

Optimization of Intravenous Lipid Emulsion Use in Pediatric Patients Receiving Parenteral Nutrition at Harborview Medical Center



Skyler Austin | UW Food Systems, Nutrition, and Health Program | MS in Nutrition and GCPD Student

PURPOSE

This quality improvement project evaluated whether pediatric parenteral nutrition (PN) practices at Harborview Medical Center (HMC) align with current evidence and guidelines and identified opportunities to reduce the risk of liver dysfunction through earlier SMOF-ILE use and improved monitoring.

BACKGROUND

Current HMC practice is to initiate pediatric PN with a soy-based intravenous lipid emulsion (SO-ILE) and monitor aspartate aminotransferase (AST) and alanine aminotransferase (ALT) weekly to assess liver function. If these labs are measured three times above normal twice, the patient is transitioned to soy-, MCT-, olive-, fish-oil lipid emulsion (SMOF-ILE), a mixed-lipid emulsion.

In 2018, ESPGHAN/ESPEN/ESPR released pediatric PN guidelines strongly recommending patients be started on SMOF-ILE if expected to receive PN for more than a few days.¹ This is based on an increased risk of developing intestinal failure-associated liver disease (IFALD) while on PN.² IFALD is characterized by cholestasis, defined by a conjugated bilirubin of ≥ 2 mg/dL.²

ACKNOWLEDGEMENTS

Special thanks to Beth Faw, MPH, RD, CNSC, Pediatric ICU Dietitian at HMC for serving as my project preceptor and for providing invaluable mentorship, clinical insight, and support throughout this QI project.

For references, please contact sausti@uw.edu.

INTRAVENOUS LIPID EMULSION COMPARISON

SO-ILE <i>100% Soybean Oil</i>	SMOF-ILE <i>30% Soybean, 30% MCT, 25% Olive, & 15% Fish Oil</i>	IMPLICATIONS
↑ 7:1 ratio of Omega-6 to Omega-3 ↑ Phytosterols ↓ 35-38 mg/dL of alpha-tocopherol	↓ 2.5:1 ratio of Omega-6 to Omega-3 ↓ Phytosterols ↑ ~200 mg/dL of alpha-tocopherol	- The ratio of omega-6 to omega-3 will determine the ratio of pro- and anti-inflammatory mediators, respectively, with ideal a ratio range of 1:1 to 4:1³ - Phytosterols have been observed to accumulate in the liver and plasma of pediatric patients reliant on long-term PN is correlated with liver dysfunction² - Alpha-tocopherol is a potent antioxidant that reduces lipid peroxidation and liver damage^{1,2}

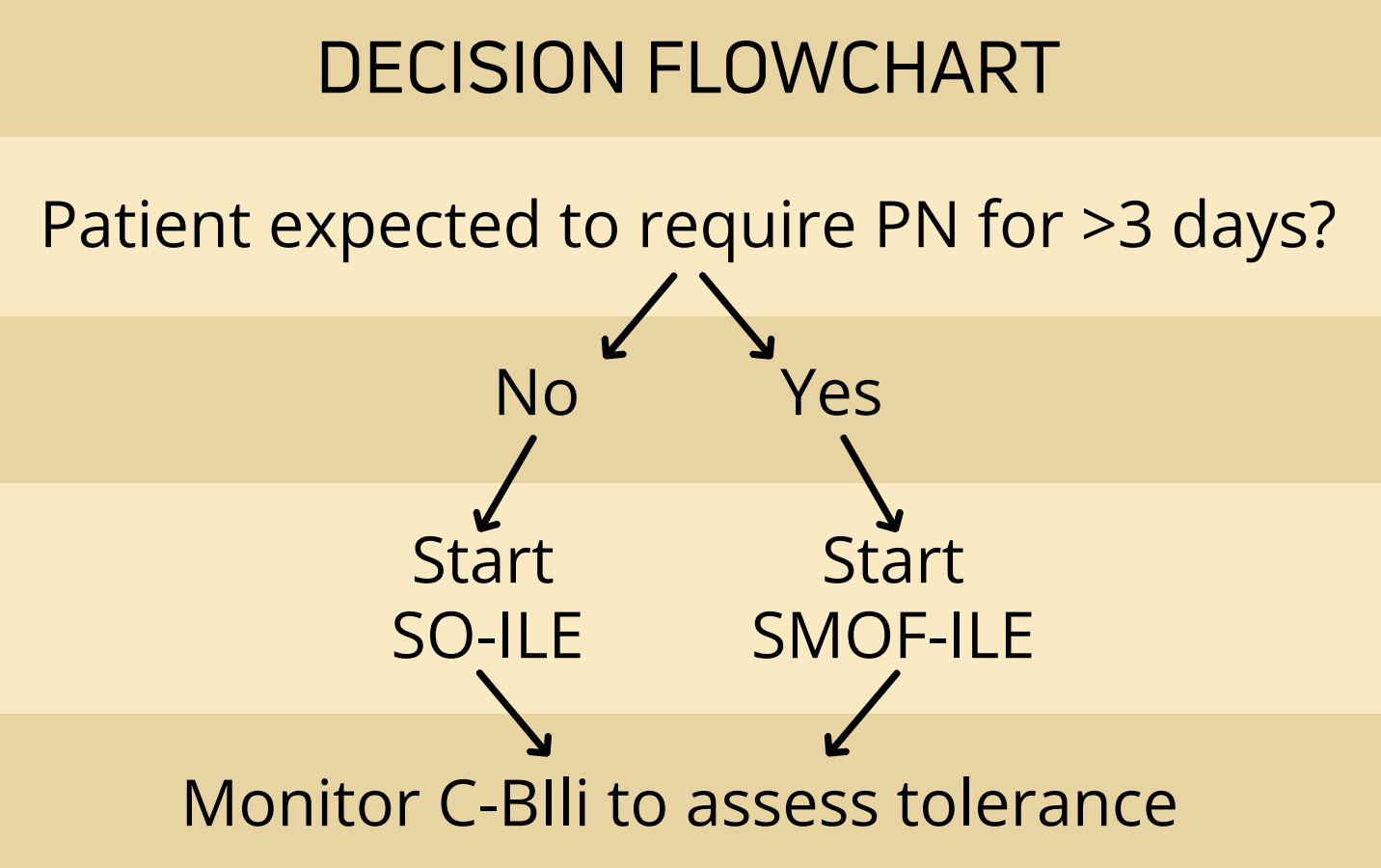
LITERATURE REVIEW

A literature review of studies published after the 2018 pediatric PN guidelines evaluated the liver function, disease outcome, and length of stay (LOS) associated with SMOF-ILE versus SO-ILE.

AUTHOR	STUDY TYPE	SAMPLE SIZE	RESULTS
Daniel, Shawnée, et al.	Retrospective Cohort	101 (60 in SMOF-ILE, 41 in SO-ILE)	- Higher incidence of IFALD with SO-ILE (32% vs. 12%, p=0.03) - Higher AST concentrations at 3-6 months (p=0.06), and higher levels of bilirubin (p=0.03)
Gupta, Neha, et al.	Retrospective, Observational	145 (111 on SO-ILE, 34 on SMOF-ILE)	Higher serum triglyceride in the SO-ILE group (p=0.002)
Haines, Krista L., et al.	Retrospective Cohort	684 (206 on SO-ILE, 478 on SMOF-ILE)	- Shorter LOS in the SMOF-ILE group (13.1 day reduction, p<0.001) - Lower serum levels of ALT and T-Bili on SMOF-ILE (p=0.02 and p=0.04)
Abrams, Steven A., et al.	Randomized, Controlled, Double-Blind, Multicenter	161 (83 on SMOF-ILE, 78 on SO-ILE)	Significantly lower C-Bili concentrations (p=0.0001) and length-of-stay (p<0.001) on SMOF-ILE

RECOMMENDATIONS

- Consideration should be given to updating HMC pediatric PN guidelines to:
- Utilization of SMOF-ILE as the preferred lipid emulsion** for patients anticipated to require PN for more than a few days
 - Update monitoring protocols to incorporate **C-Bili as the primary marker** of PN tolerance and liver dysfunction



RISK ASSESSMENT

- FINANCIAL CONSIDERATION:**
 - SMOF-ILE costs ~\$8.59 more per 250 mL bag
 - Cost difference potentially offset by decreased LOS
- REVISION OF PRACTICE:**
 - Dietitian- or Pharmacist-led in-services on revised protocol for care team
 - Dissemination of supporting literature to ensure adherence to updated standards of practice
- LIMITATION OF LITERATURE:**
 - Increased risk of confounding and reduced generizability due to study design
 - The 2018 guidelines support the clinical relavence of SMOF-ILE in long-term PN