

The Use of Midline Catheters in the Acute Care Setting – Clinical Implications and Recommendations for Practice

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ABSTRACT

Aim and objectives: The aim of this paper was to review published manuscripts on the use of midline catheters, the implications of study findings and recommendations for clinical practice in the acute care setting.

Design: Modified integrative literature review

Methods: Using key MeSH terms, we searched the electronic databases: CINAHL, Medline, and Embase. The Cochrane and Joanna Briggs databases, Google Search Engine and the reference lists of published materials were also searched. Studies were included if they were in the English language and reported the use of midline catheters in adult acute care populations.

Results: Two hundred and thirty two (232) papers were identified using the search strategy. From these identified papers, thirty (30) were included in the final review. Thematic analysis identified three major themes. These included: (i) advantages of using midline catheters (ii) disadvantages of using midline catheters (iii) insertion and management issues.

Conclusion: Midline catheters have both positive and negative implications for clinical practice. They can be used for extended periods of intravenous therapy without requiring repeated cannulations but are not without risk. Midline catheters have been associated with mechanical and chemical phlebitis along with intravascular thrombosis. As such they are not suitable across the entire adult acute population. Midline catheters reduce the number of repeated cannulations which reduces patient discomfort, increases patient satisfaction and also contributes to organisational efficiency.

INTRODUCTION:

The midline catheter (MC) is a vascular access device (VAD) that is approximately 20cm in length and is typically inserted into upper peripheral veins, above or below the antecubital crease (Anderson, 2004, 2005; Rosenthal, 2008). The MC is not used as a central venous catheter (CVC) in the adult population; this is because the tip of the MC is normally situated at or below the axillary vein and not in the central venous circulation (Anderson, 2004, 2005; Griffiths, 2007; Rosenthal, 2008).

The uses of MCs have predominantly been limited to specialist vascular access teams (Anderson, 2004; Intravenous Nurses Association [INS], 1997). They were first introduced to the clinical setting in the 1950's (Vascular Access Device, 2002) and have since been marketed as a medium to long term indwelling catheter for the administration of intravenous fluids for hydration, certain antibiotics and continuous intravenous medication infusion (Griffiths, 2007; INS, 1997).

Materials used (such as Aquavane – an elastomeric hydrogel that softens and expands once in the blood stream giving it silicone like consistency) in the manufacture of some MCs caused concern in the 1990s as some patients developed hypersensitivity reactions to the catheter material (Goetz et al., 1998; Vanek et al., 1997; Myers and Kyle, 1993). This resulted in some device companies discontinuing the manufacture of MCs and their popularity subsequently decreased.

Midline catheters have the potential to be used widely in the adult acute care population but this is yet to be established, with few outcome studies examining the use of MCs in the acute care setting (Griffiths, 2007). The aim of this study was to

undertake a review of the literature to ascertain the implications for clinical practice in the acute care setting with the insertion and use of MCs. In particular, our goal was to review which acute care population groups would benefit most from MC placement, what complications are associated with this VAD and when they are an alternative to a peripheral cannula or a peripherally inserted central catheter (PICC) and CVC.

METHODS

A health care librarian with expertise in clinical literature reviews was consulted. The electronic databases CINAHL, Medline, Embase along with the Cochrane and Joanna Briggs databases were searched using key MeSH terms that included ‘Catheterization’, ‘Peripheral’, ‘Central Venous’, ‘Catheters’, ‘Indwelling’, ‘midline or mid-line’. The reference lists of published materials were searched for additional literature. The World Wide Web was also searched using the Google Scholar search engine for related electronic documents.

An integrative review method was used because of the heterogeneity of the reviewed studies. An integrative review is a research method that allows for the inclusion of varying designs and it can provide a better understanding of the topic of interest (Whittemore & Knafl, 2005). Integrative reviews are beneficial in scoping a problem and documenting benefits for clinical practice.

Studies were included in this review if they described the use of MCs in the adult acute care population, if they discussed the implications for clinical practice or if the studies described outcomes related to the use of MCs. We limited the search to the English language and in adult acute care populations. Manuscripts describing

Aquavene - based MCs were also excluded. In light of heterogeneity and the aim to review the clinical implications for the use of MCs, all published manuscripts whether using experimental or non-experimental methods were included in the review. All articles meeting the search criteria were reviewed by the primary author and two co-authors using a critical appraisal tool (National Health Service, 2007). Content analysis was undertaken to identify categories and the number of instances these occurred in the narrative of publications. Thematic analysis, using inductive methods, was then applied to generate themes.

RESULTS

A total of 232 papers were identified using the search strategy described. The majority of papers did not discuss the use of MCs. Abstracts were reviewed by the authors (EA, LMR) to assess whether the papers met the inclusion criteria. This process identified thirty (30) papers that met the inclusion criteria. Included papers were then reviewed by the co-authors to confirm that they met the inclusion criteria. Following a thematic analysis, three themes emerged from this review relating to: (i) advantages of using midline catheters (ii) disadvantages of using midline catheters (iii) insertion and management issues. These are discussed below:

Advantages of using midline catheters:

The insertion of a MC avoids unnecessary repeated peripheral cannulation that may be required whilst hospitalised (Anderson, 2004; Griffiths, 2007; Rosenthal, 2008) and can be inserted by accredited specialist nurses (Griffiths, 2007; INS, 1997; Klein & Metules, 2001; Mermel, Parenteau & Tow, 1995). This is not only cost-effective for the institution but less traumatic for the patient and has the potential to avoid

iatrogenic effects (Gorski & Czaplewski, 2004; Larouere, 2000a; Rosenthal, 2008; Smeed, 1990; Sterba, 2001) and minimises needle stick injuries for nurses (Mermel, Parenteau & Tow, 1995; Thomson, 1993). It has been estimated that the insertion of an MC costs the equivalent of three peripheral cannulas, as such MCs can contribute to improving organisational efficiency by decreasing multiple cannulation due to compromised venous access (Anderson, 2005). Nurses experience less stress and save time when the need to re-cannulate a patient is avoided (Thomson, 1993).

Many advocate that MCs are ideally suited to patients requiring medium to long term intravenous (IV) therapy (Griffiths, 2007; INS, 1997; Kupensky, 1998). The Intravenous Nurses Society (1997) report that MCs ideal dwell time is 2-4 weeks however this time frame could be extended based on a nurse's professional assessment and judgement. Anderson (2005) suggests that the MC should be used for a patient requiring treatment for at least 5 days but no more than 28 days. Others propose a maximum dwell time of between 1-6 weeks but suggest 2-4 weeks in principle is optimal (Gorski & Czaplewski, 2004), with recent data suggesting up to 296 days (Griffiths & Philpot, 2006, cited in Griffiths, 2007).

It is widely acknowledged that MCs can be used to administer intravenous medication or hydrating fluids that would normally be administered via a peripheral cannula but with the added benefit of delivering these in a bigger diameter vessel within the venous circulation (Anderson, 2005; Griffiths, 2007; INS, 1997). This increased vessel diameter (6-8mm) facilitates a greater flow rate of blood at the catheter tip, ensuring adequate dilution of medications (Hadaway, 2000; Rosenthal, 2008). This dilution reduces the incidence of chemical phlebitis, infiltration and patient discomfort

during drug administration (Anderson, 2004, 2005; Gorski & Czaplewski, 2004; Lawson, 1998; Myers and Kyle, 1993). The MC can tolerate isotonic medications and solutions (250-350mEq/L) (Rosenthal, 2008), drugs and solutions with a pH level between 5 and 9, with a low osmolarity (<500mOsm) (Anderson, 2005; Klein & Metules, 2001; Rosenthal, 2008) or blood products (Kupensky, 1998). Additionally, the 5Fr midline catheter can tolerate high flow rates with the aid of a pump (Vygon, 2006, cited in Griffiths, 2007).

Further advantages of MCs are that once inserted, they can be used without X-ray confirmation due to its final tip position being at or below the axillary vein (Gorski & Czaplewski, 2004; Griffiths, 2007; Vanek, 2002). However, the INS (1997) recommends that radiological confirmation be obtained if there are any of the following concerns: difficulty with advancing the catheter, impaired blood return, resistance to flushing, issues with guide-wire removal or patient distress following or during catheter insertion.

The need for heparin flushing can also be eliminated as some MCs are manufactured with pressure displacement valves, these valves will only open if positive or negative pressure is applied. Thus a closed valve system assists in maintaining catheter patency by inhibiting retrograde flow of blood or air, decreasing the chance of occlusion or thrombus formation (Griffiths, 2007).

Midline catheters are ideal for patients of all ages with an uncomplicated medical history, which can facilitate early discharge into less costly community care such as home IV antibiotic programs (Griffiths, 2007). Midline catheters also provide

flexibility and can be used for the older adult with compromised venous access or chronic and complex medical issues (Anderson, 2005; Griffiths, 2007; Rosenthal, 2008; Sterba, 2001). Midline catheters have a low infection rate comparable to the infection rate of PICCs (Maki, Kluger & Crnich, 2006; Vanek, 2002). Some authors have reported a decrease in the rate of infection with increased dwell times for MCs as opposed to other vascular access devices (VADs) (Mermel, Parenteau & Tow, 1995). This has been supported by the Center for Disease Control [CDC], (2002) which reported MCs have lower rates of phlebitis than peripheral cannulas. Decreased bacterial counts on the skin over the antecubital region where midlines are inserted; in comparison to areas over the chest and neck, where CVCs are inserted have been reported to be possible factors in the low incidence of catheter related infections (Lawson, 1998).

Disadvantages of using midline catheters:

The risk of extravasation can be high with the use of MCs due to potential positioning of the catheter tip in the axillary vein. This can also put other anatomical structures at risk such as damage to arteries and nerves if extravasation goes undetected (Hadaway, 2000). Midline catheters are not recommended for the infusion of dextrose solutions >10% (Rosenthal, 2008), vesicants (Anderson, 2005; Hadaway, 2000; Rosenthal, 2008) and potent antibiotics, such as vancomycin (Anderson, 2005; Klein & Metules, 2001; Rosenthal, 2008) and in these cases a CVC or PICC is preferable due to the deeper catheter tip position. Gravity administration is not always a viable option and in most cases a pump is required to deliver medications and fluids at higher infusion rates (Griffiths, 2007).

The most common complication with MCs is mechanical phlebitis (Anderson, 2004; Rosenthal, 2008). The trauma caused to the vessel wall may be as a result of frequent manipulation of the midline catheter (Griffiths, 2007) and is generally evident a week post insertion of the line but can occur at any time while in use (Gorski & Czaplewski, 2004). In some instances, the phlebitis and discomfort can be relieved with the use of warm compresses, elevation and use of analgesia (Carlson, 1999; Gorski & Czaplewski, 2004; Larouere, 2000b).

The catheter is unsuitable for patients with compromised anatomy and conditions such as lymphoedema, or who have had previous infection or phlebitis to the arm being considered (Griffiths, 2007).

Insertion and Management Issues:

A thorough patient vascular and clinical assessment needs to be undertaken prior to the insertion of an MC. This includes reviewing past medical and surgical history including history of radiotherapy, lymph oedema, upper arm surgery or trauma and visualisation of any areas of bruising, scarring and infection from previous cannulation (Griffiths, 2007). A vascular assessment should be undertaken to ensure vessel patency, identification of any thrombosis and diameter of vessel to be cannulated. This assessment should incorporate the use of ultrasound technology (INS, 2006; Pittiruti et al., 2009).

According to Griffiths (2007) MC placement is a nursing responsibility and “nurse-led procedure”, as specialist nurses who are competency verified are best suited to

assessing patients' needs and vascular access requirements (p. 57). In agreement, Anderson's (2004, p.318) study of the Evangelical Community Hospital's (Pennsylvania) use of midlines found that "midline placement became a decision based entirely on nursing evaluation...", unlike PICC placement which still required referral to a physician.

Midlines are inserted preferably with local anaesthetic into the patient's non-dominant arm (Larouere, 2000a; Pittiruti et al., 2009) using strict aseptic technique and barrier precautions (Carlson, 1999; Pittiruti et al., 2009; Rosenthal, 2008). The point of insertion should be approximately 5cm above or below the antecubital crease (Griffiths, 2007). There is a significant risk of venous thrombosis if placement is above the axillary line (Gorski & Czaplewski, 2004).

The catheter is advanced into either the cephalic, basilic or median cubital veins of the antecubital fossa, until its tip sits at or below the axillary vein (Anderson, 2005; Gorski & Czaplewski, 2004; Griffiths, 2007; Larouere, 2000a). The larger diameter and more direct route of the basilic vein makes it the best option (Larouere, 2000a).

Griffiths (2007) described two techniques, predominantly used, for inserting MCs: the use of "a cannula with a peel-away sheath or the Seldinger technique using specific Seldinger insertion kits" (p. 50). The latter technique with ultrasound guidance is used for patients with compromised venous access (Griffiths, 2007). Once the midline is insitu, accurate documentation in the clinical notes should include length of catheter, vein used, follow-up instructions (Griffiths, 2007), patient tolerance of the procedure, difficulties encountered with insertion and brand and lot number of catheter (Carlson,

1999; Gorski & Czapslewski, 2004). Arm circumference (15cm above the insertion site) should be measured at least four times a day during a continuous infusion or before each individual dose to detect complications early (Larouere, 2000b).

Policies differ in regards to dressing, line changes and flushing technique. Aseptic technique is required when caring for midlines (flushing, dressing, infusate administration set changes) (Burns, 2006; Kupensky, 1998). The majority of policies suggest that the MC dressing be changed 24 hours post-insertion and then weekly thereafter, unless the dressing is compromised (Anderson, 2005; CDC, 2002; Griffiths, 2007). The insertion site should be secured to prevent catheter migration and should be checked daily for excess moisture, bleeding, tenderness or other complications (Anderson, 2005; CDC, 2002; Gorski & Czapslewski, 2004; Griffiths, 2007). Gorski and Czapslewski (2004) report that there is uncertainty in regards to the securement device of choice but suggest that the manufactured devices are less problematic. The three methods of securing a midline include sutures, sterile tape strips and manufactured adhesive securement devices (Gorski & Czapslewski, 2004).

Site care should always be conducted using an aseptic technique and includes skin disinfection, dressing change and if necessary a change to the securement device (Gorski & Czapslewski, 2004). The CDC (2002) prefers 2% chlorhexidine gluconate with 70% isopropyl alcohol as the most effective skin antiseptic for preventing catheter-related infections. It is applied easily (for 30 seconds) and has a quick effect (dries within 30 seconds) and provides a 6 hour microbial protection (Gorski & Czapslewski, 2004).

Gauze or transparent dressings are options however transparent dressings are optimal as they allow visualisation of the exit site, can remain insitu for a week (CDC, 2002; Griffiths, 2007; Klein & Metules, 2001) and possess high permeability properties, keeping the site dry (CDC, 2002). Gauze dressings, on the other hand, need to be changed between daily and no longer than every 2 days at least and are more difficult to inspect thoroughly without removal of the dressing (CDC, 2002; Gorski & Czaplewski, 2004, Klein & Metules, 2001).

Infusate administration sets should occur every 3-7 days (Anderson, 2005) and the CDC (2002) recommends changing infusion sets no more often than 72hrs unless clinically indicated. Extension sets and lines should be replaced within 24 hours following the administration of blood or lipid products (CDC, 2002).

A syringe size of at least 10mL or larger is used to flush the midline with a pulsating action (push-pause-push) to avoid occlusions and maintain patency (Anderson, 2005; Gorski & Czaplewski, 2004; Griffiths, 2007). The flushing solution of choice is 10mL of sterile normal saline (Anderson, 2005; Sterba, 2001). The same syringe sizes are used to administer drugs as a push to avoid excess pressure and possible rupture of the catheter (Anderson, 2005; Gorski & Czaplewski, 2004; Griffiths, 2007). Gorski and Czaplewski (2004) recommend the SASH method (saline, administer medication, saline, heparin lock) with drug administration to avoid complications associated with the mixing of the drug with heparin. Small amounts (1mL) of heparin (100units/mL) are used to prevent thrombotic occlusions (Anderson, 2005). Positive pulsatile pressure flushing and lock technique can be used to prevent retrograde flow of blood

back into the catheter and also minimises the development of a fibrin tail or eventual fibrin sheath formation (Sterba, 2001).

To conserve the midline, blood pressure cuffs and tourniquets should not be applied above the midline site (INS, 2006; Rosenthal, 2008). Institutional issues with midlines include the lack of trained, experienced staff that are able to insert midlines and in some cases lack of patient consent or compliance with devices (Griffiths, 2007).

DISCUSSION

Implications for clinical practice

Midline catheters are a viable and feasible option for adults in an acute care setting, whom require intermediate to long-term intravenous therapy (Griffiths, 2007; INS, 1997). Dwell times average 2-4 weeks however MCs can be used for longer periods without complications (INS, 1997). The longer dwell time of the MC in comparison to a peripheral cannula (96hrs) (CDC, 2002) is appealing to patients as it reduces the number of repeated cannulations that may be required while hospitalised (Anderson, 2004; Griffiths, 2007; Rosenthal, 2008), thus veins are not compromised and patient anxiety is reduced (Smeed, 1990).

Midline catheters should be inserted by suitably qualified and accredited registered nurses and registered physicians (INS, 1997; Kupensky, 1998; Rosenthal, 2008). These individuals need to be accredited and their competency verified through the completion of formal educational programs, including theoretical and practical components. Ongoing competency needs to be assessed (Burns, 2006; Carlson, 1999; Gorski & Czaplewski, 2004, INS, 1997; Rosenthal, 2008). Burns (2006) indicates that

there should be four phases in the training process: observing the process, assisting with insertions, catheter insertion with assistance and independent insertion. The CDC (2002) states that dedicated “IV teams” are a factor in the minimisation of catheter related infections and institutional costs. A recent study comparing the insertion of CVCs between a dedicated nurse-led team and anaesthetic medical staff showed favourable insertion and infection outcomes (Yacopetti et al. 2010).

There are many patient cohorts where a MC can facilitate early discharge from hospital and care at home, increasing patient satisfaction (Griffiths, 2007). These patient cohorts include those with Stage 4 Congestive heart failure needing IV frusemide boluses or patients requiring IV antibiotics for different types of infections and can be treated at home by specialist community nurses or within an outpatient setting (Griffiths 2007).

Small research studies have shown that midlines have been used successfully for patients with Acquired Immune Deficiency Syndrome (AIDS), having home IV therapy (Smeed, 1990). In retrospect, Sargent and Nixon’s (1997) study of 12 MCs and 18 PICCs found that PICCs were a better alternative for the treatment of patients with AIDS and cytomegalo virus (CMV) disease with their study participants preferring a PICC in the future.

Midlines have reportedly been used for the administration of non-vesicant medication and fluids to critically ill patients (Griffiths, 2007). They have also proven to be effective in the elderly patients or patients with difficult venous access (Anderson, 2005; Griffiths, 2007; INS, 1997; Rosenthal, 2008; Sterba, 2001).

Recommendations for Clinical Practice

Midline catheters are not suitable for patients with a history of thrombosis, hypercoagulopathy, medical conditions that impede venous flow to the extremity (i.e. paralysis, lymphoedema, orthopaedic, neurologic conditions) and patients undergoing dialysis who have an AV fistula (Larouere, 2000a). Patient preference is also important and the patient should determine whether the midline is best suited to their needs, taking into consideration their activity levels and purpose of treatment (Gorski & Czaplewski, 2004; INS, 1997). These recommendations for practice are summarised in Table 1.

Although a range of drugs and solutions can be safely infused through a MC, the majority of administration guidelines indicate that midlines should not be used to administer vesicants such as continuous chemotherapy (Anderson, 2005; Banton & Leahy-Gross, 1998; Hadaway, 2000; INS, 1998, 2000; Larouere, 2000a; Rosenthal, 2008) or dopamine (Anderson, 2005; Banton & Leahy-Gross, 1998; Rosenthal, 2008) as they can cause tissue damage and chemical phlebitis (Hadaway, 2000). In addition, most of the literature reveals that MCs do not tolerate and are not safe for the delivery of solutions such as total parenteral nutrition (TPN), solutions with greater than 10% dextrose or greater than 5% protein (INS, 2000) and drugs with a pH <5 or >9 or with an osmolality >500mOsm/L (INS, 1998, 2000; Larouere, 2000a). Drugs and electrolytes not suited to midlines include vancomycin (Anderson, 2005; Banton & Leahy-Gross, 1998; Hadaway, 2000), phenytoin, (Banton & Leahy-Gross, 1998; Klein & Metules, 2001; Rosenthal, 2008), calcium, potassium, nitroprusside,

promethazine (Hadaway, 2000) and rapid, large volume infusions or high pressure boluses (Larouere, 2000a).

Rosenthal (2008) clearly outlines that midlines can safely administer isotonic drugs and solutions (250-350mEq/L), plain fluids, drugs and solutions with a pH between 5 and 9, cephalosporin antibiotics, antifungals such as amphotericin B (Ambisome). Heparin can also be safely administered via a midline (Anderson, 2004, 2005).

Additionally, Pittiruti and colleagues found that midlines, placed under ultrasound guidance, were safe for the administration of parenteral nutrition with an osmolarity <800mOsm/L and had minimal complications, although it must be noted that the study sample size was small, 94 midlines inserted for patients requiring >10 days of parenteral nutrition (Pittiruti et al., 2009). Guidelines suggest that midlines should be used sparingly to administer parenteral nutrition, osmolarity should be less than 850mOsm/L and vigilant monitoring is essential (Pittiruti, Hamilton, Biffi, MacFie & Pertkiewicz, 2009). Matsumoto, Shirotani and Kameoka (1999) agree that midline catheters are safe for the administration of parenteral nutrition, optimally with an osmolarity ratio of 3.1 or less and glucose/fat ratio 1:2.

Another study demonstrated that fine bore midlines can be safely used to administer peripheral intravenous nutrition and the addition of heparin prolonged feeding times, but there remains public concerns for the use of heparin as a feed additive and further studies are needed (Catton et al., 2006).

Strengths and Limitations:

One clear limitation of this review is the small number of outcome based studies showing the effectiveness of MCs. A large proportion of papers were narrative in nature and quasi-experimental in design. We excluded papers or studies that were not in English or not in the adult population; this may have precluded the authors in reviewing potential articles of interest. Despite these limitations, this review was undertaken in a prospective and systematic way and as such has encapsulated the majority of papers and studies describing the use of MCs in adult care settings.

CONCLUSION

This literature review was undertaken to ascertain the implications for clinical practice in the acute care setting with the insertion and use of MCs. The review has highlighted that MCs have a role to play in many patient cohorts and can be used as an alternative to multiple peripheral cannulations.

There is also a potential that in some cases a MC can be used in place of a PICC or CVC which can reduce risk of insertion complications and the need for a chest x-ray. A MC can be a cost effective replacement to peripheral IV cannulas and can potentially improve organisational efficiencies by reducing work load demands on clinicians inserting VADs. Midline catheters can also be used to facilitate early discharge from hospital where some patients can be treated in the community setting rather than remaining in hospital for treatment. This can lead to improved patient satisfaction and potential cost savings (Griffiths, 2007).

Although there are many benefits for the use of MCs, there are also disadvantages. Midline catheters have been associated with mechanical and chemical phlebitis and are not suitable for patients with abnormal compromised venous circulation. Midline catheters are also only suitable for patients who require short to intermediate therapy up to 4 weeks in general and if longer treatment is required a PICC or CVC is more suitable.

Overall, there are many advantages for the use of MCs, they can be used in a variety of acute care settings where traditionally multiple peripheral cannulas have been used or as a replacement for a PICC or CVC.

AUTHORS' CONTRIBUTIONS EA, LMR and TS planned and conducted the review; SAF, YS and PD assisted in the review of the literature and manuscript formation. All other authors had an active role in data interpretation. All authors contributed to the final manuscript.

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TABLE: 1

RECOMMENDATIONS FOR PLACING MIDLINE CATHETERS IN THE ADULT ACUTE CARE SETTING
<p><i>Recommendations for insertion:</i></p> <ul style="list-style-type: none">• Use strict aseptic technique.• Insert under ultrasound guidance above the ante cubital crease.• Basilic vein preferable.• Catheter distal tip should be at or below the axillary vein.• Chest x-ray indicated:<ul style="list-style-type: none">▪ With difficult catheter advancement▪ No blood aspirate▪ Inability to flush <p><i>Recommendations with therapy:</i></p> <ul style="list-style-type: none">• Ideal for IV therapy lasting between 2 – 4 weeks.• Use with near isotonic solutions (250-350mEq/L).• Medication pH should be no less than 5 or exceed 9.• Good for elderly patients with limited venous access.• Parenteral nutrition with osmolarity <800mOsm/L <p><i>Special considerations for midline use:</i></p> <ul style="list-style-type: none">• Patients at risk of thrombosis.• Patients with compromised circulation.• Patients at risk of lymph oedema.• Patients with end stage renal disease requiring vein preservation.

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TABLE: 1

RECOMMENDATIONS FOR PLACING MIDLINE CATHETERS IN THE ADULT ACUTE CARE SETTING
<p><i>Recommendations for insertion:</i></p> <ul style="list-style-type: none">• Use strict aseptic technique and maximal barrier precautions.• Insert under ultrasound guidance above the ante cubital crease.• Basilic vein preferable.• Catheter distal tip should be at or below the axillary vein. <p><i>Recommendations with therapy:</i></p> <ul style="list-style-type: none">• Ideal for IV therapy lasting between 2 – 4 weeks.• Use with near isotonic solutions (250-350mEq/L).• Medication pH should be no less than 5 or exceed 9.• Good for elderly patients with limited venous access.• Fluids with osmolality <600mOsm/L (However, up to 800mOsm/L has been cited by Pittiruti et al., 2009) <p><i>Special considerations for midline use:</i></p> <ul style="list-style-type: none">• Patients at risk of thrombosis.• Patients with compromised circulation.• Patients at risk of lymph oedema.• Patients with end stage renal disease requiring vein preservation.