Parenteral Nutrition Given to Children and Adults: Experience of a Procedure Applied in Mexico

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ABSTRACT

Nutritional support is a critical step in caring for hospitalized patients both to avoid possible metabolic alterations that would worsen the patient's condition, or as a direct result of a particular disease. The purpose of the present study was to describe a procedure for the prescription of total parenteral nutrition (TPN), its administration, monitoring and the complications experienced in a third level hospital in Mexico, as applied to pediatric and adult patients given TPN. The study was carried out for a period of 30 months. TPN was prescribed according to the clinical status of patients. The study reviewed 4,000 parenteral nutrition records from January 2005 to June 2007 (30 months). Based on data here presented a guideline was applied to improve the nutritional support of patients as part of the need to ensure their recuperation during their hospitalization. We observed that TPN must be individualized, based on daily nutrient recommendations, which can be useful to assess the nutritional status of the hospitalized patient with diverse pathologies.

INTRODUCTION

Total parenteral nutrition (TPN) is a therapeutic and prophylactic method conducted to provide life-sustaining support for patients at high risk for malnutrition, when they cannot take food by mouth. TPN allows supply all of the elements required to maintain or recuperate an adequate nutritional state intravenously [1-3]. In order to determine an individual's nutritional state, a nutritional history must be taken along with disease history and physical exam and metabolic analysis of nutrient and lab values [4,5].

CLINICAL PROCEDURE

To determine one person's nutritious regimen background, the clinician determines what kind of foods were ingested in the last 24 hr, and what kind of foods does the patient eat regularly. The patient can list all of the foods taken for three days, as solicited by the clinician. The person's behavior and general appearance, as well as the body fat distribution and the body organ functioning can be assessed in the physical examination.

An individual's nutritional state can be determined in various ways. One of these is to measure the size and weight, and compare them with standardized tables. Another is to determine the body mass index, which can be obtained by dividing the weight (kg) by the body surface area (m^2). A body mass index between 20 and 25 is considered normal for males or females [6]. It is very important to define the type of parenteral nutrition that is intended to be given intravenously or peripherally to an individual, (Fig. 1) once his nutritional state has been determined [7,8]. In order to feed those people who are not able to take foods orally by themselves or for those for whom neither nutrient absorption nor digestion can be achieved, these guidelines may be helpful.

When patients cannot be adequately fed through a nasogastric tube, they must be given an intravenous parenteral nutrition rather than using the peripheral route. As an example, severely malnourished patients, those subjected to surgery, radiotherapy and chemotherapy, as well as those who have suffered severe burns or gut paralysis, or those who present with persistent diarrhea and vomiting will require intravenous nutrition.

Intravenous nutrition can supply the patient's total nutritional needs. The effects exerted by adequate nutritional support of the patient are observed as nutritional balance, such as "protein saving", which is a clearly insufficient support and only intends to reduce as much as possible the level of nutritional state deficit that is emerging.

The situation known as tissue maintenance reaches an equilibrium between the protein gains and losses. The situation of "protein synthesis", which is the desirable effect of TPN, predominates when the synthesis of needed proteins exceeds protein breakdown which represents a situation of positive nutritional balance [9].

The available parenteral solutions can be modified to feed those people who suffer from renal or hepatic diseases. Peripheral parenteral nutrition requires the introduction of an intravenous line (catheter) larger than those used for routinely administered intravenous solutions. Therefore, a bigger venous vessel, as the subclavian vena located nearly under the clavicle, must be used for this procedure.

Those people who receive TPN are carefully controlled to detect weight changes and variations in their urine production patterns, as well as signs of infection. Infection is a prevalent risk, since the catheter is generally implanted in the same place for a long time, and the parenteral solutions that pass through it, often contain a high glucose concentration, a substance that favors bacterial growth [6].

In spite of the hygienic control and aseptic techniques carefully taken for the manipulation and installation of

these parenteral solutions evaluated in the present study, a few catheter contamination cases occurred, which were completely eradicated after the creation of a special staff, skilled in these techniques and exclusively dedicated to set the parenteral nutrition f the entire hospital. This staff is coordinated by the institution's infection control committee. Nutritional solution formulation was carried out in special installations provided to the hospital by an external company, which accomplishes all the quality standards included in the Mexican Official Norm (NOM).

After the compilation of all records of parenteral nutrition prescribed during the period from January 2005 to June 2007 (30 months), the review of up to 4,000 parenteral nutrition records in the same period was achieved.

DATA ANALYSIS

After thoroughly reviewing the nutritional records, a guiding format was developed (Table1), with all the components and nutrients that have been used to give nutritional support (energy supply, nitrogen supply, trace elements, vitamins and water) both to pediatric and adult hospitalized patients.

This format is intended to facilitate monitoring of the patients' nutrition schedule and may decrease undesirable effects, such as nutrition mixture hyperosmolarity, responsible for the appearance of phlebitis. It is advisable that the mixtures do not contain more than 900 mOsm/L [9].

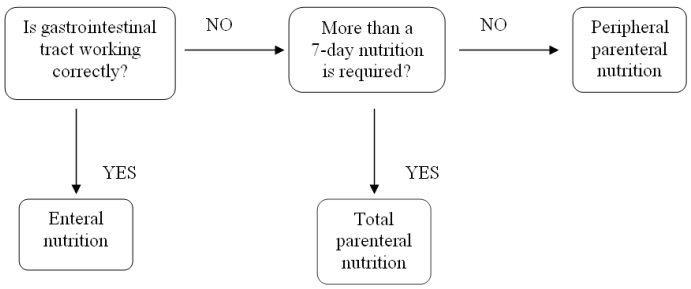

Figure 1. Algorithm aimed to choose peripheral or total parenteral nutrition.

DISCUSSION

Nutritional support must be considered not just as a form of administration of nutrients, but also as a means to get the best use of these by the patient; so that the actual tendencies are directed to formulate a nutritional support in which quantitative and qualitative issues are evaluated, as well as the metabolic support, oriented to prevent protein degradation, stimulating protein synthesis and relieving the pathophysiological situation as much as possible [10]. To accomplish such a task, prescription of parenteral nutrition must be individualized, based on the daily nutrient recommendations in the TPN [11].

Although literature prohibits the use of drugs whose studies of stability with the TPN are not supported [12], it has been necessary, for clinical reasons, to mix the nutrient solutions of the present study with therapeutic drugs, such as: ranitidine, bumetanide, hydrocortisone and omeprazole, separated, without presenting any incompatibility or secondary effect.

Table1. Format for individualized TPN.

Record to include all patient demographic data.

COMPOSITION	AMOUNT	
Amino acids 10% (mL)		
Amino acids 8.5% no electrolites (mL)		
Amino acids 8.5% with Electrolites (mL)		
Dextrose 50% (ml)		
Dextrose 10% (ml)		
Dextrose 5% (ml)		
Mixed lipids 20% (mL)		
Mixed lipids 10% (mL)		
Sodium chloride 0.9% (mL)		
Normosol Solution DX 5% (mL)		
Sodium chloride 17.7% (mEq)		
Potassium chloride (mEq)		
Calcium gluconate (mEq)		
Magnesium sulfate (mEq)		
Potassium phosphate (mEq)		
Sodium bicarbonate (mEq)		
ADITIVES		
Albumin 25% (g)		
Albumin 20% (g)		
Folinic acid (mg)		
Glutamine 20% (g)		
Combined oligoelements (mL) *		
Adult multivitaminic (mL)		
Pediatric multivitaminico (mL)		
Omega-3 1 fatty acids % (mL)		
Iron (mg)		
Zinc (mg)		
Selenium (µg)		
Vitamin K (mg)		
Vitamin C (mg)		
L-Carnitine (mg)		
Heparin (U.I)		
Insulin (U.I.)		
Injectable water		
DRUGS		
Date of preparation		
Observations*: etc.*		

*Each 100 mL oligoelemental solution contains: Zinc 55 mg, copper 16.9 mg, manganese 38.1 mg, sodium 163.9 mg, fluoride 14 mg, iodide 1.3 mg, chloride 25.6 mg.

Today, companies such as Baxter and Fresenius Kabi, distribute formulations of parenteral nutrition that can be prepared immediately (10 min), avoiding possible contamination, due to their easily-mixing system, and low chemical instability problems. These mixtures can be very useful to expedite nutritional support at reasonable cost to adult patients. Pediatric standardized formulations are not available.

Based on the information and data presented above, it is suggested that the guidelines for the control of individual total parenteral nutrition in adult and pediatric patients, can be useful to assess the nutritional status of the hospitalized patient with diverse pathologies, to whom nutritional support is administered.

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