

Retrospective analysis of the clinical use of parenteral nutrition and its substitutability with a licensed product

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Introduction

Parenteral nutrition (PN) is the intravenous administration of nutrients when enteral nutrition is not possible or insufficient. At the University Children's Hospital Zurich aseptically produced, basic standardized solutions (S) of a contract manufacturer are used and customised by nursing staff on the ward by adding supplementary nutrients before administration (Fig. 1). Using a non-sterilised manufactured S and its individualization on the ward is risky. We therefore assessed whether a licensed all-in-one product (LP) would provide comparable amounts of macro- and micronutrients.

Conclusions

- With the LP higher quantities of macronutrients and comparable amounts of electrolytes would be given in the same PN volume.
- Better nutrition requirements could be achieved with LP, notably in critically ill cardiologic patients with a limited volume intake.
- In preterm infants with hyperglycaemia or dyselectrolytaemia a S with a low dextrose and electrolyte amount may still be mandatory.
- LP could be problematic in children with elevated serum electrolyte levels.
- The substitutability of our previously used S is possible for most of our patients and only in individual cases specially customised solutions are still necessary.

Patients & Methods

1. A retrospective observational study in the years 2018/2019 was performed.
2. Prescriptions of four S were collected: S_{10%}, S_{15%} with 10% resp. 15% dextrose (D) for preterm infants, S₂ and S_{2EF} with and without electrolytes for term neonates and infants up to 10 kg body weight
3. The amount of every single nutrient in the individualised S was compared to the same amount of the LP based on the administered total volume and its substitutability was evaluated according to pre-set experts' criteria (Fig. 1).
4. The influence of cardiologic diagnosis, hospitalisation on the intensive care unit (ICU) and the paediatric index of mortality 2 (PIM 2-Code) on the substitutability was analysed.

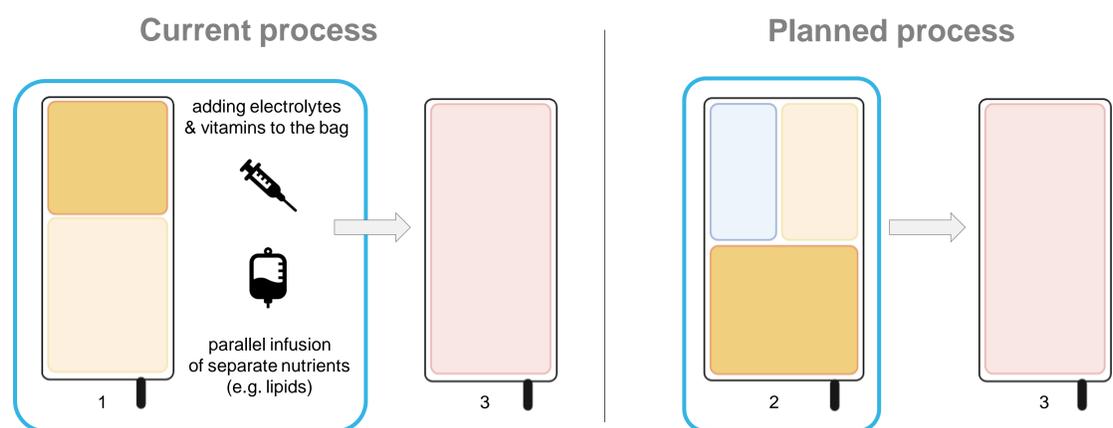


Figure 1: 1 standardized solution (S): 2-in-1 bag, non-sterilised, produced by a contract manufacturer, currently used at the University Children's Hospital Zurich; 2 licensed all-in-one product (LP): all-in-1 bag, sterilised; 3 bag after mixing all phases, possible individualisation on the ward by adding electrolytes and vitamins; ● amino acids ● dextrose ● lipids ● mixture of all phases

Results

Substitutability of S_{10%} and S_{15%}

100% of dextrose (D) prescriptions in S_{10%} were lower than the notional quantity in the LP. 100% of the amino acids (AA), 73% resp. 87% of the lipid (L) prescriptions in S_{10%} and S_{15%} were lower compared to the amount given by the LP, whereas prescriptions of electrolytes except potassium were mostly higher in both S₁.

Substitutability of S₂

With S₂ 48% of the dextrose prescriptions, 45% of the amino acids and 59% of the lipid prescriptions were substitutable. We found an ever higher substitutability regarding the electrolytes: sodium 50%, potassium 68%, chloride 97% and 100% with calcium, phosphate and magnesium (Fig. 2).

Substitutability according to the severity of illness

With our previous S less macronutrients were administered in patients on the ICU and in patients with cardiologic diagnosis compared to possible amount which could have been given with LP.

The more severely ill the patient (higher PIM 2-Code), the lower the administered amount of macronutrients was, because of volume restrictions. Thus the substitutability of S diminished. With LP a higher amount of macronutrients could be administered. On the other hand the substitutability of the electrolytes increased or was stable at a high level (Fig. 3).

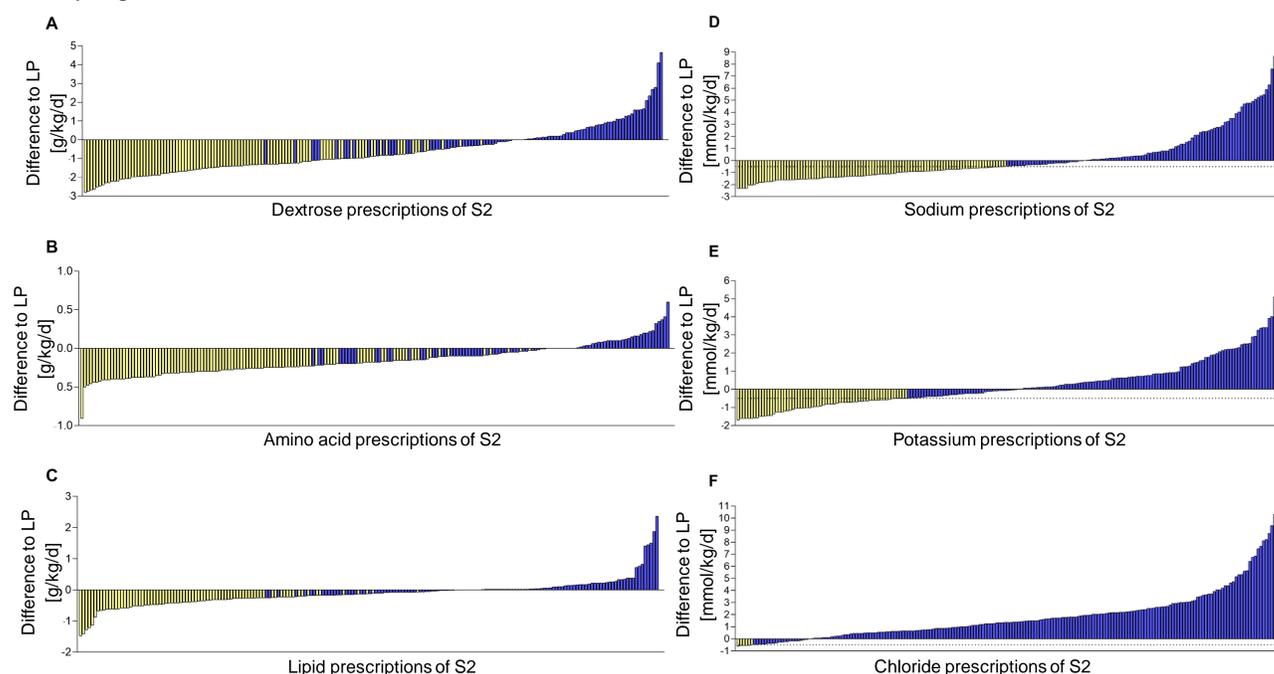


Figure 2: Columns representing the difference between the prescribed amount of nutrients of S₂ (n=196) compared to the theoretical amount of nutrients given with the LP (baseline), blue: substitutable prescriptions; yellow: not substitutable prescriptions; A: dextrose, B: amino acids, C: lipids, D: sodium, E: potassium, F: chloride

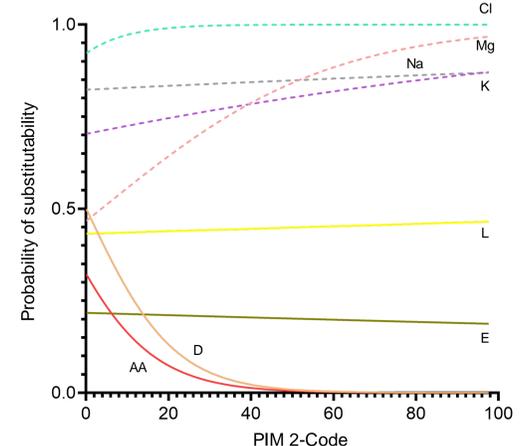


Figure 3: Correlation between the substitutability of every single nutrient of the S-prescriptions (S_{10%}, S_{15%} and S₂) and the PIM 2-Code on the ICUs (n=117). AA: amino acids, D: dextrose, L: lipids, E: total energy, K: potassium, Mg: magnesium, Na: sodium, Cl: chloride