Ultrasound-guided Peripheral IV Catheters

# Difficult Venous Access

Clinical Evidence Summary

B BRAUN
SHARING EXPERTISE

# Content Overview
# Difficult Venous Access

# 1. Ultralong IV catheters have longer in-dwell times compared to standard long IV catheters

Bahl A, Hijazi M, Chen NW, Lachapelle-Clavette L, Price J. Ultralong versus standard long peripheral intravenous catheters: a randomized controlled trial of ultrasonographically guided catheter survival. Annals of Emergency Medicine. 2020 Aug 1;76(2):134-42.

## 1.1 Topic

Difficult Venous Access (DVA)

Increased Catheter Dwell-time

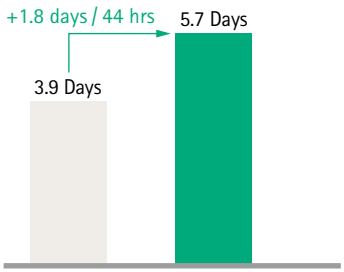
## 1.2 Design & Method

- To compare the survival of an ultrasound-guided, ultralong peripheral IV catheter vs. a standard long peripheral IV catheter, when inserted into the upper arm of an adult, difficult venous access patient
- Products used: a standard long, 20-gauge, 4.78-cm (1.88 inch), Becton Dickinson (BD) Insyte Autoguard IV catheter and an ultralong, 20-gauge, 6.35-cm (2.5 inch), B. Braun Introcan Safety® Deep Access IV catheter
- 270 adult patients presenting to the emergency department with self-reported difficult venous access were recruited and randomized to each of the two study groups (BD short PIVC vs. B. Braun long PIVCs). In total, data from 257 patients were analyzed and reported
- A single-site, prospective, 2-arm, non-blinded, randomized controlled trial of catheter survival
- The study was conducted in the United States at a large, academic, suburban tertiary care center with 1,100 hospital beds and 130,000 annual emergency department (ED) visits

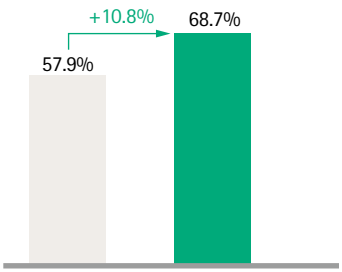
## 1.3 Results

- A significant catheter survival benefit in the ultralong PIVC group compared with the standard long PIVC group
- The median ultralong PIVC survival was 136 hours (5.7 days) and median standard long PIVC survival was 92 hours (3.9 days)
- 90 patients (68.7%) in the ultralong PIVC group reached completion of therapy compared with 73 patients (57.9%) in the standard long PIVC group
- On average, the ultralong PIVC group required a mean of 0.48 rescue catheters to reach completion of therapy compared with 0.91 in the standard long PIVC group
- Although vesicant and irritant medications appeared similar, patients in the standard long PIVC group had 11 cases of phlebitis and 16 infiltrations, whereas the ultralong PIVC group had 3 cases of phlebitis and 6 infiltrations

**Median Catheter Dwell-time (in days)**

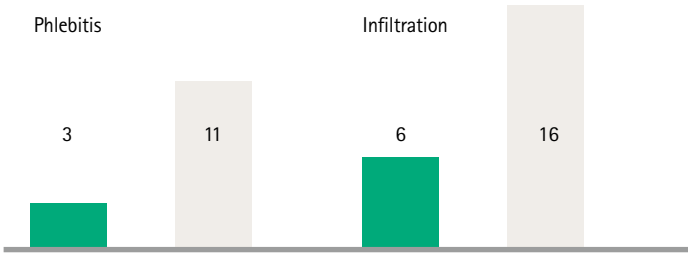



**Therapy Completion (in %)**




Standard Long PIVC  Ultralong PIVC

**PIVC Complications**




Ultralong PIVC  Standard Long PIVC

## 1.4 Key Findings

- This study supports the use of **ultralong PIVCs** over standard long PIVCs **for upper arm insertions** because these catheters have a **favorable survival profile for difficult venous access patients**
- In patients with difficult venous access, longer length Introcan Safety® Deep Access IV catheters have **longer in-dwell** times compared to short Becton Dickinson Insyte Autoguard IV catheters
- Unlike midline or extended dwell catheters, longer length Introcan Safety® Deep Access IV catheters **require no specialized training beyond ultrasound placement**
- **Increased length of the catheter in the vein,** sometimes referred to as vein purchase, **is strongly associated with enhanced catheter survival.** The 6.35 cm (2.5 inch) longer length Introcan Safety® Deep Access IV catheter may be more suitable for achieving optimal catheter length in deeper veins
- Need > **2.75 cm of catheter in the vein for optimal catheter survival**

# 2. Difficult venous access takes 3 times longer compared to a standard procedure

Whalen M, Maliszewski B, Baptiste DL. Establishing a dedicated difficult vascular access team in the emergency department. Journal of Infusion Nursing. 2017 May 1;40(3):149-54.

## 2.1 Topic

Difficult Venous Access (DVA)

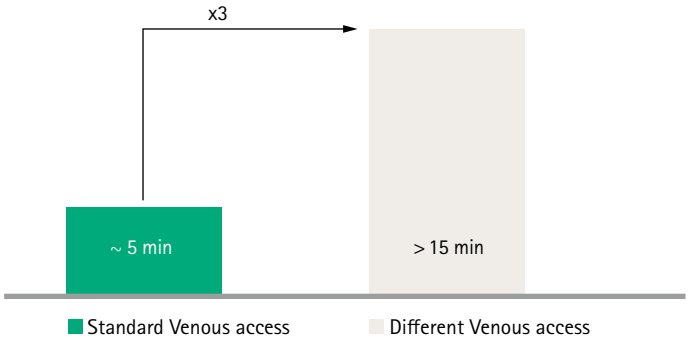

First stick success

## 2.2 Design & Method

- The study assesses the need for and benefits of a dedicated vascular access team to increase first stick success in an adult emergency department (ED)
- The study includes literature review, chart reviews and data collection
- Data collected on time needed to successfully create vascular access (n=150)
- Chart review with focus on number of IV starts among difficult venous access patients (n=51)
- The study was conducted in the United States at an urban academic medical center with 70,000 patients annually
- Catheters were placed by trained clinical technicians

## 2.3 Results

- Difficult venous access (DVA) is a common challenge in an adult ED:
  - 25.6% of patients required >15 minutes for successful venous access
  - 40.4% of patients required approximately 5 minutes for a short IV catheter placement
- Successful venous access among patients identified as having difficult venous access took 3 times longer (15 minutes)
- 45% of patients with DVA waited 1 to 4 hours for a short IV catheter to be placed by a specialist
- Six patients waited >8 hours for a placement
- Patients with DVA required 2 to 6 attempts for successful placement




## 2.4 Key Findings

- **DVA takes 3 times longer** compared to a standard procedure
- **DVA requires multiple stick attempts**
- **DVA may result in delay of treatment**
- A dedicated vascular access team can potentially reduce resource utilization and improve patient safety

# 3. One out of ten patients in the emergency department (ED) may result in difficult venous access

Fields JM, Piela NE, Au AK, Ku BS. Risk factors associated with difficult venous access in adult ED patients. The American journal of emergency medicine. 2014 Oct 1;32(10):1179-82.

## 3.1 Topic

Difficult Venous Access (DVA)

## 3.2 Design & Method

- The study aim was to observe risk factors for difficult venous access in adult patients in the emergency department (ED)
- The standard practice involved ED staff determining the requirement of venous access, followed by a nurse or an ED technician performing the insertion. In cases of repeated failures, an attending physician or an emergency medicine resident would perform rescue venous access
- This study included adult patients who came to the emergency department in need of venous access (n= 743)
- The study was conducted in the United States in an ED of an urban academic hospital with a high volume of patients (65,000 patients/year) from 07/2012 to 02/2013
- The study identified patient variables that could be associated with difficult venous access, namely age, sex, race, BMI, history of chemotherapy, diabetes, dialysis, IV drug abuse, swelling, sickle cell disease, and recent ED visit or hospitalization within the last 90 days
- A logistic regression model was used to analyze the effect of these variables on DVA

## 3.3 Results

- The initial attempt for venous access was successful in 76% of patients, leaving 24% of patients who needed a second attempt or rescue vascular access
- Of these patients, 88 patients met the definition of DVA, resulting in a prevalence of 11%
- Diabetes, intravenous drug abuse and sickle cell disease were identified as independent risk factors for DVA
- Patients with a history of requiring multiple IV attempts or alternative methods of access were more likely to have DVA
- Use of a smaller IV catheter (22 or 24 gauge) for the first attempt was also associated with DVA.

## 3.4 Key Findings

- Approximately **11% of ED patients were identified to have difficult venous access**
- **Risk factors for DVA are IV drug abuse, diabetes and sickle cell disease**
- The study showed no significance for DVA associated risk factors like age, dialysis and obesity

# 4. Multiple needlesticks result in higher pain levels

Fields JM, Piela NE, Ku BS. Association between multiple IV attempts and perceived pain levels in the emergency department. J Vasc Access. 2014;15:514–8

## 4.1 Topic

Difficult Venous Access (DVA)

Pain Level of IV Access

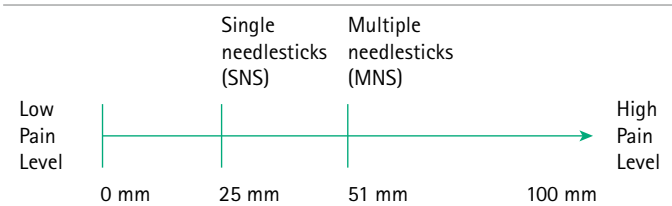
## 4.2 Design & Method

- The study assesses the relation between the number of IV starts and overall pain perceived by the patient
- This study included adult patients who came to the emergency department (ED) in need of venous access, 20-gauge IV catheter in the upper arm (n=729)
- Cross-sectional observational study of patients undergoing IV access conducted from July 2012 to February 2013
- The previous study was conducted in the United States in an ED of an urban academic hospital with a high volume of patients (65,000 patients/year)
- The level of pain has been assessed on a 10 cm visual analog scale (1 being "very dissatisfied" and 10 being "very satisfied")

## 4.3 Results

- Of the 729 patients, 24% required multiple needlesticks (MNS)
- The reported pain level was significantly higher in the group of multiple needlesticks (MNS) than in the single needlestick (SNS)
- Mean pain level experienced: 51 mm (MNS) vs. 25 mm (SNS)
- The highest average pain level reported was in those who underwent five attempts
- Of the MNS group, 58% indicated that the IV placement caused the most pain during their time in the ED

**Visual Analog Pain Scale**




24 % Multiple needlesticks

76 % Single needlesticks

## 4.4 Key Findings

- **Multiple needlesticks result in higher pain levels**
- A reduction of needlesticks may result in reduced pain and may impact patient satisfaction

# 5. Training in ultrasound-guided IV catheter placement reduces the use of more invasive PICCs and midline catheters

Galen B, Baron S, Young S, Hall A, Berger-Spivack L, Southern W. Reducing peripherally inserted central catheters and midline catheters by training nurses in ultrasound-guided peripheral intravenous catheter placement. BMJ Quality & Safety. 2020 Mar 1;29(3):245-9.

## 5.1 Topic

Difficult Venous Access (DVA)

Ultrasound-guided IV catheter placement

Reduction of more invasive PICCs and midline catheters

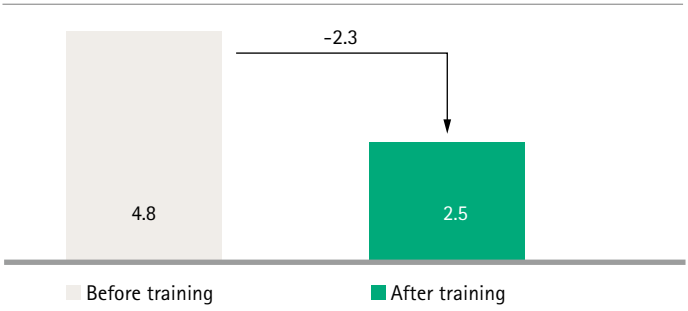
## 5.2 Design & Method

- The study aimed at assessing the correlation between proper nurse training in ultrasound-guided IV catheter placement and the potential reduction of more invasive midline catheters and PICCs
- Interventional group: Training on ultrasound-guided IV catheter placement included an online module, bedside demonstrations and simulator training. After two successful placements on a simulator, the nurse was considered certified to use ultrasound on the bedside
- All nurses of this unit had been trained on ultrasound-guided IV catheter placement, none of them had used ultrasound before
- A portable high-end ultrasound device was used during the nurse training and study period
- Control group: a comparable ward where nurses did not receive training on ultrasound-guided IV catheter placement
- Data was collected on the number of newly placed catheters before (21 months), during (10 months) and after the implementation (7 months)
- The study was conducted in the United States in a single inpatient medical unit

## 5.3 Results

- Throughout the implementation period (10 months), 99 ultrasound-guided IV catheters were placed, 97% of them successfully
- The use of PICCs and midline catheters decreased from an average of 4.8 per month to 2.5 during the implementation. After the implementation, the number of use has risen again to a level of 4.3 per month
- In a similar inpatient medical unit where the nurses did not receive a training or provision of ultrasound-guided devices, an average of 6 midline catheters/ PICCs per month was measured. There were no significant changes during the study period

**Number of PICCs & midlines placed per month**




## 5.4 Key Findings

- **Training nurses** in ultrasound-guided IV catheter placement helps **to reduce the number of PICCs and midline catheters**
- Total training time for each nurse was less than 60 min

# 6. Extended length peripheral IV catheters provide reliable access in patients with difficult venous access

Smith E, Irimia V. Evaluation of extended-length cannula inserted using ultrasound guidance in patients with difficult IV access. British Journal of Nursing. 2023 Jul 27;32(14):S14-20.

## 6.1 Topic

Difficult Venous Access (DVA)


Improved first stick success and catheter dwell-time

## 6.2 Design & Method

- The study reports the results of introducing extended length PIVCs, inserted using ultrasound guidance in patients with difficult venous access by a vascular access team
- Products used: B. Braun longer length PIVCs (50 and 64 mm)
- Sample size of 1,485 individual insertions
- The evaluation was conducted across a tertiary hospital setting in the NHS Foundation Trust with about 750 beds (Liverpool, UK)
- Data collected between 2019 and 2022, with patients who had been referred to the vascular access team due to difficult venous access
- Member of vascular access team were nurses with 3 – 10 years of experience in ultrasound-guided vascular access cannulations

## 6.3 Results

- A mean catheter dwell time of 6 days
- A first stick success rate under ultrasound-guided cannulation of 91%
- A therapy completion rate of 75 and 78% for inpatient and outpatients respectively

## 6.4 Key Findings

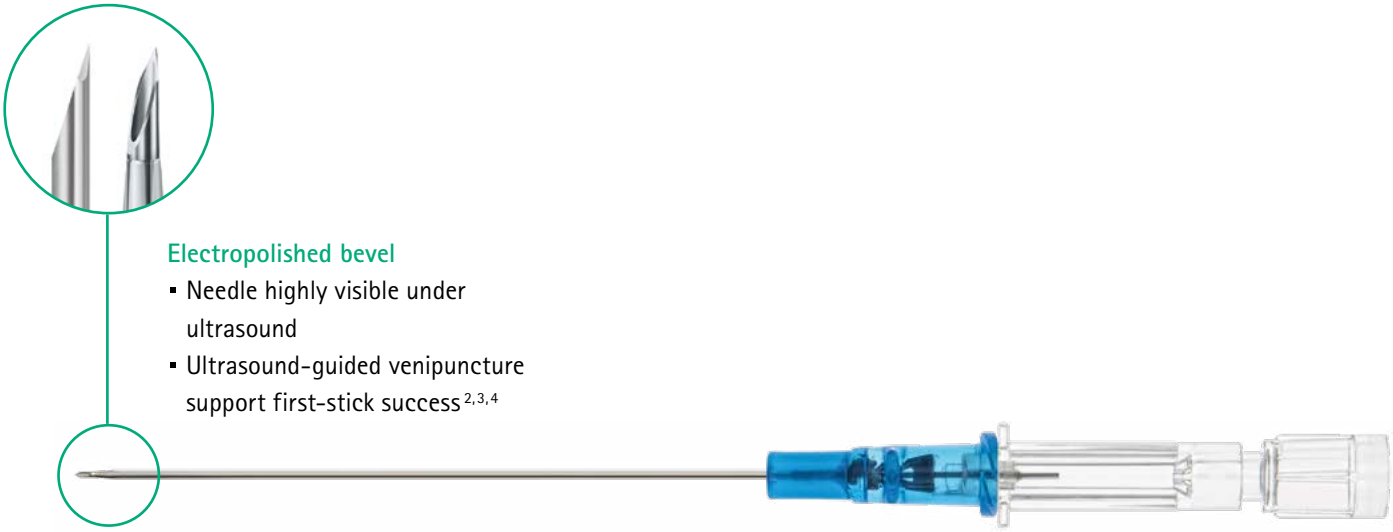
- **Extended length PIVCs provide a safe and reliable vascular access** in patients with difficult venous access (DVA)
- Ultrasound-guided PIVCs can be **successfully implemented in a vascular access team**
- Ultrasound-guided cannulations **improve first stick success rate** in patients with DVA
- **Increased dwell times and low complication rates** can be achieved in patients with DVA
- Extended length PIVCs **reduce resources and time** wasted on failed attempts and subsequent impact on patient journey
- Extended length PIVCs improve the quality of life for patients with DVA
- Extended length PIVCs **can be successfully placed at optimum IV insertion sites** (away from areas of flexion, in superficial upper arm vessels)
- Extended length PIVCs **reduce the necessity to use more costly invasive lines for cannulation, improves the delivery of therapy and procedures, and improves first stick success for patients with DVA**

# Introcan Safety® Deep Access
## Longer Length Peripheral IV Catheter

### Polyurethane catheter
- For a softer, more comfortable indwelling performance[6,7,8]

### 64 mm catheter
- Longer part of capillary in the vein
- Reduced catheter related complications and extended dwell times[5]

### Passive safety needle shield
- Helps eliminate needlestick injuries[1]
- Deploys automatically
- Cannot be bypassed
- Requires no user activation



### Electropolished bevel
- Needle highly visible under ultrasound
- Ultrasound-guided venipuncture support first-stick success[2,3,4]


References:

1. Tosini W, Ciotti C, Gover F, Lolom I, L'Hériteau F, Abiteboul D, Pellissier G, Bouvet E. Needlestick injury rates according to different types of safety-engineered devices: results of a French multicenter study. Infection Control & Hospital Epidemiology. 2010 Apr; 31(4):402-7.
2. Scoppettuolo. G, Pittiruti M, Pitoni S, Dolcetti L, Emoli A, Mitidieri A, Migliorini I, Annetta MG. Ultrasound-guided "short" midline catheters for difficult venous access in the emergency department: a retrospective analysis. International journal of emergency medicine. 2016 Dec;9(1):1-7.
3. Vinograd, A.M., Chen, A.E., Woodford, A.L., Fesnak, S., Gaines, S., Elci, O.U. and Zorc, J.J., 2019. Ultrasonographic Guidance to Improve First-Attempt Success in Children With Predicted Difficult Intravenous Access in the Emergency Department: A Randomized Controlled Trial. Annals of emergency medicine.
4. Stolz LA, Stolz U, Howe C, Farrell IJ, Adhikari S. Ultrasound-guided peripheral venous access: a meta-analysis and systematic review. The journal of vascular access. 2015 Jul; 16(4):321-6.
5. Bahl, Amit, et al. "Ultra long versus standard long peripheral intravenous catheters: a randomized controlled trial of ultrasound-guided catheter survival." Available at SSRN 3401988 (2019).
6. Kus B. Büvükvilmaz F. Effectiveness of vialon biomaterial versus Teflon catheters for peripheral intravenous placement: A randomized clinical trial. Japan Journal of Nursing Science. 2020:2.
7. Maki D.G. Ringer M. Risk Factors for infusion-related Phlebitis with Small Peripheral Venous Catheters: A randomized Controlled Trial. Ann Intern Med. 1991 May 15; 114(10):845-54
8. Stanley M.D. Meister E. Fuschuber K. Infiltration during intravenous therapy in neonates: comparison of Teflon and Vialon catheters. South Med J. 1992 Sep, 85(9):883-95.

B. Braun Melsungen AG | Hospital Care | 34209 Melsungen | Germany
Tel. +49 5661 71-0 | www.bbraun.com

Date of last revision: 03.2024