

# Comparison of the Effects of Intralipid 10% and 20% on Peripheral Catheter Ablation in a Pediatric Intensive Care Unit

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## ABSTRACT

**Background:** Energy deficit is a common and serious problem in pediatric intensive care units. Parenteral nutrition, either alone or in combination with enteral nutrition, can improve nutrient delivery in critically ill patients by preventing or correcting the energy deficit and improving the outcomes. Intralipid 10% and 20% are lipid emulsions, widely used in parenteral nutrition. Despite several clinical advantages, intravenous Intralipid therapy has been associated with several complications. In this study, we aimed to investigate the effects of Intralipid 10% and 20% on peripheral intravenous catheter ablation in children receiving Intralipid in a pediatric intensive care unit.

**Methods:** In this observational study, 96 patients were recruited through simple non-random sampling over six months. In total, 48 patients received intravenous Intralipid 10%, while 48 patients were administered Intralipid 20% as part of their parenteral nutrition plan. Through separate peripheral intravenous catheters, 0.5-3 g/kg/day of Intralipid was administered at an infusion rate of 0.5 g/kg/h. Length of hospital stay and intravenous catheter ablation were compared between the two groups.

**Results:** Age of the patients ranged between two days and eight years. Esophageal atresia was the most common condition among patients receiving intravenous Intralipid infusion (8.3%). The mean duration of catheter survival was significantly shorter in patients receiving Intralipid 20% (28.77 vs. 68.23 h,  $P < 0.001$ ), while length of hospital stay was not significantly different between the two groups ( $P = 0.48$ ).

**Conclusion:** Based on the findings, concentration of Intralipid infusion in pediatric patients, receiving parenteral nutrition, might be associated with intravenous catheter ablation.

**Keywords:** Catheter, Intralipid, Parenteral nutrition, Pediatric intensive care unit

## Introduction

Energy deficit is a common and serious problem in pediatric intensive care units (PICUs) and is associated with the increased incidence of complications, prolonged hospital stay, and increased mortality (1). Parenteral nutrition (PN), either alone or in combination with enteral nutrition, can improve nutrient delivery in critically ill patients (1). The nutritional plan for patients in the ICU setting should aim at blunting the catabolic state and enhancing anabolic activity during recovery while avoiding overfeeding (2).

Lipids provide a key source of calories in PN formulations by preventing or correcting energy deficits and improving the outcomes. Although lipids are generally administered to provide 30% of

total calories, dose reduction should be considered in case serum triglyceride concentration exceeds 400 mg/dL (3). Intravenous (IV) fat emulsions containing soybean triglycerides, such as Intralipid, are principally administered to prevent deficiency of essential fatty acids, supply the required calories for energy expenditure and growth, and improve the absorption of fat-soluble vitamins in patients of all ages (4, 5).

Intralipid 10% and 20% are soybean-based lipid emulsions, which are used in PN plans (6). Although a few studies have confirmed that Intralipid 20% could be safely used without inducing hyperlipidemia (6), Intralipid infusion, regardless of its concentration, has been associated

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with several complications such as embolism in neonates, children, and adults (4, 5), increased pulmonary vascular resistance (7, 8), and increased risk of bronchopulmonary dysplasia (9-11).

In addition, Intralipid infusion in neonates has been associated with microcirculatory deterioration, which is related to several mechanisms such as lipid peroxide production (12), increased production of prostaglandins and thromboxanes (13, 14), and diminished bioavailability of nitric oxide as an endothelium-derived vascular relaxant (15).

Considering the findings reported in several studies, which have focused on the complications of Intralipid therapy, in the present study, we aimed to investigate the effects of Intralipid concentration (10% vs. 20%) on peripheral catheter ablation in patients receiving Intralipid in the PICU of Dr. Sheikh Pediatric Hospital, Mashhad, Iran.

## Methods

In this observational study, patients were recruited via simple non-random sampling over six months. The study was approved by the Ethics Committee of Mashhad University of Medical Sciences and was conducted in the PICU of Dr. Sheikh Pediatric Hospital, Mashhad, Iran.

The inclusion criterion was IV administration of 0.5-3 g/kg/day of Intralipid 10% or 20% through a peripheral IV catheter (angiocatheter) according to the PN plan. On the other hand, the exclusion criteria were allergic reactions following the administration of Intralipid infusion, vasculitis, collagen vascular disease, severe infections, sepsis, and serum triglyceride level exceeding 400 mg/dL.

The patients were divided into two groups, based on the concentration of Intralipid infusion (i.e., 10% and 20%). The sample size was calculated to be 30 cases per group, considering 95%

confidence interval. Through separate peripheral IV catheters, 0.5-3 g/kg/day of Intralipid was administered to a region where no other IV drugs or parenteral solutions were administered.

The used materials in this study included Intralipid (Fresenius Kabi Austria GmbH, Graz, Uppsala, Sweden, 16HK0061) and a blue angiocath (Biomedica SpA, 21036 Gemonio VA, Italy, gauge: 22, OD: 0.9 mm, length: 25 mm, M2-2225). The infusion rate was set at 0.5 g/kg/h. The baseline characteristics included age, sex, and medical conditions. The data were recorded and the patients were closely followed-up by PICU nurses. Length of PICU stay and IV catheter survival were recorded and compared between the two groups.

For data analysis, SPSS Version 16 was applied. Data were reported as mean±standard deviation (SD). Student's t-test was used for the comparison of normally distributed quantitative data, while Mann-Whitney test was performed to compare quantitative data, which were not normally distributed. Also, Chi-square test was performed to compare qualitative variables. P-value less than 0.05 was considered statistically significant in all the comparisons (P<0.05).

## Results

In total, 96 patients were recruited in this study. The subjects were equally divided in two groups (n=48 per group), based on the Intralipid concentration (i.e., 10% and 20%) in their PN plan. The mean age of the patients was 1.7 years (ranging from 30 days to 8 years). More than half (54.2%) of the patients were female. Esophageal atresia was the most common condition among patients receiving Intralipid infusion. The baseline demographic and disease characteristics of patients are presented in Table 1.

**Table 1.** Demographic characteristics of the patients

Characteristics	Value
Mean age (range)	1.7 years (30 days to 8 years)
Sex	Male
	Female
Type of disease	Congenital anatomical anomalies
	Sepsis
	Renal disorders
	Gastrointestinal disorders
	Respiratory disorders
	Cardiovascular disorders
	Nervous system disorders
Cancer	

**Table 2.** Comparison of variables associated with Intralipid concentration between the two groups

	Intralipid 10%	Intralipid 20%	P-value*
Mean length of stay in the pediatric intensive care unit (days)	7.5±2.4	7.9±2.4	0.48
Mean duration of catheter survival (hours)	86±19.7	48±17.32	<0.001

\*Student's t-test

No significant difference was detected in terms of age or sex between the patients of two groups ( $P=0.59$  and  $P=0.68$ , respectively). The mean length of PICU stay was insignificantly shorter in patients receiving intralipid 10%, while the mean duration of catheter survival was significantly different between the two groups. In fact, the mean duration of catheter survival was shorter in patients receiving Intralipid 20% (Table 2).

## Discussion

According to the present findings, catheter survival was shorter in patients receiving Intralipid 20%, compared to those receiving Intralipid 10%, while length of PICU stay was not significantly different between the two groups. Although several articles have discussed PN-associated complications, studies focusing on the effects of different concentrations of parenteral solutions (including Intralipid) are rather limited.

Based on previous studies, PN, regardless of the concentration of solutions, can be associated with increased rates of bacterial and fungal sepsis, mechanical complications attributed to the insertion of venous catheters, and miscalculations and errors in manufacture, supply, and administration. PN is also associated with metabolic derangement, hepatic dysfunction, and increased risk of contamination with toxins such as aluminum, which enters solutions during the manufacturing process (16). Moreover, obstruction and thrombosis due to central venous catheter insertion in PICUs are common complications (17).

With regard to the ingredients of parenteral solutions, lipid emulsions are associated with cholestatic liver disease, which is one of the major complications, as previously demonstrated (18). In the present study, we tried to exclusively focus on the concentration and osmolality of the infused solution as fundamental elements in parenteral feeding. All aspects of PN, including safety, indications, ingredients, and disadvantages, should be evaluated in order to prevent probable complications, which can increase the length of PICU stay or even mortality in pediatric patients.

According to the findings, duration of PICU stay was not significantly different between the

two groups. This may be attributed to the fact that the destructed catheter was immediately replaced and the PN plan continued in PICU care. In other words, catheter destruction did not cause any gap or delay in IV treatments, and consequently, duration of PICU stay was not influenced. However, replacing the destructed catheter could cause a major discomfort for pediatric patients, which should not be neglected.

A major limitation of the current study was that no differentiation was made between different causes of catheter ablation. Another limitation was that we did not consider the exact amount of Intralipid infusion administered each day, although the amount of Intralipid infusion may affect catheter ablation.

Overall, the obtained findings may have important implications in terms of preventing PICU complications and reducing discomfort in pediatric patients. It is recommended that future studies focus on the concentration of different parenteral solutions, the probable complications, and different causes of catheter ablation

## Conclusion

Based on the findings, peripheral catheter survival in PICU patients was significantly lower in cases receiving Intralipid 20%, compared to those receiving Intralipid 10% according to their PN plan. It can be suggested that the concentration of Intralipid infusion in pediatric patients receiving PN is associated with intravenous catheter ablation.

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