

Initiating intravenous therapy

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IN THE PAST DECADE, more than 90% of patients admitted to hospitals have received some form of intravenous (I.V.) therapy. Changes in long-term-care reimbursement and greater patient acuity have increased the number of infusions initiated at long-term-care facilities. So no matter where you work, the chances are good that your patient will need to have an I.V. catheter inserted during the course of his care to receive nutrition, hydration, medications, and blood or blood products.

Many states allow LPNs to assume care for all or part of a patient's infusion therapy, especially if they've completed additional coursework targeted to this care. LPNs are allowed to insert I.V. catheters, hang plain solutions, and provide routine I.V. site care in many states. Other states place few, if any, restrictions on what LPNs can do or infuse.

Before using the techniques discussed in this article, make sure you know and follow your state's scope of practice for LPNs, as well as your employer's policies and procedures.

Size does matter

The size and type of I.V. access the patient needs depends on both therapy- and patient-related factors. Patient-related factors include:

- age
- previous history of I.V. therapy (also surgery/dialysis access)
- severity of illness or injury
- skin integrity
- degree of hydration
- presence of edema
- obesity
- ability to function with the access in place.

Therapy-related factors include:

- length of therapy
- concentration of drugs/solutions to be infused
- number of incompatible drugs/solutions to be infused
- potential for tissue damage in the event of the I.V. leaking into surrounding tissue
- whether the intended infusion is to be run continuously or intermittently.

Short peripheral I.V. catheters are suitable for short-term (generally less than 6 days) therapies that aren't especially

irritating to the veins. (Patients requiring I.V. therapy for more than 6 days should be evaluated for a midline catheter or a peripherally inserted central venous catheter.)

Peripheral I.V. catheters are placed in the superficial veins of the hands and forearms in adults and older children, and in the legs, feet, scalp, and arms of infants. In adults, they may dwell from 48 to 72 hours, according to the Infusion Nurses Society's standards of practice and recommendations from the Centers for Disease Control and Prevention (CDC).

These catheters are available in a variety of sizes (gauges). The larger the gauge number, the smaller the catheter's diameter. Always select the smallest catheter that'll deliver the prescribed therapy. You rarely use a catheter larger than 20 gauge, unless the patient requires rapid fluid replacement, such as in a trauma situation or when you have to administer blood quickly.

Most therapies infuse well through 22-gauge or smaller catheters. Using these smaller catheters helps to minimize complications within the vein while the catheter is in place. The smaller the catheter, the more easily blood can flow around it in the vein. This maximizes hemodilution and prevents pooling of the infusion at the site, which can lead to vessel damage and leakage.

Keep it short

Unless it's necessary to insert an I.V. into a deep vein, or the patient has a lot of edema or overlying tissue, a catheter that's 1 inch or less should ensure its stability in the vein without irritating a long segment of the vessel. The advantages of short peripheral catheters include their ease of insertion, their low cost, and their relatively low infection rate. Disadvantages include the requirement for adequate veins for placement in the hands or forearms, their short dwell times, and the lack of suitability for irritating therapies.

According to the Infusion Nurses Society's standards of practice, you should never give certain types of infusions through a peripheral I.V. catheter. These include:

- solutions with more than 10% dextrose or 5% protein
- vesicant drugs (those that will cause blistering if they come into contact with the surrounding tissue)
- irritant medications (those with an extremely acidic or alkaline pH [<5 or >9])

- drugs that are indicated by their manufacturers to be given only through a central venous catheter.

The right site

Before starting an I.V., perform a baseline assessment on the patient. See *Taking a baseline assessment* for more information. You should use this time to provide basic teaching to the patient about the catheter insertion and the complications to report.

The baseline assessment will allow other staff caring for the patient to later assess his response to the therapy, based on the patient's condition before the start of I.V. therapy. For example, suppose the patient develops a complication. Your assessment will help determine if it's related to his infusion.

As you assess the patient, examine his hands and forearms for suitable veins for venipuncture (see *Where to find the veins*). Give preference, if possible, to sites in the patient's nondominant arm. Suitable veins should feel round, soft, elastic, and engorged, not hardened, bumpy,

flat, or excessively curved. Young children, babies, and older patients tend to have fewer accessible veins than older children and younger adults.

Also, think about the type of solution you're going to infuse. If it's an irritant or vesicant medication—even if it's given for only a short time—a larger vein is the best choice, because it allows for better hemodilution.

Consider, too, your own skill level. As you become more skilled with venipuncture, you may be more confident trying veins that are smaller, deeper, or otherwise more difficult to access. In the meantime, try to work with veins that you can easily see and feel. If the patient doesn't have veins that meet those criteria, ask someone more experienced to perform the I.V. start.

The wrong place

Not every site is right for every patient. Avoid veins in extremities with compromised circulation, such as in patients who've had a mastectomy with lymph node dissection, are paralyzed on one side, or have a permanent



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Where to find the veins

Become familiar with the veins most commonly used for I.V. starts.

The large upper **cephalic vein** lies above the antecubital space and is often difficult to visualize and stabilize. It can accommodate 22- to 16-gauge catheters, but it should be reserved for a midline catheter or peripherally inserted central catheter.

The **accessory cephalic vein** branching off the cephalic vein is located on the top of the forearm. Medium- to large-sized, it's easy to stabilize and can accommodate 22- to 18-gauge catheters. However, the catheter tip shouldn't be placed in the bend of the arm.

The **median vein** of the forearm originates in the palm of the hand, extends along the underside of the arm, and empties into the basilic vein or median cubital vein. This vessel is medium-sized and easy to stabilize and can accommodate 24- to 20-gauge catheters.

The **median cubital vein** lies in the antecubital fossa. This site is generally used to draw blood and to place a midline or peripherally inserted central catheter. A short peripheral catheter in this site limits mobility, and I.V. complications, especially infiltration, are difficult to detect in this area. An I.V.-related complication here means that the veins below this site can't be used.

The **basilic vein** lies along the medial (little finger) side of the arm. Large and easy to see, it rolls and is difficult to stabilize. Often ignored because its location makes it difficult to work with, it can accommodate 22- to 16-gauge catheters. Increase your success with this vein by placing the patient's arm across his chest and standing on the opposite side of the bed to perform the venipuncture.

The **cephalic vein**, lying along the lateral (thumb) side of the arm, is large and easy to access. Accommodating 22- to 16-gauge catheters, it's an excellent choice for infusing chemically irritating solutions and blood products. Because the radial nerve is close to this vein, venipuncture can be done 4 inches proximal to the wrist, but not in the wrist.

The metacarpal and dorsal veins on top of the hand are good sites to begin I.V. therapy in some patients. Easily visualized, they can accommodate 24- to 20-gauge catheters. Don't use this site for vesicant medications.

dialysis shunt/fistula. Also, avoid veins over joints because an I.V. catheter might dislodge or pop in and out of the vein with movement.

Don't choose sites below previous I.V. sites in the same vein, or below infiltration or phlebotic sites. Avoid bruised areas, areas with skin inflammation or open wounds, or veins that are reddened, scarred, or uncomfortable.

Because venous valves return blood to the heart against gravity, avoid "bumps" that appear when you distend the vein with a tourniquet or blood pressure cuff. The bumps indicate pooling of blood in the sinus above the valve, and valves should be avoided; damaging them can lead to blood pooling in the distal portion of the arm. Valves are always found at bifurcations (where a vein separates into two or more smaller veins), so stay away from these as well.

Also, avoid the wrist and the antecubital fossa; the nerves are too close by. Venipuncture in the forearm should be at least 4 inches above the level of the wrist.

Patients who've had multiple I.V. sticks, are dehydrat-

ed, have received long-term chemotherapy, have low blood pressure, or whose veins are otherwise compromised due to longstanding medical problems may not be candidates for peripheral I.V. therapy. A patient with a long medical history tends to have fewer suitable veins for cannulation; they may have become narrowed or hardened from scarring, bruising, or receiving irritating medications. In that case, the patient should have a more permanent central line inserted, especially if his treatment is expected to last for a long time.

Getting ready

Once you've found a suitable site for peripheral I.V. insertion and discussed any concerns the patient may have, you're ready to begin the procedure. A prepackaged I.V. start kit saves time, but one may not always be available. If not, you'll need the following equipment:

- a single-use, disposable tourniquet
- a roll of sterile tape. Tear a 3-inch piece and apply it to the edge of the clean work surface. Tear another 3-

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inch piece, split it in half lengthwise, and attach one end of each piece to the sterile tape on the edge of the work surface.

- a catheter securement device (optional)
- isopropyl alcohol wipes
- an antiseptic; 2% chlorhexidine gluconate is recommended, but 70% isopropyl or 10% povidone-iodine is also acceptable
- 2 x 2 sterile gauze
- a pair of clean gloves
- a transparent dressing
- a sterile drape (optional)
- a patient label
- a plastic bag and tie or disposal trash receptacle
- two I.V. catheters of appropriate gauge/length for the therapy
- a needleless system valve with extension set. Flush the extension set with the flushing agent (usually normal saline) before use.
- a syringe with saline flush (as ordered or per policy).

After verifying the health care provider's order and preparing a clean work surface, assemble the equipment, and perform hand hygiene. Answer any questions that the patient or their authorized family members may have about the therapy or insertion procedure.

Ask the patient to void and to complete any tasks necessary before the I.V. insertion to minimize interruptions during the procedure. Have them get comfortable and take the telephone off the hook. While providing privacy, position the patient in bed and raise the bed so you can work at a comfortable height. Don't forget to lower it after the procedure for patient safety.

You may want to position the patient's arm on a rolled towel or pillow for support. You can place a sterile drape under the intended venipuncture site (this is an optional step). Apply the tourniquet 4 to 6 inches above the intended site, avoiding areas of flexion; place the extremity in a dependent position to help distend the vein. You can also ask the patient to open and close his hand a few times. Just be sure his fist isn't clenched during insertion. If you still can't visualize the vein, try applying a warm compress. Make sure you've put on clean gloves.

If the chosen site is very hairy, it may be necessary to clip the hair with scissors or surgical clippers before applying the prepping solutions. Don't shave the area because of the risk of site infection. Locate the vein again and cleanse the intended site with the appropriate antiseptic solution. Be sure to use only one cleansing solu-

Taking a baseline assessment

Your baseline assessment of a patient scheduled for intravenous (I.V.) therapy should include the following:

- vital signs
- skin integrity over potential sites for venipuncture, as well as the condition of mucous membranes and skin turgor
- level of consciousness
- the patient's understanding of the ordered infusion
- heart and lungs sounds to check for signs of fluid overload, such as extra heart sounds or crackles in the bases of the lungs
- baseline weight (for patients who are to receive a continuous infusion)
- renal status (lab values and urine output)

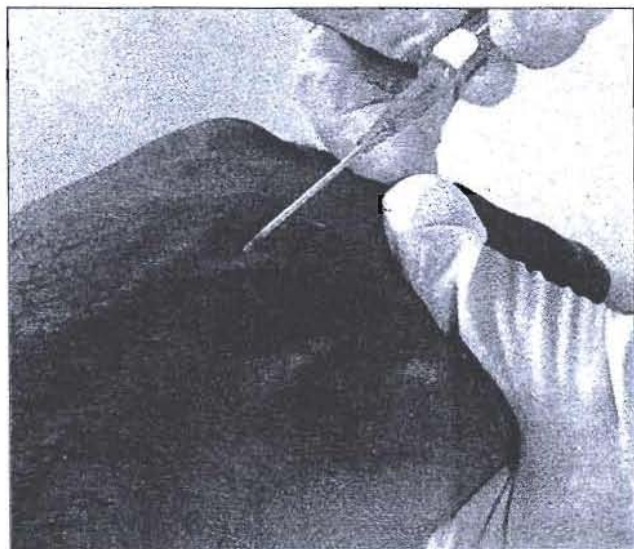
tion; don't mix and match.

With 2% chlorhexidine gluconate swabs, use a back-and-forth motion to cleanse the site, then allow 30 seconds for the solution to dry. With 70% isopropyl alcohol or 10% povidone-iodine, use concentric circles, starting in the center and cleansing a diameter of 2 to 3 inches. Drying time is 30 seconds for 70% isopropyl alcohol and 2 minutes for 10% povidone-iodine.

Venipuncture time

Open the I.V. catheter package and inspect the catheter for any flaws or contamination, such as filaments or the needle going through the catheter wall. If required by the product, turn the catheter on the needle hub or lift it just slightly to verify the ease of separation.

Apply traction to the skin and anchor the vein with your nondominant hand (below), but don't touch the



prepped area directly. Using your dominant hand, insert the catheter, bevel up, at a 10- to 30-degree angle either

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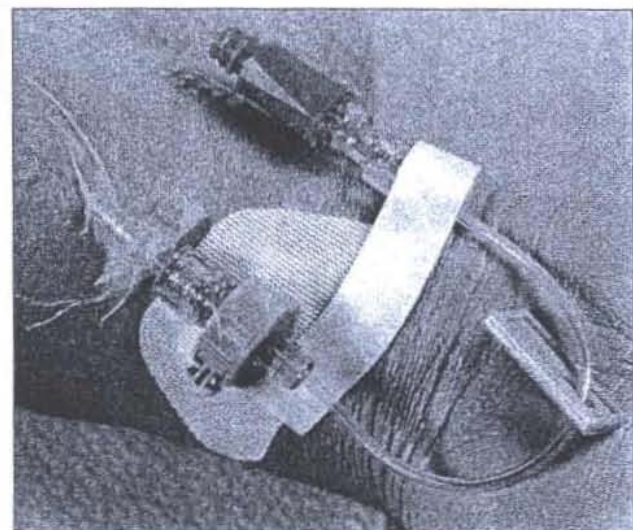
just beside or directly over the vein. Direct the needle toward the vein and stop when blood appears in the flashback chamber. Lower the catheter/needle angle so that it's parallel with the skin, and then insert it a little bit more to ensure that the catheter tip is in the vein.

Verify that blood continues to come into the flashback chamber. If flashback stops and the chamber isn't full, slowly and carefully back the catheter out until flashback returns.

Holding the needle (stylet) steady, use your index finger or nondominant hand to gently slide the catheter over the needle and into the vein up to the hub. Follow the manufacturer's instructions for catheter advancement and activation of the safety feature. Stop immediately if you meet resistance or if the patient complains of severe pain; both indicate that the catheter isn't in the vein.

Place the sterile 2 x 2 gauze under the hub of the catheter to catch any backflow of blood. Release the tourniquet and apply digital pressure proximal to the insertion site on the vein to minimize blood backflow. Hold the primed extension set in your nondominant hand and remove the stylet from the catheter hub, activating the safety feature. Attach the extension set to the hub of catheter, and flush to verify patency. Close the clamp on the extension set while maintaining pressure on the plunger of the syringe.

Next, secure the catheter with sterile tape or a commercial catheter securement device (below), per your facility's policy. Apply the transparent dressing over the



site and partially over the catheter hub so that it's possible to observe the insertion site at all times. Apply the completed patient label to the site, and appropriately discard all used supplies. Initiate any infusions as ordered.

Instruct the patient on the signs and symptoms of I.V.-

related problems and advise them to report these immediately. Wash your hands, and document the procedure. Be sure to include the date and time of the procedure, patient instruction, patient response, catheter size, and site condition. Document the flushing agent used and the amount on the medication administration record.

If your patient is on a continuous infusion, carefully monitor his intake and output; they should be balanced to prevent fluid overload. A baseline weight with follow-up weight checks can help with this monitoring. A gain or loss of $\frac{1}{2}$ pound in 24 hours is fluid related. Each liter of fluid weighs 2.2 pounds.

Caring for the site

If a patient needs infusion therapy for more than 3 days, most institutional policies require that the I.V. be moved to another location to prevent infection. The CDC recommends that peripheral I.V. sites be rotated every 72 hours in adults.

In general, site care is performed when I.V. sites are rotated, but may become necessary if the dressing doesn't adhere, if it becomes damp or soiled, or if a tape and gauze dressing are used (these are usually changed every 24 to 48 hours). Use aseptic technique, and be careful not to dislodge the I.V. catheter while removing the old dressing. Cleanse around the site with 2% chlorhexidine gluconate, or use your institution's preferred antiseptic solution as stated in written policy. After the solution is dry, replace the dressing per policy.

Use aseptic technique when removing a peripheral I.V. catheter. Gently pull it out of the site in the opposite direction as it was inserted to avoid tearing either the vein or the skin around the site.

Don't apply pressure to the vein until the catheter has been removed. Then, hold firm pressure for 2 minutes or more. Patients who are receiving anticoagulants need to have that pressure held longer to prevent bruising. Apply a sterile adhesive dressing to the site after bleeding stops.

You play an important role in your patient's I.V. care. Like most skills, the more opportunity you have to practice peripheral I.V. insertion, the greater your success and confidence will be. **LPN**

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