covering insertion site with appropriate dressing and changing as per policy and as indicated.

17. During administration of TPN assess for:
   a. Hyperglycemia
   b. Glycosuria
   c. I&O and record
   d. Daily weight
   e. Laboratory evidence of electrolyte balance and liver and renal function
   f. Caloric count of daily oral and parenteral intake

18. All TPN solutions must be dated and labeled with time started, infusion rate, time to be completed, client’s name, and nurse’s initials.

19. Ensure that TPN solution is changed every 24 hours.

Central Venous Catheters
PICC Line Tunneled Central Catheter, Implanted Ports and Nontunneled

Intermediate-Term Therapy
Peripheraly Inserted Central Catheters (PICC LINES). A peripherally inserted central catheter (PICC) is a longer-term catheter that is placed percutaneously through the basilic or cephalic vein in the arm and is threaded into the superior vena cava (SVC). The PICC catheter consists of a single or multiple lumen catheter. They are usually 20–25 inches long and range in size from 16–23 gauge. Specially trained and certified nurses (such as on the IV team) insert these catheters. They do not require surgical insertion and are easier for the client to care for. The advantage of PICC lines is that they generally can be left in place for 1–3 months. Correct placement should be confirmed by fluoroscopy or chest x-ray. Midline catheters are shorter, do not enter the SVC, and do not require x-ray confirmation of placement. Flush PICC lines daily with heparin flush.

1. Review goals of therapy and explain the procedure to the client and family if in attendance.
2. Ensure that a signed consent is obtained from the patient or designated next of kin.
3. Prepare equipment and supplies.
4. Position the client in a supine position with arm extended laterally to shoulder level.
5. Apply tourniquet above the antecubital fossa and select vein for insertion (the basilic vein is straighter and allows easier catheter advancement).
6. Follow strict surgical asepsis (gown, mask, and gloves) to prevent any potential for infection.
7. Release tourniquet and measure from the insertion site up to the shoulder and across to the midclavicular region and the sternal notch and then down to the third
intercostal space to determine the length of catheter needed for insertion into the SVC.

8. Prep and drape the area; reapply tourniquet and cover with a sterile gauze to prevent contamination during release.

9. From the sterile tray measure the catheter and add 1 inch to the calculation and trim off excess tubing or as directed by manufacturer.

10. Flush catheter with 5-mL syringe and leave it attached to the catheter.

11. Insert introducer with bevel up; blood return will be evident when the vein is entered.

12. Advance catheter through introducer using special nontoothed forceps; release tourniquet and advance catheter to the 6-inch mark.

13. Instruct the client to turn toward you and to place chin to chest to facilitate advancing the catheter into the subclavian vein.

14. Once the catheter has been threaded to the desired length, remove introducer and attach tubing to IV fluid. Run at keep open rate until verified by x-ray if placed in SVC.

**Long-Term Therapy**

**Implanted Venous Access Devices (VADS) and Venous Access Ports (VAPs).** Long-term central venous catheters are much more flexible than the short-term catheters and are composed of a silicone rubber, which is thrombogenic. Implantation of these catheters is generally performed by a surgeon, with the client under a local anesthetic in the operating room (OR). These devices permit the infusion of medications intermittently or continuously, the administration of blood or blood products as well as fluids and TPN, and blood sampling for lab studies in clients generally requiring long-term therapy.

Catheters: Some of the more common implanted catheters include: Broviac™, Triple Lumen Hickman™, Groshong™, Corcath. These catheters are threaded into the superior vena cava and junction of the right atrium and tunneled subcutaneously to a distal exit site. Catheter fixation of the Dacron cuff to local tissue usually takes 2–3 weeks. A positive pressure apparatus (infusion pump) should be used to administer fluids because these catheters can kink and clot easily. These catheters generally require daily flushing and/or after each treatment administration to maintain patency. Follow facility policy and recommendations in product literature concerning the gauge and length of needle used to access catheters.

Ports: Some of the common implanted SC ports include Infuse A-Ports, Mediport II (DL), Port-A-Cath, and Hickman subcutaneous port. These ports can be implanted by the surgeon under a local anesthetic in less than 1 hr. They consist of a catheter attached to an injection port, which has a self-sealing entry septum (diaphragm). The catheters are threaded through the subclavian vein into the superior vena cava and terminate at the junction of the right atrium. The port is implanted usually in the right infraclavicular fossa (anterior chest) just below the skin surface. Because all the components lie below the skin surface, once healed the site does not require a dressing and will not interfere with normal activities or body image. An infusion pump should be used for all continuous fluid administration. Use a noncoring needle (deflected point) or special
Huber needle to access the port to prevent catheter shear. These ports generally require flushing once a month or after each treatment. The ports are easily hidden under clothes and provide the client freedom from the pain of multiple sticks and also from long-term hospitalization. Unused ports should be flushed every 28 days with a heparin solution.

**General Nursing Considerations for SC Ports**
1. Inspect site for evidence of hematoma, swelling, excessive accumulation of exudates, infection, and device rotation or erosion after implantation. X-ray confirmation of catheter placement is usually performed after insertion and always before initial access.
2. Use aseptic technique when accessing all ports. Review product literature and follow facility policy. A Huber needle or a noncoring needle with a deflected point is used.
3. Generally, implanted devices can be used 24–48 hr after insertion. Have a trained individual perform the first access.
4. Prepare a Huber or noncoring needle attached to extension tubing filled with sterile saline for injection.
5. Palpate reservoir to locate injection port. Apply gloves and prepare site.
6. Triangulate port between thumb and first two fingers of nondominant hand. Insert a noncoring needle with a dartlike motion (at a 90 degree angle) until it hits the bottom of the reservoir.
7. Attach a 5 cc syringe to the Huber or noncoring needle to aspirate to ensure correct placement (blood return).
8. With prepared extension tubing and saline filled syringe, flush port with 5 mL sterile saline.
9. Clamp extension tubing, remove syringe with saline, and attach medication administration set.
10. Administer prescribed medication following facility procedure and at recommended rate.
11. When medication administration is completed, flush extension tubing with 5 mL saline and follow with 5 mL heparinized saline to maintain VAD patency.
12. If infusion is taking place at home, provide step-by-step instructions for the client and family to follow. Also provide the client with the name and number of the person to contact if there are problems. Train additional member and ensure that he or she can perform the procedure satisfactorily before sending the client home. Provide written guidelines and step-by-step directions to follow.

**ELECTRONIC INFUSION EQUIPMENT/DEVICES**
Electronic infusion devices permit the uniform administration and control of fluids and medication with few complications. They do require periodic monitoring but they save valuable nursing time, hospital bed use, and protect the client from potential medication overdosage. The general category of pumps includes:

- Syringe pump—administers small amounts of medication or fluid (0.01 mL/hr) slowly
- Nonvolumetric pump—measures drop rate of fluids; some require special tubing
- Volumetric pump—measures volume; requires a special cartridge or cassette
Because all pumps and manufacturers vary, it is recommended that the product literature and facility procedures be reviewed before initiating therapy. A variety of compact, lightweight infusers are now available for at home, ambulatory IV mediation therapy. Some in frequent use include:

- Ambulatory micro infusers
- Patient-controlled analgesic devices (PCA)
- Continuous subcutaneous infusions (CSI) for pain control
- Auto syringe portable infusion pumps

These advanced technological devices all require detailed and thorough in-service for staff and education and written instructions for the client before application and discharge. Facilities are moving from individual pumps to integrated infusion systems and smart pump technology in an effort to reduce errors.

**Client Family Teaching**

1. Instruct client to wear appropriate protective apparel as necessary.
2. Demonstrate appropriate technique for pump set-up, medication instillation, and priming of cassette, if applicable. Use a return demonstration teaching format.
3. Describe general principles for the correct operation of the specific infusion pump utilized and provide a printed guide with written step-by-step instructions to follow.
4. Designate how to contact the health care provider, by phone, pager, or otherwise, when assistance is needed. Some manufacturers offer a 24-hr hotline to answer questions on the illness and pump therapy (e.g., MiniMed Infusion Pump, MiniMed Technologies). Check with manufacturer about this service.
5. Stress the importance of proper device care and use to ensure proper functioning.
6. Remind client to report for all scheduled visits because compliance is of the utmost importance when performing sophisticated therapy at home.
7. Review S&S that require immediate medical attention (e.g., fever, chills, bleeding, etc.).

**INTRA-ARTERIAL INFUSION ADMINISTRATION**

Administration by intra-arterial infusion involves insertion of a catheter by a surgeon under fluoroscopy into the artery leading directly into the area to be treated. The arteries commonly used are the brachial, axillary, carotid, and femoral. The drug is then pumped steadily through the catheter. Intra-arterial ports may also be implanted. The catheter is usually inserted into the hepatic arterial system. This technique permits direct administration of potent, undiluted chemotherapy to tumors without metabolic breakdown by the liver or kidneys. The tumor receives a high concentration of the chemotherapeutic agent before the drug is distributed to the rest of the body. The drug can be administered at varying intervals of time. All intra-arterial fluids must be administered with either a positive pressure device (infusion pump) or a pressure cuff, because of arterial pressure forces. Intra-arterial infusions can be performed on an
ambulatory basis with a portable infusion pump, but the client must be taught carefully how to monitor the apparatus and therapy is reserved for only select clients.

**Intervention/Procedure**

1. **Assess:**
   a. Tissue in local area for reactions, such as erythema, mild edema, blistering, and petechia
   b. Vital signs periodically (q15 min) when therapy started and until BP is stabilized
   c. Infusion site for bleeding or infection
   d. I&O
   e. CBC, PT/PTT, liver and renal function studies
   f. Client response to therapy

2. Report pain; may be indicative of severe injury to normal tissue, vasospasm, or intravasation.

3. Maintain pump at prescribed rate; do not permit infusion fluid to run through completely because air will then enter tubing. Add fluid as needed.

4. Clamp tubing if an air bubble is noted and notify provider. Do not disconnect tubing between pump and client to release the air bubble because hemorrhage will occur.
   Apply pressure if hemorrhage occurs from artery.

5. Check tubing for kinks and prevent compression of tubing to ensure regular flow.

**PERFUSION (EXTRA CORPOREAL OR ISOLATION PERFUSION) ADMINISTRATION**

Administration by perfusion technique involves the administration of large doses of highly toxic drugs to an isolated extremity, organ, or region of the body. For perfusion in the lower extremity, the iliac, femoral, and popliteal arteries and veins are used; for upper extremity perfusion, the axillary artery and vein are injected. The abdominal aorta and vena cava are used for pelvic perfusion. The actual perfusion is accomplished in the OR where, by means of a pump oxygenator, the client’s blood is circulated in a closed system for the part of the body involved. Efforts are made by the use of a tourniquet or ligature to prevent seepage of the concentrated drug into the systemic circulation. Seepage of the drug results in destruction of normal tissue. Drugs can also be administered by intraperitoneal, intracardiac, intrapericardial, and intraosseous injections and infusions. Most facilities and nurse practice acts do not permit nurses to administer drugs by these routes unless certified/licensed perfusionist.

**INTRAOSSEOUS INFUSION (IO)**

Intraosseous infusion involves the introduction of a needle through the bone (usually the proximal tibia) into the marrow space to permit the infusion of fluids and medications. In this setting the bone marrow serves as a type of noncollapsible vein permitting infused fluids to rapidly enter the systemic circulation via an extensive network of venous sinusoids. The route is usually pursued in an emergent situation when overwhelming trauma or severe shock makes IV access impossible. Drug absorption and drug effectiveness are the same as with the IV route. This therapy is limited to only the very young because the red vascular marrow (essential for this type of therapy) is generally
replaced by age 5 with yellow, less vascular marrow. It is now a promising technique to establish access in adults according to AHA Advanced Cardiac Life Support text. Bone guns and other IO devices assist to insert a needle into the bone for access.