



IV Cannulation Training Pre-Course Workbook



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Introduction

Intravenous (IV) therapy is commonplace in acute care settings, with an estimated 50-70% of patients having some form of IV access device inserted as part of their treatment (Wilkinson, 1996). Yet it is not without risk. Complications range from mild local irritation to blood stream infections associated with significant mortality and morbidity (Lundgren & Wahren, 1999). It is imperative that clinicians involved in the care of IV access devices, are competent to do so, because the level of skill is critical in reducing and preventing complications (Robert, et al., 2000).

Self-Learning Package

This package is designed as a self-directed learning resource for clinicians who are routinely required to perform peripheral IV cannulation of adult patients as part of their practice. The handbook describes the knowledge and techniques for practice requirements to form a comprehensive manual that will guide you through the process for attaining cannulation competency.

Course Aims

To provide the theoretical basis required for safe venepuncture and cannulation

Learning Outcomes

On completion of the Self Learning package, test and attendance at the workshop, the participant will be able to:

- Discuss the responsibilities of the individual practitioner in relation to venepuncture and cannulation.
- Justify the need for venepuncture and/or cannulation in the light of your own clinical practice.
- Describe the relevant anatomy and physiology of the peripheral venous system
- Critically analyse the potential complications associated with venepuncture and/or cannulation and discuss appropriate actions to prevent and/or treat these complications.
- Define the steps required to prepare the patient for venepuncture and cannulation including equipment required.
- Identify Blood Borne Pathogens
- Demonstrate familiarity with equipment components and appropriate selection to meet the goals of IV therapy
- Identify peripheral veins suitable for cannulation
- Cannulate peripheral veins safely under simulated conditions
- Identify measures to minimize and address difficulties encountered during cannulation
- Describe infection control considerations and interventions
- Describe the action required in the event of a hollow bore needle stick injury

Anatomy & Physiology

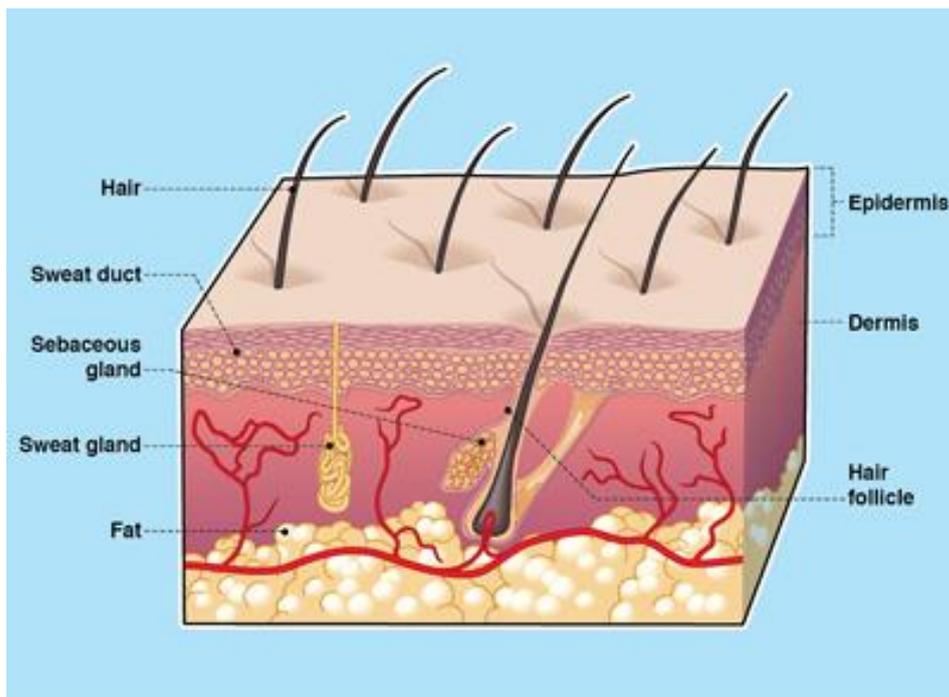
Seventy five percent of blood volume is contained in the venous system. The veins, because of their abundance and location, present the most readily accessible route for cannulation. To initiate IV therapy effectively, a clinical understanding of the anatomy and physiology of the skin and peripheral venous system is essential.

Skin Structure

The first barrier to successful cannulation is the skin. It consists of two main layers:

1) **The Epidermis** – is the least sensitive layer, largely comprised of dead squamous cells. In general, the epidermis is thickest on the palms of the hands and soles of the feet and thinnest on the inner surfaces of the extremities. But, thickness can vary depending on age and exposure to the sun or wind. The most important function of the epidermis is to act as the first line of defence against infection.

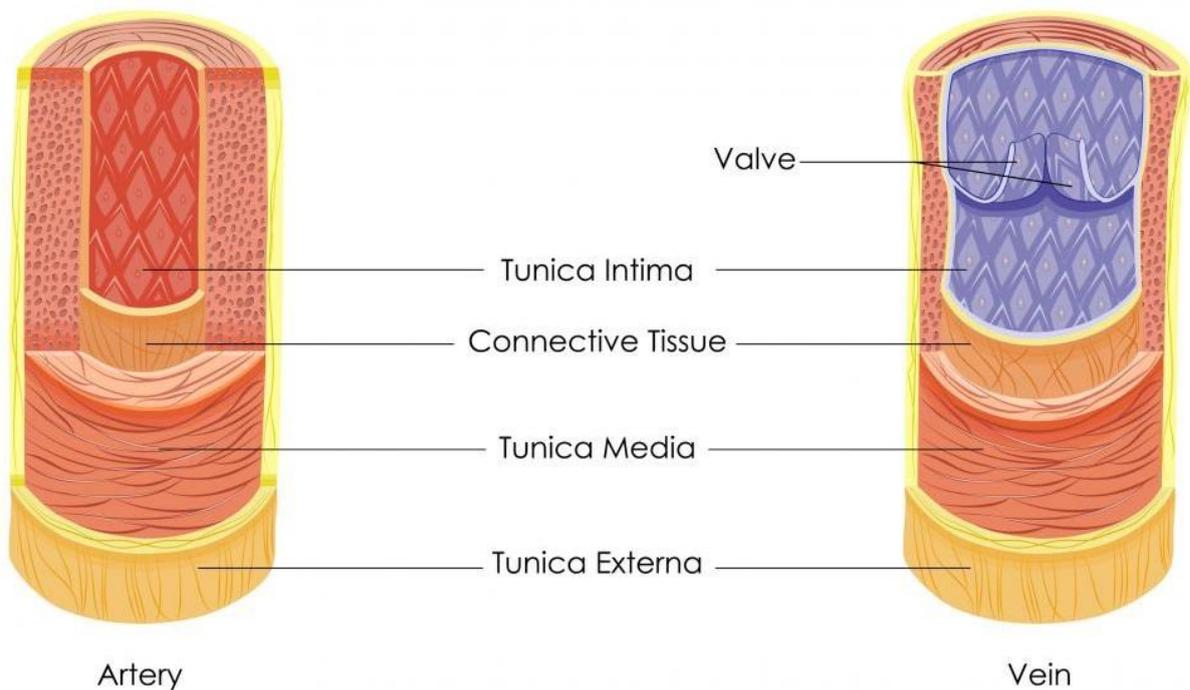
2) **The Dermis** – is the thicker and more sensitive layer, as it is well supplied with nerves. It contains blood vessels, hair follicles, sweat glands sebaceous glands, small muscles and nerves. For example, one square cm contains 4 metres of nerves, 200 nerve endings for pain and a metre of blood vessels.



Vein Anatomy & Physiology

Knowledge of the basic anatomy and physiology of the vein is essential and will assist you to become a successful IV cannulator. It will enable you to utilise normal physiological responses to your advantage, for example, using venous dilation techniques such as opening and closing the hand, tapping the vein or applying heat to the area of choice.

The following diagram depicts the three different layers of the vein, also known as coats or “tunics” (hence the Latin tunica).



- 1) The outermost layer is the **tunica externa** or **adventitia**, and is composed of connective tissue, which supports the vessel.
- 2) The middle layer, the **tunica media** is composed of primarily smooth muscle. It contains nerve fibres that cause veins to contract or relax in response to cold or heat. This layer also responds to chemical or mechanical stimulation, such as pain. Pain sensed in the tunica media can elicit vasovagal response (Hadaway, 1999) and should be anticipated in sensitive individuals.
- 3) The third or inner layer is the **tunica intima**. This innermost layer is less muscular and thin, accounting for only about 10% of the vessel diameter. It consists of three parts:
 - 1) An innermost layer of squamous epithelium,
 - 2) A basement membrane, overlying some connective tissue and,
 - 3) A layer of elastic fibres, or elastin.

Elastin fibres make the lumen very distensible and one-way valves of endothelial tissue direct blood flow. This means that cannulae should only be placed in the direction of blood flow. The valves are usually found near branches of the vein and may inhibit threading of the cannula into the lumen.

It is important to understand that any damage or abrasion occurring to the tunica intima during cannula insertion, the duration of cannula dwell, or during removal, encourages thrombus formation, caused by cells and platelets adhering to the roughened vessel wall. Damage to this layer causes phlebitis, thrombophlebitis or even result in occlusion of the vessel from a thrombus. Your insertion technique and subsequent management of a cannula can contribute to these complications.

Differences between Arteries & Veins

It is important to be able to distinguish between arteries and veins because the aim is to perform a venous cannulation NOT arterial. The following table describes the distinguishing features.

Tissue Layers	Vein Characteristics	Artery Characteristics
Tunica Intima The Inner Layer	<ul style="list-style-type: none"> Elastic endothelial lining Smooth surface allows cells and platelets to flow through the vessels Damage to this layer encourages thrombus formation 	<ul style="list-style-type: none"> Elastic endothelial lining Smooth surface allows cells and platelets to flow through the vessels Damage to this layer encourages thrombus formation
Tunica Media The Middle Layer	<ul style="list-style-type: none"> Muscular and elastic tissues Contains constrictors and vasodilators nerve fibers Not as strong and stiff Allows vein to collapse or distend with pressure changes 	<ul style="list-style-type: none"> Muscular and elastic tissues Contains constrictors and vasodilators nerve fibers Strong and stiff Arteries DO NOT collapse or distend with pressure changes
Tunica Adventitia The Outer Layer	<ul style="list-style-type: none"> Areolar connective tissues surrounds and supports the vessels 	<ul style="list-style-type: none"> Areolar connective tissues surrounds and supports the vessels- But thicker in arteries due to greater pressure

Valves	<ul style="list-style-type: none"> • Veins have valves to permit only unidirectional blood flow towards the heart. 	<ul style="list-style-type: none"> • No Valves
Other differences	<ul style="list-style-type: none"> • Usually found superficial • Blood will appear dark red • Blood will flow from cannula • Does NOT have a palpable pulse 	<ul style="list-style-type: none"> • Usually found deep and surrounded by muscles • Blood will appear bright red • Blood will pulsate from the IV cannula • Has a palpable pulse

While an artery can inadvertently be cannulated, it is uncommon. Having a good understanding of your venous anatomy and checking for pulsation prior to cannulation is important. This is discussed under "Potential Complications".

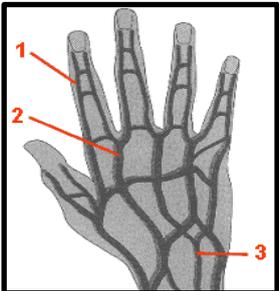
Vein Location & Characteristics

Superficial veins of the hand and arm include the digital, metacarpal, cephalic, basilic and median veins. The following two sections

- 1) Veins of the Hand & Wrist and,
- 2) Veins of the Forearm provide details of vein location, characteristics and clinical considerations that will ensure you develop competent assessment and selection skills that will positively impact on the quality of care your patient receives.

Veins of the Hand & Wrist

The following list of veins can be identified by the corresponding number in the hand diagram.

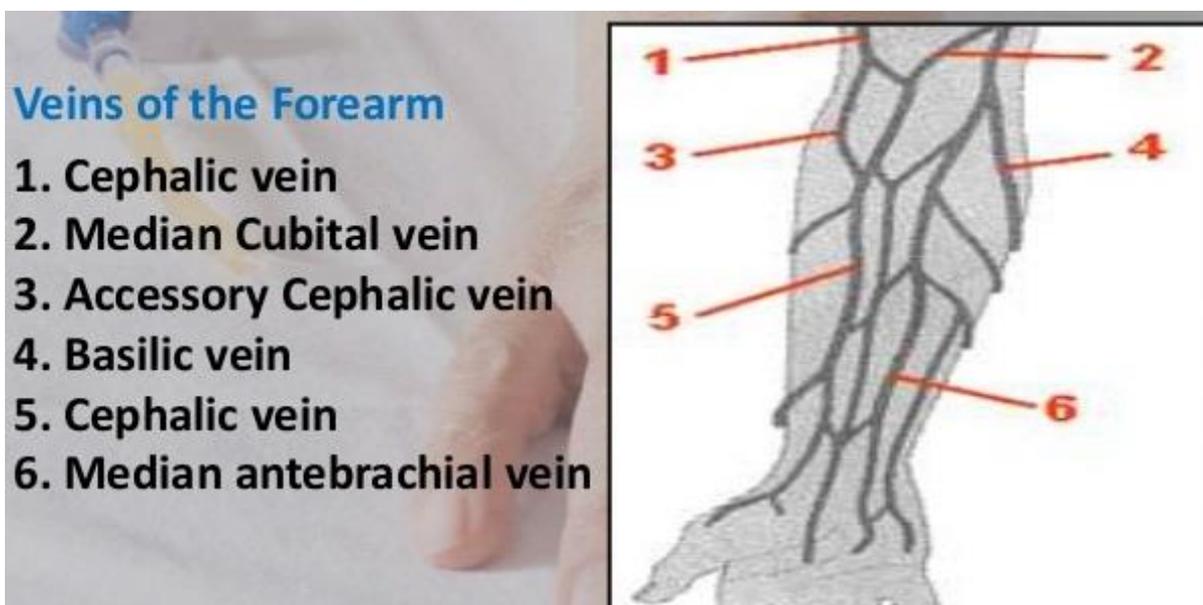
Location/ Characteristics	Clinical Considerations
<ol style="list-style-type: none"> 1. Dorsal digital veins <ul style="list-style-type: none"> • Found along the lateral portion of the fingers and thumb • Veins small & fragile 	<ul style="list-style-type: none"> • Last resort cannula site, as subject to mechanical phlebitis. • To be cannulated only by an expert clinician • If used, must be immobilized by a finger splint 

<p>2. Dorsal metacarpal veins</p> <ul style="list-style-type: none"> • Between the metacarpal bones on the back of the hand • Superficial veins usually of good size and easily visualised 	<ul style="list-style-type: none"> • Good site to start IV therapy for some patients Can accommodate 24-20g cannula • Tip of catheter should not extend over wrist joint Catheter should lie flat on the back of hand • Hub of catheter should not extend over knuckles • Should not be used for vesicant medication/ fluids
<p>3. Dorsal venous network</p> <ul style="list-style-type: none"> • Formed by the union of metacarpal veins, on the dorsal aspect of the forearm • Not always prominent 	<ul style="list-style-type: none"> • Comfortable site for the patient • Can accommodate 24-20g cannula • Angle of the vein may deter choice of site • Avoid placement over the wrist/ prominent ulna bone which can cause mechanical phlebitis or dislodgement • Should not be used for vesicant medication/ fluids

Veins of the Forearm

Location/ Characteristics	Clinical Considerations
<p>1. Cephalic Vein</p> <ul style="list-style-type: none"> • Runs the entire length of the arm from the wrist to the shoulder • Located above antecubital fossa, may be difficult to visualise 	<ul style="list-style-type: none"> • Accommodates 22-18g cannula Excellent choice for cannulation Should not be used for patient that require fistula formation • Radial nerve runs parallel so avoid wrist area
<p>2. Median Cubital Vein</p> <ul style="list-style-type: none"> • Lies in antecubital fossa • Large vein, easily visualised and accessed 	<ul style="list-style-type: none"> • Usually used to draw blood • Veins of choice for trauma or shocked patients as they can accommodate a large bore cannula 16-14g • Limited use for short peripheral cannula due to joint articulation, limit to patient mobility and difficulty of detecting infiltration • Complications at this site mean that veins below this point are not recommended
<p>3. Accessory Cephalic Vein</p> <ul style="list-style-type: none"> • Branches off the cephalic vein Located on the top of the forearm • Usually good size 	<ul style="list-style-type: none"> • Easily stabilized • Accommodates 22-18g cannula • Avoid catheter tip placement at joint articulation

<p>4. Basilic Vein</p> <ul style="list-style-type: none"> • Runs the entire length of the arm from the wrist to axilla • Depicted in the diagram along medial aspect of upper forearm 	<ul style="list-style-type: none"> • Can accommodate 22-16g cannula • Vein rotates around the arm and requires firm skin tension to stabilise vein • Increased success can be achieved by placing the patients arm across their chest and approaching from the opposite side of the bed
<p>5. Cephalic Vein</p>	<ul style="list-style-type: none"> • If accessing the cephalic vein, have the patient flex the forearm at the elbow (this will also enhance venous filling and minimize “rolling”) and face the patients feet to work on the exposed underside of the arm • Alternatively have the arm fully extended and supinate the arm with palm up
<p>6. Median Antebrachial Vein</p> <ul style="list-style-type: none"> • Arises from the palm of the hand, flows upward in the centre of the underside of the forearm • Medium size & generally easy to visualise 	<ul style="list-style-type: none"> • Accommodates 24-20g cannula May be difficult to palpate • Runs in close proximity to the nerve



Infection

Risks of Infection

Cannulation and IV therapy present risks for infection for several reasons.

- 1) A device penetrates and bypasses the protective barrier of the patient's skin.
- 2) An in-dwelling device is in situ, providing portal entry for micro-organisms to enter directly into the patient's bloodstream.
- 3) Immune-suppressed or compromised patients are especially vulnerable to infection.
- 4) Inadequate skin antisepsis and hand hygiene.
- 5) Poor securement technique increases the risk of phlebitis and infection.
- 6) IV infusions have the potential to become contaminated through manipulation and/or disconnection and glucose containing fluids provide an excellent media for bacterial growth.

Sources of Infection

The source of infection may be endogenous (part of the patient's own skin flora) or exogenous (from the surrounding environment or people).

Ports of bacterial entry, in order of significance are:

- 1) Skin colonisation.
- 2) Hub colonisation.
- 3) Contaminated infusates or transducer domes.
- 4) Haematogenous seeding of infection from remote sources within the body.
- 5) Skin colonisation from remote sources of infection within the body.

Infection may develop where the cannula enters the skin. Infection is indicated by inflammation or the presence of pus and may progress to:

1. Cellulitis in the surrounding tissues, with inflammation of the vein or phlebitis
2. Bacteraemia (bloodstream infection), is the most serious infection associated with IV therapy. This is frequently life threatening and involves additional pain and suffering for patients and their families, as well as extra treatment costs. Some common causes of cannula related infection are Staph Epidermidis, Pseudomonas, Enterobacter and MRSA.

Bloodborne Pathogens

In addition to the well-known blood borne pathogens responsible for sero- conversion following a sharps injury there is an additional 20 potential blood borne pathogens that may be transmitted through sharps injury. Refer to the list below.

Hepatitis B,C,D	Staphylococcus Aureus
HIV (AIDS)	Streptococcus Pyrogene
Blastomycosis	Syphilis
Ebola Fever	Toxoplasmosis
Diphtheria	Leptospirosis
Herpes Simplex	Brucellosis
Cryptococcosis	Treponema Pallidum
Dengue Fever	Tuberculosis
Malaria	Mycobacterium Marinum
Necrotising Faciitis	Scrub Typhus

Source: International Health Care Workers Safety Centre, Charlottesville, VA

Infection

Hand hygiene is the key to minimising and avoiding cross contamination. Effective hand hygiene is achieved by using a combination of hand washing and alcohol hand gel that kills both transit and normal skin flora. Hands should be cleaned before and after palpating, inserting, accessing, replacing or dressing an IV cannula (Centers for Disease Control and Prevention USA 2002 CDC Guidelines).

Site Care

Patients most at risk of peripheral IV site infection are those over 60 years of age, who have had a previous IV phlebitis or site infection, are malnourished, or immunocompromised. The most conclusive sign of infection is purulent discharge, but this may not be evident until the device is removed. If the site appears inflamed or other local and systemic signs of infection are present, such as inflammation, heat and pain, remove and re-site the cannula and document findings in the patient's clinical notes.

In order to prevent infection, observation of the cannula site is required at the time of IV drug administration or saline flush. The cannula should be flushed every 8 hours with Normal Saline 0.9% 5ml when not in use. In addition, peripheral IV cannula should be routinely replaced every 72 hours (CDC, 2002) to prevent phlebitis and infection. In the event that you are asked to replace a cannula due to suspected phlebitis it is important you recognise the signs and symptoms and have an understanding of phlebitis.

Sharps Safety

“Sharps must be handled with care at all times, disposed of safely immediately following use, and not re-sheathed, bent, broken or manipulated by hand” (Australia, New Zealand College of Anaesthetics (p. 4, 2005).

It is the responsibility of the person using the sharp to ensure it is safely disposed of. Dispose of equipment safely into a sharps container at point of use. Ensure sharps containers are conveniently placed, either on the trolley or on a stable surface. If a needle stick injury should occur follow local policy.

In the event of a Needle Stick Injury

Immediate care following injury;

If the infectious status of the patient is unknown the injured person must:

- Clean and irrigate the wound thoroughly with running water (10 minutes) and then wash the area with soap and water.
- Encourage bleeding, but do not traumatise the area
- Apply aqueous betadine (povidone-iodine) to the site and cover
- Notify their employer.
- At a convenient time in the next few days the injured person should have blood drawn for a baseline screen for HBV, HCV and HIV.

- Assess the type of injury. A splash injury carries extremely low risk of transmission. A deep penetrating injury with a hollow bore needle containing blood carries a higher risk of viral transmission.

- If the patient is thought likely to have HBV, HCV or HIV infection and the injury is considered likely to transmit infection then advice should be promptly sought from an Infectious Diseases Consultant. This person can be accessed via a local major hospital.
- Explain the nature of the injury and the reasons for concern to your patient and request consent from the patient for blood testing. Your patient has the right to decline testing.

If the patient is already known to be HBV, HCV or HIV positive at the time of injury: Immediately follow steps as above **AND**

- IMMEDIATELY contact the on-call Infectious Diseases Registrar or Consultant at your local major hospital for a risk assessment and recommendations for action.
- If the patient source is known to be HIV positive, this is extremely important as prophylactic treatment should be started within 2 hours of an injury with a significant risk of transmitting infection.

Preparation for cannulation

When the decision is made to cannulate a patient there are a number of factors that need to be considered. Firstly you need to have a good understanding of the indications for cannulation and goals of IV therapy. Appropriate decisions about vein, site and cannula type can only be made on the basis of a thorough patient assessment. Once these have been established patient teaching and preparation is needed.

Assessment

Intravenous access devices should be selected depending on individual patient needs. This requires comprehensive assessment of the patient, equipment, therapy, environment and operator skill. The following questions should be considered:

- Is the therapy short or long term?
- Is it continuous or intermittent therapy?
- What types of drugs or therapies are needed? (osmolality, pH, viscosity, speed/volume, and compatibility with other therapy)
- Does the patient have a history of lymphoedema, mastectomy, previous access device insertion problems, surgical or radiotherapy intervention to access site or fractures?
- Does the patient have pre-existing co-morbidities such as coagulopathy, sepsis or immunocompromised?
- What is the allergy status of the patient? (local anaesthetic, skin antiseptic, dressings)
- Does the patient have good or poor venous access? (poor venous access may be obvious due to poorly visible, bruised or thrombosed arm vessels)
- What is the patient's preference?
- What is the knowledge and skill of the person inserting the cannula?
(Hadaway, 1999; Dougherty, 2000)

In addition to these questions, read the patients notes and consider any factors that will influence effective cannulation e.g. extremes of age, steroid therapy, repeated cannulation, history of phlebitis. You will need to identify and establish the patient's previous experience of cannulation and history of a vasovagal response. Patients with a positive history of vasovagal reactions are 7.5 times more likely to have a reaction during venepuncture (Hadaway, 1999). Anxiety and pain can exacerbate this (Hadaway, 1999). These patients may be good candidates for local anaesthetics such as Amitop cream which takes approximately 20min to be effective.

Teaching & Consent

The Code of Rights states that patients have the right to be fully informed and to have informed consent. You will need to put your knowledge to good use when explaining to the patient the procedure and reasons for needing an IV cannula. Your explanation should include:

- The need for therapy
- Medications, fluids to be infused
- Probable duration of therapy
- How the patient might feel
- Possible related complications
- A response to any questions or concerns
- Consider the family/Whanau wishes

Patients should also be made aware of the risks associated with IV cannulation [anxiety pain/discomfort, site infection, haematoma formation, arterial puncture and nerve damage (Workman, 1999)] and any treatment alternatives. Obviously the patient needs to give verbal consent for the procedure.

An adequate explanation and information for the patient should help reduce the autonomic “fear” response and minimise venous vasoconstriction (which could potentially hinder successful cannulation). Explaining the procedure and ongoing care considerations will also encourage the patient’s participation in monitoring for possible complications and side effects.

Selection of Suitable a Vein

Aside from considerations of the purpose and duration of IV therapy, there are two key determinants to vein selection 1) the vein itself and 2) the location or site.

Selection of a suitable vein is achieved by examining the veins of the patient’s forearm or hand. The tourniquet will need to be applied to do this. A suitable vein for cannulation should feel round, firm, elastic, and engorged – not hard, bumpy or flat. Inspect and palpate the vein for any potential problems. Avoid cannulating veins that are:

- Covered by bruising, inflammation, skin disease and/or otherwise injured skin
- Sclerosed or thrombosed (hard and/or tortuous) Distal to the site of an infiltration or phlebitis or at flexion of joints

Patients who have had several courses of IV therapy in recent times are likely to have fewer suitable veins. Therefore, only a skilled clinician should perform cannulation on patients with limited and/or “difficult” veins and those individuals that are particularly anxious or distressed.

Selection of Suitable Site

There are some general guidelines to selection of an appropriate site, which include:

- For most adults, select veins in the non-dominant hand and arm
- Always examine both arms before making a decision as to the best vein available
- Start at a distal site so that there are veins available for subsequent cannulae to be placed proximal to the previous site.
- If replacing an IV cannula, alternate the sites by cannulating above the previous site avoiding tributaries of that vein use a vein that runs parallel to the previous site or select a vein in the opposite arm.
- Before performing cannulation at any site, palpate for arterial pulsation to exclude / prevent inadvertent arterial cannulation. The brachial and ulnar arteries can be quite shallow therefore this area should be avoided.

The following sites should be avoided:

- Lower extremities – these should be cannulated only in emergency situations by experienced physicians
- Any areas of flexion
- Hands and joints of arthritic patients or those using crutches or walkers, whenever possible
- Previous cannulation sites
- Presence of a plaster, dressing, or operation sites
- Areas of poor venous return or lymphoedema

Cannula Selection

The patient's IV therapy requirements should determine the most appropriate IV device to be utilised (Hamilton, 2000). Ensure you have a selection of cannulae available. The decision on cannula length / size may change when examining the condition of the patient's veins.

As a general rule, the cannula selected should have the smallest diameter for the purpose to allow blood flow around the cannula thereby lessening the risk of phlebitis (Hadaway, 1999; Millam, 2000). The following two points are particularly important when selecting the gauge and type of cannula:

- **SIZE** of the vein. It needs to support the gauge and length of cannula to be inserted.
- **Type of FLUID** that is to be infused, e.g. blood. The cannula needs to be of acceptable diameter to allow infusion of the product.

Guide to IV Cannulae

Gauge	Length	Uses	Considerations
24 (yellow)	19mm	Neonates Paediatric, Elderly Haematology / Onco patients	Suitable for extremely small veins, Slow flow rates.
22 (blue)	25mm	Paediatric Elderly Haematology & Onco patients	Easy to insert Suitable for small or fragile veins, short lengths. Can use for blood products & all IV fluids & medications
20 (pink)	25mm	Adolescents, adults, elderly	Most commonly used for all IV fluids & medication & blood products
18 (green)	32mm	Adults	Suitable for the administration of viscous fluids (e.g. blood) or when high flow is required
16 (grey)	32mm	Adults/maternity patients	Suitable for administration of large quantities of IV fluid. Rapid flow rate. Painful at insertion, requires a large vein

Equipment

Collect all the equipment needed for IV cannulation before attempting the procedure. This will ensure you:

- Eliminate the need to leave the patient until the procedure is completed
- Avoid breaks in asepsis
- Promote patient confidence in your skills

Your equipment should include:

- Gloves non-sterile
- Alcohol Wipe
- IV Dressing
- Selected cannula x2
- Tourniquet
- Extension set/luer plug – primed with sodium chloride 0.9%
- Posiflush 10ml pre-filled syringe sodium chloride 0.9% or saline flush
- Sterile guard & blue plastic backed sheet
- Gauze swab

Insertion Procedure

The following describes the particular skills of cannulation and their rationale.

Preparing the Patient

In addition to providing adequate explanation and gaining consent for the procedure, ensure:

- The patient is warm and comfortable.
- Restrictive clothing on the arm is removed.
- Good lighting to promote easy visualisation

Initially choose your patients carefully, only attempting to cannulate patients with good veins, when there is plenty of time, when you feel relaxed and have backup available.

Don't feel discouraged if you are not successful at first. This skill takes time to perfect and you will improve with practice.

Checking the Cannula

You need to examine the cannula for integrity of product prior to use. In particular, check expiry date on the package. Be familiar with the manufacturers recommendations i.e. don't attempt to re-insert the safety stylet. Discard if any irregularities are evident (flared tip, plastic burrs on edges, dislodged needle through cannula).

Applying the Tourniquet

The tourniquet is applied approximately 15 cm above the selected site (Millam, 1992). It should be pulled tight enough to cause engorgement of the lower capillaries and veins, without cutting off arterial flow. If the skin becomes mottled or blue or you can't feel a pulse below the tourniquet (or if the patient complains of discomfort) then the tourniquet is too tight.

Single use disposable tourniquets are recommended (Intravenous Nurses Society, 2000). The same tourniquet used on multiple patients may lead to cross contamination. Re-useable tourniquets should be cleaned after each use.

Be aware that tourniquets can also be a source of latex contact, so assess the patient's allergy status prior to use.

Preparing the Site

Preparing the site involves skin antisepsis and hair removal. Some authors recommend that antimicrobial solution should be applied to the site in a circular motion, starting at the intended insertion point and working outward, using firm friction (Baranowski, 1993; EPIC, 2004).

Although the surface area for prepping depends on the size of the extremity, in adult patients an area of approximately 50 – 100mm in diameter is usual. Never blot excess solution at the insertion site. Let the solution air dry completely. Do not re-palpate the site once skin antisepsis is complete, unless you are wearing sterile gloves (CDC Guidelines, 2002).

Hair on the skin that prevents adhesion of the transparent dressing will require removal. Hair removal is best achieved with clippers. **Shaving is not recommended** it can cause micro abrasions of the skin and increase the potential for infection (Intravenous Nurses Society, 2000).

Methods of Vein Dilation

Once the tourniquet is in place promote vein dilation. Vein dilation can be achieved in a number of ways. You may have to do one or a combination of the following:

- 1) Ask the patient to open and close their fist – use a soft ball or washcloth for the patient to squeeze if making a fist is difficult.
- 2) Place the selected arm in a position below the level of the heart to help engorge the veins and increase visibility then tighten tourniquet.
- 3) Gently tap the area to release histamine beneath the skin and cause vasodilation.
- 4) Apply warmth to the area 5 – 10 minutes beforehand to dilate veins.

Following these measures, the vein should feel elastic and have rebound resiliency. When you press and release the vein, it should spring back to a rounded, filled state. Achieving this may take some time or may not occur at all and re-selection of a vein may need to take place.

Holding the Device

Becoming comfortable when holding the cannula, may take time; however it is important for successful cannulation.

- Hold the cannula horizontal with hand on top of the device. This way the proper entry angle is assured and allows maximum flexibility of wrist when inserting the device.
- Fingers should be on the flashback chamber – not on the coloured portion of hub. This is to ensure you are ready to thread the cannula into the vein. (You can't do this if you have hold of it).
- Never hold cannula like a “Dart”. Using the cannula like a “dart” will not only cause discomfort, but is likely to result in transecting the vein.

Immobilising the Vein

Vein stabilisation is performed with the non-dominant hand and maintained until the cannula has been threaded into the vein. Stretching the skin distal to the vein will maintain the vein in a taut, distended, stable position and reduce the tendency to roll.

This can be done by gently pulling the skin in a downward motion. Superficial veins have the greatest tendency to roll. Hand veins are generally easier to immobilise and can be easier to cannulate because they're usually surrounded with less fatty tissue. Using a good technique to immobilise the vein is critical to success.

Approaching the Vein

There are several ways an IV cannula can be inserted. Regardless of which method is used, the cannulae should enter the skin at such an angle that the needle punctures the vein wall and enters the lumen without piercing the opposite wall.

The most common methods are:

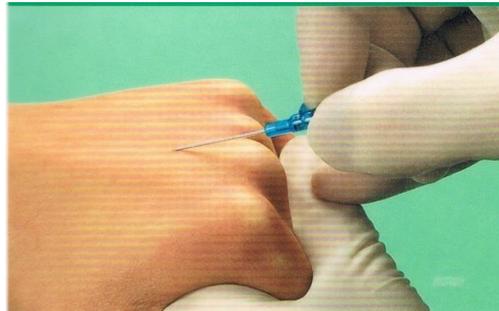
Approaching the vein from the top

Approaching the vein from the side

Approaching the vein at a bifurcation

Inserting the Cannula

The stylet is inserted bevel up at 10 - 45° angle (Briggs, 1998) depending on the depth of the vessel. The stylet is inserted bevel up to minimise discomfort and reduce the risk of puncturing the back wall of vein.

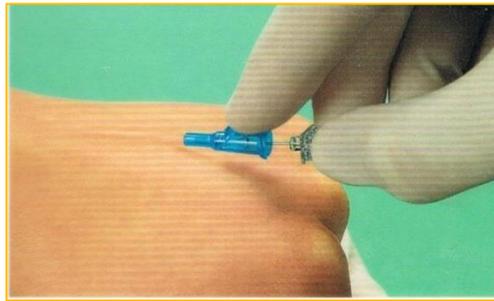


1. The skin is pierced using a smooth firm action. Blood will appear in the hub of the cannula as soon as the vein is entered.

The appearance of blood in the hub is usually a sign of successful cannulation.

(Blood may also enter the hub if the vein has been transected i.e. punctured through. If this occurs, you will not be able to advance the cannula (see next step) and a haematoma will usually immediately appear).

Advancing the Cannula

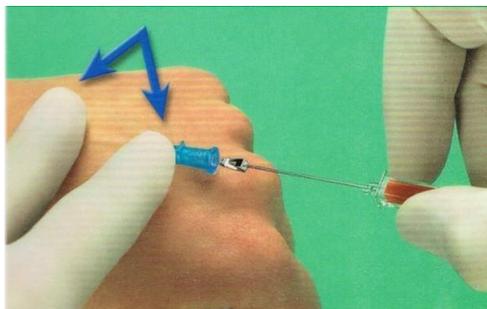


2. Once blood is seen in the hub, advance the device *slightly* and then “level off” the entry angle by lowering the cannula and stylet level with the patient’s skin. This ensures that the cannula is well within the lumen of the vein and reduces the chance of creating a false lumen between the vein wall layers. Still retracting the skin, gently push the hub to slide the cannula off the stylet and advance completely into the lumen of the vein.

Release the Tourniquet!

Releasing the tourniquet at this point ensures that when you proceed to removing the stylet, less blood will ooze from the cannula.

Remove the Stylet



3. In addition apply digital pressure beyond the cannula tip to prevent blood spillage. Stabilise the hub with the non-cannulating hand (see finger position above) and withdraw the needle/stylet. Discard the stylet immediately into the sharps container.

An acronym to help reinforce the crucial steps in the cannulation procedure is BLATS:

Blood return, advance cannula slightly

Level off

Advance into vein

Tourniquet removal

Stylet removal

Attach Extension Set/Luer Plug

With the hub still stabilised, attach the primed extension set or luer plug. An extension set is recommended to reduce mechanical phlebitis (Hadaway, 1999; Millam, 2000; CDC Guidelines 2002). Flush the cannula to ensure patency. It should flush easily. If any immediate swelling is observed the cannula should be removed. If stinging or significant patient discomfort occurs, reassess the site, ease of insertion and consider the need for removal.

Securing & Dressing

There is an expectation that the device will achieve a 72 hour dwell time. Therefore it is essential that an appropriate dressing and securement technique is used.

Use a specific IV Cannula dressing which includes sterile tape to secure the cannula. The first tape is placed over the cannula hub, the dressing applied and the second tape is applied just below where the extension set / luer plug and hub connect. Do not completely obscure the entry site with tape, otherwise monitoring for phlebitis may become difficult. Excessive manipulation should be avoided to prevent trauma at the site and inadvertent dislodgement (Rosenthal, 2003). Inadequate securing of the cannula will allow catheter movement and provide access for bacteria, potentially leading to phlebitis, thrombosis and infiltration (Hadaway, 1999).

Trouble Shooting

Problem	Practice tips
Difficulty dilating the vein	<p>If the patient is cold, hypotensive or nervous and experiencing vasomotor changes, you can expect to spend a little extra time dilating the vein before cannulation. Apply the tourniquet and assess the veins. If they are slow to fill, try the following tips:</p> <ul style="list-style-type: none"> • Position the arm below heart level or hang the arm down to encourage capillary filling. • Gently rub or stroke the arm to warm the skin. • Cover the arm with a warm towel for 5-10 minutes to trigger vasodilation. • Get patient to open and close hand to aid venous dilation <p>Apply heat to area for 5-10 minutes</p>
Puncturing the Vein	<p>If blood backflow stops when you remove the stylet, the cannula may have passed through the opposite wall. If this is suspected, you may still be able to complete a successful cannulation;</p> <ul style="list-style-type: none"> • Without removing the tourniquet, retract the cannula slightly until blood flashback appears again, indicating that you've pulled the tip back into the lumen of the vein. • "Level off" the angle and advance the cannula into the vein and promptly remove the tourniquet. <p>Never try and reinsert the stylet</p>
Failure to Insert the Cannula	<p>Inappropriate insertion angle (too steep or not steep enough) can cause the cannula to ride on top of or below the vein. If the cannula won't move freely, it usually means that it has been inserted too deep, and it is embedded in fascia or muscle. The patient may also complain of severe discomfort. Action:</p> <ul style="list-style-type: none"> • Adjust the angle of entry. • If still not successful, remove and reassess. • Repeat attempt no more than two times, before seeking assistance from a more experience clinician
Inability to Advance the Cannula	<p>This can occur if you have hit a valve or if you have failed to adequately anchor the surrounding skin. Try:</p> <ul style="list-style-type: none"> • Attaching a saline filled syringe and gently flushing. If no resistance is felt, advance the cannula, while flushing, as this may open the valve allowing the catheter to move through. • Any twisting of the vein or continued resistance, abandon the cannulation attempt and re-site elsewhere.

Problem	Practice tips
Fragile skin	<p>Patient with fragile skin are at increased risk of tissue trauma and failure to cannulate.</p> <ul style="list-style-type: none"> • Use the smallest cannula possible e.g. 24g or 22g Encourage vein dilation with warmth. • Apply minimal tourniquet pressure or substitute for a blood pressure cuff inflated just enough to distend veins • Use decreased angle of entry
Venous Spasm	<p>Venous spasm is a sudden involuntary contraction of the vein into which a cannula or solution is being placed (3M, 1999) and may result from traumatic cannulation. It is characterised by sharp, cramping, pain above the insertion site and skin blanching.</p> <ul style="list-style-type: none"> • A warm compress can be applied to the site (3M, 1999; Springhouse, 1999). • If unrelieved, re-site the IV cannula.

Potential Complications

All complications should be clearly documented, including patient response and actions taken.

Complication	Definition	Causes	Signs and Symptoms	Nursing Interventions
Infiltration	*Leaking of nonvesicant solution/medication into the surrounding tissue	*Trauma to vein with insertion *Cannula is positioned outside vein *Large volume infiltrate	*Swelling and pain to the area *Alerted flow rate *Blanching and coolness of the skin area *Leaking at the site	*Stop infusion *Remove IV cannula *Elevate limb and apply warm compresses *Restart IV in unaffected area *Document
Extravasation	*Leaking of vesicant solution/medication into the surrounding tissue (vesicant solution can cause blister formation and possible tissue necrosis)	*Trauma to vein with insertion *Cannula is positioned outside vein *Large volume infiltrate	*Swelling and pain to the area *Alerted flow rate *Blanching and coolness of the skin area *Leaking at the site *Sloughing off of tissue	*Stop Infusion *Contact MD for orders *Change tubing at hub *Infuse antidote as per MD order *Remove IV cannula *Cover with dry sterile dressing *Document
Arterial Puncture	*Accidental puncture of artery	*Inappropriate site selection *Inability to distinguish between vein/artery	*Blood pulsing from site *Inability to thread IV due to high pressure	*Remove IV cannula *Apply direct pressure to site *Document

Complication	Definition	Causes	Signs and Symptoms	Nursing Interventions
Phlebitis	*Inflammation of the Intima; inner lining of the vein	*Mechanical: - Inflammation causes by trauma or IV catheter, manipulation of the catheter *Chemical: -vein becomes irritated by medications or solution *Bacterial: -caused by breakage of skin barrier pathogens have access	*Pain at the site *Area is warm to touch *Inflammation of the vein, erythema, edema *Bacterial phlebitis may have purulent discharge, and fever	*Stop infusion *Remove IV cannula *Clean area with antimicrobial agent and apply dry dressing *Apply warm/cold compress to area *Document *Contact MD if Bacterial phlebitis is suspected
Thrombophlebitis	*Inflammation of vessel due to formation of thrombus	*See causes for phlebitis	*Pain and inflammation at the site *Hard cord like vein *Altered infusion flow rate *Limb may be cool and discolored	*Stop infusion *Remove IV cannula *Clean area with antimicrobial agent and apply dry dressing *Apply COLD compress to area to decrease flow *Followed by WARM Compress and elevate arm *Instruct client against rubbing area – may cause EMBOLI

Complication	Definition	Causes	Signs and Symptoms	Nursing Interventions
Embolism	*A thrombus is formed and becomes dislodged	*Emboli can be dislodged due -to forced flushing with syringe -manipulation of cannula	*Pain in arm *Hypotension, cyanosis, tachycardia weak pulse *Rise in venous pressure *Decreased GCS	*Apply tourniquet above IV site *Check vital signs *Place client in Trendelenberg position *Have another staff member call the MD *Do not leave client
Occlusion	*An emboli formed within or at the tip of the cannula	*Prolonged interruption of the flow of IV fluids	*Unable to resume flow of IV fluids *Blood may back up into tubing	*Do not flush IV (may cause emboli) *Remove IV cannula *Document
Pain	*As defined by the client	*Insertion site may be tender *Infusion may be too rapid *Infiltrate may be too concentrated	*Client states that they are in pain and indicate IV site as the source	*If pain is extreme remove cannula *dilute solution if possible *reposition tubing *Slow infusion rate
Fluid Overload	*Venous pressure is increased due to circulatory overload	*Large volume infused to fast	*Hypertension *Distended jugular veins *SOB *Crackles to lung fields *Possible Pulmonary Edema	*Slow rate to TKVO *Position client in Semi-fowlers if possible *Notify MD *Document

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