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CASE REPORT

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USE OF THE REPORTED PSEUDO-TUNNELING METHOD WHEN INSERTING MIDLINE CATHETERS INTO SMALL VEINS. CASE REPORT

WYKORZYSTANIE OPISANEJ METODY PSEUDO-TUNNELINGU PODCZAS WPROWADZANIA CEWNIKÓW POŚREDNICH DO MAŁYCH ŻYŁ. OPIS PRZYPADKU

ABSTRACT: The use of midline catheters (MCs), alongside Long Peripheral Catheters (LPCs) and Peripherally Inserted Central Catheters (PICCs) is one option to reduce multiple cannulations for Difficult Intravenous Access (DIVA) and multiple insertions of Short Peripheral Catheters (SPCs). In some patients, a larger catheter may need to be inserted, but this is not possible due to limitations in the availability of appropriate veins. Benvenuti et al. described a simple, safe and effective ‚pseudo-tunneling' technique that is worth using in clinical practice to achieve the best possible therapeutic outcome despite unfavourable anatomical conditions. In clinical situations that require a larger size than the vein available at the site of the planned puncture, it is not always necessary to give up the most suitable midline catheter. Pseudo-tunneling is easy to apply and is an effective solution for small-diameter veins.

KEY WORDS: case report, midline catheter, nurses, peripheral veins, pseudo-tunneling

STRESZCZENIE: Stosowanie cewników pośrednich (MCs), obok długich kaniul dożylnych (LPCs) i cewników centralnych wprowadzanych obwodowo (PICCs), jest jedną z opcji ograniczania licznych kaniulacji w przypadku trudnego dostępu dożylnego (DIVA) i wielokrotnego wprowadzania krótkich kaniul dożylnych (SPCs). U części pacjentów może wystąpić potrzeba wprowadzenia większego cewnika, ale ze względu na ograniczenia w dostępności właściwych żył nie jest to możliwe. Zespół Benvenuti i wsp. opisał prostą, bezpieczną i skuteczną technikę „pseudo-tunnelingu", którą warto stosować w praktyce klinicznej, aby osiągnąć jak najlepszy efekt terapeutyczny mimo niekorzystnych warunków anatomicznych. Wykorzystywanie dostępnych technik i wymiana doświadczeń pozwalają usprawnić codzienną praktykę kliniczną. Podobnie ważne, jak procedura kaniulacji, jest właściwe utrzymanie cewnika, aby w pełni wykorzystać wdrażane rozwiązania.

SŁOWA KLUCZOWE: cewnik pośredni, opis przypadku, pielęgniarki, pseudo-tunneling, żyły obwodowe

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INTRODUCTION

The insertion and proper maintenance of vascular access are critical to patient safety and the cost-effectiveness of the healthcare system [1]. The use of midline catheters (MCs), alongside Long Peripheral Catheters (LPCs) and Peripherally Inserted Central Catheters (PICCs), is one option to reduce multiple cannulations for Difficult Intravenous Access (DIVA) and multiple insertions of Short Peripheral Catheters (SPCs) [2, 3]. It is crucial to follow the basic principles of selecting the appropriate vessel, including the correct vein diameter [1]. Using the correct catheter-to-vein ratio, 1:3 [1, 4]. Although it is recommended to choose the most miniature possible catheter to minimise the risk of complications, in many cases, the diameter of the catheter is dictated by the diameter of the vein rather than a clinical choice [1]. In some patients, a larger catheter may need to be inserted, but this is not possible due to limitations in the

availability of appropriate veins. Benvenuti et al. described a simple, safe and effective ‚pseudo-tunneling' technique that is worth using in clinical practice to achieve the best possible therapeutic outcome despite unfavourable anatomical conditions [5]. This study aimed to present a case study of a patient in whom a pseudo-tunneling technique, described in the literature, was used during the insertion of midline catheters.

MATERIAL AND METHODS

This study used a case study method. It describes a patient who required the pseudo-tunneling technique presented in the literature to use a larger catheter size. Case Report Guidelines (CARE) were used to describe the case [14]. The patient gave her consent for the case report. The study was performed according to the standards presented in the Declaration of Helsinki [15].

CASE REPORT

A 67-year-old female patient in the internal medicine ward was presented to the Vascular Access Team (VAT) with the initial qualification of obtaining vascular access to provide intravenous therapy. Antibiotic therapy, fluid therapy, blood draws and administration of other medications over five days were anticipated. All solutions were identified as ‚low risk' for peripheral veins (pH 5–9; <600 mOsm/l, non-irritating) [6]. The patient was examined and scored four on the A-DIVA scale. [7]. History of past intravenous chemotherapy, BMI=22.71. Considering the duration of therapy, the anticipated difficulty in obtaining vascular access via SPC and the specificity of the planned solutions, the VAT decided to place MC.

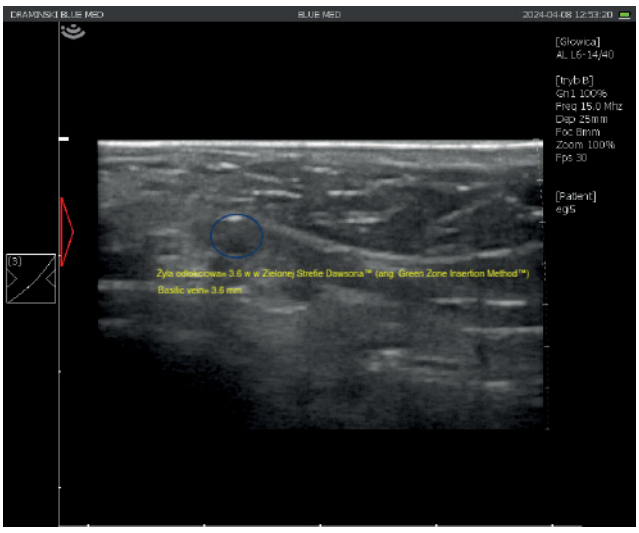

Figure 1. The basilic vein in the Green ZIM™.

After the patient consented to the procedure, ultrasound examinations of the arms of both upper limbs were performed according to the Rapid Peripheral Vein Assessment (RaPeVa) protocol [8]. The most prominent vein available was the left arm basilic vein. According to the SIP (Safe Insertion of PICCs) protocol, i.e. the described method of insertion of PICCs, which in clinical practice is also used for MC insertion, the catheter exit site should be in the Green Zone Insertion Method™ [8, 9]. The basilic vein at this site was measured at 3.6 mm (Fig. 1). In the situation described, the catheter of choice would have been a 3 Fr catheter; however, due to the indications and expectations of the ward team, a 4 Fr catheter (correspondingly possible higher flow rate of 10 ml/minute *versus* 21 ml/minute) was the better choice for successful therapy, including multiple blood draws. The appropriate diameter for placement of the 4 Fr catheter was only in the Yellow Zone Insertion Method™ (5.6 mm).

The decision was made to insert a 4 Fr diameter, 20 cm long MC into the basilic vein of the left non-dominant limb using a pseudo-tunneling method described in the literature [8]. The procedure was performed in the dedicated VAT's surgical office using the Aseptic Non-Touch Technique with a Direct Seldinger Technique (DST). A Smart-midline set consisting of a polyurethane midline catheter, a 21 G 70 mm echogenic needle, a dilator, a 50 cm guidewire and a sticker identifying the type of access (‚Midline Peripheral') was used to puncture the vessel. Disinfection of the catheter insertion site with 2% chlorhexidine with alcohol was used. Ultrasound probe covers were used, a Grip-Lock sutureless system to fix the catheter, a Needleless Connector (NC) Bionector to secure the port of the catheter extension system and a semi-permeable Protectfilm dressing.

Two points on the patient's arm were determined. The intended point of catheter exits from the skin in the Green Zone Insertion Method™ (point A) and the necessary point of venipuncture (point B), i.e. the entry of the catheter into the vessel (in the Yellow Zone Insertion Method™) (Fig. 2). The needle was then inserted under ultrasound guidance (point A), and the needle was then guided at a 15-degree angle up to the vessel wall (point B), where the vessel was successfully punctured. The distance between the skin puncture and the vein puncture was 30 mm, and this was the distance in the subcutaneous tissue where the needle was guided before the vessel was punctured (Fig. 3). The remainder of the procedure was then carried out in a typical manner (Fig. 4 and 5). Once the correct position of the catheter had been verified by possible blood aspiration, the position of the catheter tip was checked by ultrasound, which was correctly in the axillary line (Figure 4). The MC was fixed and secured. The patient returned to the ward. According to the documentation routinely maintained by the VAT, the MC was removed after 18 days due to the end of intravenous therapy. There were no complications leading to premature catheter removal.

DISCUSSION

Using the appropriate catheter for the right patient increases patient satisfaction and avoids the complications associated with repeated use of SPCs for intravenous therapy lasting more than four days [1-3]. This is particularly important in patients whose difficulties in obtaining vascular access can be predicted, e.g. using the predictive A-DIVA scale [4]. However, the choice of appropriate vascular access should be based on the expectation of the planned therapy, anatomical possibilities, and chemical characteristics [6]. The use of solutions with extreme pH (<5 and >9), venous endothelial irritation and osmolarity >600 mOsm/l may lead to chemical irritation of the veins, resulting in premature catheter removal [1, 6]. In the case described here, the patient required therapy that met the peripheral venous solution administration criteria, but the problem was the insertion of a catheter of appropriate diameter. The risk of thrombosis associated with its presence is minimised by applying the principle of a catheter-to-vein ratio of 1:3 [1, 4]. On the other hand, in real life, an MC with a diameter of 3 Fr may have too low a flow rate to perform intravenous therapy at the optimal time. These factors should

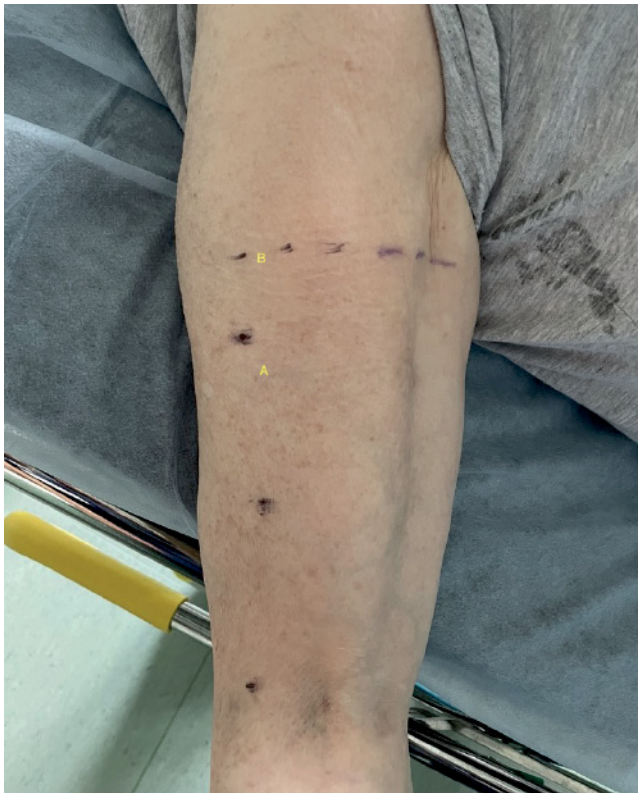

Figure 2. The catheter exit-site in the Green ZIM™ (point A) and the point of venipuncture in the Yellow ZIM™ (point B).

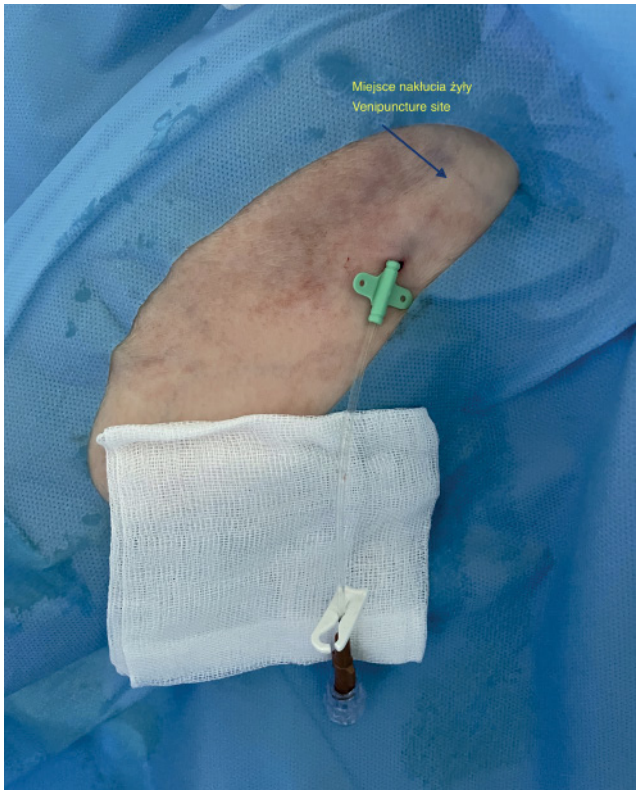

Figure 3. The venipuncture site.

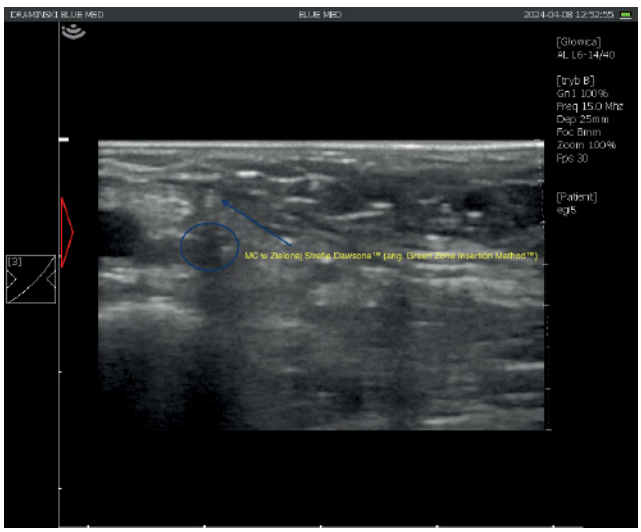

Figure 4. MC in the Green ZIM™.

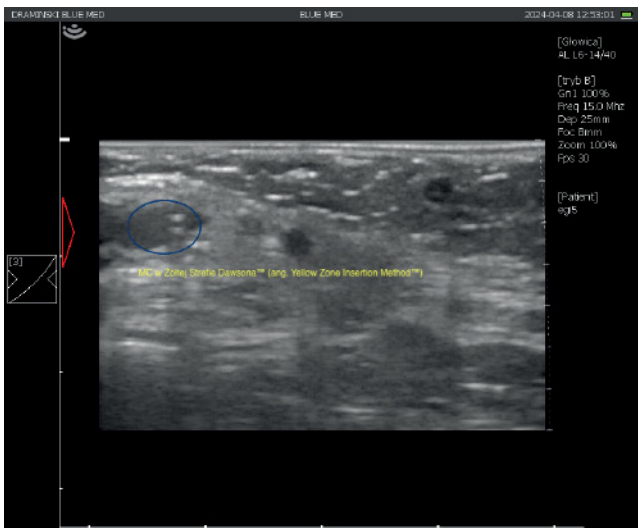

Figure 5. MC in the Yellow ZIM™.

be considered when selecting vascular access. In our practice, many patients have arm veins smaller than 4 and 5 mm, which often necessitates using a smaller catheter size or LPC [10–12]. Insertion of LPCs may work well for shorter intravenous therapy than MCs because of the location of the tip, which, unlike MCs, can be placed during the arm vein rather than in the axillary line or ‚midclavicular' position [13]. Placement of the MC tip in the axillary line is currently the site recommended by the Infusion Nurses Society guidelines and the European recommendations on the proper indication and use of peripheral venous access devices (the ERPIUP consensus) [1, 13]. In the case described, performing pseudo-tunneling requires selecting the appropriate length of the MC so that it is not only inserted into the correct vein but also at the correct distance [5]. From a technical point of view, it is essential to bear in mind the characteristics of the equipment used and the associated limitations, such as needle and dilator length. Using midline catheters shorter than 15 cm may result in incorrect positioning of the catheter tip or the need to insert the catheter in the wrong zone (in the Yellow Zone Insertion Method™). In the SIP protocol used in the hospital procedure, the catheter exit site must be in the Green Zone Insertion Method™ to minimise the risk of infection associated with the presence of vascular access [8, 9]. In the case described, pseudo-tunneling allowed the optimal selection of an MC adapted to the therapy, a suitable site and an appropriate length, confirming that the method described by Benvenuti S. et al. is easy to apply [5]. A key aspect after successful cannulation is the proper maintenance of the MC. Available protocols should be followed that consider the care of MC patency by proper flushing, the use of NCs and proper disinfection by mechanical rubbing or the use of disinfectant caps and adequate care for dressing changes [1, 13].

CONCLUSIONS

In clinical situations that require a larger size than the vein available at the site of the planned puncture, it is not always necessary to give up the most suitable midline catheter. Pseudo-tunneling is easy to apply and is an effective solution for small-diameter veins. The use of available techniques and the exchange of experience help to improve daily clinical practice. As crucial as the cannulation procedure is, maintaining the catheter appropriately takes full advantage of the solutions implemented and increases patient comfort.

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CONSENTS: The patient consented to the description of the case and photographic documentation.

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