Karolinska Institutet

Institutionen för Molekylär Medicin och Kirurgi, Karolinska Institutet, Stockholm

SUBSTRATE OXIDATION AND PLASMA ELIMINATION OF A LONG-CHAIN TRIGLYCERIDE EMULSION

-studies in healthy individuals and patients with trauma

AKADEMISK AVHANDLING

För avläggande av medicine licentiatexamen vid Karolinska Institutet som offentligen försvaras på svenska språket i föreläsningssal Medicin, A6:04, Karolinska Universitetssjukhuset-Solna

Torsdagen den 26 maj, 2011, kl 13.00

av

Wiveca Åberg
Leg. Sjuksköterska

Huvudhandledare:
Jörgen Nordenström
Karolinska Institutet
Institutionen för Molekylär Medicin och Kirurgi

Biträdande handledare:
Anders Thörne
Karolinska Institutet
Institutionen för Klinisk Vetenskap,
Intervention och Teknik (CLINTEC)

Betygsnämnd:
Lovisa Strömmer
Karolinska Institutet
Institutionen för Klinisk Vetenskap,
Intervention och Teknik (CLINTEC)

Jan Bolinder
Karolinska Institutet
Institutionen för Medicin-Huddinge

Tommy Cederholm
Uppsala Universitet
Institutionen för Folkhälsa- och
Vårdvetenskap (IFV), Klinisk
Nutrition och Metabolism

Stockholm 2011

ABSTRACT

Lipid emulsions based on long-chain triglycerides (LCTs) are frequently used during total parenteral nutrition (TPN) and are usually administrated together with glucose. The metabolism of fat is determined by the underlying condition such as trauma, infection, malnutrition or age and also by substrate interaction when different nutrients are administrated simultaneously. The aim of this thesis was to evaluate plasma elimination rate of a lipid emulsion during a hypertriglyceridaemic- (HTG) clamp and the utilization of lipids as an energy source. An additional aim was to characterise to what extent the metabolism of lipids is affected by trauma, age and administration of insulin and glucose provided as an IG clamp.

Plasma elimination rate of a lipid emulsion and its relationship with lipoprotein lipase (LPL) activity and LPL mass were investigated before and after surgery. Postoperatively, the plasma TG elimination rate was 2.6 times higher. Infusion of lipids in the postoperative state was followed by a smaller rise in free fatty acids (FFA) in comparison with the preoperative situation. The postoperative basal fasting LPL activity was half of that in the preoperative state. The LPL activity rose during the first hour of lipid infusion and then remained at that level to the end of the infusion. LPL activity values were not significantly different during the clamps. The heparin-induced rises in LPL activity and LPL mass were similar before and after surgery.

Age-related effects on the plasma elimination rate of a lipid emulsion and substrate oxidation were examined by comparing elderly and young men. Plasma TG elimination rate was similar in the elderly and young subjects. This was evident also from the similar increments in plasma FFA in the two groups. Elderly subjects had lower energy expenditure in the basal state than young individuals. The proportion of active LPL was about three times higher in the young compared to the elderly individuals. LPL activity increased during the infusion and the rise was larger in the young than in the elderly individuals.

The effect of glucose and insulin on the plasma elimination rate and oxidation of a lipid emulsion was examined by using indirect calorimetry (IC) in conjunction with HTG and insulin/glucose (IG) clamp techniques. Administration of insulin and glucose in healthy man did not influence the plasma elimination rate of a lipid emulsion. Insulin and glucose did not significantly decrease FFA concentration and total lipid oxidation in this metabolic situation with an abundant supply of both carbohydrates and lipids.

In conclusion, using the HTG clamp we have confirmed an increased capacity for lipid clearance after trauma despite a lower basal LPL activity and a virtually unchanged LPL pattern during infusion of lipids. Elderly men have a capacity to intravenously hydrolyse a high TG load administered as a HTG clamp, which is not quantitatively different from the capacity of young men. This was evident also from the similar increments in plasma FFA in elderly and young individuals. Furthermore, our results show that the plasma TG elimination rate is not influenced by moderate increments of plasma glucose and insulin levels.