The Association between a Four-Oil Lipid Emulsion and Parenteral Nutrition Associated Liver Disease–Related Laboratory Values in Adults Receiving Home Parenteral Nutrition

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Statement of Disclosures

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Agenda

- Background
- Objective
- Methods
- Results
- Conclusions
- Strengths, Limitations, Take Aways

Background

Home parenteral nutrition (HPN) is recommended for patients unable to meet their nutrition needs through an oral or enteral route

- Includes lipid injectable emulsions (ILE) as a macronutrient component, traditionally composed of soybean oil (SO); good source of essential fatty acids
- Pro-inflammatory nature of SO ILE is a potential factor in parenteral nutrition associated liver disease (PNALD) development
- Four-oil ILE is now FDA-approved for use as calorie source in adults
  - 30% SO, 30% medium-chain triglycerides (coconut oil), 25% olive oil, 15% fish oil
  - Fatty acids in fish oil contain anti-inflammatory properties
  - Potential benefit in treatment of PNALD with use of four-oil ILE; little data exists in HPN population

Objective

This study evaluated the association

between a four-oil lipid emulsion and PNALD-related lab values

in adult HPN patients with baseline abnormal liver function tests (LFTs).

Methods

Study sites:

- 12 branches of a large home infusion company in 9 states

Inclusion criteria:

- Adult HPN patients with baseline abnormal:
  - Alkaline phosphatase (ALP)
  - Alanine aminotransferase (ALT)
  - Aspartate aminotransferase (AST) **or**
  - Total bilirubin (T bili)

  x1.5 times the upper limit of normal
- Receiving four-oil ILE (Smoflipid®)

→ 77 patients included in the study

Methods

Data collected retrospectively at 6 different time points over 12 months (Baseline [four-oil ILE initiation], 1, 2, 3, 6 and 12 Months)

Primary Outcome Measures:

- Changes in ALP, ALT, AST and T bili between time points

  → High levels are indicative of liver disease

Secondary Outcome Measures:

- Changes in TG → High levels are indicative of lipid intolerance
- Reports of essential fatty acid deficiency (EFAD)

  → Physical symptoms: dry, scaly skin rash
  Elevated triene:tetraene ratio

Results: Participant Characteristics

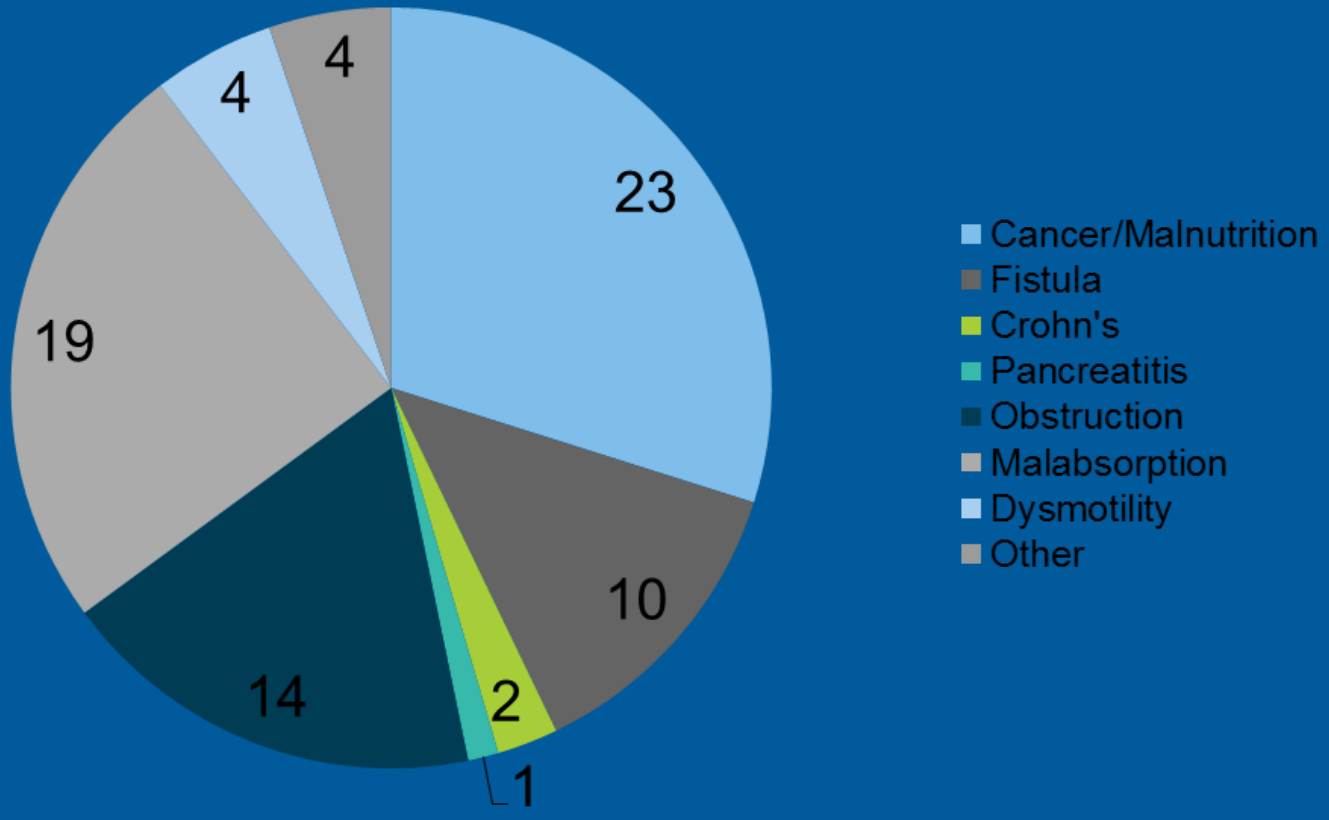
TABLE 1. BASELINE CLINICAL AND DEMOGRAPHIC CHARACTERISTICS OF SAMPLE (N=77)

	Mean ± SD	Range
Age (yr)	54.2 ± 13.3	21–77
Weight (kg)	58.0 ± 15.0	34.0–127.8
BMI (kg/m^2)	20.6 ± 5.0	12.1–48.3
Four-oil ILE intake (g/kg)	0.7 ± 0.3	0.04–1.74
	n	%
Female	45	58.4
Male	32	41.6

Mean 17.3 ± 29.9 months receiving HPN prior to Four-Oil ILE initiation
Key: SD, standard deviation; yr, year; kg, kilograms; BMI, body mass index; kg/m^2, kilograms per meters, squared; ILE, lipid injectable emulsion

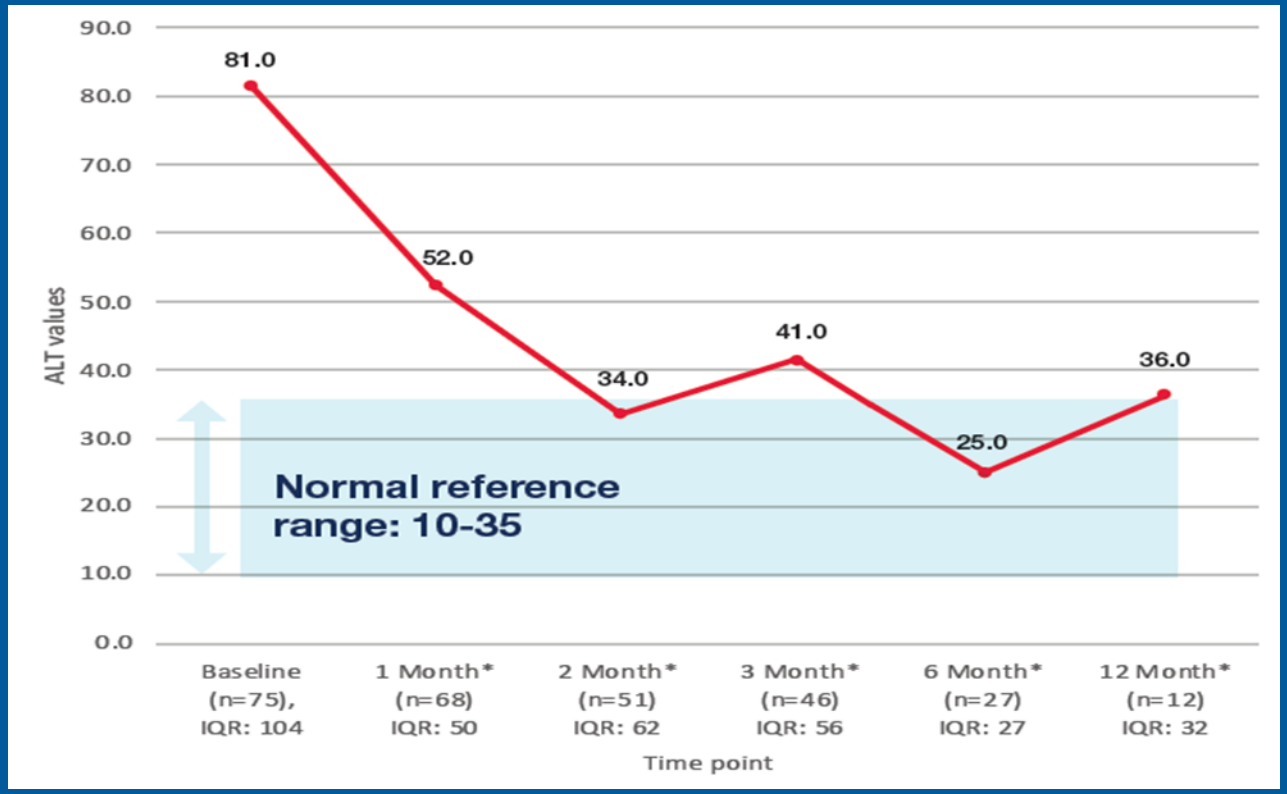
Results: Participant Characteristics

FIGURE 1. PRIMARY HPN INDICATION OF SAMPLE (N=77)



Results: ALT

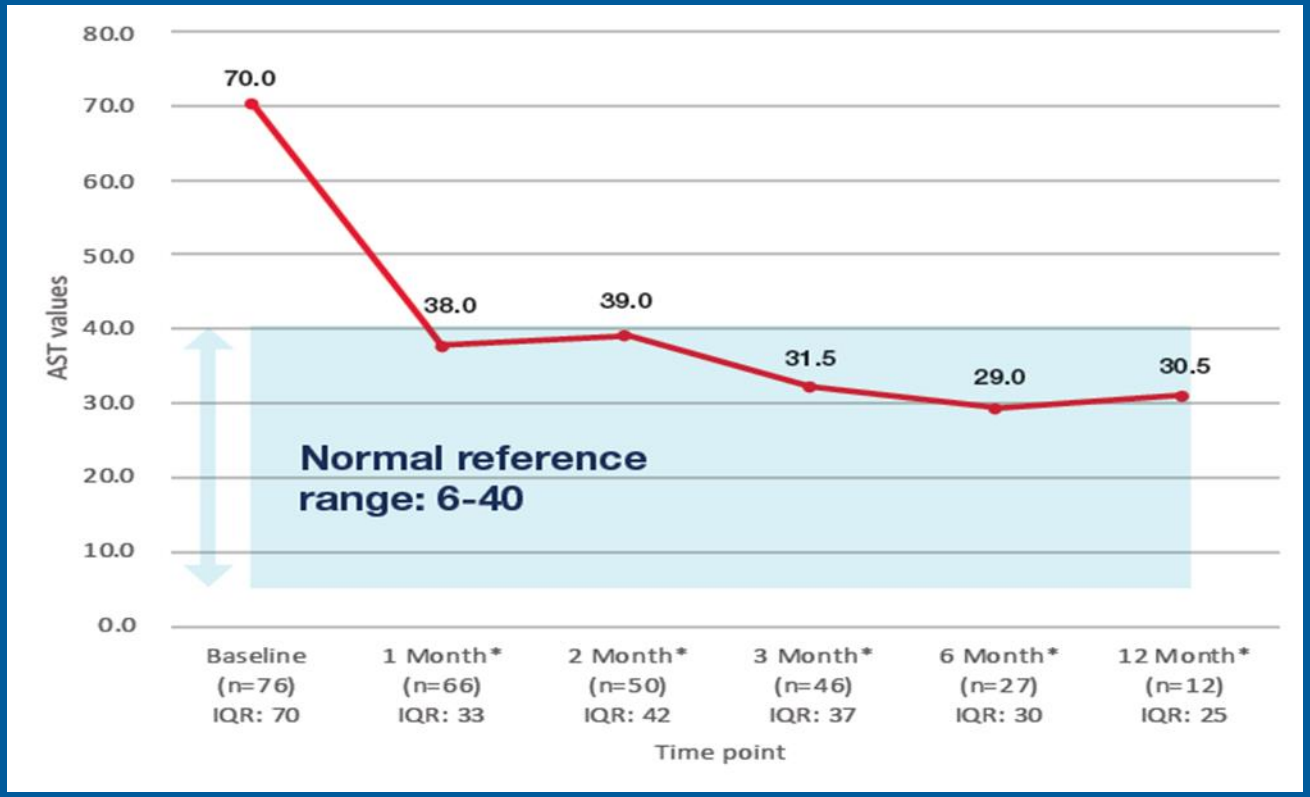
FIGURE 2. COMPARISON OF ALT LEVELS BETWEEN TIME POINTS WHILE RECEIVING FOUR-OIL LIPID EMULSION



ALT values reported in units per liter
Median values reported with interquartile range (IQR)
*$p \leq 0.05$: Baseline to 1 Month, 2 Month, 3 Month, 6 Month & 12 Month; 1 Month to 6 Month & 12 Month; 2 Month and 3 Month to 6 Month
Kruskal-Wallis tests and post hoc Mann-Whitney U tests were used to detect changes between time points

Results: AST

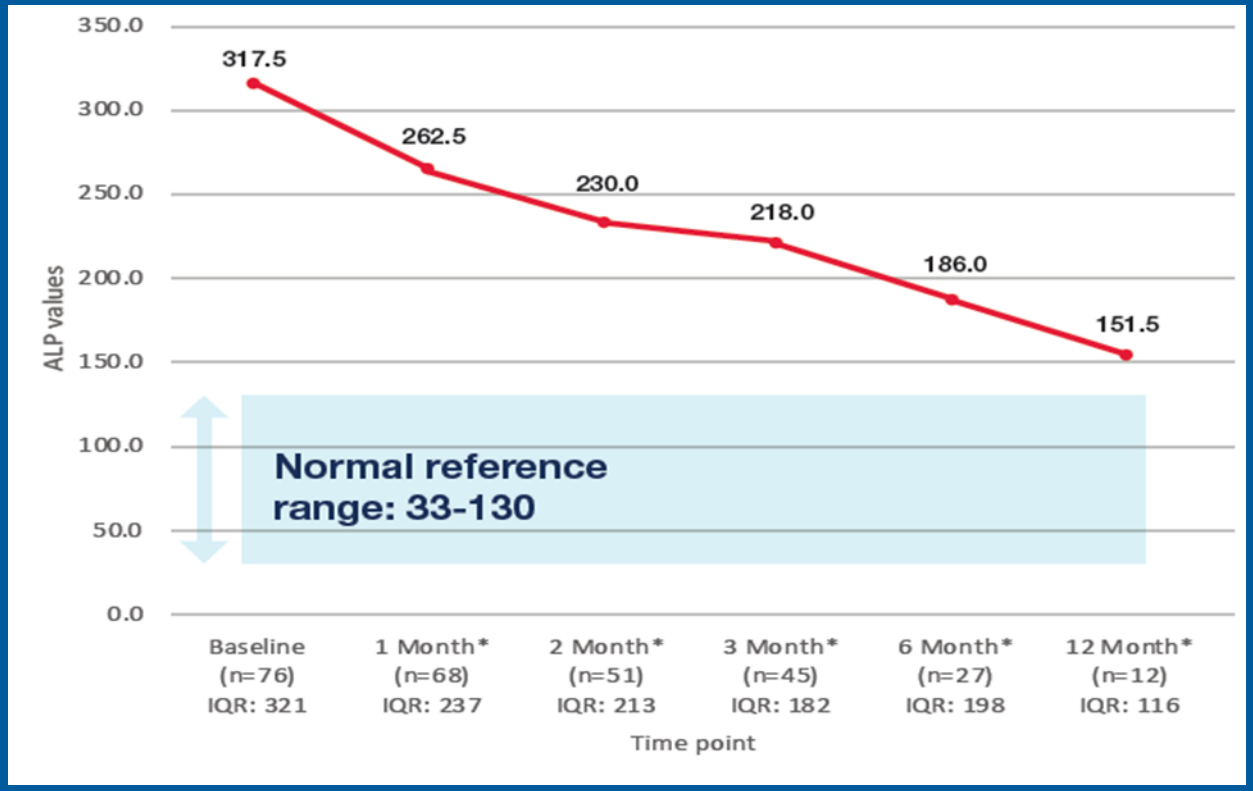
FIGURE 3. COMPARISON OF AST LEVELS BETWEEN TIME POINTS WHILE RECEIVING FOUR-OIL LIPID EMULSION



AST values reported in units per liter
Median values reported with interquartile range (IQR)
*$p \leq 0.05$: Baseline to 1 Month, 2 Month, 3 Month, 6 Month & 12 Month
Kruskal-Wallis tests and post hoc Mann-Whitney U tests were used to detect changes between time points

Results: ALP

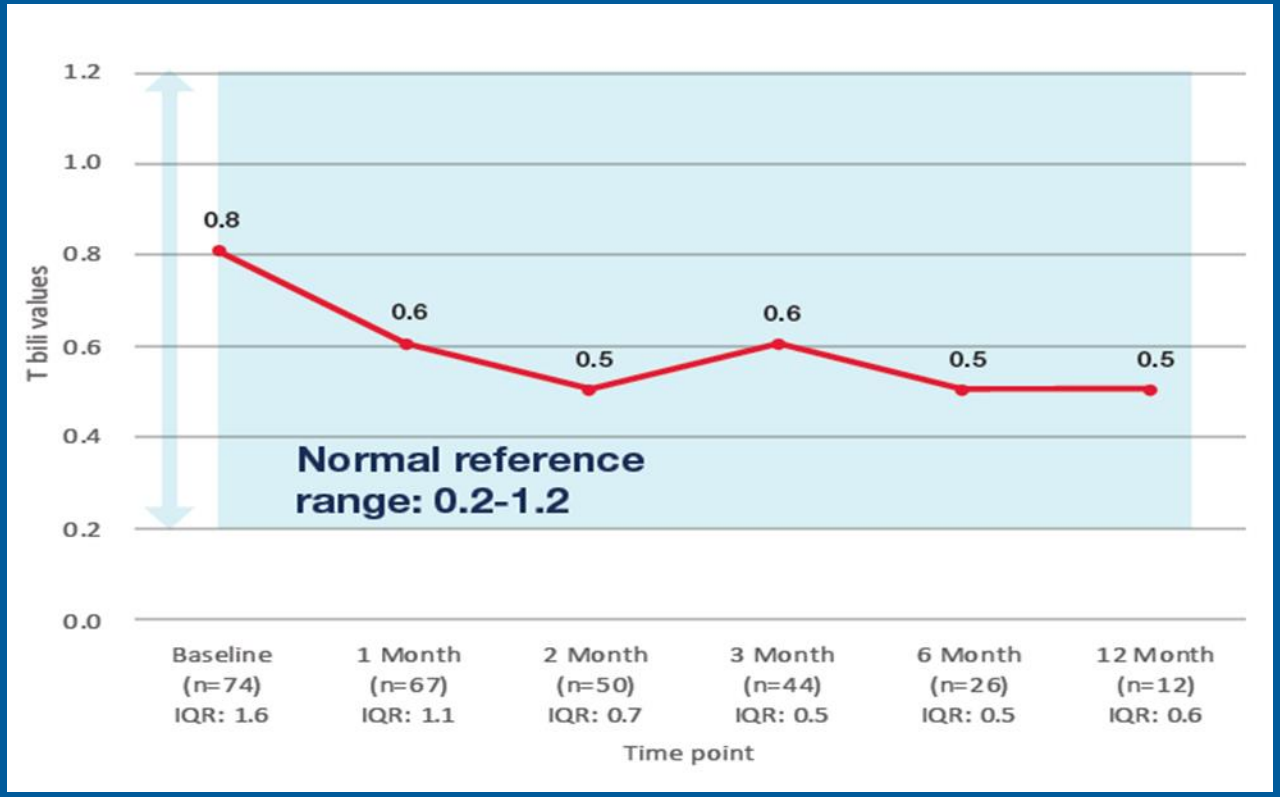
FIGURE 4. COMPARISON OF ALP LEVELS BETWEEN TIME POINTS WHILE RECEIVING FOUR-OIL LIPID EMULSION



ALP values reported in international units per liter
Median values reported with interquartile range (IQR)
*$p \leq 0.05$: Baseline to 2 Month, 3 Month, 6 Month & 12 Month; 1 Month to 12 Month
Kruskal-Wallis tests and post hoc Mann-Whitney U tests were used to detect changes between time points

Results: T Bili

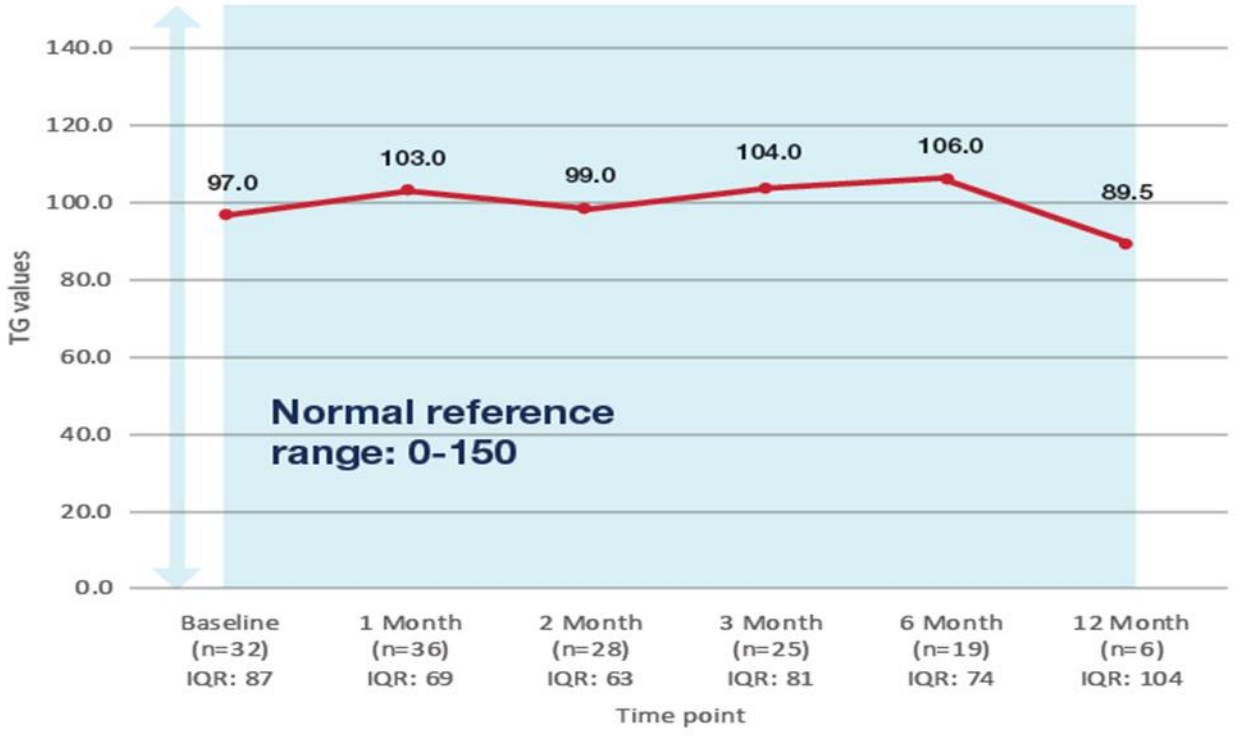
FIGURE 5. COMPARISON OF T BILI LEVELS BETWEEN TIME POINTS WHILE RECEIVING FOUR-OIL LIPID EMULSION



T bili values reported in milligrams per deciliter
Median values reported with interquartile range (IQR)
Results were not statistically significant
Kruskal-Wallis tests and post hoc Mann-Whitney U tests were used to detect changes between time points

Results: TG

FIGURE 6. COMPARISON OF TG LEVELS BETWEEN TIME POINTS WHILE RECEIVING FOUR-OIL LIPID EMULSION



TG values reported in milligrams per deciliter
Median values reported with interquartile range (IQR)
Results were not statistically significant
Kruskal-Wallis tests and post hoc Mann-Whitney U tests were used to detect changes between time points

Results: Essential Fatty Acid Deficiency

EFAD manifestation

- There were two reports of physical manifestations of EFAD (dry, flaky skin) at the Baseline (n=1) and Month 1 (n=1) time point in the same patient
- No triene: tetraene ratio results were reported for any subject at any time point

Conclusions

ALT	AST	ALP
• Statistically significant decrease from Baseline to Month 12 • Initial return from abnormal values at Baseline to normal at Month 2 • Month 12 values near normal	• Statistically significant decrease from Baseline to Month 12 • Sustained return from abnormal values at Baseline to normal at Month 1	• Statistically significant decrease from Baseline to Month 12 • Trend toward normal values from Baseline to Month 12

Limitations & Strengths

LIMITATIONS

- Retrospective design only allows for association, not causation
- Volume & frequency of soy-based ILE was not always known prior to change to four-oil ILE
- Unable to make definitive conclusions about EFAD

STRENGTHS

- Data was collected over 12-month period - longer than most comparable studies
- Four-oil ILE dosing was comparable - slightly higher than most related studies
- Intake of four-oil ILE was relatively stable over 12 months, slightly increased over time
- Relatively large sample size compared to related studies

Take Away Points

- **Further studies are necessary to confirm benefit of four-oil ILE over SO ILE in adult HPN patients with PNALD-related lab values**
- **Continue using strategies to reduce risk of PNALD development**
  - Avoid overfeeding of nutrients, ensure appropriate dextrose & ILE provision, cycle infusion over fewer hours
- **Consideration of four-oil ILE use in adult HPN patients with abnormal LFTs after appropriate formula adjustments have been implemented and elevated LFTs persist**

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