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Utilisation of midline catheters in palliative care

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Abstract

Continuation of intravenous therapy is an important aspect of improving quality of life in chronic or palliative patients, because current medical measures make it possible to relieve physical symptoms in many cases. Expected therapy over 5 days, combined with difficult intravenous access, indicates the possibility of using midline catheters (MCs) in a group of patients who do not have a long-term vascular port implanted. Obtaining intravenous access with MCs reduces the pain associated with numerous cannulation attempts, thus increasing patient comfort. Catheter-related complications are often secondary to poor maintenance, so proper catheter care is key to MC maintenance. Proper infusion care by properly trained staff can reduce the incidence of complications, because MCs are exposed to a number of mechanical complications compared to other types of vascular access.

Key words: pain, vascular access, difficult intravenous access, midline catheter, infusion care.

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INTRODUCTION

Maintaining peripheral vascular access until the end of intravenous therapy is a challenge for healthcare staff and patients. Difficult intravenous access (DIVA) can affect patients at different stages of palliative care, regardless of the cause. Examples of patients for whom palliative care is used include those with end-stage cancer after numerous cycles of chemotherapy; those with neurological disorders, limb contractures (they lead to increased disability from decreased motor performance, mobility limitations, reduced functional range of motion), neurodegenerative diseases, and multiple sclerosis; and patients with cardiomyopathies [1]. Palliative care can be used to treat symptoms of particular diseases and improve the quality of life. Intravenous access may still be required for palliative therapy because current medical measures allow for the relief of all physical symptoms in many cases [2]. It can be used for palliative sedation, palliative chemotherapy, antibiotic therapy, and symptomatic therapy such as analgesia, administration of antiemetic and prokinetic agents, fluid therapy, and interventions such as electrolyte disturbances or parenteral nutrition with adequate osmolarity [3]. This type of treatment is provided both in inpatient hospitals and in pain management clinics and home care, so using individual solutions with a personalised approach to each patient allows for an increase in the quality of care [4].

MIDLINE CATHETERS

Regardless of the reason, peripheral intravenous access is currently used for therapy in many patients. Extended therapy over 5 days combined with DIVA is an indication for placement of midline catheters (MCs) in patients who do not have a long-term vascular port implanted, (for various reasons: social and organisational) rate of disease progression, or autonomous decision of the patient [4, 5]. Midline catheters are single- or double-lumen polyurethane catheters with lengths of 4–25 cm and diameters of 2–6 Fr (for adults typically >15 cm 4 Fr) implanted into the peripheral vein using the Seldinger technique under ultrasound guidance (Fig. 1) [5]. Midline catheters are usually implanted in the veins of the arm (Fig. 2), although other sites, such as the superficial femoral vein, have been described in the literature for the comfort of hospice patients with a depleted peripheral vascular system [1]. Unlike peripherally inserted central catheters (PICCs), MC is a peripheral access and therefore can be obtained by both a physician and a nurse skilled in ultrasound-guided needle insertion, regardless of specialisation. Guidelines for symptomatic treatment in palliative care of certain problems are based on the subcutaneous route, but for many others the intravenous route is recommended, i.e. rapid pain control, dyspnoea. In these cases, a central venous catheter (CVC) is preferred [6]. Increasing access to PICC and MC facilitates intraveno-

us treatment in the home care setting, making these methods increasingly popular in palliative care.

BENEFITS OF USING MIDLINE CATHETERS

Midline catheters are used in clinical settings, providing intravenous access with little pain during cannulation procedures, improving patients' quality of life and reducing treatment costs. Midline catheters are recommended for intravenous therapy lasting longer than 5 days, but they are rarely used [4, 5, 7, 8]. Implantation of MCs reduces the number of venipuncture attempts in the case of DIVA and reduces the number of cannulations with short intravenous catheters, simultaneously improving patient comfort [8]. Analyses conducted in this area have shown low pain and stress scores during the procedure, as well as low rates of local and systemic complications and a favourable impact on patients' quality of life [9, 10]. Further research is needed to assess the use of this solution and their implementation in palliative care. Due to the site of implantation, they may be useful in patients with impaired level of consciousness due to underlying disease or medication, and who are therefore uncooperative: agitated or apathetic patients with the potential for unconscious and premature removal of access obtained on distal parts of the limbs.

LIMITATIONS

In addition to the many advantages of using MCs, however, they have their limitations. Due to their peripheral nature, they should not be used for infusion of chemically incompatible solutions with extreme pH (appropriate pH is 5–9) [4, 5]. If such drugs need to be administered, PICCs should be considered because of the risk of extravasation of highly irritating drugs or the development of thrombosis [4, 5, 11]. In particular, cytotoxic or immunosuppressive chemotherapy may increase the risk of cancer-related venous thromboembolism by 50% compared with cancer patients without prescribed treatment [11]. When selecting appropriate solutions, venous thrombosis associated with MCs is comparable to PICCs [12].

IMPLANTATION AND INFUSION MANAGEMENT

Organisation of the puncture site

The expected long retention time of the catheter requires the application of appropriate aseptic principles during its implantation (Fig. 3). Cannulation can be performed in the patient's room, ensuring

Fig. 1. Ultrasound image of the basilic vein located 0.75 cm under the skin

Fig. 2. Midline catheter placed on the arm

proper conditions, or the procedure can be carried out in an adapted place (e.g. surgery room). Before insertion, it is important to prepare the patient and the catheter insertion site and set up an instrument table (or instrument stand). The role of the assistant is to help organise the station, prepare the equipment, assist with the insertion of the ultrasound probe protection, and administer the equipment to the clean field. Sets that contain all the necessary equipment in one package can be used to perform the procedure at the patient's bedside, which greatly simplifies implementation (Fig. 4).

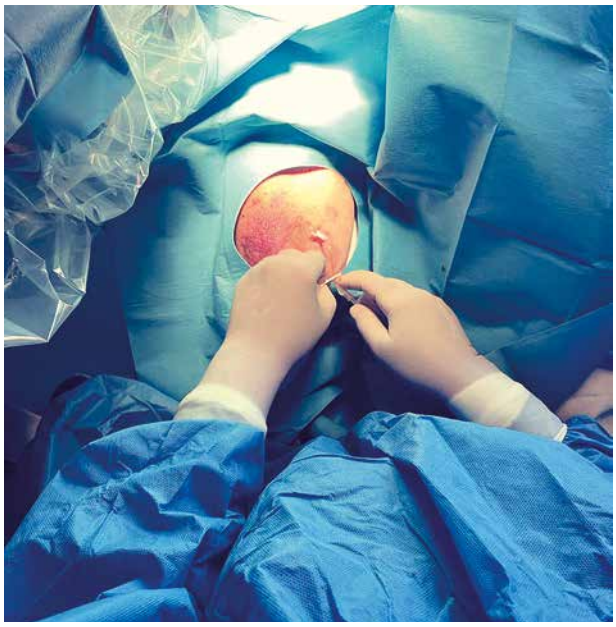

Fig. 3. Sterile draping of the implantation site

Fig. 4. Cannulation set with modified Seldinger technique

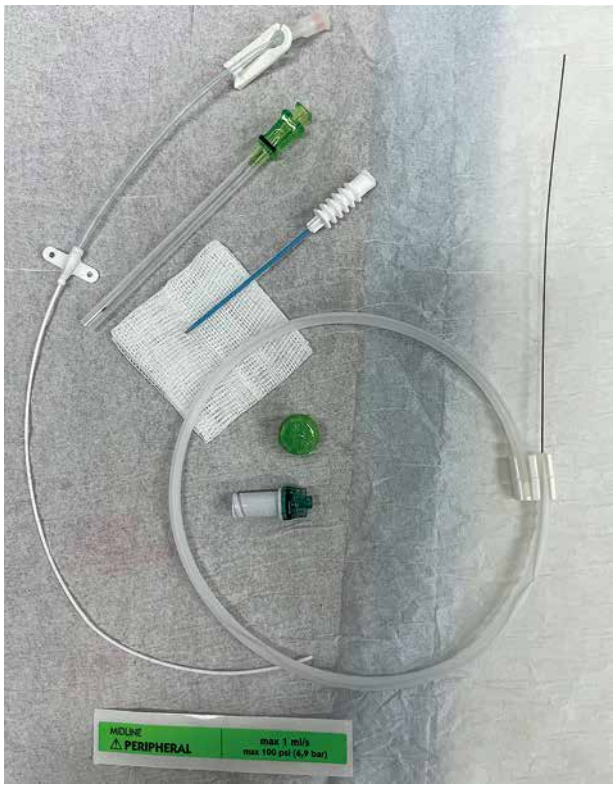

Fig. 5. Cannulation set with Seldinger technique

Composition of the implantation set

The set using the Seldinger technique consists of an echogenic needle for puncturing the vein, a simple stainless steel or nitinol guidewire, a dilator, and a catheter of a specific diameter and length (Fig. 5). The remaining components depend on the set of the respective manufacturer and the dedicated technique (direct or modified Seldinger technique). The following items are also needed for cannulation: 2% chlorhexidine gluconate in 70% isopropyl alcohol disinfectant for skin decontamination, sterile gauze pads, sutureless catheter fixation systems, self-adhesive, transparent dressing, 10 ml syringe with 0.9% NaCl, tourniquet, sterile gloves, surgical apron, drape with opening, drapes for the treatment table or patient bed, and a sterile ultrasound probe cover.

Catheter selection and puncture site

Midline catheters are inserted into the peripheral veins of the arm, most commonly the basilic and cephalic veins in the midline of the arm (in the green Dawson zone) (Fig. 6). The size should be chosen according to the patient's anatomical capabilities. The diameter of the catheter should not occupy more than one-third of the diameter of the vein, and the length of the cannula should be estimated by selecting the cannulation site [4, 7]. An easy way to do this is to measure the length from mid-arm to the first rib, so that the tip of the MC is maximally in the axillary vein. The tip of the MC should be in the axillary line, and this is the recommended location. Although some authors describe the origin of the subclavian vein as the so-called 'midclavicular', it may be associated with more serious complications and requires further study [5].

Pain management

Pain related to needle punctures is associated with physical and psychosocial complications. Fear of needles involved in medical procedures and the associated pain may lead to treatment avoidance and de-

layed therapy or preventive health care [14]. The use of local anaesthesia helps reduce patient distress at the time of the procedure, serves to facilitate needle insertion, and helps improve patient satisfaction and hospital experience [14, 15]. Buffered lidocaine injection reduces venipuncture pain more than lidocaine cream, without affecting the success of insertion [16]. However, local anaesthesia may not be available or may cause additional pain due to the puncture. It is worth considering the use of topical agents. Topical anaesthesia avoids the need for infiltrative local anaesthesia and can be utilised for MC insertion. It is available as gels, sprays, creams, and patches. Topical anaesthetics work by blocking nerve conductors near the site of administration and therefore provide a temporary loss of sensation in a limited area [17]. In addition to lidocaine in various concentrations, vapocoolant may also be used. Moreover, the vapocoolant intervention was concluded to be effective, safe, and acceptable for reducing pain associated with peripheral cannulation in adults [18].

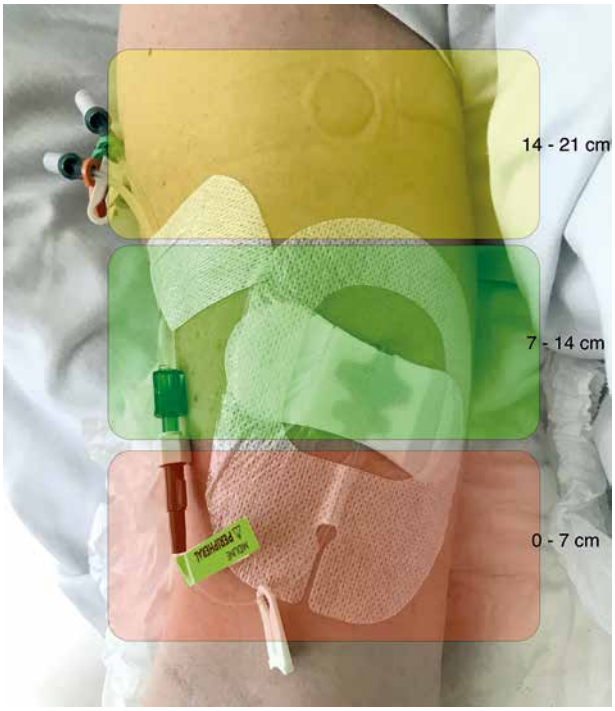

Fig. 6. Dawson's zoning of the arm. Recommended cannulation in the green zone

Performing the procedure

Performance of the procedure using the Seldinger technique is shown in Table 1.

Infusion care

Midline catheters can be maintained for up to 29 days or more if the patient can benefit from it and the MC is observed and carefully cared for. There are reports in the literature of safe maintenance for catheters up to 60 days [19]. The strategy for maintaining MCs is based on attention to aseptic principles, proper dressing changes and maintaining catheter patency. Aseptic principles should be remembered when connecting syringes and infusion sets to the catheter, and intervals for changing intravenous line elements should be observed [4]. Sutureless catheter fixation systems should be considered (Fig. 2). These catheter fixation systems can compete with traditional sutures in terms of stable fixation, ease of use and reduced infection [20]. An important aspect is the reduction in pain associated with suturing the catheter and the redu-

Table 1. Procedure of the midline catheter implantation [13]

	Performing the midline catheter implantation procedure
	Subsequent steps
1	Initial ultrasound examination of the veins, assess and select site for cannulation
2	Prepare the set up with aseptics, insert a single-use torniquet, disinfect the skin, protect the field with a hole drape and identify the vein with an ultrasound
3	Consider the local or topical anaesthesia
4	Insert the needle into the vein under ultrasound guidance – confirmation is free flow of blood
5	Then, minimising the movement of the needle, insert the guide through the needle
6	Advance the needle leaving the guidewire in the vein – it may be necessary to apply a gauze pad to the insertion site if minor bleeding occurs
7	Once the needle has been removed, release the torniquet and, depending on the size of the catheter, use the dilator by inserting it along the guidewire, then insert the catheter and remove the guidewire
8	The ability to aspirate blood from the catheter confirms its correct placement, the catheter does not require X-ray confirmation of the position
9	After implantation, add a needle-free connector, flush the catheter with 10 ml of 0.9% NaCl, fix with a sutureless system and secure with a transparent dressing
10	Mark the cannula as peripheral, e.g. with a "midline peripheral" sticker
11	Record cannula implantation in the documentation according to local protocols

ced risk of damage caused by the catheter adhering to the skin. For MC maintenance, it is also crucial to take care of catheter patency by flushing the catheter with 0.9% NaCl before and after drug administration. The infection rates for MCs are lower than the reported rates of CVC; however, they have a higher rate of mechanical complications [21]. In the literature, catheter occlusion, depending on the authors, is reported at 1.9–17% [22, 23]. Possible complications described by Gravdahl *et al*., especially in palliative care patients, are bleeding from the catheter insertion site (2.4%), accidental removal (3.5%), and infections (1.1%) [24]. Catheter-related complications are often secondary to poor maintenance and dwell time, so proper catheter care is key to MC maintenance [25]. Proper infusion care by properly trained staff can reduce the incidence of complications, because MCs are exposed to a number of mechanical complications compared to other types of vascular access [4, 21, 25].

CONCLUSIONS

Appropriate vascular access and maintenance of intravenous therapy is an important aspect of improving quality of life in some chronic or palliative care patients. Obtaining intravenous access with MCs may increase patient comfort by avoiding frequent vein cannulations. Midline catheters are safe and effective parenteral access devices for palliative patients in whom continuity of intravenous symptom management is seen as an advantage, and they may be a robust option for intravenous symptom management outside the hospital setting, where parenteral drug administration practice has traditionally relied on a subcutaneous route. We recommend considering the use of medium-term catheters in surgical wards, conservative wards, hospital emergency departments, post-operative wards, palliative care units, and hospices.

DISCLOSURES

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3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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