professional development

Intravenous Therapy Learning Module

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Introduction

- Intravenous (IV) therapy is a skill that requires time and practice in order to become proficient. This learning module will familiarize the learner with information necessary for:
  - initiating a peripheral IV
  - maintaining a peripheral IV
- This module is intended to enhance the knowledge and skills of all health care professionals in the major aspects of initiating, and maintaining peripheral IV sites to improve safe patient care outcomes.
- Staff requiring updating in the educational program may independently refer to the learning module, repeat portions of, or complete the entire program in collaboration with the Patient Care Manager/Clinical Nurse Educator. Please direct any questions or concerns to the preceptors/ educators/ managers in your area.
- Professionals are accountable for assessing their competencies and related skills in providing care. Specific Learning Modules regarding intravenous medication administration are available and separate from this module.

Learning Objectives

On completion of this learning module, the learner will be able to:

1. Discuss the principles and indications for IV therapy.
2. Verbalize the differences between an artery and a vein.
3. Discuss the risks and benefits of isotonic, hypertonic and/or hypotonic IV solutions in various situations.
4. Discuss the benefits, risks and potential complications of IV therapy.
5. Demonstrate principles used to prepare and initiate peripheral IV's.
6. Identify the various equipment and materials required to initiate, maintain, and/or discontinue an IV.
7. Develop plans of care pertaining to the IV that are centered on the needs of the patient and their current health needs.
8. Develop teaching plans to meet patient's needs specific to intravenous therapy.
9. Explain the importance of adhering to Infection Control Guidelines.

Definitions

Patient

- Term used to represent any variation of patient, client, resident, or health care consumer.

Peripheral Intravenous (IV)

- Intravenous access via small surface veins on the extremities, primarily the hands and arms, but may include the feet (in certain practice settings only) or the scalp (infants only).
- The end of the catheter remains in a small surface vein (peripheral) and does not extend into deeper central veins.
- Peripheral IVs are intended for short-term use only, and the site is changed every 96 hours.

  Note: If the patient has difficult to access veins and the site is healthy, check with your site policy if the IV can be left in longer.

Target Audience

- This learning module is intended for all health care professionals in Alberta Health Services who's Scope of Practice (as determined by the Health Professions Act, List of Restricted Activities and Professional Colleges) permits this activity.

Instructions for Completion

1. Check for any policies, procedures or guidelines in your area on IV therapy.
2. Review each section of the learning module.
3. Complete the Intravenous Therapy Learning Module Exam and submit answer sheet to your Clinical Nurse Educator or designate.
4. To successfully complete the theoretical portion of the module, you must achieve a pass mark of 90% on the Intravenous Therapy Learning Module Exam .
5. You must also successfully complete the clinical application portion of the module by demonstrating the correct process of initiating and maintaining a peripheral IV as reflected in two supervised IV starts.

Section One

Anatomy of Arteries and Veins

It is important to understand the anatomy of the peripheral blood vessels in order to choose the appropriate vessel for venipuncture and avoid inserting IV devices into an artery. Table A provides a comparison between the physiological differences of arteries and veins. Each professional is accountable to have a clear understanding of the physiology and anatomy of the circulatory system.

Physiological Comparison	
Arteries	**Veins**
Pulsatile	Non-pulsatile
High pressure system carries oxygenated blood from the heart to the rest of the body	Low pressure system carries de-oxygenated blood back to the heart for re-oxygenation
Commonly located deep in tissue	Commonly more superficial on arms and legs
Elastic and thick walled	Thin-walled and flaccid
Generally not visible on arms and legs	Visible on limbs, bluish in color
Blood in vessel appears very “red”	Blood in vessel appears very “dark”
Do not collapse	Collapse easily
Do not contain valves	Valves present

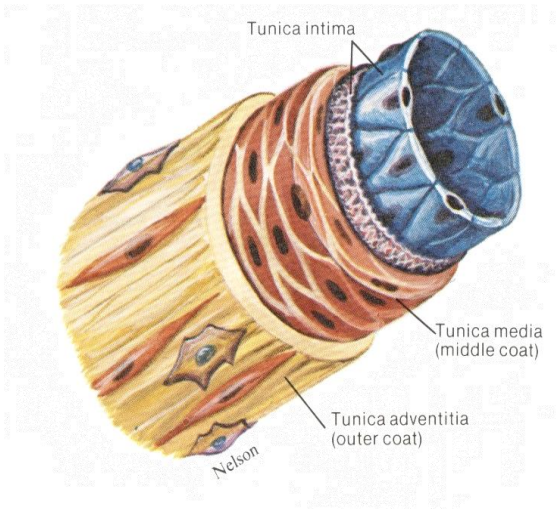
Blood Vessel Anatomy

There are three layers of the blood vessel.

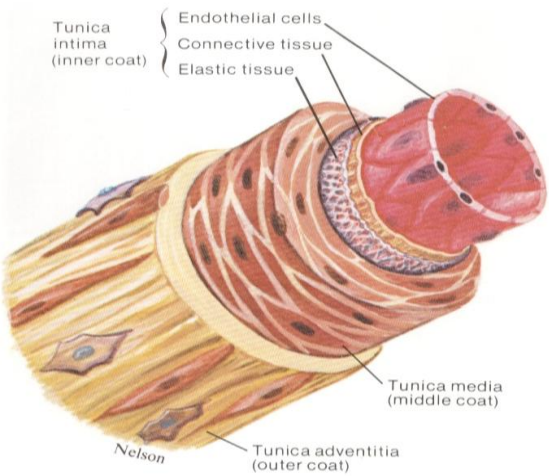
Tunica intima: The internal layer of arteries and veins. It is made of endothelial tissue and consists of a flat, smooth, single layer of cells which allows for free flow of cells and platelets through the vessels. Semilunar folds form valves in veins that assist with the unidirectional flow of blood back to the heart.

Tunica media: The middle layer of artery and veins. Tunica media is composed of muscle, nerve and elastic tissue. This layer provides structure and support to the vessel. In veins, this layer is reactive to the rise and fall of systemic pressure therefore distend and collapse. The nerve tissue responds to the change in temperature through vasoconstriction and vasodilation.

Tunica adventitia: The outer layer of artery and veins. The tunica adventitia is composed of connective tissue. The connective tissue provides a barrier and support to the vessels and is notably stronger in arteries because of the pressure exerted on these vessels.



VEIN



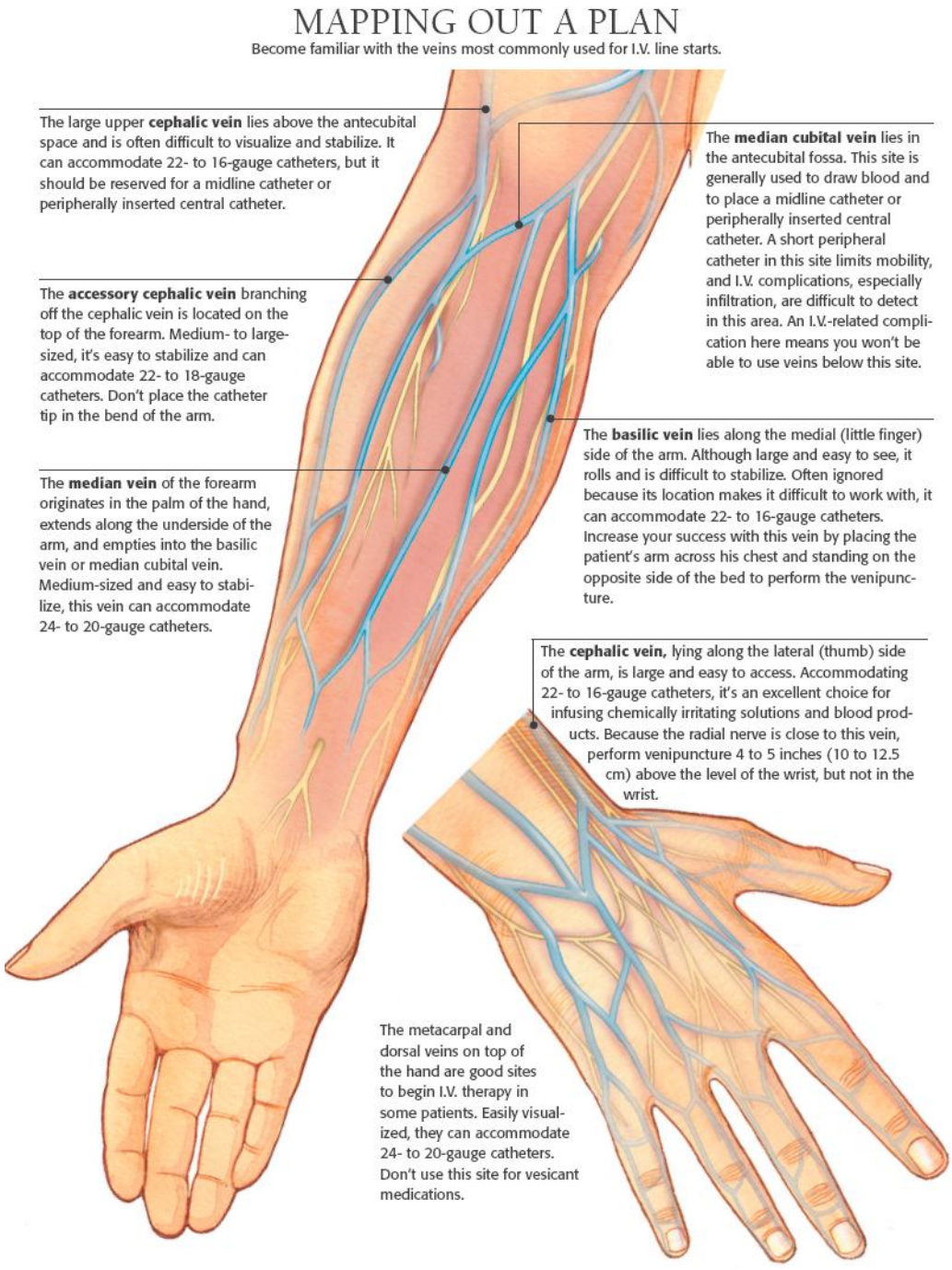
ARTERY

Upper Extremity Veins

It is important to know the location of appropriate veins and the advantages and disadvantages of each site. Selection of the appropriate site in which to initiate intravenous therapy is dependant on the purpose. In Diagram 1, veins shown are appropriate for infusion therapy; some are more desirable than others.

IV Site Selection Criteria

The goal in choosing a site to start IV therapy is to choose a vein that is visible, palpable, soft, and straight with evidence of good blood flow. It is best to choose the most distal site to prevent damaging sites above that may be required later on in the course of therapy. It is also important to choose a vein that is the appropriate size to accommodate the IV catheter necessary for the purpose of the infusion.



When choosing the most appropriate site for IV therapy the following factors need to be considered:

- Condition of veins / patient – geriatric and pediatric patients may have fragile veins or a person with a history of IV drug use may have very damaged veins.
- The catheter selected shall be the smallest gauge and length, with the fewest lumens and shall be the least invasive device needed to accommodate and manage the prescribed therapy.
- Type of IV fluid or medication to be infused. Therapies not appropriate for peripheral catheters include continuous vesicant therapy, parenteral nutrition, infusates with an osmolality greater than 600mOsm/L and infusates with a pH less than 5 or greater than 9.
- Purpose of IV therapy – blood administration, rapid infusion, large fluid volumes or an irritating medications will require a large vein selection.
- Duration of IV therapy – the catheter selected shall be the smallest gauge and length with the fewest number of lumens and shall be the least invasive device need to accommodate and manage the prescribed therapy.
- Age, body size, level of physical activity – consider pediatric or geriatric, emaciated or over weight, bed rest versus able to move around freely.
- Medical conditions and general condition of patient may limit site selection for IV therapy.

Sites to Avoid

- Operative site when surgery is on that extremity.
- Sites distal to previous venipuncture site.
- Flexion point such as the wrist – wrist flexion can obstruct flow – use shorter catheters or use arm boards to immobilize.
- Ventral surface of the wrist – contains numerous tendons that could be damaged.
- Sites such as the Antecubital Fossa – this site can cause discomfort to the patient and obstruct IV flow. Arm boards can be used if it is necessary to use this site.
- Valves are often visible or palpated as small depressible “knots” along the length of the vein, use of a shorter catheter can help avoid them.
- Bruised or traumatized veins or areas below traumatized tissue.
- Limbs with reduced sensation – the patient cannot report any unusual sensations that can alert the staff to potential complications.
- The area below an existing phlebitis.
- Extremities or side of body with impaired circulation (e.g., CVA, third degree burn).
- AV shunts, grafts, or fistulas.
- A limb in which the circulation of lymph fluid and blood is inadequate (e.g., post mastectomy patients may have impaired lymphatic circulation)and the lateral surface of the wrists approximately 4-5 inches because of potential nerve damage.

Learning Activity #1

Instructions: Chose the best response for questions 1 – 5. **Do not write in this module.**

1. The internal layer of arteries and veins are called tunica _____.
   (adventitia, intima, media)
2. Arteries are _____ walled.
   (thick, thin)
3. Veins are _____ on arms and legs.
   (not visible, visible)
4. A common vein used to start an IV is the _____ vein.
   (cephalic, antebrachial)
5. When choosing an IV site, choose the most _____site.
   (distal, proximal)

For questions 6 – 10, indicate whether you would use (U) or avoid (A) using the following sites:

_____ 6. Vein in a bruised area.
_____ 7. Operative site when surgery was on that arm.
_____ 8. Area above an existing phlebitis.
_____ 9. Arms with a shunt.
_____ 10. Veins that appear soft.

Note: See page 38 for answer key.

Section Two

Purpose, Complications & Supplies

When a practitioner orders IV therapy there are several key pieces of information that the care provider must know in order to determine the best site and method of delivery for maximum effectiveness. These include purpose, complications and types of intravenous solutions and products that could be used.

Purpose of IV Therapy

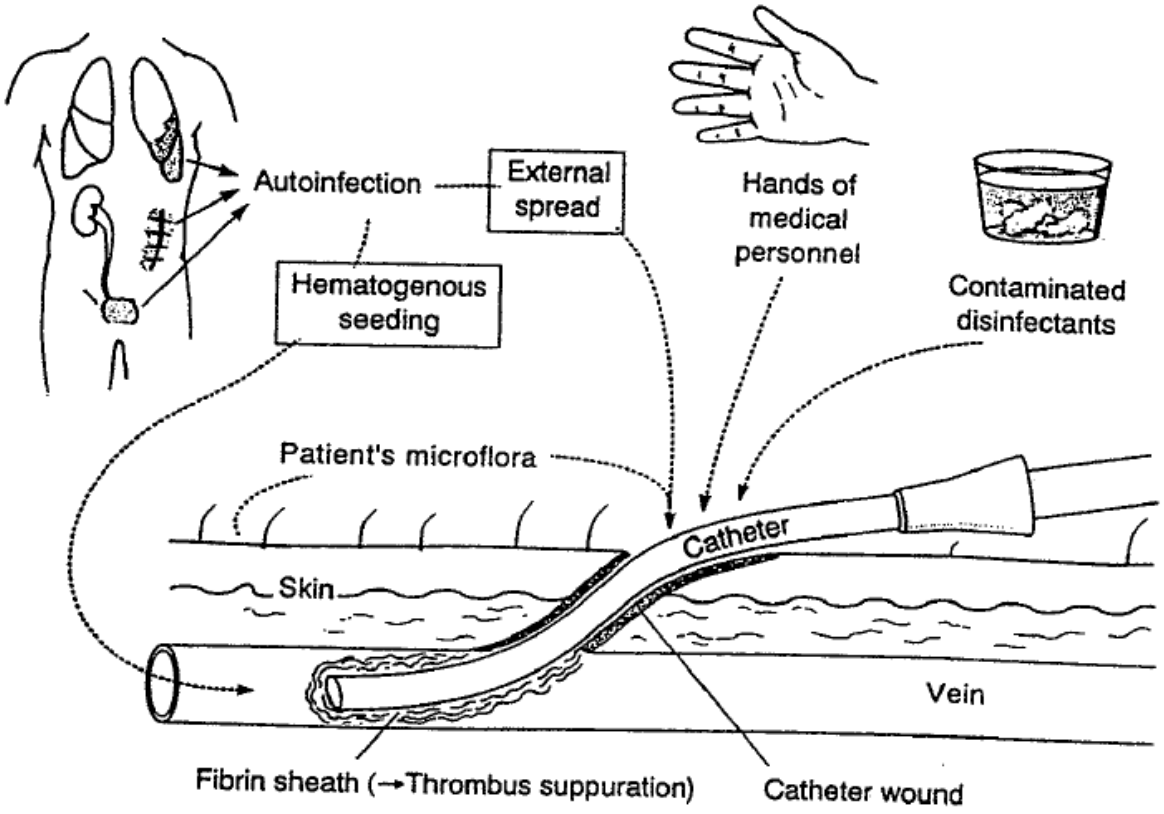
Once an order is written for IV therapy to be initiated it is important for the healthcare provider to understand the purpose or rationale for the therapy. The information can be obtained from various sources, patient assessment, history or physician notes or the order it self. The order must include the date and time, the type of access, the required solution and a flow rate and length of therapy, if appropriate.

IV therapy can be initiated for one of the following reasons:

- Restoration / maintenance of fluid and electrolyte balance
- Restoration / maintenance of nutritional status
- Administration of regular intermittent, continuous and emergency medications
- Administration of blood/ blood products
- To gain venous access for emergencies
- Administration of diagnostic reagents
- Administration of general anaesthesia or procedural sedation

Complications of IV Therapy

Localized and systemic complications can occur with IV therapy, it is critical to assess the IV site as per site policy to recognize complications quickly.



Localized Complications

Infiltration / Extravasation

Definition: The inadvertent administration of a nonvesicant/vesicant medication or solution into the surrounding tissues.

Signs and Symptoms: Pain, burning, itching, swelling, blanching at insertion site, inability to palpate the tip of the IV catheter, cool skin, wet site, continued infusion, even when manually occluded.

Treatment: Discontinue the IV, elevate the limb, and apply warm moist compresses prn. If an irritant or vesicant infiltrates, check with site policies for follow-up procedures.

Note: Do not lower the IV container to check for infiltration; this action may dislodge blood clots that have formed at the site.

Phlebitis

Definition: Inflammation of the vein caused by trauma or chemical irritation.

Signs and Symptoms: Warmth, tenderness or pain at IV site, redness, streaking along vein, palpable cord-like vein, area of hardness, edema (with thrombophlebitis).

Treatment: Discontinue IV; apply warm moist compresses to site as necessary.

Infection

Definition: Invasion of the insertion site by bacteria.

Signs and Symptoms: Generalized redness and heat to the IV site, may involve redness progressing up the arm, purulent drainage may be present, fever.

Treatment: Discontinue the IV; notify the physician, antibiotics and a swab of any drainage may be required. Monitor the site and patient closely for spread of infection and signs of systemic infection such as fever and general malaise. If restarting IV, do so in the other arm.

Hematoma

Definition: Infusion of blood into subcutaneous spaces.

Signs and Symptoms: Discoloration, swelling, tenderness.

Treatment: Remove IV, rest affected limb, apply pressure over the IV site.

Systemic Complications

Septicemia

Definition: Systemic infection resulting from invasion of the bloodstream by pathogenic bacteria.

Symptoms: Chills, fever, headache, disorientation, signs of shock, nausea and or vomiting.

Treatment: Discontinue IV, culture site if drainage apparent, culture tip of catheter. Notify physician – may need blood cultures, antibiotics as required.

Pulmonary Embolus

Definition: The pulmonary artery or one of it's branches becomes blocked when a blood clot is dislodged into the circulation from another part of the body.

Symptoms: Chest pain, shortness of breath, haemoptysis, signs of shock.

Treatment: Remember ABC's, supportive therapy – may require a VQ scan.

Circulatory Overload

Definition: Excessive fluid in the alveoli of the lungs. Also known as pulmonary edema; prevalent among those who have received excessive IV fluids.

Symptoms: Dyspnea, cyanosis, increased work of breathing, tachycardia, frothy pink sputum, distended neck veins.

Treatment: Semi-fowlers position, remember ABC's – administer oxygen, notify physician, supportive therapy as required.

Catheter Embolism

Definition: Catheter fragment in the bloodstream.

Symptoms: Chest pain, signs of shock, shortness of breath, evidence of missing catheter fragment after IV removal.

Treatment: Apply tourniquet proximal to the site, consider the ABC's – provide care to support this. (e.g., oxygen) Notify the physician, Fluoroscopy may be required –catheters are radiopaque.

Air Embolism

Definition: A significant amount of air introduced into the circulatory system causing blockage of the pulmonary capillaries.

Symptoms: Anxiety, chest pain, shortness of breath, signs of shock.

Treatment: Stop infusion, check for air in system, and turn patient to left side with head down to trap air in right atrium. Remember ABC's – administer oxygen. Notify physician.

Inadvertent Arterial Cannulation

Definition: Accidental insertion of an IV catheter into an artery.

Symptoms: Bright red flashback, pulsation of blood in tubing, IV will not infuse.

Treatment: Remove catheter immediately, apply firm pressure for 5 minutes, and observe for continued bleeding.

Intravenous Solutions

IV fluid resuscitation has three purposes: to correct electrolyte imbalances, to replenish fluids in one or more of the fluid compartments, and to assist with acid-base balance. There are several types of IV solutions available with each one having been formulated to have a different effect on the body. These solutions can either stay within the intravascular space to increase the volume of circulating blood, leave the intravascular space and enters the interstitial space or can be evenly distributed between the intravascular, interstitial and cellular space.

Solution Properties		
	Colloid	**Crystalloid**
Definition	• Solutions that contain suspended substance particles in water • The particles do not dissolve completely • Does not pass through a semi-permeable membrane • Stays within the intravascular space • Hypertonic	• Contain solutes that are completely dissolved in water • Readily passes through a semi-permeable membrane • Comprised of dextrose, electrolytes or a combination of the two • Electrolyte solutions can be classified into **isotonic, hypotonic** and **hypertonic** solutions
Examples	Blood and blood products such as albumin, Dextran, or Voluven	Ringer's Lactate, Saline fluid solutions
Uses	Plasma expanders used to replace circulating blood volume	• To expand intracellular or extra cellular fluid volumes and replace electrolytes • Choice of solution depends on desired outcome

To further understand how crystalloids can be evenly distributed between the intravascular, interstitial space and the cellular space a clear understanding of osmolarity is needed.

Osmolarity refers to the amount of osmotic pressure exerted by the particles in a solution. Normal blood serum osmolarity is 280 – 300 mmol/kg. Categories that further divide crystalloid solutions: isotonic, hypertonic and hypotonic, are based upon comparing the osmolarity of the IV solution to normal blood serum osmolarity. Osmolarity influences the osmotic pressure, which has a direct impact on osmosis (movement of fluids and solutes between semi permeable membranes). This is pertinent in IV therapy because choice of IV solution can create very different clinical outcomes based on the osmolarity. See Table C for differentiation of the three types of crystalloids.

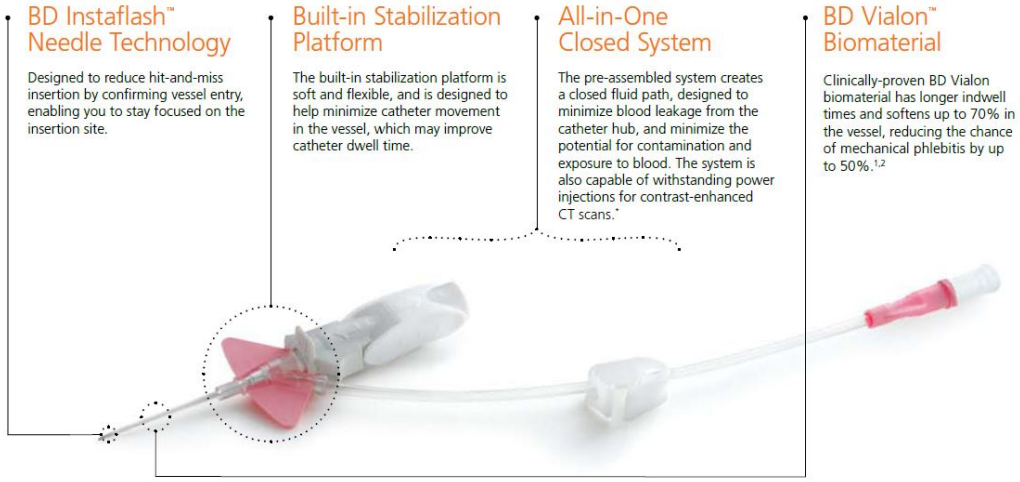
Types of Crystalloids				
	Osmolarity	**Indications**	**Precautions**	**Solution**
Isotonic	Between 250–330 mOsm/L Blood is between 280–300 mmol/kg	• No net increase in cell size • Increases the volume of intravascular • Replaces water losses • Treatment of dehydration and fluid replacement	• Excessive amounts can lead to circulatory overload and pulmonary edema • Monitor electrolytes; alterations can occur depending on the solution amount used • Use with caution in patient's with CHF, renal impairment and cardiac insufficiency	• D5W* • 0.9% NaCl • Lactated Ringers • 3.3% dextrose 0.3% sodium chloride
Hypotonic	Less than 250 mOsm/L	• Will cause fluid to shift into the cells • Used for cellular re-hydration	• Contraindicated in increased intra-cranial pressure (ICP) and hypovolemia • Monitor for water intoxication	• D5.45 NaCl • 0.45 NaCl • 0.33 NaCl
Hypertonic	Greater than 330 mOsm/L	• Will cause fluid shift from the cells into intravascular space • Restores electrolytes and nutrients • Often used as a diuretic	• Cellular dehydration • Fluid overload	• 5% NaCl • Mannitol 10–20% • D5 Lactated Ringers
**Dextrose is rapidly metabolized in IV solutions. Dextrose-only solutions become hypotonic in the body once all the dextrose is metabolized. Close monitoring for water intoxication is therefore indicated.*				

Types of Intravenous Needles

In June of 2010, Alberta Health Services (AHS) carried out a mass conversion of many of the intravenous needles. Unless a safety device does not exist or the safety device does meet the need necessary for use within some clinical areas a safety device should be used wherever possible. There are two types of intravenous catheters used in the initiation of peripheral intravenous therapy.

1. BD Nexiva

BD Nexiva is a all-in-one closed system. The pre-assembled system creates a closed fluid path, which has been proven to significantly reduce blood exposure during insertion, minimizing the potential for contamination and exposure to bloodborne pathogens. It also has a built-in stabilization platform which is soft and flexible, and , combined with a bordered transparent dressing, has proven to significantly reduce dislodgement.



2. BD Insyte Autoguard

BD Insyte Autoguard shielded IV catheters made of BD Vialon™ biomaterial mean added safety for you. They're the safety-engineered version of the popular BD Insyte IV catheter. BD Insyte Autoguard shielded IV catheters do not contain elasticized PVC or natural rubber latex and can be used for Taxol administration.

The unique push-button shielding mechanism releases the spring and allows the needle and flash chamber to quickly retract into the safety barrel. The clinician maintains control of the process by deciding when to active the push-button shielding mechanism

3. The Cleo Device (For Subcutaneous Use Only)

The Cleo 90 infusion set is an all-in-one, single use set. It's different from other infusion sets because it has a canister that houses both an inserter needle and a cannula. The canister serves as both the inserter and needle retractor, so you don't need to see or touch the needle at all if you don't want to. You can insert the set quickly and with just one hand. The Cleo 90 infusion set uses a standard Luer connection, which means that it can be used with any pump that has a Luer fitting.

Guidelines for Choosing Catheter Gauge

Key points to consider:

- type of solution or medication to be infused
- type of therapy to be delivered
- patient diagnosis, history of IV therapy
- patient activity level
- patient age
- condition of the vein

14 gauge: Large gauge; used for life saving emergencies

16 gauge: Trauma, high risk procedures, Situations where rapid infusion of large volumes of blood/ fluids is required

18 gauge: Major trauma or surgery, blood/ administration, rapid infusion

20 gauge: Minor trauma, most common size for routine infusions, appropriate for blood administration if high rates are not required

22 gauge: Small or fragile veins such as children or elderly, transfusion of platelets or plasma

24 / 26 gauge: Neonates, pediatrics, adults with extremely small or fragile veins

Always assess the purpose of the therapy first, and then select the smallest gauge with the shortest needle and the most appropriate site that will allow for proper administration of the prescribed therapy for your patient.

Currently there are several administration sets available throughout AHS. It is the responsibility of the healthcare provider to be aware of variety of administration set, the purpose of each, the drip factor and the correct technique to prime the administration set within their unit/site/facility.

The drip factor (how many gtts/mL) will be indicated on the infusion set packaging. Drip factors can range from Macrodrip 10 – 20 gtts/mL to Microdrip 60 gtts/mL depending on the company.

- **Macrodrip**: 10-20 gtts/mL
- **Microdrip**: 60 gtts/mL
- **Blood Sets**: 10-15 gtts/mL

Add-On Devices

Several devices can be used as **add-on** to facilitate the delivery of the prescribed therapy. These include:

- **Micron filter:** this device is available in a variety of sizes, most common is the 0.22 micron filter. The purpose is to filter out particulate matter in certain IV solutions/medications to prevent potential damage to the pulmonary and or circulatory systems. The addition of such a device is recommended by the manufacturers of the medications and can be found in the pharmacy manual on the intranet or on the package inserts for the medications themselves.
- **Stopcock**: for use in specific care areas where intermittent access to the closed system is required.
- **Extension set / loops**: provides additional length, allows for easier securement and may provide additional closed system access to insertion site if a needleless adaptor is present on the extension set. Can also be used as the “lock” for the saline lock if needleless device is present.
- **Injection / access cap / needleless adaptor**: may provide an additional port in which to attach a syringe or administration set to allow access to a closed system.

Note: These devices increase the potential for infection due to increased manipulation or risk of separation. Use should be limited to practice care-setting protocols.

These add-ons must be:

- attached aseptically using a luer lok™ connection
- primed when the primary administration set is primed

Add-ons should be changed:

- immediately if contamination is suspected
- when there is a break in integrity
- when the primary administration set is changed
- when the device in which it is attached to is change
- at established time intervals

Learning Activity #2

Instructions: Choose the best answers. **Do not write in this module.**

11. Crystalloids:
    a. readily pass through a semi-permeable membrane
    b. stay in the intravascular space

12. The purpose of IV therapy may include: (circle all that apply)
    a. administer blood or blood products
    b. restore electrolyte balance
    c. restore nutritional status
    d. access for emergency situations

13. Complications of IV therapy include: (circle all that apply)
    a. catheter embolism
    b. circulatory overload
    c. pulmonary embolus
    d. aneurysm

14. This type of crystalloid can be used as a diuretic:
    a. isotonic
    b. hypertonic
    c. hypotonic

15. The drip factor from microdrip tubing can be:
    a. 10-15 gtts/mL
    b. 10-20 gtts/mL
    c. 20-45 gtts/mL
    d. 60 gtts/mL

Note: See page 38 for answer key.

Section Three

Insertion

Practitioner Order

The components of an order for IV therapy to be initiated must contain these key pieces of information:

- date and time
- IV solution
- rate
- signature of ordering practitioner

Preparation of Patient

Upon approaching a patient/family, it is important to identify yourself, and let the patient and family know that an IV has been ordered. A two-identifier system is used for patient identification verification. This generally includes the patient name and a unique identification number or photograph. As two patients can have same name and date of birth, the unique ID number is considered the ultimate identifier. Explain why the IV has been ordered and answer any questions the patient/parent/guardian may have regarding the procedure. This communication is important to decrease the anxiety and fear that the patient may have about the procedure. Have patient lie in a comfortable recumbent position, semi-Fowlers or lower with the insertion arm extended. The use of local anesthetic should be considered for patients.

Supplies

Gather supplies necessary and perform any necessary task prior to the initiation of the IV such as priming extension set or IV tubing. Each site/zone has a variety of products that are used within each facility, become familiar with products and procedure used within the practice setting. If attaching an administration set, ensure that line is flushed according to manufacturer's recommendations.

Required supplies include:

- Tourniquet
- Alcohol / Chlorhexidine Swab
- Dressing
- Solution set or extension set
- 0.9% Normal Saline to flush or prescribed solution (check expiration date)
- Clean non-latex gloves
- Variety of IV catheter sizes
- Tape
- Sharps container
- Incontinent pad/Absorbent pad
- Optional: use of local anesthetic or 24% sucrose as per NICU for pain relief measures

Hair Removal

If required, clipping of hair is recommended to facilitate catheter insertion and dressing adherence. Never shave site (micro-abrasions) or use depilatory creams.

Vein Dilation Techniques

Vein dilation will increase the visualization of the veins. A tourniquet is not always necessary in hypertensive patients or recommended if a patient has fragile veins, it is at the discretion of the healthcare provider to use a tourniquet. Depending on the practice setting, there are a couple of techniques that could be utilized for vein dilation. Choose the technique that is appropriate for the practice setting and the patient.

- **Tourniquet**: **a single patient use**, non latex, stretchable band. Place the tourniquet just above the antecubital area will allow visualization of the entire arm. Allow 2 – 3 minutes for venous dilation. Once the site is chosen based on patient, diagnosis and therapy remove the tourniquet and reapply 10 – 15 cm above intended site.

- **Blood Pressure Cuff:** cuff inflation should not exceed the patient's diastolic pressure to prevent arterial circulation impairment. A radial pulse should still be palpable when inflated.

If the vein is not dilating to allow adequate visualization, remove tourniquet and use additional techniques to promote dilation.

Additional techniques to dilate veins

- **Relaxation** – explaining the procedure or assist them to practice deep breathing if particularly nervous.

- **Gravity** – dangling the arm below the level of the heart.

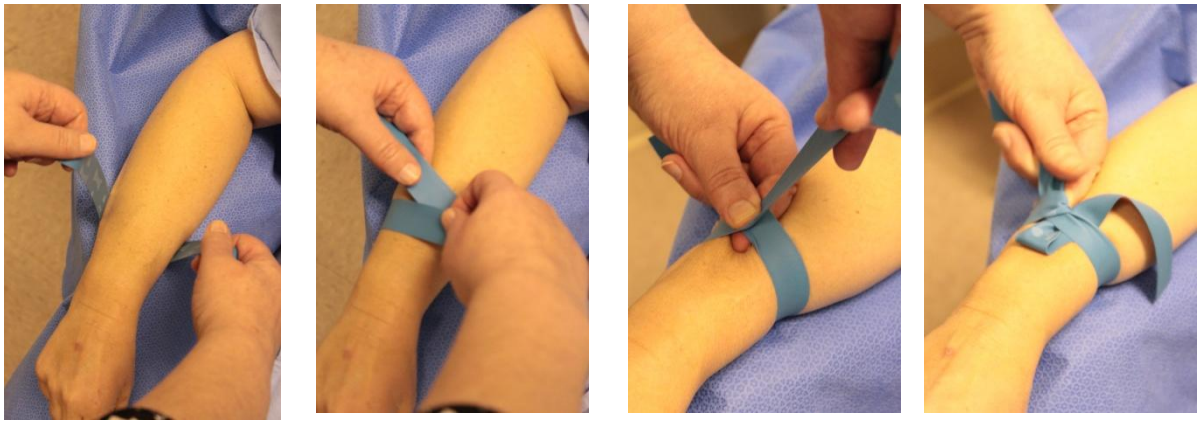
- **Heat** – a warm blanket can be wrapped around the arm (have the patient check the temperature first; it should not feel too hot or uncomfortable in any way). Applied heat is usually effective within 10 minutes.

- **Opening and closing of the fist.**

- **Gently tapping the vein – do not slap or flick the vein.**

To Apply Tourniquet

1. Lay the tourniquet under the arm
2. Pull the tourniquet straight up until it is taut
3. Cross the right side of the tourniquet over the left
4. Push the right side of the tourniquet up under the left to form a loop



Cleansing of the Site

Correct preparation of the IV site is important to help reduce the chance of infection. It is vital to cleanse an area larger than the outer size of the dressing. Cleanse the site with friction using repeated back- and- forth strokes. Palpating the vein with a gloved fingertip must be done prior to cleansing.

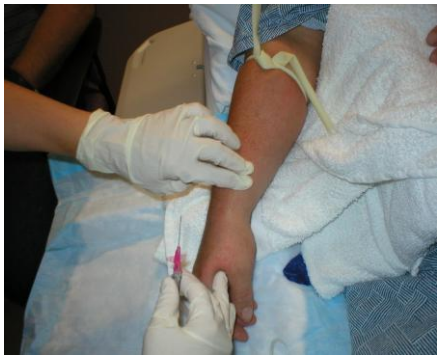
The following antiseptics are appropriate for site preparation, use what is available within your unit/site:

- **Chlorhexidine (CHG):** several concentrations are available, follow site procedure for cleansing if using Chlorhexidine
  - 2% chlorhexidine with 70% alcohol-based preparation is preferred
    Note: 0.5% CHG with 70% alcohol may be used
  - Cleanse for 30 seconds or as directed by site procedure
  - Allow to dry thoroughly as directed by site procedure
  - Do **not** wipe away solution to decrease dry time
- **Alcohol**
  - 70% is the most common
  - Requires a one-minute friction rub
  - Allow to dry thoroughly
  - Do **not** wipe away solution to decrease dry time

If gross contamination is visible, wash the area with warm water and soap before starting the procedure.

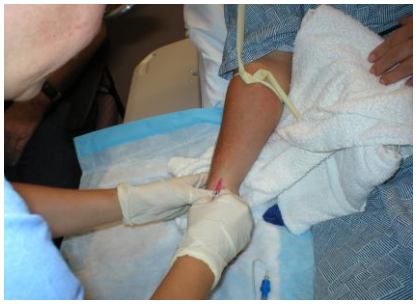
Insertion of BD Insyte Autoguard

- Place incontinent pad under patient's arm to protect bedding.
- Apply gloves
- Open the IV cathelon package and, if recommended by manufacturer, loosen the plastic cathelon from the underlying needle by turning the cathelon 360° and reseat the cathelon firmly onto the needle. Carefully replace the cathelon into the protective plastic cover being careful to maintain sterility and avoid needle stick to caregiver.

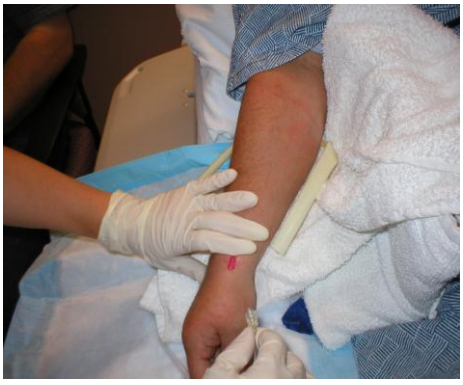


- Position yourself with the catheter in your dominant hand while palpating the vein with the other hand.
- Insert the catheter into the chosen vein. Watch for flashback in the chamber.
    - **Indirect:** use for smaller veins, fragile veins (those that tend to collapse) or those that are extremely mobile when palpated. This technique is accomplished by insertion of the catheter into the skin below the point that the vein is visible and enter into the vein.

Catheter should be inserted in the "bevel up" position. Apply traction to the skin either above or below to stabilize the vein.



    - **Direct**: use for all other veins as required. Enter the vein directly on top at a 10–30 degree angle. Decrease the angle to 5 degrees for more superficial veins.
- Once flashback is seen at flashback chamber, lower the catheter to almost parallel with the skin and then advance the catheter a few more millimetres (6–7 mm).
- Occlude the blood flow and remove the tourniquet prior to activating the retraction device on the cathelon to reduce blood spill.



Successful initiation of IV's takes a great deal of practice.

- Activate the safety device to retract the stylet into the plastic chamber. Regardless of the device being used, the safety device must be engaged immediately after/upon removal of the stylet.

Note: If using BD product, button must be pushed while the stylet is in the catheter to prevent blood splatter.

Never re-insert the stylet; this could cause shearing of the catheter and an embolus to your patient.

- Always have a sharps container close to your work area and dispose of the stylet, regardless of safety device, as soon as it is removed from the catheter. The sharps container should be puncture proof, tamper-proof and marked with a biohazardous waste symbol.

Never *recap your stylet or place it on a bed or floor.*

Helpful Hints for Insertion

- If using metacarpal veins, hold and splint the patient's hand with your non-dominant hand. This technique further assists in stabilizing the vessel as you insert the catheter.
- Always start your IV in the most distal position that is appropriate. This assures the integrity of the vessels above should your first attempt be unsuccessful.
- It is appropriate to ask for assistance after two unsuccessful attempts – this is in no way a reflection on your skill; rather, an attempt to acknowledge that often all that is needed is a "fresh pair of eyes". Review your sites IV therapy procedure to be aware of the number of attempts allowed before assistance must be requested.
- **Always** put your patient first.

Insertion of BD Nexiva

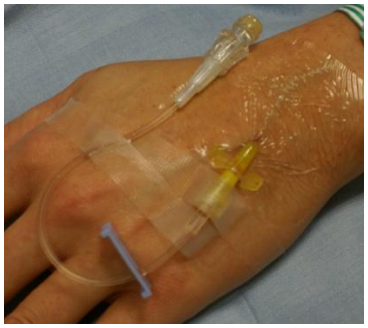
- Secure vent plug, clamp should not be engaged.
- Twist to remove needle cover, pull back approximately 1/8" on finger grips, then push finger grips back to original position.
- Access the vessel- initial blood return is along the catheter and then up the extension tube. Look at the catheter for initial blood return.

- Then lower and advance the entire catheter and needle unit slightly to ensure the catheter tip is in the vessel.
- Place pad of index finger behind the push-tab and push the catheter off the needle into the vessel.
- Stabilize the system and pull back until the push-tab component releases.
- Engage the clamp. Remove the vent plug and attach administration tubing or access port
- Release the clamp to flush or infuse.
- Apply transparent dressing to cover.

Securement

IV dressings are required to provide stabilization and protection of the catheter and insertion site. Because the insertion of the IV breaks the skin integrity it is important that dressings are sterile to help protect this portal from contamination. A transparent dressing is recommended to allow visualization of the site. Some patients and circumstances require the use of different dressing techniques; you will need to assess each situation for the type of dressing that is appropriate. There are some principles to IV dressing that must be adhered to:

- The dressing should not be tight and should be comfortable for the patient.
- Only sterile tape should be applied under the transparent dressing.
- Dressings should be changed when loose or soiled and as per policy.
- Dressings are **not** a replacement for thorough IV site care and assessment.
- Loop IV tubing and tape to the patient's limb to prevent accidental dislodgement.
- A sterile skin barrier wipe can be used to provide additional adhesive underneath and around the transparent dressing.



If splinting devices are used, the immobilized joint should be positioned in a position of slight flexion. Range of motion exercises should be performed periodically when assessing the IV site.

Label tubing with line date, time and solution infusing proximal to the site. Types of labels may vary. Become familiar with the labels used in your area.

Apply a transparent dressing just to the edge of the hub and secure the tubing above and below with tape. Change IV dressings with site rotation or when integrity is compromised.

Documentation

Upon completion of the initiation of the IV documentation of the procedure is required. Location of documentation will vary from site to site, be familiar with the required location of documentation in the unit/site/zone. The following information must be documented:

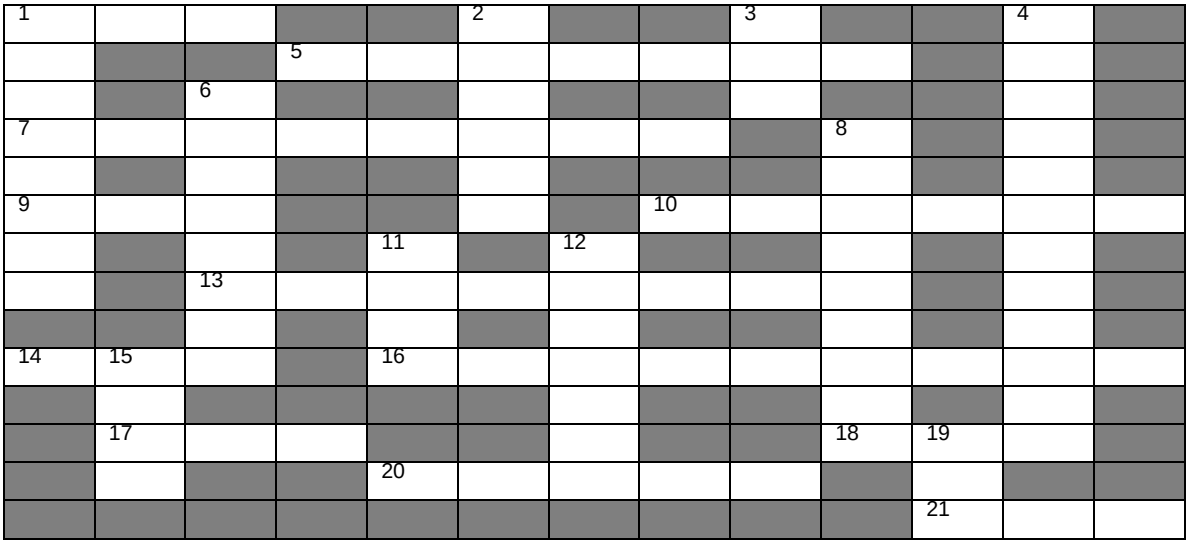
- date and time of initiation
- location
- size/gauge of catheter
- number of attempts
- infusate
- how procedure was tolerated
- any difficulties that may have occurred

Troubleshooting

Problem	Symptoms	Possible Causes	Solution
IV not in vein	• No flashback • Swelling with infusion • IV will not infuse	• Catheter missed the vein • Poor body alignment • Poor lighting • Vein movement	• Place bevel directly on top of the vein • Reposition yourself or patient • Ensure adequate lighting • Reposition the vein and stabilize • Ensure adequate dilation
Traumatic insertion causing haematoma	• Rapidly filling pocket of blood at the insertion site	• Vein trauma • Excessive force applied • Failure to reduce angle of device • Poor condition of veins • Catheter too large • Poor technique when separating the stylet from the catheter	• Decrease insertion angle • Reduce amount of force used • Reduce angle on device immediately after flash is noted • Use a smaller catheter • Smooth gentle separation of stylet from catheter • Test stylet movement in catheter prior to insertion
Unable to advance catheter into the vein	• Skin may “pucker” as threading is attempted • Catheter will not slide evenly into the vein	• Damaged vein (IV drug use, damage from vesicant medications) • Resistance from a valve • Poor angle • Wrong catheter size • Stylet removed to early	• Choose a different vein • If on a valve - pull stylet back slightly and attempt to advance with IV solution flowing slowly • To correct angle, pull back on the entire device, lower the angle and advance • Maintain the catheter and stylet as a unit until you determine it is actually in the vein

Learning Activity #3

Instructions: Complete the crossword puzzle. **Do not write in this module.**



Across

1. antiseptic used for site preparation (abbreviation)
5. type of connection used
7. infusion of blood in subcutaneous spaces
9. number of unsuccessful attempts before asking for help
10. type of IV catheter used for starting an IV
13. type of solution used to replace water losses
14. most common place to start an IV
16. inflammation of the vein
17. applied heat is usually effective within _____ minutes
18. stabilize vein with ____ dominant hand
20. stopcocks and needleless adaptors are known as _____ devices
21. additional port can be provided by adding an access _____

Down

1. Nexiva is a type of IV _____
2. type of blood seen in flashback chamber
3. sensation felt when entering a vein
4. accumulation of fluids in the subcutaneous tissue
6. caused by a blood clot or large amounts of air
8. bacterial invasion at insertion site
11. allows for easier securement
12. an example is albumin
15. a key component of an order for IV therapy
19. most common type of IV catheter used (abbreviation)

Note: See page 38 for answer key.

Section Four

Maintenance

Assessment of the IV Site / System

There are common interventions that must be carried out as part of the care for patient's receiving IV therapy. Review site procedure for care and maintenance of IV therapy and always follow site policy for frequency of the following interventions:

1. Inspect the IV site for phlebitis, infiltration and infection.
2. Check infusion rate hourly and PRN. Record intravenous intake every 4 hours on the intake and output record or as per site procedure.
3. Change primary IV bags every 24 hours or as per site procedure.
4. Change administration sets every 96 hours; change the IV bag at the same time.

   Note: There are exceptions to this rule. For example, TPN tubing is changed every 24 hours or as per site procedure.
5. Change intermittent set every 24 hours or as per site procedure.
6. Change the secondary set every 24 hours or as per site procedure.
7. Re-site the catheter every 96 hours, if possible.

   Note: This depends on availability of veins, length of therapy and patient condition.

Troubleshooting the IV Infusion

Problem	Possible Causes	Prevention	Treatment
IV not infusing	• Tubing kinked	• Check for kinks in tubing	• If no visible kinks, remove dressing and check catheter and site
	• IV catheter bent	• Stabilize and secure catheter with each IV start • Apply arm board	• Re-secure catheter or restart IV if required
	• Catheter tip against vein wall	• Avoid insertion over site of flexion	• Gently reposition the catheter slightly • Re-tape if repositioning successful
	• IV clotted	• Ensure continuous flow of solution • Use of infusion pumps prevent IV's from running dry	• Disconnect IV tubing; directly connect a 3-5 mL syringe, gently attempt to aspirate the clot. **Never irrigate the catheter**
	• Blood back-up with ambulation	• Maintain or increase pressure from above the site	• Adjust the height of IV pole with gravity infusions
	• Blocked in-line filter or air-lock in filter	• Prime filters correctly	• Inspect filters; replace if needed
	• Phlebitis	• Change site per protocol, monitor site and patient closely	• Remove IV, apply warm, moist compresses
Venous spasm as evidenced by pain at site	• Trauma	• Use slow, gentle, fluid insertion techniques, insert bevel-up • May use a smaller catheter and a large vein if appropriate	• Apply warm compresses to the area • Slower rate of infusion • Use blood warmer if appropriate
	• Chemical irritation	• Slow IV rate or dilute if not contraindicated	
	• Viscous fluids	• Dilute if not contraindicated	
	• Cold IV fluids	• Use fluid warmer	
	• Rapid infusion	• Slow IV rate if not contraindicated	

Problem	Possible Causes	Prevention	Treatment
Air in line	• Incorrect priming of the IV tubing	• Prime the line as per manufacturer's recommendations, pay attention to y-ports, back check valves and filtering devices	• Close tubing below the air with the roller or slide clamp, gently tap the IV tubing below the air bubbles to force air into drip chamber • Lock a syringe onto the medication port below the air bubbles and gently aspirate the air • Remove the tubing from the catheter, maintaining sterility of catheter and run the air out of the line
	• Failure to close clamps when changing IV bags	• Always close clamps before removing an existing IV bag to replace with a new one	• Remove air if required using one of the techniques described above
	• IV solution runs out	• Check IV infusion hourly • Use infusion pump	• Close roller clamp • Ensure adequate solution levels • Remove air as required
Painful IV site	• Phlebitis	• Change site per protocol, monitor site and patient closely	• Remove IV and apply warm, moist compresses
	• Chemical irritation	• See phlebitis	• Increase dilution as indicated • Reduce flow rate • Flush vein • Add an inline filter • Discontinue and apply compresses
	• Catheter inserted too far	• Do **not** insert beyond 2 mm of the hub of the catheter • Check with the patient re: comfort	• Loosen tape and pull catheter back and re-tape

Problem	Possible Causes	Prevention	Treatment
Painful IV site (cont)	• Infection	• Follow proper insertion protocol • Monitor patient and IV site closely	• Culture swab, remove IV, restart on other arm; apply warm compresses and notify physician
	• Infiltration	• Follow proper insertion protocol • Monitor patient and IV site closely	• Remove IV; apply warm, moist compresses
	• Catheter too large for vein	• Use the smallest gauge possible for purpose of the IV • Consider patient anatomy	• Remove the IV and select a smaller catheter
	• IV catheter against a nerve	• Select IV site carefully • Be familiar with anatomy	• Remove the IV • Assess for motor or sensory impairment • Decreased ability to move hand or limb, burning or numbness and tingling, continued pain despite removal of IV • Record and inform physician

Patient Teaching

Patients need to be aware that IV therapy should not be painful. Reinforce that if the patient experiences pain at the insertion site or up the arm, redness is noted, swelling at the site, numbness, the area feels cold or hot that they need to let their healthcare provider know. Additional information about the general care of the IV that the patient should be aware of:

- the need to have the site covered when showering
- do **not** adjust the rate/flow
- keep the site below heart level to prevent backflow of blood
- call for assistance if the IV bag is almost empty or if the dressing appears to be loose

This is not an all inclusive list.

Patient teaching about the care of an intravenous site is ongoing. It begins with the initial contact prior to starting an IV. Explaining the reason for the IV and ensuring the patient/family understand why it is required and continues on for the length of the therapy answering questions that may arise. Check for any additional patient education materials that may be available and applicable to share with your patient.

Learning Activity #4

Instructions: Identify what actions you would take from Column B for IV problems identified in column A. **Do not write in this module.**

Note: there may be more than one correct action to take.

	Column A	Column B
_____	Air in line	a. Apply warm, moist compress
_____	Chemical irritation	b. Aspirate IV
_____	Infection	c. Close roller clamp
_____	Infiltration	d. Flush IV
_____	IV catheter bent	e. Gently tap IV tubing
_____	IV clotted	f. Increase dilution
_____	Phlebitis	g. Irrigate IV catheter
		h. Loop tubing around pen
		i. Notify physician
		j. Perform Culture & Sensitivity swab
		k. Remove IV
		l. Resecure IV catheter
		m. Restart IV if required
		n. Slow IV rate

Note: See page 38 for answer key.

Section Five

Discontinuation

Intravenous therapy may need to be discontinued for many reasons: prescribed therapy complete, the site may not be healthy, ordered by practitioner, or it may be being discontinued based on a single time use standing order (e.g., used only to inject dye for a diagnostic procedure).

Safe removal of the existing IV is essential to protect the patient and the health care provider.

1. Wash hands and gather supplies.
2. Ensure that the device to be discontinued is a peripheral IV and that it is safe to be removed (peripheral line vs. central line).
3. Clamp off IV tubing.
4. Remove tape securing tubing to the patient.
5. Don gloves. Remove the dressing distal to proximal in order to stabilize the catheter. This prevents catheter dislodgement and potential risk of blood exposure from splatter.
6. Examine insertion site for complications (e.g., purulent discharge, swelling or inflammation).
    a. If purulent discharge is noted, cleanse site with normal saline, milk the vein toward the site and obtain a swab for C&S.
    b. If phlebitis or infiltration apparent; apply warm compresses.
7. Hold sterile gauze lightly over the insertion site and gently remove the catheter keeping it level with the skin.
8. Apply firm pressure with gauze and elevate the limb. Maintain pressure until bleeding stops.
9. Examine the catheter to ensure it is intact.
10. Apply small bandage if required.
11. Document IV removal as per protocol.

Standard [universal] precautions must be utilized with all patients.

The potential for coming into contact with a patient's blood while starting an IV is high and increases with the inexperience of the operator. Gloves **must** be worn while starting an IV and where risk of blood spatter is high, such as an agitated patient, the operator should consider eye protection as well as a gown…once removed from the [plastic] sheath, IV catheters should either be used to start the IV for a patient or go into an appropriate sharps container…**Recapping of needles is one of the most common causes of preventable needle stick injuries in health care workers.**

Protective Clothing

- Gloves are required by Occupational Safety and Health as standard precautions for the prevention of blood-borne pathogen exposure for all invasive procedures.
- Gown, mask, and goggles are required when the procedure may generate droplets or splashing of blood/body fluids.
- Consider use of further isolation techniques when dealing with an immuno-suppressed patient or those who have been diagnosed with a highly communicable disease. If uncertain in these complex situations, you may contact the regional Infection Control office.

Assembly of Equipment

- Prepare equipment using aseptic technique.
- Assemble and open equipment immediately prior to use.

Disposal

- Utilize a mechanism for safe disposal of all sharp items.
- Container must be non-permeable, tamperproof and accessible to prevent cross-contamination and/or accidental needle-stick injury.
- A mechanism must be in place to dispose of gowns/masks soiled with blood/body fluids.

Learning Activity #5

Instructions: Identify the correct steps for performing a procedure. **Do not write in this module.**

You need to discontinue an IV. Put the following steps in the correct order.

_____ a. Apply dressing
_____ b. Clamp off IV tubing
_____ c. Don gloves
_____ d. Examine catheter while applying firm pressure
_____ e. Examine IV site
_____ f. Gather supplies
_____ g. Hold sterile gauze over insertion site
_____ h. Remove IV catheter
_____ i. Remove tape securing IV
_____ j. Wash hands

Note: See page 38 for answer key.

Answer Keys

Learning Activity #1

1. intima
2. thick
3. visible
4. cephalic
5. distal
6. A
7. A
8. U
9. A
10. U

Learning Activity #2

12. a
13. a, b, c, d
14. a, b, c
15. b
16. d

Learning Activity #3

1 C	H	G			2 V			3 P			4 I	
A			5 L	U	E	R	L	O	K		N	
T		6 E			N			P			F	
7 H	E	M	A	T	O	M	A		8 I		I	
E		B			U				N		L	
9 T	W	O			S		10 S	A	F	E	T	Y
E		L		11 L		12 C			E		R	
R		13 I	S	O	T	O	N	I	C		A	
		S		O		L			T		T	
14 A	15 R	M		16 P	H	L	E	B	I	T	I	S
	A					O			O		O	
	17 T	E	N			I			18 N	19 O	N	
	E			20 A	D	D	O	N		N		
										21 C	A	P

Across

1. ***CHG***
5. ***luer lok***
7. ***hematoma***
9. ***two***
10. ***safety***
13. ***isotonic***
14. ***arm***
16. ***phlebitis***
17. ***ten***
18. ***non*** dominant hand
20. ***add on*** devices
21. ***cap***

Down

1. IV ***catheter***
2. ***venous***
3. ***pop***
4. ***infiltration***
6. ***hematoma***
8. ***infection***
11. ***loop***
12. ***colloid***
15. ***rate***
19. ***ONC***

Learning Activity #4

c, e, h	Air in line
a, d, f, k, n	Chemical irritation
a, i, j, k, m	Infection
a, k, m	Infiltration
l, m	IV catheter bent
b	IV clotted
a, k, m	Phlebitis

Learning Activity #5

You need to discontinue an IV. Put the following steps in the correct order.

j, f, b, i, c, e, g, h, d, a

10	a.	Apply dressing
3	b.	Clamp off IV tubing
5	c.	Don gloves
9	d.	Examine catheter while applying firm pressure
6	e.	Examine IV site
2	f.	Gather supplies
7	g.	Hold sterile gauze over insertion site
8	h.	Remove IV catheter
4	i.	Remove tape securing IV
1	j.	Wash hands

Intravenous Therapy Leaning Module Exam

1. B
2. B
3. C
4. A
5. C
6. D
7. E
8. A
9. D
10. C
11. cells / intravascular space
12. Handwashing
13. Air Embolism
14. False
15. True
16. False

Intravenous Therapy Learning Module Exam

Instructions: Copy answer sheet from Appendix A. Choose the best answer to the questions below. **Do not write in this module.**

1. What is the easiest way to discern an artery from a vein?
   A. apply tourniquet, if the vessel becomes distended it is an artery
   B. assess for a pulse
   C. there is no easy way unless you attempt the insertion

2. What are the criteria for vein selection? The vein is _____ and _____.
   a. straight
   b. firm and pulsating
   c. most proximal site
   d. soft and spongy
      A. a, b
      B. a, d
      C. b, c
      D. c, d

3. Which of the following is **not** a consideration in the selection of a vein for venipuncture?
   A. type of solution to be infused
   B. patient's preference
   C. gender of the patient
   D. duration of the therapy

4. A risk of infusing large amounts of isotonic solution is:
   A. circulatory overload
   B. dehydration
   C. interstitial spasm
   D. no risk

5. Excess hair on the patient's arm should be:
   A. left in place
   B. removed with a razor
   C. removed with scissors or a surgical clipper

6. Which of the following are examples of hypertonic solutions?
   a. 0.45% sodium chloride
   b. 5% dextrose in water
   c. Lactated Ringers
   d. Mannitol

   A. a, b, c
   B. a, c
   C. b, d
   D. d only
   E. all of the above

7. Infiltration / Extravasation can be prevented by:
   a. monitoring IV sites as required by policy or more frequently
   b. avoiding insertion of an IV where limb flexion occurs
   c. selecting an appropriate vein for the required therapy
   d. ensuring the IV catheter and tubing is secured well

   A. a, b, c
   B. a, c
   C. b, d
   D. d only
   E. all of the above

8. When securing an IV catheter:

   A. loop and tape the IV tubing to patient's limb
   B. apply non-sterile tape under the dressing
   C. apply a clean dressing over the insertion site

9. Your patient has redness and swelling at the IV insertion site and is complaining of pain as the IV is infusing. The IV site feels warm. The symptoms are suggestive of:

   A. hematoma
   B. infiltration
   C. infection
   D. phlebitis

10. A 500 mL bag of D5W solution has been removed from the outer pouch, labeled with date and time and not used. How long can this IV bag be stored at room temperature for future use?

    A. 24 hours

    B. 7 days

    C. 30 days

    D. indefinitely

11. Hypertonic solutions cause fluid to shift out of _____ and into the _____.

12. The cornerstone of infection control and one of the most important steps to ensure infection prevention during the initiation of intravenous therapy is _____.

13. The risk of **not** purging out all of the air from the IV tubing when priming the line is _____.

14. Activate the safety device when flashback is seen at the flashback chamber.

    True

    False

15. Expected clinical practice includes selecting the most appropriate gauge and length of catheter for the type of infusion required.

    True

    False

16. You have separated the stylet from the hub after obtaining blood in the flashback chamber. You are now unable to advance the catheter into the vein. Your next step would be to reinsert the stylet back into the catheter.

    True

    False

Note: See page 38 for answer key.

Intravenous Therapy Learning Module Exam answer sheet

Name: _____ **Site and Unit:**_____

1. A, B, C
2. A, B, C, D
3. A, B, C, D
4. A, B, C, D
5. A, B, C
6. A, B, C, D, E
7. A, B, C, D, E
8. A, B, C
9. A, B, C, D
10. A, B, C, D
11. _____, _____
12.
13.
14. True False
15. True False
16. True False