

PERIPHERAL INTRAVENOUS CANNULATION & PRIMARY CARE SPECIFIC MEDICATION ADMINISTRATION



INFORMATION PACKAGE FOR

Primary care, including:

- general practice settings
- aged residential care

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INTRODUCTION

This is a self-directed learning and information package for registered health care professionals for whom peripheral intravenous cannulation and Primary care specific drug administration is part of expected practice. Those undertaking peripheral intravenous cannulation and Primary care specific drug administration must have successfully achieved certification having completed education, training and competency validation in peripheral intravenous cannulation and Primary care specific drug administration.

In addition, those undertaking peripheral intravenous cannulation and Primary care specific drug administration will do so in accordance with policy and procedure documents.

Purpose

This package has been developed to assist registered health care professionals to achieve competence to safely manage peripheral intravenous cannulation and administer Primary care specified intravenous therapy. Completion of this package is self-directed and forms part of the overall certification process – see page 5.

The information in this package is designed to assist registered health care professionals establish a knowledge base for clinical practice.

The purpose of this learning package is to:

- outline the roles and responsibilities of the registered health care professional performing peripheral intravenous cannulation and Primary care specific drug administration
- set out procedures based on best evidence, supported by practice or organisational policy in order to safeguard the patient and guide registered health care professionals in the performance of peripheral intravenous cannulation and Primary care specific drug administration procedures
- aid in the preparation and support of patients/guardians and their families while undergoing peripheral intravenous cannulation and Primary care specific drug administration procedures

Material in this document provides peripheral intravenous cannulation and Primary care specific drug administration information at a basic level. You are encouraged to further develop your knowledge through practice.

Scope

This learning package informs all registered health care professionals who are undergoing or have successfully completed the required education, training and competency assessment to carry out peripheral intravenous cannulation and Primary care specific drug administration.

Disclaimer

The information contained within this learning package is the most accurate and up to date, at date of approval.

Learning objectives

At the completion of this learning programme the registered health care professional will be able to:

- list the parts of a cannula or butterfly and their function
- identify peripheral veins suitable for cannulation
- cannulate peripheral veins safely
- discuss problems associated with cannulation and preventative measures for decreasing the incidence of those complications

- administer approved IV antibiotics via peripheral IV cannula/butterfly by
 - bolus or short infusion
- be aware of and manage any complications that can arise from the administration of IV antibiotics
- administer IV Zoledronic acid via peripheral IV cannula/butterfly by
 - short infusion
- be aware of and manage any complications that can arise from the administration of IV Zoledronic acid

SECTION ONE: Professional standards

LEGAL ASPECTS OF INTRAVENOUS THERAPY

Organisational code of conduct outlines conduct expected of health care professionals employed within its organisation. This ensures the health care professional:

- is accountable for practicing safely within his/her scope of practice
- demonstrates expected competencies in the Primary care area in which he/she is currently engaged
- is responsible for maintaining his/her professional standards
- takes care that a professional act or any omission does not have an adverse effect on the safety or wellbeing of patients
- is familiar with relevant legislation as appropriate.

Relevant Legislation

- Privacy Act (1993)
- Health information Privacy Code (1994)
- Health Practitioners Competency Assurance Act (2003)
- Health and Disability Commissioner Act (1994)
- Code of Health and Disability Consumers' Rights (1996)
- Medicines Act (1981), Medicines Regulations (1984)
- Misuse of Drugs Act (1975).

Duty of Care

Registered health care professionals have both a legal and a professional duty to care for patients they have contact with. In law, courts can find a health care professional negligent if a patient suffers harm because they failed to care for them adequately. For a registered health care professional, professional negligence or a breach of professional duty of care is of great importance. A failure in responsibilities with regard to their duty of care to a patient, can lead to the removal of the professional's registration and right to practice.

Cannulation and Primary care specific drug administration certification requirements for Registered nurses.

1. Comprehension and completion of this cannulation and Primary Care specific drug administration self-directed learning package and all associated readings/policies as recommended in the reading list attached – p 97.

NOTE: Completion of this learning package must precede attendance at any associated training.

2. Completion of the RN IV antibiotic and/or Zoledronic acid and/or other therapy administration certification requirements as required by your Primary care organisation:

- 2a. Approved antibiotic related certification requirements:

- passed RN IV antibiotic administration theory test
 - passed RN IV therapy bolus practical assessment.

- 2b. Zoledronic acid related certification requirements:

- passed RN IV Zoledronic acid administration theory test
 - passed RN IV therapy infusion practical assessment.

- 2c. Other therapy related certification requirements:

- passed RN IV other therapy administration theory test
 - passed RN IV other therapy bolus and infusion practical assessments.

3. Completion of the peripheral IV cannulation certification requirements:

- attendance at a recognized cannulation training course (4 hour minimum)
 - completion of 2 successful supervised cannulations performed as per the practical assessment.

INTRAVENOUS THERAPY STANDARDS OF PRACTICE

- Standard 1. Prescription and Initiation of Therapy
- Standard 2. Informed Consent
- Standard 3. Infection Prevention and Control
- Standard 4. Intravenous Therapy Administration
- Standard 5. Documentation

STANDARD I.

PRESCRIPTION AND INITIATION OF THERAPY

Intravenous therapy shall be initiated upon the order of a medical officer or a legally authorised prescriber. The medical officer's or authorised prescriber's order shall comply with the Medicines Act 1981, Medicines Regulations 1984, and the Misuse of Drugs Act 1975. The prescription shall be complete with regard to medication and delivery. Consent for treatment shall be obtained from the patient/guardian (or family/whanau as appropriate). Initiation of therapy shall comply with patient rights.

Verbal orders

Verbal orders are signed by the medical officer or authorised prescriber within an appropriate time frame in accordance with practice or organisational Policy and Procedure.

Standing orders

A standing order is a written instruction issued by an authorised prescriber, in accordance with the regulations, authorising any specified class of health care professional engaged in the delivery of health services to supply and administer any specified class or description of medicines or controlled drugs to any specified class of patients under their care, in circumstances specified in the instruction, without a prescription. A standing order becomes invalid if it is not reviewed and authorised by the expiry date.

The health care professional administering the prescribed medicine/IV fluid verifies that it is appropriate for the medical diagnosis and clinical condition of the patient, as well as the appropriate dose, frequency, time and route.

The medicine chart is signed immediately following administration (bolus) or at the initiation of intravenous therapy (infusion).

Practice Criteria

- The medication prescription is legibly and indelibly printed.
- The medication prescription should include the following:
 - patient name and details
 - medicine/fluid using the generic name preferably written in capital letters
 - date therapy is to commence

- dose and route
- rate of fluids
- administration times
- patient's weight on the prescription/medicine chart where the medicine is dosed to patient's weight
- order of administration when more than one medicine is prescribed and the sequence of administration is significant
- prescriber's full signature with contact details and/or printed name underneath
- any medical alerts/sensitivity reactions
- any extra instructions with regard to administration
- stop date and initials of medical staff discontinuing therapy.

STANDARD 2.

INFORMED CONSENT – PATIENT/GUARDIAN

The patient/guardian (or family/whanau as appropriate) shall be informed of the prescribed treatment and potential complications associated with the treatment or therapy. The patient will have the right to accept or refuse treatment. The patient/guardian has the right to effective communication in a form, language, and manner that enables them to understand the information provided. Where necessary and reasonably practicable, this includes the right to a competent interpreter.

Practice Criteria

Where legally needed, written informed consent shall be obtained in accordance with practice or organisational Policy.

- Where written informed consent is not required, the health care professional must inform the patient/guardian of:
 - the clinical indication for the use of intravenous therapy
 - the drugs therapeutic action
 - possible common side effects
 - the regime and duration of treatment.
- The health care professional shall avoid using medical terminology and adapt their language so that it is readily understandable by the patient.
- If treatment is refused, the health care professional will document this in the patient's medical notes, giving the process undertaken and the patient's reason for refusing treatment.

STANDARD 3.

INFECTION PREVENTION AND CONTROL

Infection prevention and control methods shall be employed in all aspects of IV therapy. Hand hygiene shall be routine practice for health care professionals working in clinical practice situations. Acceptable hand hygiene techniques shall be employed observing the 5 moments for all clinical procedures. Use of aseptic non-touch techniques, the observation of standard precautions, and assurance of product sterility shall be required for all IV therapy. Gloves shall be used and consideration given to maximal sterile barrier precautions when performing IV therapy.

All disposable sharp items e.g. needles, stylets shall be discarded in a non-permeable, puncture resistant, tamper proof sharps container.

Practice Criteria

- Heath professional's hand hygiene technique will comply with practice or organisation Policy for *hand hygiene*.
- Hand hygiene is carried out observing the 5 moments for all IV procedures.
- Use non-sterile clean gloves in accordance with practice or organizational policy
- Aseptic non-touch techniques are used for IV procedures
- Approved antimicrobial solutions are used to cleanse skin, medication vials, swab access ports, clean vascular access devices etc... use should be as specified in practice or organizational policy
- Scrub the hub (bung) for 15 seconds using a firm friction scrub with an approved single use antiseptic swab to disinfect connector surfaces effectively.

SCRUB the HUB 15 SECONDS

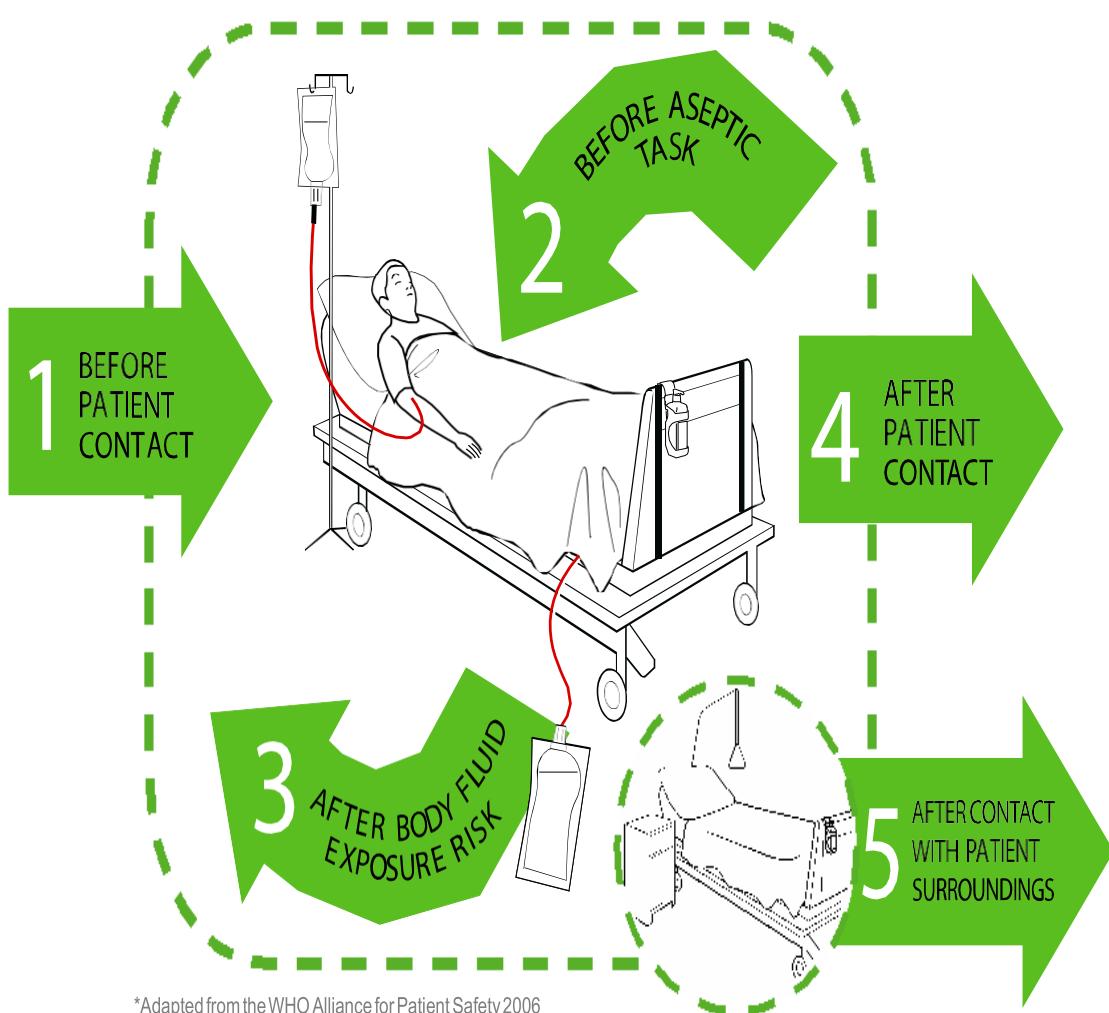
- Approved sharps containers are placed are easily accessible locations, preferably beside the patient and are not allowed to become over full.

HAND HYGIENE

Hand hygiene is the most effective method of reducing the risk of infection. The 5 moments for hand hygiene are:

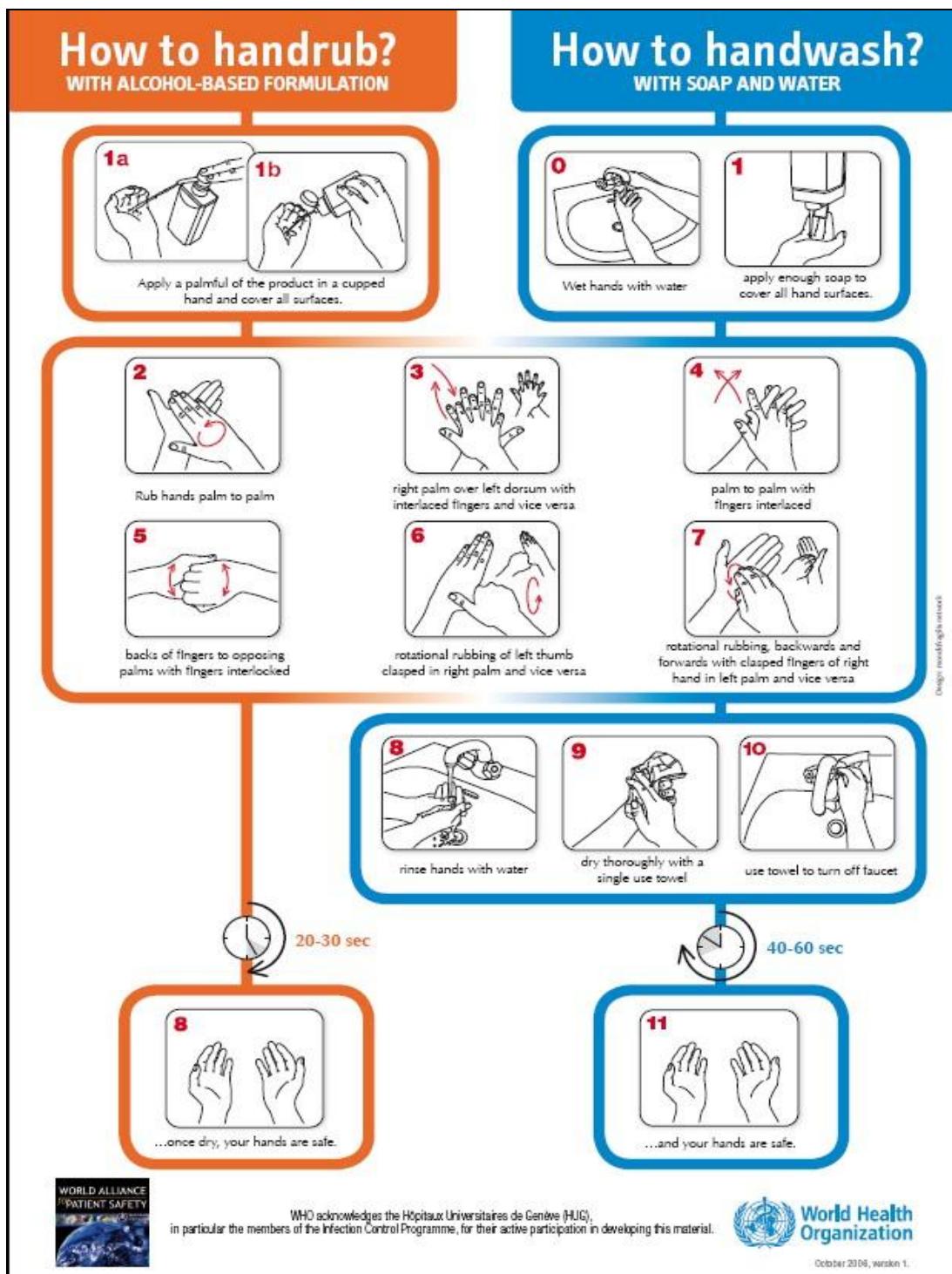
- before patient contact
- before a procedure
- after a procedure or body fluid exposure risk
- after patient contact
- after contact with patient environment.

Your 5 moments for hand hygiene at the point of care*



*Adapted from the WHO Alliance for Patient Safety 2006

THE HAND HYGIENE PROCESS



The use of alcohol based hand sanitisers is recommended for all situations where hand hygiene is indicated except when hands feel dirty or have been contaminated with blood or body fluids.

A hand wash using a neutral pH liquid soap solution is also satisfactory for most clinical areas and procedures in accordance with practice or organizational policy.

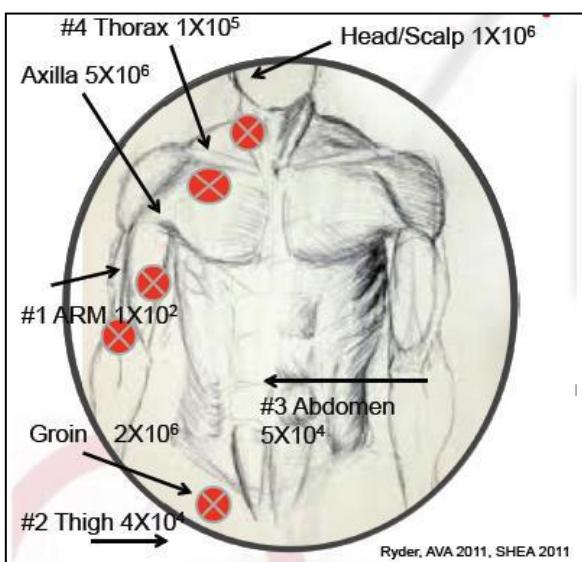
Sources of Cannula-Related Infection

The main sources of cannula-related infection are the skin flora, contamination of the catheter hub, contamination of infusate, and hematogenous colonisation of the device. Infection sources can be classified as endogenous and exogenous. Endogenous infections are caused by a person's own flora. Exogenous infections are from sources outside the person's body.

Of importance to health care professionals are infections known as 'nosocomial'. These are infections that develop within a hospital/healthcare setting or are produced by organisms acquired during hospitalisation. The transmission of a nosocomial infection is usually caused by the transfer of a pathogen to the patient by a health care professional. This can be a pathogen resident on the health care professional, or transferred from another patient or healthcare equipment. Microorganisms

most frequently associated with peripheral intravenous cannula infections include coagulase negative staphylococci, staphylococcus aureus, and candida.

The patient's skin is a fertile environment for bacterial growth. Some estimates indicate that a minimum of 10,000 organisms are present per square centimetre of normal skin. These numbers are estimated to be significantly greater in certain locations such as the axilla and groin due to a greater presence of moisture and warmth as shown in the Ryder diagram.

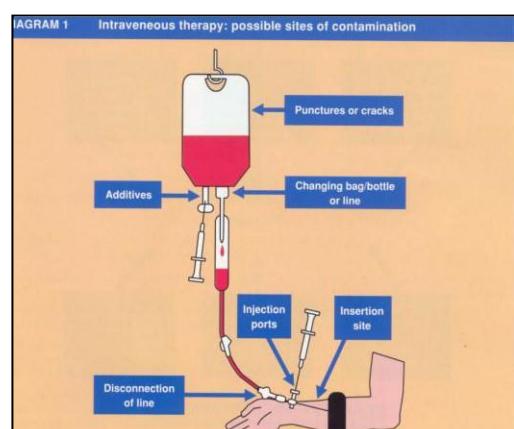
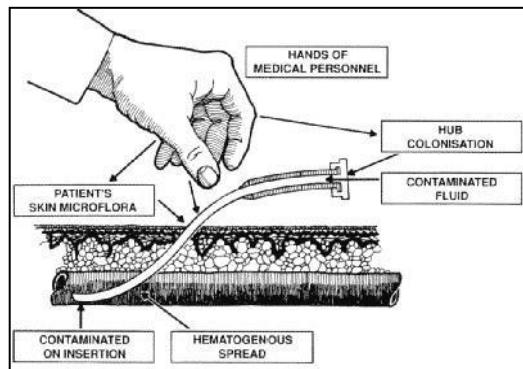


All patients are at risk of infection; however patients receiving infusion therapy are predisposed because:

- the device penetrates and bypasses the protective barrier of the patient's skin
- an in-dwelling device provides access and potential entry of micro-organisms into the patient's bloodstream
- IV infusions have the potential to become contaminated through manipulation and/or disconnection.

At risk groups especially vulnerable to infection include those:

- immuno compromised/suppressed patients
- with an implanted prosthetic device which may serve as a focus for infection
- with reduced capacity to deal with infection e.g. organ impairment or diabetes.



Transmission of Pathogens on Hands

Transmission of nosocomial infections from one patient to another, via the hands of a health care professional, follows a sequence of events:

- Organisms present on the patient's skin, or that have shed onto an inanimate object in close proximity to the patient are transferred to the hands of a health care professional.
- These organisms survive on the hands of the health care professional.
- The hand hygiene or hand asepsis of the health care professional is inadequate or omitted entirely; or the agent or technique used is ineffective/inappropriate.
- The contaminated hands of the health care professional make direct contact with another patient, or with an inanimate object that will come in contact with another patient.

Gloves

- Are essential for the health care professional and must be used when inserting cannulae due to the risk of exposure to blood-borne infections.
- Non-sterile (clean) gloves can be used for aseptic non-touch procedures such as IV medication preparation and administration, venepuncture or cannulation where it is possible to undertake the procedure without touching key parts or sites.
- Gloves can transfer micro-organisms and should be changed immediately on contamination or suspected contamination.
- Change must also be changed between tasks and procedures on the same patient.
- Remove gloves promptly after use, before touching non-contaminated items and environmental surfaces, and before going to another patient, complete hand hygiene immediately on removal.



Become accustomed to glove use from the start, rather than 'getting used to them' later.

Use an aseptic non-touch technique

Aseptic non touch technique (ANTT) is a standardised technique that is used during clinical procedures to identify and prevent microbial contamination of aseptic key parts and key sites by ensuring that they are not touched either directly or indirectly.

Perform procedures using the following core components of ANTT:

- Identify and protect key parts and sites.
- A 'key part' is the part of the equipment that must remain sterile, such as a syringe hub, and must only contact other key parts or key sites. Key parts are those that directly or indirectly come in to contact with the patient's sterile internal spaces i.e. the bloodstream.
- A 'key site' is the area on the patient such as a wound, or IV insertion site that must be protected from microorganisms.



- Ensure aseptic key parts/sites only contact other aseptic key parts/sites.
- Use hand hygiene, non-touch technique, a defined aseptic field, sterile equipment and/or clean existing key parts, such as an IV access bung, to a standard that renders them aseptic prior to use.
- Attempt not to touch key parts/sites directly **but...** if this is necessary, wear sterile gloves.
- Sequence your practice to ensure efficient, logical and safe order of tasks. Sterile equipment and an aseptic non-touch technique are always used for insertion and management of IV cannulae and IV therapy preparation and administration.
- Use of the IV Start Pak™ (or equivalent aseptic single use items) at cannulation provides items that are needed for prevention of infection (adequate skin preparation, a sterile drape and tourniquet and an appropriate dressing for securing the cannula and protecting the insertion site).

Always wash hands effectively
Never contaminate key parts
Touch non key parts with confidence
Take appropriate infective precautions

Site care

- Loose or moist dressings should be replaced. If a cannula site appears infected, assess the patient for other local and systemic signs of infection, consider removing and resiting the cannula. Document actions taken.
- Peripheral IV cannula should be replaced when clinically indicated only, provided the insertion procedure has taken place aseptically and the skin has been sufficiently decontaminated prior to cannula insertion. A cannula inserted in sub-optimal conditions (e.g. an emergency) should be replaced as soon as practicable, but not longer than 48 hours.
- Dressings must remain dry, intact and clean. Residue of old blood provides a source for contamination and enhanced microbial growth, and dressing changes should occur if key sites are soiled.

Line management

- Hand hygiene and use of aseptic technique at insertion, when accessing and changing lines and when preparing admixes.
- IV lines used for uninterrupted continuous infusions should be changed every 96 hours or coincide with cannula resiting.

Antiseptics

The skin preparation of choice for catheter insertion is a combination 70% isopropyl alcohol and 0.5-2% chlorhexidine gluconate swab/applicator. The combination gives effective skin disinfection with residual antibacterial effect. The area to be disinfected must extend at least 2cm surrounding the intended site of skin puncture. Apply and leave to air dry (approximately 30 seconds).

Chlorhexidine gluconate should be used with awareness of potential chlorhexidine allergy and an alternative used (for example 10% povidone iodine in alcohol) where this is the case (RCN, 2016).

Patient teaching

Explore the patient's experience of the cannulation and the infusion; use this knowledge to:

- explain procedures, ongoing care considerations and limitations to the patient
- encourage their participation in monitoring and reporting possible side effects of cannulation e.g. tenderness, pain, redness, fluid leakage and loose dressings at IV site/s.

Maintaining Standards

- Challenge poor practice when observed. This will avoid unnecessary risk and pain for the patient.
- Be a good role model.

Sharps safety

Needleless access devices are strongly recommended. Do not use needles or non-safety devices if a needleless or needle safety alternative is available. If you have to use a needle, remember:

- needles must only be disposed of in a sharps container
- always take a portable sharps container to the patient's bedside for point of care disposal
- never transport a used needle to a distant sharps container.
- never re-cap the needle
- never attempt to disconnect or tamper with the needle after it has been used – dispose of the needle and syringe as one unit
- do not allow sharps containers to become over full. Change when three quarters full
- a needle stick injury is a reportable event.



STANDARD 4.

INTRAVENOUS THERAPY ADMINISTRATION

The administration of intravenous therapy shall be carried out by authorised personnel in a safe, standardised manner. Patient safety is a paramount consideration in all IV therapy procedures. IV related equipment shall be used in accordance with the manufacturer's guidelines.

Practice Criteria

- The management of fluid and medicine administration should only carried out by health care professionals holding current generic IV and related or Primary care specific therapy certification as specified.
- Health care professionals who have not undertaken generic IV and related or Primary care specific therapy certification or are awaiting certification, will have all aspects of IV therapy carried out under direct supervision of a GP or RN holding current generic IV and related or Primary care specific therapy certification.
- All IV therapy is carried out in accordance with practice or organisational IV therapy Policy and Procedures,
- Where Policy and Procedure documents do not exist for an IV procedure, practice is be based on best practice guidelines identified in current medical/nursing literature.
- If a health care professional decides that it would be inappropriate or unsafe to administer any medicine/fluid as prescribed, that person will not administer the therapy. This decision should be made in conjunction with the prescribing GP. The decision and relevant comments are documented in the patient record.
- The health care professional has a thorough working knowledge of any equipment used in the administration process and has achieved appropriate competencies as required
 - The health care professional is familiar with operating and trouble-shooting administration devices in accordance with manufacturer's instructions.
 - The appropriate equipment for the individual procedure to be undertaken is available and utilised accordingly.

STANDARD 5.

DOCUMENTATION

Documentation in the patient's medical record shall contain complete information regarding IV therapy and vascular access. Documentation shall be legible, accessible to appropriate health care professionals, and readily retrievable. Documentation includes, Patient notes, Medication Charts, Observation Charts or other sources as approved by your organisation.

Practice Criteria

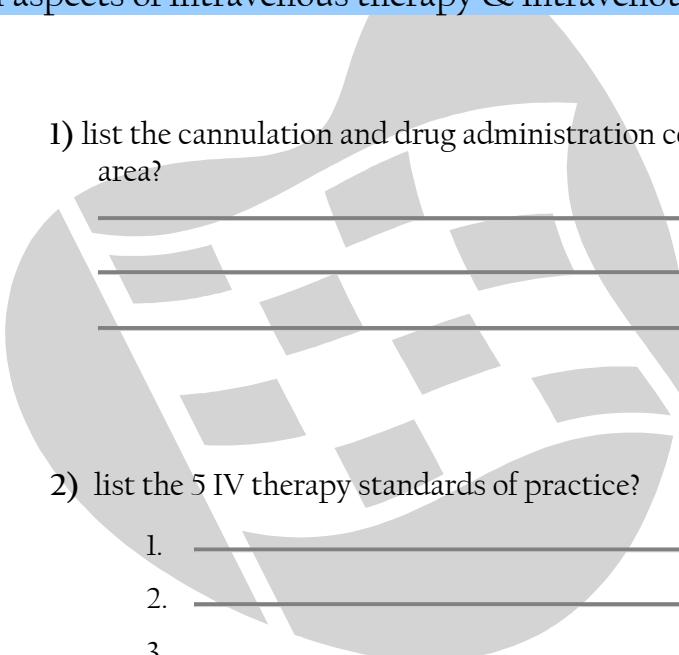
- Documentation should comply with practice or organisational Policy and Procedure documents.
- Documentation should be made by appropriate health care professionals.
- Documentation should include information related to the presence, appearance and function of all IV access devices.
- Documentation should include, but not be limited to, the following:
 - type, length and gauge of vascular access device

- date and time of insertion, number and location of attempts, identification of site, type of dressing, patient’s tolerance of insertion, and identification of the person inserting the device
- site condition and appearance
- care of site
- specific safety or infection prevention and control precautions taken
- patient/guardian or family/whanau participation in and understanding of therapy and procedures
- communication among health care professionals responsible for patient care and monitoring
- type of therapy; drug, dose, route, time, rate and method of administration
- patient’s tolerance of therapy
- pertinent diagnosis, assessment and vital signs
- patient’s response to therapy, symptoms, and/or laboratory test results
- barriers to care or therapy, and/or complications
- discontinuation of therapy, including catheter length and integrity, site appearance, dressing applied, and patient tolerance
- errors/drug incidents shall be recorded as specified in the practice or organisational “Reportable Events” Policy and Procedure document.

LNI sub-regional DHB intravenous therapy ‘Standards of Practice’ are adapted from the Intravenous Nurses Society (INS), Standards of Practice, 2016 and the Royal College of Nursing (RCN), Standards for Infusion Therapy, 2016.

CHECK POINT - SECTION ONE:

legal aspects of intravenous therapy & intravenous therapy standards of practice

- 
- 1) list the cannulation and drug administration certification requirements for your practice area?

- 2) list the 5 IV therapy standards of practice?

1. _____
2. _____
3. _____
4. _____
5. _____

- 3) select one standard and define the practice criteria?

Standard:

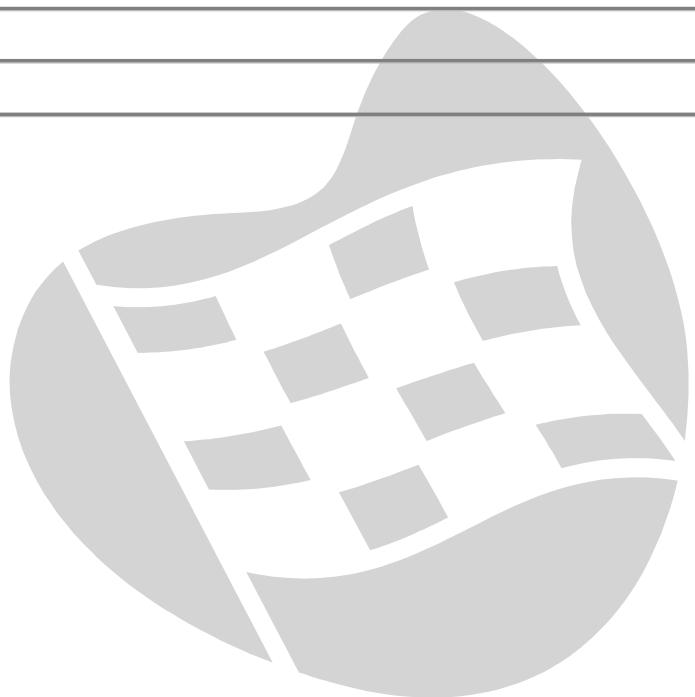
- 4) define the 5 moments for hand hygiene?

1. _____
2. _____
3. _____
4. _____
5. _____

- 5) define 4 essential infection prevention strategies?

1. _____
2. _____
3. _____
4. _____

- 6) define the practice criteria related to documentation for your Primary care area of practice?

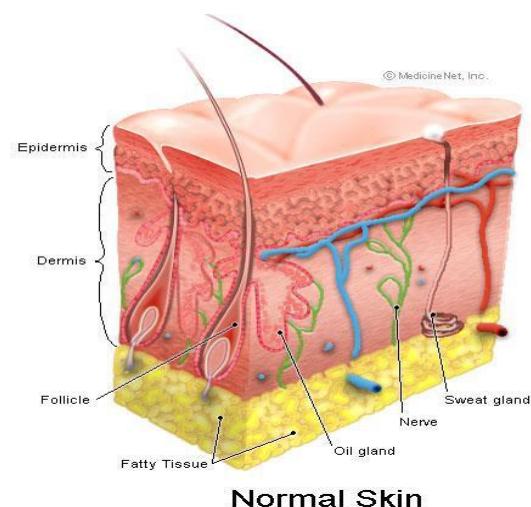


SECTION TWO:

Anatomy and physiology

To initiate IV therapy effectively, the health care professional must have a clinical understanding of the anatomy and physiology of the skin and vascular systems and surrounding structures.

The Skin



The skin is the first organ affected by IV access. It is the body's first line of defense against external pathogens. This initial defense system is breached when vascular access is attempted.

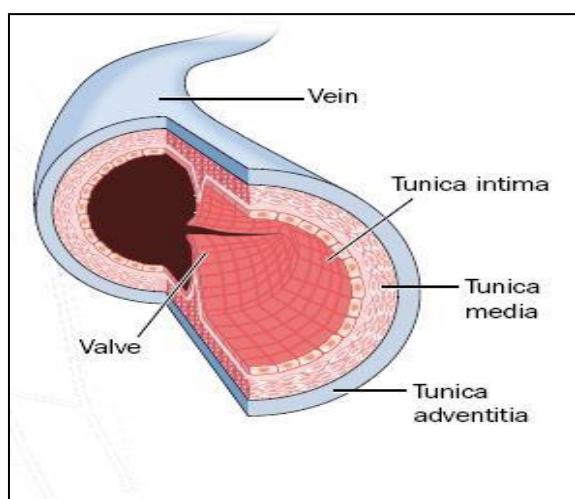
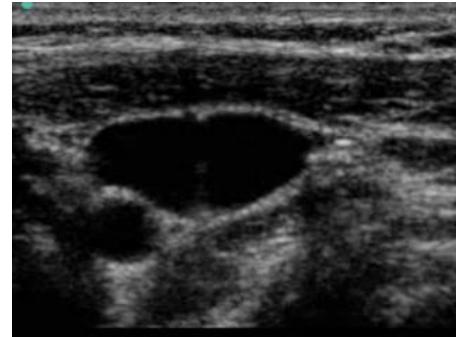
The skin is made up of two layers – the *epidermis* and the *dermis*. The epidermis forms a protective covering for the dermis. The dermis is highly sensitive and vascular. It contains many capillaries and thousands of nerve fibres. Below this lies a *subcutaneous* layer or superficial fascia, providing a covering for blood vessels and connective tissue.

The Veins

The veins are a collecting system of vessels for blood returning from the peripheries to the heart, which are under low pressure. All veins except for the pulmonary veins carry deoxygenated blood and carbon dioxide.

Veins:

- are more superficial than arteries
- have valves
- do not pulsate
- have less fibrous tissue than arteries, making them bouncy and easily compressible.

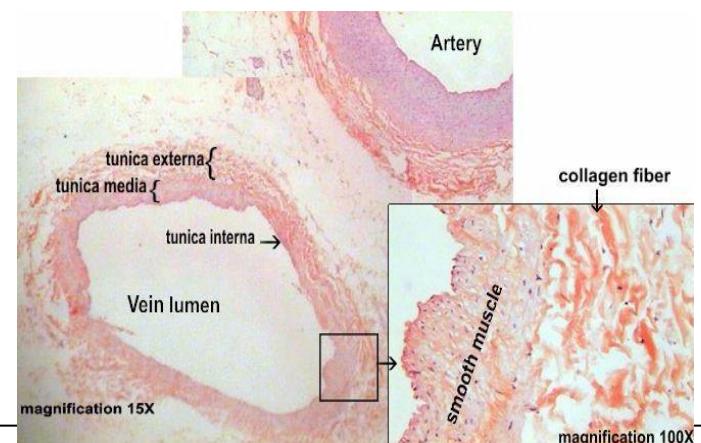


The superficial or cutaneous veins are generally used for peripheral IV access. They are made up of three layers - *tunica interna* (intima), *tunica media* and *tunica externa* (adventitia).

Tunica intima (innermost layer):

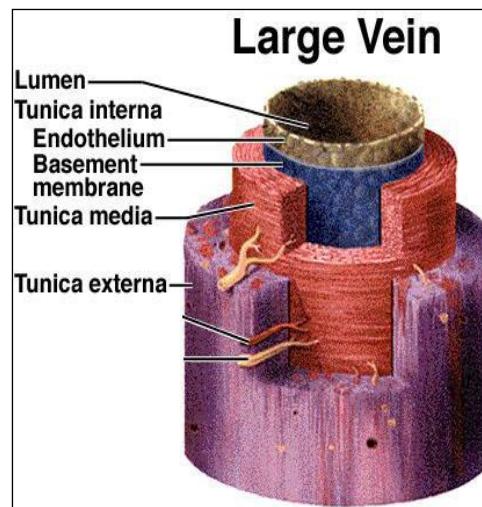
- composed of smooth endothelial cells and sub-endothelial connective tissue
- the smooth surface promotes blood flow by preventing blood cells from adhering to the wall of the vessel
- sensitive to changes in pH
- damage to this lining or presence of foreign material induces an inflammatory response resulting in potential complications i.e. phlebitis, thrombus formation.

Anatomy of a vein



Tunica media (middle layer):

- composed of elastic tissue and smooth muscle
- fibres more prone to collapse
- contains nerve fibres (vasoconstrictors and vasodilators) that can stimulate the vein to constrict or dilate
- vasoconstriction can occur in response to a sudden change in temperature e.g. if infusing cold fluids, or by mechanical or chemical irritation
- stimulation of this layer can cause vasospasm
- vein media thinner than artery media
- patients may feel pain during venepuncture, when the needle penetrates this layer.



Tunica adventitia/externa (outer layer):

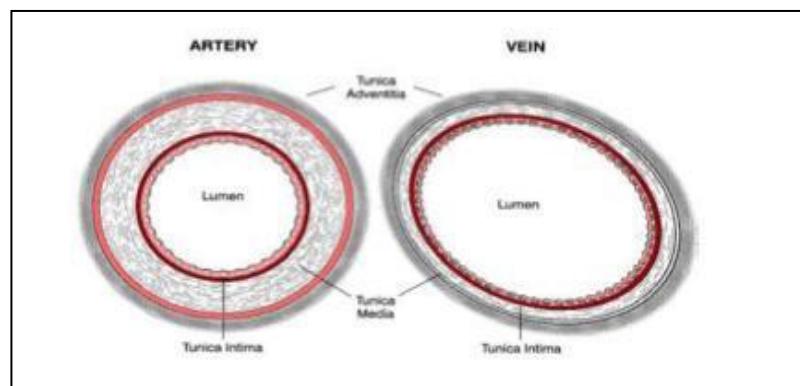
- composed of connective tissue, collagen and nerve fibres
- surrounds, supports and protects the vessel
- blood vessels to the vein are also present in this layer
- a haematoma may be formed if one of the vessels is penetrated.

The arteries

The arteries are the blood vessels that carry oxygenated blood from the lungs to the organs and tissues. All arteries, except the PULMONARY arteries, carry oxygenated (bright red) blood. Arteries supply circulation to a single area. If arterial circulation is impaired through vasospasm or thrombus formation, permanent tissue damage can result.

Arteries:

- have the same three layers as veins
- are thicker and more muscular than veins to enable them to cope with a pulsatile flow of blood under high pressure



- vary in size which is demonstrated by how far away from the heart they lie
- lie deep within the tissues, protected by the muscles
- pulsatile, especially when compressed
- valve-less
- do not collapse except in shock.

Tunica adventitia:

- tough fibrous layer of collagen and elastic fibres that protect the artery, and merge it with the surrounding connective tissue.

Tunica media:

- thick layer of intermingled smooth muscle cells and elastic fibres.

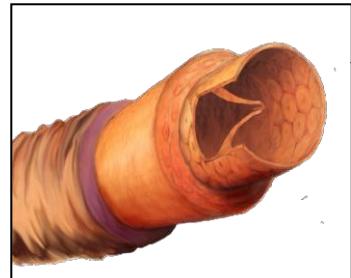
Tunica intima:

- consists of endothelial cells surrounded by a thin layer of elastic tissue
- endothelial cells are flat and line the vessel to promote the smooth continual flow of blood
- release chemical substances involved in the initiation of clotting.

Some patients may have arteries in a more superficial location, not usually found in normal human physiology. This is commonly referred to as an aberrant artery and may increase the risk of arterial puncture. The most important aspect is therefore the correct identification of an artery.

The valves

Valves are semi-lunar projections of tunica intima covered by endothelium and strengthened by collagen elastic fibres.



The valves:

- function is to maintain blood flow toward the heart preventing venous stasis
- occur at sites of venous branching or joining, and occasionally along a straight path
- are particularly important in the lower limbs, where they are most abundant, as venous flow is working against gravity
- most often are found in pairs, but they can also exist as a trio or singular cusp

Large veins in the thoracic and abdominal regions do not have valves and rely on gravity and negative intrathoracic pressure to generate blood flow. Similarly valves are not present in veins <1mm in diameter.

Valves must be avoided when cannulating a patient as they can interfere with:

- advancement of the cannula
- withdrawal of blood due to the suction effect initiating valve closure.

The Venous System

80-90% of all blood volume is contained within the systemic circulation with around 20% of this being arterial, 5% within the capillaries and around 75% within the main systemic, pulmonary and portal venous systems.

The systemic venous system:

- drains blood from all the organs, except for the lungs and gastrointestinal (GI) tract, back to the right atrium
- can be sub-divided into a SUPERFICIAL and DEEP venous systems according to the veins' relationship to the superficial fascia of the body
- superficial veins are in areas where blood is collected near the surfaces of the body and are especially abundant in the limbs
- deep veins are usually enclosed in the same sheath as their corresponding artery.

The pulmonary venous system:

- drains de-oxygenated blood from the heart to the lungs for oxygenation.

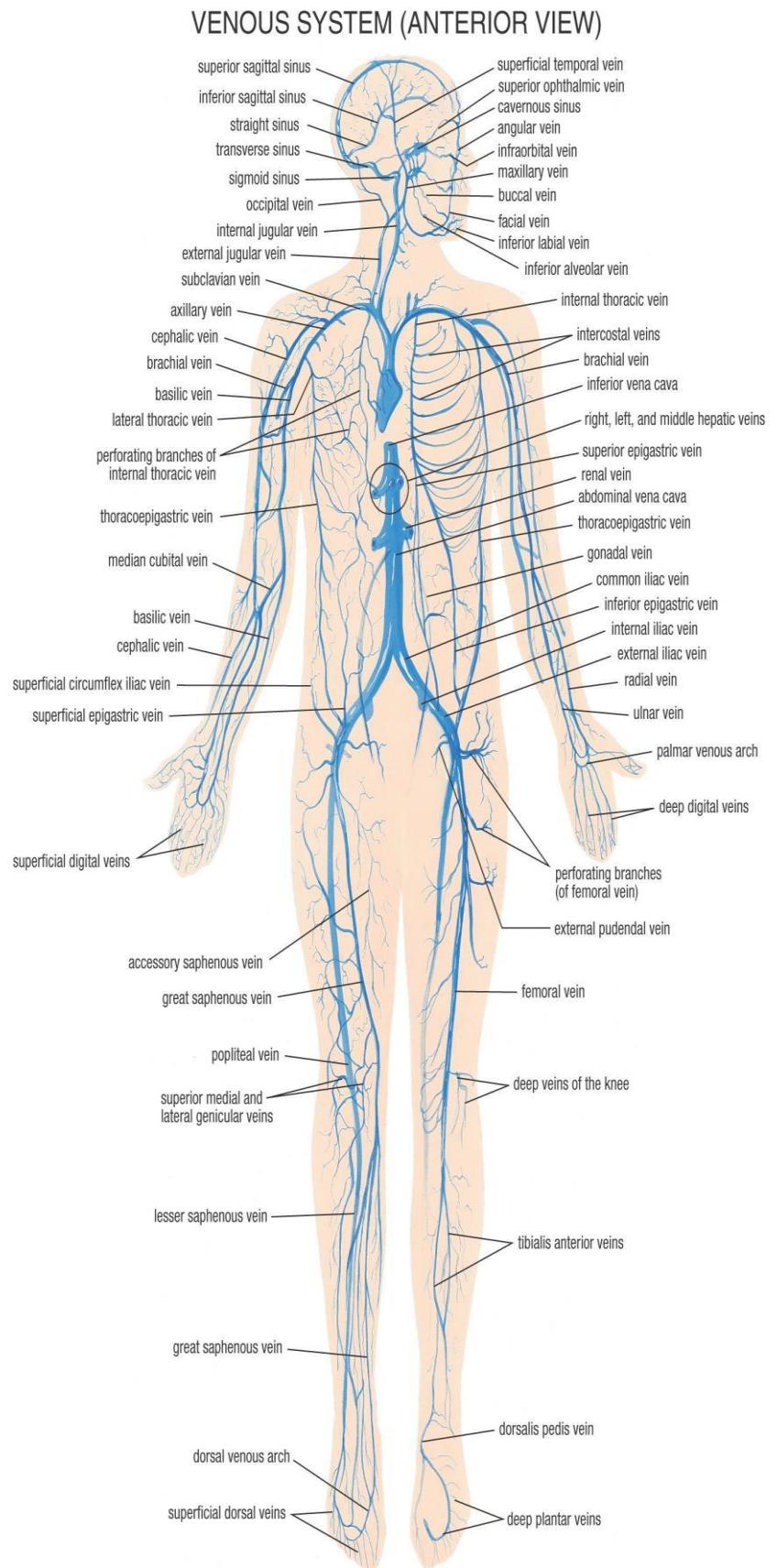
The portal venous system:

- drains blood from the GI tract between the gastro-oesophageal junction and the recto-anal junction, and carries it to the liver
- blood then drains into the systemic system via the hepatic veins.

All veins, except for the superficial systemic veins, have a similar pattern of distribution as arteries eg femoral vein and artery, carotid artery and internal jugular vein (external jugular is a superficial vein).

Several factors influence venous flow. Flow towards the heart is brought about by muscular contraction and the negative intrathoracic pressures generated during inspiration.

Systemic variations in venous pressure and flow will cause changes in the diameter of veins due to contraction and relaxation of the muscle layer in the tunica media. This response is mediated



by the sympathetic nervous system. Afferent nerve fibres running within the tunica adventitia mediate a sensation of pain associated with vein trauma.

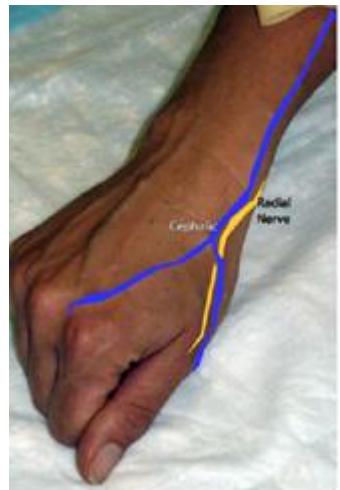
The veins, because of their abundance and location, present the most readily accessible route for venepuncture. Through knowledge of the structure and position of superficial veins, the health care professional acquires a sense of discrimination in the choice of veins for cannulation.

Nerves

It is important to remember that there is a network of nerves close to most major veins.

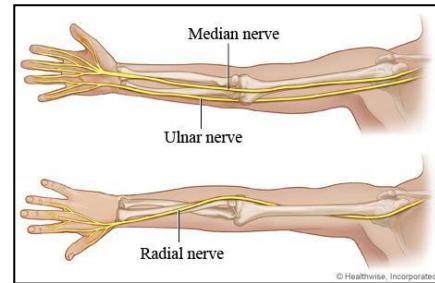
Nerve damage can occur as a result of:

- inadvertent puncture during cannulation
- compression due to haematoma or infiltration
- prodding with the cannula to find a vein.



Particular care should be taken when cannulating the following areas:

- the dorsum (back) of the hand, there are a great number of nerve-endings in this region
- the inner aspect of the wrist should be avoided within a 5 cm radius due to potential damage to the radial, median, and ulnar nerves
- the cephalic vein on the side of the wrist
 - proximity of this vein to the superficial branch of the radial nerve may increase the incidence of nerve injury.



VEIN SELECTION

Main area of choice is between the wrist and antecubital fossa (acf) using the Cephalic, Median cubital, and Basilic veins. The upper arm should be avoided where possible as it reduces the ability to use veins in the lower arm later if extravasation or phlebitis occurs.

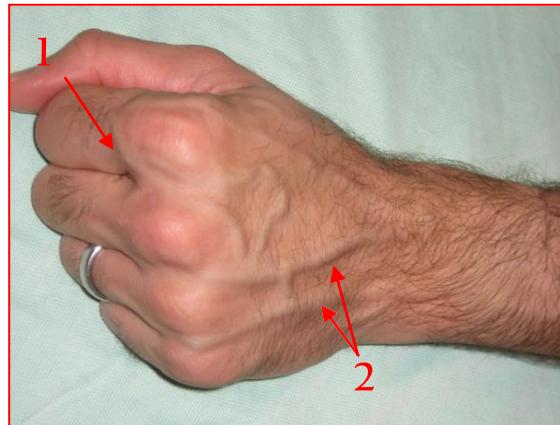
The main superficial veins of the arm used in cannulation are the:

- digital veins
- metacarpal veins
- dorsal venous arch vein
- cephalic vein
- basilic vein
- antebiarmial vein
- antecubital veins

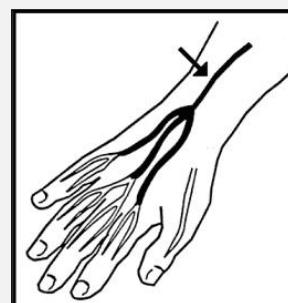
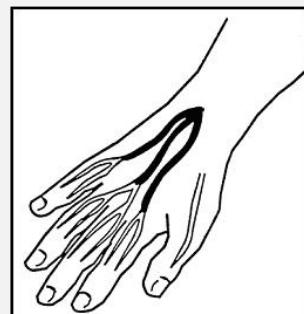
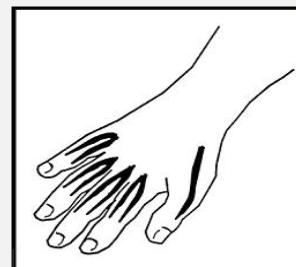
Do not use veins of the lower extremities unless absolutely necessary due to risk of tissue damage, thrombophlebitis, and ulceration (INS, 2016).

Metacarpal Veins

Veins that should be considered for peripheral cannulation are those found on the dorsal and ventral surfaces of the upper extremities, including the metacarpal, cephalic, and basilic and median veins (INS, 2016). Care must be taken to find a vein that is straight and will accept the entire length of the cannula. The following list of veins can be identified by the corresponding number in the hand diagram. The back of the hand may be used but cannulation in this region will have a limited life span and can be more uncomfortable.



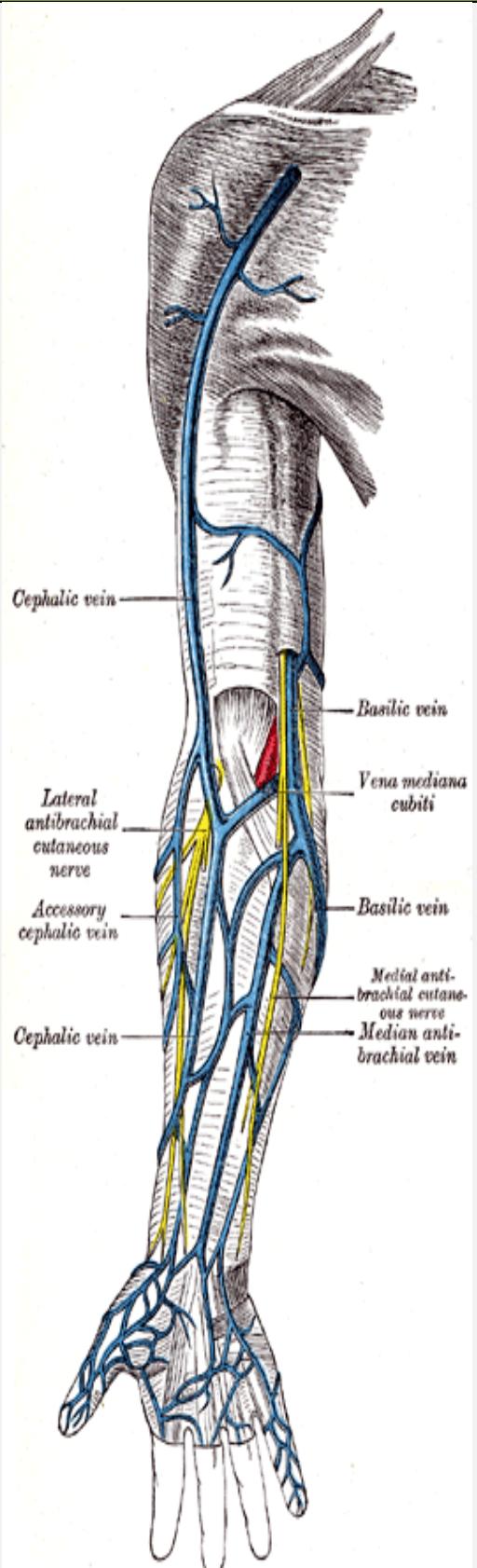
Location/Characteristics	Clinical considerations
1) Dorsal digital veins: <ul style="list-style-type: none"> found along the distal and lateral portions of the fingers and thumb small & fragile. 	<ul style="list-style-type: none"> last resort cannula site, due to risk of mechanical phlebitis and infiltration short term use only to be cannulated only by an expert clinician if used, must be immobilized by utilizing a finger splint.
2) Dorsal metacarpal veins: <ul style="list-style-type: none"> between the metacarpal bones on the back of the hand formed by the union of the distal veins superficial veins usually of good size and easily visualised. 	<ul style="list-style-type: none"> good site to start IV therapy for some patients insertion can be painful because of nerve endings can accommodate 20-24g cannula tip of cannula should not extend over wrist joint cannula should lie flat on the back of hand hub of cannula should not extend over knuckles use with caution for vesicant medication/fluids.
3) Dorsal venous network: <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 20-24g cannula angulation of the vein may deter choice of site avoid placement over the wrist/ulnar bony prominence which can cause mechanical phlebitis or dislodgement use with caution for vesicant medication/fluids.



Veins of the forearm

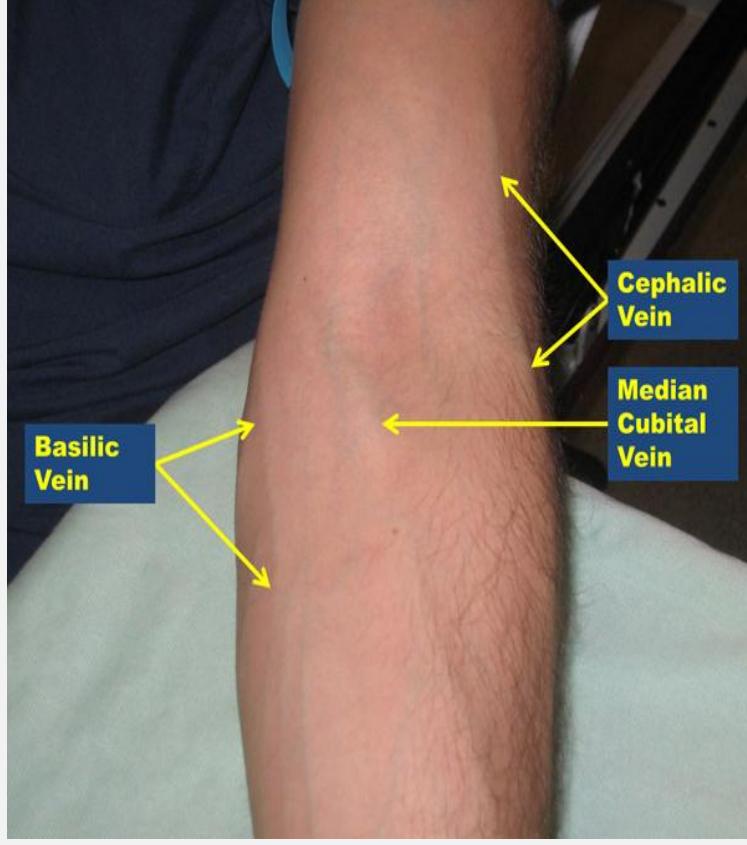
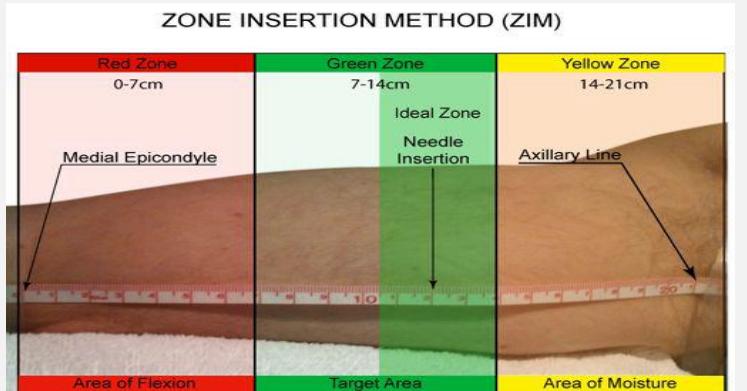
Preferred locations for cannulation as they are away from flexion areas and bony prominences.

Location/Characteristics	Clinical Considerations
Cephalic vein: <ul style="list-style-type: none"> lies along lateral (thumb) side of the forearm and runs along the radius runs the entire length of the arm from wrist to shoulder large vein size, easy to access 	<ul style="list-style-type: none"> excellent choice for cannulation accommodates 16-24g cannula can be visualised above the acf does not impair mobility unless placed over an area of flexion acceptable size for infusing chemically irritating solutions and blood products should not be used for patients that require arteriovenous fistula formation disadvantages - runs parallel with the radial nerve, so cannulation should be performed 5 or more centimetres proximal to the wrist, not at the wrist.
Accessory cephalic vein: <ul style="list-style-type: none"> branches off the cephalic vein located on the top of the forearm medium to large size. 	<ul style="list-style-type: none"> easily stabilized accommodates 18-24g cannula avoid cannula tip placement at joint articulation.
Basilic vein: <ul style="list-style-type: none"> lies along the medial (little finger) aspect of upper forearm runs the entire length of the arm from the wrist to axilla usually large and easy to visualise. 	<ul style="list-style-type: none"> can accommodate 16-24g cannula often overlooked as vein rotates around the arm and is a difficult to immobilize success can be achieved by placing the patients arm across their chest and approaching from the opposite side of the bed or by laying the arm along the side of the body and rotating inwards 90°.
Median antebrachial vein: <ul style="list-style-type: none"> arises from the palm of the hand, flow upward in the centre of the underside of the forearm medium size and easy to visualise. 	<ul style="list-style-type: none"> accommodates 20-24g cannula may be difficult to palpate tendons run in parallel not used as a first choice because it can be painful due to close proximity to the nerve.
Median cubital Vein: <ul style="list-style-type: none"> lies in antecubital fossa (acf) large vein easily visualized 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 14-24g cannula limited use for short peripheral cannula due to joint articulation, limits to patient mobility and difficulty detecting infiltration complications at this site make use of veins distally contraindicated due to the risk of extravasation.



Veins of the antecubital fossa

Veins in this area are for limited/short term use for short peripheral cannulation due to joint articulation, limit to patient mobility and predisposition to mechanical phlebitis and infiltration.

Location/Characteristics	Clinical Considerations
Cephalic Vein: <ul style="list-style-type: none"> A continuation of the vein upward from the antero-lateral aspect of the forearm onto the antero-lateral aspect of the arm over the biceps muscle. From here it passes up to the deltoid muscle where, at a variable point, it passes through the superficial fascia to join the brachial vein to form the axillary vein. 	
Median Cubital Vein: <ul style="list-style-type: none"> there may be more than one 'median' vein in the antecubital fossa. They are formed by the convergence and divergence of branches of the 3 forearm veins. 	
Basilic Vein <ul style="list-style-type: none"> a continuation of the vein from the antero-medial aspect of the forearm. It may pierce the superficial fascia in the antecubital fossa and join the deep veins to form the brachial vein or it may traverse the antecubital fossa and pierce the fascia at a variable point on the medial aspect of the arm. 	<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 complications at this site make use of veins distally contraindicated due to the risk of extravasation ultrasound guided temporary peripheral vascular access is gained via the upper arm just above the flexion point of the acf peripherally inserted central catheter (PICC) access is gained using ultrasound guidance via the upper arm in the ideal (green) zone 7-14cm above the flexion point of the acf. <p style="text-align: center;">ZONE INSERTION METHOD (ZIM)</p> 

SECTION THREE:

cannulation

Peripheral IV cannulation is considered a high risk intervention and as such must be recorded appropriately to ensure patient safety and quality outcomes of care.

INDICATIONS

Common indications for the insertion of a peripheral intravenous cannula in primary care include:

- medication administration
- management of fluid balance
- management of electrolyte imbalances
- venous access in emergency situations.

PREPARATION

Consent

- Introduce yourself to the patient and obtain consent.
- Explain the intended therapy outlining:
 - the need for therapy
 - medications, fluids to be infused
 - probable duration of therapy
 - how the patient might feel
 - possible related complications
 - probable consequences if therapy not given.
- Respond to queries and concerns.
- Obtain verbal consent. *Note: the patient has the right to refuse treatment. In these situations, full documentation of the patients' reasons should be made.*

Informed consent is obtained from the legal guardian or next of kin if the patient does not have the cognitive ability to understand or make an informed decision.

If the patient does not speak English, arrangements should be made to ensure the procedure is understood and the consent is valid.

Adequate information that the patient understands should minimise the patient anticipatory fear and anxiety. This will help reduce the autonomic nervous system response and reduce contraction of the veins, which makes visualisation difficult.

Clinical Assessment

A thorough clinical assessment should be carried out by the health care professional prior to the peripheral IV cannulation additionally taking in to consideration device selection.

A four step approach to the clinical assessment is outlined as follows:

Check

- The indication for peripheral intravenous cannulation. If IV medication or fluids could be given by any other route. Purpose, duration and rate of the intravenous infusion.
- Type of intravenous fluid or medication to be administered via the vein.
- The clinical condition (acute/chronic/emergency) of the patient.
- Other medical conditions (e.g.: presence of AV fistula).
- The insertion area should be warm prior to cannulation procedure (veins constrict if cold, making the procedure more difficult).
- Allergies to medications, dressings or plasters.
- For needle phobia.
- Patient preference and level of activity.
- Use of non-dominant arm where possible.
- Previous history of difficult peripheral intravenous cannulation procedures.
- For history of blood borne viruses, bleeding disorders or if receiving anticoagulation therapy.

Choose - Vein Selection

Vein selection should be carried out prior to setting up for cannulation. This is so that when the tourniquet is applied for cannulation the inserter goes straight for the site previously identified, preventing patient discomfort by leaving the tourniquet on too long whilst finding a vein.

- Vein selection should begin distally and work proximally:
 - metacarpal.
 - dorsal venous arch.
 - cephalic.
 - basilic.
 - antecubital veins – usually reserved for venous blood sampling, access in emergencies or when high flow and dilution is required short term, as indicated.
 - digital – short term only, used only as a last resort.
 - median antebrachial – superficial vein, used only as last resort.
- Identify long, straight veins; easily palpable, easily visualised.
- Ensure safe locations, avoiding arteries and nerves.
- Apply a tourniquet 10-15cm above the intended site; check radial pulse; apply tight enough to distend vein without occluding arterial flow. Apply for 1-2 minutes only.
- Encourage venous filling by:
 - lightly Tapping/stroking the vein (distal to proximal)
 - asking the patient to gently open and close their fist
 - lowering the extremity below heart level
 - applying a warm compress or immersing the limb into a bowl of warm water for 5 to 10 minutes prior to the procedure.
- Ensure the patient is relaxed. Veins are more likely to go into spasm during IV

- cannulation if the patient is anxious or distressed
- A tourniquet should not be used with:
 - fragile veins
 - distended veins.
- Stabilise vein with thumb/finger prior to attempting cannulation.

Only a skilled health care professional should perform a venepuncture on an anxious or distressed patient with limited and/or difficult veins.

Hair on the arm, that will prevent adhesion of the transparent dressing, needs to be removed. Hair is best removed with clippers. Shaving is not recommended.

Avoid

- hard, sclerosed, fibrosed, knotty, thrombosed veins or previous cannulation sites
- areas with increased subcutaneous fat
- sites with existing IV infusions in situ
- valves in the vein (if visible or palpable).

Do Not Use

- areas of lymphoedema, points of flexion, infected areas, presence of an AV fistula, at or distal to bruised areas or site of infiltration or phlebitis, broken/damaged skin, sclerosed/thrombosed veins, the side of a mastectomy/surgical procedure, fracture etc.
- cannulation of the lower extremities (legs) should be a last resort and only performed by experienced health care professionals.

Patient comfort and environment

Ensure:

- the patient is warm and comfortable
- constrictive clothing is removed
- good lighting to promote easy visualization.

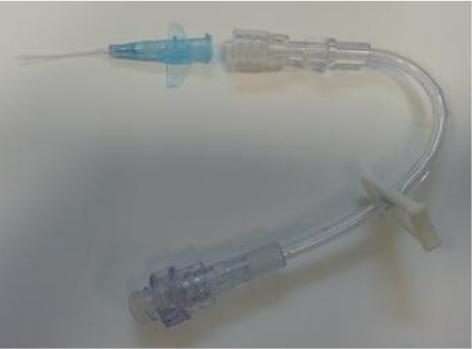
Assemble Equipment

Collect all the equipment needed for IV cannulation before going to the bedside to:

- eliminate the need to leave the patient until the procedure is completed
- avoid breaks in asepsis
- promote confidence in the health care professional.

Equipment:

Recommended cannula set up by application table

Cannula set up options –	Indications/considerations/benefits for configurations
<p>• 1 of the following set ups should be chosen*</p> <p>1. Closed IV cannula system with a pre-attached extension set and needleless access bung</p> 	<ul style="list-style-type: none">• can be used for any IV access requirements• allows multiple use and reduced trauma to the insertion site caused by manipulation of the cannula when being accessed• pre-attached extension set limits manipulation and opportunity for system contamination on insertion• the extension set has an integral clamp which allows for the device to be locked under positive pressure and prevent negative reflux of blood into the cannula during syringe disconnection• bloodless system reduces operator blood and body fluid exposure• system does not need to be primed prior to insertion.
<p>2. Straight cannula system with an attachable IV catheter extension set and needleless access bung</p> 	<ul style="list-style-type: none">• can be used for any IV access requirements• allows multiple use and reduced trauma to the insertion site caused by manipulation of the cannula when being accessed• the extension set has an integral clamp which allows for the device to be locked under positive pressure and prevent negative reflux of blood into the cannula during syringe disconnection• requires cannula and extension set manipulation and opportunity for system contamination on insertion• blood and body fluid exposure on insertion during connection• needs to be primed prior to insertion.
<p>3. Straight cannula system with an attachable needleless access bung</p> 	<ul style="list-style-type: none">• recommended for single use requirements only• trauma will occur at the insertion site during manipulation of the cannula when being accessed• no ability to lock the device under positive pressure and prevent negative reflux of blood into the cannula during syringe disconnection• requires cannula manipulation and opportunity for system contamination on insertion• blood and body fluid exposure on insertion during connection with needleless access bung.

*Pictures are examples of provider system configurations only and are not being promoted for purchase.

IV Starter Pack (can be substituted for appropriate sterile individual equipment) this includes:

sterile drape	2% chlorhexidine and 70% alcohol swab/applicator stick
gauze swabs	occlusive, transparent split dressing with securement strips
line label	label for patients notes (attached to front of pack)
	disposable latex free tourniquet

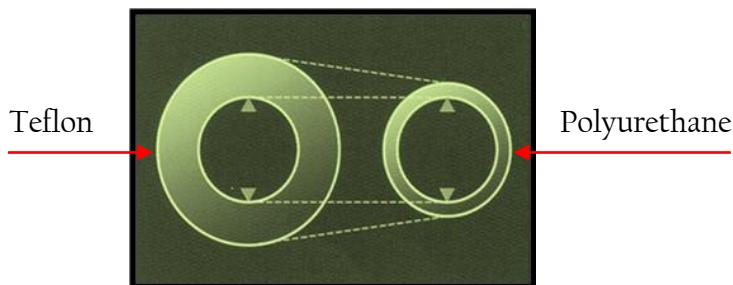
Other equipment items as indicated:

5 or 10ml leur lock syringe and 5 or 10mls 0.9% sodium chloride ampoule <u>or</u> a 10 ml pre-filled saline syringe	sharps container for point of care disposal
non-sterile gloves	cleaned working surface i.e. trolley or tray

CANNULA SELECTION

Cannula Material

Cannula material can vary depending on the products available. The two main materials used are teflon and polyurethane. Polyurethane is a more robust material which means that the cannula wall is thinner therefore the channel in which the fluid travels through the cannula can be the same size as a larger teflon cannula.



BD cannulas are most commonly used in lower north island DHBs. BD cannulas are made of Vialon Biomaterial- a unique polyurethane.

Vialon offers:

- reduced cannula related complications
- a smoother surface which reduces cannula drag upon insertion
- reduced formation of cannula-related thrombosis during indwelling periods.

Once inside the vein, the cannula softens, which reduces irritation to the intima (the inner lining) of the vein. This softening capability allows the cannula to conform to the natural lie of the vessel, resulting in less pressure to the vessel walls and reducing the risk of vessel wall irritation.

Cannula size

Cannula diameter is expressed by gauge. The larger the number the smaller the internal lumen diameter.

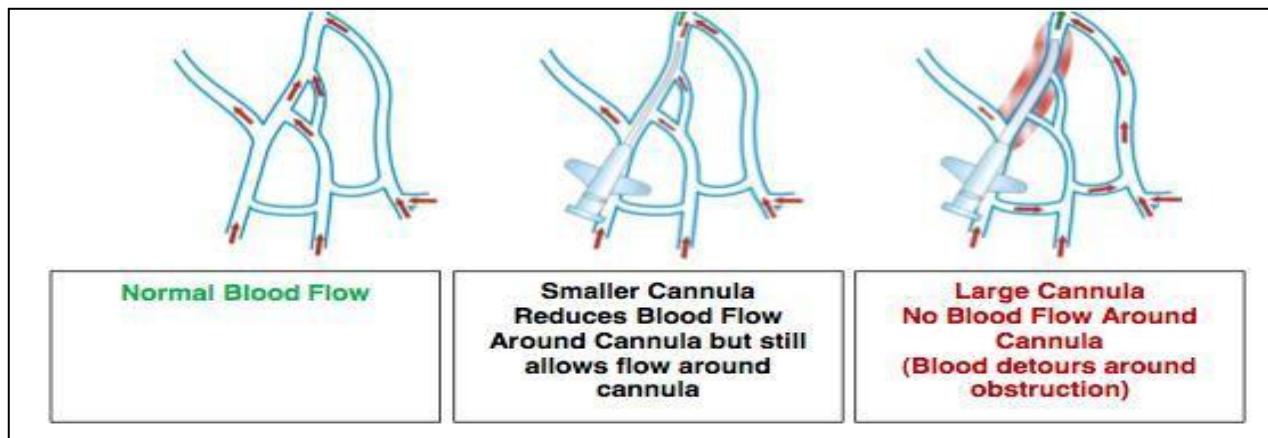
A selection of cannula should be available on the trolley or tray to take to the bedside. The decision on cannula length and gauge may change and when examining the condition of the patient's veins. A clean cannula is needed for every attempt at cannulation.

Cannula selection by indication.

Colour	Size/Gauge	Common applications	Flow rate
Orange	14G	Rapid transfusion of whole blood.	330 mls/min
Grey	16G	Rapid transfusion of whole blood or blood components.	215-220 mls/min
Green	18G	Surgical and other patients receiving blood components and large fluid volumes.	94-105 mls/min
Pink	20G	Patients receiving up to 2-3 litres per day, patients on long term medication.	55-64 mls/min
Blue	22G	Patients on longer term medication, oncology patients, paediatric patients, adults with small veins. Suitable for IV contrast injection <3 ml/second.	36 mls/min
Yellow	24G	Paediatric patients, neonates, elderly patients with particularly fragile veins.	24 mls/min

Factors influencing selection of cannula and site:

Studies show that the vein size to cannula size ratio is of critical importance with respect to the development of thrombi. Therefore, always use the smallest size cannula possible to adequately deliver the desired therapy. A smaller cannula will permit a higher blood flow around the cannula thus improving the haemodilution of the fluids and drugs administered. Improved haemodilution will reduce the damaging effect of irritant solutions on the intima of the vein. Similarly, the degree of mechanical irritation and insertion trauma is minimised by the use of a smaller gauge.



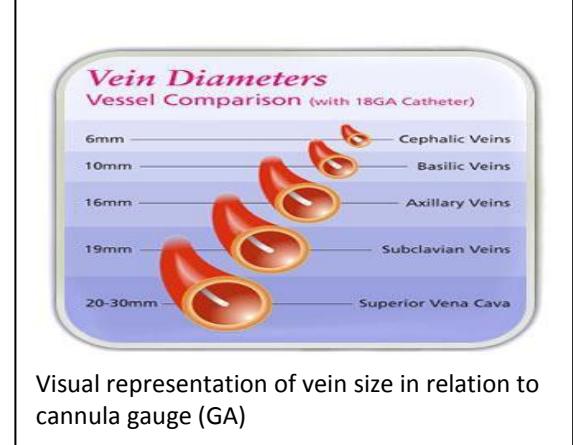
An extension set is required to reduce trauma to the insertion site caused by manipulation of the cannula when being accessed. This helps prolong the patency of the device.

An exception to this would be a cannula inserted for short term/single use in which case a needleless access bung could be directly applied to the cannula hub e.g. in emergency situations.

Estimated vein flow rates per minute

Vessel flow rates:

- Digital – 10 ml/min
- Forearm – 20-40 ml/min
- Basilic – 90-150 ml/min
- Axillary – 150-350 ml/min
- Subclavian – 350-800 ml/min
- SVC – 2000 ml/min



Difficult venous access

Many factors must be considered as they will contribute to difficulties in vascular access. The *venous access assessment score* below provides health care professionals with a tool to identify those patients who may pose difficulty for venous access.

VENOUS ACCESS ASSESSMENT SCORE:		
*Score 1 point for each box □ checked		
Diagnosis	<input type="checkbox"/> Sepsis <input type="checkbox"/> Osteomyelitis <input type="checkbox"/> Endocarditis <input type="checkbox"/> Wound infection/cellulitis <input type="checkbox"/> Trauma <input type="checkbox"/> Pancreatitis <input type="checkbox"/> Bowel disorders <input type="checkbox"/> Hyperemesis	
Predisposing conditions	<input type="checkbox"/> Diabetes <input type="checkbox"/> Steroid dependence <input type="checkbox"/> Obesity <input type="checkbox"/> Drug abuse <input type="checkbox"/> Coagulopathies <input type="checkbox"/> Renal disease <input type="checkbox"/> Heart failure <input type="checkbox"/> Peripheral vascular disease	
Medications	<input type="checkbox"/> Medications with a pH <5 or >9 <input type="checkbox"/> Vesicant or irritant medication >2 doses <input type="checkbox"/> Infusions with osmolarity >900 mOsm/l	
Duration of therapy	<input type="checkbox"/> 5 days or more	
Limited venous access	<input type="checkbox"/> Age less than 4 <input type="checkbox"/> Age greater than 70 <input type="checkbox"/> Only 1 extremity available	
Diagnostic Testing	<input type="checkbox"/> Daily labs for 6 days or more <input type="checkbox"/> Serial CT Scans ordered	
Venous considerations	<input type="checkbox"/> > 2 PIV device failures in 24 hours <input type="checkbox"/> > 3 IV attempts in 24 hours <input type="checkbox"/> > 2 PICCs in past 12 months <input type="checkbox"/> Previous chemotherapy	
Add totals:		
Score of 3 or more		
<ul style="list-style-type: none"> ▪ Patient is a candidate for further clinical assessment attempting peripheral IV access may be inappropriate. 		

The peripheral IV cannula

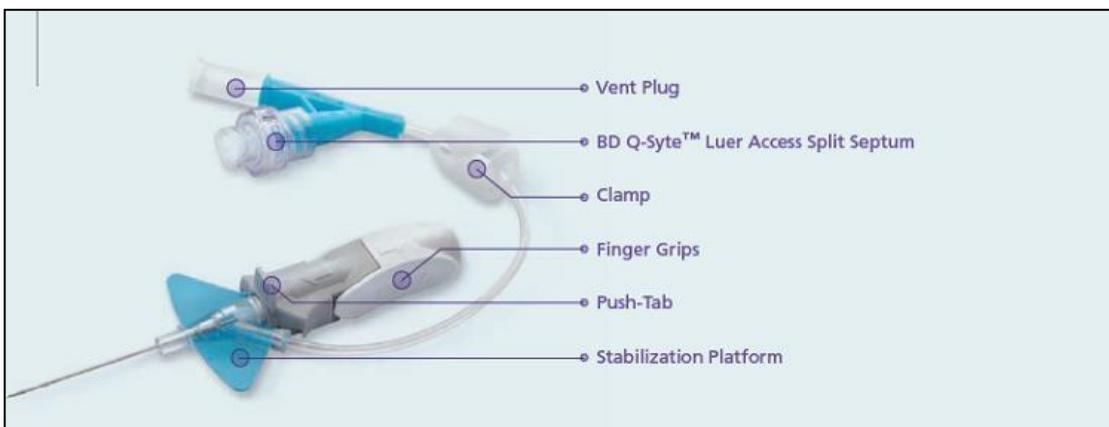
A peripheral cannula is defined as one that is less than or equal to 3 inches (7.5cm) in length. Peripheral cannulae should be selected for short term therapy of 3–5 days and for bolus injections or short infusions in the outpatient/day unit setting (RCN, 2016).

Peripheral intravenous safety cannula

An ‘over-the-needle’ catheter that consists of a needle (stylet) and catheter sheath. The point of the needle extends beyond the tip of the catheter. After venipuncture, the needle is retracted into the protective shield using a sheathing technology. This safety technology has been proven to effectively safeguard healthcare workers from accidental cannulation related needle stick injuries. Where available and not clinically contraindicated use safety equipped cannulation equipment.

Point to practice with the selected BD Nexiva cannula is as follows, page 38.

BD Nexiva cannula pictured



Bevel	The distal tip of the needle/stylet. The first part to enter the skin.
Needle/Stylet	The introducer needle that punctures the skin but is removed when the vein is correctly cannulated.
Hub	Colour coded indicator of the gauge of the catheter.
Catheter	Flexible tube which remains in the vein.
Flashback Chamber	Blood return will be seen here when the vein is cannulated. Fingers should be on the flashback chamber during cannulation.
Vent plug	The proximal end of the catheter; allows flashback to occur.

STANDARD CANNULA INSERTION TECHNIQUE

The peripheral IV cannulation procedure follows basic aseptic principles. Procedural hand hygiene is required and the use of non-sterile, clean gloves.

An aseptic non-touch technique should be used when inserting a peripheral IV cannula. This means that the following key parts must only be touched by sterile items:

- all parts of the cannula except the outer protective shield and outer housing section
- tip of the leur lock cap

- tips of extension set (if used)
- tip of syringe
- shaft and tips of needle used for flush
- section of gauze that is in contact with cannula
- side of dressing in contact with cannula.

A maximum of two attempts should be made by any one health care professional before seeking a more experienced inserter to complete the task.

- collect the appropriate equipment, inspect it's integrity and check expiry dates
- perform hand hygiene
- prepare equipment – prime extension set
- ensure a sharps container is easily accessible at patient's side
- position patient - put support under patient's arm if required
- perform hand hygiene
- apply tourniquet 10 to 15cm above intended insertion site
- put on non-sterile gloves keeping them as uncontaminated as possible, especially the thumb/fingers (these gloves cannot be put on as one would normally don sterile gloves)
- palpate proposed site to re-locate vein
- cleanse skin with >0.5% chlorhexidine gluconate and 70% alcohol swab/stick - clean away from site in a circular motion, ensuring some friction is applied to the skin surfaces, covering an area slightly larger than the dressing to be applied
- allow skin to dry
- immobilize vein with thumb/finger
- insert stylet/cannula at 10/30° angle with the bevel up
- watch for blood return into flashback chamber to indicate vein puncture
- lower flash-back chamber until level with skin
- advance the whole unit approximately 5mm into vein
- hold/stabilise the stylet and advance only the cannula into vein
- release tourniquet
- apply gentle pressure over the vein distal to the cannula tip to stop bleeding – required if using an open hub, straight cannula
- retract/remove stylet and place directly into sharps container (this disposal includes sharps safety devices)
- attach primed extension set with previously attached needleless access bung or needleless access bung alone if required and hold to prevent accidental removal of cannula
- secure cannula with securement strip (see following picture, pg. 47)
- flush the cannula with 0.9% sodium chloride after aspirating a small amount of blood in the system to confirm correct placement
- apply transparent dressing

- further secure extension set to patient with 2nd securement strip
- apply dressing label indicating – date, time, gauge of cannula and name of inserter
- dispose of equipment and perform hand hygiene
- update patients clinical notes including the information on the dressing label and the site of the cannula placement
- update patient's clinical notes including the site of the cannula placement and any other relevant details.

ACRONYM

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

<u>BLASTS</u>	
B	Blood return
L	Level off the cannula
A	Advance the whole device slightly
S	Slide the cannula over the stylet until it is flush with the skin
T	Tourniquet removal
S	Stylet/needle removal

CANNULA INSERTION CAREBUNDLE

PERIPHERAL INTRAVENOUS CANNULA - INSERTION CAREBUNDLE

Hand hygiene

- compliance with the 5 moments of hand hygiene
- hands decontaminated before clean glove application

Personal protective equipment

- clean gloves applied immediately prior to insertion
- plastic apron applied if indicated

Skin preparation

- 2% chlorhexidine gluconate in 70% isopropyl alcohol is applied and allowed to dry
- if patient sensitivity, use 10% povidone-iodine
- if indicated, hair is removed using clippers (not shaven) to improve dressing adherence

Aseptic technique

- compliance with aseptic non-touch technique
- a new sterile cannula for all cannulation attempts
- a single use latex free tourniquet

Dressing

- a sterile, semi-permeable, transparent dressing is applied allowing observation of insertion site

Practice

- no more than two attempts at insertion by the same health care professional when alternative clinical support is available
- fluid administration containers, tubing and connectors must be replaced when a new PIVC is inserted

Documentation

- date, catheter size, reason for insertion, location and operator undertaking insertion
- number of attempts if more than one and any associated complications

Safety

- where available and not clinically contraindicated use safety equipped cannulation equipment
- sharps container for point of care disposal.

BD Nexiva™ Closed IV Catheter System

Points to Practise

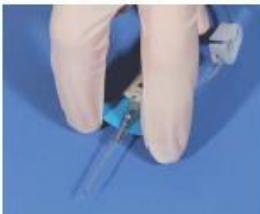


Stage 1 Insertion

BD Nexiva™ accommodates a variety of grip techniques, so hold as preferred



Ported technique



Winged technique



Straight technique



Insert needle into vein as normal.



Look for initial flashback along the cannula.



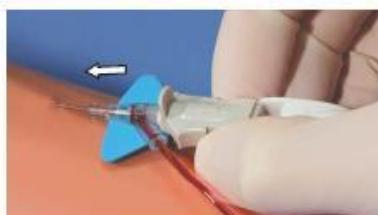
Lower the device and advance the entire system slightly (approx 2mm) to ensure cannula tip is inside the vein.



Note continued flashback along the extension tube confirming vein entry.

Stage 2 Advancement

Advance the cannula into the vein using your preferred technique. Then release tourniquet before proceeding further.



Hooded technique



One handed technique



Two handed feed off technique

Stage 3 Needle removal



Place one finger on the wing and one on the needle safety shield. Pull back needle until audible click is heard.



Remove finger from needle safety shield, but continue to support wing and withdraw needle fully until the needle separates from the cannula hub. Dispose of needle into a nearby sharps container.

Stage 4 Dressing

Apply your preferred dressing as shown, ensuring the rear septum is covered.

If dressing is supplied with securing strips, you may use one to secure extension tubing.



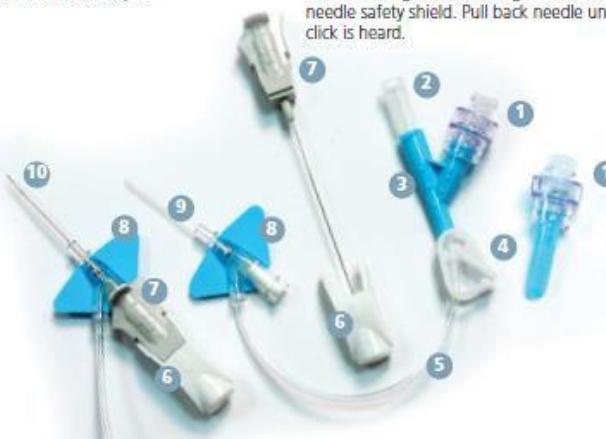
BD Veca-CTM dressing



Ported dressing



Non-ported dressing



BD Nexiva™ Closed IV Catheter System

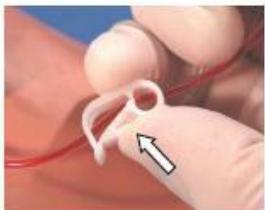
Points to Practise



Stage 5 Preparation for Use



Y-Type Version



Stopcock Version



Engage pinch clamp or turn tap to **OFF** position.



Remove vent plug.



Attach flushing syringe and disengage pinch clamp or turn tap to **ON** position. Then flush as normal.



IMPORTANT

To avoid catheter reflux, maintain pressure when flushing complete...



...and at the same time re-engage pinch clamp or turn tap to **OFF** position prior to disconnecting



Attach white end cap or other needlefree device or administration set.
Your BD Nexiva™ is now ready for use.

Stage 6 Care and Maintenance

Flushing the BD Q-Syte™ Closed Luer Access



Disinfect access port with an appropriate cleaning agent. Allow to dry.



Attach syringe until secure.
Do not over-tighten or push luer too far into device.



Flush until clear using pulsating technique to generate turbulent flow.



Partially withdraw the syringe half a turn and flush again to clear the device fully.



To avoid catheter reflux, maintain syringe pressure when flushing complete...



... and at the same time re-engage pinch clamp or turn tap to **OFF** position prior to disconnecting.

BD Insyte™ Autoguard™ BC

WITH BLOOD CONTROL TECHNOLOGY

POINTS TO PRACTISE & TIPS FOR SUCCESS

- Safety IV cannula designed to reduce blood exposure and needlestick injury
- Blood control technology designed to restrict blood flow from the cannula hub once, at insertion



- Holding the cannula hub, rotate the barrel 360°
- Make sure the push tab is facing upwards and the cannula is seated back in the notch



- Stabilise the vessel and perform the venipuncture
- Look at the cannula for initial blood return (20-24 G), then in the flash chamber behind the white button
 - In 18 G and larger, blood return will only be in the flash chamber



- Once you see blood return, lower the cannula angle and advance the entire cannula and needle unit slightly to ensure the cannula tip and not just the needle tip is within the vessel
- Whilst still stabilising the vessel, push the cannula off the needle and into the vessel. Avoid pulling the needle out



- Release the tourniquet
- Gently stabilise the cannula hub
- Push the white button to retract the needle
- It is not necessary to occlude the vessel as blood flow will be restricted until a secure luer connection is made and permanently opens the septum

CONNECTION

- Connect any accessory devices and flush or begin the infusion
- Blood flow will be restricted until a secure luer connection is made
- Once a luer connection is made, the fluid path is permanently open
- Disconnection of the luer requires vessel compression to prevent blood leakage

STABILISATION

- Stabilise the cannula and apply a sterile dressing according to your policy and procedure

Refer to package insert for complete instructions for use

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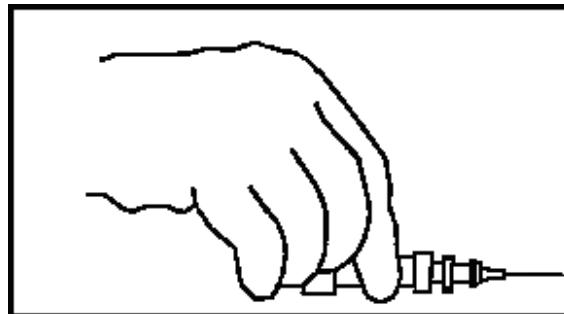


Australia: Becton Dickinson Pty Ltd,
4 Research Park Drive, Macquarie University
Research Park, North Ryde, NSW 2113.
Toll Free telephone: 1800 656 100.

New Zealand: Becton Dickinson Limited,
8 Pacific Rise, Mt Wellington, Auckland.
Toll Free telephone: 0800 572 468.

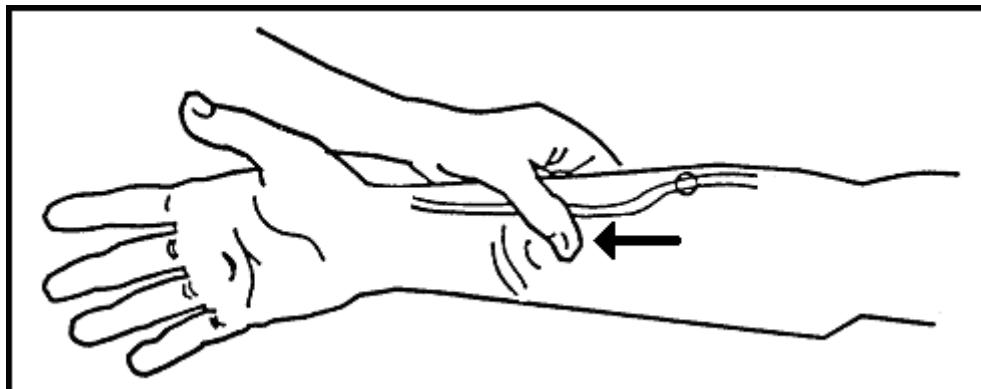
PRACTICE POINTS

Holding the cannula.



- Hold the cannula horizontal with hand on top of the device. This way the proper entry angle is ensured and allows maximum flexibility of wrist when inserting the device.
- Bevel is always up.
- Fingers should be on the flashback chamber - not on the hub.
- Fingers must be even with line of the cannula.
- Never hold cannula like a “dart”. This may cause the inserter to go through the skin and through the back wall of the vein.

Skin Retraction



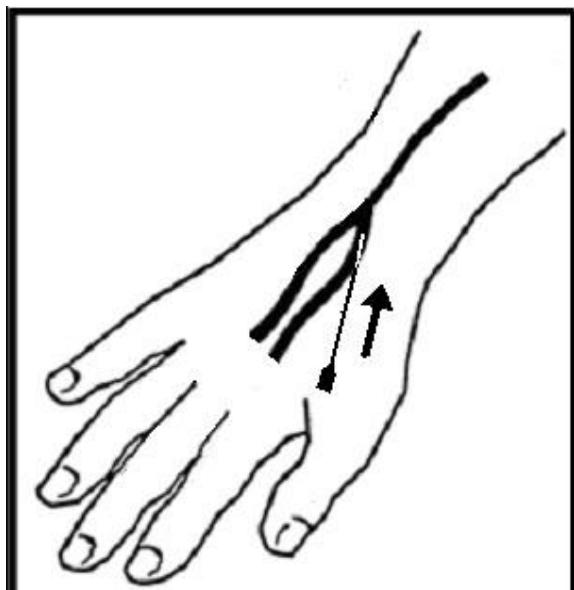
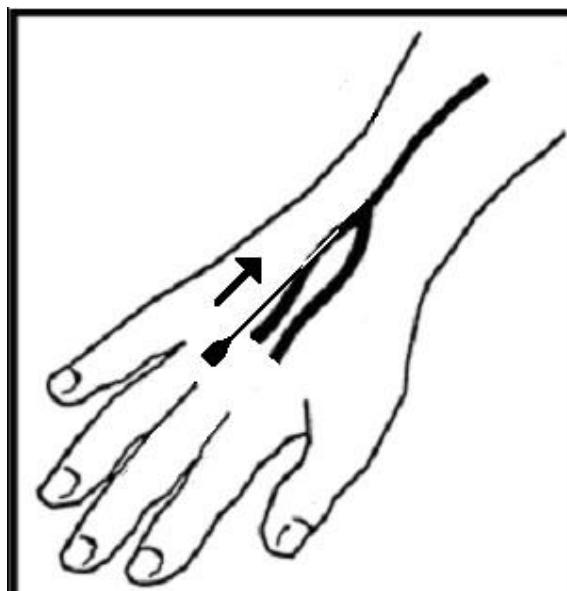
- Anchor the vein by tightly pulling the skin downward.
- Non-cannulating thumb should be placed three inches below the intended insertion site.
- Anchor the vein in place by pulling tightly on the skin in a downward motion.

How to Approach a Vein

There are four ways to approach a vein. No matter which method you use, the cannula should enter the skin at such an angle that the needle punctures the vein wall and enters the lumen without piercing the opposite wall.

1) Approaching the vein from the top.

Insert the cannula depending on vein depth. Veins that can be visualised and palpated are superficial ($0-5^\circ$ angle). Veins that can only be palpated and not visualised are deep. There is a layer of fascia or fat between the skin and the vein ($10-15^\circ$ angle). Take care not to insert too far into the lumen, or it may penetrate the back wall.

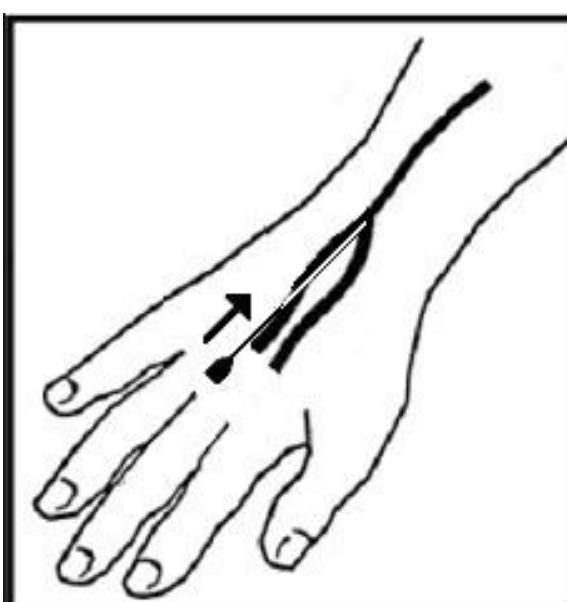


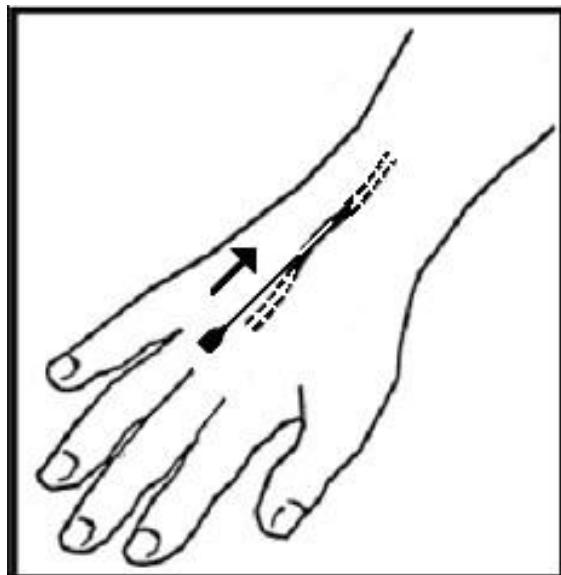
2) Approaching the vein from the side.

Position the cannula tip adjacent to the vein, aimed toward it. This method, which is preferred if you've injected a local anaesthetic, reduces the risk of piercing the vein's back wall. Useful on small, sclerosed or hard to visualise veins.

3) Approaching below a bifurcation.

A bifurcated vein looks like an inverted V. Insert the cannula about 1cm below the bifurcation, then tunnel it into the vein at the V. The vein is more stable and less likely to roll. This approach prevents you from entering the vein at too steep an angle and reduces trauma.





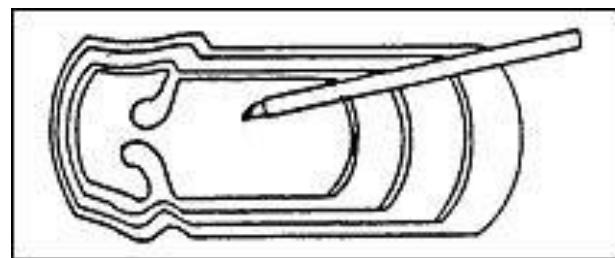
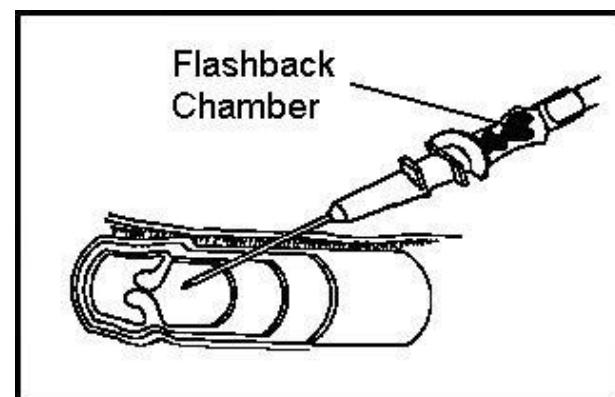
4) Approaching a palpable vein visible for only a short segment.

Insert the cannula about 1cm in front of the vein's visible segment, and then tunnel the cannula through the tissue to enter the vein. Helpful for deeper tissues, where you can't see or feel it. Tunnelling may reduce trauma to the vein wall on insertion.

Cannula Placement

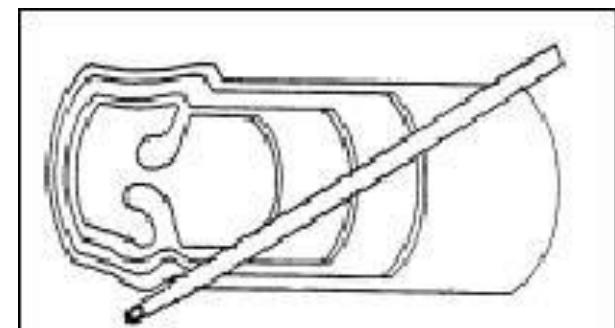
Flashback on Vein Access

- Pulling the skin tightly in a downward action, insert the cannula in one quick motion through the skin and into the vein.
- When the vein is accessed correctly, a blood return will appear in the flashback chamber of the cannula (wait for the appearance of blood).



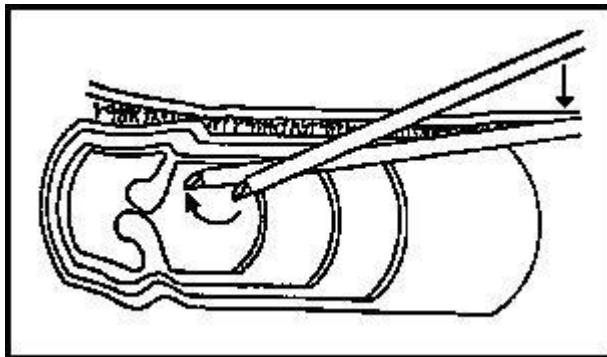
Vein Access

- The vein is correctly accessed when both the stylet and the tip of the cannula pass through the tunica intima, into the inner lumen of the vein.



Cannula advanced too far

- Excessive pressure applied on the device during insertion can result in the stylet and cannula going into the lumen of the vein, continuing on and passing through the back wall of the vein, thereby causing a haematoma to form. Remove the device. Cannulate in a new location.

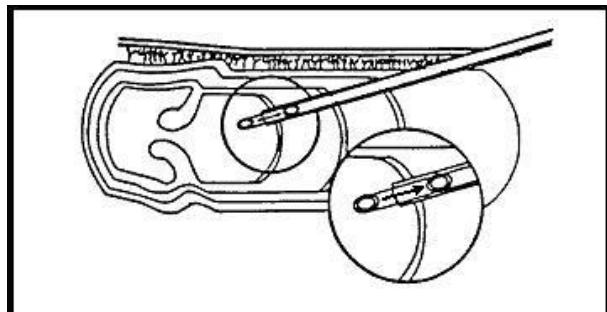
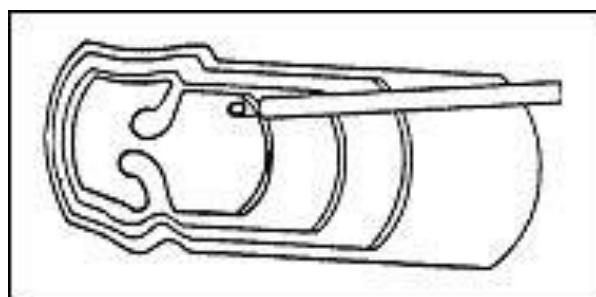


Leveling off the Cannula

- When blood return is obtained, level off the entry angle of the cannula by lowering the flashback chamber flat onto the skin.
- While retracting the skin, advance the cannula slightly (-5mm), keeping the needle/stylet stationary.

Vein not Accessed

- If the needle/stylet is removed before the cannula tip enters the inner lumen of the vein, the cannula will be difficult to advance. There might also be no blood return in the flashback chamber. Remove the device and recannulate in a new location.



Needle/Stylet Removal

- Remove the tourniquet.
- Hold the hub with the non-cannulating hand, and withdraw the stylet.
- Discard stylet into Sharps container.
- Attach primed extension set to the cannula.
- Never reinsert the stylet into the cannula while the vascular access device is in the patient. This can cause catheter tip shearing, possibly leading to catheter emboli.



TIPS FOR SUCCESS

SHARP INSERTION:

- > Keep the stabilization platform and finger grips pushed together.
- > DO NOT insert holding only onto the stabilization platform as this will push the needle back into the catheter.
- > Avoid holding in a manner that pushes against the stabilization platform.

EASY VESSEL ACCESS:

- > Look for initial blood return in the catheter near the insertion site.
- > Lower and slightly advance the entire system to ensure the catheter tip is within the vessel.
- > Look for continuous blood flow along the extension tubing to confirm you are still in the vessel.

SMOOTH CATHETER ADVANCEMENT:

- > Push the catheter forward off the needle rather than pulling the needle back.
- > Use the pad of your index finger and not your fingernail behind the push tab.
- > Push down and forward against the push tab.

SIMPLE NEEDLE SHIELD REMOVAL:

- > Pushing down gently on the stabilization platform, pull back on the finger grips until the needle shield releases.
- > Do not touch the push tab during needle removal.

BLOOD CONTAINMENT:

- > Clamp the extension tubing before replacing the vent plug.
- > Secure the vent plug and the BD Q-Syte™ Luer Access Split Septum device before insertion.

EASY SYSTEM ACCESS:

- > Insert the male luer into the BD Q-Syte device using a straight-on approach.
- > Clamp BEFORE disconnecting the flush syringe.
- > Hold bottom of BD Q-Syte device when removing the syringe or tubing during disconnection.
- > Use a straight-off approach when removing the male luer.



Cannula securement

Poor cannula securement can lead to movement which may result in phlebitis, infiltration, extravasation, infection and premature device failure. It is important to secure the cannula well to prevent complications. This can be done with a special adhesive dressing. Care should be taken to avoid the insertion site. If the device is located over a joint (this should be avoided where possible) the joint should be immobilised with a splint to prevent cannula movement and dislodgement.

The cannula site is dressed with a transparent moisture permeable dressing - from the IV Starter pack. The dressing must fully occlude the cannula insertion site (wound) up to but not over the junction between the cannula hub and the needle less access bung or extension. Place the notch of the dressing over the hub and seal around the cannula by gently pressing down on the dressing. Do not obscure the insertion wound or obstruct venous flow when taping.

- Dressings must be labeled with date, gauge of cannula inserted, time of insertion and practitioner's name.
- Dressing can remain in situ as long as the integrity of the dressing is maintained and the insertion site is clean and dry.
- Do not stack dressings, or allow dressings to overlap.
- Check dressing frequently to assure adhesion of dressing especially after bathing, showering, or if the dressing and cannula site becomes wet. Loss of adhesion can occur, potentially resulting in cannula dislodgement and loss of medicationflow.
- If the dressing comes off, evaluate to ensure proper cannula placement, and then apply a new dressing. As with all adhesive products, apply and remove carefully from sensitive or fragile skin.

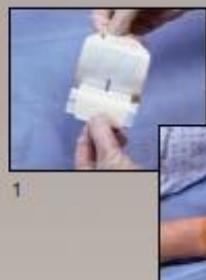
To remove the dressing lift and stretch the edges away from the cannula maintaining stability of the cannula with non-dominant hand. This causes the dressing to lift from the outside edge so preventing trauma to the patient's skin, and the vein.

DIRECTIONS FOR APPLICATION OF TEGADERM 1633 DRESSING - FOR EFFECTIVE CANNULA SECUREMENT

3M™ Tegaderm™ I.V. Transparent Dressing

1633 - The clear choice for superior site protection and catheter security

Application Instructions



1. & **2.** Peel off the center card with the tape strips.



3. Remove tape strip from card. Apply sterile tape strip to secure hub (*optional*).



4. Peel the back off the dressing.



5. Position the dressing so the deepest part of the notch rests just below the Luer-lok connection; the clear part of the dressing covers the insertion site.



6. Press the **clear** part of dressing into place.



7. To create a seal and hub cushion, slightly overlap the soft cloth tabs under the hub and then press into place.



8. While slowly peeling off the paper border, smooth down the dressing edge. Next, smooth down dressing from center toward the edges.



9. Use sterile tape strip to secure hub, lumens, and/or tubing.



10. Label dressing according to protocol.

3M Health Care

**DIRECTIONS FOR APPLICATION OF SMITH&NEPHEW IV3000 CANNULA DRESSING -
FOR EFFECTIVE CANNULA SECUREMENT**



IV3000 Application

IV3000 Ported 7cm x 9cm

Suitable for dressing peripheral catheters

Step A



Clean and thoroughly dry the application area.
First remove section 1 from the rounded end of the dressing.
This contains 2 strips and a date label.

Step B



The strips can be used on the catheter wings or body for improved security, to secure tubing or to stabilise catheter lumens.
Remove the backing paper marked 2.

Step C



Position the dressing over the catheter port.
Remove the backing papers marked 3 from the non woven sections and adhere over the catheter wings.

Step D



Using the tab, gently peel off the top carrier marked 4.

Step E



Mould the film around the catheter, ensuring that the dressing is secure and the patient is comfortable.
Finally place the date label from section 1 on the skin or the dressing (without obscuring the view of the catheter site).



Removal

Gently peel back the non-woven wings to the point at which they reach the film section (stabilising the patient's skin and catheter with the other hand).
Take one corner of the film and gently pull parallel to the skin. Release and repeat the process.

INSERTION TROUBLESHOOTING

Problems	Possible Cause	Corrective Action
Missed the vein.	<ul style="list-style-type: none"> Catheter was not inserted on top of the vein. Poor visualisation of site. Vein moved due to inadequate anchoring. 	<ul style="list-style-type: none"> Insert the catheter directly on top of the vein. Reposition yourself to ensure accurate visualisation of the vein. Re-anchor the vein and maintain traction on the vein until the catheter is completely inserted. Too much traction on the vein can cause it to flatten.
Haematoma with insertion. 	<ul style="list-style-type: none"> Insertion angle too great. Too much force with insertion. Failure to lower the angle after entering the vein causing trauma to the posterior wall. Fragile veins due to age, medical condition, steroid use etc. Catheter too large. Rough threading of cannula. 	<ul style="list-style-type: none"> Decrease angle of insertion. Decrease amount of force with insertion to avoid puncturing the posterior wall of the vein. Lower the angle after entering the vein. Choose the best possible vein with a good blood volume. Use a smaller catheter. Use a smooth threading to prevent injury to the intima.
Paper thin transparent skin.	<ul style="list-style-type: none"> Age. Medicine e.g. steroids. 	<ul style="list-style-type: none"> Use smallest catheter possible e.g. 22 gauge. Use pressure and warm compress to distend. Apply minimal tourniquet pressure. Decrease angle of entry.
Unable to palpate or visualise veins.	<ul style="list-style-type: none"> Obese patient. Dehydrated patient. 	<ul style="list-style-type: none"> Create a visual image of venous anatomy. Select a longer catheter (e.g. 1.88 inch).

Problems	Possible Cause	Corrective Action
Catheter enters the vein but won't thread in.	<ul style="list-style-type: none"> Sclerosed vein. Resistance from a closed valve. Wrong angle. Catheter too large for vein. During separation, the introducer was withdrawn too far. Catheter trapped between tunica adventitia and tunica media layers. 	<ul style="list-style-type: none"> Remove the catheter and choose a larger vein. Remove the introducer. Concurrently administer a flush of sodium chloride 0.9% and advance the catheter. Pull back the catheter slightly. Lower the angle and advance again. Use a smaller catheter. Ensure introducer remains under the skin after separation so that the catheter can be guided into the vein. Advance the introducer slightly before advancing the catheter.

INSERTION COMPLICATIONS

Nerve injury

Nerve injury is an inadvertent injury to the nerve.

Probable Causes

- inappropriate selection of the cannulation site
- poor technique.

Signs and Symptoms

- pain described as an 'electrical shock' or a 'pins and needles' sensation
- loss of mobility or reluctance to move the affected limb.

Prevention

- appropriate clinical assessment
- appropriate site selection
- skilled technique.

Treatment

- release the tourniquet, remove the cannula and apply gentle pressure
- explain and reassure the patient about what has occurred

- advise that any symptoms of altered sensation may persist for a few hours
- arrange a medical review, if required
- monitor, treat as prescribed and document in the patients clinical record
- finally, report the occurrence of this complication, as per organisational policy.

Arterial Puncture

The inadvertent puncture of the artery.

Probable Causes

- inappropriate selection of the cannulation site
- poor technique.

Signs and Symptoms

- presence of bright red blood
- expressions of pain.

Prevention

- appropriate clinical assessment
- appropriate site selection
- skilled technique.

Treatment

- release the tourniquet, removing the cannula immediately and apply pressure until haemostasis has been achieved
- explain and reassure regarding what has happened
- request that the patient seeks medical advice if bleeding recurs from the puncture site, if pain continues or if there is increasing swelling or bruising
- arrange a GP review
- monitor, treat as prescribed and document in the patient notes
- report the occurrence of this complication, as per organisational policy.

Embolism

An embolism is an air bubble, fat particle or blood clot which can move through the circulation, causing a blockage in a vein.

Probable Causes

- an embolism occurs when an air bubble, fat particle, or blood clot becomes detached and is carried by the venous flow to the heart and potentially into the pulmonary circulation.

Signs and Symptoms

- pain

- shortness of breath
- collapse
- shock.

Prevention

- embolism can be prevented by stopping air from entering the system, ensuring that all connections are secure, careful flushing and by securing the cannula adequately.

Treatment

- seek urgent GP assistance

Haematoma

The localised collection of blood in tissue due to a break in the wall of a blood vessel.

Probable Causes

- patient susceptibility (e.g. receiving anticoagulant medicines, steroids, clotting disorder).
- poor cannulation technique (e.g. inserting needle through vein, excessive trauma to IV site at time of insertion).
- trauma to IV site post insertion.

Prevention

- be aware of possible medical condition/treatment that might increase the risk of bleeding
- skilled cannula insertion
- prevention of trauma to injection site post insertion.

Signs and Symptoms

- discolouration of tissue at IV site, oedema, bleeding from injection site
- site swelling and discomfort.

Intervention

- observe if superficial & no further bleeding
- if active bleeding:
 - discontinue IV
 - remove cannula
 - apply pressure with sterile gauze for approximately 2-5 minutes
- document in patient's notes
- inform GP.

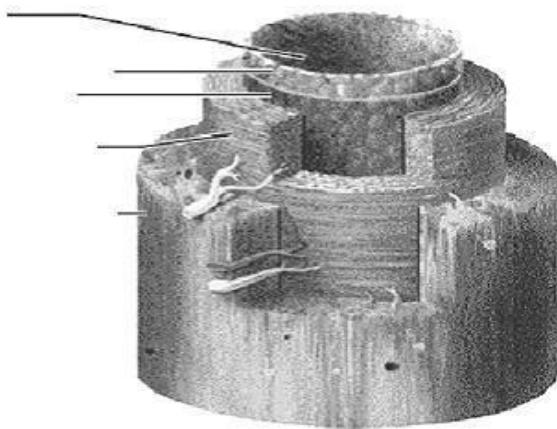
CHECK POINTS - SECTION TWO & THREE:

Anatomy & Physiology and Cannulation

- 1) Name the two main layers of the skin and their function

a. _____

- 2) Name on the diagram below, the three main layers of the vein and indicate their functions

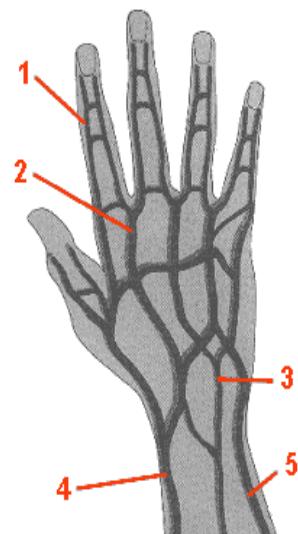


- 3) List 4 differences between arteries and veins below

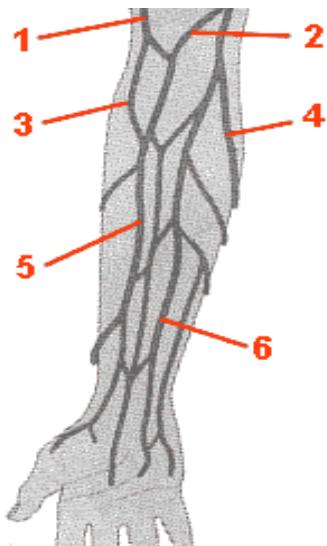
Arteries	Veins

- 4) Use the diagram of the superficial veins of the hand to identify each vein by number in the table below

Vein	Number
Cephalic	1
Dorsal Venous Arch	2
Basilic	3
Metacarpal	4
Digital	5



- 5) Use the diagram of the superficial veins of the arm to identify each vein by number in the table below



Vein	Number
Cephalic (upper arm)	1
Basilic	2
Cephalic (lower arm)	3
Median antebrachial	4
Accessory Cephalic	5
Median cubital	6

- 6) Fill in the gaps:

The _____ vein is located along the radial bone, (thumb side) and crosses the antecubital fossa.

The _____ vein is located along the ulna bone (little finger side)

The _____ veins are used primarily for phlebotomy and peripherally inserted central catheter (PICC) placement.

7) List four indications for cannula insertion:

1. _____
2. _____
3. _____
4. _____

8) List four main sources of cannula related infection:

1. _____
2. _____
3. _____
4. _____

9) List three ways to assist venous distension (other than applying a tourniquet):

1. _____
2. _____
3. _____

10) Give two situations where the use of a tourniquet would be discouraged:

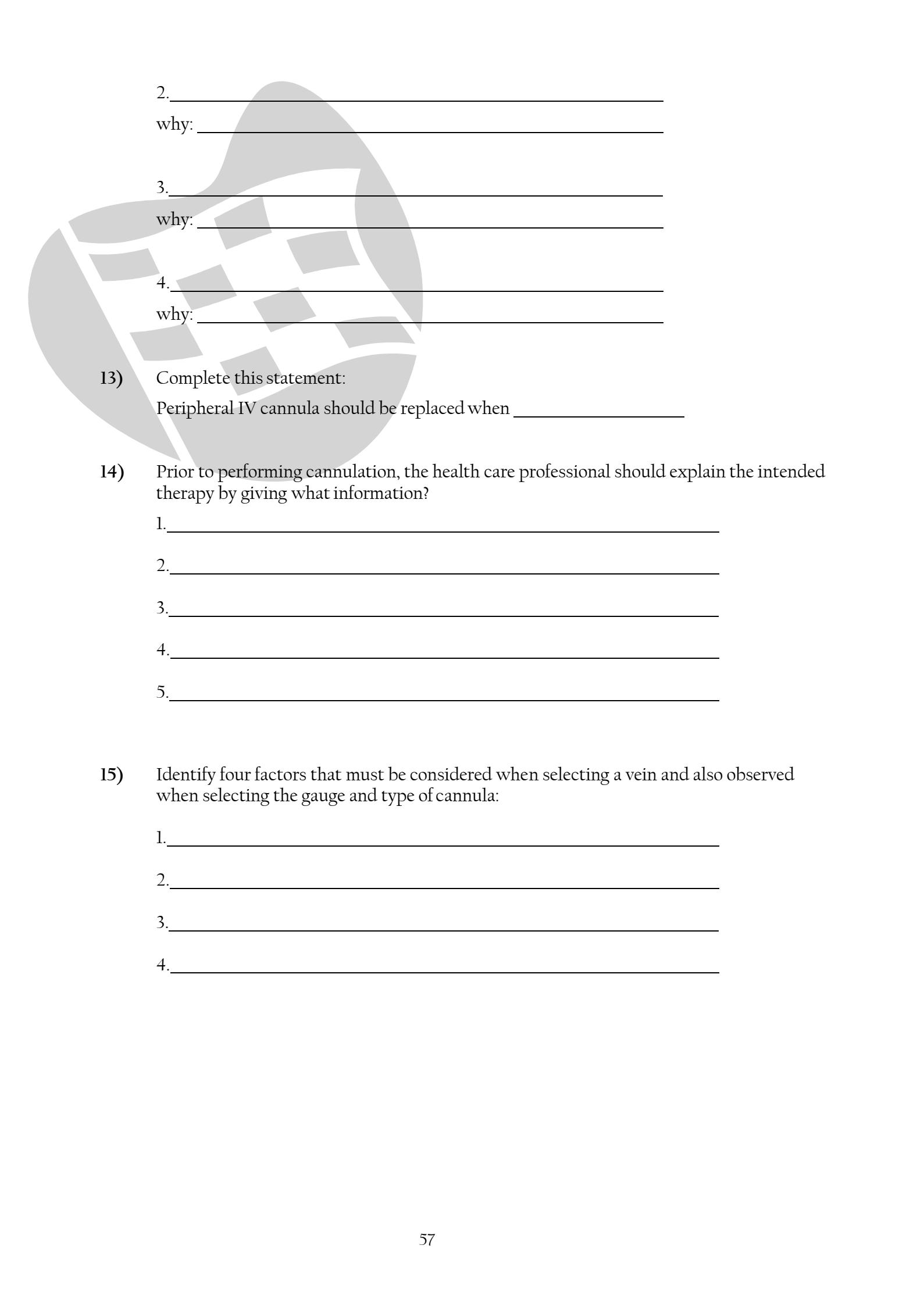
1. _____
2. _____

11) List 4 predisposing conditions that might render a patient difficult to cannulate:

1. _____
2. _____
3. _____
4. _____

12) List 4 body sites that should be avoided for routine cannulation and why:

1. _____
- why: _____



2. _____

why: _____

3. _____

why: _____

4. _____

why: _____

13) Complete this statement:

Peripheral IV cannula should be replaced when _____

14) Prior to performing cannulation, the health care professional should explain the intended therapy by giving what information?

1. _____

2. _____

3. _____

4. _____

5. _____

15) Identify four factors that must be considered when selecting a vein and also observed when selecting the gauge and type of cannula:

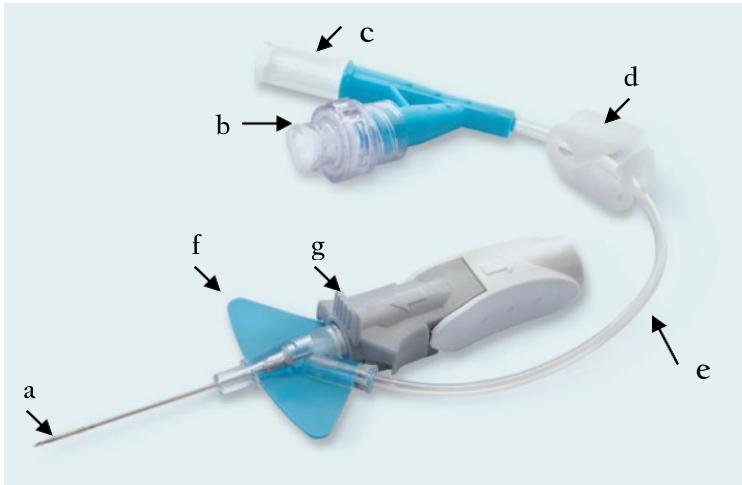
1. _____

2. _____

3. _____

4. _____

- 16) Label the parts of the Nexiva Cannula:



- a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____

- 17) Complete the acronym below with respect to the cannulation procedure:

B_____
L_____
A_____
S_____
T_____
S_____

- 18) Why do you advance the cannula slightly after you have a 'Flashback'?

- 19) What documentation detail do you need to include after cannula insertion?

on the dressing: _____

in the clinical notes: _____

- 20) Haematoma is caused by blood leakage into the surrounding tissue at the insertion site.
List four measures you can use to prevent this occurrence:

1. _____
2. _____
3. _____
4. _____

21) List four possible reasons a catheter enters the vein but won't thread in:

1. _____
2. _____
3. _____
4. _____

22) List 4 corrective actions to take when cannulating paper thin transparent skin:

1. _____
2. _____
3. _____
4. _____

SECTION FOUR:

Infusion therapy

PERIPHERAL INTRAVENOUS CANNULA -ONGOING CARE BUNDLE	
Hand Hygiene	<ul style="list-style-type: none">compliance with the 5 moments of hand hygienehands decontaminated before clean glove application
Personal protective equipment	<ul style="list-style-type: none">clean gloves applied immediately prior to ongoing care activitiesplastic apron applied if indicated
Bung/line preparation	<ul style="list-style-type: none">70% isopropyl alcohol is used and allowed to dry.
Aseptic technique	<ul style="list-style-type: none">use an aseptic non-touch techniquesaline flushing shall be in a pulsatile (push-pause-push) motionSaline flush – inject at least 1-5ml of 0.9% sodium chloride into the PIVC as appropriateAdministration of medicine as per prescriptionSaline flush – inject at least 1-5ml of 0.9% sodium chloride into the PIVC using positive pressure (clamping) technique at completion
Dressing	<ul style="list-style-type: none">a sterile, semi-permeable, transparent dressing must remain dry and intact or is changed immediatelyif the insertion site is obscured by an opaque dressing, preventing visual inspection, this dressing must be changed
Practice	<ul style="list-style-type: none">PIVC that are no longer clinically indicated must be removed promptlyPIVC are left in situ in community care patients for the duration of therapy unless complications occurPIVC insertion sites must be revealed and inspected daily in the community and every time the cannula is accessed, or infusion rates are altered
Documentation	<ul style="list-style-type: none">PIVC(s) site location, appearance (using the 0-5 visual infusion phlebitis scale), and on-going care requirements should be recorded daily in the patient's clinical notes any other actions, significant or exceptional findings must be documented in the appropriate clinical record
Safety	<ul style="list-style-type: none">use needleless access systemsuse leur lock connectionssharps container for point of care disposal
Removal	<ul style="list-style-type: none">dressing is removed gently, use of adhesive remover if skin is fragilePIVC is removed slowly and gentle pressure is applied as tolerated for 2-3 mins or until bleeding stopssite is assessed and dressing appliedintegrity of PIVC is checked before disposal in to biohazard bagif site appears infected, swab is taken and sent to microbiology for culture and sensitivitysite is covered with an adhesive dressing, left in place for 24 hrsdate, time and reason for removal is documented in the clinical notesa reportable event form is completed if required

PIVC CARE INSTRUCTIONS WITH RATIONALE TABLE

PIVC CARE INSTRUCTIONS WITH RATIONALE	
Action/caution	Rationale
When a cannula is initially inserted, an extension set and needle less access bung is also attached.	The extension set reduces the amount of trauma to the insertion site caused by accessing/manipulating the cannula. This helps to reduce the risk of mechanical phlebitis and subsequent increased risk of infection. This is not usually required for day cases.
Use of leur lock connections is recommended. If a leur slip connection is used, insert the slip connection into the bung using a firm push and twist clockwise motion.	Leur slip connections must not be left unattended. If left they can come apart or pop off.
Access bungs should be changed immediately if the integrity of the system is compromised or if residual blood remains within the bung. Luer lock access bungs are needle less intravenous access systems.	Use of needles on these systems will cause damage and breach the integrity of the bungs which could cause leakage and/or allow the free passage of air or bacteria. Residual blood in the bung provides a medium for bacterial adherence and growth.
Accessing a PIVC is an aseptic non-touch procedure.	Minimises the potential to introduce micro-organisms into the PIVC and/or the patient's bloodstream via the needle less access bung.
PIVC are flushed with Sodium Chloride 0.9% before and after the administration of medicine/fluids.	This procedure helps prevent catheter occlusion, helps assess patency, acts as a buffer between medicine doses and prolongs catheter patency.
Flush PIVC every shift with 0.9% sodium chloride if not in more frequent use.	Assesses PIVC function and is part of the monitoring requirements for indwelling PIVC.
PIVC are flushed using a pulsatile (push-pause or start-stop-start) motion.	Pulsatile flushing creates a turbulent flow within the catheter lumen, effectively removing residue.
The flush should be started gently, checking for any signs of fluid leakage at the exit site, swelling at the cannula site, or discomfort experienced by the patient.	If the PIVC has become dislodged or complicated, initial gentle flushing will reduce the amount of discomfort experienced by the patient.
A positive pressure (clamping) technique is used prior to disconnection of the final syringe in an administration sequence, if the device is in intermittent use.	Prevents the negative reflux of blood in to the cannula on syringe disconnection caused by the valve refilling the space occupied by the syringe.
If a cannula can not be flushed on access using gentle pressure, vigorous attempts and applying excessive force are not recommended. The cannula should be removed and a new catheter inserted if clinically indicated.	PIVC can become occluded secondary to internal lumen thrombus formation – (blood clot in the lumen creating total blockage).
Saline flush – inject 2-5ml of 0.9% sodium chloride into the PIVC using positive pressure (clamping) technique at completion.	By using a positive pressure technique when completing the flush i.e. applying the clamp to the line while the final 0.5ml of fluid is injected, the risk of occlusion through negative reflux on disconnection is prevented.
PIVC must be promptly removed if no longer required. Regular medical review should determine if IV access is still indicated or an alternate route is available.	PIVC access has associated risks i.e. infection because of the potential for direct microbial entry to the bloodstream, or other preventable complications.

ADVANTAGES AND DISADVANTAGES OF IV THERAPY

The main indications to initiate peripheral IV Therapy in primary care are to:

- Restore and maintain fluid and electrolyte balance.
- Provide medication.

Therapies which are not appropriate for certain peripheral cannulae include continuous vesicant chemotherapy, parenteral nutrition solutions and/or medications with osmolarity greater than 900 Osm/L (INS, 2016). These aspects should not be considered in isolation and a risk assessment that includes vein assessment, duration and environment of therapy as well as pH and osmolarity is important prior to any site and device selection (RCN, 2016).

Advantages

- An immediate, therapeutic effect is achieved due to rapid delivery of the drug to its target site, which allows a more precise dose calculation and therefore more reliable treatment.
- Pain and irritation caused by some substances when given intramuscularly or subcutaneously are avoided.
- The vascular route affords a route of administration for the patient who cannot tolerate fluids or drugs by the gastrointestinal route.
- Some drugs cannot be absorbed by any other route; the large molecular size of some drugs prevents absorption by the gastrointestinal route, while other drugs, unstable in the presence of gastric juices, are destroyed.
- The IV route offers the facility for control over the rate of administration of drugs; prolonged action can be provided by administering a dilute infusion intermittently or over a prolonged period of time.

Disadvantages

- There is an inability to retrieve the drug once given and in some cases the ability to reverse the action of it. This may lead to increased toxicity or a sensitivity reaction.
- Insufficient control of administration may lead to speed shock or circulatory overload.
- Drug incompatibilities and interactions if multiple additives are prescribed.
- There is a level discomfort associated with some intravenous procedures, especially for patients who have a needle phobia.
- This route is usually more expensive than the oral route due to drug costs, equipment needed, and the time involved in administration.
- Additional complications may occur, such as:
 - microbial contamination (extrinsic or intrinsic)
 - vascular irritation, e.g. chemical phlebitis.

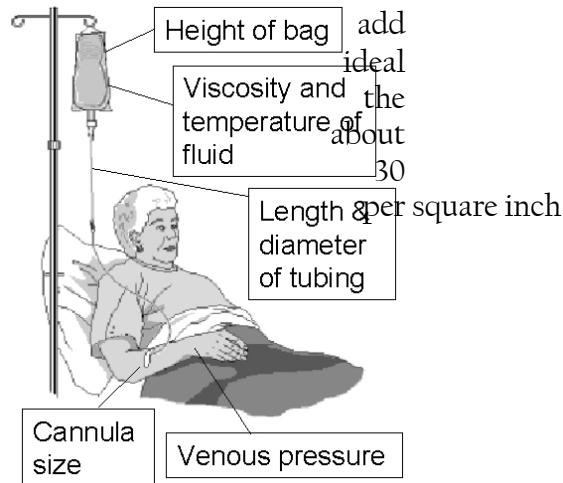
Factors Influencing Infusion Flow Rate

Many factors influence the delivery of IV fluids at the prescribed rate. A solution will flow into a vein if the pressure exerted by the fluid is greater than the venous pressure of the patient. For a non-EID infusion, gravity is used to exert such a pressure.

Gravity's force equals 14.2 psi at sea level. One can only exert so much pressure by raising the container. The height of the fluid container is 36 inches (1m) above the patient's heart - this produces around 1.3 psi, or twice the peripheral venous pressure (around 0.6 psi/mmHg). Pressure is commonly expressed in pounds

$$50 \text{ mm/Hg} = 1 \text{ psi.}$$

When an infusion is gravity dependent there are a number of factors that will affect the drop rate and thus the accuracy of the infusion volume and duration. In particular, the ambulatory patient is most at risk of changes in rate⁷. Careful and frequent monitoring is required to make fine adjustments to the drop rate to ensure that patients receive the prescribed therapy and to protect against over and under infusion.



Patient Characteristics

The condition and size of the vein are important contributors to drop rate. For example the infusion of cold solution can precipitate venous spasm and halt flow entirely. Alternatively a fibrin sheath or thrombosis can impede flow. Any patient movement is likely to affect flow rate especially if the cannula is inserted near an area of flexion or rotation and in some individuals this is particularly pronounced. Even if the cause is not obvious, altered flow rate can occur because of the position of the cannula within the vein itself, as it can become adhered to the vein wall or a valve.

Fluid & Container

The type of fluid, viscosity and temperature all affect the drop rate. Fluid in a container exerts a pressure, which reduces as the container empties. The height at which the container is placed in relation to the insertion site contributes to this pressure. As previously stated, the ideal height for a container is 36 inches (1m) above the patient's heart. The higher the container the faster the drop rate. For non-collapsible containers, make sure that vented tubing is used or an air vent is in situ, fluid will only flow if it can be displaced by air. A particular feature of any viscous fluids is that as they reach room temperature the drop rate increases.

IV Equipment

The cannula needs to be an appropriate size for the intended clinical use. Kinking or compression of the IV line will clearly impede flow. It is also possible for roller clamps to loosen when there is marked tension or stretching on the tubing resulting in an increased flow rate. Patients that are highly active are more prone to this complication.

Factors that affect flow rate cannot be eliminated entirely; however certain patients require closer monitoring than others do, such as:

- infants, young children and the elderly
- patients with compromised cardiovascular or renal impairment
- patients with major sepsis or shock

- postoperative or post trauma patients
- stressed patients whose endocrine homeostatic mechanisms are affected.

IV MANAGEMENT CONSIDERATIONS FOR – THE OLDER ADULT

Skin

Epidermis

The older adult has thinning of the epidermis and an increase in the fragility of the skin. Dry, transparent, paper thin tissue can tear and blister easily, it heals more slowly, has a decreased tolerance to ultraviolet light and an increased tendency toward neoplasia.

Dermis

There is a decrease in the papillae, which hold the collagenous fibre and elastic fibre that support blood vessels. The decrease in flexibility of the elastic fibre results in a “loose skin” effect and wrinkles. There is also a marked decrease in the vascularity of the dermis resulting in the skin becoming pale and the nerve endings losing their sensitivity.

Subcutaneous connective tissue

The amount of subcutaneous fat decreases and with it the production of sebum and sweat also decreases.

The blood vessels

Blood vessel changes can be as varied as the chronic diseases that affect the older adult.

Arteriosclerosis and atherosclerosis occur resulting in accumulation of lipid containing materials within the vessels as well as thickening, hardening and loss of elasticity. These changes may occur in the intima or medial layers of the blood vessels and affect the vessels ability to distend and contract. Thickening of the internal layer results in a thinning of the internal lumen of the vessel, an increase in peripheral vascular resistance, a decrease in venous return and capillary refill and ineffective bung action.

Effect on IV Therapy Management

Care cleansing the skin is required as too vigorous action on the skin can result in tearing. The use of skin prep to form a layer between the skin and transparent dressing adhesive is recommended to minimise the potential for skin injury on removal of the dressing.

Ensure the cannula is secured to minimise movement. Monitor the IV site often as tussuing and phlebitis can occur more frequently in this population and go unnoticed due to physiological changes such as reduced sensitivity of nerve endings (patient will not feel discomfort until the condition is severe).

Vessels should be cannulated by staff skilled in cannulation of the older adult. The smallest gauge cannula that can deliver the therapy should be inserted. A 22g is recommended to reduce insertion related trauma and provide maximum blood flow around the cannula. Increased blood flow around the cannula reduces vein irritation from either the insertion or the medications.

COMPLICATIONS OF INTRAVENOUS THERAPY

Complications that occur from intravenous therapy are either systemic or local or a combination of both.

Local

- Venous spasm, Haematoma, Phlebitis, Thrombophlebitis, Infection, Infiltration, Extravasation.

Systemic

- Bacteraemia, Septicaemia, Cardiovascular Overload, Speed Shock, Emboli (air, particle, thrombus), Allergic Reaction/Anaphylaxis.

The healthcare professional managing IV therapy is pivotal in the prevention, early detection and management of any complication associated with the administration of IV therapy. This includes accurate documentation in patient notes and the completion of a reportable event form to track complication occurrence and facilitate quality improvement.

The following provides an overview of common complications, their signs and symptoms and treatment options. The main strategies for prevention common to all complications are:

- knowledge of intravenous therapies and administration equipment
- vigilant checking procedures
- adherence to stringent hand hygiene and asepsis before and after manipulation of the IV system.

Venous Spasm

The sudden involuntary contraction of the vein into which a cannula or solution is being placed.

Probable Causes

- infusion of cold or irritating solution
- too rapid infusion flow rate
- traumatic cannulation.

Prevention

- use recommended dilution and/or infusion duration
- ensure adequate haemodilution for type of solution
- bring solutions to room temperature prior to infusing (if appropriate)
- use appropriate access device for the treatment.

Signs and Symptoms

- sharp cramping pain above the insertion site, blanching of skin, sluggish flow rate despite infusion being set to free flow.

Intervention

- apply warm compress to site
- decrease flow rate until spasm relieved
- dilute medications further

- if unrelieved, resite IV cannula
- document in patient's notes.

Phlebitis/Thrombophlebitis

The inflammation of a vein/inflammation and the presence of thrombus within the vein.

Probable Causes

- Mechanical – poor cannulation technique, internal friction of the cannula against the wall of the vein, cannula gauge too large for the vein, poor site for cannula placement, inadequate securing of cannula, trauma from patient activity, cannula insitu for too long.
- Chemical – High/low pH of fluid/medicine, hypertonic solutions, drug not reconstituted/diluted correctly, reaction to cannula material.
- Infective – Poor asepsis of inserter, poor asepsis when accessing cannula, cannula insitu for too long, self-seeding from distant infection site.

Prevention

- skilled cannula insertion
- maintain sterile intact dressing
- stable cannula fixation
- frequent flushing to prevent thrombus formation
- ensure adequate haemodilution for type of solution
- vigilant monitoring of intravenous therapy (see visual infusion phlebitis scale)
- maintain consistent flow rate
- educate patients on symptoms to report.

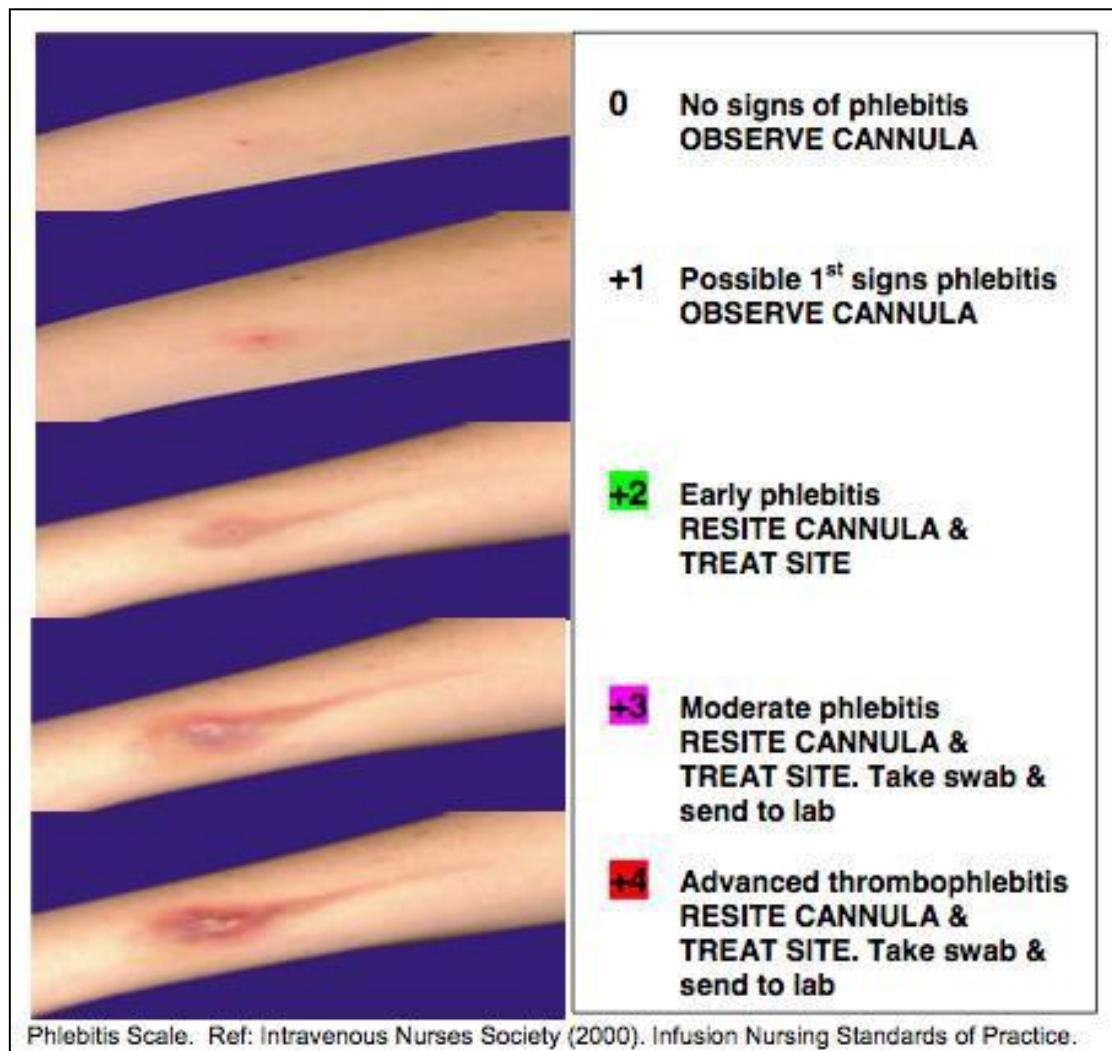
Signs and Symptoms

- tenderness/pain at IV site, erythema, increased skin temperature, induration, oedema, palpable venous cord, streak formation, slowing of infusion rate, pyrexia.

Intervention

- discontinue IV therapy (see scale)
- if infected, swab injection site and send for cultures
- remove cannula (see scale)
- document in patient's notes
- inform the GP.

Visual infusion phlebitis tool (Intravenous Nurses Society, 2000).



Infection

Invasion of a pathogenic organism; may be local or systemic.

Probable Causes

- introduction of the organism into the local tissue/bloodstream by health care worker or patient
- poor aseptic technique of the health care worker
- contaminated infusate, equipment, dressing
- self-seeding from distant infection site
- general poor health of the patient increasing susceptibility.

Prevention

- effective hand hygiene
- maintaining aseptic technique whenever manipulating IV system
- rigorous skin decontamination prior to IV insertion
- changing equipment/solution as recommended
- maintaining sterile intact dressing

- appropriate labeling of equipment alerting when changes due
- vigilant monitoring of intravenous therapy
- educate patients about symptoms to report.

Signs and Symptoms

Local - Pain at IV site, erythema, increased skin temperature, induration, palpable venous cord, slowing of infusion rate, pyrexia, cellulitis, discharge of purulent exudate at exit site, raised WBC.

Systemic - Onset may be abrupt, patient may become hot and flushed, pyrexia, chills/rigors, muscle and joint pains, tachycardia, tachypnoea, apathy, nausea, vomiting, headache, fatigue, hypotension, raised WBC, positive blood cultures.

Intervention

Local - Stop infusion, remove cannula, swab injection site and send for cultures, clean and dress site, monitor temperature and pulse, inform Medical Officer, treat, document in patient's notes.

Systemic – Treat as an emergency, call Ambulance , monitor vital signs, change tubing, KVO with infusion of 0.9% normal saline and document in patient's notes.

Infiltration

The escape of non-vesicant solutions from the intravascular space into extravascular tissue.

Probable Causes

Partial or complete puncturing of vessel due to:

- insertion needle/stylet puncturing the vein wall on cannulation
- puncturing of the vein wall by the cannula secondary to poor stabilisation of cannula/limb
- poor location of cannula e.g. over a joint/area of flexion
- trauma from patient activity
- fragility of a patient's veins.

Other (less common):

- increased hydrostatic pressure secondary to a blood clot or vasoconstriction beyond the cannula, forcing fluid out of the vessel
- inflammation of the vein increasing vessel permeability allowing fluid to infiltrate into the surrounding tissues.

Prevention

- skilled cannulation avoiding areas of flexion
- stable cannula fixation
- use recommended dilution and/or infusion duration
- ensure adequate haemodilution for type of solution
- vigilant monitoring of intravenous therapy (see infiltration scale)
- educate patients on symptoms to report and their role in prevention.

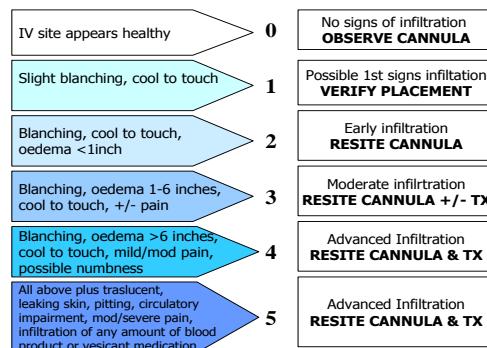
Signs and Symptoms

- Coolness of skin around site, skin taut, oedema, blanching, pain at site, slowing of infusion rate, numbness, fluid leaking from injection site.

Intervention

- discontinue IV use
- remove cannula (see scale)
- elevate the extremity based on patient comfort
- document in patient's notes
- inform GP

Infiltration Scale



Extravasation

The escape of vesicant solutions from the intravascular space into extravascular tissue.

Examples of known vesicant solutions

Antibiotics	Electrolyte solutions	Antineoplastic drugs	Vasopressors	Miscellaneous
Vancomycin	Calcium	Dactinomycin	Adrenaline	Radio opaque
Penicillin	Chloride	Daunorubicin	Noradrenaline	contrast
Doxycycline	Calcium	Doxorubicin	Dopamine	Mannitol
Nafcillin	Gluconate	Epirubicin	Dobutamine	Dextrose >10%
Piperacillin	Potassium	Idarubicin	Metaraminol	Digoxin
	Chloride	Mechlorethamine		Lorazepam
	Sodium	Mitomycin C		Sodium
	Bicarbonate	Paclitaxel		Thiopental
		Vinblastine		Phenytoin
		Vincristine		Promethiazine
		Vinorelbine		

There are several mechanisms by which certain vesicant solutions can cause tissue damage when extravasation occurs:

- osmotic damage
- acids and bases damage
- ischaemic necrosis due to vasoconstriction
- direct cellular toxicity
- irritant damage.

Probable Causes

Partial or complete puncturing of vessel due to:

- insertion needle/stylet puncturing the vein wall on cannulation
- puncturing of the vein wall by the cannula secondary to poor stabilisation of cannula/limb
- poor location of cannula e.g. over a joint/area of flexion

- trauma from patient activity
- fragility of a patient's veins.

Other (less common):

- increased hydrostatic pressure secondary to a blood clot or vasoconstriction beyond the cannula, forcing fluid out of the vessel
- inflammation of the vein increasing vessel permeability allowing fluid to infiltrate into the surrounding tissues.

Prevention

- anticipate extravasation when administering vesicant solutions
- know medication antidotes and extravasation management procedure
- choose access device appropriate to purpose
- avoid using butterfly needles
- skilled cannulation avoiding areas of flexion
- secure cannula fixation
- aspirate for blood return prior to medication administration to establish that catheter/cannula is situated in the venous system
- use recommended dilution and/or infusion duration
- ensure adequate haemodilution for type of solution
- vigilant monitoring of intravenous therapy
- educate patients on symptoms to report and their role in prevention.

Signs and Symptoms

- Pain or burning at/around the injection site, coolness of skin around site, skin taut, oedema, blanching, slowing of infusion rate, fluid leaking from injection site, erythema, blistering, tissue necrosis (late symptom).

Intervention

- discontinue IV immediately
- leave cannula in place and try to aspirate the vesicant solution with a 10ml syringe
- mark the skin with a pen outlining the area extravasated into
- Advise GP
- consult pharmacy/manufacturer's guidelines for treatment recommendations for extravasation e.g. instil the appropriate antidote then remove cannula (if unable to aspirate the extravasated drug from the IV cannula/extension set, do NOT instil the antidote through the cannula - inject subcutaneously), apply cold/warm compress
- elevate the extremity
- administer analgesia
- document in patient's notes.

Cardiovascular Overload/Pulmonary Oedema

The administration of a greater fluid volume than the circulatory system can manage leading to Pulmonary Oedema; a severe state of increased interstitial fluid within the lung that leads to

flooding of the alveoli with fluid.

Probable Causes

- rapid infusion of fluids
- excessive volume of fluids infused
- renal/cardiac dysfunction.

Prevention

- assess patient history, identify those at risk & monitor closely
- utilise electronic infusion devices to deliver consistent volumes
- eliminate accidental free flow by using volume control sets avoid increasing infusion rate to 'catch up'.
- maintain fluid balance record & 24-hour net balance
- monitor weight
- early consultation with GP if concerned.

Signs and Symptoms

- Rapid weight increase, positive fluid balance, restlessness, raised JVP, tachypnoea/dyspnoea, tachycardia, persistent moist cough, pink frothy sputum, drop in SpO₂, crackles on auscultation.

Intervention

- slow or stop the infusion, keep the IV open
- place patient in high Fowler's position
- administer oxygen via Hudson mask if SOB
- monitor vital signs
- consult with GP
- administer medications as prescribed (usually includes diuretics, vasodilators, morphine)
- document in patient's notes.

Speed Shock

A systemic reaction that occurs when a substance foreign to the body is rapidly introduced to the circulatory system.

Probable Causes

- rapid infusion of medications/fluids
- rapid bolus administration of medication.

Prevention

- follow recommended bolus injection times and dilutions
- maintain constant infusion rate.

Signs and Symptoms

- Dizziness, facial flushing, headache, chest tightness, hypotension, irregular pulse, shock, loss of consciousness, cardiac arrest.

Intervention

- stop the infusion immediately, keep cannula open
- Call Ambulance
- inform GP
- remain with the patient
- treat symptoms of shock
- monitor vital signs
- document in patient's notes.

Air Embolism

The inadvertent entry of air into the cardiovascular system via the intravenous line leading to the occlusion of blood vessels.

Probable Causes

- loose connections on IV equipment
- failure to clamp line when accessing/changing solution
- damage to connections/IV line when using forceps
- solution container is empty.

Prevention

- vigilant assembly and checking of system
- use luer-lock connections
- careful adherence to clamping when accessing the line
- use protected cover on forceps when using on IV equipment

Signs and Symptoms

- Dyspnea, hypotension/dizziness, tachycardia, cyanosis, anxiety, confusion, loss of consciousness, cardiac arrest.

Intervention

- immediately stop the infusion
- prevent further air entry
- place patient on left side, head down (left Trendelenburg)
- Call Ambulance
- seek immediate medical assistance
- remain with the patient
- administer oxygen via Hudson mask
- monitor vital signs
- treat shock/arrest
- document in patient's notes.

Pulmonary Embolism

Pulmonary embolism refers to the lodgment of a free-floating blood clot (or emboli) in the

pulmonary vasculature.

Probable Causes

- thrombosis development
- force flushing a vascular device
- prolonged venous stasis
- coagulopathy.

Prevention

- discontinue flushing if resistance encountered
- aspirate blood prior to flushing devices

Signs and Symptoms

- Pleuritic pain, tachypnea, dyspnea, restlessness, apprehension, hypoxia, wheeze, transient ECG changes, hypotension, tachycardia, diaphoresis, fever.

Intervention

- stop the infusion immediately
- maintain IV access
- seek immediate medical attention
- remain with the patient
- administer oxygen for SOB and place in high semi Fowler's position
- administer anticoagulant and analgesia as prescribed by GP
- document in patient's notes.

Allergic Reaction

An allergic reaction is an inappropriate, hypersensitive immune response to the solution being administered and can range from a mild delayed reaction to anaphylaxis.

Probable Causes

- IV antibiotics

Prevention

- always ask the patient about allergies prior to intravenous fluid/medication administration
- knowledge of substances likely to cause anaphylaxis.

Signs and Symptoms

- Pruritis, urticarial rash, local oedema, watering eyes/running nose, dyspnoea, wheezing, stridor, hypotension, tachycardia, respiratory/cardiac arrest.

Intervention

- stop the infusion immediately
- Seek urgent medical assistance. Call Ambulance as appropriate
- maintain IV access
- institute basic life support as indicated
- administer oxygen for respiratory distress

- administer fluid bolus for hypotension as prescribed
- administer antihistamine, anti-inflammatory medications as prescribed
- follow procedure for anaphylaxis as needed (refer organisational policy)

CHECK POINT - SECTION FOUR:

Infusion therapy - Anaphylaxis

- 1) List 4 symptoms of an anaphylactic reaction:

1. _____
2. _____
3. _____
4. _____

- 2) a. What route, dose and medication would you administer for a suspected anaphylactic reaction?

Route: _____ Dose: _____ Medication: _____

- b. How would you manage a suspected anaphylactic reaction?

*Please read and be familiar with your work Primary care anaphylaxis management guidelines.

INTRAVENOUS THERAPY TECHNIQUES

Method of reconstituting IV medication from a single dose (rubber bung) vial using a non-coring drawing up needle™ and a non splash back technique

- Wash and dry hands.
- Remove cap and swab the top of the medicine vial with an alcohol swab and allow to dry.
- Place vial flat on the working surface.
- Attach drawing up needle to the syringe.
- Vertically puncture medicine vial with the drawing up needle.
- **Do not inject fluid now.**
- Withdraw some air from the vial.
- Inject a lesser volume of fluid than volume of air removed.
- Continue to withdraw air, replacing it with fluid until desired volume is in the vial.
- Holding syringe and vial firmly, invert and shake gently to reconstitute contents.
- *Ensure needle does not become contaminated during the reconstitution process through retraction and reinsertion through the rubber stopper.*
- When reconstitution is complete and no particulate matter remains in vial inject air back into vial and withdraw fluid into syringe. This procedure is a measured one as previous.
- Replace cap on drawing up needle leave on syringe.
- Remove all air from syringe by gently tapping the side of syringe and ejecting air through the drawing up needle.

If these steps are followed there will be no escape of fluid vapour from the vial to contaminate fingers or the environment. Note: *place the drawing up needle in the sharps bin on disposal.*

Method of administering Bolus Medication via a Syringe using SAS protocol and a positive pressure technique

- Wash and dry hands.
- Prepare 10ml syringe with 10ml 0.9% sodium chloride and label.
- Prepare medication to be administered.
- Wash and dry hands.
- Put on non-sterile clean gloves.
- Unclamp extension set attached to the patient's cannula (only if closed by a needleless access bung)
- Clean the needleless access bung thoroughly with the alcohol swab.
- Allow alcohol to dry (approximately 1 minute).
- Access the needleless access bung with syringe using **SAS** protocol as follows:

Saline flush – Inject 2 to 5ml of 0.9% sodium chloride into the peripheral cannula.

Administer medicine as per prescription.

Saline flush – Inject 2 to 5ml of 0.9% sodium chloride into the peripheral cannula using positive pressure technique at the completion.

- Ensure extension clamp is on (part of positive pressure technique).
- Discard all equipment into a general waste bag. Any equipment contaminated with blood/blood product must be disposed of in a yellow Biohazard bag.
- Wash hands.

Saline flush

A bolus injection of 0.9% sodium chloride. The saline flush helps establish the catheter's patency, dislodges particles that adhere to the internal wall of cannula helping maximise catheter lifespan, pushes previous medicine though the catheter lumen and acts as buffer between subsequent medication administrations.

Positive Pressure Technique

The Positive Pressure Technique ensures that no blood is drawn back into the cannula by the negative displacement caused when the syringe is removed from the needleless access bung. This can be achieved by:

- keeping a forward motion on the syringe plunger and clamping the extension set during the last 0.5mls of the solution.

Method of priming and administering fluids via an Intravenous Infusion Set

- Select equipment required.
- Wash and dry hands.
- Check correct Intravenous solution type/volume through bag before opening.
- Remove from bag and check expiry date, that the solution bag is undamaged, and for evidence of precipitation/contaminants.
- Remove IV infusion set from packaging. Check for signs of damage. Close off the roller clamp below the drip chamber.
- Hang the bag on the drip stand.
- Remove the plastic guard from the access port on the solution bag and on the spike of the infusion set. Insert the spike of the infusion set into the access port of the solution bag. Ensure that the spike/access port is not contaminated in the process. Screw the spike in tightly into the solution bag.
- Prime set by squeezing drip chamber and filling to desired level
- Slowly release the roller clamp and begin priming the solution set. Ensure check bung and y sites if present are inverted during priming and tapped as fluid passes through them to purge air. Check line to ensure that there is no air remaining.
- Attach a time line label to the outside of the solution bag if it is to be infused by gravity.

If the solution to be infused is contained in a glass bottle or non-collapsible container, a vented spike adapter needs to be used (if unavailable use an air inlet needle).

SECTION FIVE:

Medication management

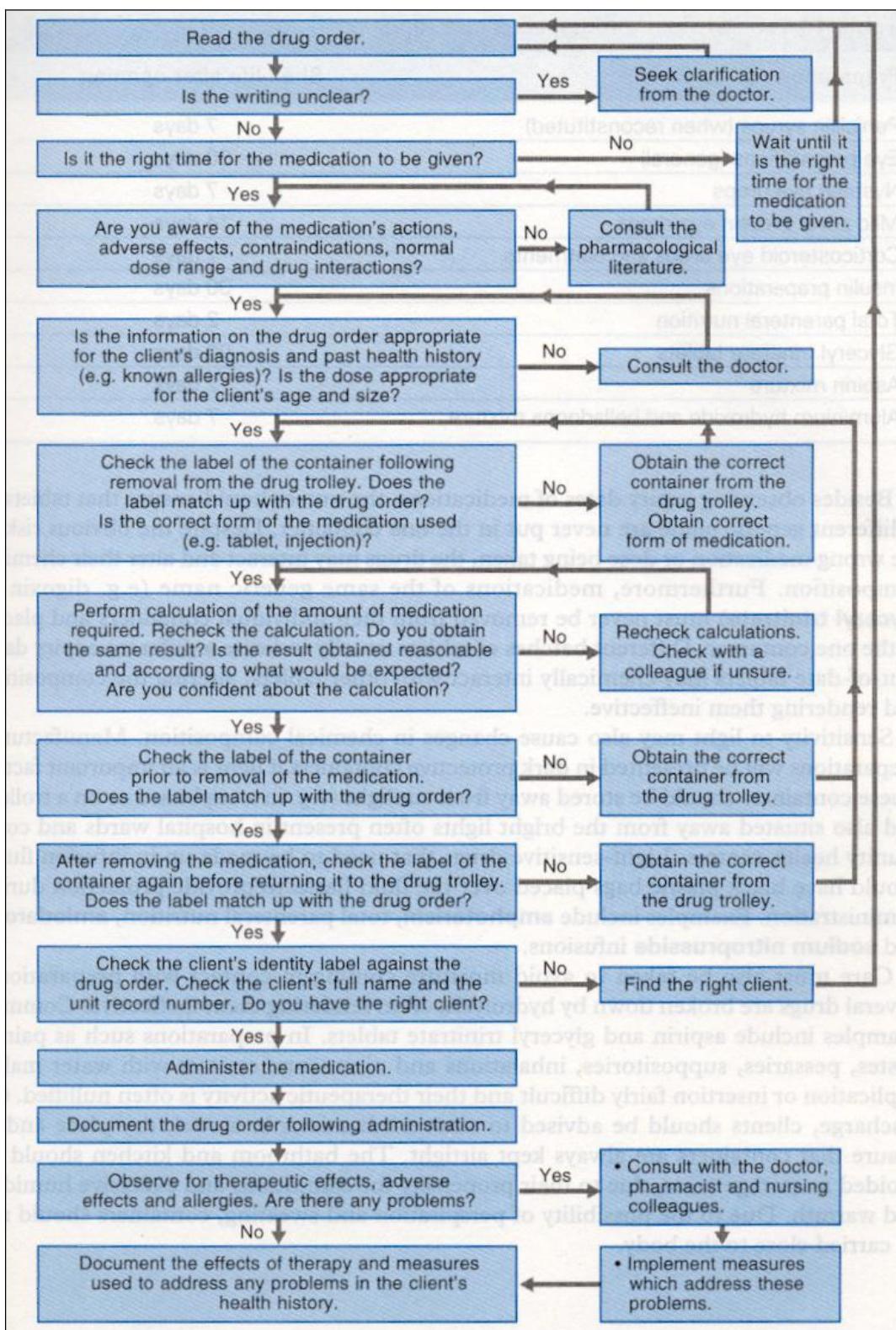
AVOIDING MEDICATION ERRORS

Research indicates that 18% of serious preventable drug events occur because healthcare professionals know too little about the patient before prescribing, dispensing or administering drugs. Opioids and antimicrobials cause the most serious injuries related to drug allergies. In addition, one in ten medication errors relate to the use of incorrect drug names, dosage error or misunderstood abbreviations. The following guidelines highlight the most significant factors in administering drugs safely:

- Adhere to the five rights of drug administration.
 - Right Patient
 - Right Drug
 - Right Dose
 - Right Time
 - Right Route
- Always refer to the original prescription.
- Know the patient and involve them in the administration process e.g. seek information on renal and liver function. Identify the patient
- Know the drugs and have drug information readily available e.g. adenosine is only effective if administered as a rapid bolus over 1-3 seconds, most drugs are safer administered as a push over 3-5 minutes.
- Check the accuracy of calculations before drug administration. If using a calculator, estimate the correct answer manually first.
- If a drug has an antidote, know its location and dosage. If there is no antidote, be prepared to provide supportive measures if an adverse reaction occurs.
- Be aware of look alike and sound alike drugs e.g. dopamine and dobutamine.
- Communicate clearly e.g. follow process for obtaining verbal orders, question unclear prescriptions, follow procedure for solving disagreements and don't be intimidated.
- Optimise the work environment e.g. ensure good lighting, uncluttered workspace, minimise multitasking, avoid transcribing.
- Complete documentation immediately following administration (bolus) or at the initiation of intravenous therapy (infusion).

CHECKING PROCEDURE FOR DRUG ADMINISTRATION

Although not specific to IV medication administration, the following chart shows the correct checking procedure for the administration of medications.



C

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N

DBL™ CEPHAZOLIN SODIUM FOR INJECTION

500 mg and 1 g vials

Presentation

DBL™ Cephazolin Sodium for Injection 500 mg and 1 g vials contain a white to slightly yellow powder which reconstitutes with Sterile Water for Injection to give a colourless solution.

DBL™ Cephazolin Sodium for Injection 500 mg vial contains cephazolin sodium equivalent to 500 mg of cephazolin.

DBL™ Cephazolin Sodium for Injection 1 g vial contains cephazolin sodium equivalent to 1 g of cephazolin.

Uses

Actions

DBL™ Cephazolin Sodium for Injection is a semisynthetic cephalosporin for intramuscular or intravenous administration. *In vitro* tests demonstrate that the bactericidal action of cephalosporins results from inhibition of cell-wall synthesis.

DBL™ Cephazolin Sodium for Injection is active against the following organisms *in vitro* and in clinical infections:

Staphylococcus aureus (including penicillinase-producing strains), *Staphylococcus epidermidis*. Group A β-haemolytic streptococci and other strains of streptococci (many strains of enterococci are resistant).

- Streptococcus pneumoniae*
- Escherichia coli*
- Klebsiella sp.*
- Proteus mirabilis*
- Haemophilus influenzae*
- Enterobacter aerogenes*

Most strains of indole-positive *Proteus* (*Proteus vulgaris*), *Enterobacter cloacae*, *Morganella morganii*, and *Providencia rettgeri* are resistant.

Methicillin-resistant staphylococci, *Serratia*, *Pseudomonas* and *Acinetobacter calcoaceticus* (formerly *Mima* and *Herellea sp.*) are almost uniformly resistant to cephazolin.

Disc Susceptibility Tests--Quantitative methods that require measurement of zone diameters give the most precise estimates of antibiotic susceptibility. One such procedure has been recommended for use with discs for testing susceptibility to cephazolin. With this procedure, a report from the laboratory of "susceptible" indicates that the infecting organism is likely to respond to therapy. A report of "resistant" indicates that the infecting organism is not likely to respond to therapy. A report of "moderately susceptible" suggests that the organism would be susceptible if high dosage is used or if the infection were confined to tissues and fluids (e.g. urine) in which high antibiotic levels are attained.

For gram-positive isolates, a zone of 18 mm is indicative of a cephazolin-susceptible organism when tested with either the cephalosporin-class disc (30 mcg cefalothin) or the cephazolin disc (30 mcg cephazolin).

Gram-negative organisms should be tested with the cephazolin disc (using the above criteria) because cephazolin has been shown by *in vitro* tests to have activity against certain strains of *Enterobacteriaceae* found to be resistant when tested with the cefalothin disc. When using the cefalothin disc, gram-negative organisms with zone diameters ≥ 18 mm may be considered susceptible to cephazolin; however, organisms with zone diameters less than 18 mm are not necessarily resistant or moderately susceptible to cephazolin.

The cephazolin disc should not be used for testing susceptibility to other cephalosporins.

Dilution Techniques--A bacterial isolate should be considered susceptible if the minimal inhibitory concentration (MIC) for cephazolin is ≤ 16 mcg/mL. Organisms are considered resistant if the MIC is ≥ 64 mcg/mL.

Pharmacokinetics

Table 1 demonstrates the blood levels and duration of cephazolin following intramuscular administration.

TABLE 1. SERUM CONCENTRATIONS AFTER INTRAMUSCULAR ADMINISTRATION

Dose	Serum Concentrations (mcg/mL)					
	1/2hr	1hr	2hr	4hr	6hr	8hr
250 mg	15.5	17	13	5.1	2.5	
500 mg	36.2	36.8	37.9	15.5	6.3	3
1 g*	60.1	63.8	54.3	29.3	13.2	7.1

* Average of 2 studies.

Clinical pharmacology studies in patients hospitalised with infections indicate that cephazolin produces mean peak serum levels approximately equivalent to those seen in normal volunteers. In a study (using normal volunteers) of constant intravenous infusion with dosages of 3.5 mg/kg for 1 hour (approximately 250 mg) and 1.5 mg/kg for the next 2 hours (approximately 100 mg), cephazolin produced a steady serum level at the third hour of approximately 28 mcg/mL. Table 2 shows the average serum concentrations after IV injection of a single 1 g dose: average half-life was 1.4 hours.

TABLE 2. SERUM CONCENTRATIONS AFTER 1 g INTRAVENOUS DOSE.

Serum Concentration (mcg/mL)					
5 min	15 min	30 min	1 hr	2 hr	4 hr
188.4	135.8	106.8	73.7	45.6	16.5

Controlled studies in adult normal volunteers receiving 1 gram four times a day for 10 days, monitoring CBC, AST, ALT, bilirubin, alkaline phosphatase, BUN, creatinine, and urinalysis indicated no clinically significant changes attributed to cephazolin.

Cephazolin is excreted unchanged in the urine primarily by glomerular filtration and, to a lesser degree, by tubular secretion. Following intramuscular injection of 500 mg, 56% to 89% of the administered dose is recovered within 6 hours, and 80% to nearly 100% in 24 hours. Cephazolin achieves peak urine concentrations greater than 1000 mcg/mL and 4000 mcg/mL respectively, following 500 mg and 1 gram intramuscular doses.

In patients undergoing peritoneal dialysis (2 L/hr), mean serum levels of cephazolin were approximately 10 and 30 mcg/mL after 24 hours' instillation of a dialysing solution containing 50 mcg/mL and 150 mcg/mL respectively. Mean peak levels were 29 mcg/mL (range 13-44 mcg/mL) with 50 mcg/mL (3 patients), and 72 mcg/mL (range 26-142 mcg/mL) with 150 mcg/mL (6 patients).

Intraperitoneal administration of cephazolin is usually well tolerated.

When cephazolin is administered to patients with unobstructed biliary tracts, high concentrations well above serum levels occur in the gallbladder tissue and bile. In the presence of obstruction, however, concentration of the antibiotic is considerably lower in bile than the serum.

Cephazolin readily crosses an inflamed synovial membrane, and the concentration of the antibiotic achieved in the joint space is comparable to levels measured in the serum. Cephazolin readily crosses the placental barrier into the cord blood and amniotic fluid. It is present in very low concentrations in the milk of nursing mothers.

Indications

DBL™ Cephazolin Sodium for Injection is indicated in the treatment of the following serious infections due to susceptible organisms:

Respiratory Tract Infections

Due to *S. pneumoniae*, *Klebsiella* sp., *H. influenzae*, *Staph. aureus* (including penicillinase-producing strains), and Group A β-haemolytic streptococci.

Injectable penicillin G benzathine is considered to be the medicine of choice in the treatment and prevention of streptococcal infections, including the prophylaxis of rheumatic fever.

Cephazolin is effective in the eradication of streptococci from the nasopharynx; however, data establishing the efficacy of cephazolin in the subsequent prevention of rheumatic fever are not available at present.

Genitourinary Tract Infections

Due to *E. coli*, *P. mirabilis*, *Klebsiella* sp., and some strains of *Enterobacter* and enterococci.

Skin and Skin Structure Infections

Due to *Staph. aureus* (including penicillinase-producing strains) and Group A β-haemolytic streptococci and other strains of streptococci.

Biliary Tract Infections

Due to *E. coli*, various strains of streptococci, *P. mirabilis*, *Klebsiella* sp., and *Staph. aureus*.

Bone and Joint Infections

Due to *Staph. aureus*.

Septicaemia

Due to *S. pneumoniae*, *Staph. aureus* (penicillin-susceptible and penicillin-resistant), *P. mirabilis*, *E. coli*, and *Klebsiella* sp.

Endocarditis

Due to *Staph. aureus* (penicillin-susceptible and penicillin-resistant) and Group A β-haemolytic streptococci.

Appropriate culture and susceptibility studies should be performed to determine susceptibility of the causative organism to cephazolin.

Perioperative Prophylaxis:

The prophylactic administration of cephazolin preoperatively, intraoperatively, and postoperatively may reduce the incidence of certain postoperative infections in patients undergoing surgical procedures that are classified as contaminated or potentially contaminated (e.g. vaginal hysterectomy, or cholecystectomy in high-risk patients, such as those over 70 years of age who have acute cholecystitis, obstructive jaundice, or common-bile-duct stones).

The perioperative use of DBL™ Cephazolin Sodium for Injection may also be effective in surgical patients in whom infection at the operative site would present a serious risk (e.g. during open-heart surgery and prosthetic arthroplasty).

The prophylactic administration of DBL™ Cephazolin Sodium for Injection should usually be discontinued within a 24-hour period after the surgical procedure. For surgery in which the occurrence of infection may be particularly devastating (e.g. open-heart surgery and prosthetic arthroplasty), the prophylactic administration of DBL™ Cephazolin Sodium for Injection may be continued for 3 to 5 days following the completion of surgery. If there are signs of infection, specimens for cultures should be obtained for the identification of the causative organism so that appropriate therapy may be instituted. (See Dosage and Administration).

Dosage and Administration

DBL™ Cephazolin Sodium for Injection may be administered intramuscularly or intravenously after reconstitution. Total daily dosages are the same for either route of administration.

The intrathecal administration of DBL™ Cephazolin Sodium for Injection is not an approved route of administration for this antibiotic; in fact, there have been reports of severe CNS toxicity including seizures when Cephazolin Sodium for Injection was administered in this manner.

Intramuscular Administration

Reconstitute as directed by Table 3 with 0.9% Sodium Chloride Injection, Sterile Water for Injection or Bacteriostatic Water for Injection. Shake well until dissolved. DBL™ Cephazolin Sodium for Injection

should be injected into a large muscle mass. Pain on injection is infrequent with DBL™ Cephazolin Sodium for Injection.

TABLE 3. DILUTION TABLE

Vial Size	Diluent to be added	Approx. available volume	Approx. average concentration
500 mg	2 mL	2.2 mL	225 mg/mL
1 g*	2.5 mL	3 mL	330 mg/mL

*The 1 g vial should be reconstituted only with Sterile Water for Injection or Bacteriostatic Water for Injection.

Intravenous Administration

DBL™ Cephazolin Sodium for Injection may be administered by intravenous injection or by continuous or intermittent infusion.

Intermittent Intravenous Infusion

DBL™ Cephazolin Sodium for Injection may be administered along with primary intravenous fluid management programmes in a volume control set or in a separate, secondary IV bottle. Reconstituted 500 mg or 1 g of DBL™ Cephazolin Sodium for Injection may be diluted in 50 to 100 mL of one of the following intravenous solutions: 0.9% Sodium Chloride Injection, 5% or 10% Dextrose Injection, 5% Dextrose in Lactated Ringer's Injection, 5% Dextrose and 0.9% Sodium Chloride Injection (also may be used with 5% Dextrose and 0.45% or 0.2% Sodium Chloride Injection), Lactated Ringer's Injection, 5% or 10% Invert Sugar in Sterile Water for Injection, Ringer's Injection, Normosol-M in D5-W, Ionomol B with Dextrose 5% or Plasma-Lyte with 5% Dextrose.

Intravenous Injection

(Administer solution directly into vein or through tubing): Dilute the reconstituted 500 mg or 1 g of DBL™ Cephazolin Sodium for Injection in a minimum of 10 mL of Sterile Water for Injection. Inject solution slowly over a period of 3 to 5 minutes. Do not inject in less than 3 minutes.

Dosage

The usual adult dosages are given in Table 4.

TABLE 4. USUAL ADULT DOSAGE

Type of infection	Dose	Frequency
Pneumococcal pneumonia	500 mg	q12h
Mild infections caused by susceptible gram-positive cocci	250 - 500 mg	q8h
Acute uncomplicated urinary tract infections	1 g	q12h
Moderate to severe infections	500 mg - 1 g	q6 - 8hr
Severe, life-threatening infections (e.g. endocarditis and septicaemia)*	1 g - 1.5 g	q6h

*In rare instances, doses up to 12 g of cephazolin per day have been used.

Dosage adjustment for Patients with Reduced Renal Function

DBL™ Cephazolin Sodium for Injection may be used in patients with reduced renal function with the following dosage adjustments: Patients with a creatinine clearance \geq 55 mL/min or a serum creatinine \leq 1.5 mg % can be given full doses. Patients with creatinine clearance rates of 35 to 54 mL/min or serum creatinine of 1.6 to 3.0 mg % can also be given full doses but dosage should be restricted to at least 8-hour intervals. Patients with creatinine clearance rates of 11 to 34 mL/min or serum creatinine of 3.1 to 4.5 mg % should be given half the usual dose every 12 hours. Patients with creatinine clearance rates \leq 10 mL/min or serum creatinine \geq 4.6 mg % should be given one half the usual dose every 18 to 24 hours. All reduced dosage recommendations apply after an initial loading dose appropriate to the severity of the infection. For information about peritoneal dialysis, see Pharmacokinetics.

Perioperative Prophylactic Use

To prevent postoperative infection in contaminated or potentially contaminated surgery, the recommended doses are as follows:

- a. 1 g IV or IM administered one half to 1 hour prior to the start of surgery;
- b. For lengthy operative procedures (e.g. 2 hours or longer), 0.5 to 1 g IV or IM during surgery (administration modified according to the duration of the operative procedure);
- c. 0.5 to 1 g IV or IM every 6 to 8 hours for 24 hours postoperatively.

It is important that:

1. The preoperative dose be given just prior (one half to 1 hour) to the start of surgery so that adequate antibiotic levels are present in the serum and tissues at the time of the initial surgical incision and
2. If exposure to infectious organisms is likely, DBL™ Cephazolin Sodium for Injection be administered at appropriate intervals during surgery in order that sufficient levels of the antibiotic be present when needed.

In surgery in which infection may be particularly devastating (e.g. open-heart surgery and prosthetic arthroplasty), the prophylactic administration of DBL™ Cephazolin Sodium for Injection may be continued for 3 to 5 days following the completion of surgery.

Children

In children, a total daily dosage of 25 to 50 mg/kg of bodyweight, divided into 3 or 4 equal doses, is effective for most mild to moderately severe infections (Table 5). Total daily dosage may be increased to 100 mg/kg of bodyweight for severe infections.

TABLE 5. PAEDIATRIC DOSAGE GUIDE

Weight	25 mg/kg/day Divided into 3 doses		25 mg/kg/day Divided into 4 doses	
	kg	Approx single dose (mg q8h)	Vol (mL)needed with dilution of 125 mg/mL	Approx single dose (mg q6h)
4.5	40 mg	0.35 mL	30 mg	0.25 mL
9	75 mg	0.6 mL	55 mg	0.45 mL
13.6	115 mg	0.9 mL	85 mg	0.7 mL
18.1	150 mg	1.2 mL	115 mg	0.9 mL
22.7	190 mg	1.5 mL	140 mg	1.1 mL
Weight	50 mg/kg/day Divided into 3 doses		50 mg/kg/day Divided into 4 doses	
	kg	Approx single dose (mg q8h)	Vol (mL) needed with dilution of 225 mg/mL	Approx single dose (mg q6h)
4.5	75 mg	0.35 mL	55 mg	0.25 mL
9	150 mg	0.7 mL	110 mg	0.5 mL
13.6	225 mg	1 mL	170 mg	0.75 mL
18.1	300 mg	1.35 mL	225 mg	1 mL
22.7	375 mg	1.7 mL	285 mg	1.25 mL

In children with mild to moderate renal impairment (creatinine clearance of 70 to 40 mL/min), 60% of the normal daily dose given in divided doses every 12 hours should be sufficient. In children with moderate impairment (creatinine clearance of 40 to 20 mL/min), 25% of the normal daily dose given in divided doses every 12 hours should be sufficient. In children with severe impairment (creatinine clearance of 20 to 5 mL/min), 10% of the normal daily dose given every 24 hours should be adequate. All dosage recommendations apply after an initial loading dose is administered.

Since safety for use in premature infants and in infants under 1 month of age has not been established, the use of DBL™ Cephazolin Sodium for Injection in these patients is not recommended.

Contraindications

DBL™ Cephazolin Sodium for Injection is contraindicated in patients with known allergy to the cephalosporin group of antibiotics.

Warnings and Precautions

Warnings

BEFORE DBL™ CEPHAZOLIN SODIUM FOR INJECTION THERAPY IS INSTITUTED, CAREFUL INQUIRY SHOULD BE MADE CONCERNING PREVIOUS HYPERSENSITIVITY REACTIONS TO CEPHALOSPORINS AND PENICILLIN. CEPHALOSPORIN C DERIVATIVES SHOULD BE GIVEN CAUTIOUSLY TO PENICILLIN-SENSITIVE PATIENTS.

SERIOUS ACUTE HYPERSENSITIVITY REACTIONS MAY REQUIRE ADRENALINE AND OTHER EMERGENCY MEASURES.

There is some clinical and laboratory evidence of partial cross-allergenicity between the penicillins and the cephalosporins. Patients have been reported to have had severe reactions (including anaphylaxis) to both medicines.

Antibiotics, including DBL™ Cephazolin Sodium for Injection should be administered cautiously to any patient who has demonstrated some form of allergy, particularly to medicines.

Pseudomembranous colitis has been reported with virtually all broad-spectrum antibiotics (including macrolides, semisynthetic penicillins, and cephalosporins); therefore, it is important to consider its diagnosis in patients who develop diarrhoea in association with the use of antibiotics. Such colitis may range in severity from mild to life-threatening. In moderate to severe cases, appropriate measures should be taken.

Usage in Infants: Safety for use in prematures and infants under one month of age has not been established.

Precautions

General

If an allergic reaction to DBL™ Cephazolin Sodium for Injection occurs, the medicine should be discontinued and the patient treated with the usual agents (e.g. adrenaline or other pressor amines, antihistamines, or corticosteroids).

Prolonged use of DBL™ Cephazolin Sodium for Injection may result in the overgrowth of nonsusceptible organisms. Careful clinical observation of the patient is essential. If superinfection occurs during therapy, appropriate measures should be taken.

When DBL™ Cephazolin Sodium for Injection is administered to patients with low urinary output because of impaired renal function, lower daily dosage is required (see Dosage and Administration).

The intrathecal administration of DBL™ Cephazolin Sodium for Injection is not an approved route of administration for this antibiotic; in fact, there have been reports of severe central nervous system (CNS) toxicity including seizures when DBL™ Cephazolin Sodium for Injection was administered in this manner. Broad-spectrum antibiotics should be prescribed with caution in individuals with a history of gastrointestinal disease, particularly colitis.

Carcinogenesis, Mutagenesis, Impairment of Fertility:

Mutagenicity studies and long-term studies in animals to determine the carcinogenic potential of DBL™ Cephazolin Sodium for Injection have not been performed.

Usage in Pregnancy:

Reproduction studies have been performed in rats given doses of 500 mg or 1 g of DBL™ Cephazolin Sodium for Injection /kg and have revealed no evidence of impaired fertility or harm to the foetus due to Cephazolin Sodium for Injection. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this medicine should be used during pregnancy only if clearly needed.

Labour and Delivery:

When DBL™ Cephazolin Sodium for Injection has been administered prior to caesarean section, drug levels in cord blood have been approximately one-fourth to one-third of maternal drug levels. The medicine appears to have no adverse effect on the foetus.

Nursing Mothers:

DBL™ Cephazolin Sodium for Injection is present in very low concentrations in the milk of nursing mothers. Caution should be exercised when cephazolin is administered to a nursing woman.

Adverse Effects

The following reactions have been reported:

Hypersensitivity

Medicine fever, skin rash, vulvar pruritus, eosinophilia, and anaphylaxis have occurred.

Blood

Neutropenia, leucopenia, thrombocythaemia and positive direct and indirect Coombs' tests have occurred.

Renal

Transient rise in BUN levels has been observed without clinical evidence of renal impairment. Interstitial nephritis and other renal disorders have been reported rarely. Most patients experiencing these effects have been seriously ill and were receiving multiple medicine therapies. The role of DBL™ Cephazolin Sodium for Injection in the development of nephropathies has not been determined.

Hepatic

Transient rise in AST, ALT, and alkaline phosphatase levels has been observed rarely. As with some penicillins and some other cephalosporins, transient hepatitis and cholestatic jaundice have been reported rarely.

Gastrointestinal

Symptoms of pseudomembranous colitis may appear either during or after antibiotic treatment. Nausea and vomiting have been reported rarely. Anorexia, diarrhoea and oral candidiasis (oral thrush) have been reported.

Other

Pain on intramuscular injection, sometimes with induration, has occurred infrequently. Phlebitis at the site of injection has been noted. Other reactions have included genital and anal pruritus, genital moniliasis, and vaginitis.

Interactions

Used concurrently, probenecid may decrease renal tubular secretion of cephalosporins resulting in increased and more prolonged cephalosporin blood levels.

A false-positive reaction for glucose in the urine may occur with Benedict's solution, Fehling's solution, or CLINITEST Tablets, but not with enzyme-based tests, such as CLINSTIX and TES-TAPE (Glucose Enzymatic Test Strip, Lilly).

Positive direct and indirect antiglobulin (Coombs') tests have occurred; these may also occur in neonates whose mothers received cephalosporins before delivery.

DBL™ Cephazolin Sodium for Injection should not be mixed in the syringe with aminoglycoside antibiotics.

Overdosage

Signs and Symptoms

Toxic signs and symptoms following an overdose of cephazolin may include pain, inflammation, and phlebitis at the injection site. The administration of inappropriately large doses of parenteral cephalosporins may cause dizziness, paresthesias, and headaches. Seizures may occur following overdosage with some cephalosporins, particularly in patients with renal impairment in whom accumulation is likely to occur.

Laboratory abnormalities that may occur after an overdose include elevations in creatinine, BUN, liver enzymes and bilirubin, a positive Coombs' test, thrombocytosis, thrombocytopenia, eosinophilia, leucopenia, and prolongation of the prothrombin time.

Treatment

In managing overdosage, consider the possibility of multiple medicine overdoses, interaction among medicines, and unusual medicine kinetics in your patient.

If seizures occur, the medicine should be discontinued promptly; anticonvulsant therapy may be administered if clinically indicated. Protect the patient's airway and support ventilation and perfusion. Meticulously monitor and maintain, within acceptable limits, the patient's vital signs, blood gases, serum electrolytes, etc.

In cases of severe overdosage, especially in a patient with renal failure, combined haemodialysis and haemoperfusion may be considered if response to more conservative therapy fails. However, no data supporting such therapy are available.

Pharmaceutical Precautions

Stored below 25°C, DBL™ Cephazolin Sodium for Injection has a shelf life of 2 years.

Stability

In those situations in which the medicine and the diluent have been mixed, but not immediately administered to the patient, the admixture may be stored under the following conditions:

Vials

Reconstituted DBL™ Cephazolin Sodium for Injection diluted in Sterile Water for Injection, 5% Dextrose Injection, 0.9% Sodium Chloride Injection, or Bacteriostatic Water for Injection is stable for 24 hours at room temperature and for 10 days if stored under refrigeration (2° to 8°C).

Solutions of DBL™ Cephazolin Sodium for Injection in Sterile Water for Injection, 5% Dextrose Injection, or 0.9% Sodium Chloride Injection that are frozen immediately after reconstitution in the original container are stable for as long as 12 weeks if stored at minus 20°C (freezer). Once thawed, these solutions are stable for 24 hours at room temperature or for 10 days if stored under refrigeration (2° to 8°C). If the product is warmed, care should be taken to avoid heating it after the thawing is complete. Once thawed, the solution should not be refrozen.

Secondary Diluents

Solutions of DBL™ Cephazolin Sodium for Injection for infusion in 10% Dextrose Injection, 5% Dextrose in Lactated Ringer's Injection, 5% Dextrose and 0.9% Sodium Chloride Injection (also may be used with 5% Dextrose and 0.45% or 0.2% Sodium Chloride Injection), Lactated Ringer's Injection, 5% or 10% Invert Sugar in Sterile Water for Injection, Ringer's Injection, Normosol-M in D5-W, Ionomol-B with Dextrose 5%, or Plasma-Lyte with 5% Dextrose should be used within 24 hours after dilution if stored at room temperature or within 96 hours if stored under refrigeration (2° to 8°C). Do not freeze DBL™ Cephazolin Sodium for Injection diluted with the above diluents.

Prior to administration, parenteral medicine products should be inspected visually for particulate matter and discolouration whenever solution and container permit.

Medicine Classification

Prescription Medicine.

Package Quantities

The 500 mg and 1 g vials are available in cartons of 5 vials.

Further Information

Sterile Cephazolin Sodium is 5-Thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylic acid, 3-[[[(5-methyl-1,3,4-thiadiazol-2-yl)thio]methyl-oxo-7-[[1 H-tetrazol-1-yl]acetyl]amino]-, monosodium salt (6 R - trans). The sodium content is 48.3 mg/g of cephazolin sodium. The molecular formula is C₁₄H₁₄N₈O₄S₃. The molecular weight is 476.5. The pH of the reconstituted solution is between 4.5 and 6.

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PACKAGE LEAFLET: INFORMATION FOR THE USER

Aclasta 5 mg solution for infusion Zoledronic acid

Read all of this leaflet carefully before you are given this medicine.

- Keep this leaflet. You may need to read it again.
- If you have any further questions, ask your doctor, pharmacist or nurse.
- This medicine has been prescribed for you. Do not pass it on to others. It may harm them, even if their symptoms are the same as yours.
- If any of the side effects gets serious, or if you notice any side effects not listed in this leaflet, please tell your doctor, pharmacist or nurse.

In this leaflet:

1. What Aclasta is and what it is used for
2. Before you are given Aclasta
3. How Aclasta is given
4. Possible side effects
5. How to store Aclasta
6. Further information

1. WHAT ACLASTA IS AND WHAT IT IS USED FOR

Aclasta contains the active substance zoledronic acid. It belongs to a group of medicines called bisphosphonates and is used to treat post-menopausal women and men with osteoporosis or osteoporosis caused by treatment with steroids, and Paget's disease of the bone.

Osteoporosis

Osteoporosis is a disease that involves the thinning and weakening of the bones and is common in women after the menopause, but can also occur in men. At the menopause, a woman's ovaries stop producing the female hormone oestrogen, which helps keep bones healthy. Following the menopause bone loss occurs, bones become weaker and break more easily. Osteoporosis could also occur in men and women because of the long term use of steroids, which can affect the strength of bones. Many patients with osteoporosis have no symptoms but they are still at risk of breaking bones because osteoporosis has made their bones weaker. Decreased circulating levels of sex hormones, mainly oestrogens converted from androgens, also play a role in the more gradual bone loss observed in men. In both women and men, Aclasta strengthens the bone and therefore makes it less likely to break.

Aclasta is also used in patients who have recently broken their hip in a minor trauma such as a fall and therefore are at risk of subsequent bone breaks.

Paget's disease of the bone

It is normal that old bone is removed and is replaced with new bone material. This process is called remodelling. In Paget's disease, bone remodelling is too rapid and new bone is formed in a disordered fashion, which makes it weaker than normal. If the disease is not treated, bones may become deformed and painful, and may break. Aclasta works by returning the bone remodelling process to normal, securing formation of normal bone, thus restoring strength to the bone.

2. BEFORE YOU ARE GIVEN ACLASTA

Follow all instructions given to you by your doctor carefully before you are given Aclasta.

You should not be given Aclasta

- if you are allergic (hypersensitive) to zoledronic acid, other bisphosphonates or any of the other ingredients of Aclasta.

- if you have hypocalcaemia (this means that the levels of calcium in your blood are too low).
- if you have severe kidney problems.
- if you are pregnant.
- if you are breast-feeding.

Take special care with Aclasta

Tell your doctor before you are given Aclasta:

- if you are being treated with Zometa, which contains the same active substance as Aclasta.
- if you have a kidney problem, or used to have one.
- if you are unable to take daily calcium supplements.
- if you have had some or all of the parathyroid glands in your neck surgically removed.
- if you have had sections of your intestine removed.

Before you receive treatment with Aclasta, tell your doctor if you have (or have had) pain, swelling or numbness in your gums, jaw or both, if your jaw feels heavy, or if you have lost a tooth. Before you receive dental treatment or undergo dental surgery, tell your dentist you are receiving treatment with Aclasta.

Use in children

Aclasta is not recommended for anyone under 18 years of age. The use of Aclasta in children and adolescents has not been studied.

Taking other medicines

Please tell your doctor, pharmacist or nurse if you are taking or have recently taken any other medicines, including medicines obtained without a prescription.

It is especially important for your doctor to know all the medicines you are taking, especially if you are taking any medicines known to be harmful to your kidneys (e.g. aminoglycosides) or diuretics ("waterpills") that may cause dehydration.

Using Aclasta with food and drink

Make sure you drink enough fluids (at least one or two glasses) before and after the treatment with Aclasta, as directed by your doctor. This will help to prevent dehydration. You may eat normally on the day you are treated with Aclasta. This is especially important in patients who take diuretics ("water pills") and in elderly patients.

Pregnancy and breast-feeding

There is no adequate information on the use of zoledronic acid in pregnant women. Studies in animals have shown reproductive toxicological effects. Additionally, there is no information on the use of Aclasta in breast-feeding women. You must not be given Aclasta if you are pregnant or plan to become pregnant.

You must not be given Aclasta if you are breast-feeding.

Ask your doctor, pharmacist or nurse for advice before taking any medicine.

Driving and using machines

If you feel dizzy while taking Aclasta, do not drive or use machines until you feel better.

3. HOW ACLASTA IS GIVEN

Follow carefully all instructions given to you by your doctor or nurse. You should check with your doctor or nurse if you are not sure.

Your doctor should do a blood test to check your kidney functions (levels of creatinine) before each dose of Aclasta. It is important for you to drink at least one or two glasses of fluid (such as water), within a few hours before receiving Aclasta, as directed by your doctor or nurse.

Osteoporosis

The usual dose is 5 mg given as one infusion per year into a vein by your doctor or nurse. The infusion will take at least 15 minutes.

In case you recently broke your hip, it is recommended that Aclasta is administered two or more weeks after your hip repair surgery.

It is important to take calcium and vitamin D supplements (for example tablets) as directed by your doctor.

For osteoporosis, Aclasta works for one year. Your doctor will let you know when to return for your next dose.

Paget's disease

The usual dose is 5 mg, given to you as one initial infusion into a vein by your doctor or nurse. The infusion will take at least 15 minutes. Aclasta may work for longer than one year, and your doctor will let you know if you need to be treated again.

Your doctor may advise you to take calcium and vitamin D supplements (e.g. tablets) for at least the first ten days after being given Aclasta. It is important that you follow this advice carefully so that the level of calcium in your blood does not become too low in the period after the infusion. Your doctor will inform you regarding the symptoms associated with hypocalcaemia.

If a dose of Aclasta is missed

Contact your doctor or hospital as soon as possible to re-schedule your appointment.

Before stopping Aclasta therapy

If you are considering stopping Aclasta treatment, please go to your next appointment and discuss this with your doctor. Your doctor will advise you and decide how long you should be treated with Aclasta.

If you have any further questions on the use of this medicine, ask your doctor, pharmacist or nurse.

4. POSSIBLE SIDE EFFECTS

Like all medicines, Aclasta can cause side effects, although not everybody gets them. In most cases, no specific treatment is required.

Side effects may occur with certain frequencies, which are defined as follows:

Very common:	affects more than 1 user in 10
Common:	affects 1 to 10 users in 100
Uncommon:	affects 1 to 10 users in 1,000
Rare:	affects 1 to 10 users in 10,000
Very rare:	affects less than 1 user in 10,000
Not known:	frequency cannot be estimated from the available data.

Side effects related to the first infusion are very common (occurring in more than 30% of patients) but are less common following subsequent infusions. The majority of the side effects, such as fever and chills, pain in the muscles or joints, and headache, occur within the first three days following the dose of Aclasta. The symptoms are usually mild to moderate and go away within three days. Your doctor

can recommend a mild pain reliever such as ibuprofen or paracetamol to reduce these side effects. The chance of experiencing these side effects decreases with subsequent doses of Aclasta.

Very common side effects

Fever

Common side effects

Headache, dizziness, sickness, vomiting, diarrhoea, pain in the muscles, pain in the bones and/or joints, pain in the back, arms or legs, flu-like symptoms (e.g. tiredness, chills, joint and muscle pain), chills, feeling of tiredness and lack of interest, weakness, pain, feeling unwell, skin reactions such as redness, swelling and/or pain at the infusion site.

In patients with Paget's disease: symptoms due to low blood calcium, such as muscle spasms, or numbness, or a tingling sensation especially in the area around the mouth.

Irregular heart rhythm (atrial fibrillation) has been seen in patients receiving Aclasta for post-menopausal osteoporosis. It is currently unclear whether Aclasta causes this irregular heart rhythm but you should report it to your doctor if you experience such symptoms after you have received Aclasta.

Uncommon side effects

Flu, upper respiratory tract infections, decreased red cell count, loss of appetite, sleeplessness, sleepiness which may include reduced alertness and awareness, tingling sensation or numbness, extreme tiredness, trembling, temporary loss of consciousness, eye infection or irritation or inflammation with pain and redness, eye sensitivity to light, spinning sensation, increased blood pressure, flushing, cough, shortness of breath, upset stomach, abdominal pain, constipation, dry mouth, heartburn, skin rash, excessive sweating, itching, skin reddening, neck pain, stiffness in muscles, bones and/or joints, joint swelling, muscle spasms, shoulder pain, pain in your chest muscles and rib cage, joint inflammation, muscular weakness, abnormal kidney test results, abnormal frequent urination, swelling of hands, ankles or feet, thirst, toothache, taste disturbances.

Additional side effects which have been reported (frequency not known): severe allergic reactions including dizziness and difficulty breathing, swelling mainly of the face and throat, decreased blood pressure, pain in the mouth, teeth and jaw, swelling or sores inside the mouth, numbness or a feeling of heaviness in the jaw, or loosening of a tooth, kidney disorder (e.g. decreased urine output), dehydration secondary to post-dose symptoms such as fever, vomiting and diarrhoea.

Unusual fracture of the thigh bone particularly in patients on long-term treatment for osteoporosis may occur rarely. Contact your doctor if you experience pain, weakness or discomfort in your thigh, hip or groin as this may be an early indication of a possible fracture of the thigh bone.

If you notice any of these side effects, tell your doctor.

If any of the side effects gets serious, or if you notice any side effects not listed in this leaflet, please tell your doctor, pharmacist or nurse.

5. HOW TO STORE ACLASTA

Your doctor, pharmacist or nurse knows how to store Aclasta properly.

- Keep out of the reach and sight of children.
- Do not use Aclasta after the expiry date which is stated on the carton and bottle after EXP.
- The unopened bottle does not require any special storage conditions.
- After opening the bottle, the product should be used immediately in order to avoid microbial contamination. If not used immediately, in-use storage times and conditions prior to use are the responsibility of the user and would normally not be longer than 24 hours at 2°C – 8°C. Allow the refrigerated solution to reach room temperature before administration.

INFORMATION FOR THE HEALTHCARE PROFESSIONAL

The following information is intended for medical or healthcare professionals only (see section 3):

How to prepare and administer Aclasta

- Aclasta 5 mg solution for infusion is ready for use.

For single use only. Any unused solution should be discarded. Only clear solution free from particles and discolouration should be used. Aclasta must not be mixed or given intravenously with any other medicinal product and must be given through a separate vented infusion line at a constant infusion rate. The infusion time must not be less than 15 minutes. Aclasta must not be allowed to come into contact with any calcium-containing solutions. If refrigerated, allow the refrigerated solution to reach room temperature before administration. Aseptic techniques must be followed during preparation of the infusion. The infusion must be conducted according to standard medical practice.

How to store Aclasta

- Keep out of the reach and sight of children.
- Do not use Aclasta after the expiry date which is stated on the carton and bottle.
- The unopened bottle does not require any special storage conditions.
- After opening the bottle, the product should be used immediately in order to avoid microbial contamination. If not used immediately, in-use storage times and conditions prior to use are the responsibility of the user and would normally not be longer than 24 hours at 2°C - 8°C. Allow the refrigerated solution to reach room temperature before administration.

6. FURTHER INFORMATION

What Aclasta contains

- The active substance is zoledronic acid. Each bottle with 100 ml of solution contains 5 mg zoledronic acid anhydrous (as monohydrate).
One ml solution contains 0.05 mg zoledronic acid (as monohydrate).
- The other ingredients are mannitol, sodium citrate and water for injections.

What Aclasta looks like and contents of the pack

Aclasta is a clear and colourless solution. It comes in 100 ml plastic bottles as a ready-to-use solution for infusion. It is supplied in packs containing one bottle as unit pack or in multi-packs comprising 5 packs, each containing 1 bottle. Not all pack sizes may be marketed.

Bisphosphonates

Bisphosphonates are potent inhibitors of bone resorption. They stick to the bone surface and make the cells that destroy bone tissue less effective. This allows bone rebuilding cells to work more effectively, resulting in increased bone density.

Because Zoledronic acid (Aclasta), works for a long time, only a single dose is required each year, making this osteoporosis therapy advantageous for frail older people living in the community or residential aged care.

An association between bisphosphonate use and a rare dental condition termed osteonecrosis of the jaw has been reported. The small risk of this condition needs to be considered against the significantly reduced risk of fracture and other skeletal complications in older people with established osteoporosis. One approach is to ensure appropriate oral health and dental treatment before prescription, particularly if high doses or intravenous drugs are prescribed, or if a dental extraction is already planned.

CHECK POINT - SECTION FIVE:

Primary care specific therapy considerations – Cephazolin Sodium for injection

- 1) Which therapeutic drug group does Cephazolin belong to:

- 2) What is the main indication for the prescription of Cephazolin in primary care?

- 3) Cephazolin Ig should be reconstituted in _____ mls of water for injection when given as a direct IV injection.

- 4) Cephazolin 2 grams can be diluted in _____ mls of water for injection and added to a _____ ml bag of normal saline when being given via an intermittent infusion. This should be infused over _____ minutes.

- 5) Reconstituted Cephazolin is stable for _____ at room temperature.

- 6) List four adverse effects that can occur with the administration of Cephazolin.

1. _____

2. _____

3. _____

4. _____

- 7) What is the main indication for reducing the dose of Cephazolin?

- 8) What is the pH of Cephazolin? _____ Does this make it appropriate to be administered via a peripheral cannula?

YES NO

- 9) Can patients who are breastfeeding be administered Cephazolin?

YES NO

CHECK POINT - SECTION FIVE:

Primary care specific therapy considerations –

Intravenous Zoledronic Acid (Aclasta)

- 1) Name the main active ingredient of Aclasta.

- 2) Aclasta belongs to the Bisphosphonate group of medicines. Aclasta inhibits bone resorption by _____

- 3) What are the 2 main indications for the prescription of Aclasta:

1. _____

2. _____

- 4) List 5 underlying conditions/circumstances that contraindicate the use of Aclasta:

1. _____

2. _____

3. _____

4. _____

5. _____

- 5) List four common or very common adverse effects that can occur with the administration of Aclasta:

1. _____

2. _____

3. _____

4. _____

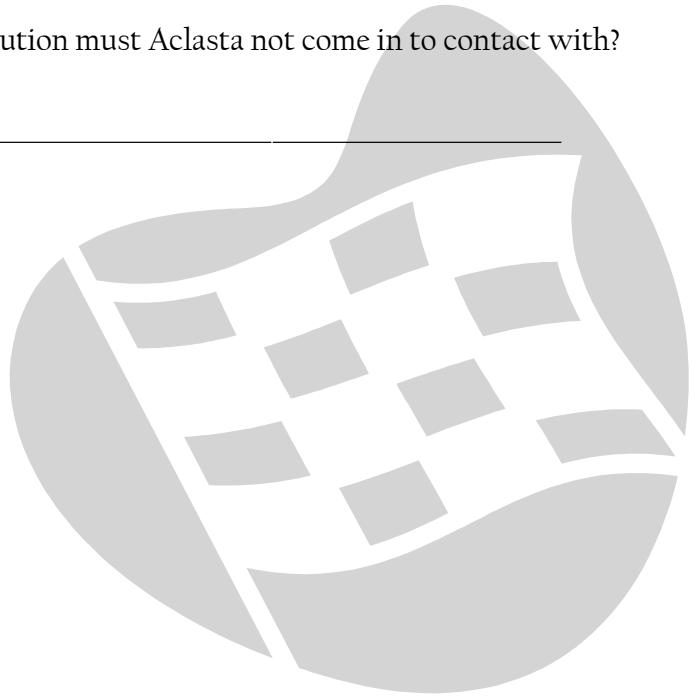
- 6) Why is it important to ensure the oral and dental health of each patient prior to commencing Aclasta treatment?
-

- 7) Can children be administered Aclasta?

YES NO

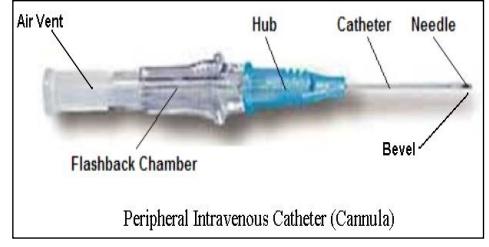
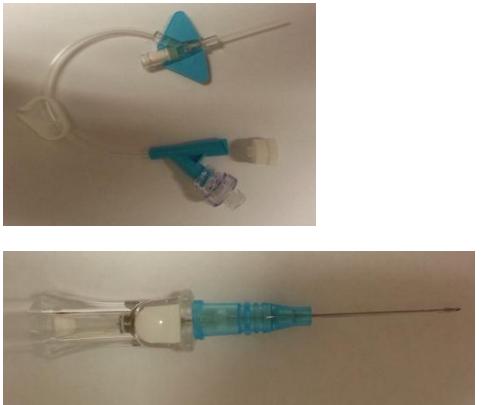
- 8) Aclasta is administered over _____ minutes via a separate _____ infusion set, at a _____ infusion rate, directly from its ready to use container.

- 9) Which electrolyte containing solution must Aclasta not come in to contact with?
-

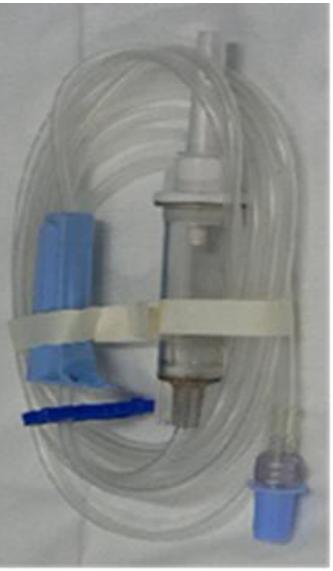


Appendix One:

Standard Equipment Used in Intravenous Therapy

EQUIPMENT DESCRIPTION	EQUIPMENT EXAMPLE
<p>Needleless access connectors (NAC)</p> <p>Male luer-lock device with a female luer locking connection for accessing IV cannula without the use of a needle, to administer medications or draw blood. Will fit onto all standard IV cannula hubs and allows the use of all standard male luer lock connecting IV systems without any requirement for add on devices.</p> <p>A cannula inserted for short term/single use may have a NAC directly applied to the cannula hub; otherwise the NAC must be pre-attached or applied to the IV cannula extension at insertion.</p>	
<p>IV cannula extension sets</p> <p>A short (usually less than 12cm) extension set that is attached to the open IV catheter hub to provide swabbable access. An extension set is required to reduce trauma to the insertion site caused by manipulation of the cannula when being accessed. This helps prolong the patency of the device.</p> <p>Cannula extension sets have an approximate priming volume of less than 1 ml. They need to be primed with 0.9% sodium chloride before being attached the cannula and closed with a NAC. The extension set has an integral clamp which allows the cannula system to be locked under positive pressure, preventing negative reflux of blood into the cannula following syringe disconnection.</p>	
<p>Peripheral IV Catheter/ Cannula</p> <p>The peripheral cannula is an ‘over-the-needle’ catheter that consists of a needle (stylet) and catheter sheath. The point of the needle extends beyond the tip of the catheter. After venepuncture, the needle is withdrawn and discarded, leaving a flexible catheter in the vein. The catheter is a flexible tube attached to a hub. Once sited within the vascular system, the warmth of the blood softens the catheter helping reduce incidences of mechanical phlebitis. Gauges range from 24g to 14g.</p>	 <p>Peripheral Intravenous Catheter (Cannula)</p>
<p>Peripheral IV safety cannula</p> <p>An ‘over-the-needle’ catheter that consists of a needle (stylet) and catheter sheath. The point of the needle extends beyond the tip of the catheter. After venepuncture, the needle is retracted into a protective mechanism.</p> <p>Some safety devices are passive and some are active. This safety technology has been proven to effectively safeguard healthcare workers from accidental cannulation related needle stick injuries. Where available and not clinically contraindicated use safety equipped cannulation equipment.</p>	

<p>IV starter pack</p> <p><i>These packs can be substituted for individual items as available.</i></p> <p>Equipment contained in most IV starter packs used for insertion of a peripheral cannula includes –</p> <p>1X chlorhexidine and alcohol swab, 1X transparent membrane IV dressing, 1X tourniquet, 3X pieces of gauze, 1X waterproof backed sterile guard, 1 X IV label attached to the dressing and an addition label in the pack to provide insertion detail.</p>	
<p>Blunt drawing up needle</p> <p>The drawing up needle is used for rapid aspiration and reconstitution of medications from non-snap top glass ampoules. 18 gauge, 40-degree bevel needles helps to minimise coring and the generation of particulate matter in medication preparation and can be used to add medications to flexible IV infusion bags.</p>	 <p>Current Individual Graphic</p> 
<p>Filter Needle (5 micron)</p> <p>A needle free, luer lock drawing up device fitted with a one way 5 micron filter, which acts as a sieve to trap contaminants and particulate matter – especially glass fragments, when drawing up medications from snap top glass ampoules. Discard once medication is drawn up to avoid particulate filtrate being injected into a fluid bag.</p>	 <p>Current Individual Graphic</p> 
<p>Sterile syringes</p> <p>Syringes come in two types – luer lock and slip. The luer lock syringes (pictured) attach to IV equipment via a screw action. As the name suggests, the syringe is ‘locked’ into place and provides a secure connection with little risk of detachment during the procedure.</p> <p>The slip syringe accesses IV equipment by pushing directly into the device. It can be removed easily by applying force in the opposite direction. Slip connections are not considered reliable and must not be left unattended.</p>	
<p>Water for Injection ampoules</p> <p>Water for Injection is used for reconstituting most powdered IV medication. They come in plastic 5ml, 10ml and 20ml vial sizes.</p>	
<p>Normal saline ampoules</p> <p>0.9% Sodium Chloride (normal saline) is used for flushing IV cannula.</p>	

<p>Normal saline flushing</p> <p>A blunt drawing up needle, syringe and saline ampoule is required in combination to aseptically prepare a saline flush.</p> <p>A syringe with 0.9% saline will be needed to prime the extension set and flush the cannula to assess patency after insertion. It is also used to flush the cannula before and after any medication administration to displace medications that remain within cannula extensions and connections following administration.</p>	
<p>Pre-filled saline syringes</p> <p>Pre-filled saline syringes are available in 3, 5 and 10 ml volumes for flushing purposes only. The syringe barrel size is standard across all volumes.</p> <p>They are not sterile on the outer, only sterile through the fluid pathway. To prepare, depress plunger with tip cap on to release the stopper seal. Do not pull back on the plunger.</p>	
<p>Infusion administration sets</p> <p>IV tubing - or solution sets, are used to administer medicines/fluids over a prolonged period, rather than over a short period as in bolus administration. The infusion set is a tube that connects the bag/bottle of IV solution to the patient via an IV catheter/cannula. All modern IV access systems are needleless. The NAC is accessed by screwing together the male luer lock adapter at the end of the administration set.</p> <p>Most infusion sets have a 'drip chamber'. The drip chamber provides a method of measuring the delivery volume. They are calibrated in drops per ml i.e. a certain number of drops, which can be viewed through the chamber, is equal to one ml of fluid. Infusion sets are calibrated at 10 to 60 drops per ml. All drip chamber style IV infusion sets have a means of controlling the drip rate. The most common method of controlling the flow rate is with a roller clamp situated along the tubing. In the on position it allows for unrestricted flow through the solution set. As the roller is moved towards the narrow end, it gradually restricts flow. When fully moved to the narrow end, flow is completely stopped.</p> <p>There is another sliding clamp which is utilised when the solution set is placed in an electronic infusion device. This can also be used to manually start and stop flow but cannot vary the rate.</p>	
<p>Needleless access y-sites or side arms</p> <p>In some infusion/extension sets, medications can be administered along with a compatible infusion solution via a NAC - Y-site. Y-sites can be used for injecting bolus medications and can also be used for setting up 'Secondary' infusions.</p>	

Vented bag spikes and venting (air inlet) needles

This device is used with infusions from rigid (non-collapsible) fluid containers. For fluid to flow air must displace fluid. The adapter is spiked into the infusion container, and piercing into the open end connects the appropriate infusion line. Air will enter via air vent.

Some administration sets are configured with vented spikes in which case an air venting needle is not required.

On administration sets that are not configured with vented spikes, an air needle must be added allowing air to enter the rigid container and displace the fluid to the set.



RECOMMENDED READING LIST:

Associated references:

- <http://www.medicines.org.uk/emc/medicine/18284/pil>
- <http://www.medsafe.govt.nz/profs/datasheet/c/Cephazolinsodiuminj.pdf>

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Related documents:

CCDHB documents:

- C&C DHB (2016). Intravenous therapy instructional package for nurses, midwives and technicians.
- C&C DHB (2016). Peripheral Intravenous Cannulation Information Package.
- CCDHB policy documents:
 - Peripheral intravenous cannula insertion and ongoing care – excluding neonates
 - Intravenous (IV) therapies administration and management procedure & policy
 - Anaphylaxis (adults) - emergency management by nurses and midwives

Acknowledgements

- Whanganui District Health Board Intravenous Resource Book, 2012

Notes