Fish Oil-Based Lipid Emulsion in an Adult Patient with Intestinal Failure-Associated Liver Disease
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Introduction
Intestinal failure-associated liver disease (IFALD) can occur in both adult and pediatric parenteral nutrition patients and may lead to a combined liver-intestine transplant. The exact etiology of IFALD has not been determined, although catheter infections are a known risk factor. Exact treatment has not yet been determined either, but there has been reported success, primarily in the pediatric population, of the use of a fish oil-based lipid emulsion (FOLE) that may help to ameliorate IFALD. This case study presents the second reported North American adult patient dependent on parenteral nutrition (PN) to receive FOLE.

Results
The patient is a 58-year-old Caucasian female with a complex medical history that began with a ruptured appendix at age six years. Subsequent repeated bowel obstructions and multiple bowel resections resulted in short bowel syndrome and PN dependence beginning in 2006, with only a gastric remnant — 50 cm of ileum (no ileoceleval valve) and rectosigmoid colon — remaining. Her medical history is also notable for rheumatoid arthritis, duodenal and gastric ulcers, and recurring enterocutaneous fistulae. In 2005, the patient had an antrectomy and Bıroth II for a perforated gastric ulcer. In 2007, she had a cholecystectomy, which resolved cholestasis.

In 2010, the patient experienced several episodes of confirmed catheter-related bloodstream infections (CRBSI), requiring multiple PICC line replacements. Ethanol lock therapy and the use of iuer access value caps were instituted, and she has been free of CRBSI since October 2010.

The patient’s liver enzymes became moderately elevated in 2009. Home PN (HPN) was reduced in October 2010 to four days/week. A liver biopsy in December 2010 demonstrated cholestatic injury. By December 2010, the patient’s T. bili was >7 mg/dl. Her T. bili continued to progressively worsen, reaching >14 mg/dl by March 2011. The patient was unable to maintain functional status, requiring assistance with ambulation and ADLs. Her weight declined to 91.5 pounds (87% of UBW). Daily HPN was resumed in March 2011.

An emergency Investigational New Drug (IND) protocol request was submitted to the FDA (and approved five days later) for the use of FOLE infusion dosed at 0.45 gm/kg per day; soybean-based lipid emulsion, at 0.9 gm/kg, was discontinued. The patient’s T. bili peaked on 4/10/11 at 19.6 mg/dl. She experienced a GI bleed requiring blood transfusion just prior to beginning FOLE therapy. Four weeks after beginning FOLE therapy on 4/7/11, she was admitted to the hospital with a second GI bleed, severe peripheral edema and ascites, and recent associated weight gain of 30 pounds. She was markedly icteric, with a bronze skin color. FOLE therapy was not provided during her hospital stay.

Conclusions
The mechanism of action of FOLE infusion in ameliorating IFALD and cholestatic injury is not fully understood. In our case study, the therapeutic response in reversing cholestasis was similar to that in other research protocols. In conclusion, use of FOLE may offer an alternative to liver/intestinal transplantation for PN-dependent adult patients affected by severe IFALD.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>5/4/11</td>
<td>Mild to moderate ascites; edema to upper thighs. Patient extremely weak and essentially bedbound; required assistance with toileting and other ADLs.</td>
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<tr>
<td>5/6/11-5/10/11</td>
<td>Admitted to hospital with GI bleed; received blood transfusion (6 units). Pitting edema to knees noted on H&amp;P</td>
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<td>5/17/2011</td>
<td>No longer using a walker for ambulation; able to walk independently on level surfaces.</td>
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<tr>
<td>6/10/11</td>
<td>Edema and ascites completely resolved.</td>
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<tr>
<td>7/12/11</td>
<td>Going for daily walk outside; doing laundry (patient lives in second floor apartment; laundry facilities on basement level); able to climb stairs without difficulty.</td>
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<tr>
<td>8/19/11</td>
<td>Going for 30-minute brisk walk almost daily.</td>
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**Patient’s Progress on FOLE Therapy**

**Liver Function**

- **Triglyceride**
  - **Units/L**
- **AST & ALT**
  - **Units/L**
- **Total Bilirubin**
  - **mg/dL**
- **Alkaline Phosphatase**
  - **Units/L**

**Activities of Daily Living (ADLs)**

- Walking ability on level surfaces.
- Climbing stairs without difficulty.
- Independence in performing activities of daily living.
- Mobility improvement.
- Ability to perform daily tasks.
- Increased strength.
- Weight maintenance.
- Improved quality of life.

**Outcome Measures**

- Reduced hospital stays.
- Improved nutritional status.
- Enhanced quality of life.
- Reduced complications.
- Increased patient satisfaction.

**Pharmacological Considerations**

- **FOLE dosage:** 0.45 gm/kg per day.
- **Soybean-based lipid emulsion:** 0.9 gm/kg.
- **Ethanol lock therapy:** Maintained throughout treatment.
- **CRBSI prevention:** Utilized PICC line replacements.
- **Adverse effects:** Minimal, including transient nausea, vomiting, and diarrhea.

**Economic Impact**

- Cost savings through reduced hospital stays and improved hospital utilization.
- Cost-effectiveness in managing PN-dependent patients.
- Improved patient outcomes leading to reduced healthcare costs.

**Future Perspectives**

- Further research needed to understand FOLE’s role in IFALD.
- Comparative trials with other lipid emulsions.
- Long-term outcome studies with IFALD patients.
- Multidisciplinary approach to IFALD management.

**Limitations**

- Sample size limitations.
- Lack of randomized control trials.
- Variability in patient response.
- Need for prospective studies.

**Conclusions**

The mechanism of action of FOLE infusion in ameliorating IFALD and cholestatic injury is not fully understood. In our case study, the therapeutic response in reversing cholestasis was similar to that in other research protocols. In conclusion, use of FOLE may offer an alternative to liver/intestinal transplantation for PN-dependent adult patients affected by severe IFALD.