GIPPSLAND HEALTH SERVICES CONSORTIUM

# COMPETENCY ASSESSED
# SELF DIRECTED LEARNING PACKAGE

# PERIPHERAL
# INTRAVENOUS CANNULATION (PIVC)

NAME_____

HEALTH SERVICE / DEPARTMENT_____

GRCE Points 3 for package
+ 1 point for competency assessment
TOTAL 4 POINTS

Developed November 2005, Revised November 2009, January 2014, July 2019, June 2024

# CONTENTS:

## INTRODUCTION

Peripheral Intravenous Cannulation (PIVC) is one of the most common invasive procedures performed in hospitals and is now carried out by a variety of health professionals in many hospital and domiciliary settings. The procedure allows for short term access to the bloodstream. The skills to enable safe practice must be underpinned by a sound theoretical base. Knowledge of the anatomical structures of the arm, including location of various nerves, arteries and veins, will ensure that accidental injury to other structures is avoided.

PIVC is associated with risks of both local and bloodstream infections (BSIs). BSIs are associated with increased morbidity and mortality (NHMRC 2019). Application of key infection prevention and control principles are an integral component of both the theoretical and practical component of training for PIVC insertion.

All health professionals are required to undertake procedures within their scope of practice, maintaining knowledge & skills and be subject to regular competence reviews (Australian Health Practitioners Regulation Agency). Health professionals are at all times responsible for their own actions and are expected to be aware of their abilities and perform within these limits.

### Rationale

Patients require peripheral intravenous cannulation for the administration of drugs and/or fluids, or for intravenous access in case it is required. It is a medical officer's responsibility to order any fluids or medications, it is now considered an integral component of other groups of health workers' role to perform peripheral intravenous cannulation when it is required.

### Aim

The aim of this learning package is to enable health professionals to develop competency in performing peripheral intravenous cannulation.

### Process for obtaining competency

The avenue for obtaining competency in peripheral intravenous cannulation is a five step process.

1. Read the learning package
2. View the online video –The Complete Guide to Intravenous (IV) Cannulation LIVE DEMO | 2022 update (youtube.com). (ABCs of Anaesthesia, 2022)
3. Answer all of the questions at the end of the package and return to your clinical educator for marking
4. Arrange a practical demonstration and practice on a mannequin/task trainer
5. Undertake five (5) successful PIVC's on patients under direct supervision of a clinical expert, clinical nurse specialist or clinical educator & successfully complete competency assessment with a clinical educator

Objectives

- Be able to discuss the legal requirements relating to peripheral intravenous cannulation (PIVC).
- Demonstrate knowledge of the anatomy & pathophysiology of the skin
- Demonstrate knowledge of the anatomy & pathophysiology of the vascular system
- Identify the major vessels of the forearm and hand.
- Describe the structure and function of the veins and arteries.
- Identify the indications for PIVC.
- Identify the optimal veins and sites suitable for PIVC.
- Identify factors that may influence the vein and cannula selection.
- Demonstrates compliance with infection prevention & control guidelines.
- Demonstrates the practice of aseptic technique during insertion procedure.
- Outline the management strategies related to the prevention/recognition of complications of PIVC.
- Complete documentation re insertion, management and removal of PIVC.
- Maintain PIVC competency according to individual organisation PIVC policy.

Legal Aspects

The procedures for insertion of a PIVC will follow individual organisation's relevant policies for

1. PIVC inserter accreditation & ongoing competency
2. PIVC insertion, ongoing management, replacement and removal
3. Consent & Patient Identification
4. Documentation & reporting

Please refer your own organisation's policies re Peripheral Intravenous Cannulation here.

- Health professionals should carry out only those clinical procedures for which they have been prepared. This preparation should include theory and supervised practice until they have been assessed as competent. (NHMRC 2019)(WHO 2024) Maintenance of knowledge and skill in performing clinical procedures is essential and measures should be in place to ensure regular (annual) review of competence.
- Health professionals are at all times responsible for their own actions. They are expected to operate within their scope of practice.
- Health professionals should be aware of the policies and procedures of their employing organisation. However, it should be noted that acting within a guideline or policy statement of an employer, any other organisation or professional group does not relieve them of responsibility for their own actions and may not provide immunity in case of negligence.

# PART 1: ANATOMY AND PHYSIOLOGY

## a) The Skin

The skin is the largest organ of the body. One of its vital functions is to protect the underlying structures from trauma and invasion of micro-organisms.

Usually, the natural dryness of the skin and a pH of 5 – 6 maintains a mildly acidic environment, and allows for continual sloughing off of old cells and normal microbial skin flora. These actions prevent microbial invasion of the underlying structures. Interruption to the surface of the skin integrity, such as occurs with PIVC, presents an opportunity for infection to occur.

The skin consists of two layers, the epidermis and the dermis, with the subcutaneous tissue lying beneath them.

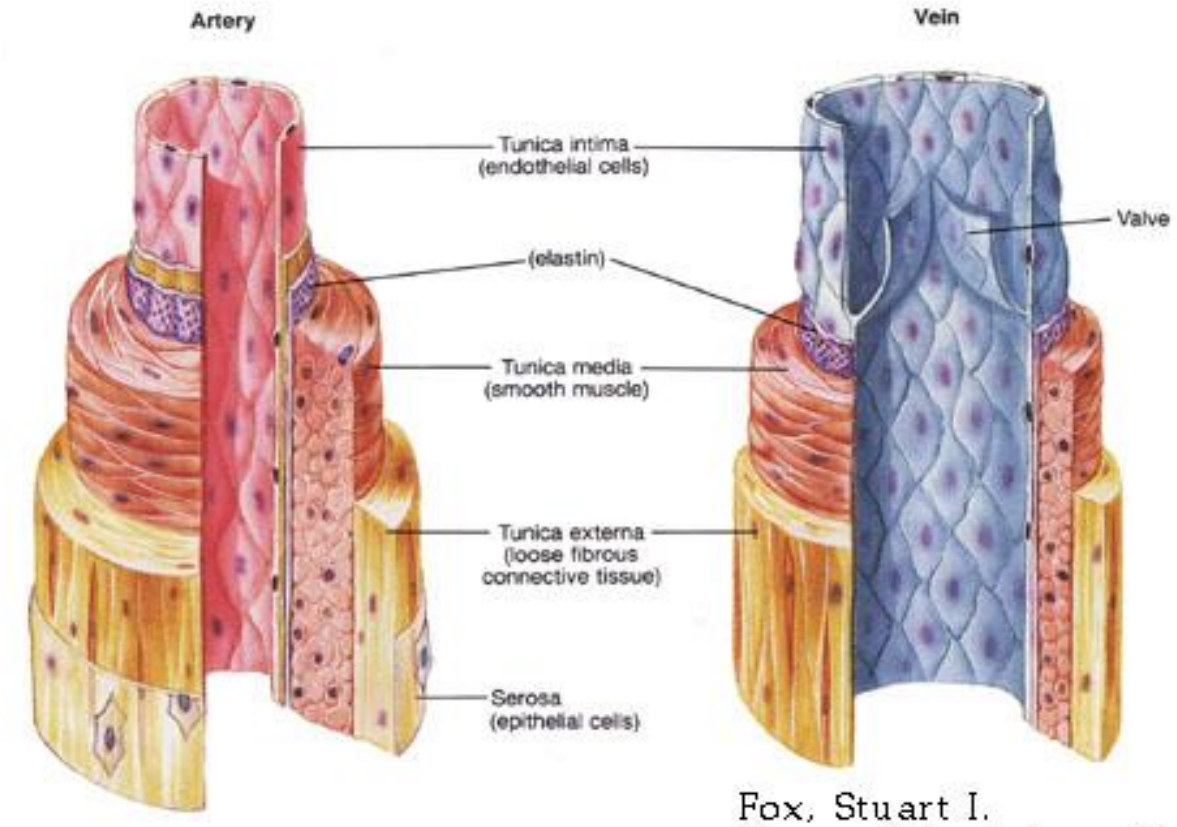
- Epidermis:
  - Top layer
  - Thickness varies in different parts of the body, thickest on palms and soles of feet, thinnest on the inner surface of limbs.
  - Thickness varies with age, tends to be thinner in the elderly.
- Dermis:
  - Highly vascular, contains a large number of capillaries.
  - Highly sensitive, contains thousands of nerves which react to temperature, pain, touch and pressure.
  - Number of nerve fibres varies in different parts of the body, making some areas more sensitive than others (e.g., inner aspect of the wrist more painful than dorsum of hand or forearm).
- Subcutaneous tissue (superficial fascia):
  - Superficial veins are located in this layer.
  - Loosely covers muscles and tendons.
  - Varies in thickness.
  - Potential site for cellulitis if strict aseptic technique is not used during insertion and care.

## b) The Vascular System

It is important to be aware of the characteristics which differentiate arteries from veins, in order to avoid complications related to an accidental arterial puncture. Arteries and veins are similar in structure, both being made up of three layers, however it is the differences within these layers that allow for the different pressures and functions.

| Layer | Artery | Vein |
|---|---|---|
| Tunica Intima (inner layer) | Elastic endothelial lining.<br>No valves. | Elastic endothelial lining which also forms the valves. Valves are present in larger veins of extremities, absent in many of the small veins. Valves may be recognised by a bulge in the vein. Damage to this layer through introduction of foreign material may cause phlebitis or thrombus formation |
| Tunica Media (middle layer) | Consists of muscular and elastic tissue.<br>Nerve fibres in this layer stimulate relaxation and contraction of the vessel.<br>Muscular layers strong and stiff, preventing collapse of vessel.<br>Vasospasm and constriction caused by an irritating drug may cause ischemia and resultant gangrene to area affected therefore medication is NEVER injected into an artery. | Consists of muscular and elastic tissues.<br>Nerve fibres in this layer stimulate relaxation and contraction of the vessel.<br>Weaker muscle layer allows vein to collapse or distend as pressure rises or falls.<br>Application of heat to the local area will promote vasodilation and reduce vasospasm. |
| Tunica Externa/Adventitia (outer layer) | Areolar connective tissue which surrounds and supports the vessel.<br>Thicker layer than found in veins due to greater pressures from within the vessel. | Areolar connective tissue which surrounds and supports the vessel. |

(Pappano & Wier 2013)




Fox, Stuart I.
Human Physiology 4th
Brown Publishers

"Arteries pulsate and veins do not, a helpful differentiating characteristic" (Weinstein 2014).

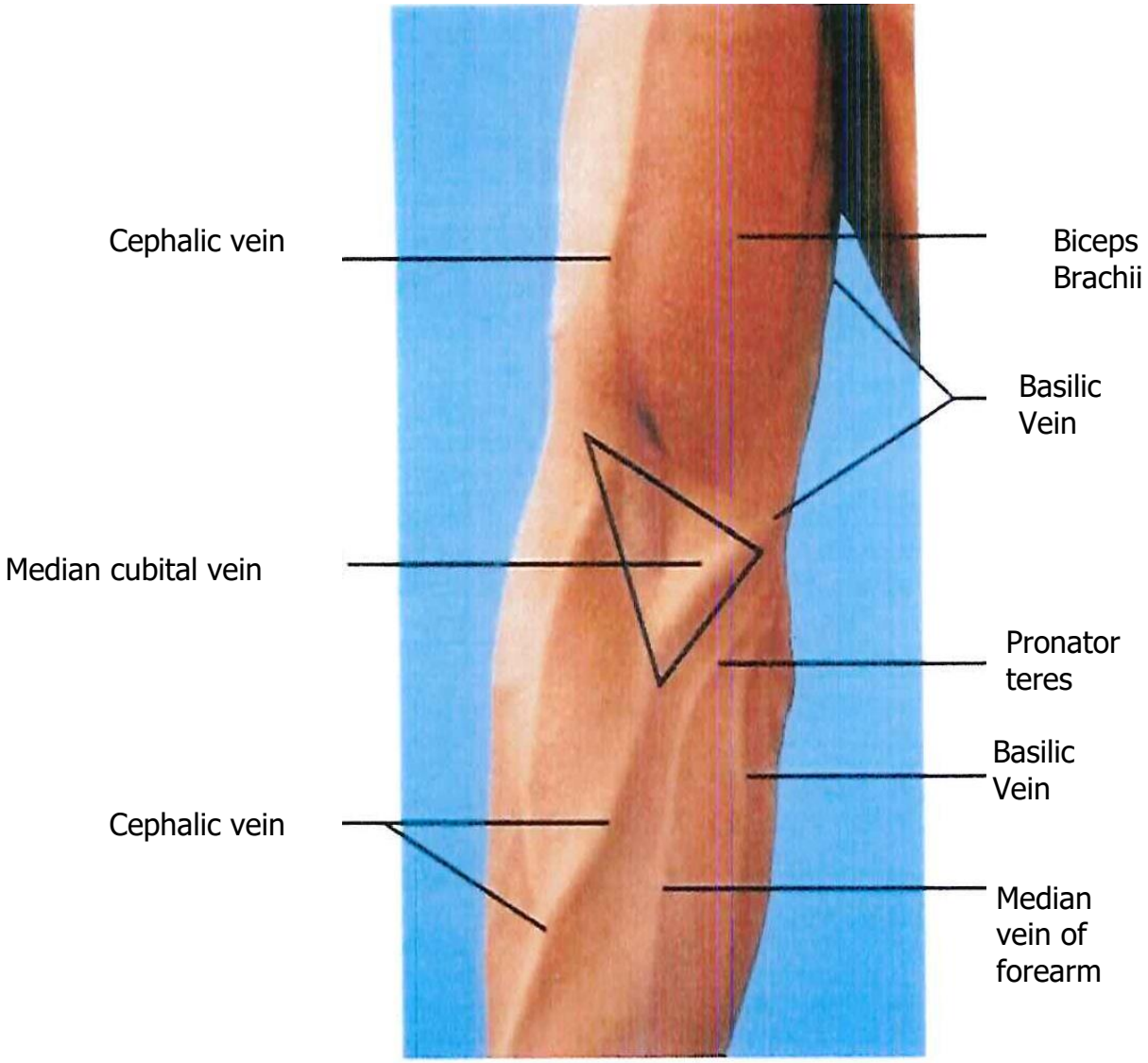
The systemic veins are divided into three classes;

- Superficial
- Deep
- Venous sinuses

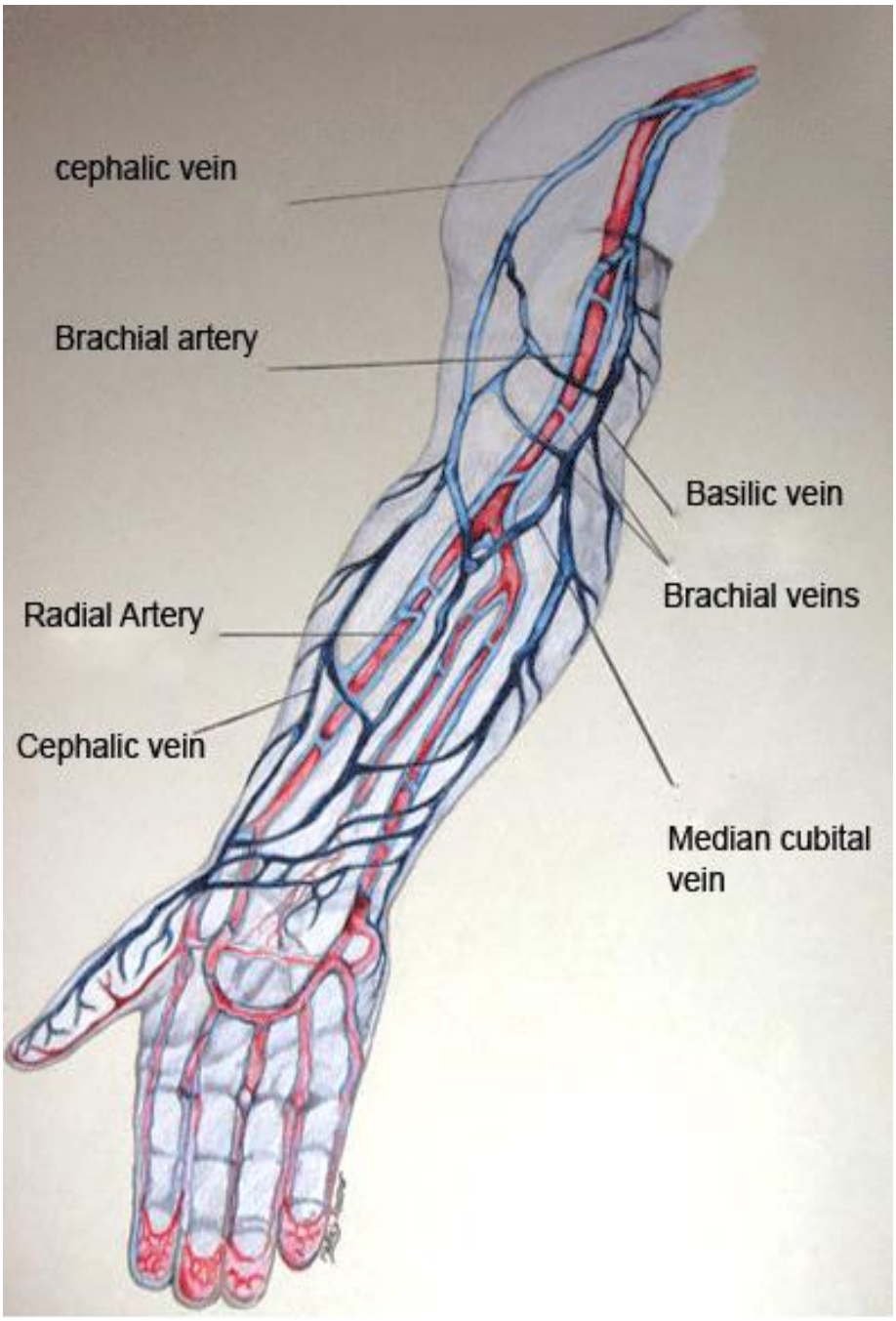
The superficial veins are those used in venepuncture and PIVC. They are located just beneath the skin in the subcutaneous tissue.

The superficial veins of the arm and hand are shown in the following diagrams; they consist of the basilic, cephalic, median veins and their branches, in the arm, and the digital and metacarpal in the hand. Note the close proximity of the arteries to the veins.

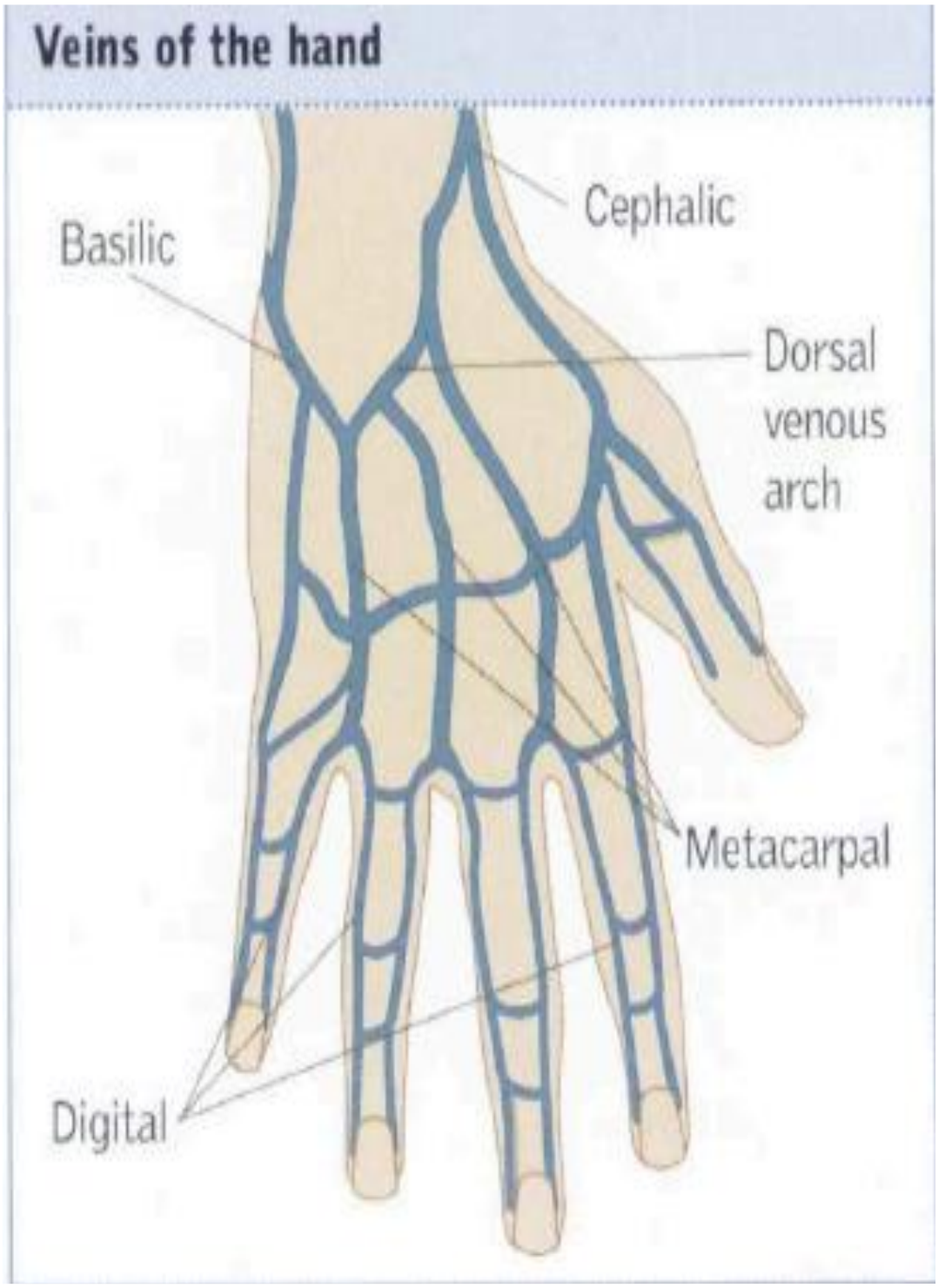
Superficial veins of the forearm:



Veins in relation to arteries: forearm



Superficial Veins of the dorsal aspect of the hand:



# PART 2: PIVC

PIVC's should only be inserted if clinically indicated (NHMRC, 2019).

## Indications for PIVC

- Drug administration - Inpatient, Hospital In The Home (HITH)
  - Continuous e.g. analgesic, infusion or PCA
  - Intermittent e.g. antibiotics
- Fluid maintenance/resuscitation
- Administration of blood products
- Emergency access
- Pre-emptively for patients at risk of clinical deterioration
- Blood sampling post thrombolytic or anticoagulants
- Pre procedure e.g. DCR, surgery, radiography
- Unstable patient
- It is a short term device
- Current PIVC requires replacing; this will depend on individual organisation's policies: (this will be discussed on page 25: Device replacement)

## Contraindications for PIVC

- Lack of consent
- Cellulitis or other skin infection over the potential PIVC site
- Superficial or DVT at or near the potential site
- Mastectomy +/- axillary clearance on proposed PIVC side
- Hemiparesis or contractures
- Arterio-venous fistula (or proposed site in a pre-dialysis patient)
- Burns or recent trauma/injury at or near potential site

## Vein Selection

Vein selection should be made with the following considerations in mind:

- What types of medications / fluids will be infused (or likely to be infused),
- How quickly will the fluids be infused,
- How long the cannula needs to be insitu,
- Size and condition of patient's vein.

Remember that a smaller size/gauge (larger numbers denoting smaller sizes) cannula will allow for better venous flow around it when it is insitu, allowing for better haemodilution of the infused medication, so whenever possible, use the smallest size cannula suitable for the purpose (NHMRC, 2019). If the patient requires, or is likely to require infusion of a blood product (non-emergency), a minimum of size 20 gauge (pink) should be selected.

## PIVC sites

| SITE | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| METACARPAL VEINS:<br>Located on the dorsum of the hand. Formed by the joining of the digital veins | • Easily accessible<br>• Connections lie flat on hand<br>• Bones of the hand can act as a splint on large child or adult | •Wrist mobility is impaired unless a short cannula is used<br>•Very painful insertion because of the large number of nerve endings<br>•More prone to phlebitis<br>•Thin skin and loss of connective tissue in elderly patients may predispose to extravasation<br>•Only suitable for slow infusion, minimal volume |
| BASILIC VEIN:<br>Extends along ulnar aspect of the forearm and upper arm | • A straight strong vein suitable for insertion of large gauge cannula<br>•Easily palpated | • Difficult position for patient to hold arm during insertion<br>• Difficult to access vein due to location |
| CEPHALIC:<br>Runs along radial aspect of forearm and upper arm | • A large vein suitable for large gauge cannula, excellent route for blood product transfusion<br>• Mobility of arm not affected<br>• Natural splinting by other structures of the arm | • Due to joint motion increased risk of complications |
| ACCESSARY CEPHALIC VEIN:<br>Located along the radius as a continuation of the metacarpal veins | • Large vein suitable for large gauge cannula<br>• No restriction to mobility of arm<br>• Good choice for transfusion of blood product | •May be difficult to get connections to sit flat on skin<br>•Valves at junction of cephalic vein may prohibit advancing cannula |
| ANTECUBITAL VEINS:<br>•Found in the cubital fossa;<br>•Median cephalic; radial side<br>•Median basilic; ulnar side<br>•Median cubital; in front of elbow joint | •Usually visible and/or palpable in children when unable to access other veins<br>•Easy to cannulate in an emergency or as a last resort | • Joint must be immobilised<br>• Median cephalic crosses in front of the brachial artery, increasing risk of accidental arterial puncture and infusion, causing permanent damage.<br>• Veins may be small and scarred if used frequently in the past |
| MEDIAN ANTEBRACHIAL VEIN:<br>Originates from the palm and runs along the ulnar aspect of the forearm | •Medium sized vein. Easy to cannulate | •Painful because of number of nerve endings in area<br>•Infiltration occurs easily, increasing risk of nerve damage because of proximity to median nerve |

Points to Consider when Selecting Vein

- Correct selection of the vein may be the deciding factor in the success of the PIVC and the preservation of the vein for further infusions if required.
- The most prominent vein may not be the most suitable; the prominence may be related to sclerosing or from previous damage. Big "ropey" veins often roll when touched by the PIVC so need to be firmly anchored during the procedure.
- Selection of veins away from the joints is preferable as this minimises the risk of the cannula bending and kinking when the joint is flexed.
- Long, straight elastic veins are best.
- Use the most distal site in the non-dominant arm as the first choice. By doing this, the availability of other sites is maximised for future IV therapy if required. Selection of the non-dominant arm is more convenient for the patient and is likely to reduce problems associated with movement of the arm.
- The dorsal metacarpal veins may be an inappropriate choice in some elderly patients. Blood extravasation is more likely to occur in small thin veins and the cannula may not be sufficiently supported because of thin skin and lack of supportive tissue in the surrounding area.
- The use of lower extremities (i.e. legs) is not recommended if an alternative is at all possible due to the increased risk of thrombus development in immobile limbs and the subsequent risk of DVT or thrombophlebitis (NHMRC 2019). This pooling can also result in pooling of unfused medications, which, when absorbed, may be in toxic levels. Varicosities become susceptible to trauma caused by the stagnant blood and resultant phlebitis interferes with patients' ambulation.
- PIVC's inserted into lower limbs often become overlooked due to the difficulty of visual access to look for complications.
- Any PIVC inserted into a lower extremity should be changed as soon as a satisfactory site can be established elsewhere.
- Local warming of the lower arm can facilitate insertion of the PIVC, reducing both the time and number of attempts required.
- If the patient is hemodynamically unstable, try to insert a 20 gauge or larger cannula in a large vessel in the forearm or upper arm.
- Avoid PIVC's near areas where there is local skin infection or veins damaged by infiltration or phlebitis.
- Do not insert PIVC's below any constricting or restraining devices.
- Avoid using the veins in the anterior forearm, particularly the cephalic vein, in patients that have chronic renal failure. If the skin around the insertion site is hairy, the hair may need to be clipped. Clipping is preferable to shaving, as the risk of micro-abrasions is minimised, therefore reducing the risk of infection. The occlusive dressing is more likely to remain adhered to the skin if the hair is removed first.

Selection of Appropriate Cannula Size

| Gauge | Uses | Flow Rates * Max. | | Considerations |
|---|---|---|---|---|
| | | mL per min | L/hr | |
| 14 (Brown / orange) | • Adults or large adolescents<br>• Trauma<br>• For rapid infusion of fluids or blood products | 300-340 | 18.9 | • Very painful when being inserted<br>• Very large vein required |
| 16 (Grey) | • Adults and adolescents<br>• Trauma<br>• Infusion of large volumes of fluid or blood products | 200-210 | 12.6 | • Painful when being inserted<br>• Large vein required |
| 18 (Green) | • Adults, adolescents and large children<br>• For fluid resuscitation<br>• Obstetric patients<br>• Infusion of blood products in non-emergency | 90-100 | 6.0 | • May cause pain when inserted<br>• Medium to large size vein required |
| 20 (Pink) | • Adults, adolescents and children<br>• Suitable for most fluid types<br>• TKVO IV access<br>• Medication administration<br>• Infusion of blood products in non-emergency (20 gauge or larger) | 60-65 | 3.9 | • Commonly used size as suitable in most instances<br>• Slower to infuse large volumes rapidly |
| 22 (Blue) | • Infants, toddlers, children, adolescents and adults (particularly the aged and emaciated)<br>• Suitable for most infusions<br>• Medication Administration | 30-38 | 2.3 | • Easier to insert into fragile or small veins<br>• Only suitable for slower infusions<br>• Difficult to puncture and insert through tough skin |
| 24 (Yellow) | • Toddlers, infants and neonates<br>• Adults with very fragile veins | 24 | 1.4 | • Only suitable for very slow infusion rate, minimal volume. |

Nursing (2008)
*Flow rates specified will vary between brands

Where ever possible to reduce the risk of phlebitis use the smallest, shortest PIVC suitable for prescribed therapy (NHMRC 2019).

Insertion Procedure

To be read in conjunction with individual hospital policies; review your organisations requirement re use of sterile gloves when performing PIVC.

**1.** Review the indication for PIVC

Is there an actual or potential need for the patient to have a PIVC inserted?
(Collecting a blood sample is not an indication for PIVC)

**2.** Prepare the patient

**a)** Patient identification: Check patient identification using 3 nationally recognised identifiers against the order for PIVC

Patient Consent: Other than in emergency situations, there should be time to discuss the procedure with the patient and obtain verbal consent. (Refer to hospital policies on consent: competent patients, non-competent patients and emergency). Patients should receive information and education about why they need the device and the procedure. Their role in reducing complications with the PIVC should also be discussed. This can help reduce patient anxiety. Consider using the IV-WISE discussion tool (IV-WISE patient discussion tool (safetyandquality.gov.au)) in these conversations and consider giving the patient a fact sheet about PIVCs. Check patient allergy status (chlorhexidine, iodine, tape) (Australian Commission on Safety and Quality in Health Care (2021)

**b)** Local or topical anaesthetic: If the patient is a child, apply topical anaesthetic cream (e.g., Emla) to site 30 – 60 mins prior to cannulation being performed.
Note: If the use of subcutaneous local anaesthetic is deemed necessary, an order must be written by a medical officer.

**c)** Privacy & comfort: If possible, parents should be encouraged to stay with their child during the procedure.

**3.** Attend to routine hand hygiene (5 moments) at all appropriate steps throughout the procedure

**4.** Clean the trolley or designated work surface and ensure sharps container readily accessible

**5.** Obtain equipment

**a)** Most areas have IV trolleys which have an assortment of necessary equipment including IV starter kits, PIVC's in assorted sizes, tourniquet's, normal saline for flushing, syringes, pathology blood specimen tubes, sharps disposal unit, tape and splints.

**b)** IV starter kits contain skin prep, transparent dressing, sterile towel, single use tourniquet, gauze, documentation labels and tray.
Note: contents will vary between manufacturers, check what is used in your organisation.

**c)** Sterile gloves if it is your organisations policy for this procedure or if you unable to protect key sites (skin prepped area)

**6.** Have trolley and other equipment within easy reach

This is particularly important as you will be using your dominant hand to hold the cannula in place until it is secure. Ensure that the sharps disposal unit can be easily reached for immediate disposal of the sharp.

**7.** Open IV starter kit or dressing pack maintaining aseptic technique

**8.** Identify vein / insertion site

**a)** Put the tourniquet on patient's arm with enough tension to promote venous distension but without restricting arterial blood flow. Tourniquet should be placed just below cubital fossa when attempting cannulation of the lower arm or hand and just above it when cannulating upper arm. Palpate vein, identifying direction of "rolling". If you are uncertain as to whether you are feeling a vein or a tendon, release tourniquet. If the structure is a vein, it will collapse after the tension is released; a tendon will remain the same. Avoid bony prominences over wrist whenever possible. See "Vein Selection" chart (Page 12) for details. When the vein has been identified, release tension on tourniquet.

**b)** Clip Hair if Necessary

**9.** Select appropriate PIVC

**a)** The PIVC should be the smallest size suitable for the available vein and the type and rate of the infusion to be infused. (Refer to chart for size selection).

**b)** Remember that at least a 20gauge cannula is preferred for the administration of blood products (non-emergency)

**10.** Gather PPE: gloves and eye protection

Select gloves that are reasonably tight fitting to allow for better tactile sensation. Selection of sterile vs. non-sterile gloves will be determined by your organisations policy / procedural guidelines or your skill in above procedure

**11.** Reapply tension on tourniquet

**12.** Prepare the site

Cleanse using a friction rub motion with 2% Chlorhexidine Gluconate and 70% alcohol. If sensitive/allergic to chlorehexidine then use 5% alcohol-based povidone iodine. (NHMRC 2019).
Prep an area of the skin which is larger than the transparent dressing. Ensure area air dries before commencing.

**13.** DON PPE
**14.** Stabilise the vein

Anchor the vein by gently pulling the skin taut below the insertion site using the thumb of your non dominant hand.
Do not re palpate the skin prepped site unless wearing sterile gloves

**15.** Insert PIVC

**The actual technique for inserting the PIVC can vary depending on the type of cannula used at your health service. This applies particularly to shielded PIVC catheters with the self-retracting needle, or similar. Please consult your clinical educator for specific instructions when inserting this type of cannula.**

Note that you may need to loosen the cannula from the needle to ensure it slides over the needle when inserted. How you manage this step will be product dependent you need to check what the specific product requirements are for the PIVC's used at your health service.

There are two insertion methods commonly used:

Indirect Method: This method consists of two components to the insertion. Point the needle in the direction of blood flow and hold it at an angle of approximately 15° with the bevel up. (See diagram 1).

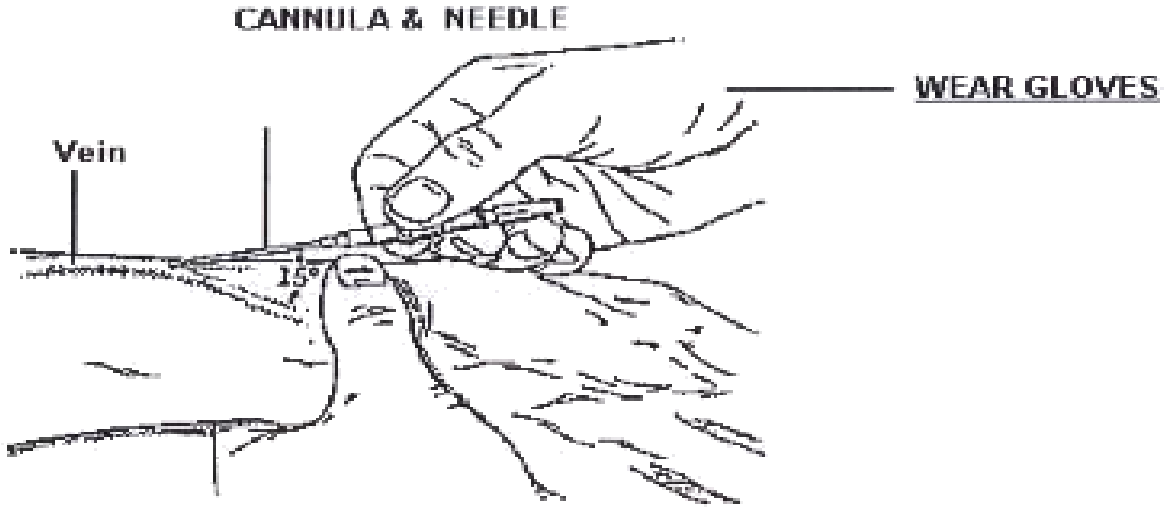



Diagram 1: angle of cannula and technique for stabilising vein

Diagram 2: Ensure tip of cannula has entered the vein

- The cannula enters the skin below or beside where the vein is visible. Insert the needle through the skin.
- Advance the needle into the vein until a flashback of blood is seen in the hub. Lower the angle of the needle so that it is almost parallel with the skin. Advance the needle slightly more (about half a centimetre) to make sure the cannula itself is in the vein, not just the needle tip (see diagram 2). Holding the needle firmly, slowly advance the cannula off the needle and into the vein

Direct method: Not suitable for PIVC of small veins as haematoma will usually result. Veins must be large, straight and superficial.

- Insert the cannula directly over the vein bevel up. Holding the cannula with the bevel up enter the skin at an angle of 20° - 30° and puncture the skin and the vein in one action.

Techniques for advancing the Catheter: There are two techniques for advancing the cannula and withdrawing the needle. See diagrams 3 and 4.

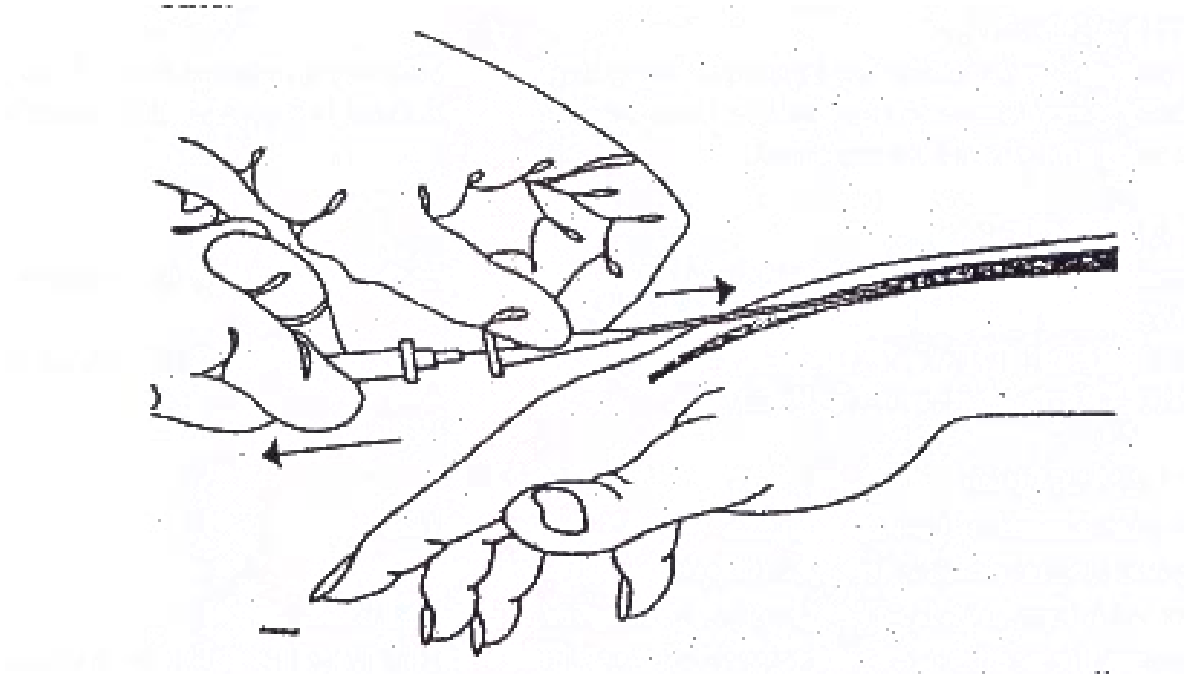


Diagram 3: Two handed method of advancing cannula and withdrawing needle.

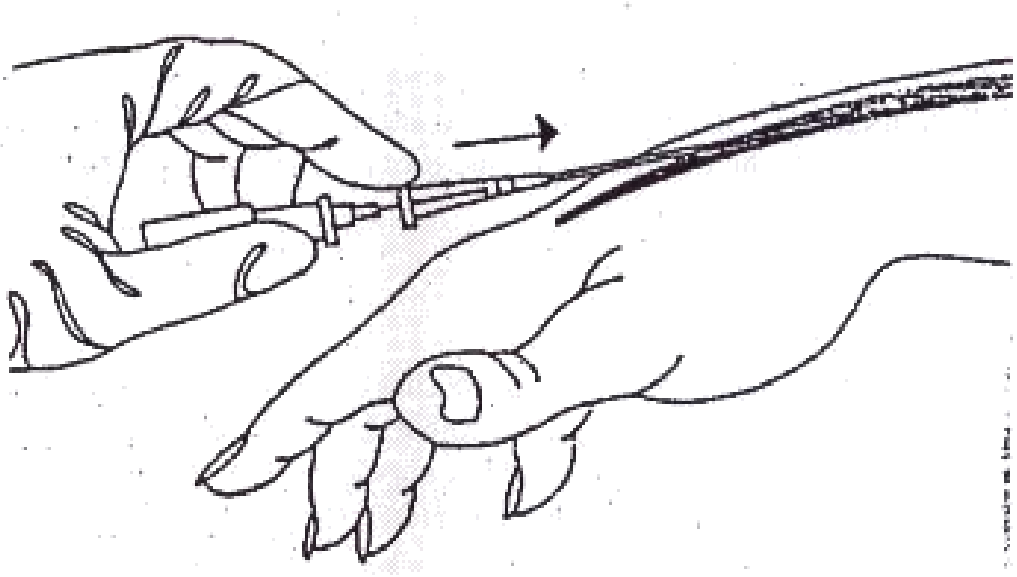


Diagram 4: One handed technique of advancing cannula over the needle.

**16.** Release the tourniquet whilst holding cannula steady

**17.** Withdraw the needle

a) You may need to place a finger on the vein at the distal end of the cannula, this will restrict blood flow back out through the cannula as the needle is withdrawn. Again, this is product dependent some products have a valve that prevents backflow and you may need to stabilise the cannula only. Slowly withdraw needle, making sure cannula is held securely. The mechanism for retractable needles is generally activated as a means of safely withdrawing the needle from inside the cannula

b) Place needle directly onto sharps container. Don't put it in the dressing tray as you will only have to move it later, increasing risk of sharps injury.

**18.** Connect necessary device to cannula
Usually, a one-way valve with an extension set attached

**19.** Flush the cannula
Using a minimum of 5mls (depending on the cannula) of sterile normal saline for injection flush the cannula slowly to ensure that it is in the vein prior to taping. If there is resistance to the flush or local swelling as the fluid is injected, the cannula is not in the vein and should be removed.

**20.** Secure cannula – taping and splinting

**a)** Apply sterile transparent semi permeable dressing
**b)** Try to plan insertion into an area that doesn't require splinting.
**c)** If a splint is unavoidable, select an appropriately sized arm board.

**d)** Secure with tape, bandage or tubigrip, whichever is deemed necessary
**e)** Ensure that the insertion site is not covered and that clear visibility of the site is maintained.

**21.** Dispose of used equipment

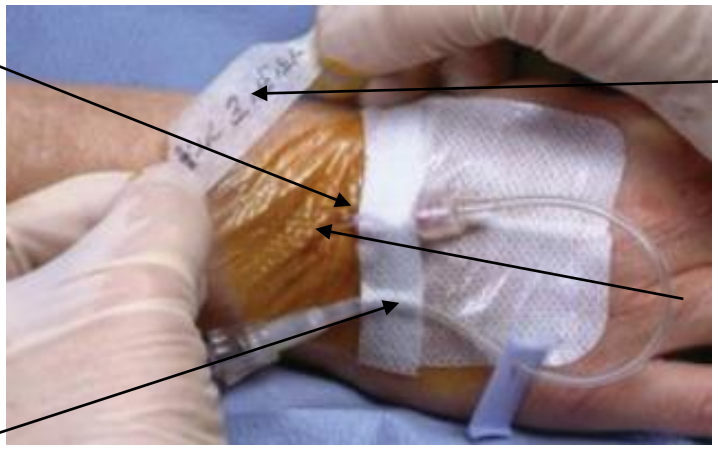
Failed attempt?
If the cannula fails to enter the vein, do not attempt to reinsert the needle into the cannula. Remove the entire unit and start again.

**Do not have more than 2 attempts on the same patient. Multiple insertion attempts increase risk of infection (NHMRC 2019). If still unsuccessful after 2 attempts follow your local PIVC inserter escalation pathway. Ultrasound guided PIVC may be an option in this cohort of patients if your health service has this capability.**

**22.** Document

PIVC must be documented in the patient's clinical pathway and progress notes, stating location of cannula, size of cannula, date & time and person who inserted it. The person inserting the cannula must sign and date label provided on the dressing and adhere it to the patient at the edge of the dressing. Document the need for frequent pressure area checks if a splint is in place. Ongoing assessment and documentation of PIVC at least once per shift. When the PIVC needs replacing should also be documented.

If more than one attempt at PIVC insertion is required document the reason why (e.g. patient dehydration, patient movement) in the patients medical record (Australian Commission on Safety and Quality in Health Care (2021).



Taking blood from a PIVC

A blood sample may be taken from a newly inserted cannula, before the tourniquet is released. This can be done using a vacutainer adaptor designed to fit into the PIVC hub. Once the cannula has been flushed, it should not be used for blood sampling.
If the patient has had an intravenous thrombolytic (e.g. alteplase/tenecteplase) or anticoagulant (e.g. heparin) and will require frequent blood sampling in the next 48 hours, a dedicated cannula, should be inserted for this purpose.

If taking a sample for blood cultures, all other aseptic requirements for blood culture testing should be implemented. Blood cultures can only be taken on PIVC insertion. If further cultures are required a fresh site via venepuncture should be used to prevent contamination (Australian Commission on Safety and Quality in Health Care (2021)).

Points for consideration

**a)** In general, try to select the distal end of the vein so that the more proximal veins are able to be used if other attempts are unsuccessful. Remember, however, that PIVC of the veins in the hands whilst may appear to be the easy option they are not always suitable for larger cannulas or in an acutely unwell patient.
**b)** Inform the patient that it may be painful, but only for a short time and that they need to remain still. Proceed without delay.
**c)** Do not hesitate once you have decided to insert the needle. Puncturing the skin should be one smooth motion.
**d)** Once the needle has been withdrawn, or partially so, from the cannula do not reinsert it. To do so may result in a section of the cannula being sheared off by the needle and causing a cannula embolus.

Trouble shooting

**a)** Mobile Vein
- Hold skin taut as you insert the cannula
- Limb positioning (flex or extend wrist or elbow) to pull skin taut and/or stabilise veins

**b)** Failure to penetrate vein
- Reassess location, change angle for depth
- Stabilise vein

**c)** Cannula Damage
- Avoid reinserting the stylet

**d)** Poor veins to choose from
- Select carefully and seek assistance early
- If you are not confident of success, don't start, refer to a more experienced practitioner (unless you are the only person available and the need is urgent). Follow local escalation protocol for difficult PIVC
- Ultrasound guided PIVC should also be utilised under these circumstances

**e)** Vasospasm
- Decrease patient anxiety and apply warmth to the limb. (Weinstein 2007)

Tips for PIVC

- Veins are differentiated from arteries by palpation.
- Veins most suitable are those that are soft, elastic to touch, visible, well supported by surrounding tissue, straight, non-branching with a large lumen.
- Observe an experienced operator.
- If a large bore PIVC is required it needs to go into a larger vein
- Don't try really difficult veins to begin with.
- Do not continue if you make two unsuccessful attempts.
- Try not to be discouraged by setbacks!
- Don't be rushed or pressured. It is better to spend ten minutes looking for a suitable vein than having multiple failed attempts
- Use an IV arm for practice, available from the Clinical Nurse Educators.
- If you are experienced, help others to learn.
- Don't always do all cannulae by yourself.
- Visualise the veins on other people and yourself.
- Warmth applied to the skin will assist vasodilatation. This can be done using warm blankets, heat packs or placing the limb in warm water.
- Placing the limb below the level of the heart promotes venous engorgement.

Prevention and Management of Complications

PIVC is an invasive procedure which has a risk of complications which may cause significant patient discomfort and or higher morbidity or mortality.

**1.** Infection: Local or Blood Stream Infection (BSI)
Invasion of pathogens localised in the surrounding tissues of the PIVC site or BSI
- Signs and Symptoms Local: Tenderness, swelling, erythema, induration, purulent drainage.
- Signs and Symptoms BSI: Systemic S & S
- Prevention: Strict aseptic technique during PIVC insertion and equipment assembly, frequent checking of the insertion site.

**2.** Haematoma:
A localised collection of extravasated blood, usually clotted, in an organ, space or tissue.
- Signs and Symptoms: Swelling, tenderness, decolourisation.
- Prevention: Proper device insertion with minimal manipulation of the needle, pressure over site on removal.

**3.** Infiltration:
Diffusion or accumulation of injected fluid into the subcutaneous space.

- Signs and Symptoms: Swelling, slowing of the infusion, pain, coolness of the skin and may feel firm.
- Prevention: Appropriate selection of a site and a device, proper stabilisation of the device, frequent checking of the insertion site. Stop administration of fluids or drugs immediately if there are any signs of infiltration.

**4.** Phlebitis:
Inflammation of the vein.

- Signs and Symptoms: Tenderness, redness, heat, oedema.
- Prevention: Smooth insertion, aseptic technique, proper stabilisation of the device, frequent observation of the insertion site and changing of the site as soon as any signs of inflammation appear.

**5.** Thrombophlebitis:
Formation of thrombus and inflammation in the vein.

- Signs and Symptoms: Tenderness, redness, heat, oedema, cordlike appearance of vein, slowing or cessation of the flow of the infusate.
- Prevention: Smooth insertion, aseptic technique, proper stabilisation of device, correct administration and dilution of medication, frequent checking of the insertion site and changing of the site as soon as any signs of infection appear.

**6.** Occluded Line:
Slowing or cessation of the flow of infusate due to fibrin formation in or around the tip of the cannula, or mechanical occlusion of equipment, e.g., line kinking.

- Signs and Symptoms: Slowing or cessation of the infusate.
- Prevention: Continued observation to assure IV giving set does NOT run dry or problems do not develop in equipment, increased venous pressure is NOT applied proximally to the cannula (e.g. the use of blood pressure cuff), once occlusion is identified immediate removal and reinsertion of a new cannula in another site.

**7.** Tissue Sloughing:
The formation or separation of necrotic tissue from viable tissue.

- Signs and Symptoms: Tissue necrosis.
- Prevention: Appropriate selection of site and device, proper stabilisation of device, frequent checks for infiltration particularly for toxic or chemically irritating solutions or drugs.

**8.** Syncope
There is the potential for patients to faint during insertion of the cannula.

- Signs and Symptoms – Sudden temporary loss of consciousness.
- Prevention – Have patient lying down or at a minimum sitting down whilst performing procedure, and have susceptible patients look the other way when inserting the cannula.

**9.** Other Complications to be aware of

- Allergic reaction, e.g. to skin prep
- Infiltration or extravasation of fluid or medications
- Air embolus

Infection Prevention & Control Issues

Adherence to infection prevention and control principles, including hand hygiene and aseptic technique on insertion, and with all care and interventions whilst the PIVC remains insitu, will reduce the risk of infection.

Causes of infection associated with PIVC include:

- Prolonged hospitalisation prior to the insertion of the PIVC
- Prolonged placement of PIVC
- Contamination of the cannula hub, insertion site or equipment form healthcare workers hands or contaminated equipment
- Contaminated substance being infused
- Colonisation from a distal source (e.g. skin infection)

The risks of infection can be reduced by:

- Assessment of clinical need for PIVC
- Effective and timely hand hygiene (5 moments) prior to patient contact and preparation of equipment.
- Use of standard precautions when inserting or accessing PIVC.
- Strict aseptic technique when inserting cannula and when carrying out any interventions.
- Appropriate skin preparation.
- Correct device and site selection.
- Education of patient/carers re reporting of discomfort, pain, swelling, bruising or bleeding.
- Device must be secured and covered with sterile, semipermeable dressing. Ensure dressing integrity, inspect site at least once per shift and only replace if required: soiled, non-adherent. Replacement of dressing under aseptic technique.
- Prompt removal of PIVC as soon as no longer clinically indicated or infection suspected. Assessment of ongoing requirement for PIVC must occur on a regular basis.
- Once PIVC has been removed the insertion site should be observed for signs of pain and infection. Provide education to patients and family about this for those patients that have them removed just prior to discharge.
- Adhering to local policy in relation to PIVC replacement (see section under device replacement p 25)
- Replace PIVC inserted in an emergency or prior to admission within 24 hours.

Use of a sterile cap on cannula if IV infusion set not attached

Aseptic technique for IV cannulation:

Australian Guidelines for the Prevention and Control of Infection in Healthcare (2019) recommend either a standard or surgical aseptic technique for PIVC. Local hospital policy should guide your practice regarding this. NHMRC 2019 states "Although technically quite simple the close proximity of healthcare workers hands to the puncture site and key sites may demand sterile gloves – dependent upon the healthcare workers competency"
A risk assessment by the healthcare worker at the time of cannulation may determine the need for sterile gloves in order to maintain aseptic technique.

Device Replacement

Australian Guidelines for the Prevention and Control of infection in Healthcare (2019) and World Health Organisation (2024) recommendations:
Two options for replacement of PIVCs in adults:

Option 1
Replace a PIVC every 72-96 hours

Option 2
Replace on clinical indication: this option should only be considered if the facility complies with the requirements listed on page 171 of the Australian Guidelines for the Prevention and Control of infection in Healthcare 2019 https://www.nhmrc.gov.au/about-us/publications/australian-guidelines-prevention-and-control-infection-healthcare-2019
Please consult your local policy/guideline as that will direct your practice in relation to these options. (NHMRC 2019)

PIVC are not to be routinely replaced in neonates & children (NHMRC 2019)

PPE & Inserter safety

- Standard precautions (including aseptic technique) must be used during insertion and when accessing the PIVC
- Wearing gloves won't protect you from a needle stick but will prevent contamination by blood spill.
- Protective devices such as goggles will prevent risk of contamination from splashes.
- Correct and immediate disposal of sharps.
- Ensuring patient understands process will increase likelihood of them remaining still.
- Promoting support from parents with paediatric patients, rather than have to use force to keep child still.
- Appropriate mechanisms to prevent patient from moving during insertion. This relates to children, confused or uncooperative patients who may appear to understand what is going to happen but resist once the needle enters the skin.
- Allowing an adequate amount of time to complete task.

## DEMONSTRATION VIDEO

Please view the video on PIVC at the website below. Please note that there are some differences to what may be policy at your health service but the key principles apply.

The Complete Guide to Intravenous (IV) Cannulation LIVE DEMO | 2022 update - YouTube

## PRACTICAL SESSION

Once you have completed the following questions please contact your nurse educator for information on obtaining a practical demonstration of PIVC on a simulation arm (if available), prior to attempting your first PIVC on a patient.

References:

ABCs of Anaesthesia (2022) *The Complete Guide to Intravenous (IV) Cannulation LIVE DEMO | 2022 update*

Australian Commission on Safety and Quality in Health Care (2021) *Management of Peripheral Intravenous Catheters: Clinical Care Standard*

Gawkrodger, D.J. & Arden-Jones, M.R. (2020) *Dermatology (7th Ed.)* Churchill Livingstone. Philadelphia.

Hand Hygiene Australia (2019) *5 Moments Hand Hygiene* www.hha.org.au

National Health & Medical Research Council (2019) *Australian Guidelines for the Prevention and Control of Infection in Healthcare*
Australian Guidelines for the Prevention and Control of Infection in Healthcare (2019) | NHMRC

Nursing, (2008) I.V. *Rounds Comparing short peripheral cannula insertion sites* Nursing 2008 May
Comparing short peripheral cannula insertion sites : Nursing2024 (lww.com)

Nutbeam, T. & Daniels, R. (2010) *ABC of practical procedures.* Blackwell Publishing Ltd. West Sussex, UK.

Pappano, A.J. & Wier, W.G. (2018) *Cardiovascular Physiology (11th ed.)* Mosby, Philadelphia.

Patel, V. & Morrissey, J. (2011). *Practical and professional clinical skills.* Oxford University Press, Oxford.

Weinstein, S. (2014). *Plumer's principles and practice of intravenous therapy.* (9th Ed.) Lippincott, Williams & Wilkens, Philadelphia.

World Health Organisation (2024)

*Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part 1: peripheral catheters.* World Health Organization

Geneva: WHO; 2024. p. 166.

https://www.who.int/publications/i/item/9789240093829

**SKILLS ASSESSEMNT TEST PART A**
**PIVC**

NAME: _____ DATE: _____

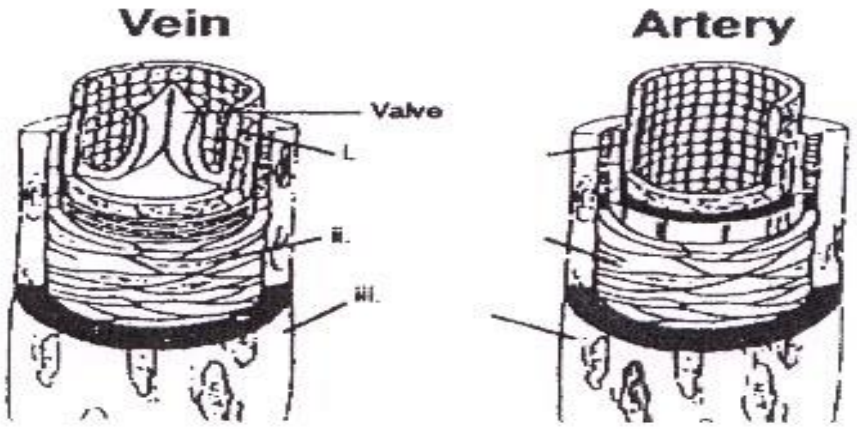
1. *What is the structure and function of a vein?*

_____
_____
_____
_____
_____
_____

2. *What is the structure and function of an artery?*

_____
_____
_____
_____
_____
_____

3. *Name the three (3) layers of the vessels on the following diagram.*

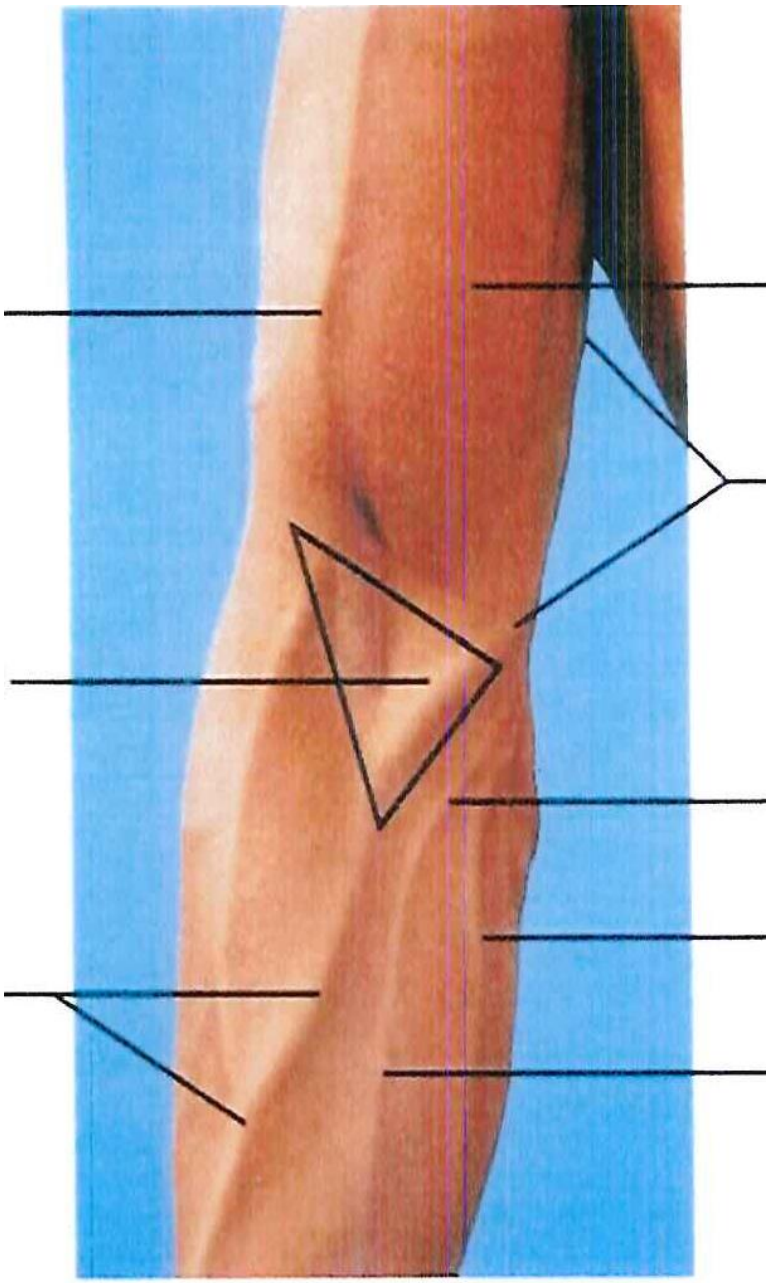



4. *List the difference between arteries and veins below:*

| ARTERIES | VEINS |
|---|---|
| | |

| | |
|---|---|
| | |
| | |
| | |

5. *Name the major veins on the following diagram*



6. Name five (5) indications for IV Cannulation

_____
_____
_____
_____
_____
_____

7. *Name one (1) advantage and one (1) disadvantage of each of the following veins.*

a) *METACARPAL VEINS*

_____
_____
__

b) *BASILIC VEIN*

_____
_____
__

c) *CEPHALIC VEIN*

_____
_____
__

d) *ANTECUBITAL VEIN*

_____
_____
____

8. *For each of the following statements mark true or false, cross out the incorrect answer.*

a) The most proximal site on the non – dominant hand would always be the first choice
TRUE / FALSE

b) The most prominent vein is <u>always</u> the best one to choose
TRUE / FALSE

c) Blood extravasation is more likely to occur in the small thin veins of the elderly
TRUE / FALSE

d) It is good to use the veins in the legs especially if the patient is immobile, as they are usually quite big
TRUE / FALSE

e) You should not insert an PIVC into the arm on the affected side of a person who has had a mastectomy
TRUE / FALSE

f) It is best not to insert a PIVC below a restraining device
TRUE / FALSE

g) In an unstable patient it is best to insert a 22 gauge cannula into a metacarpal vein
TRUE / FALSE

9. *State the size cannula you would <u>ideally</u> insert in each of the following situations*

a) Infant unable to tolerate oral fluids

_____

b) A 55 year old requiring a non-urgent blood transfusion

_____

c) An 18 year old footballer trauma patient

_____

d) An 88 year old requiring intravenous antibiotics.

_____

**10.** *What are the signs and symptoms of four (4) complications of PIVC*

a) _____
_____
_____

b) _____
_____
_____

c) _____
_____
_____

d) _____
_____
_____

11. *List four measures required to maximise staff protection during PIVC*

_____
_____
_____
_____
_____
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_____

12. *How do you reduce the risk of cannula site infection?*

_____
_____
_____
_____
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**CLINICAL SKILLS COMPETENCY -: PERIPHERAL INTRAVENOUS CANNULATION (Guide only)**

NAME: _____ DATE: _____

| DEMONSTRATES: The ability to safely and efficiently perform a peripheral intravenous cannulation (PIVC)<br><br>It is an expectation that the clinician is familiar with local policy and protocols and performs within these guidelines. | CRITERIA<br>C = Competent<br>S = Requires supervision<br>D = Requires development | | |
|---|---|---|---|
| PERFORMANCE CRITERIA | C | S | D |
| 1. Identifies reason for PIVC | | | |
| 2. Identifies safety considerations | | | |
| 3. Ensures all necessary equipment is at hand | | | |
| 4. Positively identifies patient using 3 identifiers | | | |
| 5. Provides explanation to patient & obtains verbal consent (if possible) | | | |
| 6. Provides privacy and comfort to patient | | | |
| 7. Demonstrates correct Standard and transmission-based precautions including doffing/donning PPE and 5 moments of hand hygiene throughout procedure | | | |
| 8. Demonstrates correct aseptic non touch technique throughout procedure-can use gloves | | | |
| 9. Positions patient appropriately with adequate lighting | | | |
| 10. Assesses arm and selects site | | | |
| 11. Assembles equipment and places in an accessible place | | | |
| 12. Applies the tourniquet correctly | | | |
| 13. Palpates to select suitable vein, releases tourniquet | | | |
| 14. Selects cannula and prepares according to manufactures recommendations | | | |
| 15. Reapplies tourniquet | | | |
| 16. Cleanses the site using a friction rub motion | | | |
| 17. Stabilises the vein and informs patient that the needle is about to be inserted. | | | |
| 18. Successfully inserts needle into vein, identifies flashback, advances cannula into vein | | | |
| 19. Releases tourniquet and occludes vein proximal to cannula prior to removing needle (if this required). For valved cannulas stabilise cannula | | | |
| 20. Disposes needle directly into sharps container | | | |
| 21. Attaches one way valve and flushes with Normal Saline | | | |
| 22. Applies occlusive, transparent dressing with insertion site visible and tapes lines appropriately | | | |
| 23. Labels dressing with insertion date & time | | | |
| 24. Disposes, cleans and replaces equipment appropriately | | | CONT.. |

| | | | | |
|---|---|---|---|---|
| 25. | Documents appropriately in the patient's progress notes and clinical pathway | | | |

COMMENTS_____
_____
_____
_____

COMPETENT YES

NOT YET – REQUIRES FURTHER SUPERVISION

NOT YET – REQUIRES FURTHER DEVELOPMENT I.E. RE READING THE PACKAGE

Assessee _____

Assessor _____

PIVC Evidence Log

Please document evidence of initial 5 supervised successful PIVC's whilst undertaking learning package.

Following this at least one cannulation insertion per month should be documented.

This log sheet should be made available for assessor to review when annual competence is assessed.

| Date | Patient's UR Number | Signature of assessor | Date | Patient's UR Number | Signature of assessor |
|---|---|---|---|---|---|
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# PERIPHERAL INTRAVENOUS CANNULATION

Date: _____ How long did this package take to complete? _____
Please indicate your response to each of these statements by ticking the appropriate box and return to Nurse Educator

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1. Overall, I found this learning package worth while | ❑ | ❑ | ❑ | ❑ | ❑ |
| 2. The way in which the learning package was presented made it easy to understand | ❑ | ❑ | ❑ | ❑ | ❑ |
| 1. My knowledge of this topic was improved after completing this learning package | ❑ | ❑ | ❑ | ❑ | ❑ |
| 2. My skills in this area have been enhanced since completing this learning package | ❑ | ❑ | ❑ | ❑ | ❑ |
| 3. The resources provided were sufficient for me to answer the test adequately | ❑ | ❑ | ❑ | ❑ | ❑ |
| 4. I would recommend this learning package to others | ❑ | ❑ | ❑ | ❑ | ❑ |
| 5. I will be able to apply knowledge and skills acquired in my clinical practice | ❑ | ❑ | ❑ | ❑ | ❑ |

Comments (Optional)

_____

_____

Thank you for taking the time to complete this evaluation. Your comments are valued and appreciated. Please return this form to your Nurse Educator