Stability of total parenteral nutrition admixtures for pediatric home care in the presence of high concentrations of electrolytes

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INTRODUCTION

In a clinical practice electrolytes-enrichment of the parenteral nutrition admixtures is a usual demand, especially in the neonatal/pediatric wards [1]. The supplementation of parenteral nutrition with high concentration of electrolytes is a living problem due to decreased stability of lipid emulsions in nutrition admixtures caused by bivalent cations. When higher intakes of Ca²⁺ and phosphate are necessary an organic salts of calcium and phosphate (e.g. gluco-o-t-phosphate or glycero phosphate) should be used [2]. Precipitation of calcium phosphate can be overcome by using organic salts [3]. It was found that glycero phosphate provided much better compatibility with Ca²⁺, allowing the addition of up to 100 mmol/L phosphorus and 40 mmol/L Ca²⁺, without any precipitation[4].

EXPERIMENTAL METHODS

TPN pre-admixtures were prescribed by physicians in the Copernicus Specialist Hospital of Gdansk (Tab.1).

RESULTS AND DISCUSSION

Visual inspection of all completed TPN admixtures did not reveal other changes but very slight creaming after 24 h of storage at room temperature (t=0+24h).

Despite the various composition and type of lipid emulsions in microscopic observations all TPN admixtures were characterized by size of oily particles not larger than 1 µm, which is safe for a patient (Fig. 2). Microscopic observations were confirmed by using PCS and LD methods.

Only in two of the complete admixtures (TPN 15b and 16a) at t=21 days+24h few oily droplets up to 8-10 µm and some agglomerates of these droplets were observed in microscopic observations despite the fact that no oily globules larger than 1 µm were detected in these admixtures by using laser diffractometry and PCS methods (Fig. 4). This observation was confirmed in another independent experiment, so these admixtures was classified as unstable.

The pH values of TPN admixtures were in range 6.2-6.5. These values did not change during storage (Fig. 5).

Despite the high electrolytes concentration zeta potential values in TPN admixtures were in range -35.0 to -47.0 mV. These values did not change during storage (Fig. 6).

CONCLUSIONS

TPN pre-admixtures with proposed compositions may be stored for at least 21 days at 4°C. The complete TPN admixtures demonstrated stability for at least 24 h at room temperature. Type of the lipid emulsion has no influence on stability of the studied admixtures. It was possible to obtain stable admixtures despite of the high concentration of electrolytes. Laser diffractometry did not show destabilization of complete admixtures which were visually or microscopically observed as unstable. Oily droplet size distribution measured by laser diffractometry should always be verified by microscopic observations.

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