

When Light Can Lead to Harm: Neonatal TPN and Lipid Light Protection

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LOYOLA
MEDICINE

INTRODUCTION

OVERVIEW

Loyola University Medical Center is approximately 12 minutes west of Chicago. A 50-bed Level III NICU, it is one of 10 Perinatal Centers in IL and is a member of the Vermont Oxford Network (VON).

Total Parenteral Nutrition (TPN) and lipids are often required in preterm infants and sick term newborns to maintain required nutrition. There has been controversy in the past as to whether or not these TPNs require light-protection. In September 2021, the American Society of Enteral and Parenteral Nutrition (ASPEN) recommended that all neonatal TPN, lipids, and tubing be light protected.

Most previous recommendations for shielding light sources come from adult data. However, there is a growing concern that neonates, especially premature neonates, may be susceptible to significant adverse effects associated with breakdown products when TPNs and lipids are exposed to light. Specifically, oxidants (free radicals) including peroxides/peroxidases and cytotoxins such as aldehydes can form with light exposure to TPN and lipids. Preterm neonates are even more vulnerable due to their weakened anti-oxidant defense system and exposure to other oxidative stress (i.e. oxygen therapy, phototherapy), which increases the risk of tissue damage and can be associated with hypoxic-ischemic encephalopathy, intraventricular hemorrhage, chronic lung disease, retinopathy of prematurity, necrotizing enterocolitis (NEC) and intestinal failure-associated disease.

An ideal scenario would offer complete photoprotection, however, there is limited materials available to accomplish this. Even though there may be amber colored tubing available, not all companies have adapted tubing to fit certain infusion pumps nor provide amber colored microbore tubing needed for use in infants.

To achieve this goal, our NICU formed a multidisciplinary team to determine the products and procedure needed to provide light protection for TPN, lipids and tubing while performing a sterile line set-up/change.

AIM

The aim of this project is to provide light protection to TPN, lipids and tubing to reduce neonatal exposure to additional oxidants and toxic agents during their hospitalization.

TEAM MEMBERS

- o NICU Nursing
- o Pharmacy
- o Service Coordinators (Unit Secretary's)
- o NICU Medical Team
- o Supply Chain

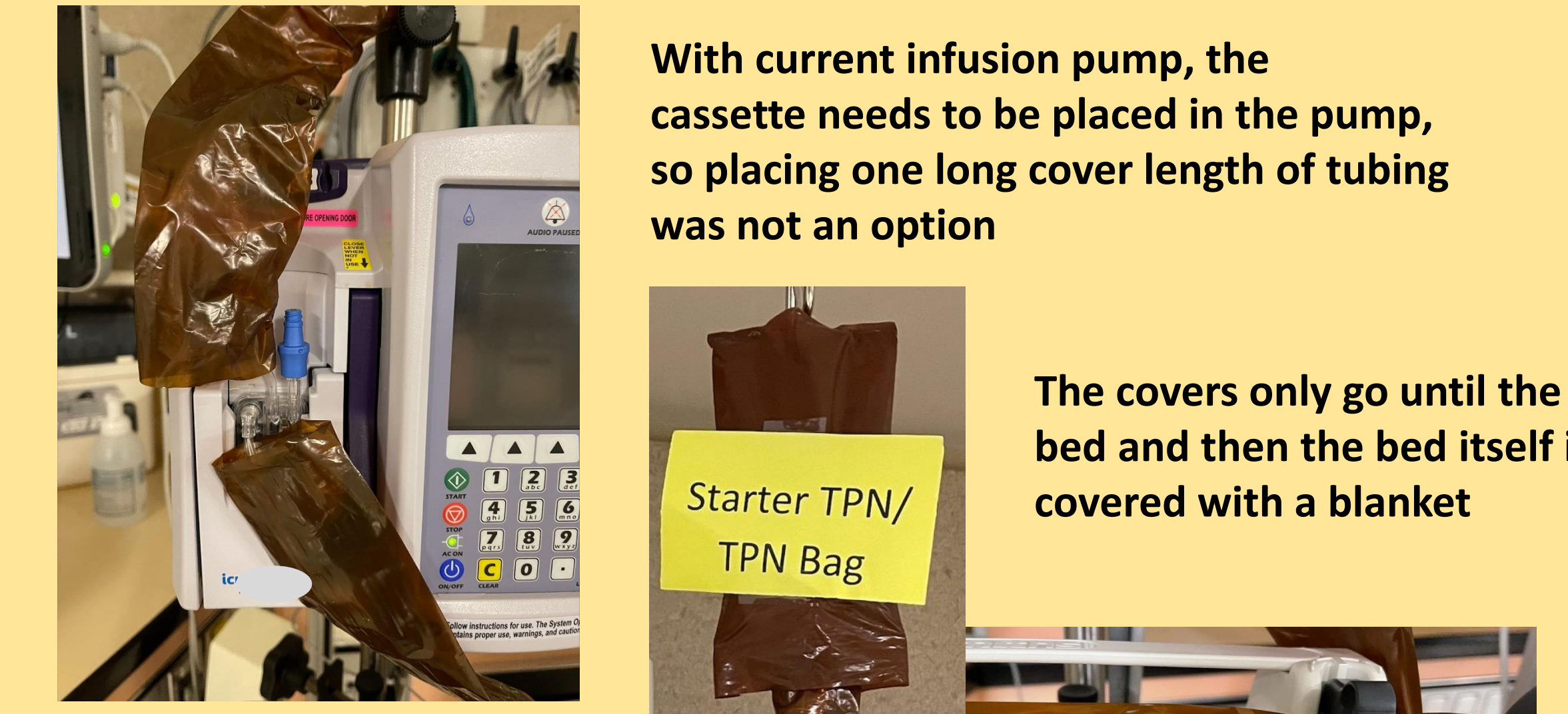
KEY COMPONENTS

Central Line (CL) Tubing Changes with Light Protection Cover for TPN & IL

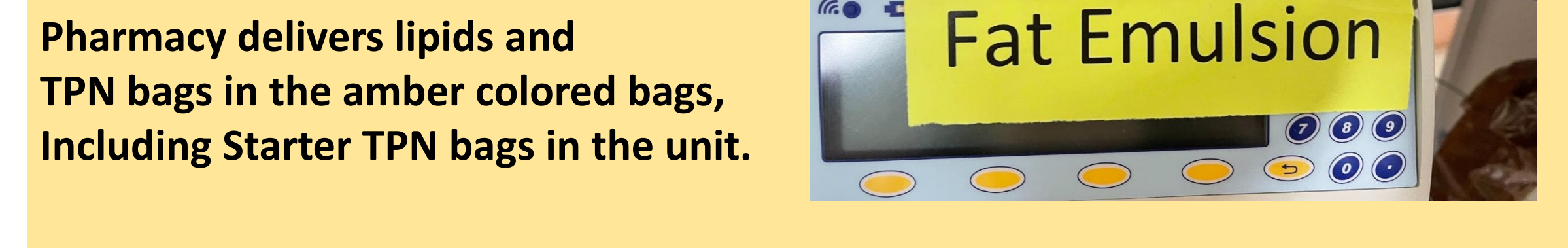
Light Protection Covering Set Up for TPN & IL	
Central Lines need to be kept as sterile as possible	
SUPPLIES: Clean and sterile gloves, hat, mask, CL Tubing Change Kit, Pre-cut Amber IV Tubing Covers (x3), Sterile Field, and additional tubing and Microclaves for fluids/medications if needed (Fentanyl, Dopamine, etc.)	
NOTE: Pharmacy will deliver TPN and IL (with filter & tubing) with the Amber Bag covers for the bag/syringe only. NICU RNs will add tubing cover to the IV tubing.	
1.	Clean pump and work area with PDI wipe (grey top)
2.	Wash hands and don hat, mask and clean gloves
3.	Remove CL Tubing Change Kit from packaging and open on cleaned work area
4.	Unwrap CL Tubing Change Kit and open white sterile barrier; Remove and open blue sterile field from kit
5.	Discard OLD Medline packaged tubing (Smiths Medical-Medex)
6.	With CLEAN gloves, remove Plum Pump Primary Tubing with Cassette from CL Tubing Change Kit and place on blue sterile field (REMEMBER: do not touch other sterile pieces underneath the Primary Tubing!); Keep the rest of the CL Tubing Change Kit covered and to the side until step 12
7.	Slide small amber tubing cover on Plum Pump Primary Tubing above the Plum Cassette (Make sure cap remains on spike)
8.	Slide large amber tubing cover on Plum Pump Primary Tubing below the Plum Cassette (Make sure cap remains on end of tubing)
9.	Slide the IL amber tubing cover over the IL tubing (connected to syringe). (Make sure cap remains on end of tubing)
10.	Keep all tubing with amber tubing covers off to side until step 15
11.	Open second sterile field; If additional lines for fluids/medications are needed, open and carefully drop any extra tubing and Microclaves onto second sterile field
12.	Remove clean gloves, gel or wash hands, and DON STERILE GLOVES
13.	Carefully drop remaining items from CL Tubing Change Kit onto second sterile field; Organize all items on sterile field, open alcohol packets
14.	Attach Microclave to end of 5-lead filter extension set; Attach Microbore tubing and Microclave for medication line; Attach additional lines and Microclaves for fluids/medications to appropriate extension arms on 5-Lead (Fentanyl, Dopamine, etc.) if needed
15.	Using saline flush syringes included in kit, flush through added medication line (Microbore tubing) and length of extension arm (0.2 mL); If additional extension arms are <u>not</u> being used, flush through with saline and clamp each unused extension arm. If additional extension arms are being used (i.e. Dopamine); attach additional syringes, Do NOT flush yet! Attach IL Syringe/primed IL Tubing to extension arm.
16.	Remove cap from end of Plum Pump Primary Tubing and attach to the 5-lead filter extension set
18.	Prime each additional syringe with fluid/medication until the extension arm; Spike IV fluid bag and run fluid through tubing, place in pump and set pump; place additional syringes in pumps, set each pump and finish priming each pump
19.	If infant in isolette, open/drop down door (observe safety precautions)
20.	Remove gloves, gel or wash hands and DON NEW STERILE GLOVES
21.	Place sterile 4x4 gauze pad (from kit) under patient CL connection site (Microclave)
22.	Clean around connection site between CL tubing and existing Microclave with alcohol pad (as for Scrub the Hub); Allow to dry
23.	Clamp/pinch off patient CL and remove existing Microclave
24.	Attach new Microclave/CL tubing set
25.	Unclamp CL main line tubing and extension arms with running lines; Run IV(s)
26.	Attach Swap Caps on all ports; label all tubing (96 hour on all tubings EXCEPT IL tubing - 24 for IL)

Things to Remember	
Pharmacy will be delivering TPN and IL with primed tubing in light protection bags	
To make sure IL syringe is covered, cut open the identified "IL Syringe" amber colored tubing and place over the syringe on the pump to keep syringe covered but allows access to see syringe	
Make sure the amber tubing cover does not go into the isolette	
The amber tubing covers will be placed only on lines with TPN & IL and will be replaced each line change while TPN & IL are running	

Amber colored tubing covers are individually cut and separated based on the size:
1.) Main IV Tubing (above cassette)
2.) Main IV Tubing (below cassette)
3.) IL Tubing



The covers only go until the bed and then the bed itself is covered with a blanket



LIMITATIONS

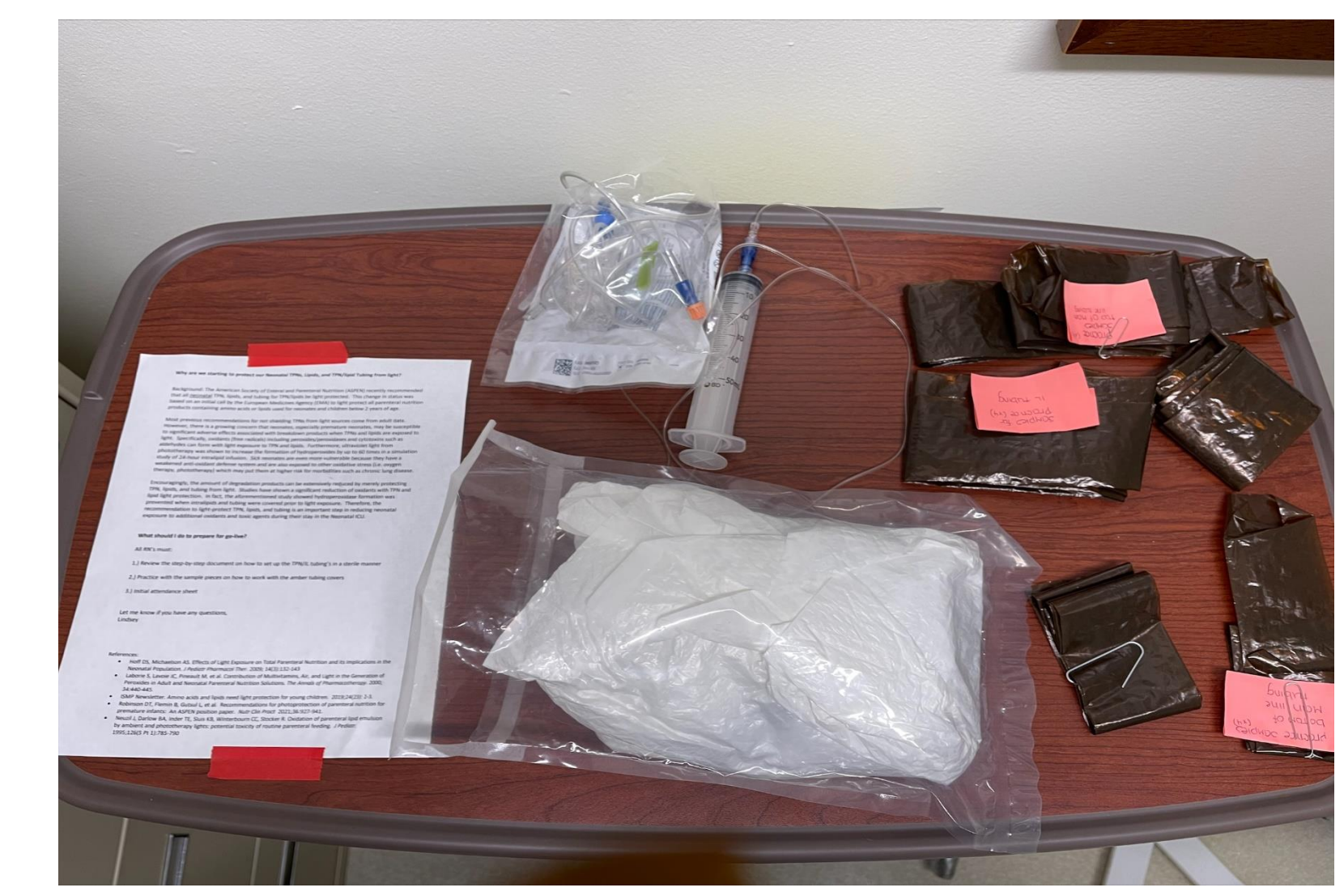
- Amber covers over syringe/TPN bag and tubing obstructs easy view of the label
- Using a non-sterile product when setting up a sterile connection
- If staff forgets to add amber coverings and lines are connected, there is an increased risk of infection if this process is done after the fact. Nursing will then cut the amber coverings and try to place them around the tubing

IMPLEMENTATION

Discussion within the Neonatal ICU Medical team started in January of 2022 to implement this practice. Research began to evaluate if amber colored tubing was a possibility for our current infusion pump and research what other products were available. Amber tubing was not compatible with our set-up but other products were found for tubing, TPN bags and lipid syringes.



Once the products were identified, many step-by-step processes were worked out to ensure sterile line set-up/change and decrease stress on nursing. Nursing education was started in June with review of a step-by-step written guideline and a station for nurses to practice set-up. Group in-services were provided and super users were identified. Process will be evaluated and optimized in 4th quarter 2022.



Education was provided to the Service Coordinators (Unit Secretaries) in June on how to cut the various sizes of the amber colored tubing covers. This includes ensuring the bins are stocked efficiently with all sizes.

ACKNOWLEDGEMENTS

We would like to thank all the NICU nurses for their dedicated work in learning this new process while focusing on maintaining a CLABSI free environment. A special thank you to Dr. Sachin Amin, NICU Medical Director, unit secretaries, Pharmacy, and Supply Chain.

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