IV Therapy: Tips, Care, and Complications

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Purpose and Objectives

The purpose of this course is to provide a brief overview of intravenous (IV) therapy, including care and potential complications.

After successful completion of this course, you will be able to:

- Identify types and purposes of a variety of peripheral IV catheters and fluids for adult patients.
- Identify technique and documentation criteria for inserting and removing a peripheral IV line or saline lock.
- Discuss standards of management of IV lines, including tubing changes, rotation of IV sites, and peripheral dressing changes.
- Recognize potential complications of IV therapy and management strategies.

Introduction

Intravenous (IV) therapy is very common practice, particularly with patients in acute care settings. It is estimated that over 85% of hospitalized patients have an IV at some time during their stay, and that at least 2% of medical lawsuits involve a complication from a peripheral IV line (Carson, Dychter, Gold, & Haller, 2012). It is important that nurses understand the theory behind initiating and maintaining an IV, including familiarity with anatomy, selection of equipment, assessment, and prevention of potential complications.

Please note that this course focuses on adult patients. Special considerations with pediatric and neonatal patients are outside the scope of this course.

Anatomy Review

It is important for nurses to become familiar with the anatomy of blood vessels and blood flow, especially with regard to the venous system and the administration of intravenous therapy. Understanding the anatomy of a vein will help to facilitate appropriate decisions about the placement and maintenance of an IV catheter.

To briefly review the anatomy of a vein, you will likely recall that veins are highly distensible, thin-walled vessels that transport blood back to the lungs and heart, and act as a volume reservoir for our circulatory system.

Vein Anatomy

Each vein is composed of three layers:

- Tunica intima (internal layer)
- Tunica media (middle layer)
- Tunica externa or tunica adventia (outer layer)

(Martini, Nath, & Bartholomew, 2012)

Veins also contain valves that provide footholds for the blood as it travels against gravity towards the heart. For example, blood returning to the heart from the foot has to travel against gravity. Venous valves and the muscles of the leg contract to help prevent a backflow of blood from occurring and facilitate the flow back to the heart.

Veins versus Arteries

It is also important to identify differences between veins and arteries.

Vessel	Type of blood	Presence of valves	Ability to collapse	Pulsation	Location
Vein	Unoxygenated (dark red in color)	Has valves	Can collapse	Does not pulsate	Superficial; can be deep
Artery	Oxygenated (bright red in color)	Does not have valves	Does not collapse	Pulsate	Deep in tissue; protected by muscle

Vein Location

Certain conditions can make veins more difficult to locate, such as obesity, edema, scar tissue, burns, patients who are IV drug users, or other circumstances. Veins located in the lower extremities more commonly unite with deep veins, which can increase the risk of thrombosis or embolus. Thus, superficial veins in the upper extremities are preferred for IV therapy; most facilities require a physician's order prior to using a vein in the lower extremity for an IV.

Commonly Accessed Veins of the Upper Extremity

The most commonly accessed veins of the upper extremity and hand include:

Basilic Vein: The largest arm vein of the upper extremity. It courses along the medial (ulnar) aspect of the arm from wrist to shoulder. It begins at the dorsum of the hand, crosses the elbow and drains into the brachial vein (Martini et al., 2012).

Cephalic Vein: This vein runs along the lateral (radial) aspect of the arm also from the wrist to shoulder and empties into the axillary vein. Although the basilic vein is larger, the cephalic vein is more superficial and easier to access (Martini et al., 2012).

Median Vein: Forms a Y just below the elbow and drains into both the basilic and cephalic veins (Martini et al., 2012).

Median Antecubital Vein: Oblique coursing vein at the elbow that joins the basilic and cephalic veins (Martini et al., 2012).

Deep Forearm Veins: These are 2 or 3 veins each that course with and are named like the corresponding arteries of the forearm (radial & ulna) (Martini et al., 2012).

Brachial: These veins are the deep veins of the upper arm, usually paired and smaller than the superficial veins. They travel in the upper arm parallel to (on either side) the brachial artery and join with the basilic vein to form the axillary vein (Martini et al., 2012).

Dorsal Metacarpal Veins: These veins are formed by a union of the digital veins on the dorsum of the hand, between the knuckles. This makes them more suitable for IV therapy. Their use early in IV therapy saves the larger veins in the upper arm (Martini et al., 2012).

Dorsal Digital Veins: These veins flow laterally on the fingers and are joined by communicating branches. They are used as a last resort because of their curvature and small size (Martini et al., 2012).

Test Yourself:

A vessel that pulsates and has bright red blood is a:

Vein

Artery - **Correct**

Capillary

Reasons for IV Therapy

Maintenance Therapy: Maintenance therapy provides basic nutrients and meets daily fluid requirements. Some examples may be patients who are NPO or have limited oral intake, prior to surgery or procedures, or post-operatively (Infusion Nurses Society [INS], 2010).

Replacement Therapy: This replaces fluids and/or repairs imbalances from conditions such as dehydration, blood loss, trauma, vomiting, diarrhea, draining wounds, nasogastric suctioning, or burns (INS, 2010).

Types of Fluids

There are several choices of fluids for a practitioner to order for IV therapy, depending on the reason and condition of the patient. These may include blood products, colloid, and crystalloid solutions. The most common fluids for IV therapy include:

- Isotonic fluids: These are very similar in composition to plasma, with little to no difference in osmotic pressure. Examples include 0.9% sodium chloride (normal saline), Lactated Ringer's (or Ringer's Lactate), and 5% dextrose in water (D5W) (Crawford & Harris, 2011; INS, 2010).
- Hypotonic fluids: These have a lower osmolarity than body fluids, causing fluids to shift back into cells. Examples include 0.33% or 0.45% sodium chloride, and 2.5% dextrose in water (Crawford & Harris, 2011; INS, 2010).
- Hypertonic fluids: These have a higher osmolarity than body fluids, drawing fluids out of cells into the extracellular space; used for correcting fluid and electrolyte imbalances. Examples include 3% or 5% sodium chloride, and dextrose 10% in water (D10W) (Crawford & Harris, 2011; INS, 2010).

For more information on blood and blood products, please see RN.com's course Blood Administration and Transfusion Reactions. For more in-depth information on fluids, please see RN.com's course *What's Your Line: Overview of Fluids, Central Lines, and PICCs.*

Cannula Considerations

The choice of cannula should be of the smallest gauge that will accommodate the prescribed therapy. This will allow for sufficient blood flow around the cannula. The larger the gauge number, the smaller the bore of the cannula. Choices of cannula size include:

- 16g to 18g- trauma, major surgery, obstetric surgery, administration of viscous fluid, blood and blood products
- 20g- acceptable for most adult patients, older children
- 22g- acceptable for most patients, pediatric patients, and the elderly

- 24g- neonates, pediatric patients, the elderly
- 26g- neonates

Test Yourself

An example of an isotonic fluid is:

0.45% sodium chloride

0.9% sodium chloride - **Correct**

3% sodium chloride

Types of Catheters/Devices

Facilities may have specific guidelines regarding which type of access device they prefer.

- Winged infusion ("butterfly" needles): May be used for short-term therapy for any cooperative adult, such as procedures, bolus, or medication administration.
    - Advantages: Easy to insert and ideal for IV push drugs.
    - Disadvantages: Can easily infiltrate due to rigidity of catheter. These needles should not be used with fluid or medication that may cause tissue necrosis (O'Grady et al., 2011).

- Over the needle catheter: Used for longer-term therapy for the agitated or active patient.
    - Advantages: Accidental puncture of the vein is less likely than with a needle, contains radiopaque thread for easy location, more comfortable for the patient.
    - Disadvantages: More difficult to insert.

Types of Devices

- Through the needle catheter: Used for long term therapy for the agitated or active patient.
    - Advantages: Accidental puncture of a vein is less likely than with a needle, more comfortable, contain radiopaque thread for easy location, available in many lengths.
    - Disadvantages: Leaking at the site may occur, especially in the elderly patient. If a needle guard is not used, the catheter may be severed (INS, 2010).

- Catheter with guidewire: This type of catheter was recently introduced as "bloodless." Used for long term therapy for the agitated or active patient.
    - Advantages: Decreases exposure to blood during IV initiation, increased dwell time, increased success with first IV attempt.
    - Disadvantages: Can be more difficult to insert initially, as there is a learning curve for use.
    - Advantages and disadvantages are currently being examined through research (ClinicalTrials.gov, 2013).

Initial Steps

The first step in the insertion of a peripheral IV line or saline lock is obtaining an order from the healthcare provider. IV therapy should only be initiated after this order is obtained, or as necessitated in an emergency situation.

After you have confirmed the order from the healthcare provider to initiate IV therapy, you must verify the patient's identity by at least two methods prior to administering any treatment. The Joint Commission's (TJC) National Patient Safety Goals (NPSG) specify that healthcare professionals should always identify patients utilizing a minimum of two patient identifiers prior to any treatment or diagnostic procedure (TJC, 2014). Check with your organization about specific guidelines on which identifiers they use.

Patient Education

Another important NPSG that affects administering treatment to your patient is the education and involvement of the patient in their own care (TJC, 2014). You will want to provide patient and/or family education regarding the procedure and obtain consent if appropriate. Once you have verified the order for intravenous fluids and explained the procedure to your patient and/or significant others, it is time to gather your materials and prepare for IV insertion.

Safe Equipment

In an effort to reduce needle sticks injuries, Occupational Safety & Health Administration (OSHA) instituted Bloodborne Pathogens Regulations to protect employees without compromising patient safety.

OSHA recommends the use of the needleless system, except where no satisfactory needleless system is available (OSHA, n.d.). Examples of the "needleless system" consist of devices like the clave added onto extension tubing, which allows nurses to connect syringes and luers to peripheral and central line infusion catheters.

In addition, safer medical devices, including self-sheathing needles, are recommended (OSHA, n.d.).

Test Yourself

The use of a needleless system comes from a recommendation by:

CDC

TJC

OSHA – **Correct**

Gathering Equipment

Many facilities use a pre-packaged IV start kit that contains all the essentials to initiate the IV (excluding the fluid and sterile tubing). Equipment needed for IV insertion includes:

- Antiseptic solution/alcohol wipes
- Gloves
- Tourniquet
- Peripheral IV cannula
- Sterile 2x2 gauze pads
- Sterile, transparent, semi-permeable dressing
- Sterile tape or a manufactured securing device
- Flush solution (0.9% sodium chloride, preservative-free
- Flush syringes (3-5 mL size)
- IV solution with primed tubing
- Primed saline lock
- IV pump

Additional equipment that might be required includes:

- Arm board
- Warm packs
- Local anesthetic (if ordered)
- Scissors

Saline Locks

IV saline locks are devices inserted into a peripheral vein and ”capped-off” for future administration of medications as needed, or to maintain venous access for emergency purposes. These devices can be converted to continuous IV at any time. There have been numerous studies examining the use of heparin locks versus saline locks. Saline locks are preferred over heparin locks, as heparin is a blood thinner and has associated risks (Infusion Nurses Society, 2011; American Society of Health-System Pharmacists, 2012). This course will refer to saline locks only.

The key to an effective “lock” is the use of positive pressure. Positive pressure flushing prevents the backflow of blood into the cannula with syringe removal and may increase the life of your patent IV site, by reducing the potential for thrombus formation. This is achieved by flushing the line and clamping the tubing while still flushing. Some needleless caps on these lines actually provide positive pressure. Check with your organization to learn which systems are used.

Next Steps

The next steps are to perform hand hygiene and apply the tourniquet. The tourniquet should be applied approximately 4 – 6 inches above the insertion site to dilate the vein.

Check for a distal pulse. If there is no pulse, the tourniquet is too tight and is occluding the arterial blood flow. Remove the tourniquet immediately and reapply.

Lightly palpate vein with your index and middle fingers, while stretching it to prevent rolling. If the vein feels hard or rope-like, select another site! If the vein is easily palpable, but not sufficiently dilated, try the following techniques to promote engorgement of the vessel with blood:

- Tap the skin over the vein lightly
- Place vein in a more dependent position
- Warm the vessel
- Have patient open and close fist a few times (Smith-Temple & Johnson Young, 2010)

Did You Know?

In most patients, dependent positions increase capillary refill and may increase the likelihood you will be successful in inserting the IV.

For cold skin, warm it by rubbing or stroking the skin or applying warm packs for 5-10 minutes as needed.

In elderly patients, apply the tourniquet carefully to prevent damaging the skin. If the skin is thin, and veins are visible and palpable, the IV can often be started without a tourniquet (INS, 2010).

Select Insertion Site

When selecting an IV site, assessment of the patient’s condition, vein condition, vein size and location, patient age, and the type and duration of therapy should be done to insure ideal and safe IV access.

The most distal sites should be used first, so that you can move proximally as needed. If possible, the non-dominant arm should be used. If the insertion site is visibly soiled, it should be cleaned first with soap and water.

Do not use previously used veins, and injured or sclerotic veins. Avoid areas with scar tissue (Smith-Temple & Johnson Young, 2010).

Did You Know?

When choosing a site for IV therapy, the antecubital area should not be used in the patient who may need a peripherally inserted central catheter (PICC). Veins should not be used in the affected arm of an axillary dissection or in the arm of a dialysis AV fistula.

Only one device should be utilized for each attempt; never reuse a catheter. Stylets should never be reinserted into the cannula when attempting IV access.

Prepare the Site

1. Put on gloves and clean the site: Use the antiseptic solution your facility recommends by applying in a circular motion, outward from the insertion site to approx. 2" to 4". Use friction to “scrub” the site in this circular fashion. Allow the cleansing agent to dry thoroughly (INS, 2010).
2. If ordered, you may administer a topical, local anesthetic such as Emla™ Cream (a combination of Lidocaine and Prilocaine), intradermal lidocaine, or normal saline.
3. Hold skin taut to stabilize the vein.
4. Grasp needle or catheter bevel up:
   - If using a winged infusion set, grasp by both wings between the thumb and forefinger of the dominant hand.
   - If using the over-the-needle-catheter, grasp the plastic hub with your dominant hand, remove cover and examine catheter tip. Use the opposite hand to keep the vein stabilized by holding the skin taut below the insertion site.
5. Lightly palpate the vein. The vein should be engorged, round, firm, and resilient (Intravenous Nurses Society [INS], 2010).

IV Insertion

Confirm the integrity of the product and insert the device according to the manufacturer’s guidelines.

Alert the patient that you are ready to insert the IV, and then insert the device. There are two approaches that can be used when entering the skin:

- Direct approach: Enter the skin directly over the vein at a 30 to 40 degree angle.
- Indirect approach: Enter the skin slightly adjacent to the vein and direct the device into the side of the vein wall at a 30 to 40 degree angle.

Once the needle has pierced the skin, lower the needle to a 15 to 20 degree angle, and advance the device slowly and steadily until you pierce the vein. You may feel a "pop" or a sensation of release when the needle enters the vein. Advance the catheter device so that needle is held stationary by the hub. Be careful not to advance the needle too far, to avoid penetrating through the vein (INS, 2010).

Blood Return

Once in the vein, observe for flashback (blood return). This indicates that the catheter has entered the vein. If you fail to see flashback, pull the catheter slightly back and rotate slightly. If you still fail to see flashback, remove the catheter,

apply pressure to the site (until any bleeding has stopped) and select a new site and use a new IV needle. Never reinsert a stylet into a catheter.

When you see a flashback, withdraw the needle while holding the catheter at the hub so it doesn't move. As you withdraw, press slightly on the catheter to prevent bleeding. Release the tourniquet, and withdraw the stylet (INS, 2010).

Test Yourself

In an IV attempt, it is acceptable to reinsert a stylet into the catheter to further advance it.

True

False – **Correct**

Attach Fluids

Attach IV fluids or saline lock. Check for placement of the cannula in the vein either by opening the roller-clamp on the IV, or flushing with saline according to the facility policy (INS, 2010).

If the device is resistant to flushing or you notice a “wheal” of fluid developing under the skin, remove the cannula immediately. It is not in the vein and should not be used for IV therapy (Intravenous Nurses Society, 2010).

Secure the Site

Use sterile tape or sterile surgical strips to secure the hub of the cannula to the skin, so that the device is secure, but the tape does NOT obscure the insertion site.

If using a manufactured stabilizing device, follow the manufacturer’s instructions for securing the IV.

Dressing the Site

The IV site should be dressed according to the facility policy and procedure; generally by either using a transparent semi-permeable membrane dressing or a gauze dressing.

Gauze dressings are not generally recommended, as they can obscure the visualization of the IV site (INS, 2011). They can be used when there is a significant amount of moisture on the skin or site drainage. When using a gauze dressing, the dressing’s edges must be secured with tape. A gauze dressing must be changed every 48 hours, or when it becomes soiled.

Dressings

A transparent semi-permeable membrane dressing is recommended, as it allows routine visualization of the insertion site, and the dressing can be changed when the site is changed (unless soiled or there is noticeable moisture under the dressing). If a transparent semi-permeable dressing is applied over gauze, then it is considered a gauze dressing and should be changed every 48 hours at minimum (INS, 2011).

Flushing the Line

After the dressing is applied, secure connection junctions and flush the site with saline per facility policy if IV fluids are not initiated. A minimum of 2 mL is needed to flush the line (INS, 2010).

Note: Many facilities recommend using an extension set (saline lock) with IV therapy. Check your policies at your facility.

An arm board may also be needed to secure the line.

Patient Teaching

Review potential limitations of range of motion with the patient. Instruct the patient in signs and symptoms to report, and encourage patient to notify nurse immediately of any problems or discomfort (Smith-Temple & Johnson Young, 2010).

Documentation of Initiation

Whether documentation is done on paper or in an electronic health record, there are certain required components. These include:

- Site of IV insertion
- Size and type of catheter/needle
- Date/time of action and date/time of documentation
- Number of attempts
- Type and rate of infusion (if continuous infusion)
- Status of IV site, dressing, fluids, and tubing
- Patient's tolerance of insertion procedure and fluid infusion
- Patient teaching and evidence of patient's understanding

(Smith-Temple & Johnson Young, 2010)

Monitoring

IV sites should be monitored at established intervals to insure these devices are working properly. This inspection includes both equipment and site inspection. It is recommended that fluids and IV sites should be monitored every one to two hours, as well as with any physical assessment; please check your facility's policy.

Assessment should include:

- The catheter itself for migration
- All connections are secure
- Fluids being infused
- Pump function and flow rate
- Condition of the insertion site
- Patient's report of pain or discomfort at access site
- Signs of IV-related infections or complications, such as discoloration (i.e. blanching, erythema), disruption of sensation (i.e. pain, tenderness, numbness), edema or localized swelling, exudate, increase in skin or body temperature, induration (i.e. sclerosis) with palpable cord (Intravenous Nurses Society, 2010)

Site Changes

For adult patients, short-peripheral catheter sites should be rotated at established intervals (consult your institution's policies and procedures) and immediately upon suspected contamination. The Intravenous Nurses Society (2010) recommends that these catheters should be rotated every 48 hours or every 72 hours if the institution's phlebitis rate is less than 5% for three consecutive months.

It is not recommended to change access sites in pediatrics unless indicated by the assessment of the site. Additionally, if your patient has limited venous access due to the condition of their veins, changing the site may be extended for longer than the recommended dwell time. A physician's order is usually required to extend the dwell time of a short peripheral catheter if necessary.

Removal

Peripheral catheters should be removed per unit protocol or by physician order when therapy is completed, during routine site rotation, when contamination or IV- related complication is suspected, or when the tip location is no longer appropriate for the prescribed therapy.

Minimal equipment is needed, including an alcohol wipe, sterile gauze, and adhesive bandage.

Steps for Removal

1. Discontinue the administration of all infusions.
2. Wash your hands and don gloves.
3. Carefully remove the dressing from the IV site ensuring the cannula remains in place, and inspect the cannulation site.
4. Remove the catheter securement device and cleanse the cannulation site with an alcohol wipe, using aseptic technique.
5. Place the first two fingers of your non-dominant hand lightly above the catheter- skin junction site with the gauze between the fingers.
6. Use your other hand to withdraw the catheter slowly and smoothly, keeping it parallel to the skin.
7. Inspect the catheter tip. Apply pressure to site for a minimum of 30 seconds or until bleeding has stopped.
8. Apply a new gauze or adhesive bandage to the insertion site per facility policy.
9. Remove your gloves and wash your hands.
10. Change the dressing as needed every 24 hours until site is healed (Intravenous Nurses Society, 2010).

Did You Know?

If during the removal you encounter resistance or a complication occurs, stop removing it, secure it in place and notify the physician immediately (cap the cannula to prevent infection).

If the catheter's condition is different than it was when originally placed, notify the physician immediately and assess the patient (INS, 2010).

Documentation of Removal

Documentation required for IV catheter removal includes:

- Date and time and reason of removal
- Size, type and condition of catheter upon removal
- Location and condition of the site
- Type of dressing applied
- How the patient tolerated the procedure
- Any actions taken for infiltration or phlebitis or extravasation

(Smith-Temple & Johnson Young, 2010)

Test Yourself

A possible reason for removal of an IV catheter could be:

The catheter has been in place for 24 hours

IV fluids are going to be changed

The site is painful to the patient – **Correct**

Administration Set Changes

Administration sets, including add-on devices and tubing should be changed immediately when contamination is suspected or observed or as deemed necessary due to kinks, uncleanness or damage to tubing. Otherwise, they should be changed at set intervals determined by your institution. Set changes should occur based upon the type of infusate prescribed and/or by the type of infusion set being used. Additionally, all tubing should be dated, timed, and initialed.

Guidelines for frequency of set changes are based on INS standards (2010), and CDC recommendations to prevent blood stream infections (O'Grady et al., 2011).

Changes by Infusate

- Blood or Blood Components: Set should be changed after each unit or every four hours.
- Lipid Emulsions: Set should be changed after each unit of lipid emulsion is administered or every 24 hours.
- Parenteral Nutrition: Set should be changed every 24 hours.
- Medications: Some medications require that IV sets are changed at regular intervals. For example, propofol is a liquid that requires changing of the tubing every 12 hours. Always check the drug manufacturer's recommendations.

Changes by Infusion Set

- Continuous Administration – Primary and Secondary Administration Sets: The INS states that sets should be changed every 72-96 hours. The Centers for Disease Control (CDC) recommends that the intravenous tubing including add-on devices be changed no more frequently than every 96 hours (Intravenous Nurses Society, 2010; O'Grady et al., 2011).
- Intermittent Administration – Primary Sets: These sets should be changed every 24 hours (Intravenous Nurses Society, 2010).

Complications

As with any invasive procedure, there are potential complications that can occur with IV therapy. These complications will be reviewed, including assessment and management.

Phlebitis: Phlebitis is the inflammation of a vein. If it is associated with clot formation as well it is known as thrombophlebitis. Signs and symptoms of phlebitis include redness, swelling, pain, and edema at the insertion site and/or along the vein. It is often caused by poor blood flow around the venipuncture device, friction from catheter movement in the vein, clotting at the catheter tip (such as medications or fluids with a low pH or high osmolarity), or large bore catheters. Phlebitis is the most frequent complication of peripheral IV therapy, which may occur at rates as high as 50-75%, particularly with patients who have higher risk, such as sepsis.

Treatment includes removal of the catheter, application of heat and analgesia. Anti-inflammatory agents can be beneficial in reducing inflammation at the cannula site (Carson et al., 2012). A picture should also be taken to document the injury.

Infiltration: Catheter dislodgement occurs when the catheter backs out of the vein. The IV solution may infiltrate and the catheter will be backed out further than normal from the vein and the tape may be loose. Infiltration is the inadvertent leakage of a nonvesicant solution into surrounding tissue. Other causes of infiltration include improper insertion of the IV catheter, damage or swelling of the vein, clot formation in the vein, or when the cannula punctures or erodes through the opposite wall of the vein (Carson et al., 2012)

Signs and symptoms of IV infiltration include cool skin temperature at the IV site, skin that looks blanched, taut, or stretched, edema, discomfort; tenderness, change in quality and flow of the infusion, or IV fluid leaking from the insertion site.

Treatment includes immediately stopping the infusion, elevation of the limb, application of heat or cold (depending on the infusate), dressing the old site and restarting the IV (Carson et al., 2012). A picture should also be taken to document the injury, and an incident or variance report completed.

Extravasation: Extravasation occurs when the venipuncture device is dislodged from the vein, either from improper insertion of the IV catheter, damage or swelling of the vein, clot formation in the vein, or when the cannula punctures or erodes through the opposite wall of the vein. Extravasation is the inadvertent leakage of a vesicant solution into surrounding tissue.

Signs and symptoms of extravasation include swelling at and above the limb, discomfort, burning or stinging pain at the site, tightness at the site, cooler temperature at the site, blanching at the site, absent backflow of blood, redness followed by blistering, tissue necrosis, and ulceration (Carson et al., 2012).

Treatment includes immediately stopping the infusion, calling the physician, elevation of the limb, delivery of a local antidote (if appropriate), and ice initially and warm soaks (Carson et al., 2012). A picture should also be taken to document the injury, and an incident or variance report completed.

Occlusion: Occlusion occurs when fluid or medication cannot enter the vein. The IV flow is interrupted and blood may be backed up in the tubing or heparin or saline lock. Treatment includes attempting to flush with mild pressure. If the catheter does not flush with mild flush, do not force it. Remove the IV and start a new one in a new site (Smith-Temple & Johnson Young, 2010).

Vein Irritation: Vein irritation occurs due to solutions with high or low pH and high osmolarity (such as potassium chloride, phenytoin, vancomycin, erythromycin, and nafcillin). Signs and symptoms of vein irritation include the patient's report of pain at the site, possible blanching, red skin over the vein during infusion, and quickly developing signs of phlebitis. Treatment includes decreasing the flow rate and diluting the infusions (Smith-Temple & Johnson Young, 2010).

Hematomas: Hematomas occur when blood leaks into the extravascular space. The patient will have tenderness at the site, a bruise may be evident at the site, and the infusion will not flow. The IV catheter must be removed and restarted elsewhere. Additionally, you should apply pressure until the bleeding stops and warm soaks to aid in the absorption of the blood (Smith-Temple & Johnson Young, 2010).

Venous Spasm: Venous spasm occurs due to severe vein irritation, administration of cold fluids or blood, and a very rapid flow rate. The patient will experience pain at the IV site, the flow rate will become sluggish even if roller clamp is wide open, and the skin will be blanched over the vein. Treatment includes warm soaks over the vein and reduction in the flow rate of the infusate (Smith-Temple & Johnson Young, 2010).

Vasovagal Reaction: Vasovagal reactions can occur when the patient experiences vasospasm from anxiety or pain. The vein suddenly collapses during venipuncture and causes the patient to become pale, diaphoretic, faint, dizzy, and

nauseated. The patient may also have a sudden drop in blood pressure. If this occurs, lower the head of the bed and have the patient take slow deep breaths while you monitor vital signs.The reaction should resolve quickly (Smith-Temple & Johnson Young, 2010).

Thrombosis: Thrombosis occurs when the platelets adhere to the tunica intima of the vein due to vessel injury during venipuncture. The vein will appear painful, red and swollen. The IV infusate will not run quickly. If thrombosis occurs, you will need to remove the IV catheter and restart the IV in the opposite arm if at all possible. Warm soaks can also be applied (Smith-Temple & Johnson Young, 2010).

Damage: Nerve, tendon or ligament damage occurs due to improper venipuncture technique, tight taping or improper arm board application. The patient will experience extreme pain at the insertion site, numbness, muscle contraction and eventually may exhibit paralysis, numbness and deformity (Smith-Temple & Johnson Young, 2010).

Circulatory Overload: Circulatory overload can occur when the IV roller clamp is loosened and the infusate is allowed to run into the vein quickly. The patient may be anxious, experience respiratory distress, crackles in the lung bases, increased blood pressure and neck engorgement. Treatment includes raising the head of the bed, administering oxygen and IV furosemide as ordered, and prompt notification of the physician (Smith-Temple & Johnson Young, 2010).

Infection: Localized infection, systemic infection or bacteremia can occur as a result of phlebitis, poor taping that allows the venipuncture device to move in and out of the vein, prolonged dwell time of the catheter, and failure to maintain aseptic technique during insertion or site care. Signs and symptoms of localized infection may include erythema, exudate, warmth at the site, induration, pain, palpable venous cord, or venous thrombosis. Signs and symptoms of systemic infection include malaise, fever, headache, tachycardia, nausea, vomiting, and chills.

Treatment includes contacting the physician, culturing the site and device, administering antibiotics and hemodynamic support (Carson et al., 2012). A picture should also be taken to document the injury, and an incident or variance report completed.

Air Embolism: Air embolism occurs when the solution container runs empty and the added container pushes air down the line into the patient. This is a rare occurrence with the use of today's IV pumps. The patient will experience respiratory distress, unequal breath sounds, a weak pulse, increased central venous pressure, decreased blood pressure, and loss of consciousness. If air embolism is suspected, discontinue the infusion, place the patient in Trendelenburg, administer oxygen, and notify the physician (Smith-Temple & Johnson Young, 2010).

Allergic Reaction: Allergic reaction may occur when the patient is allergic to the catheter that has been inserted or the medications being administered. The patient will itch, develop watery eyes and nose, experience bronchospasm, wheezing, and possibly anaphylaxis. If a reaction does occur stop the infusion or discontinue the catheter. Emphasis should be placed on notification of the physician and airway support. Administration of an antihistamine, a steroid, or epinephrine may be indicated (Smith-Temple & Johnson Young, 2010). An incident or variance report should be completed.

Home Care

Most patients going home with IV therapy will have a central line placed. If not, they will be going home with peripheral access. If your patient is going home with a short- peripheral catheter, you should ensure that the patient and family have appropriate teaching, and evidenced understanding of the following:

- Care of the IV site, including return demonstration.
- Identification of potential complications, and what to do if these occur. Teach the patient how to examine the site and notify the physician if they experience any redness, swelling, drainage, or increased pain.
- Teach the patient the role of the home health nurse in their IV catheter care, how to reach this nurse, and when it is important to call her or him.
- If the patient has a saline lock, teach the patient how and when to flush it.

- Teach the patient to document daily - pain, redness, or swelling (Dugdale, 2012).

Conclusion

IV therapy is a common and essential treatment for many patients and it can be complex. It is important for nurses to have a basic theoretical understanding of IV therapy for appropriate care and management of these patients. The skills required for IV therapy are acquired through knowledge and experience, including hands-on training with an instructor or mentor.

Because nurses are at the forefront in providing IV therapy, they have the ability to recognize and minimize infusion-related complications. This can have a significant impact on patient safety, satisfaction, healthcare costs, and length of hospital stay.

Resources

Centers for Disease Control and Prevention. Website: www.cdc.gov

Infusion Nurses Society. Website: http://www.ins1.org

Occupational Safety & Health Administration. Website: www.osha.gov

The Joint Commission, National Patient Safety Goals. Website: http://www.jointcommission.org/standards_information/npsgs.aspx

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