

Evaluating Line Snugglers in Protecting and Organizing Central Lines in a Pediatric Transplant Population

Summary Report

June 14, 2019

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Project Overview

Blood stream infections from central lines occur at a rate of 249,000 per year in US hospitals and occur at higher rates in patients who are immunocompromised. And despite preventative measures, central line associated blood stream infections still occur. Patients admitted to the Pediatric Blood and Marrow Transplant Units have double or triple lumen central venous lines connected to IV tubing for transplant medications. Children often play with their lines, and inadvertently disconnect, tangle, chew, spill fluids, or are scared at the sight of them. Recently, a nursing product labeled the Line Snuggler, has provided a means to protect lines from such contamination or entanglement.

The purpose of this study was to evaluate a clinical component, consumer satisfaction, and usefulness of the utilization of Line Snugglers in the pediatric blood and bone marrow transplant population at Duke University Hospital.

The clinical component of this study assessed if Line Snugglers increased the amount of bacterial growth compared to other items in the environment. To determine clinical outcomes, subjects were enrolled after they completed the chemotherapy phase of transplant. Each subject served as their own control for the first phase of the study (control phase), and then receive the intervention (a Line Snuggler placed around their IV lines) for the second phase of the study (intervention phase). Bacterial growth was measured using a standardized swabbing technique on Study Days 1 and 3 of the control phase. On the evening of Study Day 3 and after the total line/cap change was completed, the subject began the second phase or intervention phase of the study, utilizing a clean Line Snuggler. On the morning of Study Day 4 and Day 6, the same swabbing procedures took place. In addition, the inside cover of the Line Snuggler near where the IV tubing connects to the central line caps was also swabbed. All swabs were immediately tested using an ATP bioluminescence monitor.

Family members and clinicians were also asked to complete a one-time online survey about consumer satisfaction and usefulness of the Line Snuggler at the completion of the study.

Executive Summary

Results from the clinical component suggest that the amount of bacterial growth on the Line Snuggler was not different than the amount of ATP growth on other items in a patient's environment, such as sheets.

Clinicians and family members both reported high satisfaction and usefulness of the Line Snuggler.

Disclosure: This study was conducted at Duke University Medical Center and was funded by the Duke University School of Nursing's Health Innovation Lab and a Kids Care Grant. Institutional review board (IRB) approval was obtained and analysis performed by an independent statistician not associated with Nursing and Patient Care Innovations LLC.

How Does Bacterial Growth on a Line Snuggler Compare to other Items in a Patient's Environment?

To determine if the line snuggler increases the amount of bacterial growth compared to other items in the environment, we conducted a study using the adenosine triphosphate (ATP) test. This test measures actively growing microorganisms through detection of ATP. In this study (N=30), we examined if the line snuggler grew more ATP than a frequently used item in a patient's environment – the sheets – in a population of high risk pediatric blood and marrow transplant patients.

Results indicate that ATP on the line snuggler was lower than ATP on the sheets on day 1, before the snuggler was put on ($t=2.34, p=.03$). On days 4 and 6 ($t=-0.10, p=.92$ and $t=-0.66, p=.51$, respectively), ATP was not different after the line snuggler was put on.

Table 1. Mean differences in ATP by location (N=30)

	Sheets M(SD)	Line Snuggler M(SD)	test statistic	p-value
Day 3	200.76 (423.33)	3.40 (2.60)	$t(24)=2.34$.03
Day 4	295.08 (513.29)	314.54 (794.97)	$t(25)=-0.10$.92
Day 6	251.61 (426.53)	391.00 (966.60)	$t(22)=-0.66$.51

This suggests that the amount of ATP growth on the line snuggler is not different than the amount of ATP growth on other items in a patient's environment, such as sheets.

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Clinicians Report High Satisfaction with the Line Snuggler

We assessed clinician satisfaction (N=44) with using the Line Snuggler for patient care. Among a sample of clinicians (7 MDs, 35 RNs, 2 NPs), users reported high satisfaction with use of the Line Snuggler. Table 2 shows the results from the survey (1=strongly agree to 5=strongly disagree). Lower numbers indicate strongly agreeing with the statements.

Table 2. Satisfaction Survey Results (N=44)

Survey Item	M	SD
The Line Snuggler improved my patient's/child's ability to walk with an IV pole and connected IV tubing.	1.05	0.21
I would be willing to have my patient/child use the Line Snuggler for every admission on the inpatient unit.	1.21	0.42
It is important to have the Line Snuggler keep the lines organized.	1.17	0.54
It is important to have the Line Snuggler keep the lines off the patient/my child and the bed.	1.21	0.41
Patient/family understands how to use Line Snugglers.	1.12	0.33
Patient/family can easily use Line Snugglers.	1.07	0.26
Line Snugglers are easy to apply.	1.29	0.74
Line Snugglers save nurses time.	1.12	0.33
It is easy to teach others how to use Line Snugglers.	1.07	0.26
I would use Line Snugglers for other patients.	1.09	0.37
Line Snugglers increase patient safety.	1.33	0.69
Line Snugglers increase work productivity.	1.31	0.75
Line Snugglers increase work quality.	1.21	0.52
Line Snugglers increase staff satisfaction.	1.09	0.29
Line Snugglers increase parent-patient satisfaction.	1.07	0.34
Line Snugglers provides a peace of mind that my patient's/child's lines are protected.	1.14	0.41
Line Snugglers decrease the worry of my patient's/child's family surrounding central lines.	1.18	0.45
Line Snugglers decrease adverse events.	1.11	0.32
Line Snugglers require minimal training.	1.30	0.60
Line Snugglers are cost effective to implement.	1.21	0.41
Line Snugglers do not hinder routine access of lines.	1.12	0.32
Line Snugglers are some of the best products for line organization and protection that could have been provided for my patient/child.	1.21	0.41
A Line Snuggler is exactly what I need for line organization and protection.	1.14	0.35
Using a Line Snuggler has been a good experience.	1.09	0.29
Line Snugglers protect my patient/child's central line, IV caps and tubing from unexpected fluid spilling on them.	1.09	0.29
Line Snugglers shelter my patient's/child's central line, IV caps and tubing from traditional childhood activities.	1.09	0.29

Note: item response range from 1=strongly agree to 5=strongly disagree; M=mean; SD= standard deviation

We asked clinicians to please share a story or anecdote you have witnessed about a Line Snuggler benefiting a patient:

- A patient I was caring for vomited on themselves. Luckily, she had her Line Snuggler on, and did not get any fluids on her central line. This eliminated the need for antibiotics and further testing, since the integrity of the line was not compromised.
- A patient who loved to walk in the hallways was able to get a line snuggler after his mom had previously used a glove and tape to organize, secure, and protect his lines. The line snuggler allowed this organization, security, and protection and eased walking in the hallway with her child.
- I cannot say enough good things about how much I LOVE Line Snugglers! They are so secure, so safe, and so time efficient for nursing. I can't tell you the amount of times they have save a line break, especially at night. They make walking in the hallway while on the IV pole a million times easier and safe. Instead of trying to hold 9 IV lines, EKG leads, a pulse ox, and an NG tube you can safely hold just one line snuggler with everything tucked inside. Lab draws and central line access at night is safe and fast when the lines are neatly placed in a snuggler. We used to wrap lines in plastic bags and coflex to keep them safe which was disorganized, loud, and hard to do. Some people wouldn't go the extra yard to do this which lead to more line breaks, as well. In my experience the kids love their line snugglers as well. If I am ever in the hospital myself or for my family member I hope that I can have a line snuggler, even as an adult.
- I have experienced many instances when a patient's central line has been saved from emesis or stool from the line snuggler. This has prevented the need for blood cultures being drawn, possible infection and need for antibiotics.
- I have had patient's lines be protected from vomit, stool, and even feeds leaking from an NG/g-tube due to the line snuggler.
- I have had several incidents were the line smuggler has protected the lines and caps from different bodily fluids (emesis, urine, etc.). The waterproof lining protected the patient from cap changes, blood cultures and additional antibiotics. We were able to simply remove the snuggler and place the extra one on the lines.
- I have on multiple occasions had a patient who vomits or stools and it reaches places you wouldn't think it could reach. The line snuggler always protects my patient's lines and eliminates the time-consuming and worrisome process of changing out all of the lines, changing caps, culturing the lines, and splitting antibiotics through lumens. Parent, patient, and staff satisfaction is largely increased by the use of a line snuggler.
- I have seen line snugglers protect central lines from emesis, stool, and leaking enteral feeds. This both benefits the patient (decreasing the risk for infection), the nurses (saving time as we do not have to make new lines, change caps, etc.), and the hospital (no extra cost to provide antibiotics and all new drip medications depending on where the line was contaminated).
- Lines snugglers help save pt lines from contamination
- Multiple times I was caring for a patient and had it catch unwanted fluid (tube feeds, emesis, bubbles, paint, etc) from reaching a patient's lines. Parents enjoy knowing the lines are protected so their child can play and they don't have to be as concerned about the patient's lines.

- My patient had a very large stool and the line snuggler protected the lines by preventing the stool from getting onto the lines.
- No comment
- On multiple occasions I have watched families/patients spill or body fluids would be on a line cover, and the lines were completely dry. The snuggler clearly protected the lines.
- Taking care of a 6 yr old “diagnosis” pt, she liked to sleep prone if not in fetal position. She was not always able to communicate when she would vomit or have an accident. If it wasn't for her line snuggler, her CVL would have been contaminated multiple times with vomit and stool. It possibly saved her from additional exposure to antibiotics and line stream infections.
- There have been multiple times recently where a pt stooled a large amount and stool covered the line snuggler but was found nowhere on the IV lines.
- There was a really pukey 3-yr old that would frequently throw up. She had already thrown up once on her lines (pre-Line Snuggler), requiring cultures from all lumens and then needing a dose of antibiotics. Parents were upset that this happened and felt at fault. A few days later, I had this patient again, and she threw up again, but this time with a Line Snuggler on! It protected her lines and protected her from pathogens! The Line Snuggler got dirty, but her lines did not. In this situation, it helped save resources (cultures), lessened the use of antibiotics, and most importantly, saved the severely immune-suppressed patient from an exposure to pathogens!
- Throughout the BMT process, our patients (infants, toddlers, and even adolescents) occasionally lose control of their bodily functions from the chemotherapy or perhaps medications that we are giving them. Therefore, I have seen countless times where our patients have vomited or stooled right where their lines would have been. Fortunately for all parties involved, those lines have been saved by the line snuggler protecting them!
- Very impressed with this product. Excellent patient, family, RN and provider satisfaction. Would highly recommend using for all pediatric oncology or BMT patients.
- With a very active patient, 6 years old, the line snuggler protected from food and drink spills. In addition, it created an "out of site, out of mind" for the young child and kept her from playing with or touching her central lines, providing an overall cleaner environment for her lines. They also made walking throughout the unit much easier and efficient with great organization of lines.

We asked clinicians what, if any, safety issues have you observed during use of the Line Snugglers?

- I have not observed any safety issues regarding the use of Line Snugglers! In fact, I think it helps safety!
- Many parents mention the top Velcro piece as an irritant for their child's skin (itching and scratching esp while they sleep). I usually have to cover that part of the line snuggler with soft koflex.
- No comment
- No safety issues noted.

- none
- None
- none
- None
- None
- none witnessed
- NONE! They are amazing!
- The only one that comes to mind is if an emergent situation were to arise, having the line snuggler in place could be a barrier to accessing the lines as quickly.
- The Velcro can be irritating on the patient's skin
- They make the lines slightly heavier (especially for an already heavy line), jeopardizing the CVL dressing.

Other comments?

- 2 thumbs up for line snugglers!
- Absolutely love the line snuggler and hope that any patient or family that could benefit from one has the opportunity to have one!
- Families have expressed their concern with the price of the line snugglers. They would be a wonderful thing to stock on the unit, but I am personally not a fan of pushing families to buy them.
- I absolutely love line snugglers. I hope that we can use them for all of our patients in the future. They give me a peace of mind, especially with our pediatric population who are undergoing chemotherapy and having n/v/d. I have witnessed first hand how amazing these line snugglers are, and I am very excited about using them more in the future.
- It is helpful to have a backup line snuggler (or multiple backups!) in the case that the snuggler gets soiled and needs to be washed. In the time that it's getting washed, it is not unusual for the patient to have another episode of emesis or diarrhea that may get on the lines.
- Line snugglers are a great addition to our unit!
- My only reason for choosing Neither for question #20 was because I am unaware of how much the Line Snugglers cost.
- Parents and RN's love them!
- The only minimal issue is that occasionally the Velcro will wake a sleeping child when routine access is needed. Most children aren't affected but very light sleepers are.
- This is the best product on the market for line safety and patient safety.

Families Report High Satisfaction with the Line Snuggler

We assessed family satisfaction (N=25) with using the Line Snuggler for patient care. Among a sample of family members, users reported high satisfaction with use of the Line Snuggler. Table 3 shows the results from the survey (1=strongly agree to 5=strongly disagree). Lower numbers indicate strongly agreeing with the statements.

Table 2. Satisfaction Survey Results (N=25)

Survey Item	M	SD
The Line Snuggler improved my patient's/child's ability to walk with an IV pole and connected IV tubing.	1.28	0.46
I would be willing to have my patient/child use the Line Snuggler for every admission on the inpatient unit.	1.24	0.44
It is important to have the Line Snuggler keep the lines organized.	1.48	0.71
It is important to have the Line Snuggler keep the lines off the patient/my child and the bed.	1.44	0.71
Patient/family understands how to use Line Snugglers.	1.40	0.71
Patient/family can easily use Line Snugglers.	1.33	0.70
Line Snugglers are easy to apply.	1.72	0.94
Line Snugglers save nurses time.	1.40	0.58
It is easy to teach others how to use Line Snugglers.	1.44	0.65
I would use Line Snugglers for other patients.	1.52	0.71
Line Snugglers increase patient safety.	1.76	0.78
Line Snugglers increase work productivity.	1.71	0.75
Line Snugglers increase work quality.	1.67	0.82
Line Snugglers increase staff satisfaction.	1.32	0.48
Line Snugglers increase parent-patient satisfaction.	1.32	0.56
Line Snugglers provides a peace of mind that my patient's/child's lines are protected.	1.40	0.65
Line Snugglers decrease the worry of my patient's/child's family surrounding central lines.	1.64	0.76
Line Snugglers decrease adverse events.	1.28	0.46
Line Snugglers require minimal training.	1.87	0.97
Line Snugglers are cost effective to implement.	1.72	0.94
Line Snugglers do not hinder routine access of lines.	1.56	0.71
Line Snugglers are some of the best products for line organization and protection for my patient/child.	1.48	0.65
A Line Snuggler is exactly what I need for line organization and protection.	1.28	0.46
Using a Line Snuggler has been a good experience.	1.28	0.54
Line Snugglers protect my patient's/child's central line, IV caps and tubing from unexpected fluid spilling on them.	1.36	0.49
Line Snugglers shelter my patient's/child's central line, IV caps and tubing from traditional childhood activities.	1.28	0.54

Note: item response range from 1=strongly agree to 5=strongly disagree; M=mean; SD= standard deviation

We asked family members to share a story or anecdote they have witnessed about Line Snuggler benefiting a patient:

- Was able to get out of bed easier without having to gather all of my lines. ~The snuggler protected the lines from spills and accidents; also made clean up faster
- Thanks, this has helped a lot, prefer to have design on outside of course.... but it's not that important. My son rolls over a lot at night and this kept his lines tangle free; my son vomited and some got on the snuggler- but his lines stayed dry and clean.
- I don't know how much it cost to mak[e] a line snuggler so I cannot answer question 20. But what I can say the vest is a great idea but you need a little in pavement with the pattern you must break it up in order for it not to look complicated. Outside of that it is a great product I have love it . Thank you the “last name” family.
- I love the Line Snuggler. My grandson’s lines where all over the place even the floor before the Line Snuggler. Now they are together neatly wrapped and organized. I would recommend that they come in longer lengths. Thank you for such a great idea.
- In my opinion the line snuggler makes it easier to move around with the iv pole. This eliminates the need to hold the lines to keep them from being tangled or dragging on the floor.
- It was easy for my son to walk while being hooked up. It also prevented him from getting tangled up in his lines overnight.
- It's thicker, so it's harder for little kids to pull on it.
- My daughter has many lines and the line snuggler was amazing in not only keeping them clean, but also keeping them from tangling and my daughter getting her hands caught up in them. I LOVE IT!!
- Once, our daughter's diaper leaked, which required cleaning everything that had been contaminated. Since we were using a line snuggler, we could tell at a glance that since it wasn't dirty the 10+ lines running through it were also clean and didn't need to be cleaned or changed.
- Our child is very particular about her lines and when they get tangled her anxiety increases. With the line snuggler she has not even been paying attention to her lines and if she wants or needs to, she can adjust the line snuggler herself.
- The line snuggler protected my son’s lines during two events that would have caused a need for complete line change and it being the middle of the night. It's safe and easy to use as a parent and gives perfect access for the nurses.

Other comments:

- Great design and wonderful product
- Great product, would recommend to anyone!
- So easy to wash and clean.
- The only thing that I think could be simplified is the vest. The arm straps didn't seem necessary to keep the lines held up with the Velcro piece that goes around the stomach. I think it would still work fine and there would be less velcro for sensitive skin.