The Effect of Lipid Emulsion on Outcomes in Critical Illness

Background

Intravenous fat emulsions (IVFE) are used in parenteral nutrition to provide a source of energy as an alternative to dextrose as well as provide essential fatty acids.[1] IVFE are an energy-dense source of calories (~10kcal/g) compared with proteins (4kcal/g) and dextrose (3.4kcal/g). It is generally recommended in clinical practice that lipids should provide 15% to 30% of total calories or 30 to 50% of non-protein calories. IVFE are typically infused at rates of 0.8 -1.5g/kg body weight and should not exceed 2.5g/kg per day (0.11g/kg per hour) because side effects such as hypertriglyceridemia, respiratory insufficiency, and infectious complications have been reported above this threshold.

The American Society of Parenteral and Enteral Nutrition and the Society of Critical Care Medicine published guidelines in 2009 that included a recommendation that critically ill patients who receive parenteral nutrition should not be given soybean oil-based IVFE for the first week in the ICU.[3] The recommendation was based on a single randomized controlled trial performed by Battistella and colleagues in 57 critically ill trauma patients.[4] The study examined clinical outcomes in patients who received parenteral nutrition with and without IVFE during the first 10 days of admission to the ICU. They found a statistically significant decrease in ICU mortality, pneumonia, and catheter related bloodstream infection in the group that was not exposed to IVFE.[1]

The recommendation to withhold IVFE in critically ill patients is based on a limited amount of evidence. To further explore the clinical impact of soybean oil IVFE on outcomes in critically ill patients, we will analyze the data maintained in the critical care database maintained in the adult surgical intensive care unit.

Objective

The objective of this review is to retrospectively determine if IVFE has an adverse effect on outcomes in critically ill patients.

Study design:

This is a retrospective review of patients with a prolonged ICU stay defined as $\geq$ 3 days in ICU. We will determine if the amount of IVFE received during the first three days of admission to the surgical ICU (SICU) is associated with several outcomes (controlling for other covariates as needed).

Time frame

2001 - 2005.

Inclusion criteria

All adult patients admitted to SICU for three or more days.

Exclusions

Patients less than 18 years old

Outcomes:

Hospital length of stay, intensive care unit length of stay, ventilator days, ventilator free days, infections and mortality.

Variables:

avgexp:	Average amount of IVFE received by the patient (g/kg of body weight per day) during the first 3 days of their SICU stay
maxexp:	Maximum daily IVFE received by the patient (g/kg of body weight per day) during the first 3 days of their SICU stay
age:	Age in years
gender:	Gender
race:	Race
bmi:	Body mass index (weight divided by height squared)
apache2:	Apache 2 score at admission; a disease severity score
glucose:	Blood glucose level at admission
hosp.los:	Hospital length of stay
hosp.death:	Indicator of death in the hospital (1=died, 0=survive)
unit.los:	Length of stay in the surgical ICU
unit.death:	Indicator of death in the surgical ICU (1=died, 0=survived)
ventdays.hosp:	Days spent on ventilator while in hospital
ventdays.unit:	Days spent on ventilator while in surgical ICU
ventfree.unit:	Days not on the ventilator while in the surgical ICU
bsi.inf:	Bloodstream infection (1=infection, 0=no infection)
eent.inf:	Eye, ear, nose, throat infection (1=infection, 0=no infection)
gi.inf:	GI infection (1=infection, 0=no infection)
lri.inf:	Lower respiratory infection (1=infection, 0=no infection)
pneu.inf:	Pneumonia (1=infection, 0=no infection)
ssi.inf:	Surgical site infection (1=infection, 0=no infection)
sst.inf:	Skin structure infection (1=infection, 0=no infection)
sys.inf:	Systemic infection (1=infection, 0=no infection)
uti.inf:	Urinary tract infection (1=infection, 0=no infection)

References:

1. Wanten GJA, Calder PC, (2007) Immune modulation by parenteral lipid emulsions. *AM J Clin Nutr* 85:1171-84.

2. Calder PC, (2009) Hot topics in parenteral nutrition, rational for using new lipid emulsions in parenteral nutrition and a review of the trials performed in adults. *Proceedings of the Nutrition Society* 68:252-260.

3. McClave SA, Martindale RG, Vanek VW, McCarthy M, Roberts P, Talyor B, Ochoa JB, Napolitano L, Cresci G, the ASPEN Board of Directors, the American College of Critical Care Medicine, (2009) Guidelines for the Provision and Assessment of Nutrition Support Therapy in the adult Critically Ill Patient. *J Parenteral and Enteral Nutrition*, 33(3):277-316

4. Battistella FD, Widergren JT, Anderson JT et al. (1997) A prospective, randomized trial of intravenous fat emulsion administration in trauma victims requiring total parenteral nutrition. *J Trauma* 43(1):52-60.

5. McCowen KC, Friel C, Sternberg J, Chan S, Forse RA, Burke PA, Bistrian BR, (2000) Hypocaloric total parenteral nutrition: effectiveness in prevention of hyperglycemia and infectious complications: a randomized clinical trial. *Crit Care Med*., 28(11):3606-3611.