



A practical guide to IV site care

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Contents

1. Introduction
2. Icons
3. Competencies
4. Aseptic procedures
5. Types of IV access device
6. Choice of IV access device
7. IV access site selection
8. IV access site preparation
9. IV access site placement
10. Protection and management of the IV access site
11. IV access site care
12. Maintenance of IV access device
13. Patient education and information
14. Appendix – consensus statements for reducing the risk of infection
15. References

1. Introduction

Vascular access devices (VADs) are used to deliver essential fluids, IV medications, blood products and nutrients. Ninety per cent of all patients admitted to hospital for care have a vascular access device placed at some stage during their admission.¹ VADs and IV therapy are also increasingly common in the community.² These IV access devices can provide routes for micro-organisms to enter the bloodstream and can be a source of serious infection. The risk of infection can be reduced and minimised by always using appropriate infection prevention precautions.

This booklet is designed to provide an overview of these prevention precautions together with information about the use and maintenance of IV access devices. It should be used in conjunction with the policies and procedures of your own hospital or organisation.

The personal experience of the members of the IV Site Care Forum in reducing the risk of infection is also summarised in the appendix, by a series of summary statements. We hope that you will find them to be useful reminders in practice.

2. Icons

Throughout this booklet various icons will be used to indicate that certain procedures need to be followed.



When any procedure needs to have written documentation in the patient's notes.



When aseptic procedures need to be followed (see section 4).



When your organisation's own set of procedures and protocols should be followed.

3. Competencies

Competencies will vary from country to country:

In the UK qualified nurses trained and deemed competent can place peripheral vascular access devices. Qualified nurses who have been specifically trained and deemed competent can also place some types of central vascular access devices.

In the US, only nurses trained and deemed competent are allowed to insert vascular access devices. Trained and competent nurses may also place infusion lines with a physician's order.

In Japan, nurses who have enough clinical experience and are trained in a specific programme can place peripheral IV lines with a physician's order.

4. Aseptic procedures



Use of aseptic procedures are crucial in the prevention of all healthcare associated infections.



Each organisation will have their own protocols and practices; make sure you know yours.

Hand Hygiene

Effective and frequent hand washing is essential and should be performed before all clinical procedures and putting on gloves and after all clinical procedures and after removing gloves.³

First:

- Remove all hand and wrist jewellery
- Cover all cuts and abrasions with waterproof dressing
- Make sure fingernails are short with no varnish, nail art, or nail extensions^{3,4,5,6}

Then:

- Prepare hands and wrists under running water
- Wash all surfaces of the hands and wrists with liquid soap^{3,5,7}



1



2



3



4



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6



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Proper hand washing technique:

Begin with the wrists and work downwards, interlace your fingers and slide fingers back and forth, clean under nails and nail beds. Two minutes of vigorous scrubbing with liquid soap should eliminate most micro-organisms. Then rinse thoroughly with running water from the wrist downwards

- Dry all surfaces of the hands and wrists with paper towels⁷
- Use alcohol rub or foam for clean hands or where there is no running water. Make sure the solution covers all surfaces of the hands and wrists^{5,7}
- Use emollient hand cream regularly to protect hands³

Use of protective equipment

Protective equipment such as gloves, aprons and gowns should be worn whenever there is a risk of contamination.

All protective equipment should be 'single-use', put on immediately before patient contact and removed immediately after and all should be disposed of in an appropriate clinical waste container.

- Gloves should be worn for all invasive procedures. They protect hands from contamination by organic matter, micro-organisms and toxic substances and reduce any risk of cross contamination between patient and nursing staff.^{5,8} Wearing gloves also reduces the risk of transmission of infection from sharps injuries
- Disposable plastic aprons should be worn when there is a risk of contamination of clothing by body fluids
- Sterile full-body gowns should be worn when there is a risk of extensive exposure to body fluids and is part of the aseptic technique during insertion of central venous access devices
- Face masks and eye protection should be worn when there is a risk of facial exposure to body fluids

5. Types of IV access device

The terminology for classification of catheters differs and this can be confusing. "Catheter" simply means a hollow tube that is used for access into the body. It is usually used in reference to centrally placed VADs rather than peripheral devices. Generally, the term cannula is used in preference to catheter for some peripheral access devices.

A catheter may be identified by:

- The type of vessel it occupies – peripheral venous, central venous or arterial
- Its intended life – temporary or short-term, permanent or long-term
- Its site of insertion – subclavian, femoral, internal jugular, peripherally inserted central catheter (PICC) and peripheral
- Its pathway from skin to vessel – tunnelled and non-tunnelled
- Its physical length – short and long
- Any special characteristics – presence of a cuff, impregnation with heparin, antibiotics, or antiseptics and the number of lumens (tubes)

6. Choice of IV access device

Catheters should be selected on the basis of:

- Intended purpose i.e. continuous or intermittent therapy, types of medication, pH and osmolarity of the medication, how many lumens required etc
- Duration of use i.e. short or long-term
- Known complications
- Patient assessment (see table)
- What types of catheter are available



Your organisation may have its own protocols for the selection of IV access device.

Patient assessment & involvement history

- Previous surgery or radiotherapy and location
- Previous problems with venous access devices
- Fractures (particularly clavicle)

Current status

- Age
- Diagnosis
- Vascular condition
- Haematological stability
- Respiratory function
- Infection risk e.g. immuno-compromised.
- Allergic status
- Cardiovascular stability

If possible **discuss device selection with the patient** – patients who are involved are more likely to be compliant with management needs and better able to cope with any psychological effects.^{11,12}

- Generally the device should be of the smallest gauge and shortest length¹³
- The length of central devices should be selected to ensure that the distal tip of the catheter lies in the lower third of the superior vena cava or right atrium.^{13,14}
Note: Placement in the right atrium is contraindicated in Japan
- Choose a central venous device with the minimum number of ports or lumens for essential management¹⁰
- Choose a totally implantable device for long-term intermittent vascular access¹⁰
- Choose a PICC or tunnelled central venous catheter for frequent or continuous access¹⁰

Table 1. [Adapted from: O'Grady et al 2002]¹⁰

Catheter Type	Entry Site	Length
Peripheral venous catheter	Peripheral vein - usually in the forearm or hand	A short catheter ≤ 3.5 cms
Peripheral arterial catheter	Radial artery, femoral, axillary, brachial, posterior tibial	> 3.5 cms
Midline catheter	Peripheral vein usually below the elbow in the arm, then threaded into the veins in the upper arm proximal basilic or cephalic	7.5-20 cms
Non-tunnelled central venous catheter	Percutaneously inserted into central veins – subclavian, internal jugular or femoral	≥ 8 cms depending upon size of patient
Pulmonary arterial catheter	Inserted through a Teflon™ introducer in a central vein - subclavian, internal jugular or femoral	≥ 30 cms depending upon size of patient
Peripherally inserted central venous catheter	Peripheral vein introduction (basilic, cephalic or brachial) and threaded into large central vein – superior vena cava	≥ 20 cms depending upon size of patient
Tunnelled central venous catheter	Implanted into subclavian, internal jugular or femoral veins then tunnelled from the puncture site, down the chest wall for emergence	≥ 8 cms depending upon size of patient
Implantable port	Reservoir (port) positioned in a subcutaneous port beneath the skin and accessed using a non-coring needle. Catheter in the subclavian or internal jugular vein passes from access site to large central vein – superior vena cava	≥ 8 cms depending upon size of patient

Duration of Use	Comments
Short term, changed every 3 days	• May be associated with bloodstream infections • Phlebitis with prolonged use • Can easily become dislodged • May cause pain and discomfort • Not suitable for irritant or hyperosmolar solutions or parenteral nutrition
Short term, changed every 3-4 days	• Risk of infections low although it can be associated with bloodstream infections
Short to medium term (2-4 weeks)	• Lower rates of phlebitis than with peripheral venous catheters • Complications can be less easy to spot and may take longer to develop
Medium to long – weeks to months	• Associated with a high number of catheter-related bloodstream infections • Use of ultrasound for insertion and placement is recommended • Insertion is usually a medical procedure • Ideally should be coated with antibacterials/antimicrobials
Medium to long	• Associated with a high number of catheter-related bloodstream infections • Usually heparin-bonded • Subclavian entry is preferred site to reduce infection risk • Use of ultrasound for insertion and placement is recommended • Insertion is usually a medical procedure
Typically 4-8 weeks but longer if needed and free from infection	• Lower infection rate than non-tunnelled central venous devices • Use of ultrasound for insertion and placement is recommended • Insertion is usually carried out by nurses
A long-term device for > 3 months and for multiple daily use	• Fixed in place with a Dacron™ cuff placed beneath the skin. Examples include Hickman™, Briovac™ and Groshong™ catheters • 10-15% need replacing due to infection • May require a small surgical procedure for removal
A long-term device	• Used for intermittent IV access over long periods – eg chemotherapy • Associated with low infection risk • Requires a surgical procedure to insert and remove

7. IV access site selection

The site of catheter insertion influences the risk of catheter associated infections and phlebitis. In adults, upper extremity sites carry a lower infection risk than lower extremity sites and for peripheral venous catheters, the veins in the hand are associated with a lower risk of phlebitis than those in the wrist or upper arm.¹⁰ While infection risk is an important factor in site selection, other factors such as patient comfort, maintenance of asepsis and mechanical complications should also be taken into consideration.¹⁰

Peripheral devices	Central devices
• The site should be selected to accommodate the gauge and length of the required device • Suitable veins for peripheral catheters are in the dorsal and ventral surfaces of the upper extremities, typically the metacarpal, cephalic and basilic veins^{10,15} • Veins in the lower extremities should be used with caution in adults due to the risk of embolism and thrombophlebitis^{15,16} • Sites of flexion should be avoided¹³ • Arterial flow should not be compromised whilst distending veins¹⁷ • Selection should involve assessment of previous venepuncture and/or vein Damage and insertions should be made proximal to the previous access site³ • Midline catheters can be inserted in the cephalic, basilic or median cubital veins of the arm¹⁸ • In paediatric patients the hand, dorsum of the foot or the scalp can be used for catheter insertion¹⁰	• For PICCs the cephalic, basilic or median cubital veins of the arm can be used.^{13,18} The basilic vein is to be preferred as it is larger and has a straighter course • For non-tunnelled, tunnelled or implantable devices the internal jugular or subclavian veins can be used but the subclavian veins have a lower risk of catheter associated infections^{10,13,19} • The femoral vein should only be used with caution since implantation here is associated with a high risk of deep vein thrombosis and infection¹⁰ • In children and neonates the external jugular, axillary, long and short saphenous, temporal and auricular veins can be used for PICC²⁰
	Arterial devices
	• Suitable sites must be assessed for the presence of a pulse and for the distal circulation³ • The radial, brachial and femoral arteries are the most suitable³

8. Site preparation

Hair removal

- Hair should be removed from the intended access site when necessary
- Hair should be removed using scissors or clippers^{8,13}
- Razors or depilatories should not be used^{3,17}
- Electric clippers should have disposable heads and should be used only once²¹

Local anaesthesia

- Injectable local anaesthetics are only used on written order from a doctor^{3,22}
- Choose an agent that is least invasive and carries the lowest risk of an allergic reaction²³

Asepsis

Aseptic techniques are essential for the prevention of contamination:

- Observe proper hand-hygieneⁱ before and after palpating catheter insertion sites



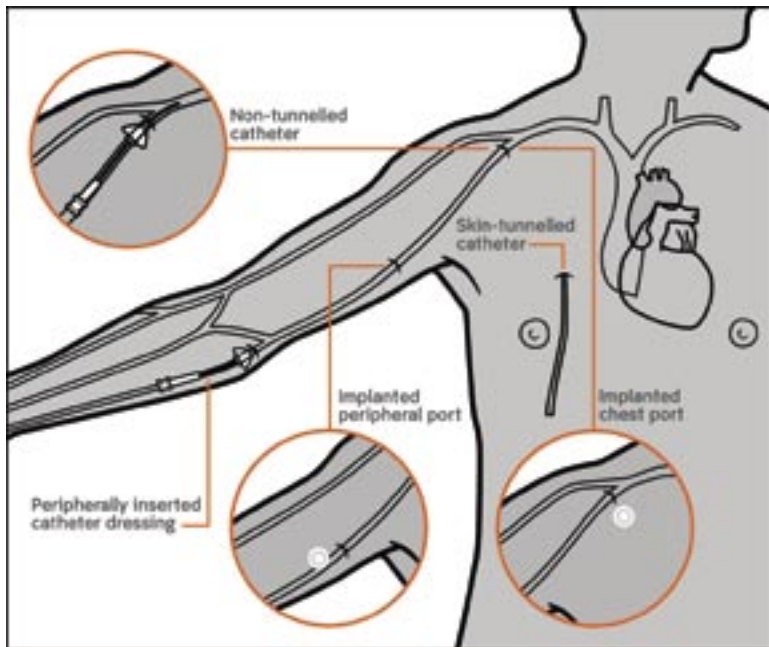
- The site should be cleaned with an appropriate antiseptic prior to insertion; 2% chlorhexidine-based preparationsⁱⁱ, tincture of iodine, an iodophor or 70% alcohol.¹⁰ Chlorhexidine is the preferred cleaning agent²⁴
- Site cleaning should take between 30 seconds (peripheral sites) and 2 minutes (central sites)^{5,10}
- The antiseptic solution should be allowed to air-dry completely before proceeding with insertion¹³
- Antiseptic solutions in a single-use-formula should be used whenever possible^{3,25}
- Sterile powder-free gloves should be worn and changed prior to midline, arterial, central and PICC placement¹³

i See section 4

ii Chlorhexidine should not be used in children under 2 months old

9. IV access device placement

Insertion sites for central venous devices



Observe aseptic techniques throughout the placement of any vascular access device.



Check your organisation's protocols and procedures for the placement of IV access devices.

Placement of peripheral, midline and PICCS are nursing procedures in most hospitals. Placement of tunnelled catheters and implantable ports are generally medical procedures at present but are a developing area of nursing practice.³

Note: In Japan, nurses can only place peripheral lines.

- Only one device should be used for each attempt³
- Make no more than two attempts to insert a device then ask for help from a more experienced colleague
- Placement of midline catheters and PICCs should be just above or below the fold of the antecubital area for comfort and to reduce the risk of kinking³
- The distal tip of a central venous catheter should dwell in the lower third of the superior vena cava or right atrium, determined radiographically prior to initiation of therapy^{14,18}
- Stylets that are part of the product should never be re-inserted due to risk of severing or puncture³
- Manufacturer's product guidelines should always be followed³
- Documentation of device, gauge, length, product name, batch, lot number, number of attempts, anatomical location and patient response should be documented in the patient's medical records³
- Radiological confirmation of the location of the tip may be required if any problems are encountered and is always needed for centrally placed vascular access devices^{3,14}

10. Protection and management of the IV access site



Once in place at the desired site, the catheter needs to be stabilised and dressed. Stabilisation should hold the external parts of the device in place. It should not interfere with assessment and monitoring of the access site and protective material should allow visual inspection, should not interfere with circulation or with infusion through the access site.³

The insertion site should be assessed on a daily basis, or each time it is accessed, for the development of complications.⁸ A record should be made of each inspection.

Site dressing material that is obscuring the direct visualisation of the point of entry should be removed at regular intervals for visual inspection of the site, to monitor skin integrity and to minimise the risk of infection.^{5,10}

Site dressing material should also be removed if it becomes wet, loosened or visibly soiled.¹⁰

Products used for stabilisation include sterile tapes, sterile gauze, transparent semi-permeable membrane (TSM) dressings, sutures, manufactured catheter securement devices and sterile surgical strips. Use of these products reduces the risk of accidental disconnection or dislodgement.

Scissors should not be used at or near the insertion site to remove dressing material, tape or securement devices.³

Site Dressings

- Sterile dressing is required for all access devices
- Choose a dressing that is adequate to cover the insertion site
- Inspect the site frequently for early signs of complications
- At each site dressing change pay careful attention to disinfecting the skin around and under the catheter
- Your professional site care is critical, nothing can compensate for poor technique

Criteria for insertion site dressings²⁶

- Sterile
- Capable of preventing moisture accumulation.
- Allow visible inspection
- Cost-effective
- Easy to apply and fix securely
- Easy to remove

Sterile non-linting gauze

- Gauze dressings are indicated when a patient suffers from profuse perspiration, or, if the insertion site is bleeding or oozing¹⁰
- The integrity of gauze dressing edges should be maintained with an occlusive material^{13,18}
- Gauze dressings are generally easy to attach and remove
- Sterile gauze requires daily changing which can lead to movement and manipulation of the catheter so increasing the risk of phlebitis²⁷
- The requirement for daily changing can increase nursing time and costs²⁷
- Gauze dressings prevent moisture pooling but allow microbial transmission when wet²⁶
- Gauze dressings prevent continuous inspection and prevent the patient from keeping the site under observation

Transparent semi-permeable membrane (TSM) dressingsⁱⁱⁱ

TSM dressings are widely accepted as the most suitable way of securing and protecting most venous access sites and have many advantages over the use of gauze and tape. A dedicated transparent dressing should be used for central lines.³¹ If further stabilisation is required, only sterile tape should be used under TSM dressings.³ TSM dressings are also used to cover the port site when non-coring needles are left in an implanted port.³

Advantages of TSM dressings	Disadvantages of TSM dressings
• Allow continuous inspection • Increase patient comfort • Are waterproof and allow patients to bathe • Do not require daily changing • Are hypoallergenic • Are presented cut to size and notched to allow a seal around the catheter • Are semi-permeable, impervious to bacteria and most promote moisture vapour transmission²⁷	• Sometimes difficult to apply and require practice • When badly applied, creases in the membrane may allow microbial transmission

For peripheral catheters, TSM dressings should be changed at the time of catheter site rotation or if the integrity of the dressing is compromised in any way.^{5,10} TSM dressings for central venous catheters should be changed at least once every 7 days or sooner if they become soiled, but the optimal time interval for changing dressings depends upon the type of dressing used, the guidelines, the age and condition of the patient and on the environmental conditions.^{7,8,10,18,21}

Existing TSM dressings include IV3000°, Tegaderm™, Veca-C™ Niko-gard™, Venigard™ and Dermafilm™. Each have their own features.

Breathability, as expressed by Moisture Vapour Transmission Rate (MVTR) has been identified as a specific benefit.

MVTR of a dressing is a measure of its permeability and determines how quickly it allows moisture to evaporate from the site. High MVTR dressings are thought to prevent accumulation of fluids and so provide a less favourable environment for pathogens^{27,28}

IV3000°	– MVTR 11140g/m ² /day
Tegaderm™	– MVTR 743g/m ² /day
Niko-Derm™	– MVTR 5606g/m ² /day

Sterile tape

Sterile tape is only suitable for application to the catheter adaptor and not for direct application to the catheter-skin junction at the site of insertion³

Sutures and sutureless securement devices

- Sutures can be used to stabilise tunnelled central catheters
- Sutures should not be used routinely for stabilisation of midlines, PICCs or non-tunnelled central catheters due to an associated increased risk of infection¹⁰
- Sutureless securement devices can be associated with a reduced risk of infections compared with sutures¹⁰

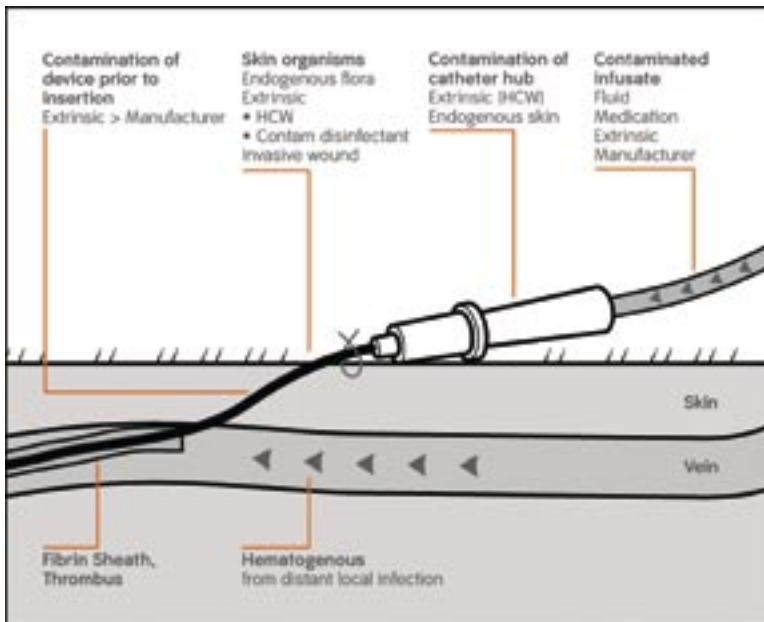
ⁱⁱⁱAlso known as Polyurethane dressings

11. IV access site care



- Site care should include observation and assessment of the catheter-skin junction and surrounding tissues for:
 - Signs of infiltration
 - Phlebitis or infection
 - Pain, redness or swelling
- Vascular access sites not in continuous use should be assessed each day, or at each visit (in the community)
- Patients should be encouraged to report any changes or discomfort
- Site care should coincide with dressing changes and include cleansing of the entry site with an appropriate antimicrobial solution – chlorhexidine is the preferred solution, either as a single agent or in combination with alcohol¹⁰
- Topical antimicrobial or antiseptic ointments for prophylaxis should not be routinely applied¹⁰
- Documentation of site care should reflect the condition of the catheter site³
- All suspected infections should be reported immediately

Sources of infection



12. Maintenance of IV access devices



Once securely in place, IV access devices must be regularly checked for a number of possible complications, these include: accidental disconnection; blockage or occlusion, and, damage to the device.¹⁶

Accidental disconnection or dislodgement

All catheters should be secured and stabilised appropriately to prevent dislodgement.^{iv}

If a catheter is suspected of disconnection or dislodgement it should not be used until its position has been confirmed.³

Accidental disconnection poses greater risks in central venous access devices than in peripheral devices since it can result in embolism or haemorrhage.¹⁶

Blockage or occlusion

The most common cause of blockage or occlusion is a blood clot and this can cause damage to the catheter, infection and disruption of therapy.¹⁶

To maintain the patency of catheters that are not in continuous use they should be regularly flushed at established intervals.¹⁶

- Two solutions are used for flushing: heparin and sodium chloride. Heparin prevents the build-up of fibrin and sodium chloride cleans the internal diameter of the catheter¹⁶
- All devices should be flushed after withdrawal of blood and before and after the administration of medications
- The correct method for flushing involves a pulsated push-pause which creates turbulence to remove any debris from the internal wall of the catheter and completion of the procedure with a positive pressure technique i.e. clamping the catheter or extension set while flushing before the syringe empties completely or maintaining pressure on the syringe plunger whilst withdrawing from the injection cap¹⁶

If blockage or occlusion does occur, the cause of the blockage must be established – either thrombotic or non-thrombotic and the agreed protocols for the use of thrombolytic agents or precipitate clearance agents should be followed once these have been prescribed.

Responsibilities include assessment for the appropriate use of these agents, documentation of the outcome and continued surveillance of the patient.

^{iv}See section 10

Prevention and management of damage

- Catheters can become damaged due to incorrect handling, entrapment or increased pressure within the device
 - Most central venous devices are made of silicone which is a soft and pliable material and easy to damage if it is handled roughly; specifically it is prone to cracking or splitting when bent or squashed^{16,29}
 - Pinch-off syndrome, due to entrapment between the clavicle and the first rib in central devices, can result in fracture of the catheter³⁰
 - Small syringes can increase the pressure within the catheter and can cause rupture.¹⁸ Always use a 10ml syringe or larger
 - If the external portion of a catheter is damaged it may be repaired according to manufacturer's guidelines
 - In the event of an accident, the catheter should immediately be clamped proximal to the area of damage to prevent blood loss or embolism and the split area covered with an alcohol swab, emergency repair can then be performed as appropriate¹⁶
-

13. Patient education and information

- Most patients requiring a vascular access device in the emergency or acute care setting will only require it for a short period of time. For longer term VADs, patients should receive appropriate education and should be encouraged to participate in any decision-making processes and care³
- Decisions about which access site to use and the type of device chosen should be made together with the patient (and carer) to limit psychological distress and to increase comfort
- Younger patients may have different clinical and lifestyle considerations than older patients. For patients who are discharged from hospital with vascular access devices in place, education about aseptic procedures and safe management of catheters and their access sites is also vital
- These patients should receive written and verbal instruction and supervision in four main areas: prevention of infection^v; maintaining a closed IV system^{vi}; maintaining device patency^{vii} and; preventing damage to the device^{viii 16}
- Your hospital or institution may already have information leaflets/booklets for patient education and information

^vSee section 4

^{vi}See section 12

^{vii}See section 12

^{viii}See section 12

14. Appendix

Consensus statements for reducing the risk of infection, reproduced by kind permission of the IV Site Care Forum.

- Quality patient care in IV therapy requires a measurable degree of competency in all relevant infection control procedures. For this to be achieved, a standardised education relating to these procedures is fundamental, and a continuing education policy of at least one hour per year for IV therapy should also be considered
- IV site care should be carried out by staff who are well versed in infection control procedures – hand hygiene being the most basic and fundamental of all. Hand hygiene must be performed using an antimicrobial solution before the insertion or manipulation of the catheter
- Infection control practices should include protective clothing, properly cleaned work surfaces, the use of an approved skin preparation, and the application of a moisture vapour permeable transparent film dressing. The higher the MVTR rating of the dressing the greater the breathability of the skin
- Surveillance programmes should include daily site visualisation and monitoring for catheter associated bloodstream infections. Transparent film dressings will facilitate visualisation of the site and provide a barrier to extrinsic contamination
- IV site dressings should be changed immediately if moist, loose or otherwise compromised; if gauze is used in conjunction with a transparent film dressing at the insertion site the dressing must be changed every 48 hours
- Documentation for IV therapy will include a minimum of:
 - Recording the insertion and removal dates
 - Noting the location of the catheter
 - Making a daily record of the condition of the insertion site and dressing

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