10.2 Strategies to Optimize Parenteral Nutrition and Minimize Risks: Use of lipids

There are no new randomized controlled trials since the 2015 updates and hence there are no changes to the following summary of evidence.

Question: Does the presence of lipids in parenteral nutrition affect outcomes in the critically ill adult patient?

Summary of evidence: There were 2 level 2 studies reviewed that compared the use of lipids high in soybean oil to no lipids in parenteral nutrition (Battistella 1997, McCowen 2000).

Mortality: Both studies reported no difference in mortality between the groups and this was confirmed when the data from these 2 studies was aggregated (RR 1.29,CI 0.16-10.7, p = 0.8) (figure 1).

Infections: A significant reduction in pneumonia (p =0.05), line sepsis (p= 0.04) and total number of infectious complications was seen in trauma patients not receiving lipids compared to those receiving lipids (Battistella 1997). In the McCowen 2000 study, the group that received no lipids (hypocaloric group) showed a trend towards a reduction in infections (p =0.2). Combining these studies, the meta-analysis done showed a significant reduction in infections in the group that received no lipids (RR 0.63,CI 0.42-0.93, p =0.02) (figure 2).

LOS and Ventilator days: A significantly shorter ICU stay (p = 0.02), hospital stay (p = 0.03) and significantly fewer ventilated days (p = 0.01) were observed in trauma patients not receiving lipids compared to those receiving lipids (Battistella 1997). No difference in LOS was seen in the McCowen 2000 study (did not report on ventilator days)

Other complications: Incidence of hyperglycemia was similar in the hypocaloric and standard groups (McCowen 2000).

Conclusions:

1) Withholding lipids high in soybean oil has no effect on mortality.
2) Withholding lipids high in soybean oil is associated with a reduction in infections in critically ill patients
3) Withholding lipids high in soybean oil may reduce LOS and duration of ventilation in trauma patients.

Level 1 study: *if all of the following are fulfilled: concealed randomization, blinded outcome adjudication and an intention to treat analysis.*
Level 2 study*: If any one of the above characteristics are unfulfilled.*

Table 1. Randomized studies evaluating lipids (PN) in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)†		RR (CI)**	Infections # (%)‡		RR (CI)**
1) Battistella 1997	Polytrauma patients N=60	C.Random: not sure ITT: no Blinding: no (8)	PN without lipids (1.5 g/kg protein, no lipids) vs. PN with lipids (30 kcal/kg/day + 1.6 gm/kg/d protein, 25 % calories from fat)	**No lipids** 2/27 (7)	**Lipids** 0/30 (0)	0.18 (0.01-3.60)	**No lipids** **Lipids** **Pneumonia** 13/27 (48) 22/30 (73) **line sepsis** 5/27 (19) 13/30 (43) **total # infections per group** 39/27 72/30		1.52 (0.97-2.38) 2.34 (0.96-5.70) NA
2) McCowen 2000	Probable ICU patients (mostly ventilated) N=48	C.Random: not sure ITT: no Blinding: no (6)	Hypocaloric PN (no lipids), Pro 70g/d CHO 1000kcal/d vs standard PN (with lipids) ,Pro1.5g/kg/d, 25kcal/kg/d + lipids	**Hypocaloric PN** 2/21 (10)	**Standard PN** 3/19 (16)	0.60 (0.11-3.23)	**Hypocaloric PN** 6/21 (29)	**Standard PN** 10/19 (53)	0.54 (0.24-1.21)

Table 1. Randomized studies evaluating lipids (PN) in critically ill patients (continued)

Study	LOS days		Ventilator days		Cost		Other
1) Battistella 1997	**No Lipids** 18± 12 (27) **ICU** 27 ± 16 (27) **hospital**	**Lipids** 29 ± 22 (30) **ICU** 39 ± 24 (30) **hospital**	**No lipids** 15 ± 12 (27)	**Lipids** 27 ± 21 (30)	**No lipids** NA	**Lipids** NA	**No lipids** **Lipids** NA NA **Calories received kcal/kg/day** 21 ± 2 28 ± 2 **Protein received gm/kg/day** 1.6 ± 0.1 1.6 ± 0.2
2) McCowen 2000	**Hypocaloric PN** 19 ± 14 (21)	**Standard PN** 17 ± 15 (19)	**Hypocaloric PN** NA	**Standard PN** NA	**Hypocaloric PN** NA	**Standard PN** NA	**Hypocaloric PN** **Standard PN** **Calories received kcal/kg/day** 14 ± 3 18 ± 4 **Protein received gm/kg/day** 1.1 ± 0.2 1.3 ± 0.2 **Hyperglycemia** 20 26%

Figure 1. Mortality

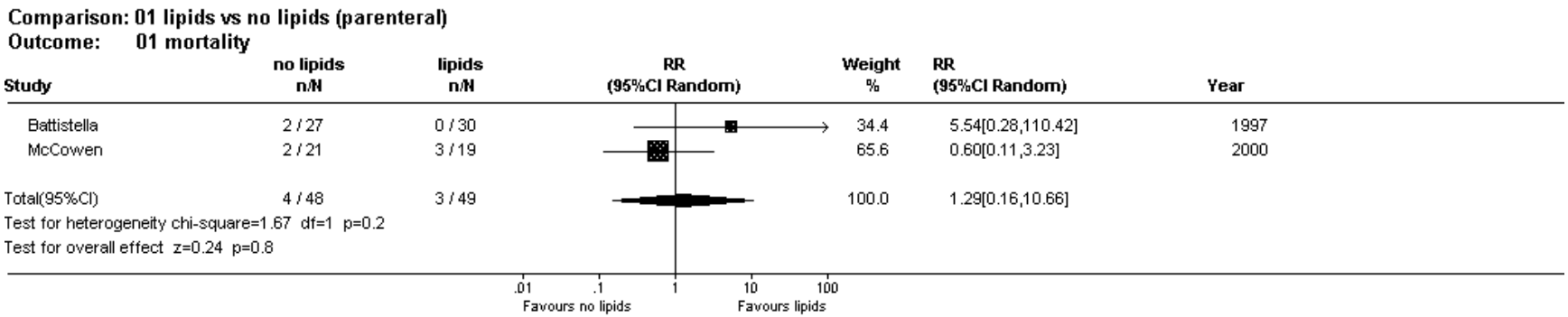
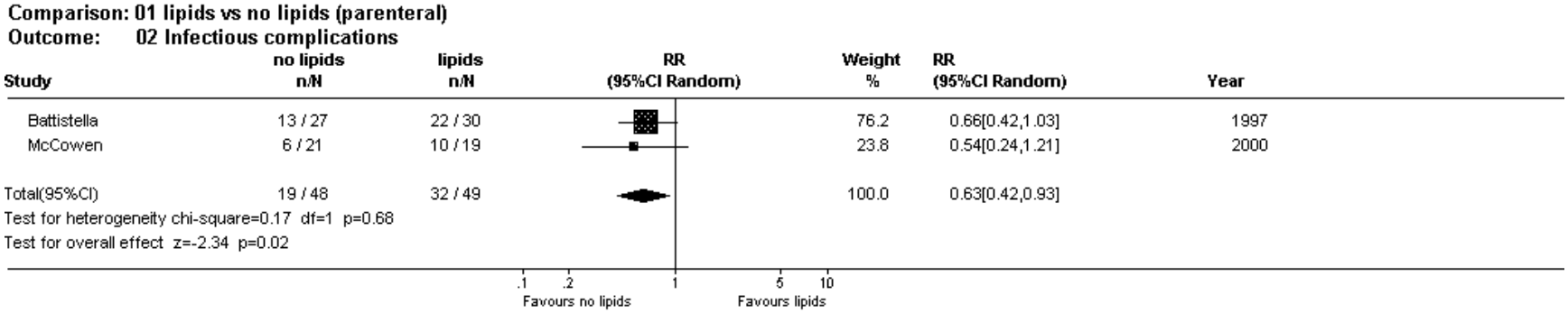


Figure 2. Infections



Reference:

Included Articles

1. Basttistella FD, Widergren JT, Anderson JT, et al. A prospective, randomized trial of intravenous fat emulsion administration in trauma victims requiring total parenteral nutrition. J Trauma Jul;43(1):52-8; discussion 58-60, 1997
2. McCowen KC, Friel C, Sternberg J, et al. Hypocaloric total parenteral nutrition: Effectiveness in prevention of hyperglycemia and infectious complications. A randomized clinical trial. Crit Care Med. Nov;28(11):3606-11, 2000.

Excluded Articles

#	Reason excluded	Citation
1	Lipids vs no lipids (control group only received IV glucose)	De Chalain TM, Michell WL, O'Keefe SJ, Ogden JM. The effect of fuel source on amino acid metabolism in critically ill patients. Surg Res. 1992 Feb; 52(2): 167-76.
2	Not ICU patients	Lenssen P, Bruemmer BA, Bowden RA, Gooley T, Aker SN, Mattson D. Intravenous lipid dose and incidence of bacteremia and fungemia in patients undergoing bone marrow transplantation. Am J Clin Nutr. 1998 May; 67(5): 927-33.
3	Not RCT, no significant outcomes	Tappy L, Schwarz JM, Schneiter P, Cayeux C, Revelly JP, Fagerquist CK, Jequier E, Chiolero R. Effects of isoenergetic glucose-based or lipid-based parenteral nutrition on glucose metabolism, de novo lipogenesis, and respiratory gas exchanges in critically ill patients. Crit Care Med. 1998 May; 26(5): 860-7.
4	Not RCT, no significant outcomes	Venus B, Prager R, Patel CB, Sandoval E, Sloan P, Smith RA. Cardiopulmonary effects of Intralipid infusion in critically ill patients. Crit Care Med. 1988 Jun; 16(6): 587-90.
5	No significant outcomes	Suchner U, Katz DP, Furst P, Beck K, Felbinger TW, Senftleben U, Thiel M, Goetz AE, Peter K. Effects of intravenous fat emulsions on lung function in patients with acute respiratory distress syndrome or sepsis. Crit Care Med. 2001 Aug; 29(8): 1569-74.
6	Not critically ill patients	Wang WP, Yan XL, Ni YF, Guo K, Ke CK, Cheng QS, Lu Q, Zhang LJ, Li XF. Effects of lipid emulsions in parenteral nutrition of esophageal cancer surgical patients receiving enteral nutrition: a comparative analysis. Nutrients. 2013 Dec 27;6(1):111-23.
7	Uncertainty of control intervention, author not responsive	Chen H.; Wang W.; Hong Y.; Zhang H.; Hong C.; Liu X. Single-blinded, randomized, and controlled clinical trial evaluating the effects of Omega-3 fatty acids among septic patients with intestinal dysfunction: A pilot study. Experimental and Therapeutic Medicine. 2017 14(2):1505-1511.
8	Not critically ill patients	Chen H, Pan D, Li L. The effects of multi-oil fat emulsion on older patients with gastric cancer. Biomedical Research (India) 28(10):4270-4276.