Research plan:

Central Venous Catheter vs Midline in Difficulty Access patient – A Randomized controlled clinical pilot trial – pilot-ACCESS-D

Content

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Overview:

Title:

1. Midline vs. Central Venous Catheter for Difficult Venous Access patients (ACCESS-D study) – A pilot trial

Study method: Randomized controlled clinical pilot trial

Purpose: To examine the feasibility of the ACCESS-D trial.

Population: 18+ age difficult intravenous access patients with expected 4-29 days of catheter dwell time in Ryhov Hospital, identified through the Acute care and Trauma unit (ATE).

Abbreviations:

CVC – Central venous catheter

DIVA – Difficult intravenous access

PICC – Peripherally inserted central catheter

PVC – Peripheral venous catheter

RCT – Randomized controlled clinical trial

USG – Ultrasound guided

VAD – Vascular access device

Introduction

Intravenous access is a necessity for nearly all inpatient medical care. Approximately half of hospitalized patients require a peripheral venous catheter (PVC), either to enable administration of medications intravenously or to repeatedly draw blood samples (1). Establishing a venous access sometimes requires repeated attempts, resulting in multiple needle sticks and prolonged discomfort for patients. In addition, this may lead to a diminished healthcare experience and create a stressful situation for both patients and healthcare personnel (2, 3). Delays in establishing intravenous access can result in setbacks in sample collection and drug administration (4, 5).

Difficult Intravenous Access (DIVA) is a situation that arises "when two or more clinicians fail two or more times to establish a peripheral access using conventional techniques, when a patient lacks visible or palpable veins or the patient has a stated or documented history of DIVA" (6). The prevalence of DIVA varies from 6% to 88% in different studies, primarily due to variations in definition of DIVA. Known risk factors are diabetes, intravenous drug abuse, sex (higher risk for women), chronic illness, obesity, malnutrition, absence of visible or palpable veins (7, 8). Although it is possible to establish a short, standard-length PVC through the help of ultrasound-guidance, this approach has limited scientific support (4, 9-11). In addition, ultrasound-guided PVCs are not health economically justifiable (12).

There are a handful of alternatives in terms of vascular access devices (VAD) for DIVA patients: Standard short PVC, Midline catheter, Central Venous Catheter (CVC) and Peripherally Inserted Central Catheter (PICC). A Midline is a long (8-12 cm), peripherally inserted venous catheter that is most commonly inserted into the upper arm via the basilic, cephalic or brachial veins, with its tip terminating below the level of the axilla (13). A Central Venous Catheter (CVC) is inserted through one of several veins (subclavian, jugular, or femoral) and terminates in a central vein, typically the superior vena cava, right atrium, or the iliac/inferior vena cava, depending on the insertion site. A PICC is an extended venous catheter inserted peripherally, similar to the Midline, inserted through the veins of the upper arm. However, the PICC terminates centrally, in the superior vena cava. There is some existing evidence supporting that Midline catheters could be safer compared to PICCs in short term (14-16). Today, CVCs are standard of care in many centers, but retrospective data indicate that Midlines could be a feasible option in DIVA patients (17). Furthermore, CVC insertion involves certain risks, such as arterial puncture, hematoma or pneumothorax (18). For DIVA patients in need of venous

access for 5 days or more, Midlines are preferred as per the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) guidelines (13). However, there are no randomized controlled clinical trials comparing Midlines to CVCs in DIVA patients.

Primary aim of study

The aim of the study is to test the feasibility of the study protocol before a future large-scale RCT.

Methods

CONSORT Methods

This pilot trial is a randomized, controlled, two-armed study with a sample size of 30 patients. A sample size of 30 is chosen as a convenience sample. The study will be conducted in Ryhov county hospital, in southern Sweden. Hospitalized patients across adult somatic wards with difficult intravenous access, are screened for potential trial recruitment. Patients are identified when staff from the ward contact the vascular access nurse. All inclusion and exclusion criteria are presented in Table 1. Patients identified, screened, and deemed eligible will be approached with study information. The trial is planned in accordance with the CONSORT guidelines for pilot trials (19).

Table 1 Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
• Age 18 and over • DIVA criterium fulfilled; o 2 attempts of venous access by 2 clinicians OR o No visible nor palpable veins OR o History of difficult venous access • 4 - 29 days of catheter dwell time anticipated as assessed by referring clinician.	• Unable to speak Scandinavian • Cognitive Impairment • Is to receive hyperosmolar solutions (600 milliosmoles/L or above). • Is to receive chemotherapy

Setting

The patient flowchart, depicted in Figure 1, outlines the vascular access procedures at Ryhov County Hospital. This process involves collaboration between a ward nurse and an anesthesia (vascular access) nurse. In case the ward nurse encounters difficulties in establishing venous access, patients are referred to the anesthesia nurse accordingly.

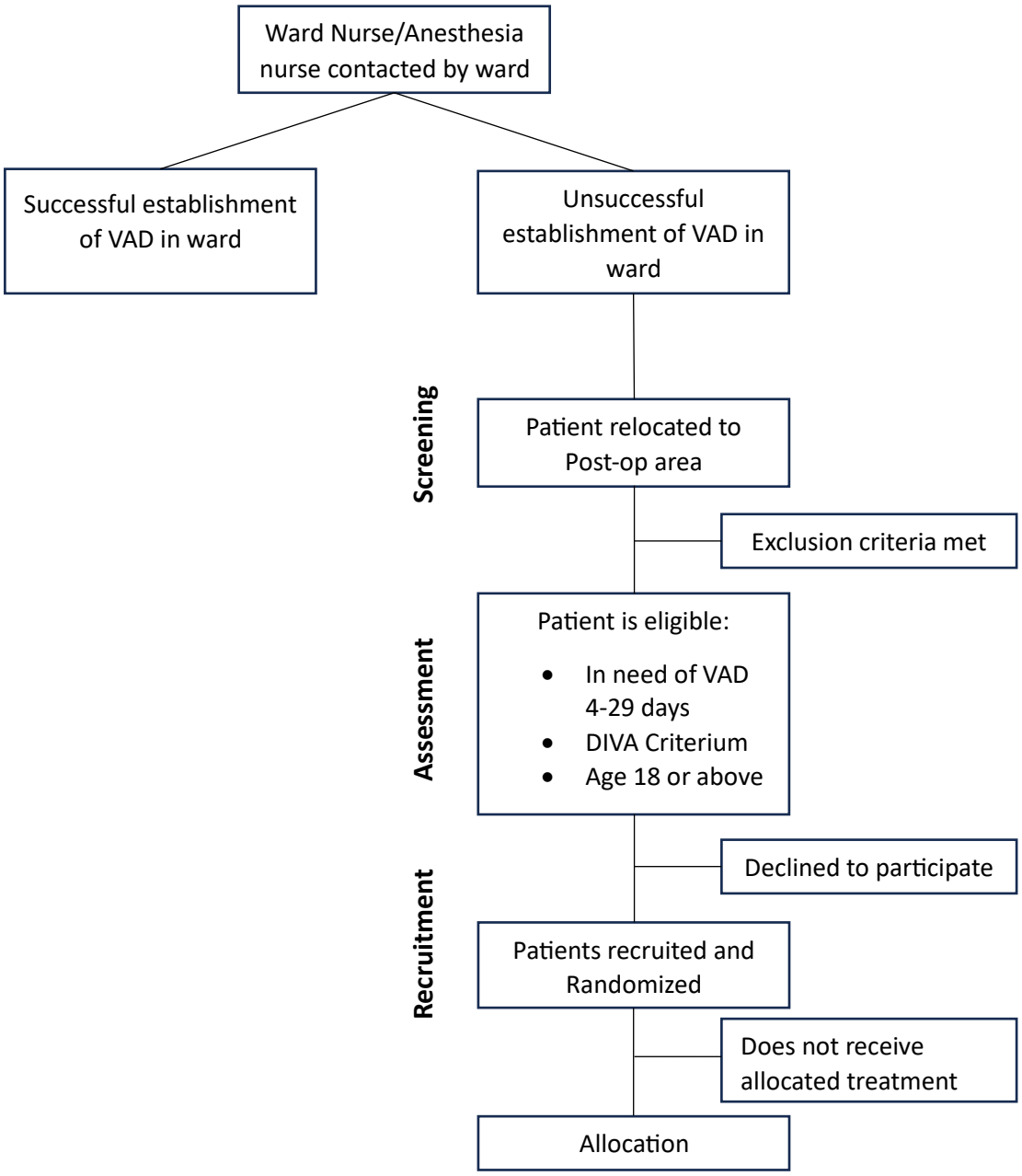
The insertion of catheters occurs in a dedicated post-op area. Clinicians in this setting have the option to choose between establishing a Midline catheter guided by ultrasound or opting for a Central Venous Catheter (CVC), also guided by ultrasound (USG).

Recruitment, Randomization and Blinding

Patients are assessed by the vascular access clinician in the Post-op ward. The recruitment process takes place in collaboration with anesthesiologists from the Acute Care and Trauma unit. Written consent and information are obtained by the physician. Subsequently, patients are randomized by the trial clinician using StudyRandomizer (https://www.studyrandomizer.com). Due to the visible nature of the intervention, blinding is not feasible. Trial participants are randomized in a 1:1 ratio using a block size of 6.

Patient identification, screening, and recruitment are outlined in Figure 1. After obtaining written consent, randomization, allocation and insertion of the VAD, patients return to their respective wards.

Figure 1: Flowchart of screening, assessment, recruitment and allocation in study.



Intervention, Midline:

Patients in the intervention group receive a 10 cm PowerGlide Pro™ Midline Catheter (Becton Dickinson). Catheters are inserted with ultrasound-guidance by an anesthesiologist using sterile gloves, mask, and large drape. The insertion site is treated with a solution of 0.5% chlorhexidine (wt/vol) in 70% alcohol (SCHA) and allowed to dry for 1 to 2 minutes prior to insertion. No prophylactic antibiotics are given as per default. All catheters are secured with using a

StatLock™ Stabilization device (Becton Dickinson), and the site is dressed with a semipermeable dressing (Tegaderm HP; 3M Healthcare, St. Paul, MN). A red paper tag is attached to the catheter, indicating study participation. Choice of insertion site on arm below or above the elbow avoiding catheter across joints and at the clinician's discretion.

Control, Central Venous Catheter (CVC):

Patients in the control group receive a Celsite 320 or 315 (B. Braun) or Pressure Injectable Arrowg+ard Blue Plus+ (Arrow). Catheters are inserted with ultrasound-guidance by an anesthesiologist with maximal sterile precautions (cap, mask, gown, gloves, and large drape) using the Seldinger technique. The insertion site is treated with a solution of 0.5% chlorhexidine (wt/vol) in 70% alcohol (SCHA) and allowed to dry for 1 to 2 minutes prior to insertion. No prophylactic antibiotics are given as per default. Catheters are secured with monofilament sutures, and the site is dressed with a semipermeable dressing (Tegaderm HP; 3M Healthcare, St. Paul, MN). A red paper tag is attached to the catheter, indicating study participation. The choice of insertion site is at the clinician's discretion.

Catheter care

Catheters (Midline and CVC) are controlled daily by the ward nurse. Control includes inspection of dressing, puncture site, the catheter itself and tags. The catheter function is assessed and flushed with minimum 20mL saline solution daily and in conjunction to use. For CVCs dressing is replaced every third day or earlier if necessary. Extension tubing, three-way connectors and injection valves are replaced every third day or earlier if necessary. With Midline, StatLock™ Stabilization device is replaced every 7th day or earlier if necessary.

Outcomes

The main outcomes are related to feasibility. Feasibility is defined as eligibility (>50% of screened patients considered eligible), recruitment (>70% of eligible patients consent to partake in trial), retention and attrition (<10% of patients lost to follow up, including those who withdrew consent), adherence (>80% of enrolled patients receive their randomized intervention), missing data (<10% of enrolled patients data missing) and venipuncture attempts (<20% of enrolled patients receive 2 venipunctures per insertion).

The secondary outcomes are insertion time and dwell time measured in minutes and days respectively. Catheter complications (infection, thrombosis and mechanical failure) are measured by objectively through bacterial culture, radiology and clinical expertise as per

standard clinical routine. Catheter complications during insertion and reason for removal are also registered during follow-up.

Follow-up

Follow-up will be performed in-ward every Monday and every Thursday by a research nurse or research assistant. Follow-up will be performed until the catheter is removed or until 28 days. Patients who are discharged from hospital with their catheter in situ will be followed through telephone interviews and chart reviews of out-patient notes

Ethical considerations

Ethical approval from the Swedish Ethical Review Authority is mandatory prior to trial start. The trial will be carried out in accordance with the study protocol under the principles of the Helsinki Declaration. The trial and study protocol will be prospectively registered on www.clinicaltrials.gov.

Regardless of whether a patient participates in the study, the need for venous access remains. Both midline catheters and CVCs are well-established methods for securing venous access, and the study presents no significant disadvantages or ethical concerns associated with their implementation.

Participation in the trial is entirely voluntary and is based on informed and signed consent. Participants have the right to withdraw their consent at any time for any reason, without prejudice to their medical care. Comprehensive oral and written information about the trial will be provided to participants before obtaining their consent and before their inclusion in the study. The research material will be stored in a secure safe where the research team have exclusive access.

Statistical analysis

Descriptive statistics are used to outline patients' baseline characteristics. For measurements that follow a normal distribution, group differences will be assessed using Student's t-test. Given the small sample size of 30, Mann-Whitney U test will be used to calculate differences in dwell time and insertion time between groups.

Funding

Carl Mellander has 25% part-time research funded by RJL and LiU.

Time plan (revised December 2024):

2024 Q1: Protocol construction

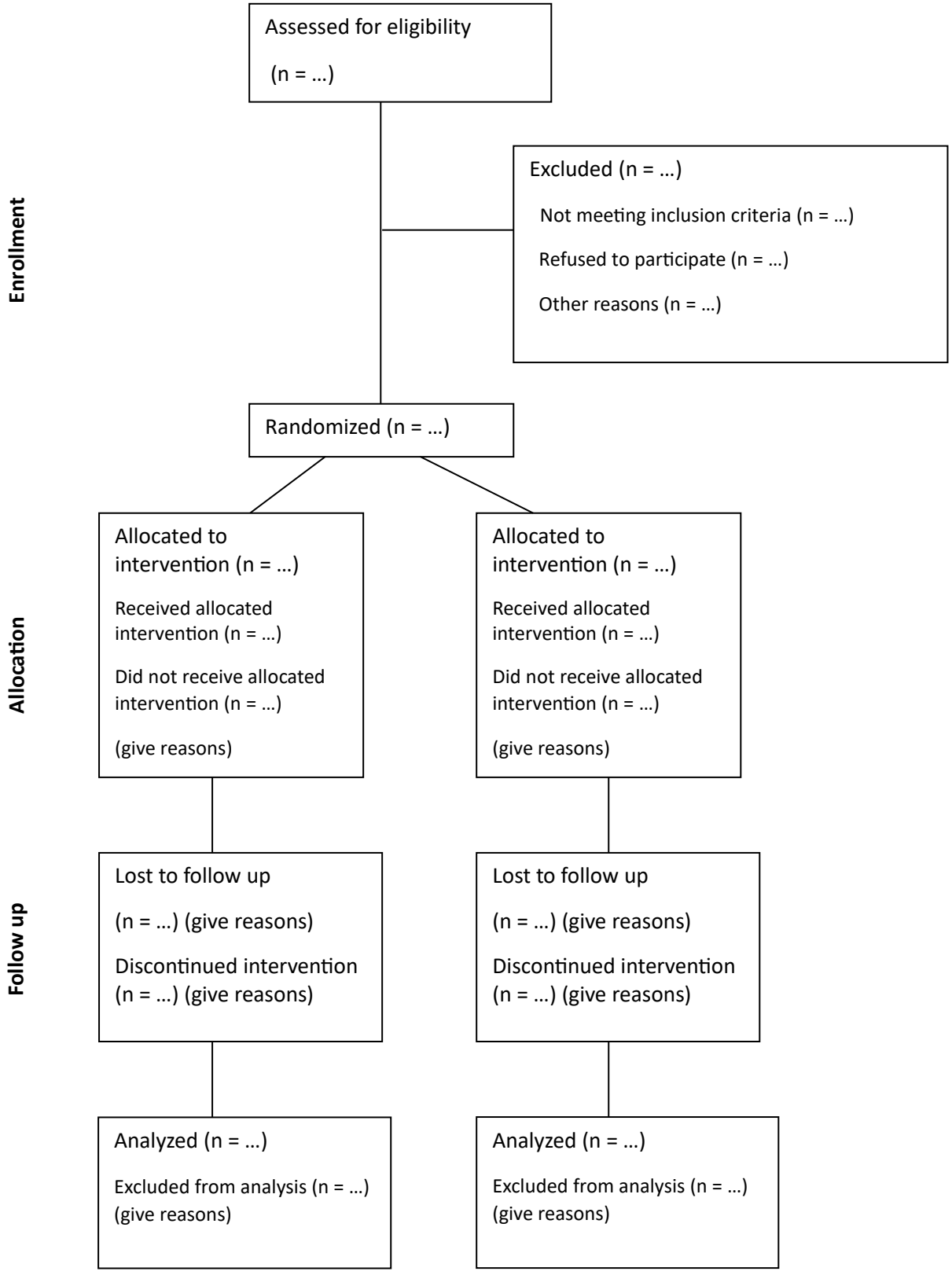
2024 Q2: Protocol submitted to Ethics Review Board

2025 Q1: Study start (January 13)

2025 Q2: Data analysis and manuscript

Results

Figure X: Patient flowchart according to CONSORT.



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