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Effectiveness of Using DIVA Scores in Assessing Intravenous Access Difficulty in Adult Patients: A Literature Review

Ryzka Amalia Dewi S, Maria Astrid
Postgraduate Program, STIK Sint Carolus Jakarta, Indonesia
radsugantha08@gmail.com

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Abstract
Introduction*: DIVA Score, known as a level of difficulty guidance for intravenous access, is designed to assist healthcare workers in reflecting the likelihood of successful PIVC implantation or the risk with certain outcomes in patients and provide information for their decision-making. Approximately 90% of hospitalized patients receive peripheral intravenous catheters, to administer fluids, parenterals and medications. However, for healthcare professionals, difficulties in obtaining devices are sometimes frustrating, challenging, and time-consuming, as well as significant costs associated and often requiring the involvement of other healthcare professionals for further action. In addition, some attempts are associated with complications such as extravasation and phlebitis, including peripheral intravenous tissue depletion and treatment delays.* ***Objective:*** *Looking for further action for failed PIVC insertion.* ***Methods****: A search was performed in research for DIVA Scores in Adults. Twelve publications were identified.* ***Results****: USG guided has great results in successful attempts for PIVC in high DIVA Score patients.* ***Conclusion:*** *USG can be the treatment of choice for Difficult Intravenous Access patients instead of medical workers' experience or internal factors from the patients.*

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Introduction

Currently, DIVA Score, known as a guide for the difficulty level of intravenous access for adult patients, is still lacking in terms of implementation (Setiasih, Murtiningsih, & Inayah, 2022). Based on available clinical data, this scale can be used to identify patients who may experience intravenous access problems. This predictive model is easily accessible and can improve clinical practice while aiming for patient comfort (Shokoohi et al., 2020). In general, the DIVA Score predictive model is designed to assist healthcare providers in estimating the likelihood of successful PIVC insertion or risks with specific outcomes in patients and provides information for their decision-making (Paterson et al., 2022). Approximately 90% of inpatients receive peripheral intravenous catheters for fluid and parenteral administration as well as medications. When the inserter cannot locate the target vein through palpation or visualization, cannulation can be performed using an alternative method.

However, the installation of PIVC can be considered a difficult procedure even for experienced healthcare services; venous access requires several attempts to successfully place the PIVC, resulting in trauma and painful experiences, disrupting their care experience, and potentially diminishing their trust in healthcare professionals. For healthcare professionals, the difficulties in obtaining peripheral access can sometimes be frustrating, challenging, and time-consuming, as well as incurring significant related costs and often requiring the involvement of other healthcare professionals for subsequent actions. Additionally, several attempts are associated with complications such as extravasation and phlebitis, which also include peripheral intravenous tissue thinning and delays in treatment. To avoid these negative impacts, current good practice recommendations emphasize the need for a proper assessment of the patient's peripheral intravenous network.

The purpose of writing this manuscript is to identify the risk factors that arise in the failure to perform peripheral intravenous cannulation in adult patients. The DIVA Score scale allows for the calculation of the failure risk during intravenous cannulation on the first attempt and categorizes patients with a likely difficult intravenous access.

Methods

The literature search was conducted in the Pubmed database using title/abstract search with the keywords Adult AND (Difficult Intravenous Access OR DIVA Score) as the main problem and for Intervention, Comparison, and Outcome referring to standard guidelines because the purpose of this literature search is to find appropriate interventions for the problem, comparisons with other methods if any, as well as outcomes, namely the success of intravenous access placement. In this literature review, we obtained 8 results, with suitability filtration yielding 5 articles that can be used. Another literature search was conducted in the Proquest database using title search with the keywords (Difficult Intravenous Access OR DIVA Score) AND Adult. In this literature search, we obtained 6 results, with suitability filtration and elimination of duplicates yielding 2 articles that can be used.The third literature search was conducted in the Science Direct database by searching titles using the keyword Difficult Intravenous Access. In this literature search, we found 5 articles that can be used. All literature searches used a limitation of the last 5 years. A total of 12 articles were obtained for a systematic review.

Result and Discussion

1. Result

In this systematic review, it was found that issues with intravenous insertion occur worldwide, some due to factors related to patients as well as healthcare professionals. The factors relating to patients require further research on why and how to address patients with difficult-to-see and palpate veins. Some studies also focus on delays in treatment, patients' pain levels, and worsening conditions due to unsuccessful attempts at venous access placement. From the healthcare professional's perspective, several conditions include a lack of experience that is difficult to assess on a scale, as well as various techniques that may be options for therapy. Table 1 shows various studies worldwide, both large and small-scale, that indicate similar root problems and similar management approaches. A summary of the interventions and outcomes from several studies can be seen in the following table:

Table 1
Summary of research findings

No	Source and Study	Methods	Data	Sample	Intervention	Results
1	Improving difficult peripheral intravenous access requires thought, training and technology (DART3): a stepped-wedge, cluster randomised controlled trial protocol Jessica A Schults, Nicole Marsh, et al (2023)	Cluster randomised controlled trial	From three hospitals that have > 10 PIVCs/week In: Emergency departments, inpatient wards or critical care units (CCU, ICU) Ex: Operating services, radiology, rehabilitation, or psychiatric units	240	Difficult Access Requires Thought, Training and Technology (DART3) study	The data evaluate at three- and six-months post intervention using The RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework Modified DIVA identification and escalation pathways significantly increase the incidence of first attempt PIVC insertion success below <14 weeks
2	The Adult Difficult Intravenous Access (DIVA) Cognitive Aid: An Evidence-Based Cognitive Aid Prototype for Difficult Peripheral Venous Access Philip L. Stagg (2023)	A Desriptio n about cognitive aid for DIVA	Explanation about DIVA Cognitive Aid	-	The DIVA cognitive aid: (i) Direct Puncture (ii) Ultrasound (iii) Seldinger lifelines	Found that DIVA resulted in treatment delays of up to 120 mins in some cases Cognitive aids can reduce human error and have been shown to significantly increase adherence to crisis management algorithms and significantly reduce missed steps
3	The Modified A-DIVA Scale as a Predictive Tool for Prospective Identification of Adult Patients at Risk of a Difficult Intravenous Access: A Multicenter Validation	Cross sectional study	From five hospitals in the Netherlands	3587	Based on a participant's individual score on the A-DIVA scale, they were classified into either a low, moderate, or high-risk group. A higher score on the A-DIVA scale indicates a higher	The five-variable additive A-DIVA scale is a reliable and generalizable predictive scale to identify patients at risk of difficult intravenous access

	Fredericus, et al (2019)				risk of difficult intravenous access.	
4	Effect of Two Tourniquet Techniques on Peripheral Intravenous Cannulation Success: A Randomized Controlled Trial Dr Theresa Tran, et al (2019)	Prospecti ve, single-blinded, randomiz ed controlle d trial	Tertiary care center in Minnesota	119	Two tourniquet technique	Either Blood pressure cuffs and elastic tourniquets didn't give the significant difference
5	Pain and Satisfaction Perceptions of Ultrasound-Guided Versus Conventional Peripheral Intravenous Catheterization: A Randomized Controlled Trial Laia Salleras et al (2023)	Randomi zed controlle d trial	From first level community hospital	120	US-guided compared to the conventional procedure: Insertion success was greater (91.75% versus 89.9%; p=0.04) Number of attempts was lower (1.29 (0.59) ver- sus 1.81 (1.28); p<0.001) Satisfaction was greater (7.59 (2.04) versus 6.69 (2.28); p=0.03) Required time in minutes was greater (7.89 (7.13) versus 5.1 (3.69); p=0.045)	US-guided peripheral IV catheterization in patients with DIVA was more successful, required fewer attempts, enabled use of longer and higher-calibre catheters, and led to greater patient satisfaction
6	Difficult Intravenous Access Requiring Ultrasound in the Emergency Department: Associations With Delays in Care and Areas for Quality Improvement Derric et al (2023)	Cross-sectional, observati onal analysis	Ocala Regional Medical Center, in Ocala, Florida	1250	USG for Intra venous access	DIVA cases requiring USGIV access were positively associated with significantly longer times to access, contrast CT imaging, and disposition compared to patients without DIVA IVDU and ESRD had statistically significant associations with DIVA requiring USGIV access
7	Peripheral intravenous catheter insertion and use of ultrasound in patients with difficult intravenous access: Australian patient and practitioner perspectives to inform future	Descripti ve study	Explanation about perspective	78	USG for Intra venous access	US-guided insertion of PIVCs is recommended by international guidelines for DIVA patients Not applicable in Australia: limited resources and infrastructure to support

	implementation strategies Jessica A et al (2022)					
8	Improving Adherence to Best Practices and Clinical Outcomes in Difficult Intravenous Access Patients Zimmerman T, Mielke N, et al (2023)	Observational cohort analysis	Beaumont Hospital: Royal Oak, Royal Oak, Michigan, US	3.867	Comprehensive vascular access program	The training program resulted in faster USIV insertion times, improved insertion practices, and a higher proportion of catheter dwell time to hospital length of stay
9	Difficult Intravenous Access in the Emergency Department: Incidence, Implications, and Improved Delays in Care With Nurse-Initiated Ultrasound-Guided Intravenous Access Amick AE, Davis E, et al (2018)	Single-center cohort study	Tertiary hospital ED in Chicago	148.559	USG for Intra venous access	Trained RNs using SBML to perform USGIV improves patient care
10	Difficult intravenous access in the emergency department: Performance and impact of ultrasound-guided IV insertion performed by nurses Evan M, et al (2020)	Retrospective study	Tertiary hospital ED in Chicago	147.26	USG for Intra venous access	DIVA affects many ED patients and leads to delays in PIV access-related care. Nurse insertion of USGPIVs improves care in patients with DIVA
11	Racial and sex disparities in difficult intravenous access M.R. Schwid,et al (2022)	Retrospective study	Urban ED	108.256	-	The prevalence of DIVA: highest in black patients (black 4.9%, white 3.1%, Asian 2.0%, Hispanic 1.7%, other or unidentified 2.1%) highest in women (3.6% versus 2.6%)
12	Use of point of care ultrasound (POCUS) by intensive care paramedics to achieve peripheral intravenous access in patients predicted to be difficult: An out-	Prospective observational pilot study	Ambulance Service in Victoria	32	POCUS Device	Overall success rate was 50% of which 87% were successful on the first attempt

of-hospital study Samuel et al (2023)	pilot

2. Discussion

Based on the table, it shows that the average resolution of the issues related to the difficulty of intravenous access installation is not achieved by trying until successful, but is limited to 2 insertions; if still unsuccessful, ultrasound is a common intervention performed. In this case, it can be concluded that the experience of a healthcare worker cannot be the primary basis for performing venous access interventions. Knowledge and skills in using ultrasound as an assisting tool are also required. If that still fails, central venous access becomes an option, where the patient will certainly be uncomfortable due to the overly invasive procedure.

Conclusion

This research concludes that ultrasound can be an auxiliary tool that can be used to improve the success rate of intravenous catheter placements. Regarding the model, type, and technique of using ultrasound, further studies can be conducted. This application can certainly be implemented in healthcare facilities in large cities. The proficiency of medical personnel in this regard must be enhanced both in terms of hierarchical experience and ultrasound skills.

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