

Interprofessional Development

Intravenous Guidelines for the Adult Patient

Resource Manual



“Together...supporting quality care”

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Introduction

Intravenous Guidelines for the Adult Patient is a valuable teaching resource based on current best practice for intravenous (IV) therapy and IV medication administration. This learning manual provides practice guidelines related to the initiation of a Peripheral Vascular Access Device (PVAD), assessment for the appropriateness of ongoing therapy, management of complications and medication administration via the intravenous route.

Related hospital policies and resource manuals can be found on the Intranet. For your reference a list of related hospital policies and resource manuals can be found in Appendix A of this manual. Please feel free to contact a member of professional practice for further information or resources.

Objectives

- Review anatomy of peripheral venous system
- Identify steps for IV initiation
- Discuss complications associated with IV therapy
- Discuss the necessary assessments/interventions to prevent complications associated with IV therapy
- Review IV medication administration

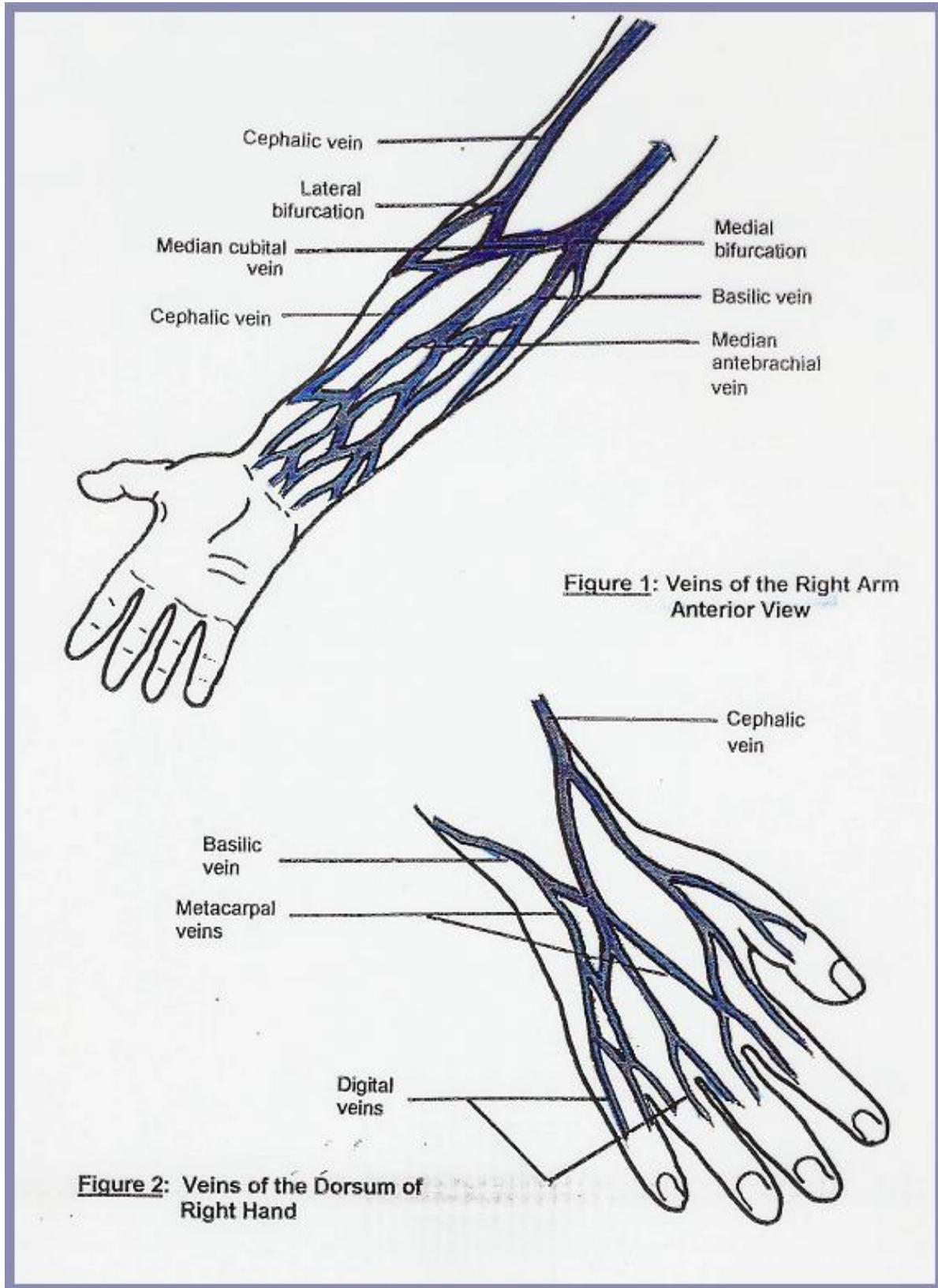
The clinician will review the resource manual and complete the test prior to hands on skill performance provided during orientation. For your reference a copy of this manual can be found on your unit and on the Intranet under Interprofessional Resources.

IV Initiation Certification Requirements

All staff administering IV therapy at QHC will successfully complete the IV Certification process. This includes:

1. Review of learning manual *Intravenous Guidelines for the Adult Patient* and complete test with a passing grade of 80%.
2. Attend demonstration lab.
3. A minimum of two successful/competent initiations observed by a clinician certified and competent in IV initiation.
4. Completion of certification checklists (as applicable)
 - a. IV medication administration below the drip chamber
 - b. Initiating an IV.
5. The completed checklist(s) should be photocopied with a copy to manager and original retained by staff member.

ANATOMY OF UPPER EXTREMITY VEINS



ANATOMY OF LOWER EXTREMITY VEINS

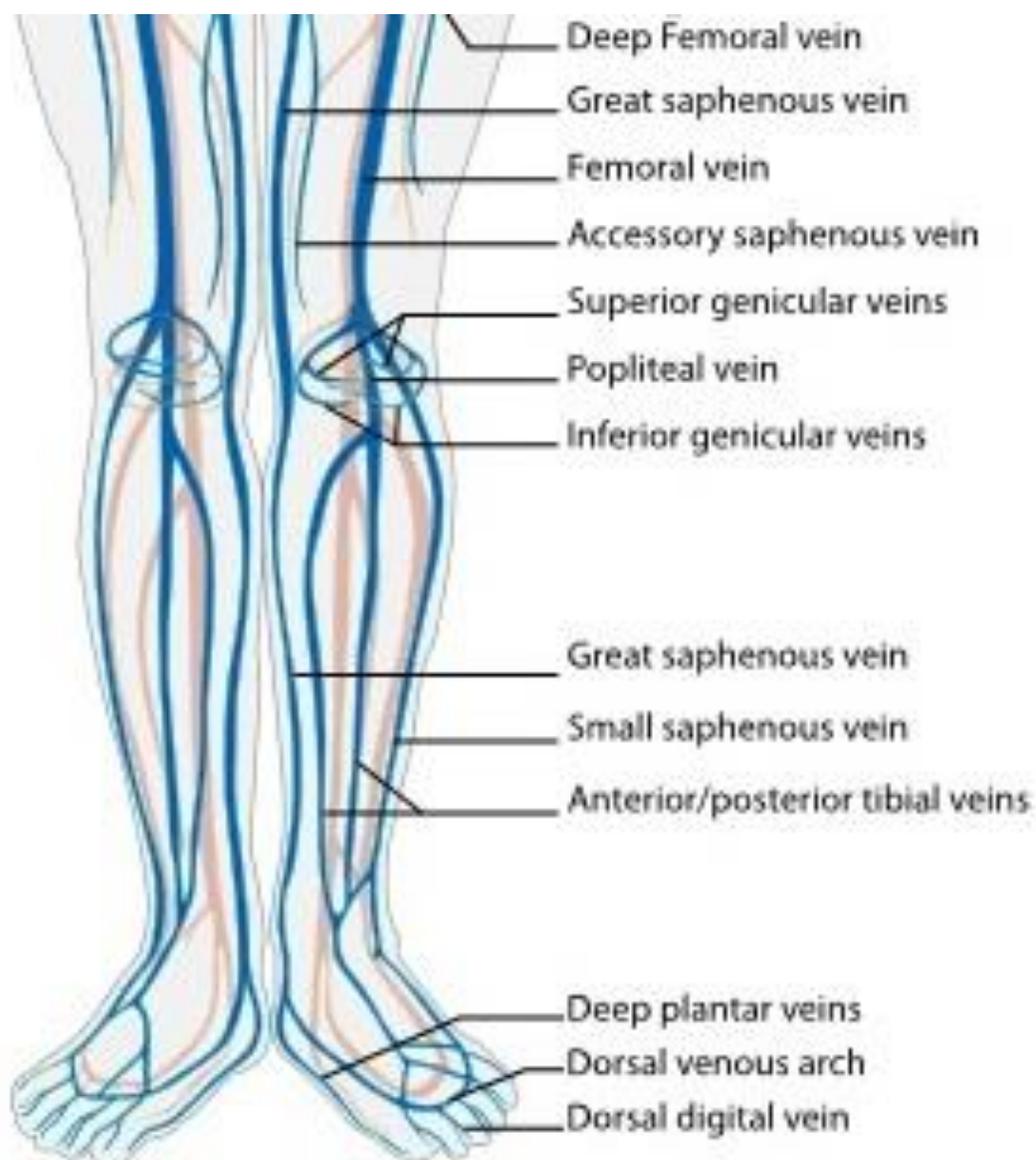


Image retrieved from: Brevard Heart and Vascular Institute (2012) <http://brevardheart.com/node/65>

COMPARISON OF VEINS AND ARTERIES

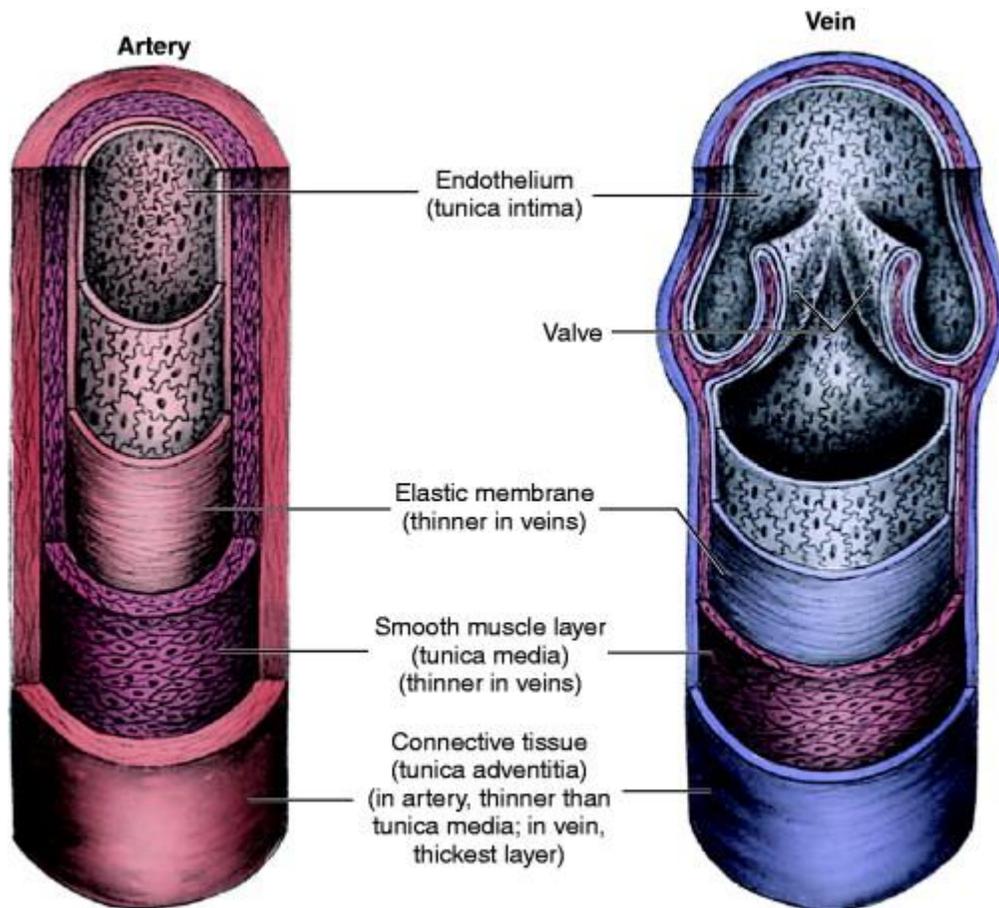


Image retrieved from: Urden, S. (2009) Critical Care Nursing: Diagnosis and management (6th ed.)

<http://www.nursingconsult.com>

ARTERIES	VEINS
<ul style="list-style-type: none"> • Pulsates • Blood is under pressure and flows rapidly • Bright pink - red colour • Prolonged direct pressure needed to stop blood flow from a venipuncture site • No valves, blood moves under pressure of the heart beat • Thick muscular wall • If fluid is infused into a superficial artery, the arterial spasm results in blanching and ischemic injury 	<ul style="list-style-type: none"> • No pulsation • Sluggish flow • Dark red in colour • Shorter duration of pressure needed to stop blood flow from the venipuncture site • Valves prevent backflow • Thin muscular wall • Veins are unlikely to spasm and are more likely to collapse; may spasm with irritating solutions or trauma

Peripheral Vascular Access Device Initiation Guidelines

Preparation

Steps	Rationale
Verify the order for IV therapy. Note the solution, rate and duration of therapy.	Risk management.
1. Gather equipment: <ul style="list-style-type: none"> • Alcohol wipes • Tourniquet • Peripheral Vascular Access Device (PVAD. e.g. angiocath) • Dressing –transparent semi permeable membrane or gauze and tape • Gauze and tape • Gloves • Primed macro bore extension set, IV solution and primed tubing if needed Syringe with 5 mL of normal saline for flush.	Be prepared.
2. Ensure proper identification of patient using two unique identifiers.	Risk management.
3. Explain procedure to the patient and obtain consent.	Reduces anxiety Risk management.

Site Selection and Vein Criteria

Steps	Rationale
1. Selecting a vein: Veins of the hand, wrist, arm	The site of choice, most distal to proximal. Consider the purpose of therapy and the size of the PVAD required when selecting the vein.
Antecubital fossa	Only use in an emergency situation or if the antecubital fossa is the only accessible site.
Lower limbs	Requires careful consideration of the contraindications, used only with a physician's order.
Avoid areas painful to palpation	Pain is an assessment factor for infiltration.
Avoid areas of flexion	Difficult to maintain IV infusion and increased risk for phlebitis, infiltration and excessive vessel damage.

Steps	Rationale
2. Do not use limb on same side of mastectomy, dialysis shunt or paralysis.	Increases risk for complications such as infection, lymphedema or vessel damage.
3. Palpate the vein in the direction of blood flow.	Vein should be soft and bouncy, elastic to the touch – pulseless.
4. Size of vein. Select a vein large enough to accommodate intended therapy.	Prevents interruption of venous flow while allowing adequate blood flow around the catheter.
5. Clip hair using scissors from selected site if needed.	Shortening of hair allows for better cleansing and adherence of dressing. Razors may leave micro tears in the skin therefore are contraindicated.
6. Perform hand hygiene and apply gloves.	Prevent the transmission of microorganisms.

Vein Distention

Steps	Rationale
1. Place limb in dependent position.	Improves venous dilation and visibility.
2. Distend vein: Apply flat tourniquet 8 to 15 cm above the intended site OR apply BP cuff to the upper arm to assess limb for venous distention.	Primary vein filling. BP cuff reduces the risk of skin tears in fragile skin.
3. If venous distention is not obtained: <ul style="list-style-type: none"> • Gently tap vein • Release tourniquet, gently rub the arm from wrist to elbow • Place a warm cloth in patients' hand or wrap the arm with a warm towel • Ask patient to make a fist and hold Remove tourniquet if more than 1 minute.	Relieve vasoconstriction. A warm environment promotes venous distention. Increases venous filling above the hand. **Vigorous friction and multiple tapping of the veins especially in older adults causes hematoma and/or venous constriction** Tourniquet should be removed after 1 minute.

Initiation Procedure

<i>Steps</i>	<i>Rationale</i>
1. Distend the vein.	See vein distention techniques.
2. Cleanse site with 60 second alcohol friction rub, starting at the centre and working outward. Allow to air dry completely .	Allows for antimicrobial effect. Wet alcohol will cause pain.
3. Remove the PVAD from the protective sheath and examine the tip. Rotate the hub of the catheter 360 degrees and ensure catheter is seated back in the notch.	To detect any defects. Ensures the tip seal is broken to facilitate stylet retraction.
4. Immobilize the vein. Anchor the vein below the site by placing the thumb over the vein 4 to 5 cm below the insertion site and a finger above the insertion site gently stretching the skin in the direction of insertion. This can also be done by applying gentle contra-lateral stretching of the skin.	To prevent rolling and minimize trauma during catheter advancement.
5. If re-palpation is necessary, re-cleanse site with alcohol wipe and let dry.	To maintain asepsis.
6. Using the smallest PVAD capable of providing the prescribed therapy, puncture skin by inserting the needle bevel up at 10 to 30-degree angle slightly distal to actual site of venipuncture using either direct or indirect insertion technique.	Reduces trauma to vein.
7. Observe for blood return confirming entry of the vessel. Once in the vessel lower the angle almost flush with the skin and advance the entire PVAD unit approximately ¼ inches. 20 gauge and smaller you will immediately see blood along the catheter shaft confirming entry of the vessel, 18 gauge and larger blood will not be seen until it enters the flashback chamber.	Prevents hematoma. Ensures complete entry of the catheter into the vein.
8. Advance the PVAD off the stylet into the vein until the hub rests at the insertion site. Stabilize the catheter with one hand and release the tourniquet with the other. Place a finger on the hub of the PVAD to stabilize and retract the stylet by pressing the white button.	To prevent movement of the needle in the PVAD.

Steps	Rationale
9. Press the tip of the primed macro bore extension tubing or clave connector into the port and twist ¼ turn. Luer the slip connector.	Luer locked connection avoids accidental disconnects.
10. Flush with normal saline and if using an extension set, clamp the extension tubing prior to removing the syringe.	Prevents clot formation at PVAD tip.
11. Tape and secure with appropriate dressing.	Prevents movement of PVAD within the vein decreasing the risk of complications. Prevents accidental dislodging of PVAD. Ensures PVAD can be visualized and assessed hourly.
12. Apply tab with date of insertion and gauge of PVAD and initials.	
13. Initiate infusion /saline lock as per doctor's order. Note correct solution and rate. Date IV tubing.	
14. Discard sharps in the designated sharps container.	Routine practices.
15. Perform hand hygiene.	Prevent the transmission of microorganisms.
16. Document the intervention in the patient's health record.	

PVAD initiation video link:

<http://www.bd.com/infusion/products/ivcatheters/resources/>

Saline Lock Maintenance

Purpose:

- To assess and maintain patency of the PVAD.

<i>Steps</i>	<i>Rationale</i>
1. Gather equipment <ul style="list-style-type: none"> • 5 or 10 mL syringe or larger and sterile normal saline or pre-filled syringe of saline for injection if available • Alcohol wipes 	Be prepared. Note: There is less pressure with larger syringes when infusing, more when withdrawing.
2. Perform hand hygiene and apply clean gloves.	Prevent the transmission of microorganisms.
3. Draw up 5 mL of sterile saline in a 5 or 10 mL luer lock syringe maintaining tip sterility.	Use the bag spike where available.
4. Cleanse clave connector with alcohol wipe using 30-second friction rub and allow to dry.	To maintain sterile fluid path.
5. Luer syringe onto the clave connector of the extension tube.	Needle free system – all connections are luered.
6. Unclamp the extension tube.	Opens fluid path.
7. Aspirate for blood return.	Assesses for patency.
8. In the presence of blood return, flush gently with saline, monitoring for infiltration and tenderness. In the absence of blood return, gently flush – if resistance is met do not continue.	If no blood return, absence of resistance and infiltration will ensure patency.
9. Do not empty the syringe completely.	Pressing the plunger to the bottom of the syringe creates a slight rebound action drawing blood back into the PVAD.
10. Clamp the extension tubing before removing the syringe (if using extension set).	Provides positive pressure lock.
11. Remove the syringe.	
12. Perform hand hygiene.	Prevent the transmission of microorganisms.
13. Document the intervention in the patient's health record and on the CMAR.	Clear communication.

The Dressing

Purpose:

- To protect the site and stabilize the PVAD.

<i>Steps</i>	<i>Rationale</i>
1. Equipment <ul style="list-style-type: none"> • Alcohol wipes • Transparent semi permeable membrane (TSM) or sterile gauze and tape. 	Be prepared.
2. Perform hand hygiene and apply clean gloves.	Prevent the transmission of microorganisms.
3. Do not put tape on the TSM dressing or under the dressing.	Puts PVAD at risk during dressing removal and breaks aseptic technique.
4. Remove the dressing if soiled or no longer occlusive. Remove old dressing from outer edges in while securing the PVAD by holding the hub in place with one finger.	May be changed PRN. Prevent accidental removal.
5. Cleanse site of blood and debris with alcohol wipe.	Reduce the risk of site infection.
6. Apply transparent semi permeable membrane (TSM) using sterile technique to cover the site and hub but not the connector. Use sterile gauze and tape if patient has sensitivity to TSM.	Reduce the risk of site infection. Gauze dressings even when dry and intact must be changed daily.
7. Further stabilize with tape across the connector and tubing.	To stabilize the connection and prevent drag on the PVAD.
8. Perform hand hygiene.	Prevent the transmission of microorganisms.

Intravenous Monitoring

Purpose:

- To provide safe consistent care of the PVAD site
- To understand the responsibility of monitoring an IV infusion

<i>Steps</i>	<i>Rationale</i>
1. Note the date of initiation of site and tubing.	IV PVAD should not be left in place greater than 96 hours. Closed system tubing is changed Q96H or when the PVAD is re-sited. Administration set changes should coincide with peripheral IV site rotation. Some medications/solutions require more frequent tubing changes.
2. Ensure the PVAD is secured in place so that it cannot be advanced or pulled out.	Movement of the PVAD increases the risk for infection and phlebitis.
3. Assess the site Q1h for: <ul style="list-style-type: none"> • Clean and dry at the insertion site and visible through the semi-permeable membrane • Inflammation or infiltration • Tenderness • Discolouration 	Drainage under the dressing may indicate infiltration, phlebitis or infection. Redness at, or around the insertion site and along vein indicates inflammation, induration and swelling with skin temperature cooler than surrounding skin may indicate infiltration. Increased temp may indicate phlebitis.
4. Note sluggish flow of IV fluid or frequent distal line occlusion alarms.	This could be evidence of an interstitial IV and requires further assessment.
5. Note the solution being infused and compare to doctor's order.	On each initial assessment the solution and rate should be verified with the order.
6. Monitor flow rate and site Q1h. Document rate and solution changes at the time the intervention occurs. Clear the infusion pump and document the amount infused when the solution is changed and/or at the end of each shift unless ordered more frequently. Pressure per Square Inch (PSI) should be documented once per shift. The maximum PSI setting for the adult patient is 6.	Note gravity flow rate formula Drops per minute = total mL ÷ total min x the drop factor. (Weinstein, 2001, p. 199)

Steps	Rationale
7. Monitor fluid balance by completing accurate intake and output at a minimum of once per shift or more often if required for IV rates greater than 30 mL/hr. Daily weight should be completed as per physician order.	Fluid balance is part of standard nursing assessment of all patients. Chest assessment and monitoring for edema is recommended for patients receiving continuous IV infusion greater than 30 mL/hr. Accurate intake includes the intravenous and all oral intake.
8. IV TKVO (To keep vein open) rate.	TKVO rate is 30 mL/hr. unless ordered otherwise by the physician.

Continuous Primary Infusion

Continuous primary infusions consist of a solution prescribed at a specific rate and may or may not contain medication. Please refer to the section on IV medication administration for continuous infusions of medication.

The three categories of IV solutions are:

- Isotonic – identical osmolality to body fluids and thus are used to replace extracellular volume
- Hypotonic – osmolality less than that of body fluids thus are used to move fluid from the vascular space into the cells
- Hypertonic – osmolality greater than that of body fluids thus are used to pull fluid into the vascular space from the cells

Isotonic Solutions	Hypotonic Solutions	Hypertonic Solutions
Dextrose 5% in water (D5W) 0.9% Sodium Chloride (NS) Lactated Ringers (LR) (2/3 & 1/3)	0.45% Sodium Chloride (half NS) 0.33% Sodium Chloride (one-third NS)	Dextrose 10% in water (D10W) Dextrose 50% in water (D50W) 3%-5% Sodium Chloride Dextrose 5% in NS Dextrose 5% in half NS Dextrose 5% in LR

Assessment of intravenous therapy begins prior to initiation and throughout therapy. Assessment includes current hydration status, the goals of the therapy and the potential complications or risks associated with the therapy.

Factors to consider include:

- Age
- Weight
- Vital signs
- Lab values
- Skin turgor, oral mucous membranes, eyes, tongue
- Presence of edema
- Chest sounds per auscultation
- Disease process
- Surgical patient
- Fluid balance
- Mentation

It is important to know the rationale for the prescribed IV therapy and whether or not it continues to be an appropriate choice of therapy for each particular patient in order to prevent complications. Administer all IV fluids carefully.

Steps	Rationale
1. Perform hand hygiene and gather equipment.	Prevent the transmission of microorganisms. Be prepared.
2. Prime standard primaryclave tubing fully with selected IV solution.	To ensure all air purged from tubing.
3. Cleanse saline lock port with alcohol wipe – 30 second friction rub. Assess for patency.	Aseptic technique. Refer to saline lock maintenance.
4. Secure distal end of IV tubing into the cleansed port by pushing into port and twist ¼ turn.	This is the initial securement.
5. Luer spin connector over clave port.	Luering ensures against accidental disconnects.
6. Unclamp extension tubing.	Opens the fluid pathway.
7. Program the infusion pump noting the dose limit, which is the total amount of fluid in the bag at the time of initiation and the rate of infusion.	To prevent air in the distal line. To ensure that patient receives the IV fluids as per the physician’s orders.
8. Note the fluid to be absorbed from the IV bag currently infusing.	Aids in calculating when you will need to prepare the next bag for infusion.

Steps	Rationale
9.The infusion pump will alarm <i>dose end</i> to signal a new IV bag is needed. Select a bag of solution to match the physician’s order. Remove the outer wrap. Check the expiry date on the bag.	Leakage of solution into the outer wrap may indicate the bag is punctured. Solution that is discoloured or cloudy should not be used. Return to SPD for quality assurance reporting. Check the IV solution for clarity. A small amount of moisture in the outer wrap is acceptable but a collection of fluid in the outer wrap may represent a damaged bag.
10.Stop the pump; remove IV bag port cover keeping the port sterile. Take down the empty IV bag; remove the tubing spike from the bag. Keeping the spike sterile thrust it into the port of the new IV bag.	
11.Follow the prompts on the pump for resetting the dose limit and restarting the pump.	At this time do not reset the amount infused.
12.When changing IV to IV lock, stop the pump, clamp tubing below the IV bag and clamp the extension set. Cleanse lower clave port with alcohol wipe x 30 seconds. Disconnect tubing from the clave extension set and luer tubing tip onto lower clave port.	To maintain positive pressure in the PVAD. To maintain tubing for intermittent infusions if ordered. Flush the lock with 5 mL of normal saline.
13.Perform hand hygiene.	Prevent the transmission of microorganisms.

Quality Outcomes

- Do not attempt more than twice – contact another member of the team.
- Contact Patient Care Lead (PCL) or In Charge for direction in obtaining assistance
- Avoid initiating IV site in:
 - Edematous areas
 - Areas of paralysis (e.g., CVA)
 - Areas where hematoma or bruise has formed. In addition to it being painful, it may not be possible to detect if site is interstitial. If no other site is available, initiate proximal to the hematoma
 - The affected arm of patients who have had a mastectomy. Lymph stasis on the affected side is common in these patients

- Excessive scars from burns and surgery. It is difficult to palpate the vein and puncture the scar tissue
- Areas of infection
- Cannula, fistula, vascular graft – Use only after consulting with physician
- Never start an IV on a patient who is standing. Make sure patient is sitting or reclining.
- Do not probe. This may be painful and cause a hematoma.
- Always allow alcohol to air dry completely for all applications.

Purpose of IV Medication Therapy

IV medications may be ordered when:

- a. A patient needs a rapid therapeutic effect
- b. The medications cannot be absorbed through the GI tract
- c. The patient can receive nothing by mouth and the drug would be irritating or painful if given intramuscularly or subcutaneously
- d. A controlled administration rate is required
- e. The medication is only available for IV administration

Advantages and Disadvantages

Advantages of IV medications therapy:

- Provides immediate drug action by producing therapeutic blood levels rapidly
- Provides an alternate route if the oral route cannot be used
- Eliminates absorption problems allowing for accurate titration and causing the patient less discomfort
- Allows drug delivery to be stopped immediately if an adverse reaction occurs
- Preferred route of medication administration in emergencies

Disadvantages of IV medications therapy:

- Requires vascular access
- Adverse reactions
- Solution and drug incompatibilities resulting from binding of two drugs, physical alterations and chemical alterations

IV medications go directly into the patient's circulation, quickly achieving therapeutic blood levels, which is the reason why IV doses are often much smaller than oral doses.

If an adverse reaction occurs, IV drug delivery can be stopped immediately. With other routes, absorption would continue until the drug was physically removed by vomiting, gastric lavage or dialysis.

Delivery Methods

Intravenous infusion medications enter the venous system directly and therefore can cause rapid effects. Special attention is given to drug preparation and dose calculation. The nurse confirms safe medication administration by using critical inquiry and evidence informed practice and is aware of the desired action and potential side effects of each medication, as well as the desired outcome.

The current QHC IV Policy and the Ottawa Parenteral Drug Therapy Manual should be consulted for all medication infusions regarding method of infusion (above or below the drip chamber), rate of infusion, proper dilution of medications and compatibility.

Utilizing the peripheral vascular access method, solutions will be administered through a vein in the arm or hand, or occasionally the foot (this site must be ordered by a physician at QHC). The peripheral vascular method is used for short term (less than 4 weeks) or intermittent therapy.

With the central vascular access therapy method, solutions are administered through a central vein, such as the right or left subclavian or the internal or external jugular. This method is used when the patient needs a large volume of fluid, or when the fluid is a hypertonic solution, a caustic drug, or a high energy parenteral nutrition solution. It may also be used in an emergency situation when a patient has inaccessible peripheral veins or needs long term therapy at home, or in hospital.

Many parenteral medications are highly alkaline and irritating to muscle and subcutaneous tissue. Thus, the IV route is best to minimize patient discomfort. The nurse administers drugs intravenously by four methods:

1. Continuous Infusion:

- Medication mixed within large volumes of IV fluids (admixture)
- Continuous infusions of IV medications should be run via the primary line (e.g. Pantoloc, Heparin, KCL)
- TPN is infused via a designated line or port. Please refer to TPN guidelines for more information.

2. Intermittent Infusion:

- “Piggyback” - after total dose of intermittent infusion is complete the primary line will resume
- “Concurrent” – allows for simultaneous infusion of both primary and secondary lines to further dilute medication
- If the infusion can be diluted in 50 mL or less it is appropriate to utilize a syringe pump if a primary infusion is not in place
- If the medication requires dilution in greater than 50mL delivery should be through a secondary infusion in a minibag
- If the mini bag is necessary for one medication, then this patient should have all IV medications given via mini bag to preserve the secondary tubing unless the medication comes supplied in a syringe from pharmacy

3. Volume controlled infusion:

- a small container, holding 50 to 150 mL of fluid, is attached below the primary infusion bag (Buretrol)
- IV medications administered above the drip chamber should be infused by the secondary port by mini bag and secondary tubing or syringe

4. Below the Drip Chamber (BDC):

- injection of a bolus or small volume of medication through an existing IV infusion line or saline IV lock
- when a medication is ordered below the drip chamber (includes administration referred to as IV push, IV direct, IV side arm or retrograde IV techniques), it may be administered via the lower Y site of an infusing intravenous or via syringe through an established IV lock
- IV patency must be established prior to the administration of the medication
- The medication should be diluted (where applicable) to at least 2mL volume and is recommended to be given over 3 to 5 minutes depending on the dose. Dilution up to 10mL may be easier to calculate and give over several minutes. Note that not all drugs can be diluted e.g. Diazemuls
- When administered via the lower Y site the IV infusion should be turned off while administering the medication

Preparing Medications

Many IV drug solutions are prepared in the pharmacy department by pharmacists or pharmacy technicians. Occasionally, the nurse will need to prepare the IV drug solution.

When preparing a medication for IV administration, be sure to take some basic safety measures: maintain aseptic technique, always use good hand washing technique, and avoid contaminating any part of the ampule, vial, syringe, needle, or container that must remain sterile. When inserting the needle tip into the vial, and withdrawing it, be sure the needle tip does not touch any part of the vial that is not sterile. Use caution to avoid needle stick injuries.

Make sure you use a syringe that is large enough to hold the entire dose, when drawing up the drug before adding to the primary solution. The needle should be at least 2.5 cm (1 inch) long to penetrate the inner seal of the port on an IV bag. Occasionally a filter may be necessary (see miscellaneous instructions in the Ottawa Manual).

Frequently, pre-mixed doses are drawn up into a syringe in the pharmacy department. The nurse then administers the dose using a syringe pump or as a secondary on the infusion pump that delivers the medication over a predetermined time period.

All medications must have a completed medication label applied including medications that are prepared by pharmacy.

Reconstitution of Drugs

Many IV drugs are supplied in a vial in powder form and require reconstitution with such diluents as normal saline, or sterile water for injection. The manufacturer's instructions and the Ottawa Intravenous Therapy Manual will provide instructions about the appropriate type and amount of diluent. The pharmacy department is also available as a resource. Liquid drugs don't require reconstitution, but they may require further dilution.

- a) Draw up the type and amount of diluent specified by the manufacturer
- b) Clean the rubber stopper of the drug vial with an alcohol wipe using aseptic technique
- c) Insert the needle connected to the syringe of the diluent into the stopper at a 45 to 60-degree angle to minimize coring or breaking off of rubber pieces
- d) Mix thoroughly by gently inverting the vial or rolling between hands as indicated in manufacturer's information sheet. Do not shake vigorously because some drugs may froth
- e) If using a multi-dose vial affix a label indicating the date and time that you reconstituted the drug

Note: Do not use a vial that was reconstituted by someone else and has not been labeled. Always check the length of time that a drug is stable in solution and compare with the date and time of reconstitution on the label, if prepared and sent by pharmacy.

Some drugs come in double-chambered vials that contain powder in the lower chamber and diluent in the upper one. To combine these contents, apply pressure to the rubber stopper on top of the vial to dislodge the rubber plug separating compartments. The diluent will then mix with the drug in the bottom chamber.

Patient Assessment

Verify patient allergies and ask the patient about past experience with receiving medication in the solution bag. Explain the purpose of the medication and any effects he or she might experience. If the medication is likely to cause discomfort to the vein, ask the patient to alert you to this so you can regulate the flow or further dilute the medication if at all possible.

Compatibility

Most IV drugs are compatible with commonly used IV solutions, however the more complex the solution or drug the greater the risk of incompatibility. There are three types of incompatibility:

Physical incompatibility – also called pharmaceutical incompatibility; occurs most often with multiple additives. Signs include precipitate haze, gas bubbles and cloudiness.

Chemical incompatibility - results from drug breakdown or degradation when two or more substances react, cause changes that can produce undesirable effects. Factors affecting compatibility include drug concentration, pH of the solution, and volume of solution used to mix medications.

Therapeutic incompatibility – can be the result of order of mixing, temperature, light, and contact in solution time. An example of this is giving tetracycline too close to penicillin in which case the bacteriocidal effect of the penicillin is inhibited.

Check compatibilities in drug information resources such as the Ottawa Parenteral IV manual, manufacturers product insert, and compatibility charts. It is always advisable to flush IV lines between IV drug administrations.

pH is the term used to refer to the degree of hydrogen ions or the acidity of the solution. pH plays an important role in drug stability, solubility and compatibility. Generally, drugs and solutions that are to be mixed should have similar pH values to ensure compatibility and stability. A pH range of 3-5 is acceptable; however certain drugs such as Vancomycin, even when reconstituted and mixed correctly, have a high pH. Vancomycin is similar to vinegar or acetic acid, therefore as with all drugs, proper mixing and rate of administration is important. Reactions between acidic and alkaline drugs and solutions can occur.

If the drug mixture contains particulates or is discoloured, throw it away and start again. Do not administer to the patient.

Intermittent Infusions Using the IV Pump

Steps	Rationale
1. Gather equipment and perform hand hygiene.	Be prepared Prevent the spread of microorganisms.
2. Prime standard primary clave tubing with compatible IV solution.	
3. Determine method of secondary delivery of medication (syringe/minibag).	If the medication can be delivered in 50 mL or less draw the medication up in a labeled 60 mL or smaller syringe or as prepared by pharmacy and luer onto the secondary clave port. If the patient has medications that require dilution in greater than 50 mL, a minibag and secondary tubing are to be used.
4. The secondary port must be cleansed with an alcohol wipe – 30 second friction rub.	
5. For pumps so equipped, deliver the overfill when using the secondary tubing. Do not deliver the overfill when using a syringe.	A small amount of air left in the syringe will prevent a proximal line occlusion alarm at the end of the syringe dose.
6. Cleanse the clave extension port on the patient's IV lock with an alcohol wipe -30 second friction rub.	
7. Establish patency with saline flush.	
8. Luer primary tubing onto the clave port and start infusion.	
9. On completion of infusion cleanse the lower Y site on the primary tubing with alcohol wipe – 30 second friction rub.	
10. Disconnect primary tubing from the patients' extension set and luer the tip onto the cleansed lower Y port.	Maintains the tubing in a closed system format.
11. Flush saline lock with 5 mL of normal saline.	
12. Document the medication on CMAR.	
13. Perform hand hygiene.	Prevent the transmission of microorganisms.

Intermittent Infusions Using the Syringe Pump

<i>Steps</i>	<i>Rationale</i>
1. Perform hand hygiene.	Prevent the spread of microorganisms.
2. Use preloaded syringe as supplied by pharmacy or prepare syringe per pharmacy guidelines.	Use of preloaded syringe decreases potential for error. Mixing as pharmacy guidelines ensures correct mix.
3. Luer medication syringe onto micro bore tubing and prime tubing.	After the first dose the tubing will remain primed and will not require priming again.
4. Insert medication syringe into syringe pump.	
5. Establish patency of IV access.	Flush saline lock per IV guidelines.
6. Luer micro tubing onto saline lock.	
7. Start syringe pump at appropriate speed setting.	Infusing a concentrated medication too quickly will irritate the vein.
8. When infusion is complete, clamp tubing, disconnect from saline lock and cover slip connector tubing tip with a sterile cap.	To maintain sterility of the system.
9. Flush the saline lock with 5 mL normal saline.	To maintain patency.
10. Leave medication syringe in place until next dose is required.	To maintain sterility. To maintain prime in the tubing.
11. When the next dose is due, remove used syringe and luer on fresh syringe. It is not necessary to purge the tubing of previous medication.	The tubing is micro bore 0.4 mL lumen volume making the interface between medications insignificant. Every medication will require reference to guidelines for infusion rate and concentration.
12. Document the medication on the CMAR.	
13. Perform hand hygiene.	Prevent the transmission of microorganisms.

****Note:** The syringe pump should not be used for delivery of any medication that requires precise delivery.

Administration sets for intermittent use (not part of a closed system) are to be changed every 24 hours.

Intravenous Bolus Medication

<i>Steps</i>	<i>Rationale</i>
1. Verify the physician's order.	
2. Perform hand hygiene.	Prevent the spread of microorganisms.
3. Equipment: <ul style="list-style-type: none"> • Alcohol wipes • Appropriate size syringe for medication dosage and dilution • Two normal saline flushes • Medication and diluent 	
4. Prepare medication by diluting with appropriate solution and volume as per the Ottawa Infusion Manual.	A minimum volume of 2 mL is recommended. Medications and allowable doses vary per patient unit.
5. Follow the eight rights of medication administration.	The right client, medication, reason, dose, frequency route, site, and time.
6. Explain procedure to the patient and obtain verbal/implicit consent.	An informed patient can assist in detection of adverse reactions.
7. Establish patency of the saline lock by performing a saline flush.	To avoid inadvertent infusion of medication into the tissue.
8. Check the site and flow rate if using a continuous IV.	As above.
9. Be aware of drug action, allergies, interactions and antidotes.	Bolus medications are absorbed totally and immediately. There is NO ROOM FOR ERROR.
10. Luer lock medication syringe onto the saline lock or the lowest Y site of a continuous infusion.	Turn off IV and pinch off tubing prior to bolus infusion.
11. Infuse slowly .	Recommend infusion over 2 – 3 minutes or longer depending on patient's condition.
12. Close observation of the patient during bolus administration is essential. Stop infusion immediately and notify physician if any adverse reaction is noted.	Drug reactions may be sudden and intense.

<i>Steps</i>	<i>Rationale</i>
<p>13. Remove the medication syringe from port and flush per protocol.</p> <p>**NOTE: To administer a HEPARIN BOLUS stop the continuous infusion, disconnect the tubing and luer Heparin-filled syringe onto extension set port. Administer the bolus then restart the continuous infusion. Do not flush after the Heparin bolus.</p>	<p>Flushing ensures all medication is removed from the tubing.</p> <p>To maintain consistent concentration of Heparin infusion with minimal interruption.</p>
14. Perform hand hygiene.	Prevent transmission of microorganisms.
15. Document on CMAR and in a focus note.	
16. Monitor patient condition post infusion for delayed reactions or adverse effects.	

Bag Spike

Purpose: To withdraw sterile saline for injection from an IV bag for flushes and medication reconstitution.

1. Prepare label for bag spike, including your initials, expiry date and time.
2. Maximum hang time of the bag spike is 72 hours (3 days). Change both bag and bag spike at the expiry date. ****The bag may be changed prn during this 72-hour period.**
3. Hang one litre (size may vary according to unit) 0.9% saline in the designated area.
4. Remove protective cover from IV bag outlet maintaining sterility.
5. Remove protective cover from bag spike, maintaining sterility of spike.
6. Spike the IV bag until spike is **fully** inserted into the bag outlet.
7. Cleanse the clave connector with an alcohol wipe using a 30 second friction rub.
8. Remove syringe from packaging, keeping the tip sterile.
9. Luer syringe onto clave bag spike connector and withdraw desired amount of solution.
10. Disconnect the syringe, label with flush solution, and apply blue sterile cap or capped needle.
11. Note that the bag spike has an inline back check valve so that solution cannot be returned to the bag preventing unwanted infusion into the bag.
12. Dispose of used syringes appropriately. Never reuse or use for more than one application. Needle free syringes are disposed of in the regular garbage.
13. Ensure that the date on the bag spike is not expired.

Complications of Intravenous Therapy

COMPLICATIONS	DEFINITION	SIGNS AND SYMPTOMS	CAUSE	INTERVENTION
Phlebitis	Inflammation of the vein	<ul style="list-style-type: none"> • Pain • Tenderness • Erythema 	<ul style="list-style-type: none"> • PH, osmolality of solution, medication • Injury to the vein • Inadequate stabilization • PVAD gauge too large for vessel 	<ul style="list-style-type: none"> • Remove PVAD • Elevate extremity • Warm, moist compress • Appropriate comfort measures
Extravasation	Infiltration of vesicant or irritant drug into the surrounding tissue. Can cause tissue necrosis or blistering.	<ul style="list-style-type: none"> • Erythema • Edema • Pain • Burning • Loss or change in blood return 	<ul style="list-style-type: none"> • Medication being administered into the surrounding tissue inadvertently 	<ul style="list-style-type: none"> • Stop medication infusion and notify Dr. • Do Not remove PVAD until antidote has been given • Aspirate any residual vesicant from the cannula and administration set • Administer appropriate antidote • Apply heat or cold • Do not apply pressure to the site • Document findings • Photograph site for later comparison

COMPLICATIONS	DEFINITION	SIGNS AND SYMPTOMS	CAUSE	INTERVENTION
Infiltration	Fluid administration into surrounding tissues.	<ul style="list-style-type: none"> • Pain • Edema • Cool skin • ↓ flow rate 	<ul style="list-style-type: none"> • Puncturing of vein wall during insertion • PVAD penetrates through the vein wall during infusion 	<ul style="list-style-type: none"> • Remove PVAD and re-site • Elevate extremity • Appropriate comfort measures • Monitor site for adverse effects
Fluid Overload	Excess fluid volume.	<ul style="list-style-type: none"> • ↑BP • Dilation of neck veins. • SOB • Tachypnea with rales. 	<ul style="list-style-type: none"> • Infusion rate > what the pt. can tolerate 	<ul style="list-style-type: none"> • Slow infusion to TKVO rate • Place pt. in High Fowler's • Notify Dr. • Monitor V/S, intake & output
Speed Shock	Systemic reaction that occurs when a foreign substance is rapidly introduced into the circulatory system.	<ul style="list-style-type: none"> • Syncope • Headache • Flushed face • Tightness in the chest • Irregular pulse • Hypotension • Shock and cardiac arrest may occur 	<ul style="list-style-type: none"> • Too rapid rate of infusion or bolus 	<ul style="list-style-type: none"> • Discontinue medication infusion • Maintain IV at TKVO • Notify Dr. • Monitor pt.
Catheter Embolism	A portion of the catheter is carried into the circulatory system and has the potential to impede and/ or obstruct circulation	<ul style="list-style-type: none"> • May be asymptomatic • Hypotension • Tachycardia • Diaphoresis • Cyanosis • Loss of consciousness 	<ul style="list-style-type: none"> • Can occur when the stylet is reintroduced into the device • May occur upon insertion when the device is withdrawn through the needle introducer 	<ul style="list-style-type: none"> • Discontinue IV and inspect device for rough edges • If catheter has fragmented, apply tourniquet above the site and obtain an X-ray • Notify physician • Bedrest

COMPLICATIONS	DEFINITION	SIGNS AND SYMPTOMS	CAUSE	INTERVENTION
Thrombosis	Blood clot within a blood vessel.	<ul style="list-style-type: none"> • Erythema at site • Tenderness • Edema • Pain 	<ul style="list-style-type: none"> • Trauma to vessel due to PVAD too large for vein • PVAD in situ > 96 hrs. • Venous stasis • Meds or solutions with high pH or tonicity • Incompatibility with medication and solution • Multiple venipunctures 	<ul style="list-style-type: none"> • Remove IV • Apply cold compresses to ↓blood flow • Notify Dr. • Monitor site
Site Infection	Infection where cannula enters the skin.	<ul style="list-style-type: none"> • Erythema • Edema • Pain • Purulent discharge • Fever 	<ul style="list-style-type: none"> • Break in aseptic technique • Use of contaminated equipment • Improper handwashing prior to initiation 	<ul style="list-style-type: none"> • Remove PVAD • Culture site and PVAD tip • Notify Dr. • Review technique for inserting PVAD

Trouble Shooting

<i>Problem</i>	<i>Resolution</i>
1.High skin resistance – extremely tough skin due to tanning, weather beaten.	Increase the angle of the catheter so that the tip of the stylet breaks the skin. Maintain skin tautness.
2.Fragile skin and veins.	Use BP cuff instead of the tourniquet. Use low angle approach with gentle vein stabilization.
3.No flashback in the chamber.	Ensure complete entry into the vein. Change angle and advance the PVAD. Stabilize the vein (rolling veins use counter traction). Redirect the PVAD. DO NOT PROBE.
4.Resistance when threading the PVAD into the vein.	Remove the tourniquet. If there is visible flashback, connect the IV and run solution slowly. Advance the PVAD with the infusion of solution. If unable to advance, remove PVAD and apply pressure to site.
5.Infiltration.	Remove PVAD, apply pressure. Reinitiate IV proximal to the site of infiltration or in the opposite limb.
6.Maintaining the flow rate.	Gravity infusions should hang 1 metre above the site. If the insertion site is below a joint (e.g. the wrist) try using an arm board to stabilize.

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- The Ottawa Hospital. (2015). *Parenteral Drug Therapy Manual*. (36th ed.)
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APPENDIX A

Related Policies and Resource Manuals

<i>Policy Number</i>	<i>Policy Title</i>
3.1.2	Blood/Blood Product Verification, Requesting, and Monitoring
3.8.2	Intravenous Initiation Certification
3.8.3	Infliximab (Remicade) Administration
3.8.4	Intravenous Medication
3.8.6	Intravenous Immune Globulin
3.12.5	Independent Double Checks
3.12.7	Medication Administration
3.12.12	Potassium Chloride (KCl) Administration
3.16.7	Nursing – Service Standards of Care
3.2.17	Disposal of Pharmaceutical Waste
3.12.18	Medication – Automated Dispensing Cabinets
Resource Manual	Enteral and Parenteral Nutrition for the Adult Patient

APPENDIX B

Authorization Test: Establishment of Peripheral Vascular Access Device (PVAD)

1. Reasons for establishing a Peripheral Vascular Access Device (PVAD) include the following:
 - a. To maintain or replace body stores of water, electrolytes and vitamins
 - b. To replenish blood loss or administer blood component
 - c. To provide a route for administration of medications
 - d. All of the above

2. What isotonic fluid is infused with a blood transfusion?
 - a. Dextrose 5% in water
 - b. Lactated Ringers
 - c. Sodium Chloride 0.9%
 - d. All of the above

3. An example of a hypertonic solution is:
 - a. Sodium Chloride 0.45%
 - b. Dextrose 5% in water
 - c. Dextrose 10% in water
 - d. 3.33% Dextrose in 0.3% sodium chloride (2/3 & 1/3)

4. The tourniquet can be left on for a maximum of 2 minutes.
 - a. True
 - b. False

5. Factors affecting site selection include:
 - a. Size of PVAD required
 - b. Patients activity level
 - c. Duration of the intravenous therapy
 - d. Condition of the patient's veins
 - e. All of the above

6. Initiation of a PVAD in areas of flexion increases the risk for phlebitis, infiltration and excessive vessel damage.
 - a. True
 - b. False

7. TKVO rate is _____ mL/hr. unless ordered otherwise by the physician.

8. Match the PVAD complication with the symptoms:

Phlebitis	Swelling, cool skin, decreased flow rate
Infiltration	SOB, tachypnea, crackles, Increased BP
Infection	Pain, erythema
Fluid Overload	Pain , erythema, purulent drainage

9. A PVAD should not be left in place longer than _____ hours.

10. The PVAD site should be assessed for inflammation, infiltration, tenderness, discoloration and integrity:

- a. Hourly
- b. Q2h
- c. Q Shift
- d. When a new bag is hung