CASE REPORT

Intravenous access in patients with morbid obesity

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Pielęgniarstwo Chirurgiczne i Angiologiczne 2024; 18(2): 71–74 DOI: https://doi.org/10.5114/.2024.141479

Submitted: 09.05.2024, accepted: 29.05.2024

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Summary

Intravenous therapy is a common procedure performed in hospitals. Patients in surgical departments usually require intravenous access due to a planned surgical procedure, and therefore anaesthesia, pain, antibiotic, and fluid therapy. Problems in obtaining intravenous access, even by experienced clinicians, can be caused by difficult intravenous access (DIVA). One risk factor for DIVA is obesity. The purpose of this paper is to present a case report of a patient with DIVA due to morbid obesity, who was scheduled for clean diabetic feet associated with type 1 diabetes. A case study method was used in this study. By implementing the appropriate strategy, the patient's comfort was increased, staff time was saved, and the planned therapy was successfully carried out. Vascular access teams consisting of experienced providers should be present in every hospital to deliver the highest quality medical services according to patients' needs.

Key words: difficult intravenous access, midline catheter, ultrasound, nurses, vascular access team.

Introduction

Intravenous therapy is a common procedure performed in hospitals [1]. Patients in surgical departments usually require intravenous access due to planned surgery, and hence anaesthesia, analgesic therapy, antibiotic therapy, and fluid therapy [2, 3]. Difficult intravenous access (DIVA) can be a problem, even by experienced healthcare providers (HPs) [3, 4], and it may affect 59% of patients, especially female patients with a history of difficult access. Hence, strategies should by implemented to minimise the common complications associated with it [5]. The most common complications associated with DIVA include repeated unsuccessful attempts to insert short peripheral intravenous catheters (SPCs), associated pain, decreased patient satisfaction, delayed implementation of planned treatment, and increased procedure time [3]. Difficult intravenous access is defined as unsuccessful attempts (1–3) by an experienced practitioner to insert an SPC and/or inability to visualise the veins without the use of additional equipment, such as ultrasonography [4, 6]. The use of ultrasound is a recommended tool in the management of HPs in patients with DIVA, and it is increasingly recommended in routine management as well [7–9]. Even before the first attempt at cannula insertion, HPs can use predictive and helpful scales to estimate the risk of failure, such as the "A-DIVA scale" (Table 1) or order the sequence of management, such as "the DIVA cognitive aid" [3, 10, 11]. A simple approach can be used depending on the number of points scored on the scales to increase the success rate (Table 2) [11]. One of the risk factors for DIVA is obesity [7]. The use of ultrasound in patients with DIVA allows a high success rate for the first cannulation attempt, but it does not guarantee the success of intravenous therapy [12]. The success of intravenous therapy depends on the type of IV catheter used, and the SPC is usually too short to hold it safely in the vein. This is important not only because of having obtained intravenous access, but also to

Table 1. A-DIVA scale [3]

Risk factor	Point
History of a difficult intravenous cannulation	1
Practitioner's expectation of a difficult intravenous access	1
No palpable vein after tourniquet placement	1
No visible vein after tourniquet placement	1
Diameter of the vein less than 3 mm after tourniquet placement	1

Table 2. Interventions to increase the chances of successful cannulation [11]

After assessing the difficulty of cannulation and scoring 0–3 on the A-DIVA scale, the following procedure can be implemented to improve cannulation conditions
Move the limb downwards to reduce venous return in the limb
Apply massage to the area of visible veins, which will dilate them
Apply a warm compress for 10–15 minutes or ask the patient to clean the limb in warm water
After assessment of the difficulty of cannulation and a score of 4–5 on the A-DIVA scale
Ask a more experienced HP for help, use ultrasound or contact the vascular access team
After 2 unsuccessful cannulation attempts
Ask a more experienced HP for help, use ultrasound or contact the vascular access team
After 2 unsuccessful cannulation attempts by an experienced healthcare providers
Use ultrasound or contact the vascular access team

avoid possible related complications, such as drug infiltration. To ensure reliable intravenous access, in addition to the correct catheter-to-vein ratio (33% of the vein can be filled by the catheter), length is also important [7]. It is recommended that 2/3 of the catheter be in the vein [7]. In patients with obesity, this can be a challenge. To this group of patients, long peripheral catheters (LPCs) or midline catheters (MCs) are dedicated, depending on the type of therapy, duration, and economic possibilities [7]. Although guidelines generally recommend the use of LPCs and MCs for intravenous therapy > 5 days, in the situation of patients with DIVA, they may need to be used earlier when SPCs are technically impossible to use [7, 8]. Long peripheral catheters are 6–15-cm catheters inserted by various techniques into the peripheral veins of the forearm or arm [7, 8]. Midline catheters are 15–25-cm catheters inserted using the direct Seldinger technique (DST) or modified Seldinger technique (MST) into the arm veins, with the tip in the axillary line [7, 8]. The use of LPCs and MCs allows for the puncture of the vein and, due to their length, the effective placement of the catheter in the vein. They can be used for intravenous therapy with non-irritating solutions of pH 5–9 and osmolarity < 600 mOsm/l, i.e. drugs commonly known as "intended for peripheral veins" [7, 8]. These are "low risk" and "medium risk" drugs according to the categorisation developed by Manrique-Rodríguez *et al.* [13]. Choosing the right intravenous access and the appropriate cannulation technique can minimise complications and delay treatment to ensure effective intravenous access.

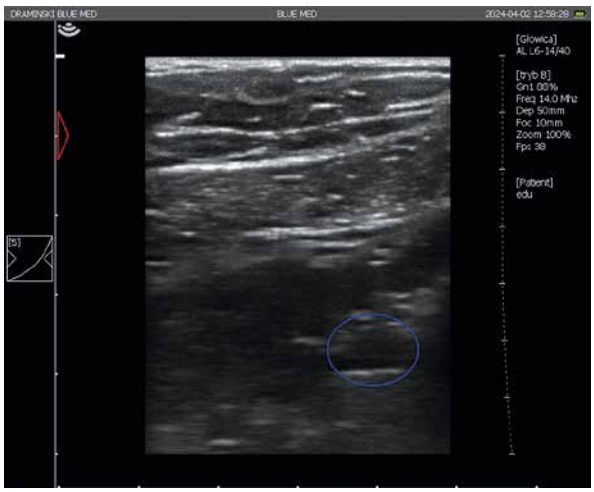

Fig. 1. The basilic vein at a depth of 4 cm

The aim of this study is to present a case report of a patient with DIVA due to morbid obesity, who was scheduled for clean diabetic feet associated with type 1 diabetes (T1D).

Material and methods

A case study method was used in this study. We describe the case of a patient with DIVA treated at an academic hospital in Poland, who required intravenous access due to planned intravenous therapy and anaesthesia for a procedure to clean diabetic feet associated with T1D and long-term immobilisation. Case Report Guidelines 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 59-year-old female patient was admitted to the hospital for debridement of a foot wound associated with insulin-dependent diabetes mellitus and long-term immobilisation due to morbid obesity. The patient was conscious, in verbal-logical communication, with a history of T1D, hypertension, supraventricular arrhythmia, and vision problems. The patient was recumbent, with morbid obesity: body mass index = 41. The patient was referred to the hospital's vascular access team (VAT) due to difficulties in obtaining intravenous access. The healthcare providers (physician and nurses) on the surgical ward rated the patient at 5 on the A-DIVA scale and made no attempt to insert an SPC. After reviewing the documentation and the type of planned intravenous therapy, the VAT qualified the patient for peripheral venous access. On ultrasound, there were no corresponding veins on the forearms. Veins of the arm examined according to the rapid peripheral venous assessment (RaPeVA) protocol were clearly visible on the right limb: the basilic vein, the brachial veins, and the cephalic vein [16]. The basilic vein had 5.8-mm diameter, the cephalic vein 3.2-mm diameter, and the brachial veins adjacent to the brachial artery and median nerve of

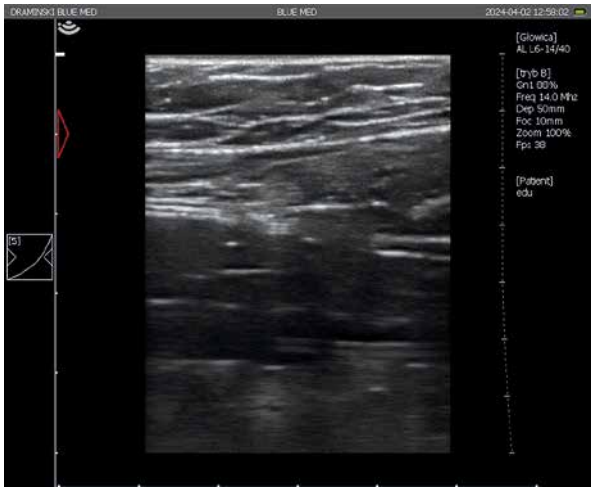

Fig. 2. The catheter in the basilic vein (long axis)

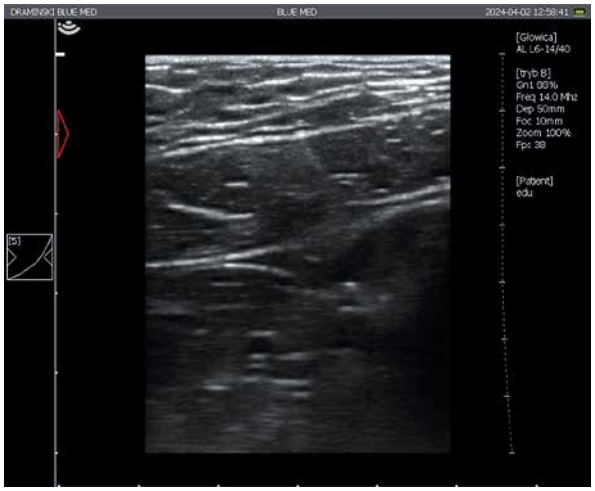

Fig. 3. The catheter in the basilic vein (short axis)

the elbow lying under the biceps muscle of the arm had 4.5- and 4.7-mm diameter. Because of the diameter of the vein and its position relative to other veins, the basilic vein was chosen (Fig. 1). During the selection of the catheter, the following factors were taken into consideration: the length of the catheter, the possibility of using DST or MST (due to the presence of a guidewire in the set), and the length of the needle. It was decided to insert a 4 Fr 20 cm midline catheter due to the longest needle available (7 cm) with the possibility of inserting the catheter safely using a guidewire. The procedure was carried out by 2 members of the VAT due to anticipated difficulties in moving in the sterile field. The procedure was performed according to the Safe Insertion of Peripherally Inserted Central Catheters protocol [16]. Using the surgical Aseptic Non-Touch Technique, the catheters were inserted into the sterile field using sterile drapes to protect the catheter insertion site, treatment table drapes, a cap, mask, sterile gloves, and surgical gown; the skin was disinfected with 2% chlorhexidine with alcohol, and a MC set (DST) was prepared, which included a 20-cm-long, 4 Fr diameter polyurethane catheter, a 50-cm stainless steel guidewire, a dilator, a sticker identifying the "midline peripheral" access, a needleless connector, an adhesive sutureless fixation system, and a transparent dressing. Routine placement of a disposable tourniquet was abandoned due to the vein's location. The vein was punctured using a line ultrasound probe at a non-standard angle of about 60 degrees, because estimating the potential distance led to the concern that the needle would be too short (vein depth of 4 cm, puncturing at 45 degrees gives a realistic distance of about 6 cm). What is important is that the vein at a depth of 4 cm was measured with a slight pressure of the ultrasound transducer to the patient's body, and it had to be maintained in this position after obtaining blood flow from the vein. Insertion of the guidewire into the vein was performed non-standardistically by the second operator, while the first operator kept the needle and ultrasound transducer in a fixed position at all times to avoid the needle slipping out of the vein. After confirming the correct position of the guidewire in the vein, a dilator was carefully inserted, followed by the successful insertion of MC. The midline catheter port was secured, and the proper position of the catheter was confirmed by possible blood aspiration and on ultrasound (Figs. 2, 3). The midline catheter was secured with an adhesive sutureless fixation system and a transparent dressing. The patient was transferred to the surgical ward. The patient expressed satisfaction with the procedure and the effectiveness of the solution used.

Discussion

Difficult intravenous access can be a challenge for healthcare providers. Obtaining peripheral access in a timely manner using a landmark method can be difficult, especially in patients with chronic diseases, obesity, and a history of intravenous drug use [12]. The Infusion Nurses Society recommends the use of ultrasound to increase the chance of success and avoid unnecessary attempts that cause patients pain and involve HPs [7]. Early qualification using predictive scales allows selection of the optimal method for obtaining intravenous access minimising the pain and stress associated with numerous procedures [3, 7]. The peripheral access strategy includes various options that should be considered in terms of clinical utility, chance of success, and the hospital's economic situation [8]. Short peripheral intravenous catheters can be useful in DIVA, but technical feasibility is limited to veins up to 7–10 mm below the skin due to the length of the needle and catheter and the distance from the skin to the vein, which increases as the angle of the needle decreases. An alternative peripheral solution to SPCs are LPCs. According to the literature, they have lower complication rates (e.g. 25% vs. 70% for SPCs) [17, 18]. In

the case described herein, it could be a suitable solution due to its higher flow rate than MC; however, due to the depth of the vein (4 cm), it was safer to use a 20-cm catheter rather than a 10–12-cm catheter because 2/3 of the catheter should be in the lumen of the vein [7, 19]. Carrying out the procedure in an appropriate manner by an experienced clinician, the support of a second person in a sterile field, and the cooperation of the patient allowed the effective and efficient insertion of the MC, which was maintained until the end of intravenous therapy. Self-assessment by a nurse-led VAT, clinical decision-making, and implementation of appropriate interventions are part of the advanced practice nursing model, which is worth developing in Poland.

Conclusions

Difficult intravenous access poses a challenge for HPs. Adequate patient preparation, HP interview, and implementation of an appropriate strategy can increase patient comfort, save HPs' time, and effectively deliver planned therapy. A vascular access team consisting of experienced clinicians should be present in every hospital to deliver the highest quality medical services according to patients' needs.

Disclosures

1. Institutional review board statement: Not applicable.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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