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**Dożylne cewniki pośrednie w praktyce**  
**Zespołów Dostępów Naczyniowych**

The Midline Catheters in practice Vascular Access Teams

Rozprawa doktorska na stopień doktora

w dziedzinie nauk medycznych i nauk o zdrowiu

w dyscyplinie nauki o zdrowiu

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Warszawskiego Uniwersytetu Medycznego

Warszawa 2024

### 3. STRESZCZENIE W JĘZYKU ANGIELSKIM

*Introduction:* This doctoral dissertation series of five publications presents the implementation of a vascular access strategy using midline catheters inserted by a dedicated Vascular Access Team. Midline catheters are a secure peripheral intravenous access dedicated to expected intravenous therapy over 5 days. According to European guidelines, midline catheters for adult patients are polyurethane catheters >15 cm in length placed in a peripheral vein using the Simple Seldinger Technique or the Modified Seldinger Technique with ultrasound guidance. The position of the tip of the midline catheter in the peripheral vein allows the administration of non-irritating solutions with a non-extreme pH (5-9) and osmolarity <600 mOsm/l. Complications associated with infusion via midline catheters such as catheter occlusion, vein thrombosis and infection are common (8-38%). Proper maintenance of midline catheters is an important issue. Performing the appropriate management steps is related to the level of vascular access care. The expected time of intravenous therapy is the primary, but not the only, indication for insertion of a midline catheter. In many cases, a midline catheter is applicable for difficult intravenous access. Difficult intravenous access can affect up to 59% of hospitalised patients. The use of methods to increase the quality of care for patients with vascular access is increasingly being delegated to a group of competent practitioners who are implementing an appropriate evidence-based strategy by forming vascular access teams.

*Aim:* The common aim of the dissertation research publication series was to analyse the qualification of patients, the performance of the midline catheter insertion procedure by a dedicated Vascular Access Team and to assess the effectiveness of their use for intravenous therapy by hospital ward practitioners. The specific aims of the

research conducted in this thesis were to present the role of the Vascular Access Team in difficult intravenous access (Publication 1), to analyse the implantation and use of midline catheters (Publication 2), to determine the optimal preparation of healthcare providers for the procedure (Publication 3), to determine the risk of complications during the procedure (Publication 4) and to analyse the effectiveness of the introduced solution in a 3-year perspective (Publication 5).

*Material and methods:* This review paper presents the concept of the Vascular Access Team's clinical work and the use of midline catheters in difficult intravenous access (Publication 1). The records of 98 patients with inserted midline catheters over a 10-month period in 2021 (Publication 2), and over a 6-month period in 2022 (Publication 4) were then analysed. In 2023, two groups of nurses with different experience comprising the Vascular Access Team were compared over a 4-month period (Publication 3). Publication 5 evaluates the programme to establish a Vascular Access Team to perform the procedure of inserting peripheral accesses with ultrasound guidance, the impact of education on the incidence of complications and the number of central catheters inserted due to difficult intravenous access over a 3-year period based on a retrospective analysis of 1020 midline catheters inserted.

*Results:* The success rate of cannulation increased in subsequent analyses from 92% (n=98/107) (Publication 1), through 95.3% (n=82/86) (Publication 4) to 99.8% (n=1020/1033) (Publication 5). The procedure was performed in 93% (n=80) (Publication 4) and 96% (n=985) (Publication 5) by nurses. The number of cannulation attempts decreased in subsequent years from 1.44 (n=82; SD 0.73) in 2021, through 1.56 (n=85; SD 0.98) in 2022 to 1.25 (n=370; SD 0.65) in 2023 (Publication 5). Inexperienced nurses achieved cannulation times comparable to experienced nurses after 20 procedures

(Publication 3). The main indication reported by ward staff at the start of midline catheter use was difficult intravenous access in 83% (n=81) and expected intravenous therapy >5 days in 17% (n=17) (Publication 2). In subsequent years, patients were mainly qualified by the criteria of duration of therapy (n=833; 81.6%), although 71.37% (n=728) also had difficult intravenous access (Publication 5). The time from hospital admission to midline catheter insertion was reduced from 15 days (Publication 2) to 10 days (Publication 5). End of intravenous therapy with an inserted catheter was possible in 44% (n=43) (Publication 2), 40.2% (n=33) (Publication 4) and finally in 64.6% (n=659) (Publication 5). The incidence of occlusion leading to early removal of the midline catheter decreased over 3 years from 36% (n=36/98) (Publication 2) to 14.6% (n=149/1020) (Publication 5). The number of central catheters inserted annually changed over 5 years from n=697 in 2017 to n=387 in 2023, including those inserted solely because of difficult intravenous access from n=108/697 (15.4%) to n=18/387 (4.66%).

*Conclusions:* The introduction of midline catheters into clinical practice has opened up new possibilities in the strategy of selecting an appropriate vascular access (Publication 1). Appropriate qualification of patients at the admission stage allows peripheral vessels to be saved during scheduled intravenous therapy and avoids multiple cannulation attempts in case of difficult intravenous access (Publication 2). Implementation of an ultrasound-guided midline catheter insertion procedure should be based on properly conducted training and supervised clinical experience (Publication 3). Implantation of midline catheters in patients, including those with difficult intravenous access, can be performed effectively and safely with a minimum number of cannulation attempts (Publication 4). The introduction of the midline catheter as a possible peripheral venous access option reduces the use of centrally

inserted central catheters (Publication 5). Healthcare providers should be trained in infusion care to achieve better outcomes in qualifying and maintaining specific types of vascular access (Publications 2 and 5). It is reasonable to establish Vascular Access Teams in every hospital where a large number of vascular cannulation procedures are performed.