Midline catheters: indications, complications and maintenance


Summary
Midline catheters are commonly inserted by nurses to make short and long-term infusion of intravenous fluids and medication easier. This article provides an overview of the value of these devices in adult nursing. It also describes the history and management of the midline catheter in relation to current research and evidence-based practice.

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Aims and intended learning outcomes
Intravenous (IV) therapy is a vital component of patient care for inpatients and those receiving home therapy. The aim of this article is to help nurses gain an understanding of the midline catheter, including its history, placement, general care and maintenance, indications for use and potential complications.

After reading this article you should be able to:
› Outline insertion techniques in relation to the anatomy of the venous system.
› Discuss the care of patients with a midline catheter.
› Demonstrate an awareness of possible catheter-related complications and methods of assessment and management.
› Discuss issues related to the nurse’s role and responsibilities in relation to nurse-led practice.

Introduction
The midline catheter has been available for many years and has been widely used to facilitate the administration of IV medication (Anderson 2004). In recent years the device has been reintroduced into the peripheral vascular access range (Dougherty 1999). The midline catheter minimises the need for repeated peripheral cannulations, is well tolerated by patients with minimal complications, and if the patient’s condition permits it, allows the patient to be discharged early and cared for at home. In patients who require medium to long-term IV therapy a midline catheter should be considered, as it is a reliable and safe vascular access device (VAD) for both hospital and community IV drug administration.

This article aims to provide nurses with the knowledge to establish a nurse-led midline catheter placement service for a variety of patient groups. However, each trust should establish its own evidence-based protocols for the insertion, care and maintenance of the device based on manufacturers’ guidelines and published research.
A clear understanding of the venous anatomy and principles of physiology is important for any practitioner involved in the care of the patient with a VAD (Sansivero 1995). VADs can be threaded many centimetres into the veins, therefore the location of valves, the structure and diameter of veins, and blood viscosity are significant factors. Successful placement of any VAD depends on the healthcare professional’s ability to take all these factors into consideration before placement, to ensure that the correct device is chosen for the individual patient (Scales 1999).

### The structure of the vein

The vein has three layers (Figure 1). The tunica adventitia is the outer fibrous layer composed of elastic connective tissue, which surrounds and supports the vein. The tunica media makes up the middle layer. It is a thicker layer composed of connective tissue and elastic and nerve fibres. The nerve fibres, both vasoconstrictors and vasodilators, receive impulses causing them to contract and relax as a result of changes in venous pressure and blood flow. The tunica intima is the inner layer and is composed of a single layer of elastic epithelial cells, which also form the valves in the veins. This inner layer provides a delicate, low-friction smooth surface, a perfect environment for the flow of blood. However, this delicate inner layer can be easily damaged during insertion of a VAD (Tortora and Grabowski 2000).

#### Control of the venous system

The sympathetic nervous system is responsible for the contraction and relaxation of the muscle layer in the tunica media via the vasomotor centre in the medulla oblongata. The medulla constantly sends signals via the nerve fibres to enable the muscle layer in the tunica media to change diameter in response to systemic variations in venous pressure and flow of blood. Afferent nerve fibres also supply veins and are responsible for pain sensation (Tortora and Grabowski 2000). Venous flow is influenced by several factors. Flow towards the heart is a result of contraction of the respiratory muscles and the negative intrathoracic pressures generated during inspiration. The presence of valves found within the larger veins of the extremities ensures that the flow of deoxygenated blood continues towards the heart (Tortora and Grabowski 2000). Veins are compressed by contracted leg muscles, and the valves in the lower limbs are particularly important when venous flow is working against gravity (Tortora and Grabowski 2000).

#### Valves

Valves are semi-lunar projections of tunica intima covered by endothelium and strengthened by collagen elastic fibres. Most often these valves are found in a pair, however, they can also exist as a trio or singular cusp. Their role is to keep blood flowing towards the heart and to prevent pooling of blood by gravity at the distal end of limbs (Figure 2). Valves are most commonly found at the bifurcation of veins and are more prominent when a tourniquet is applied. Large veins do not have valves and rely on gravity and negative intrathoracic pressure to generate blood flow. Valves can cause an obstruction to the smooth advancement of any VAD and if forced, can cause pain and rupture of the vessel (Dougherty 1999).

#### Vascular anatomy and physiology

Historically, the large veins found in the antecubital fossa have been considered unsuitable for the routine placement of peripheral VADs (Scales 1999).
importance when placing VADs, and while it is difficult to ascertain specific diameters of veins, it is widely accepted that the basilic vein is slightly larger than the cephalic vein in most adults and that the veins gradually become larger as they reach the central venous system in the chest (Terry et al. 1995, Cowley 2004).

The midline catheter

The midline catheter was first introduced during the 1950s by the Deseret Medical Corporation (Anderson 2004). The device was manufactured by Becton Dickinson and used on patients who needed one week of IV therapy (Anderson 2004). Improvements to the design continued until the 1980s when the peel-away plastic introducer was developed. During the 1990s adverse events related to anaphylaxis and phlebitis caused the midline catheter to receive negative evaluations and some products, that is those associated with aquavane, were even removed from the market (Mermel et al. 1995, Goetz et al. 1998, Anderson 2004). It was felt that aquavane, an elastomeric hydrogel material that becomes hydrated and expands after catheter insertion and which was used to form a coating on some of the midlines available at that time, may have contributed to these adverse events (Mermel et al. 1995, Goetz et al. 1998, Anderson 2004).

In recent years the midline catheter has been redeveloped culminating in its present design. This redevelopment has also included the way in which the device can be inserted by using either a cannula with a peel-away sheath or the Seldinger technique using specific Seldinger insertion kits. These kits are widely available either as part of a midline catheter pack or separately, and are used to aid insertion of midline catheters in patients with particularly fragile or difficult to locate veins (Sansivero 2000). The midline catheters available today are made of polyurethane or silicone and are between 20-25cm in length with the tip extending no further than the axillary vein (RCN 2005). They may be single or double lumen, with an outside diameter of between 2 and 5 French (Fr), 15-19 gauge, depending on the material and the number of lumens (Cowley 2004). Midline catheters can be referred to as peripherally inserted catheters (PICCs) although this can lead to them being confused with PICCs. Staff using assorted VADs should use the correct terminology for each device to avoid such confusion.

Midline catheters often have the ability to soften, expand and lengthen on contact with liquid and when warmed, although aquavane is not present in the current catheter designs. This allows the catheter to be firm when being inserted but soft and therefore less traumatic to the vein once in situ (Fontaine 1991). Some manufacturers...
produce catheters that have a valve(s) incorporated into either the distal or proximal portion of the catheter. These valves help to prevent the passive entry of blood into the catheter by only opening when either positive or negative pressure is exerted on the valve. When there is no pressure the valve is closed, preventing blood flow into the catheter or air flow into the system (Terry et al 1995). Patency of the catheter is easily maintained without a heparin-based flush because blood is not able to flow into the device (Terry et al 1995). Unlike the PICC there have been comparatively few studies investigating the use and outcome of long-term use of the midline catheter. However, the studies that have been carried out have shown them to be a reliable VAD suitable for the safe delivery of IV drugs and fluids for patients who require medium to long-term therapy (Griffiths and Philpot 2006).

Indications for a midline catheter

The indications for the use of the midline catheter described below have been established at the trust where the author works. It is the author’s intention to share experiences of the use of midline catheters but it should be clear that the practice discussed is related to this particular trust. The advantages and disadvantages of using midline catheters are outlined in Table 1.

### Patients with stage 4 congestive heart failure

Patients with stage 4 congestive heart failure (Lillis and Vickers 2003) can be discharged home from the trust receiving IV bolus doses of furosemide as prescribed by the clinician. This therapy has been found to reduce the frequency of readmission, as patients can be monitored in the community by specialist heart failure nurses.

### IV antibiotics for cellulitis, joint infections, bone infections, chest infections or endocarditis

Following hospital/community protocols, patients with cellulitis, joint infections, bone infections, chest infections or endocarditis can be discharged into the community and can receive antibiotics by specialist home therapy teams or the patient’s carer can be taught how to administer the drugs (Lawson 1998, Anderson 2004, Gorski and Czaplewski 2004). Teicoplanin, benzylpenicillin, gentamicin, flucloxacillin and tazocin (piperacillin with

### TABLE 1

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
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<tbody>
<tr>
<td>Suitable for all intravenous (IV) fluids and drugs that would usually be administered through a peripheral IV cannula (Infusion Nurses Society (INS) 2006).</td>
<td>As the distal tip finishes no higher than the axillary vein (Figure 4), continuously infused dextrose solution &gt;10%, vesicants or corrosive substances cannot be administered due to the risk of extravasation (INS 2006).</td>
</tr>
<tr>
<td>Infusion rate of up to 70ml per minute may be achieved when an IV pump is used with a 5 French (Fr) catheter (Vygon 2006).</td>
<td>A midline catheter would not accommodate high volume fluid replacement in excess of 70ml per minute using a 5Fr or smaller catheter (Vygon 2006).</td>
</tr>
<tr>
<td>Longer dwell time than peripheral cannulae, therefore reducing the need for repeated cannulation (Anderson 2004).</td>
<td>Infusing fluid by gravity is not always possible and an infusion pump may be necessary to infuse drugs and fluids at the desired rate.</td>
</tr>
<tr>
<td>Does not require X-ray confirmation as the tip lies in a large vessel of the upper arm (Figure 4).</td>
<td>Mechanical phlebitis can be a frequent complication (Anderson 2004).</td>
</tr>
<tr>
<td>Provides long-term alternative for IV therapy when central venous access is not required or there is no clinical benefit (Mermel et al 1995). Recent research showed a dwell time of a maximum of 296 days (Griffiths and Philpot 2006).</td>
<td>Despite the use of ultrasound-guided placement, compromised anatomy such as the presence of lymphoedema, previous infection or phlebitis affecting the arm will preclude the use of a midline catheter (Terry et al 1995, RCN 2005).</td>
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<tr>
<td>Ease of insertion.</td>
<td>Lack of trained personnel to insert the device.</td>
</tr>
<tr>
<td>Patient comfort. Patients are able to maintain a greater degree of mobility compared to peripheral cannulae. If a community IV therapy service is available patients can be discharged home with a midline catheter in situ (Harwood et al 1992, Anderson 2004).</td>
<td>Lack of patient consent or the patient has a history of non-concordance with venous access devices. Patient is advised not to swim with a midline catheter in situ because of increased risk of infection.</td>
</tr>
<tr>
<td>Patient comfort, as the relatively greater flow rate of blood around the catheter tip dilutes medications likely to irritate the vessel wall and therefore reduces the risk of chemical phlebitis (Gorski and Czaplewski 2004).</td>
<td></td>
</tr>
<tr>
<td>Midlines are ideally suited for older patients, who may have limited venous access or medical conditions that contribute to increased length of therapy (Anderson 2005).</td>
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</tbody>
</table>
Insertion of a midline catheter

Careful assessment of the patient and his or her vascular system must be undertaken before insertion of a midline catheter (RCN 2005). This should include a history of any previous medical conditions or treatment that might affect insertion, including radiotherapy or the presence of lymphoedema, trauma to the arm and any previous upper arm surgery. Areas of bruising, infection or scarring from previous venepunctures or cannulations should be observed and avoided. It is also important to ascertain if the patient has experienced difficult or traumatic cannulations in the past and any preconceived feelings he or she may have regarding the midline catheter insertion procedure. Any fears the patient may have should be allayed by explaining the insertion procedure thoroughly. It is helpful if the patient can straighten his or her arm to aid visualisation and

Tazobactam are the most common drugs administered at the trust. Antibiotics that are not considered suitable for administration via a midline catheter due to the risk of extravasation include vancomycin, erythromycin and antifungals such as amphotericin B. These drugs must be administered via a central vein (Anderson 2004, 2005).

**Analgesia and sedation** While midline catheters are not routinely used for analgesia at the trust, analgesia (morphine) and sedation (midazolam) can be infused via a midline catheter without ill effects, enabling the patient to be managed at home as well as in hospital (Lawson 1998).

**Long-term therapy** Much of the published literature discusses the dwell time of a midline catheter to be between two to six weeks (Gorski and Czaplewski 2004, Anderson 2005, Infusion Nurses Society (INS) 2006). However, recent research has shown a dwell time of a maximum of 296 days (Griffiths and Philpot 2006). The company whose catheters are used at the trust support the view that, as the devices are manufactured using the same material as the PICC lines, the dwell time can be for the duration of treatment rather than for a specified time scale (Vygon 2006).

**The critically ill patient in a high dependency or intensive therapy unit** In the care and treatment of the critically ill patient, it is often necessary to use one or more peripheral cannulae for the administration of sedation, insulin and antibiotic therapy, despite the fact that a central venous catheter can provide up to four or five lumens. These additional cannulae require frequent site changes and carry the risk of extravasation of fluid into the tissues, haematoma formation and a high incidence of thrombophlebitis and infection (Richardson and Bruso 1993). Insertion of a midline catheter under these circumstances has proven to be valuable for the delivery of IV drugs and fluids (Griffiths and Philpot 2004).

**Early discharge of specific patients requiring medium to long-term IV therapy** The midline catheter is a cost-effective alternative to the PICC, which until recently was the most commonly used device for administering IV antibiotic therapy in the home environment (Harwood et al 1992, Gorski and Czaplewski 2004). Patients do not need a post-insertion chest X-ray as the distal tip is not centrally placed. From a patient’s perspective, receiving IV therapy at home is far better than being in hospital. The midline catheter is a comfortable and reliable device, which is well tolerated by patients of all ages (Terry et al 1995, Kayley 1999, RCN 2001, 2005, Anderson 2004, Gorski and Czaplewski 2004).

**Time out 2**

Consider the types of venous access that you are currently aware of in your practice. With reference to Table 1 and reflecting on the patients for whom you care, think about the following:

- What are the shortfalls of your current venous access strategies?
- Which of the patients might be suitable for midline catheter insertion?
- What would be the possible indications and contraindications of the midline catheter for these patients?
- Explain what benefits the midline catheter may present to patients.

**Insertion of a midline catheter**

Careful assessment of the patient and his or her vascular system must be undertaken before insertion of a midline catheter (RCN 2005). This should include a history of any previous medical conditions or treatment that might affect insertion, including radiotherapy or the presence of lymphoedema, trauma to the arm and any previous upper arm surgery. Areas of bruising, infection or scarring from previous venepunctures or cannulations should be observed and avoided. It is also important to ascertain if the patient has experienced difficult or traumatic cannulations in the past and any preconceived feelings he or she may have regarding the midline catheter insertion procedure. Any fears the patient may have should be allayed by explaining the insertion procedure thoroughly. It is helpful if the patient can straighten his or her arm to aid visualisation and
palpation of the vein. Ideally the catheter should be placed in the patient's non-dominant arm, two inches above or below the antecubital crease and following manufacturers' guidelines (RCN 2005). A thorough assessment at this stage will give the practitioner the opportunity to choose the most appropriate vein and also decide on the best approach for insertion.

Once the insertion site for the midline catheter has been chosen, the length of the catheter is measured against the distance from the insertion site. If necessary the catheter should be trimmed to ensure that the device does not extend beyond the axillary vein (RCN 2005). Ideally the patient should be in a semi-recumbent position and the arm should be supported with a pillow and abducted to 45-90 degrees. Midline catheters, as with all VADs, are inserted using strict aseptic technique. The insertion site should be cleaned with chlorhexidine gluconate with alcohol (Pellowe et al 2004, Pratt et al 2007). The area should be allowed to dry naturally before a sterile towel or a fenestrated drape is placed in such a way as to leave the area chosen for the cannulation exposed (Ross and Taams 2000).

Local anaesthesia of the insertion site is not routinely used, but can be achieved with 1% lidocaine sub-dermally or topical Emda™ cream or Ametop™ gel if the patient is needle phobic (Terry et al 1995). However, it should be noted that, apart from potential allergic reactions, the use of either application can cause problems during catheter insertion (British National Formulary 2007). The topical preparations can cause vasoconstriction resulting in a reduction in the diameter of the blood vessel, while the injection of lidocaine can distort and obscure the area around the insertion site (Mitchell and Galloway 2004).

The tourniquet should be applied above the insertion site and away from the sterilised area. Using an indirect approach the cannula is inserted through the skin, at a point distal to the vein, and then advanced towards the vein until entry is gained (Dougherty 1999). This technique is useful when dealing with fragile veins, having the advantage of forming a small tunnel between the skin surface and the vessel, which may reduce bruising (Terry et al 1995). Once in place the introducer sheath can be peeled away leaving the midline catheter in position.

When a vein is not easily visualised or palpable the Seldinger technique of catheter insertion can be used. This involves the vein first being punctured with a percutaneous needle. Once a free flow of venous blood is achieved a guide wire is passed through the needle until approximately 5-10cm of the wire is in the vein. The needle is then removed leaving the guide wire in the vein over which the catheter introducer and dilator are passed. Once in position the dilator is removed and the midline catheter is passed through the introducer and advanced to the desired length. This technique has proved particularly useful in critically ill patients as this group may have experienced numerous cannulations causing damage to the vasculature, or may have oedema making the veins more difficult to locate (Sansivero 2000). The use of ultrasound in combination with the Seldinger technique and modified Seldinger kits have enabled IV specialists to place midline catheters in patients who might otherwise have had to experience the trauma of a central venous device (Sansivero 2000).

Regardless of the method of cannulation, all midline catheters should be advanced slowly into the vein in a manner that will not traumatisethe delicate tunica intima. If an obstruction is felt, advancement of the catheter should be stopped and a check made to ensure that blood can be aspirated through the catheter, proving that it is still in the patient’s vein. A small flush of 0.9% sodium chloride may encourage a valve to open (Dougherty 1999). Ensuring that the patient is warm and relaxed will also assist catheter placement (Dougherty 1999). A successful IV placement can be checked immediately by the aspiration of blood through the catheter. Patency of the midline catheter can be confirmed by the infusion of a 10ml turbulent flush (pause/push action) of 0.9% sodium chloride (Todd and Hammond 2004, RCN 2005). Once the midline catheter insertion procedure is completed according to hospital and/or manufacturers' guidelines, the procedure is documented in the patient’s notes. Documentation includes the length of catheter that has been inserted into the patient, the specific vein that has been used and any specific follow-up care that may be required (RCN 2005).

Time out 3

What aspects of patient preparation would you ensure took place before the insertion of a midline catheter? In particular consider:
- What aspects of patient history are important?
- What issues are important regarding assessment of the patient's venous anatomy?
- How would you decide if a midline catheter is appropriate for the patient?
- How would you ensure the patient is fully aware of the implications of having a midline catheter inserted?

Catheter securement

The midline catheter should be stabilised appropriately to ensure that it is able to move in relation to the skin without causing mechanical phlebitis, catheter migration or catheter damage. The securement device should allow staff to
Ensure that the dressing is unsoiled and intact.
Check the caps are secured with no trace of blood around the Luer connection.
Check for signs of mechanical, chemical or infective phlebitis.
Injection cap changes should take place at least weekly or according to the manufacturers’ recommendations. Cap changes should always be performed using strict aseptic technique with chlorhexidine gluconate with alcohol (Pellowe et al 2004, Pratt et al 2007). Needleless systems are the preferred method for accessing all VADs as they eliminate the need for needles to be used for injecting drugs and therefore reduce the risk of needlestick injuries and potential infections (Gabriel et al 2005). Following the first dressing change at 24 hours the dressing need only be changed weekly unless it becomes soiled or damaged. If the exit site needs to be cleaned this should be done using an aseptic technique with chlorhexidine gluconate with alcohol (Pellowe et al 2004, Pratt et al 2007). The catheter should be resecured and redressed with a transparent semi-permeable membrane dressing. Waterproof covers are available to prevent excess water from soiling the dressing.

**Care and maintenance**

If the patient is being cared for in the community, local organisational policies where the author works state that the midline catheter should be assessed at least daily but while in hospital this assessment should be carried out at least during each shift (Hart 1999). Staff or the carer should use a recognised assessment tool to ensure continuity and consistency of care (RCN 2005). The purpose of the assessment is to (Hart 1999, Todd and Hammond 2004, Gabriel et al 2005, RCN 2005, Pratt et al 2007):

- Check the exit site for signs of erythema and inflammation.
- Ensure the securement device is unsoiled and intact.
- Ensure that there is no sign of the catheter migrating out of the patient.

Observe and care for the exit site. Various methods of catheter securement are available such as sutures, sterile skin closures or self-adhesive securing devices, for example, StatLock™ (Figure 5). Suture securement relies on the integrity of the skin to hold the midline catheter in place. The suture site can become inflamed which can lead to bacterial colonisation at the exit site and is therefore not recommended (Schears et al 2001, Yamamoto et al 2002, Gorski and Czaplewski 2004). Sterile skin closures can be used, however, these often need to be replaced at the weekly dressing change and can lead to a build up of sticky glue on the device, to which microorganisms can become attached (Gorski and Czaplewski 2004).

Manufactured securing devices are effective and appear to cause fewer problems than sutures and are more secure than sterile skin closures (Schears et al 2001, Yamamoto et al 2002, Gorski and Czaplewski 2004). Manufacturers recommend that these securing devices are replaced at each dressing change. Once the midline catheter is secured to the skin a small piece of sterile gauze is placed over the exit site to absorb any blood, followed by a transparent semi-permeable membrane dressing such as IV 3000™ or Tegaderm™. After 24 hours this dressing should be changed (Todd and Hammond 2004). At this stage the gauze can be omitted and if there is no further bleeding from the insertion site and if no exudate is present then the dressing can be changed on a weekly basis (Gabriel et al 2005).

![FIGURE 5: StatLock™ and transparent semi-permeable membrane dressing](image)

- Ensure that the dressing is unsoiled and intact.
- Check the caps are secured with no trace of blood around the Luer connection.
- Check for signs of mechanical, chemical or infective phlebitis.

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Maintaining the patency of the midline catheter and preventing the mixing of incompatible solutions or medications is an essential part of device care. Local policy and the particular catheter being used will dictate frequency of flushing and the solution required. If the midline catheter has two lumens then each lumen must be managed as a separate catheter. The use of a turbulent flush, delivered in a pause/push action, is thought to prevent catheter occlusion by reducing the build-up of residue on the internal lumen of the midline catheter (RCN 2005). The syringe size used for flushing a midline catheter should be in accordance with the manufacturers’ guidelines but generally should not be less than 10ml (RCN 2005). Smaller
However, if chemical phlebitis does occur the midline catheter should be removed and an alternative VAD inserted in the opposite arm. **Infective phlebitis** Infective phlebitis is caused by bacteria, which damage the vessel wall. A localised infection may be treated with more frequent dressing changes and antibiotics (Gorski and Czaplewski 2004). If the patient has pyrexia with no other obvious cause, catheter-related sepsis should be investigated (Gorski and Czaplewski 2004). It is most often identified by a positive bacterial culture taken from the midline catheter exit site or from blood cultures (Gorski and Czaplewski 2004). If the patient has a confirmed catheter-related sepsis the midline catheter should be removed and an alternative VAD should be inserted (Gorski and Czaplewski 2004). Once removed, the tip of the midline catheter should be sent for culture and microbial sensitivity (RCN 2005).

**Phlebitis**

Phlebitis is an inflammation of the vein causing damage to the tunica intima. It is characterised by erythema, swelling, pain, heat and venous cord (a hard and palpable thrombosed vein) along the course of the vein in which the midline catheter dwells (Gorski and Czaplewski 2004). Phlebitis is graded according to severity and many trusts use phlebitis scores as a matter of routine when caring for all types of VADs. Nurses caring for patients with these devices should be competent to assess the access site and initiate the correct intervention and/or treatment (RCN 2005). There are three main causes of phlebitis, namely, mechanical, chemical and infective. However, additional factors such as the age of the patient and any comorbidities will also have an effect on the patient’s risk factors for developing phlebitis.

**Mechanical phlebitis** Mechanical phlebitis is related to trauma of the vessel wall by the midline catheter. This can occur during insertion or in response to repeated shunting during each manipulation of the device. The gauge of the catheter and the material it is made from will also have an effect on the vessel wall and potentially cause irritation. Securing the device will reduce the shunting effect hence the increased use of specific securement devices (Todd and Hammond 2004). Mechanical phlebitis can be treated conservatively with heat, which dilates the blood vessel and reduces the amount of friction that may occur. Non-steroidal anti-inflammatory medication and elevation of the limb may also help. If there is no resolution of the symptoms after 48-72 hours then the midline catheter should be removed.

**Chemical phlebitis** Chemical phlebitis occurs as a consequence of administering irritant drugs through the catheter. Infuses with extremes of pH or osmolarity result in damage to the vessel wall (Lamb 1999). A thorough assessment of the proposed treatment for the patient should eliminate the risk of chemical phlebitis occurring. However, if chemical phlebitis does occur the device should be removed and disposed of safely.

**Removal of a midline catheter**

Once a decision has been made to remove the midline catheter, the dressing and securement device should be removed and disposed of safely.
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If the exit site needs to be cleaned this should be done with chlorhexidine gluconate 0.5% with alcohol and the area allowed to dry. A piece of sterile gauze should then be held over the exit site while slowly and steadily pulling on the hub of the midline catheter withdrawing it from the vein. There should be no feeling of resistance. The midline catheter should never be stretched or pulled against resistance or the catheter may break. If resistance is felt the procedure should be stopped. Venospasm is rare and usually occurs as a result of patient anxiety (Gorski and Czaplewski 2004). In such cases the patient and the vein should be given time to relax before continuing to slowly remove the catheter. Once the catheter is completely removed, the sterile gauze should be placed over the wound and pressed lightly to compress the exit site. Once haemostasis has occurred, the soiled gauze should be removed and a new swab and air occlusive dressing should be applied.

The midline catheter should be inspected to ensure that it is intact and that the length is the same as that documented at the time of insertion (RCN 2005). If the length removed is shorter than that documented, the practitioner who inserted the catheter should be contacted for further advice as the catheter may have fractured while being removed. Air embolus is unlikely to occur with a midline catheter because of its small diameter, long length and the fact that the hub of the device is usually lower than the patient’s heart (Gorski and Czaplewski 2004). However, in view of this potential risk it is recommended that the dressing remain intact for 72 hours (Scales 1999). If the site is healing no further dressings are required.

Nurse-led practice

The insertion of midline catheters is primarily a nursing procedure (RCN 2005). Expanding the responsibility of nurses in VAD placement has involved nursing staff demonstrating expertise in a narrow yet highly specialised area and the boundaries between nursing and medicine in this field of patient care are narrowing (Benner 1984, English 1993, Scales 1999). Hadaway (1990) questioned whether a midline catheter should only be inserted at the request of the patient’s clinician and this continues to be a controversial issue, both in the UK and in the United States (US).

In the UK the expanding role of the nurse has led authors such as Hopkins (1996) to suggest that the central consideration should be continuity of care and who is best placed to provide that care. Many IV specialist nurses would maintain that they are better able and have had the necessary training to assess which VAD would be most suitable for individual patient needs. To wait for a

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clinch to request a specific VAD appears somewhat inappropriate when the nurses administering the IV therapy are generally more familiar with the practicalities of administering the medication, the VADs available and the individual patient’s needs. Also, as the distal tip of the midline catheter remains within the patient’s peripheral system, there is no requirement for a specific request from a clinician (Hadaway 1990). However, as some midline catheters are designed for a longer dwell time, aiming to remain in situ for the duration of therapy, some nurses are hesitant to insert the devices without the clinician’s agreement.

Whenever nurses take on new tasks and develop more advanced and traditionally medical skills, it should be done in accordance with local organisational policies and procedures based on current evidence (Nursing and Midwifery Council [NMC] 2004). Nurses should ensure that they work within the guidelines of the NMC (2004) to establish their own ethical and legal accountability. It is also essential that nurses address the issue of informed consent. Power (1997) felt that nurses were best placed to obtain consent for many procedures, as a result of their knowledge and expertise. The NMC (2004) supported this view stating that obtaining consent is the responsibility of the individual practitioner proposing to carry out the treatment or procedure. Following a discussion with the patient regarding the device, its benefits and potential complications, written information should also be offered. This information may be specific to the trust or may have been produced by the manufacturer of the device. This information is invaluable as it is a resource for the patient, carer, and also community nurses administering the therapy.

Conclusion

All patients who need IV access require a thorough assessment to ensure that the best device for their individual need is chosen. This article has provided an overview of the principles involved in the process of insertion, care and management, and removal of a midline catheter, to enable nursing staff to ensure that patients receive quality care. Insertion of the midline catheter is primarily a nurse-led procedure that does not necessarily require a clinician’s request. Following insertion, those caring for the patient and administering the medication must be competent to perform the task, and provide expert evidence-based care to reduce the risk of complications.

Time out 5

Now that you have completed the article you might like to write a practice profile. Guidelines to help you are on page 60.


**Mitchell K, Galloway M (2004) Effectiveness of intradermal lidocaine when delivered by a needleless injector system as compared to injection by 25g needle during insertion of a PICC. Journal of the Association for Vascular Access. 9, 3, 136-140.**


**Power KJ (1997) The legal and ethical implications of consent to nursing procedures. British Journal of Nursing. 6, 15, 885-888.**


**Simcoch L (2001) Managing occlusion in central venous catheters. Nursing Times. 97, 21, 36-38.**


Midline catheters
TEST YOUR KNOWLEDGE AND WIN A £50 BOOK TOKEN

HOW TO USE THIS ASSESSMENT
This self-assessment questionnaire (SAQ) will help you to test your knowledge. Each week you will find ten multiple-choice questions which are broadly linked to the learning zone article.
Note: There is only one correct answer for each question.

Ways to use this assessment
- You could test your subject knowledge by attempting the questions before reading the article, and then go back over them to see if you would answer any differently.
- You might like to read the article to update yourself before attempting the questions.

The answers will be published in Nursing Standard two weeks after the article appears.

Prize draw
Each week there is a draw for correct entries. Send your answers on a postcard to: Nursing Standard, The Heights, 59-65 Lowlands Road, Harrow, Middlesex HA1 3AW, or via email to: zena.latcham@rcnpublishing.co.uk
Ensure you include your name and address and the SAQ number. This is SAQ No 419.
Entries must be received by 10am on Tuesday December 4 2007.

This self-assessment questionnaire was compiled by Tanya Fernandes

Report back
This activity has taken me ____ hours to complete.
Other comments:
Now that I have read this article and completed this assessment, I think my knowledge is:
 Excellent  □  □
 Good  □  □
 Satisfactory  □  □
 Unsatisfactory  □  □
 Poor  □  □
As a result of this I intend to:

Answers
Answers to SAQ no. 417
1. c  2. b  3. d  4. b  5. a
6. d  7. c  8. c  9. c  10. a

1. The tunica intima is composed of:
   a) Elastic epithelial cells  □
   b) Nerve fibres  □
   c) Connective tissue  □
   d) Muscle  □

2. Valves are projections of which layer of the vein?
   a) Tunica adventitia  □
   b) Tunica intima  □
   c) Tunica media  □
   d) Smooth muscle  □

3. Which of the following veins situated in the antecubital area are associated with midline catheter insertion?
   a) Cephalic veins  □
   b) Basilic veins  □
   c) Median cubital veins  □
   d) All of the above  □

4. Urokinase can be used to:
   a) Dissolve clots in the lumen  □
   b) Clean the exit site of the midline catheter  □
   c) Secure the midline catheter  □
   d) Treat infective phlebitis  □

5. Recent research suggests the maximum dwell time of a midline catheter is how many days?
   a) 26  □
   b) 100  □
   c) 200  □
   d) 296  □

6. A flush of what percentage of sodium chloride may encourage a valve to open?
   a) 0.1  □
   b) 0.5  □
   c) 0.9  □
   d) 1.5  □

7. Infective phlebitis is caused by which of the following?
   a) Insertion of the midline catheter  □
   b) Bacteria  □
   c) Administering irritant drugs  □
   d) Repeated shunting of the midline catheter  □

8. Assessment of a midline catheter should include:
   a) Observation of the exit site for signs of erythema and inflammation  □
   b) Observation of signs of phlebitis  □
   c) Observation of blood around the Luer connection  □
   d) All of the above  □

9. Which of the following drugs is not suitable for midline catheter infusion?
   a) Erythromycin  □
   b) Benzylpenicillin  □
   c) Flucloxacillin  □
   d) Tazocin  □

10. Which of the following statements about lidocaine is correct?
   a) It can cause vasoconstriction of blood vessels  □
   b) It can cause vasodilation of blood vessels  □
   c) It can distort and obscure the area around the midline catheter insertion site  □
   d) It can kill bacteria  □