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KINGSTON GENERAL HOSPITAL
NURSING

ESTABLISHMENT OF INTRAVENOUS ACCESS

LEARNING GUIDE

Prepared by: Nursing Education
Date: 1997 October
Revised: 2008 July

This learning guide has been developed
by
Kingston General Hospital Nursing Education Staff

TABLE OF CONTENTS

NOTE: This learning guide contains information that is current at the time of publication and distribution. Policies and procedures frequently change with the regular review process. Please refer to related policies and procedures contained in the Nursing Policy and Procedure Manuals for ongoing current information.

1.0 INTRODUCTION

This Added Nursing Skill (ANS) learning guide has been developed for use by designated Nurses employed at Kingston General Hospital (KGH).

1.1 Purpose of Learning Guide

The purpose of this guide is to provide a learning module for Nurses to utilize in mastering the necessary theoretical knowledge and skill to competency establish intravenous infusions.

Prerequisites
All nurses must have successfully completed the Venipuncture Learning Guide, be authorized and have demonstrated continued clinical skill and competency with this Added Nursing Skill.

Additional Resources
- references at the end of the learning guide;
- KGH Library;
- Bracken Library;
- Nursing Clinical Educators;
- Anaesthesia Medical Staff;
- plastic arm available through your Clinical Educator or Nursing Education;
- fellow Nursing staff;
- Policy and Procedure Manual.

2.0 AUTHORIZATION FOR ESTABLISHMENT OF INTRAVENOUS ACCESS

The authorization process includes:

- authorization to perform venipuncture (prerequisite);
- completion of the learning guide;
- completion of a written test with a score of 80% or greater;
- observation of one venipuncture initiating an infusion; and
- performance of insertion of three IV cannulae, one of which must be successful, as assessed by the Clinical Educator or delegate (authorizing nurse). The other two attempts must demonstrate correct procedure and technique.

Note: Reauthorization will be required only when the need is identified by the nurse or by the immediate manager.

If the Nurse has practice IV access within the past three years, the criteria related to performance of three insertions of 3 IV cannulae for the purpose of initiating an infusion may be waived at the discretion of the program manager or delegate.

Baccalaureate nursing students may perform establishment of IV access when:

- Theory, including classroom experience, is part of the student's basic curriculum;
- The added nursing skills is commonly practiced by Nurses on the assigned clinical unit;
- The student is in their consolidating experience at the end of their education program and is under **direct** supervision of the authorized Nurse preceptor/delegate; and
- The student completes a written test with a score of 80% or greater.

Note: This process will not authorize the student for this procedure. While consolidating students may perform procedures under certain conditions, only Nurses are eligible for authorization.

3.0 COMPETENCIES FOR LEARNERS

Instructions for use:

Refer back to these as you read each section; testing is based on these competencies.

i] Appreciate the preparation necessary for the establishment of intravenous therapy:
- State three reasons for intravenous infusions.
- Describe patient preparation.
- Identify appropriate preparation of equipment.
- Outline three important safety precautions.
- Differentiate among the various catheter and needle sizes, according to use.

ii] Comprehend the uses of different solution types:
- Identify a hypotonic solution.
- Identify an isotonic solution.
- Identify a hypertonic solution.
- State the solution used with blood transfusion.

iii] Apply knowledge of physiology and anatomy to the selection of the IV site:
- State three factors that affect IV site selection.
- Differentiate between arteries and veins.
- Locate suitable veins in the hand and arm (adult patients).
- Describe three methods of dilating veins.

iv] Demonstrate the correct procedure for establishing an intravenous infusion:
- State where to find the KGH Nursing Procedure regarding the establishment of intravenous therapy.
- Describe the use of counter-tension.
- Describe method of catheter insertion.
- Discuss advantages of various IV sites in arm veins.
- Demonstrate taping techniques.

v] Know the correct documentation for establishment of an IV at KGH:
- State four elements which much be documented.
- Demonstrate the documentation for the establishment of an IV.

vi] Recognize the necessary follow-up nursing care once an IV infusion has been commenced:
- Cite four nursing actions to prevent IV infusion complications.
- Discuss five competencies of IV therapy and appropriate nursing actions.
- Outline the procedure to convert an IV infusion to an intravenous lock.

4.0 THEORETICAL CONTENT

4.1 Preparation

4.1.1 Reasons for Intravenous Infusion

- to maintain or replace body stores of water, electrolytes, vitamins, proteins, calories and nitrogen;
- to restore acid-base balance;
- to replenish blood volume or administer blood components;
- to provide a route for the administration of medications.

4.1.2 Preparation of Patient, Equipment, Environment

Although you may feel comfortable with IVs, your patient may have many fears, such as fear of the unknown, fear of needles, fear of pain, or a fear that an IV means that one's condition is critical. The IV may be used to administer a blood transfusion. For such a patient it may create feelings of despair and feelings of being viewed as having a grave condition. The fear of HIV/AIDS is an additional concern added to the anxiety the patient may already be experiencing related to hemorrhage and shock.

After checking the patient's identify and armband, ask if he or she has ever had an IV. Explanations and a confident, reassuring manner will increase the patient's confidence as well as lessen the mystique of IV's. Anxiety can cause blood vessels to constrict, making it more difficult for you to establish an IV infusion.

Patient teaching is important to increase the patient's cooperation, both at the time of insertion and during the course of IV therapy. You should include the following, if possible:

- why patient needs IV;
- how you will start the IV;
- how the patient can help you with positioning;
- what discomfort the patient will feel;
- how the IV might limit his/her activities; and
- how the patient can help the IV flow properly.

Equipment preparation involves collecting the equipment listed in KGH Procedure I-5500 *Intravenous Access: Added Nursing Skills (ANS), Nurse*. As well, a warm cloth or towel may be useful to help dilate the vein. Remember to take extra equipment (IV catheters).

Environmental preparation refers to basic nursing care. A safe and quite area with good lighting facilitates the insertion process.

4.1.3 Safety Precautions

Correct patient, doctor's order, solution, appropriate needle gauge for patient and specific use, standard precautions, proper infusion rate, nurse knowledge about specific medication, patient's understanding and cooperation, and aseptic technique must all be considered.

Errors in technique that might cause breakage or shearing must be avoided. Never reintroduce the needle stylet into the catheter even if it has been partially withdrawn. The needle can shear off part of the catheter, creating an embolus. Avoid drawing more than one blood sample from an IV site as it is easy to "blow" the vein and established IV due to the suction applied when taking samples.

4.1.4 Needle Selection

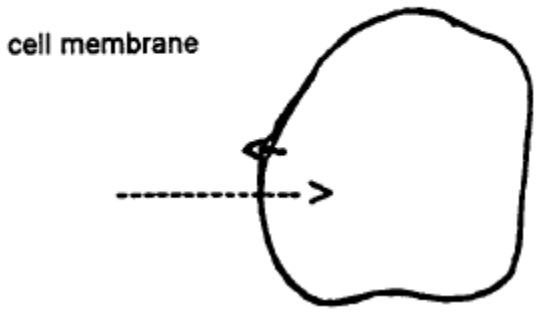
The smallest cannula appropriate for the type of therapy should be selected, as a large cannula may restrict the flow of blood through the vein. At KGH there are selveral types of IV access devices including the Vacutainer Safety-Lok blood collection set (Butterfly), Teflon catheters (i.e., Jelco), Vialon catheters (BD insyte autoguard).

4.2 Solution Types

4.2.1 Hypotonic

Hypotonic solution has less osmotic pressure than plasma, therefore water is drawn into the cells causing the cells to expand or swell (less than plasma in osmolarity).

Example: Sodium Chloride 0.45%



Hypotonic solutions are used to replace hypotonic losses, for example, urine or low specific gravity. One of the main reasons for IV therapy is fluid replacement. People require water daily, but do not always need the electrolytes (Na, K, Cl).

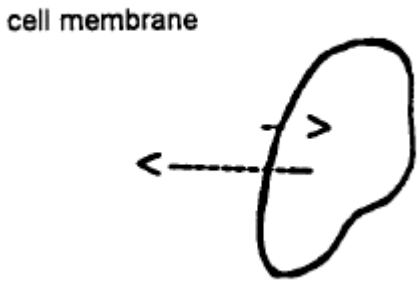
4.2.2 Hypertonic

Hypertonic solution has greater osmotic pressure than plasma, therefore, water is drawn out of the cells into the plasma, and the cells shrink.

Examples:
Dextrose 5% in Saline
Dextrose 10% in Saline
Dextrose 10% in Water
Dextrose 5% in half-strength NS
Dextrose 20% in Water
Dextrose 5% in Lactated Ringer's
Saline 3%
Saline 5%
Travesol
Mannitol

Hypertonic solutions are used to:

- replace electroyle losses, for example, sodium, in severe hyponatremia;
- infuse high calorie TPN solutions containing glucose and amino acids; and
- increase water flow from body cells to the extracellular compartment (e.g., treatment of cerebral edema with Mannitol).



4.2.3 Isotonic

Isotonic solution has the same osmotic pressure as that found across the semi-permeable membrane of the cell (equivalent to plasma in osmolarity).

Examples:	Dextrose 5% in Water	(D5W)
	Normal Saline	(Sodium Chloride 0.9%)
	Lactated Ringer's	(Saline + KCl + Ca + lactate acid)
	2/3 & 1/3	(3.33% Dextrose in 0.3% Saline)

Isotonic solutions are used to replace fluids lost through surgery, burns or GI tract to correct dehydration or sodium depletion.

cell membrane

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4.2.4 Blood Transfusion

With blood transfusion, the chosen solution is normal saline. Blood is infused with a fluid that has the same concentration of sodium and chloride that is found in plasma. A Dextrose solution, such as D5W, when, infused with a blood transfusion, changes during the infusion. After a while, the glucose is absorbed and utilized by the blood cells, leaving water outside the cells. The resulting hypotonic solution leads to hemolysis of the transfused blood cells.

4.3 Selection of IV Site

4.3.1 Factors Affecting Site Selection

Overall, the best IV site:

- tolerates the type and rate of solution;
- is satisfactory for the medications/solutions being infused;
- will accommodate the required cannula size; and
- will not greatly affect the patient's daily activities.

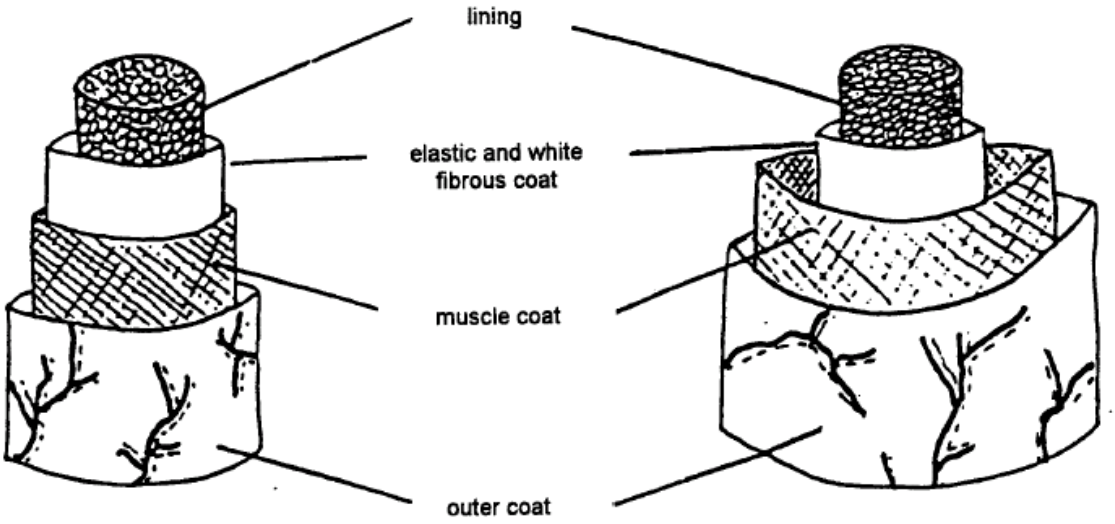
Note: cannulation in hands is associated with a lower incidence of infection than the wrist or upper arm (JBI Clinical Information Service, July 13th, 2005)

FACTOR	WHY IMPORTANT	NURSING INTERVENTIONS
Patient's Condition	• may impair circulation, be uncomfortable or be covered by dressings if in body area already compromised or injured and increase complications	• avoid infected, injured or irritated areas
Patient's Level of Consciousness	• patient restraints can interfere with IV	• if patient restrained, avoid sites near restraints • use arm board, if site near restraints
Activity of Patient	• patient may need hands to function	• if using walker or crutches, patient needs hands, wrists free

FACTOR	WHY IMPORTANT	NURSING INTERVENTIONS
Age of Patient	• infants do not have as many accessible sites as adults • choose the site based in part on the infant's history, physical examination and type of medication to be delivered • consider the potential for scarring when selecting a scalp vein site • veins of the elderly are often fragile	• may use a transilluminator to access sites such as hands, feet, legs, arms and scalp. • fragile veins must be approached cautiously.
Dominant Hand	• if used, it can limit patient activity • active arm has increased risk of infiltration	• avoid using dominant hand
Special Situations	• may affect site, R or L arm or cannula size • patients with vascular disease or dehydration often have limited venous access • patients on chemo may have poor access and poor vein texture • the veins in the arm with a dialysis fistula carry blood under arterial pressure • to facilitate patients undergoing anesthesia	• use opposite arm if patient has had a radial mastectomy • avoid sites near joints • use opposite arm to avoid 'arterial' puncture in arm with AV fistula • for OR, use left arm as able • for bronchoscopy, use right arm as able
IV Therapy	• long term use increases risk of complications	• start as distally as possible • alternate sites and arms • if no signs of inflammation, site may be maintained longer • use appropriate cannula and infusion rates
Solution Type	• hypertonic solutions, low pH and high pH solutions can be irritating • irritating solutions can cause vessel damage when passing by previous site • in neonates, high dextrose concentrations can cause extravasations	• select a large vein, start distally • ensure proper infusion rate • in neonates, a dextrose concentration of greater than 12.5% should be delivered via a central line.
IV Cannula Size	• want to avoid irritation of vein	• cannula should be smallest possible gauge for particular use of IV therapy

FACTOR	WHY IMPORTANT	NURSING INTERVENTIONS
Conditions of Veins	• rolling veins increase risk of infiltration • fragile veins are usually narrow • complications increase in damaged veins and tissues • vein at awkward angle	• if only vein available, use counter tension when inserting • apply heat, then slowly enter vein so you can feel the release of pressure, then adjust insertion angle to feed catheter along vein • avoid veins that are thrombosed, inflamed, bruised, fragile, mobile, near bony prominences or sites of infection • pad needle with gauze if needle needs to be at an angle in order to be parallel to the vein • tape and secure gauze with cannula
	• repeated venipunctures cause scarring, irritation and sclerosis • can lead to non-patent vessels and permanent damage	• avoid if possible

4.3. 2 Review of Blood Vessel Anatomy



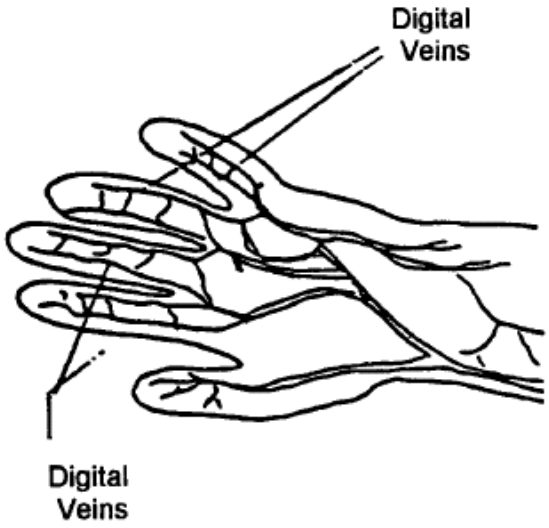
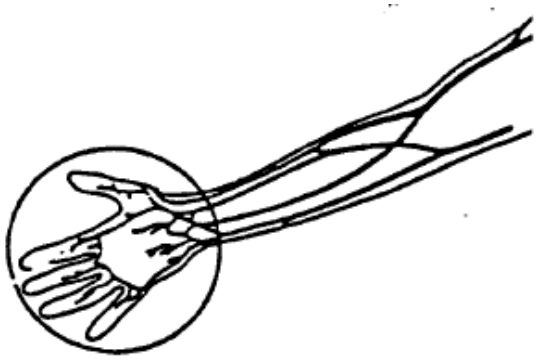
Vein

- no pulsation
- sluggish flow
- dark red colour
- shorter duration of pressure needed to stop flow from venipuncture site
- valves to prevent backflow
- thin muscular wall
- veins are unlikely to spasm and are more prone to collapse but may spasm with irritating solutions or trauma blanching and ischemic injury

Artery

- pulsates
- blood is under pressure and flows rapidly
- bright pink-red colour
- longer duration of pressure needed to stop blood flow from venipuncture site
- no valves
- thick muscular wall
- if fluid is infused into a superficial artery, the arterial spasm results

4.3.3 Anatomy of the Veins of the Arm

Digital Veins Location • found along lateral and dorsal surfaces of the fingers.  	**Use** • a small gauge cannula can be inserted when larger veins are unavailable, and as a last resort. **NOTE:** This site is not often used, but can be considered as a last resort. The thumb site might be considered when the digital vein becomes a metacarpal vein.
Metacarpal Veins Location • formed by the union of the digital veins on the dorsum of the hand, between the knuckles; • easy to find, most people have three. 	**Use** • useful as they are large veins; • best place to begin IV therapy as they are most distal; • avoid catheter which may reach the wrist and be affected by wrist movement. This can cause infiltration or phlebitis; • arm board is not necessary as they bones of the hand act as a splint.

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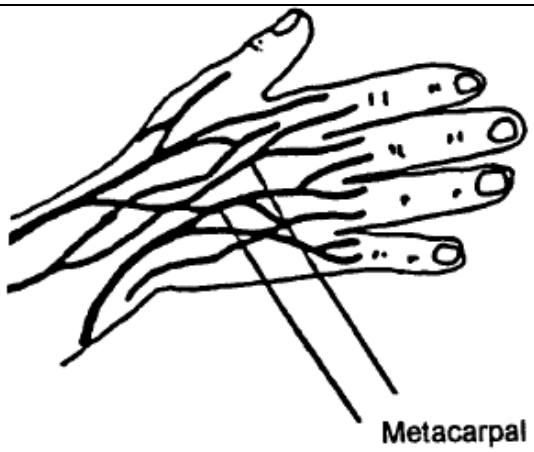
<td> 
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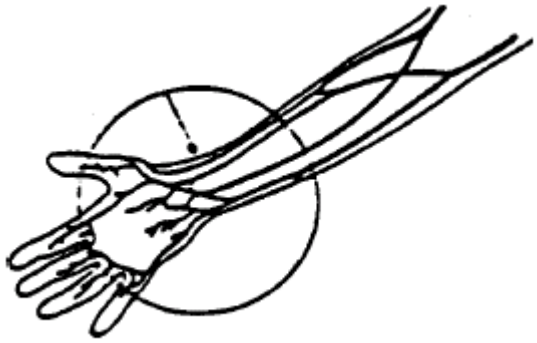
<td><u>Cephalic Veins Location</u>

• cephalic vein runs along the radial bone as a continuation of the metacarpal vein in the thumb;
• runs the entire length of the arm, raining into the antecubital fossa;
• accessory cephalic vein branches off cephalic vein, just below antecubital fossa.</td>
<td><u>Use</u>

• one of the best sites;
• larger size and can handle large cannulas for rapid infusion and adequate hemodilution of irritating solutions;
• bones of the arms (radial bones) act as splints.

  </td>
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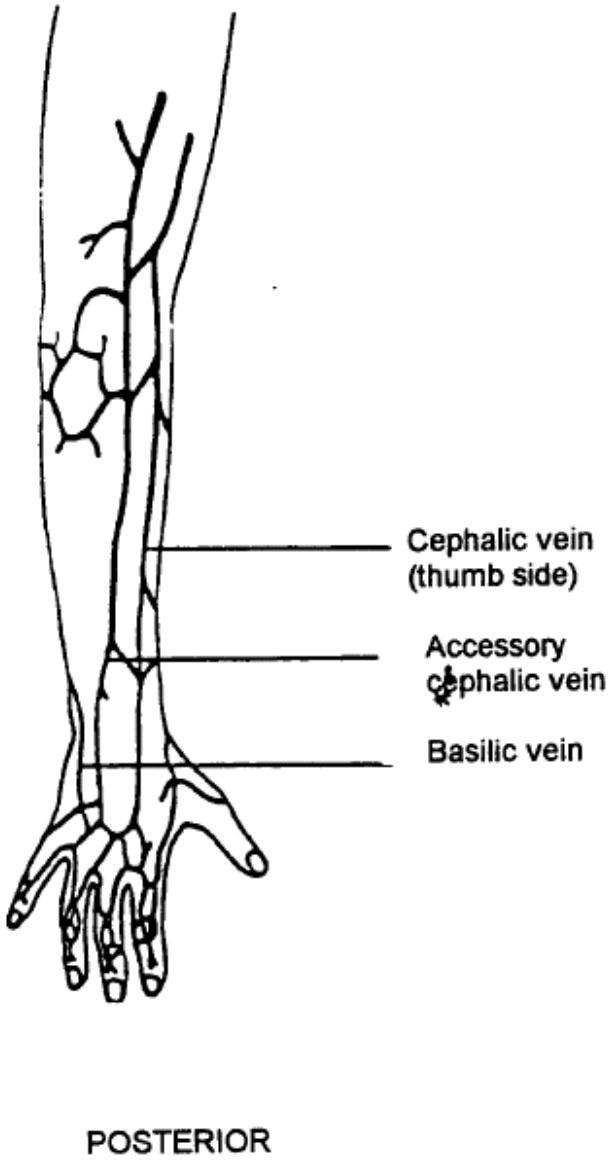
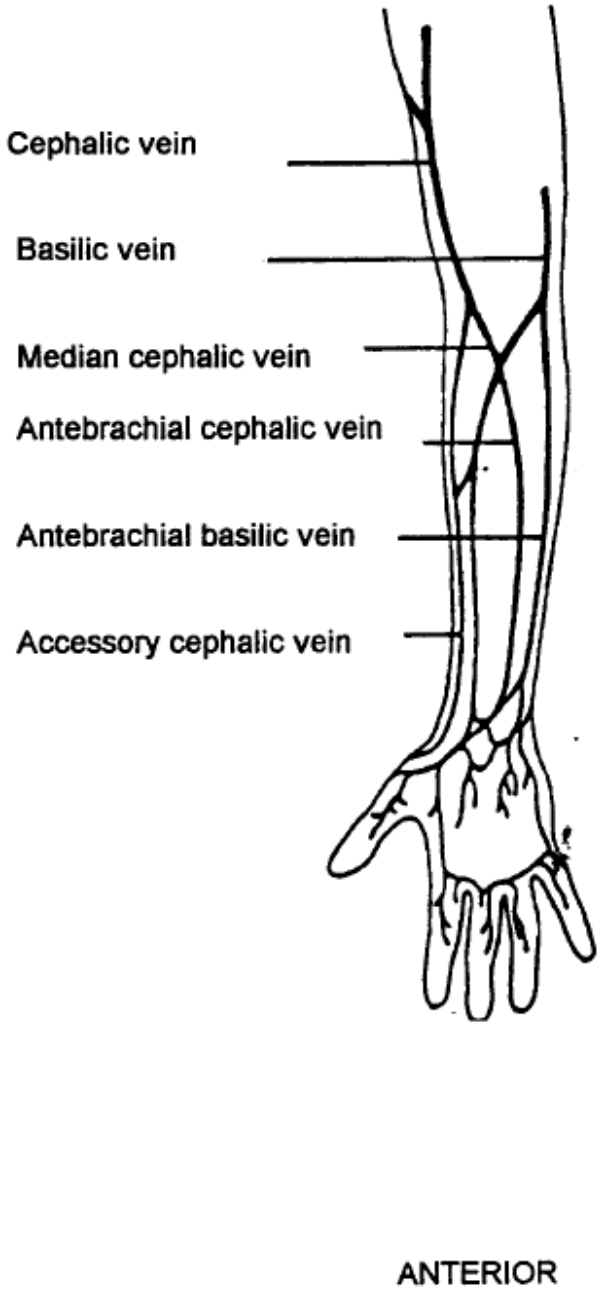


Basilic Veins Location

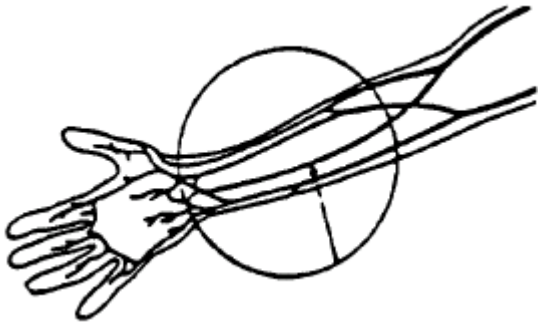
- the basilic vein is also a continuation of the metacarpal vein, but on the ulnar portion of the forearm;
- also empties into the antecubital fosa;
- these are prominent veins.

Use

- can take a large gauge cannula;
- is splinted by ulnar bone;
- tends to move easily (rolling veins).



Median Veins Location • median vein originates from network of veins on palm of hand; • runs along ulnar side of inner forearm.	**Use** • relatively small vein which cannot always take a large gauge cannula; • not always easy to find, but do not tend to

	roll due to supporting musculature; • sometimes more painful at time of insertion; • **Avoid** inner aspect of wrist, because of sensitivity of area; more specifically this is the area 1 - 2 inches above the wrist joint.

4.3.3 Vein Dilation Methods

The following methods may be used to assist in the dilation of the selected vein:

Dependent position	• Lower the extremity below the heart • Gravity slows the venous return and thus distends the vein.
Tourniquet	• Apply so that only venous return is occluded, so that venous blood can distend vein.
Heat	• Warm water-soaked towels applied to the entire limb distends the muscular layer of the vein, causing venous dilation.
Massage or stroking	• If done in the direction of the venous return, it can help venous blood flow to the selected vessel site causing distention.
Clenching of fist	• Ask the patient to open and close fist, after tourniquet is applied.
Tapping	• Veins respond to light tapping by relaxing the tone of the walls, allowing more blood to distend the vein. Too much tapping can cause vasoconstriction.

4.4 Establishment of Intravenous

4.4.1 Procedural Steps

Purpose

Fluids and/or drugs are introduced into the vein to:

- restore or maintain fluid and electrolyte balance;
- provide basic nutrition; and/or
- provide a vehicle to administer medications.

Equipment

• solution prescribed • IV administration set • #22 or #24 butterfly needle (pediatrics) • angiocath, jelco or BD insyte autoguard • alcohol swabs or 2% chlorhexidine (preferred) • tourniquet • non-allergenic tape 1” • bio-occlusive dressing • clean disposable vinyl gloves • IV pole • incontinent pads		**Pediatrics only** • Steri-strips • Armboard • 2nd person to hold/help during procedure • Buretrol and an infusion pump for all IVs • 10 cc 0.9% sodium chloride flush • T-piece • Kerlix • house (**peds** med cup cut in half) • Interlink vial adaptor/Interlink vial access cannula

Neonates: Use chlorhexidine/alcohol free wipes and 27 gauge needles only.

Nursing Actions

***Hands should be washed before and after palpating, inserting, removing, replacing, accessing, dressing or repairing any intravascular device. Gloves are worn when inserting and IV cannula or changing an insertion site dressing.**

1. Confirm physician’s order. Note specific directions re placement of IV site or size of cannula.

2. Confirm patient identity and selection insertion site. Avoid veins that are thrombosed, inflamed, bruised, fragile, mobile, near bony prominences, or sites of infection.

   In adults, upper extremities are preferable to lower extremities. Transfer lower extremity site to an upper extremity site as soon as available.

In pediatric patients, the scalp, hand or foot are preferable to legs, arms or antecubital fossa sites. Choose the site based in part on the infant's history, physical examination and type of medication to be delivered. Consider the potential for scarring when selecting a scalp vein site.

3. Select an IV cannula to match purpose of infusion and duration of use, known complications, and size of vein.

   Choose smallest size cannula possible for infusion. A large cannula (i.e., 18 gauge) may restrict the flow of blood through the vein.

   An 18 gauge cannula should be used for IV's established prior to OR.

   A large cannula should be selected for administration of blood or irritating solutions (pediatrics **- can infuse blood with #24 if it is the only available vein**).

   ***Pediatrics**
   - a second nurse, and in some instances a third nurse or PCA will assist with the procedure depending on the patient's age and cooperativeness.
   - parents can stay for the procedure; however they must be informed that it is a traumatic experience and that the child may be held/restrained during the procedure to prevent the child from harm.

4. Apply tourniquet 3 to 4 inches above the selected IV site (**pediatrics - have the 2nd person hold the limb**).

5. Activities to dilate veins may include:
   - lowering the extremity below the heart;
   - tapping gently over the vein; or
   - applying warm compress to the extremity for 15 minutes.

6. Cleanse skin at selected vein using 2% chlorhexidine (preferred) or an alcohol swab in a circular motion. Allow to dry. Do not palpate vein again. If vein must be palpated again, cleanse site.

7. Hold extremity using thumb of your non-dominant hand to keep skin taut. Insert needle, bevel up. When blood returns, advance cannula.

   *Pulsations in the blood return indicate that the IV cannula is in an artery. If this occurs, release tourniquet and remove needle, apply pressure to site a minimum of 5 minutes.

8. Release tourniquet.

9. Withdraw needle from cannula and attach IV administration set. **Pediatrics - apply the T-piece that has been flushed with 0.9% sodium chloride, and secure the angio with steri-strips and a tegaderm dressing. Flush the T-piece intermittently to prevent from plugging until the administration set, which is attached to a buretrol, is connected. All IV fluids are run via a pump**.
Run solution slowly. Observe IV site. If swelling or severe pain occurs, discontinue IV.

10. Apply dressing. Tape catheter and tubing in place.

11. If necessary, apply armboard. **Secure armboard so as to allow visualization of IV access site.**
Pediatrics - you may apply a house if patient is prone to hitting the IV insertion site (usually with smaller children and infants).

12. Regulate IV flow rate as prescribed.

13. Ensure catheter needle has been properly disposed of in a sharps container if not using the BD insyte autogard.

14. Remove your gloves and wash your hands.

15. Record date and time of catheter insertion in an obvious location near catheter insertion site.

BD Insyte Autoguard Instructions

- **not used with neonates**
- **not used on pediatric inpatient unit at the present time**

Follow steps 1 - 6 as indicated above.

7. Prior to venipuncture, rotate the catheter hub 360°. Approach vein slowly at a low angle and observe for flashback.

8. Upon flashback, lower the catheter almost parallel to the skin and advance the entire unit slightly to ensure the catheter tip is in the vein. Thread the catheter while maintaining skin traction.

9. Release the tourniquet and apply digital pressure beyond the catheter tip. Stabilize the catheter hub and press the white button.

Follow steps 10 - 14 as indicated above.

4.4.2 Procedural Particulars and Hints

Preparation and selection of a site are the most important steps. The actual insertion of the IV cannula is made much easier following preparation of the site. Other hints to help you are described below. Remember to strongly consider wearing gloves for the insertion as a means of practising universal precautions.

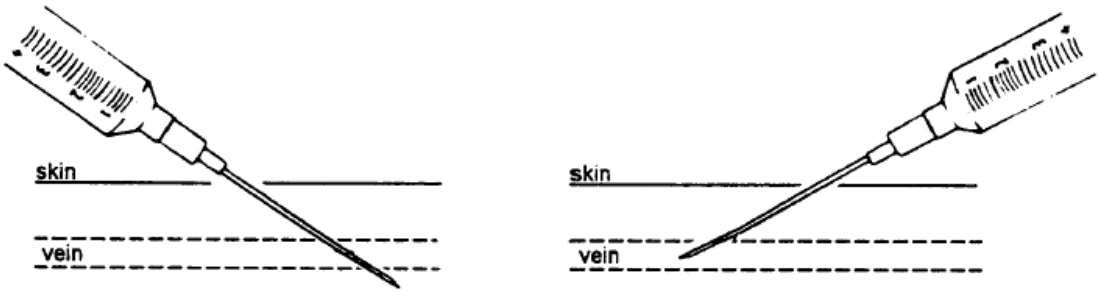
Countertension: Tense the skin directly over the vein with your fingers or thumb in the opposite direction to the insertion site. This immobilizes the vein and exerts tension in the opposite direction to the needle. The needle then goes in more easily causing less pain, and the nurse has better control over the needle.

Main Method of Insertion (cna be direct or indirect)

Direct: Hold the catheter bevel up at a 15 to 20° angle, and thrust the catheter through the skin in one thrust into the vein. Useful for large veins.

Indirect: First pierce the skin, reduce the angle and then advance the catheter into the vein. Useful when trying to insert catheter into small veins.

Shallow Veins: Sometimes holding the needle bevel down will decrease the risk of puncturing the opposite wall of the vein.



Needle into vein: A lack of resistance is felt when blood enters the needle, sometimes this is described as a snapping sensation. Flashback of blood into the cannula also verifies the needle is in the vein.

Advancement of needle: Piercing of the opposite wall of the vein can be avoided if a gentle lifting pressure is used when advancing the needle in the vein. Pull the stylet back to ¼" to ½" from the lumen of the cannula before you advance the cannula to prevent piercing

the vein wall. Advance the catheter slowly keeping the skin taut and follow the direction of the vein. **Note technique differences for Insyte Autoguard System**.

Placement of needle: To check placement of the needle in a superficial vein, palpate the needle tip. If it can be palpated easily, you have probably not gone through the vein.

Prevention of blood leakage before tubing is attached: Release the tourniquet. Apply slight pressure over the vein with small or ring fingers to temporarily stop the backflow of blood while the tubing is being attached. Place a clean 2x2 gauze under the hub of the cannula to absorb any blood. **Note technique differences for Insyte Autoguard System**.

Threading in catheter: Be sure needle and catheter have been advanced far enough in that they are both in the vein. This must be done so that when the needle is removed, the catheter is advanced in the vein and not outside the vein**.**

4.4.3 Taping Techniques

Check patient allergies, and remember that tape is not sterile. Tincture of benzoin can help tape adhere to skin.

- two 2 x 2's;
- 3 or 4 pieces of hypoallergenic tape;
- tegaderm: place this over the hub, but not over the luer lock connection.

You may want to loop the tubing to avoid kinking in an area where the patient is flexing. For example, the site may be near the antecubital fossa.

4.5 CALCULATING THE FLOW RATE

The following information is required in order to calculate the flow rate:

1. Volume of fluid to be infused during a specified time frame. (This information is found in the physician's orders.)

Example: D5W at 75 ml/hour
1000 ml N/S over 24 hours;

2. Calibration of the administration set used. This means the number of drops (gtt) per millilitre (ml) the administration set delivers. This information is found on the IV tubing package. At Kingston General Hospital, the following drip factors are common:

   Continu-Flo Tubing: 10 gtt/ml;
   Blood Tubing: 15 gtt/ml.

   The following formula is used to calculate the hourly rate:

$$\frac{\text{Drip factor of set (in gtt/ml)}}{\text{60 min (in ml/hr)}} \times \text{total hourly volume} = \text{gtt/min}$$

EXAMPLE #1

IV D5W at 75 ml/hr
Infusion set 10 gtt/ml

Equation: $\frac{10 \text{ gtt/ml}}{60 \text{ min}} \times 75 \text{ ml/hr} = 12.5 \text{ gtt/min} = \text{approximately 13 gtt/ min}$

EXAMPLE #2

IV N/S 2L over 24 hours
Infusion set 10 gtt/ml

First, convert rate to ml/hour

$\frac{2000 \text{ ml}}{24 \text{ hr}} \times \frac{x}{1 \text{hr}}$

(x = approximately 83 ml/hr)

Then, calculate the flow rate using equation:

$\frac{10 \text{ gtt/ml}}{60 \text{ min}} \times 83 \text{ ml/hr} = 13.8 \text{ gtt/min} = \text{approximately 14 gtt/min}$

Now, try to do the next two examples yourself. The answers follow.

1. IV 2/3 + 1/3 at 125 ml/hr
   Infusion set 10 gtt/ml.

2. IV N/S at 100 ml/hr
   Infusion set 10 gtt/ml.

Answers to previous examples:

1. IV 2/3 + 1/3 at 125 ml/hr
   Infusion set 10 gtt/ml.

   Equation:

   $$\frac{10 \text{ gtt/ml}}{60 \text{ min}} \times 125 \text{ ml/hr} = 20.8 \text{ (approximately 21 gtt/min)}$$

2. N/S at 100ml/hr
   Infusion set 10 gtt/ml

   $$\frac{10 \text{ gtt/ml}}{60 \text{ min}} \times 100 \text{ ml/hr} = 16.6 \text{ (approximately 17 gtt/min)}$$

When calculating IV flow rate, remember that a change in limb position will often affect the flow of the IV. For example, if your patient's IV is located in the right hand, when your patient bends and/or straightens the wrist, the IV infusion may slow down or speed up. For this reason, you must observe IV flow rate a minimum of once every hour.

Note: The term 'TKVO' means that the intravenous is to be run to keep the vein open. This means that the rate is at 30 ml/h, and the smallest possible IV fluid container is hung.

4.6 Documentation

4.6.1 Documentation at KGH

When you establish an intravenous infusion, the following must be charted on the Parenteral Therapy Record or unit specific documentation tool:

- time;
- IV insertion site;
- type and guage of cannula;
- for IV infusions:
  - IV solution hung, including additives if any;
  - volume of IV solution hung;
  - rate of flow established.

If you encounter any problems, the Progress Notes are used to document the problems and your actions. Also document number of attempts and patient response. The documentation of Parenteral Therapy can be reviewed in the Nursing Policy and Procedure Manual D-5705 *Continuous Parenteral Therapy Record*.

4.7 Review of Follow-up Care

4.7.1 Ten Ounces of Prevention

- Choose the correct size device for your patient's needs.
- Do not insert IV's near wrist or elbow.
- Refer to HDH/KGH Parenteral Therapy Manual for proper medication administration.
- Refer to Policy T-7000 regarding tubing, equipment, site, solution and dressing change recommendations.
- Wash hands thoroughly before and after all contacts with IV site.
- Do not touch any part of IV device that will enter the body.
- Monitor catheter site visually or by palpation through the intact dressing on a regular basis, depending on the clinical situation of the patient (JBI, Clinical Information Service, July 2005).

4.7.2 Ten Warning Signs of Complications

- Pain at IV site (phlebitis, infiltration, infection);
- Inflammation or other discoloration at IV site (infection, phlebitis, infiltration);
- Hard, red vein (phlebitis);
- Swelling at IV site (infiltration, infection);
- Skin cool to touch at IV site (infiltration);
- Skin at IV site warmer to touch than surrounding areas (infection, infiltration);
- Discharge at IV site (infection);

- Fever (infection);
- Disruption of infusion rate (infiltration, positional IV, clotting, kinked tubing, or other mechanical problems);
- Syncope, dyspnea, marked BP changes (speed shock, fluid overload);
- Crying/irritability with the pediatric patient who cannot communicate verbally.

Adapted from NAACOG
Obstetrics Review Course

4.7.3 Complications of IV Therapy

COMPLICATION	POSSIBLE CAUSES	SIGNS & SYMPTOMS	NURSING ACTIONS	PREVENTION TIPS
Infiltration	• needle or catheter displacement (either partial or complete); • leakage of blood around needle or catheter (especially likely in an older patient whose tissues have lost their elasticity); • catheter or needle has penetrated wall of vein.	• coolness of skin around site; • swelling around site, which may or may not be painful; • swelling of entire limb; • absence of blood backflow. If a tourniquet is applied above site, the infusion continues to run; • sluggish flow rate.	• discontinue the infusion and remove the needle or catheter immediately; • consider elevating affected limb, applying pressure, splinting and/or application of heat or cold; • restart IV in another limb; avoid affected vein until phlebitis resolved; • document what you have done; • elevate affected limb. • have extravasation kit available when irritant fluids are infused.	• avoid sites over joints; • use a splint to stabilize the needle or catheter when the site is over a joint or the patient is active. • palpate occasionally to confirm proper needle position. When a needle is placed correctly in a superficial vein, you can usually feel it easily. • select largest available vein.
Thrombophlebitis	• injury to the vein, either during venipuncture or from needle movement later; • irritation to the vein caused by subsequent long term therapy, irritation, or incompatible additives, or use of a vein that is too small to handle the amount or type of solution; • sluggish flow rate which allows a clot to form at the end of the needle or catheter; • large bore needles increase incidence of phlebitis.	• sluggish flow rate; • edema in limb; • a vein that is sore, hard, cord-like and warm to the touch. It may look like a red line above the venipuncture site.	• discontinue the infusion and remove the needle or catheter immediately; • apply cold/warm compresses; • notify physician; • restart IV in another limb; • monitor patient's temperature; • document your actions. **NOTE:** In the case of a sluggish flow rate, **never** try to irrigate the line. In addition to increasing the risk of infection, you may flush a clot into the blood stream, causing an embolus.	• if you have used an irritating additive, try to find a vein large enough to dilute it. Dilute irritating additives with dilutants, if possible. • make sure drug additives are compatible; • keep the infusion flowing at the prescribed rate; • stabilize the needle or catheter with a splint, if necessary; • choose appropriate needles or catheter for the patient's needs.

COMPLICATION	POSSIBLE CAUSES	SIGNS & SYMPTOMS	NURSING ACTIONS	PREVENTION TIPS
Circulatory Overload	• too much fluid; • fluid delivered too quickly; • failure to monitor IV infusion accurately.	• rise in BP and central venous pressure (CVP); • dilation of veins, with neck veins sometimes visibly engorged; • rapid breathing, shortness of breath, rales, dyspnea; • wide variance between liquid input and urine output; • syncope.	• slow the infusion to a keep-vein-open (KVO) rate; • raise patient's head; • keep patient warm to promote peripheral circulation and ease the stress on the central veins; • monitor vital signs; • notify physician; • Oxygen Therapy Protocol as ordered; • document your actions.	• be aware of the patient's cardiovascular status and history; • tell the physician if the fluid volume or flow rate may be more than the patient can tolerate; • monitor the patient's urine output; • use correct tubing and infusion rate.
Air Embolus	• container allowed to run dry; • air in tubing; • loose connections.	• BP drop; • rise in CVP; • weak, rapid pulse; • cyanosis; • loss of consciousness.	• turn the patient on left side and lower the head of the bed. If air has entered his heart chambers, this position may keep it on the right side of the heart. The pulmonary artery will then absorb small air bubbles; • check system for leaks; • notify physician immediately; • Oxygen Therapy Protocol as ordered; • document your actions.	• clear all air from the tubing before attaching it to the patient; • change containers before they are empty; • make sure all connections are secure.
Vein Spasm	• irritating fluids. • chilled medications; • trauma when catheter inserted; • rapid flow rates.	• pain near site and travels up arm; • pain can be distal to IV site.	• allow IV fluid to reach room temperature.	• ensure adequate dilution of medication; • use largest IV available and relatively small needle for irritating fluids; • temporarily decrease rate; • apply warm compresses to site.

COMPLICATION	POSSIBLE CAUSES	SIGNS & SYMPTOMS	NURSING ACTIONS	PREVENTION TIPS
Catheter Embolism	• withdrawing the catheter before the needle or attempting to re-thread a catheter with a needle.	• discomfort along the vein in which the catheter fragment is lodged; • blood pressure drop; • rise in CVP; • weak, rapid pulse; • cyanosis; • loss of consciousness.	• notify physician immediately and proceed according to physician orders	• remember to withdraw needle and catheter together after an unsuccessful venipuncture attempt; • check catheter for defects prior to insertion.
Infection of Venipuncture Site	• poor aseptic technique: for example, failure to keep site clean or to change IV equipment regularly.	• sudden rise in temperature and pulse; • foul-smelling discharge; • fever, malaise and pain.	• discontinue infusion and remove needle or catheter immediately; • send IV equipment to lab for bacterial analysis (need order); • culture draining (need order); • clean site, apply antimicrobial ointment and cover with sterile gauze pad; • restart IV in another limb; • document your actions.	• review and improve aseptic techniques. • **Remember**: wash your hands thoroughly before beginning any IV procedures; • check solution prior to hanging for precipitate; • change tubing and dressing according to policy; • keep site dry.
Systemic Infection (more common with plastic catheters than with metal needles)	• poor aseptic technique; • contamination of equipment during manufacture, storage or use; • irrigation of clogged IV.	• sudden rise in temperature and pulse; • chills and shaking; • blood pressure changes.	• notify physician; • cultures as ordered (i.e., urine, sputum, blood); • establish infusion in another site as indicated by physician; • document your actions.	• review and improve aseptic techniques; • take care not to contaminate the site when bathing the patient; • if any part of the system accidentally disconnected, don't rejoin it. Instead, replace the parts with sterile equipment; • check solution for contamination prior to hanging.

COMPLICATION	POSSIBLE CAUSES	SIGNS & SYMPTOMS	NURSING ACTIONS	PREVENTION TIPS
Speed Shock	• drugs administered too quickly; • improper administration of bolus infusions.	• flushed face; • headache; • tight feeling in chest, dyspnea; • irregular pulse; • loss of consciousness; • shock; • syncope; • cardiac arrest.	• discontinue drug infusion; • begin an infusion of 0.9% sodium chloride at TKVO rate. You must keep the vein open for emergency treatment; • notify physician immediately; • document your actions.	• keep infusion flowing at prescribed rate; • know the drug being administered.
Allergic Reaction	• sensitivity to an IV fluid (especially an additive), skin prep solution or IV cannula.	• itching; • rash, swelling of site; • shortness of breath; • elevated blood pressure; • lowered pulse and resp rate.	• discontinue infusion and begin infusion of 0.9% sodium chloride at TKVO rate; • notify physician; • document your actions.	• ask the patient if he has any allergies before beginning venipuncture procedures.
Positional IV	• location of catheter near wrist or elbow; • condition of vein is crooked or abnormal.	• irregular or stopped flow.	• gently pull back on catheter until solution flows freely; • may need to start IV in another site.	• choose sites away from joints; • examine veins prior to insertion.
Nerve Damage	• too tight wrapping or taping; • unpadded restraints.	• numbness of extremities; • tingling of extremities.	• remove wrapping or tape; • remove arm band.	• do not wrap restraints around arm and board; • use padded restraint board.

4.7.4 Conversion of IV Infusion to Intravenous Injection Site (Saline Lock)

Any IV cannula can be changed to an intravenous injection site by removing the tubing and inserting a primed interlink injection site. This IV site must still be changed according to policy. **Note in neonates and pediatrics a T-piece is used for any IV access device with a pre-flushed T-piece connected directly to the cannula and a pre-flushed injection site connected to the distal end of the T-piece**.

Rules/regulations governing intravenous lock devices

- Only Nurses who have been authorized to initiate an intravenous infusion may insert an intravenous injection site (saline lock).

- A physician's order must be present:
  - for the insertion of an intravenous injection site; and
  - for the amount and type of flush used to keep the intravenous injection site patent. The flush solution is normally, but not exclusively, 1.5 ml of sterile 0.9% sodium chloride for injection (adults), or 1.0 ml of sterile 0.9% sodium chloride for injection (neonates and infant pediatric patients).

Note: use of an injection site (saline lock) is no longer an Added Nursing Skill (ANS). Refer to Policy I-5600.

- The intravenous injection site will be flushed with the solution ordered by the physician:
  - after medication has been infused;
  - after blood sample(s) have been collected; **Note an interlink injection site is not normally used for obtaining blood samples in adults. In pediatrics, the interlink injection site is occasionally used for blood sampling with the exception of blood cultures. In neonates, blood samples are never drawn**; and
  - a minimum of once every 12 hours.
  - **NEONATES: flush a minimum of once every 6 hours.**

- Refer to T-7000 regarding frequency of tubing, equipment, site, solution and dressing changes.

- Limiting the use of needles to penetrate the IV lock device injection site reduces the risk of needle stick injury.

5.0 REFERENCES

BD Medical Systems, Oakville, Canada.

The Joanna Briggs Institute (1998). Management of peripheral intravascular devices. Accessed on 2005 December 15 at http://www.joannabriggs.edu.au/best_practice/bp3.php.

The Joanna Briggs Institute (2005). Care of the Intravenous Cannula. Accessed on 2005 December 15 at http://www.joannabriggs.edu.au/cis/gu_srch_intrvnshn.php.

The Joanna Briggs Institute (2005). Intravenous Cannula Insertion. Accessed on 2005 December 15 at http://www.joannabriggs.edu.au/cis/gu_srch_intrvnshn.php.

The Joanna Briggs Institute (2005). Intravenous Therapy. Accessed on 2005 December 15 at http://www.joannabriggs.edu.au/cis/gu_srch_intrvnshn.php.

The Joanna Briggs Institute (2005). Pediatric Intravenous Therapy. Accessed on 2005 December 15 at http://www.joannabriggs.edu.au/cis/gu_srch_intrvnshn.php.

Oncology Nursing Society (2004). *Access Device Guidelines. Recommendations for Nursing Practice*. Pittsburgh, PA: Author.

Registered Nurses Association of Ontario (2004). Nursing best practice guidelines. *Assessment and device selection for vascular access*. Toronto, ON: Author.

Registered Nurses Association of Ontario (2005). *Nursing best practice guidelines. Care and maintenance to reduce vascular access complications*. Toronto, ON: Author.

ADDED NURSING SKILLS (ANS)

Authorized Staff's Self-Appraisal of Competency Statement

I have the knowledge, skill and judgement to perform the Added Nursing Skill (ANS):

Establishment of Intravenous Access and Conversion to Intravenous Lock Device

Name: _____
(printed)

Signature: _____
(include professional designation)

Date: _____ / _____ / _____
Year *Month* *Day*

6.0 POST TEST

(1) 1. Reasons for establishing an intravenous infusion include the following:
a) to maintain or replace body stores of water, electrolytes, vitamins, protein, calories, nitrogen
b) to replenish blood loss or administer blood components
c) to provide a route for administration of medication
d) all of the above

(1) 2. List **3** of the safety precautions necessary when considering establishment of intravenous therapy.

1. _____

2. _____

3. _____

(1) 3. Factors affecting site selection include:
a) patient's activity level
b) age of patient
c) condition of the patient's veins
d) duration of intravenous therapy
e) all of the above

(1) 4. Fluid infused into a superficial artery will result in arterial spasm as evidenced by blanching and ischemic injury.
a) True
b) False

(1) 5. An ideal gauge intravenous catheter for an adult fasting for surgery is a #18 gauge angiocath or #18 gauge BD intrasyte autogard.
a) True
b) False

(1) 6. What isotonic fluid is infused with a blood transfusion.
a) Dextrose 5% in water
b) Lactated Ringer
c) Sodium Chloride 0.9%
d) all of the above

(1) 7. An example of a hypertonic solution is:
a) Sodium Chloride 0.45%
b) Dextrose 5% in water
c) 3.33% Dextrose in 0.3% water
d) Dextrose 10% in water

(1) 8. Documentation of intravenous infusion establishment occurs on the unit specific flowsheet.
a) True
b) False

(1) 9. Warning signs of complications may include the following:
a) pain at IV site
b) inflammation at IV site
c) swelling at IV site
d) fever
e) all of the above

(1) 10. List **3** nursing interventions to prevent infection at the venipuncture site.

1. _____

2. _____

3. _____

7.0 AUTHORIZATION RECORD

Nurse's Name: _____

Dates of: 1) Post Test _____

2) Observation _____

3) Practice Arm _____

Authorization Checklist for Establishment of Intravenous Infusion Access

SKILL COMPONENTS	#1	#2	#3
Checks physician's orders prior to establishment.			
Correctly identifies patient.			
Explains procedure to patient.			
Washes hands.			
Prepares equipment, solution and tubing.			
Evaluates site correctly.			
Chooses appropriate sized gauge of catheter.			
Applies tourniquet correctly.			
Advances catheter of needle appropriately.			
Removes stylet and attaches IV tubing. ***Note technique is different when using a BD insyte autoguard**			
Tapes and secures needle and tubing.			
Splints extremity if required.			
Ensures patient comfort and safety.			
Disposes of needle and equipment safely.			
Successful attempt.			
Documents on parenteral record or unit specific flowsheet.			
Date			
Signature of Observer			

8.0 EVALUATION OF LEARNING GUIDE

Your feedback and comments are appreciated. We will consider your comments and suggestions in any future revisions of this learning guide. **Thank you.**

Please circle your responses to the following:

		Strongly agree				Strongly disagree
1.	Content was relevant - it covered what I needed to learn. Comments:					
2.	The level of difficulty made it easy to understand. Comments:					
3.	The pace of the package was satisfactory. Comments:					
4.	I consider that my learning objectives were met. Comments:					
5.	Overall, I found that the guide was too basic. Comments:					
6.	Overall, the package was useful in learning intravenous skills. Comments:					

Comments:

Please return completed questionnaire to your Clinical Educator or to Nursing Education (Empire 2 #3-254).