

# Preventing peripheral intravenous catheter failure by reducing mechanical irritation

(MSN EBP Poster, Spring 2023)

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- I. Introduction-
  - A. Most patients require at least one peripheral vascular device for fluid and medication administration during their hospital stay
    - I. >70% of patients in acute care hospitals use peripheral intravenous catheter.
  - B. Catheter failure negatively affects patient comfort and treatment making it difficult to continue IV therapy
    - I. >25% OF PIVCs are accidentally removed, termed “catheter failure”
    - II. Replacing catheters makes patients uncomfortable, increases labor, and drives up costs.
  - C. The study focuses on mechanical irritation.
    - I. Mechanical irritation can cause vascular inflammation and thrombus formation.
    - II. PIVCs tip contact with vessel wall is associated with edema formation
  - D. Vein diameter and catheter gauge ratios were significant
    - I. The smaller the vein the greater the change of the PIVC to infiltrate
  - E. Polyurethane Catheters are the preferred catheter
    - I. Softest material
    - II. Polyurethane catheters showed a 30-50% reduction in phlebitis occurrence compared to polytetrafluorethylene (Teflon) catheters.
  - F. IV therapy involves multiple steps including site selection, catheterization, and fixation.
    - I. Appropriate selection site, device, and fixation method are equally important to the care bundle.
- II. Purpose-
  - A. To reduce catheter failure through a “care bundle”
    - I. Bundle includes “pre-scan” for selecting a large diameter vein, “post-scan” for confirming the catheter tip position after catheterization and use of a polyurethane catheter.
- III. Methods-
  - A. The study was conducted at the University Toyo hospital in Japan
    - I. Non-randomized comparative non-blinding study
    - II. July- November 2017
  - B. Participant Criteria
    - I. Greater than or equal to 20 years old
    - II. Receiving infusion therapy via PIVCs
    - III. Patients receiving chemotherapy and having poor cognitive ability were excluded
  - C. Intervention Group
    - I. Nurses participating were educated and had briefings for 30 minutes prior to the data collection period
    - II. First, Nurse assessed the site to be punctured and relayed the information to the researcher
    - III. Second, the researcher assessed vein size and location using Ultrasound (US)
    - IV. Third, researcher told the nurse the vein diameter and vein depth from the US. The nurse determined puncture point and performed the insertion.
    - V. The nurse used the polyurethane catheter or Teflon catheter depending on their comfort level.
    - VI. The researcher and the nurse adjusted the catheter tip in the vein guided by US

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## D. Control Group

- I. Inserted using conventional catheter care practices accepted by the hospital
- II. Using a Teflon catheter
- III. 24-hour hours after cannulation the researcher visually inspected the PIVC puncture site and used a US to measure vein diameter and depth.

## IV. Results-

### A. 189 catheters in the intervention group and 233 catheters in the control group were analyzed

- I. No adverse reactions occurred related to the intended intervention
- II. 68 (29.2%) catheters failed in the control group
- III. 21 (11.1%) catheters failed in the intervention group

### B. Mean vein Diameter

- I. Control Group- 2.53mm
- II. Intervention Group- 2.75mm

### C. Mean vein Depth

- I. Control Group- 2.21mm
- II. Intervention Group- 2.03mm

### D. Appropriate catheter tip Position-

- I. Control Group- 45.9%
- II. Intervention Group- 68.0%
- III. There was a significant difference between the intervention and control groups ( $p=0.004$ ) the trend was found in vein depth ( $p=0.051$ )

### E. Risk factors

- I. Hyperosmotic drugs (3x more likely for developing catheter failure), catheter placement on the back of the hand, and high CRP rates were found to increase the likelihood of catheter failure.

## V. Conclusion-

### A. The intervention showed a significant reduction of catheter failure incidence using care bundle for reducing mechanical irritation. (Pre-scan for vein diameter, post-scan for proper fixation, and polyurethane catheter).

- I. The incidence of catheter failure in the intervention group was significantly lower than the control group.

## Reference:

- a. Takahashi, T., Murayama, R., Abe-Doi, M., Miyahara-Kaneko, M., Kanno, C., Nakamura, M., Mizuno, M., Komiyama, C., & Sanada, H. (2020). Preventing peripheral intravenous catheter failure by reducing mechanical irritation. *Scientific Reports*, 10(1). <https://doi.org/10.1038/s41598-019-56873->