Safety and Effectiveness of Catheter Repair in Home Parenteral Nutrition

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Disclosure

- I have no commercial relationships to disclose
- I have no commercial relationships relevant to the topic being presented
- Ryan T. Hurt is a consultant for Nestle.
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Learning Objectives

- For both HPN providers and consumers.
- Importance of central venous access in HPN patients.
- Common complications associated with central venous catheters.
- Brief understanding of CVC repair procedure.
- Safety and effectiveness of catheter repair.
- Benefits of catheter repair over catheter replacement.

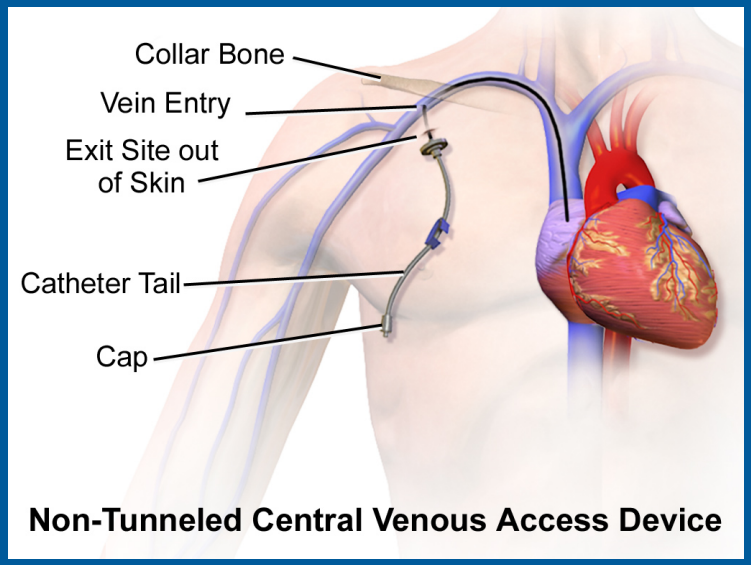
Introduction

- Approximately 25,000 people are on Home Parenteral Nutrition (HPN) due to Chronic Intestinal Failure (CIF)[1].
- Majority of them have to be on HPN for multiple years, often their lifetime.
- HPN is life saving therapy for malnourished patients, but can be associated with complications such as Intestinal Failure Associated Liver Disease (IFALD), Central Line Associated Blood Stream Infections (CLABSI) and Central Vein Thrombosis (CVT)[2].
- Maintenance of central venous access is one of the key factors determining intake of adequate nutrients and hence better outcomes in HPN patients.

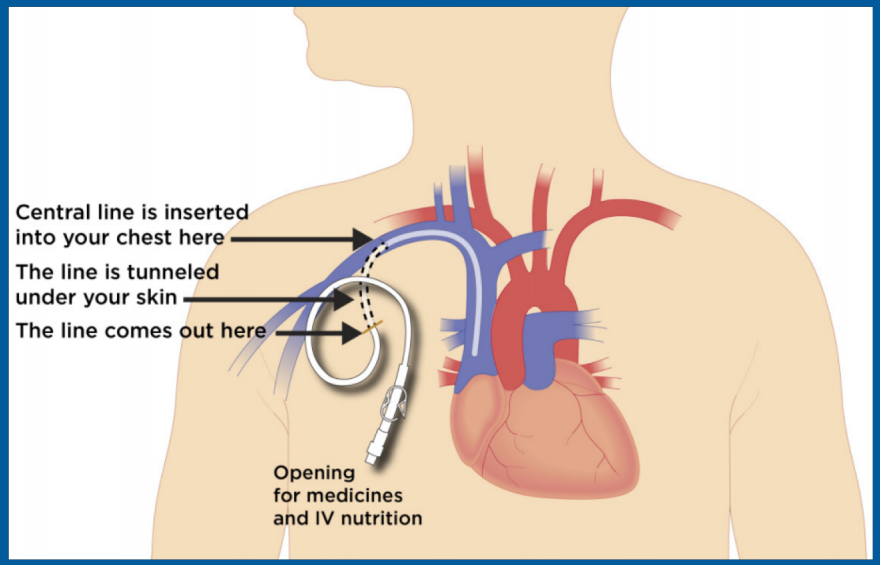
1. Mundi, Manpreet S., Adele Pattinson, Megan T. McMahon, Jacob Davidson, and Ryan T. Hurt. "Prevalence of Home Parenteral and Enteral Nutrition in the United States." *Nutrition in Clinical Practice* 32, no. 6 (December 1, 2017): 799–805.
2. Santarpia, Lidia, et al, "Home Parenteral Nutrition in Patients with Intestinal Failure: Possible Undetected Complications." *Nutrients* 11, no. 3 (March 2019): 581

Types of CVCs

- Non tunneled CVCs



- Tunneled CVCs



Quick Facts

- Not all central venous catheters are same.
- All types of CVCs can get damaged!
- Complications like damage and infection may depend on the site of the CVC[1].
- Not all CVCs are repairable.
- Not all damages are repairable.

1. Ge, X, R Cavallazzi, C Li, SM Pan, YW Wang, and FL Wang. "Central Venous Access Sites for the Prevention of Venous Thrombosis, Stenosis and Infection." *Cochrane Database of Systematic Reviews*, no. 3 (2012). https://doi.org/10.1002/14651858.CD004084.pub3.

Introduction

- Catheter breakage is one of the common complications that could occur in long term HPN patients.
- CVC replacement is as intensive and resource consuming procedure as CVC placement.
- Studies show that CVC placement by specialized expert in strict aseptic conditions and under ultrasound guidance led to less complication rates and also that catheter salvage can be done and is effective after a CLABSI[1,2].
- Whenever CVC repair is possible, it is less labor and resource intensive, can be done in out-patient setting and using nothing but commercially available repair kits and is shown to double the catheter survival[3].
- Current study aims to bridge the gap about safety and effectiveness of catheter repair in USA.

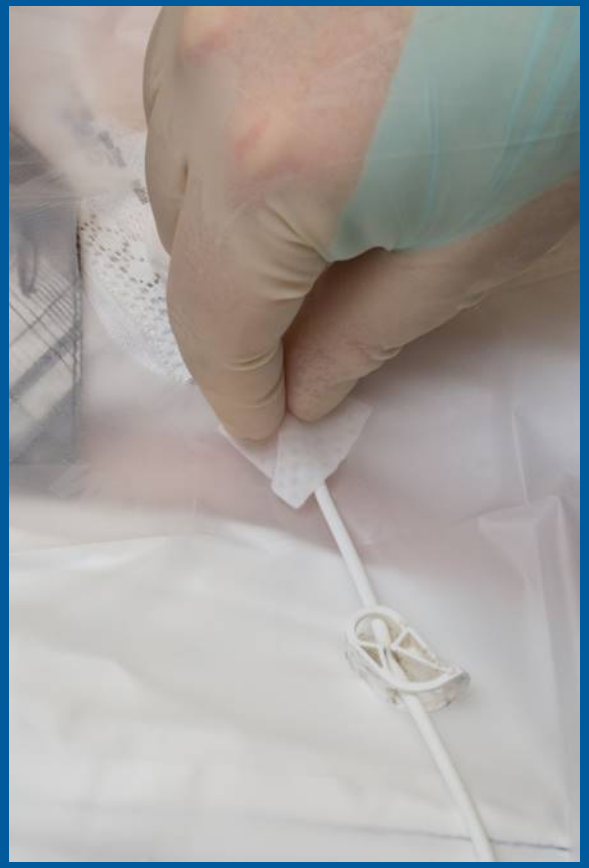
1. Hind Daniel, et al. *Ultrasonic locating devices for central venous cannulation: meta-analysis BMJ* 2003;327 :361
2. Edakkanambeth Varayil, Jithinraj, Jennifer A. Whitaker, Akiko Okano, Jennifer J. Carnell, Jacob B. Davidson, Mark J. Enzler, Darlene G. Kelly, Manpreet S. Mundi, and Ryan T. Hurt. "Catheter Salvage After Catheter-Related Bloodstream Infection During Home Parenteral Nutrition." *Journal of Parenteral and Enteral Nutrition* 41, no. 3 (March 2017): 481–88
3. Salonen, Bradley R., Sara L. Bonnes, Manpreet S. Mundi, and Simon Lal. "Repair of Central Venous Catheters in Home Parenteral Nutrition Patients." *Nutrition in Clinical Practice* 34, no. 2 (2019): 210–15

Methods

- Retrospective review of our HPN database was done to include all adult patients who were newly started on HPN from September 1, 1997 to April 30, 2018 and had at least one repair of their CVC done at Mayo Clinic, Rochester, MN.
- Extensive chart review was done for the included patients acquiring demographic data, CVC related data, HPN duration and HPN complications like CVC damage, CLABSI, CVT etc.
- Follow-up data after catheter repair was also collected to determine the success rate of CVC repairs.
- Primary outcome of interest was to evaluate how safe was catheter repair when compared to CVC replacement based on the incidence of CLABSI in both scenarios.
- Secondary outcome of interest was to assess the success rate of CVC repairs and organisms responsible for the CLABSIs.

Catheter Repair Procedure

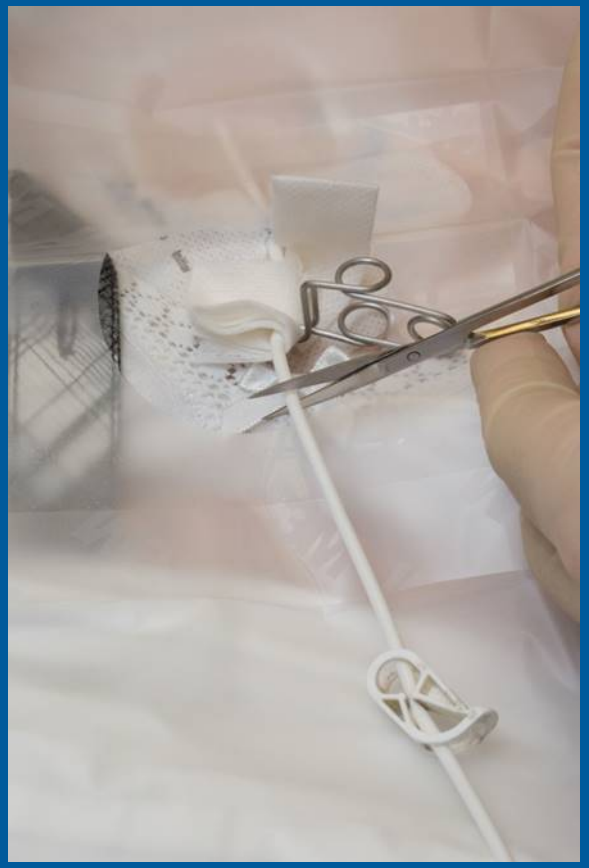
Catheter Repair Procedure



Step 1

- After taking the necessary aseptic precautions, clean the catheter proximal to the damaged area with antiseptic solution.
- Prepare a blunt needle syringe filled with the adhesive provided in the kit.

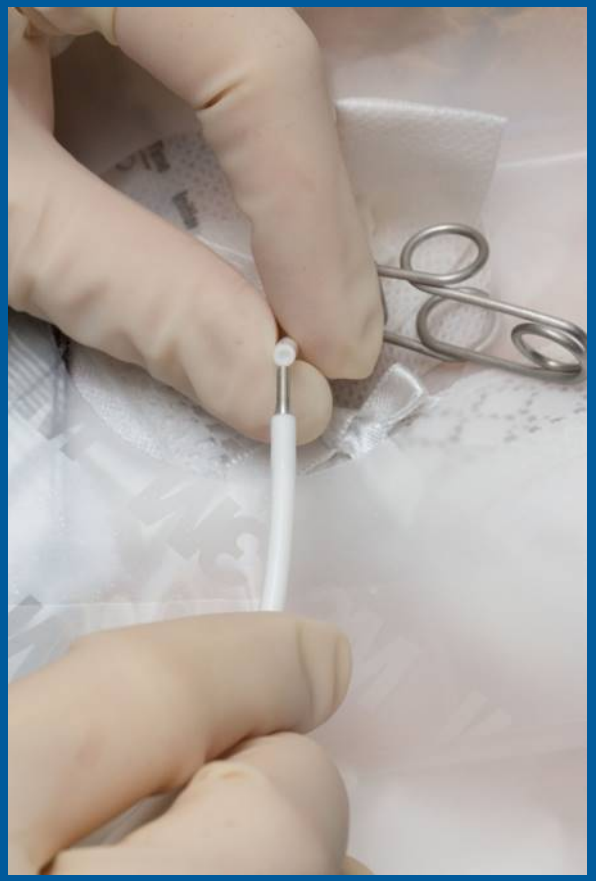
Catheter Repair Procedure



Step 2

Cut the catheter at 90 degrees immediately proximal to the damaged site.

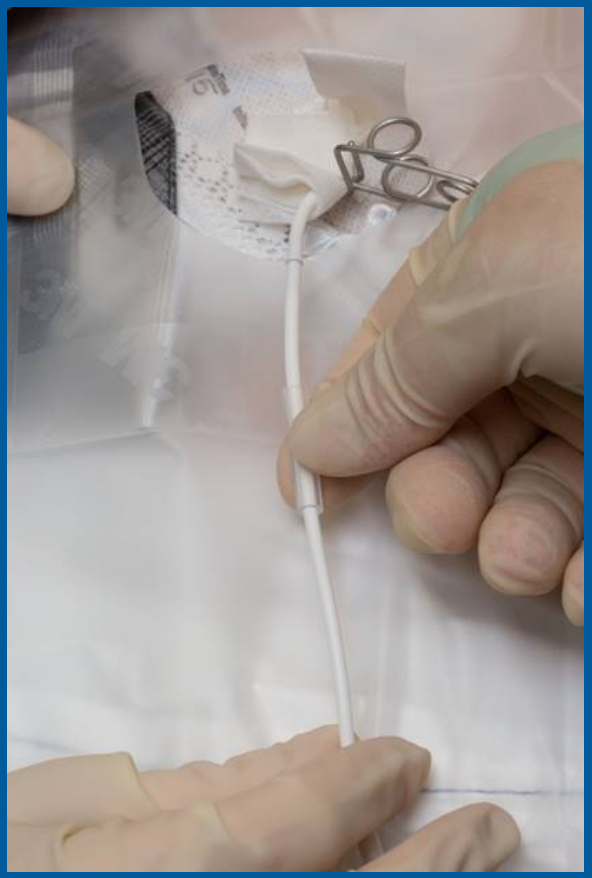
Catheter Repair Procedure



Step 3

- Insert the stent of the new catheter(provided in the repair kit) into the spliced end of the catheter being repaired.
- Do not approximate the ends fully, leave a gap of 3 mm between the splice ends.
- Fill the 3 mm gap with small amount of adhesive and approximate the ends fully.

Catheter Repair Procedure



Step 4

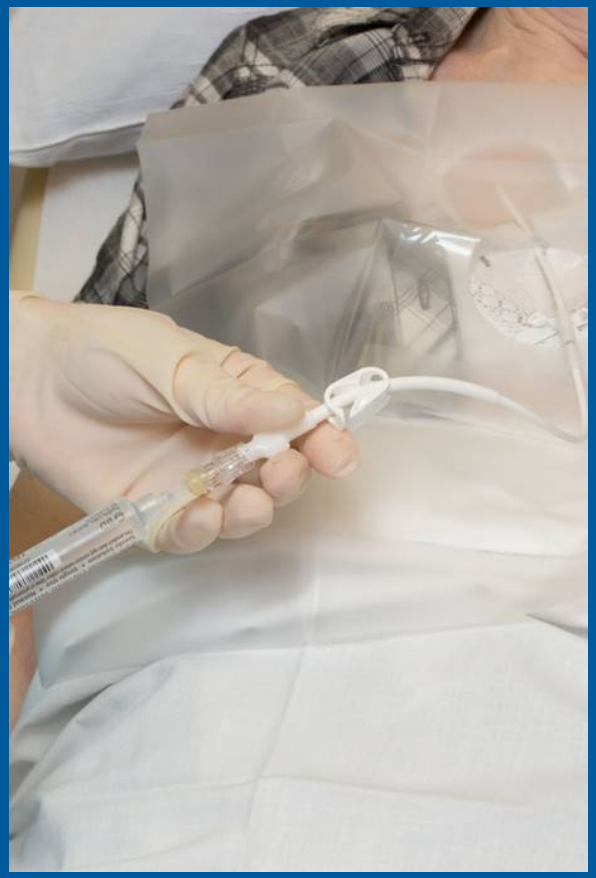
- Gently advance the transparent sleeve provided on the new(distal) catheter segment over the splice site.

Catheter Repair Procedure

Step 5

- Insert the adhesive in between the sleeve and the catheter.
- Gently roll the repair, holding the sleeve to spread the adhesive evenly.

Catheter Repair Procedure



Step 6

- Unclamp the catheter and check for patency and free flow using Saline.

Catheter Repair Procedure

Results

- A total of 55 catheter repairs were done during the study period in 36 HPN receiving adult patients.
- The median duration from the catheter insertion to repair was 895 days (IQR: 416-1639 days).
- Post-repair the median duration of repaired catheter in place increased to an additional 685 days (IQR: 136-1037 days).
- There were 24 episodes of CLABSI during the study period.
- 13 infections occurred before the CVC repair translating to 0.23 CLABSIs/1000 catheter days.
- 11 infections occurred after the CVC repair – 0.21 CLABSIs/1000 catheter days (p-value: 0.32)
- All 55 CVC repairs had no re-breaks or occlusions.

Results

895 days

895 days

895 days

685 days

Results

23 infections

23 infections

23 infections

21 infections

(per 100,000 catheter days)

Results

Baseline demographics	
Characteristic	Value
Total number of patients (n)	36
Total number of catheters (n)	45
Total number of catheter repairs done (n)	55
Catheter days before repair	895 (416-1639.5)
Age at catheter placement (mean ± SD)	57.1 ± 16.+9
Gender n (%)	
Male	13 (36%)
Female	23 (64%)
Site of catheter insertion (%)	
Internal jugular vein	69%
Subclavian vein	29%
Femoral vein	2%

Results

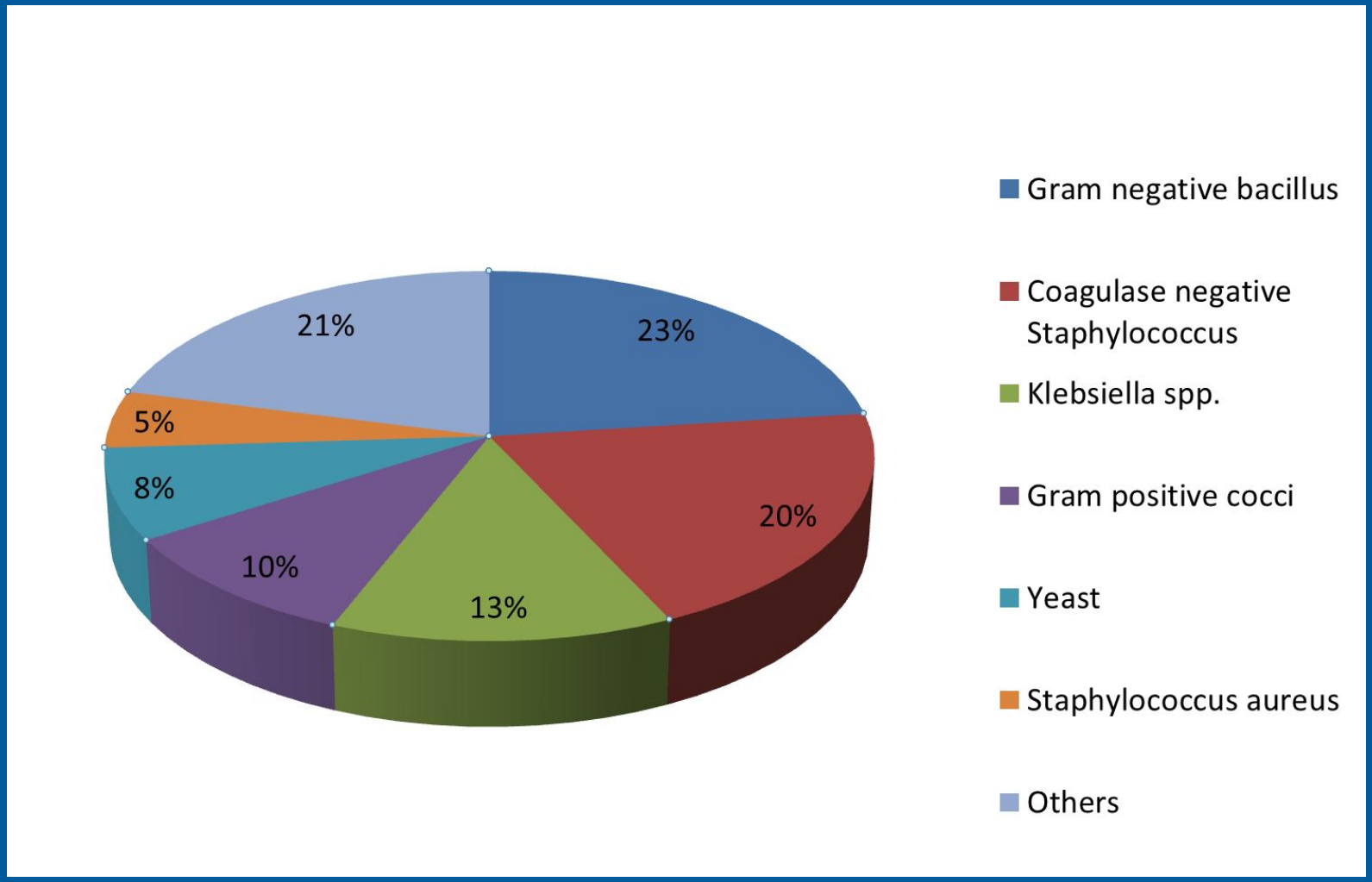
Primary Indication for Parenteral Nutrition	%
Short bowel syndrome	53
Dysmotility	9
Enteric failure	7
Malnutrition	7
Crohn's disease	4
Radiation enteritis	4
Small bowel obstruction	4
Enterocutaneous fistula	2
Hollow visceral myopathy	2
Idiopathic protein-losing enteropathy	2
Malabsorption	2
Mesenteric ischemia	2

Results

Post-catheter repair data	
Characteristic	Value
Number of infections before repair (n)	13
Infection rate before repair (measured per 1000 catheter days)	0.23
Number of infections after repair (n)	11
Infection rate after repair (measured per 1000 catheter days)	0.21
Number of repaired catheters that were subsequently infected with CLABSI n (%)	
within the first month	2 (18%)
within the first year	2 (18%)
within first 5 years	7 (64%)
Percent of repaired catheters that were replaced due to CLABSI (%)	8.69%
Indications for eventual catheter replacement (%)	
Mechanical damage	32
Infection	32
Switched to alternate mode of nutrition	24
Displacement of Catheter	6
Death	3
Other	3

P-value = 0.32

Organisms isolated by Blood Cultures during the CLABSI episodes



Other Relevant Studies

J Vasc Interv Radiol. 2008 Feb;19(2 Pt 1):201-6. doi: 10.1016/j.jvir.2007.08.030.

Tunneled infusion catheter breakage: frequency and repair kit outcomes.

Hwang FR[1], Stavropoulos SW, Shlansky-Goldberg RD, Mondschein JI, Patel AA, Solomon JA, Itkin M, Soulen MC, Chittams JL, Trerotola SO.

Pediatr Infect Dis J. 2012 Apr;31(4):337-40. doi: 10.1097/INF.0b013e31823eeec5.

Central venous catheter repair is associated with an increased risk of bacteremia and central line-associated bloodstream infection in pediatric patients.

Lundgren IS[1], Zhou C, Malone FR, McAfee NG, Gantt S, Zerr DM.

Clin Nutr. 2018 Aug 14. pii: S0261-5614(18)31347-5. doi: 10.1016/j.clnu.2018.08.005. [Epub ahead of print]

Repair of damaged central venous catheters is safe and doubles catheter survival: a home parenteral nutrition patient cohort study.

Wouters Y[1], Vissers RK[2], Groenewoud H[3], Kievit W[3], Wanten GJA[2].

References

1. Mundi, M.S., et al., *Prevalence of home parenteral and enteral nutrition in the United States.* Nutrition in Clinical Practice, 2017. **32**(6): p. 799-805
2. Hind Daniel, et al. *Ultrasonic locating devices for central venous cannulation: meta-analysis BMJ* 2003;327 :361
3. Edakkanambeth Varayil, J., et al., *Catheter salvage after catheter-related bloodstream infection during home parenteral nutrition.* Journal of Parenteral and Enteral Nutrition, 2017. **41**(3): p. 481-488
4. Wouters, Y., et al., *Repair of damaged central venous catheters is safe and doubles catheter survival: a home parenteral nutrition patient cohort study.* Clinical Nutrition, 2018
5. Hwang, Freeman R., et al., "*Tunneled Infusion Catheter Breakage: Frequency and Repair Kit Outcomes.*" Journal of Vascular and Interventional Radiology 19, no. 2 (February 1, 2008): 201-6. https://doi.org/10.1016/j.jvir.2007.08.030

Questions