

Intravenous Solution: Preparing and Administering

What Is The Process of Preparing and Administering an I.V. Solution?

- › Preparing and administering an I.V. solution involves verifying that it is the correct solution per the treating clinician's order, readying the solution bag and tubing for administration, and infusing the solution at the prescribed rate. This *Nursing Practice & Skill* will provide general information on preparing and administering a maintenance I.V. solution that does not contain an added medication; for information on administering medications via the intravenous
 - *What*: I.V. fluids are prepared and administered to prevent and treat a wide range of physiologic conditions(see *Why is Preparing and Administering an I.V. Solution Important?*, below)
 - *How*: After verifying the clinician's orders, the solution is prepared by removing the protective cover from the I.V. bag, labeling the bag, spiking the bag, priming the I.V. tubing, hanging the bag on an I.V. pole, and connecting the I.V. tubing to the patient's I.V. catheter; the I.V. solution is then administered at the prescribed flow rate using an infusion pump or flow regulator. Aseptic non-touch technique (ANTT; i.e., a type of asepsis in which nothing that is sterile is allowed to come into contact with anything not sterile) is used when preparing and administering I.V. solutions
 - *Where*: I.V. solutions are prepared and administered in all healthcare settings where I.V. therapy is provided, including in outpatient, inpatient, and homecare settings
 - *Who*: Physicians typically order I.V. therapy, but nurses are principally responsible for preparing and ensuring proper administration of the I.V. solution. The procedure cannot be delegated to assistive personnel. Family members may be present when I.V. solutions are prepared and administered

What is the Desired Outcome of Preparing and Administering an I.V. Solution?

- › The desired outcome of preparing and administering I.V. solutions is to ensure the safe administration of parental fluids. Following ANTT during preparation and administration helps to reduce the risk for catheter-related blood stream infections (CRBSIs)

Why Is Preparing and Administering an I.V. Solution Important?

- › I.V. solutions are prepared and administered to maintain the body's water balance, replace lost fluid volume, and/or provide supplemental electrolytes. Conditions which can necessitate replacement of fluid volume include acute burns, trauma, hemorrhage, polyuria, fever, dehydration, and third spacing (i.e., accumulation of fluid in the peritoneal, pleural, or other body cavity)

Facts and Figures

- › Researchers in a multicenter, randomized clinical trial evaluated the influence of crystalloid versus colloid solutions on the 28-day and 90-day mortality rates of critically ill patients resuscitated for hypovolemic shock. There was no difference in 28-day mortality between those resuscitated using crystalloids and colloids, but those receiving

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colloids demonstrated a lower 90-day mortality than did those receiving crystalloids. The researchers called these findings exploratory, however, and stated that further study is needed before a conclusion can be drawn regarding the efficacy of one over the other (Annane et al., 2013)

What You Need to Know Before Preparing an I.V. Solution

- › The clinician should be able to distinguish between various types of I.V. solutions and be aware of the potential adverse effects of fluid replacement
 - There are over 200 different types of I.V. fluids used in current clinical practice. These fluids can be classified
 - according to tonicity (i.e., concentration of ions in the fluid; also called the osmotic pressure, osmolarity, or osmolality) in comparison to blood plasma, which has an osmolality of about 290 milliosmoles per liter (mOsm/L). There are three categories of I.V. solutions: *isotonic*, *hypertonic*, and *hypotonic*
 - *Isotonic* fluids are fluids that are of equal or near-equal tonicity to blood plasma (240–340 mOsm/L). NS is an example of an isotonic fluid
 - *Hypertonic* fluids have a tonicity of > 340 mOsm/L. Hypertonic fluids include 3% or 5% NS and those that contain albumin or dextrose
 - *Hypotonic* fluids have a tonicity of < 240 mOsm/L. An example of a hypotonic fluid is 0.45% NS
 - according to the state of particles within the solution (e.g., completely dissolved, incompletely dissolved). I.V. solutions are typically referred to either being crystalloid (i.e., a solution in which particles are completely dissolved) or colloid (i.e., a solution with dispersed, but not completely dissolved, particles)
 - Crystalloids are solutions comprised of ions or sugars in water; these small molecular particles shift easily between the body's fluid spaces. Crystalloids include
 - 0.9% sodium chloride (normal saline [NS])
 - 0.25% saline
 - 0.45% saline
 - lactated Ringer's (LR)
 - 5% dextrose in water (D5W)
 - dextrose 5% in saline (e.g., D₅ 0.45% saline or D₅ 0.9% NS)
 - hypertonic saline (3% or 5%)
 - Colloids are solutions containing larger molecular particles (e.g., albumin) that tend to remain within the intravascular space, making this type of fluid useful for greater expansion of intravascular fluid volume. Colloids include
 - albumin (i.e., plasma protein)
 - dextran (i.e., polysaccharide)
 - hetastarch (i.e., synthetic starch)
 - mannitol (i.e., alcohol sugar)
 - All I.V. solutions can potentially lead to fluid overload. Monitor for signs and symptoms of fluid overload (see **Red Flags**, below) in all patients for whom I.V. fluid replacement has been ordered
- › Prior to preparing and administering I.V. solutions, it is essential that the nurse have knowledge of the following nursing responsibilities and tasks with regard to I.V. therapy:
 - Monitoring the patency and condition of the I.V. line. Infection control protocols and standard precautions using NTAT must be strictly followed when spiking I.V. bags and when connecting I.V. tubing to the patient's I.V. catheter to avoid exposure of the I.V. solution, tubing, or catheter to microorganisms that could cause local or systemic infection
 - Changing the I.V. catheter, tubing, overlying dressing, and administration set according to facility guidelines will help prevent CRBSIs. Most facilities follow evidence-based practice guidelines that require primary and secondary continuous administration sets and I.V. catheters be changed every 96 hours to reduce the risk of infection, and that I.V. solutions be changed every 24 hours
 - Back-priming infusion methods are preferred when I.V. solutions are compatible to reduce the risk of contamination caused by disconnecting secondary intermittent administration sets
 - The potential for infection increases with the number of add-on devices (e.g., stopcocks, catheter hubs, extension sets, needleless systems) and episodes requiring access
 - The nurse clinician must assess the I.V. catheter and equipment per facility protocol using both inspection and palpation to identify infiltration (**Figure 1**), infection, phlebitis (**Figure 2**), or other complication; if a complication occurs, the I.V. catheter is removed and treatment administered per clinician's order

–For more information on preventing I.V. therapy-related complications, see *Nursing Practice & Skill ... Intravenous Therapy: Preventing Complications*)

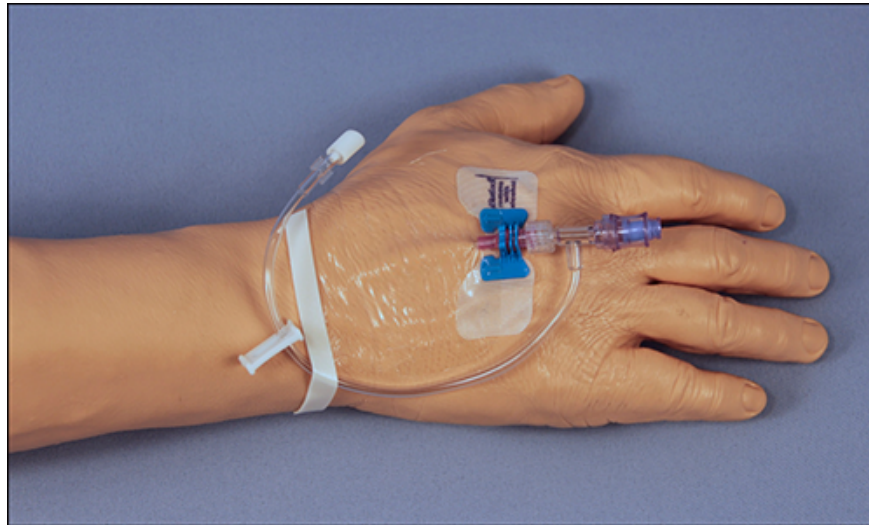


Figure 1: Example of infiltration at IV site. Copyright© 2014, EBSCO Information Services.

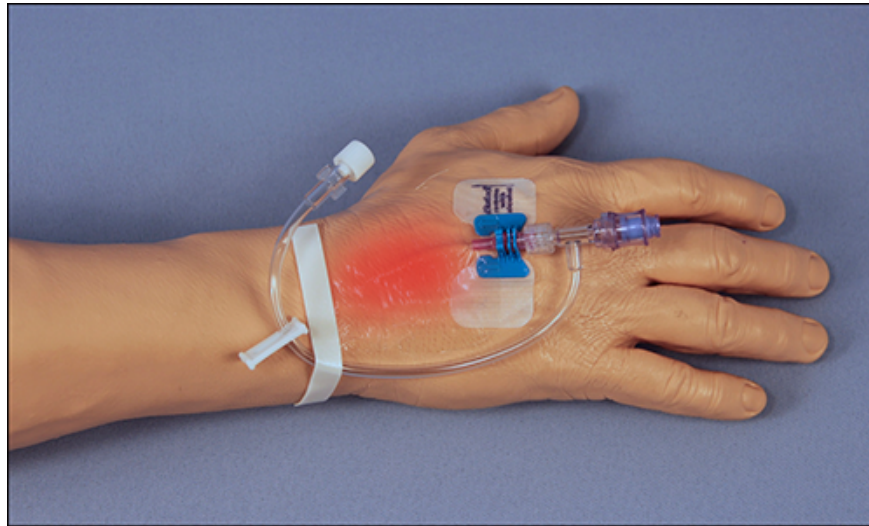


Figure 2: Example of phlebitis at IV site. Copyright© 2014, EBSCO Information Services.

- Medication administration. I.V. solutions are prescribed medications; adherence to the six “rights” of medication administration (i.e., right patient, right drug, right dose, right time, right route, and right documentation [following administration]) is essential to reduce the risk for medication errors and complications such as allergic reaction (for more information on preventing medication errors, see *Nursing Practice & Skill ... Medication Errors: Preventing Errors Associated with Intravenous Medications and Infusions*)
- How to calculate the flow rate if the solution is to be administered using an I.V. pump and the drip rate if the solution is to be administered via gravity (for more information, see *Nursing Practice & Skill ... Intravenous Infusions, Continuous: Calculating Doses and Flow Rates and Administering* and *Nursing Practice & Skill ... Intravenous Infusions, Continuous: Calculating the Drip Rate for a Gravity Flow Administration Set*)
- Preliminary steps include the following:
 - Review facility/unit-specific protocol for preparing and administering an I.V. solution, if available
 - Review the treating clinician’s order for prescribed I.V. solution to be administered
 - Verify completion of facility informed consent documents, as necessary
 - Typically the standard consent to treat document completed on admission is sufficient to allow administration of I.V. therapy
 - Review the patient’s medical history/medical record for
 - indications for I.V. therapy
 - any allergies (e.g., to latex, medications, or other substances); use alternative materials as appropriate
- Gather the necessary supplies, which typically include the following:

- Personal protective equipment (PPE; e.g., sterile/nonsterile gloves; use additional PPE [e.g., gown, mask, eye protection] may be necessary if exposure to body fluids is anticipated)
- Medication administration record (MAR)
- Prescribed I.V. solution
- I.V. administration tubing
- I.V. infusion pump, if indicated
- I.V. pole
- Facility-approved I.V. solution label
- Needleless I.V. adapter
- Facility-approved antiseptic solution
- Written information to reinforce verbal education

How to Prepare and Administer an I.V. Solution

- › Perform hand hygiene and don PPE, as needed
- › Identify the patient using at least 2 unique identifiers, per facility protocol
- › Establish privacy by closing the door to the patient’s room and/or drawing the curtain surrounding the patient’s bed
- › Introduce yourself to the patient and family member(s), if present; explain your clinical role; assess the coping ability of the patient and the family and for knowledge deficits and anxiety regarding preparing and administering an I.V. solution
 - Determine if the patient/family requires special considerations regarding communication (e.g., due to illiteracy, language barriers, deafness); make arrangements to meet these needs if they are present
 - Use professional certified medical interpreters, either in person or via phone, when language barriers exist
 - Explain the procedure, its purpose, and the patient’s expected participation during the procedure; answer all questions and provide emotional support as needed
- › Observe standard precautions and use ANTT throughout the procedure
- › Assess the patient’s I.V. site for redness, drainage, and pain (if the patient does not have an I.V. catheter in place, see *Nursing Practice & Skill ... Peripheral Intravenous Cannula: Over-the-Needle Catheter Insertion*)
 - Remove and replace the I.V. in a new location if there are indications of infiltration, drainage, or infection
- › Verify the first 5 “rights” of medication administration by checking the solution against the MAR and the clinician’s order to ensure it is the right dose of the right solution, being prepared for the right patient, at the right time. Check the intended infusion rate
- › Remove the protective cover from the I.V. solution bag
- ›
- › Visualize the I.V. solution
 - Check the bag for punctures, cracks, or leaks, and the fluid inside the bag for clarity, color, and absence of particulate matter
 - Verify that the expiration date on the bag has not expired
- › Label the I.V. solution bag with the date, time, patient’s name/room number, and your initials
- › Unwrap the I.V. tubing and close the roller clamp
- › Remove the protective covering over the I.V. tubing port of the I.V. solution
- › Hold the spike port of the I.V. tubing in your dominant hand (do not allow the tubing to drop to the floor) and remove the cap
- › Hold the I.V. solution in the nondominant hand, invert, and spike the I.V. solution by inserting the spike port into the I.V. tubing port using ANTT. Ensure that the entire length of the spike is inserted securely into the port
 - Do not allow your fingers to touch the spike
- › Hang the I.V. solution bag on the I.V. pole, while keeping hold of the tubing in your opposite hand
- › Rhythmically compress the drip chamber until the chamber is half full
- › Remove the cap from the end of the I.V. tubing, open the roller clamp, and prime the tubing (i.e., allow the tubing to fill with I.V. fluid)
- › Once the tubing is completely primed, close the roller clamp and replace the cap
- › Cleanse the patient’s needleless I.V. port by rubbing vigorously with an antiseptic agent (e.g., alcohol swab), according to facility protocol; remove the cap from the end of the I.V. tubing and attach
 - If not using a needleless port, disconnect the cap from the I.V. catheter, cleanse the catheter port;remove the cap from the end of the I.V. tubing and attach to the catheter hub
- › Open the roller clamp on the I.V. tubing and begin the infusion using one of the following two methods, per facility protocol:

- Adjust the clamp to regulate the flow of I.V. fluids via gravity at the prescribed drip rate
- Thread the tubing through the infusion pump, and program the pump to deliver the I.V. solution at the prescribed infusion rate
- › Discard used materials into the appropriate receptacle(s)
- › Perform hand hygiene
- › After administering the I.V. solution, document the following in the patient's medical record
 - Date and time solution was prepared and the infusion begun
 - Name of the solution and rate of infusion
 - Patient status prior to and after administration of the solution
 - Any unexpected outcomes and the interventions performed
 - All patient/family education

Other Tests, Treatments, or Procedures That May be Necessary Before or After Preparing and Administering an I.V. Solution

- › Frequently monitor the patient to observe for and document his or her response to the infusion, especially for adverse effects related to the infusion and for I.V. complications (e.g., infiltration, phlebitis)

What to Expect After Preparing and Administering an I.V. Solution

- › The I.V. solution is prepared correctly and using aseptic technique
- › The I.V. solution is infused at the rate ordered by the treating clinician

Red Flags

- › Monitor for **fluid overload** in all patients receiving I.V. fluids. Signs and symptoms include jugular venous distention, increased weight, hypertension, increased intake versus output, adventitious breath sounds, shortness of breath, and a rise in heart and respiratory rate; fluid overload can result in or exacerbate heart failure. The treating clinician should be notified immediately, and the patient is generally treated with diuretics and oxygen therapy
- › **Risk for hypersensitivity and anaphylaxis** is increased in patients who are receiving colloids, particularly albumin
- › **LR can increase serum potassium levels which increases risk for cardiac arrhythmias**. Monitor electrolyte levels in patients receiving LR

What Do I Need to Tell the Patient/Patient's Family?

- › Explain to the patient/family/caregiver the purpose of and steps involved in I.V. fluid therapy, and address any questions or concerns they may have
- › Reinforce to the patient the importance of notifying the clinician of discomfort or other symptoms experienced during the infusion

References

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