THE INTENSIVE CARE COURSE WITH FLUIDS AND ELECTROLYTES IN NEWBORN FOR PREVENTING COMPLICATIONS

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Abstract

Fluids and electrolytes therapy is one of the most important and useful methods
applied in the pathology of newborns and of low birth weight infants particularly.

Total and extra-cellular water in the organism, expressed as percentage of body
weight, gradually decrease as the gestational age increases.

These dynamic changes in the quantity of water in the organism are of practical importance, as the distribution of electrolytes or drugs fluctuates along with the maturity stage of the child. After birth, administration of fluids will take into consideration: the changes in body composition; nutrition changes; the changes in the development of renal function, and the changes due to the environment and to the water requi red for growth.

In this paper, we present in detail all these aspects. Finally, we approach some of the major problems of fluid therapy: extremely low birth weight infant; the newborn with: perinatal asphyxia, respiratory distress syndrome, acute renal failure; bronhopulmonary dysplasia; children with congenital heart disease; preterm newborns with patent arterial duct; gastrointestinal fluid losses; gastrointestinal tract obstructions requiring surgery.

Key words: newborn, dehydratation, fluids, electrolytes

Introduction

The abrupt exclusive nutrient supply to the fetus through maternal placenta during birth, is a challenge for neonatal physiology, especially the premature onset of extrauterine life (1).

The use of fluid and electrolyte management is one of the most difficult aspects of the neonatal care of premature infants. Understanding the processes of the neonatal adaptation to the extrauterine life and how the transition affects premature immaturity is based on the management processes postnatal electrolyte rebalancing (2).

Often this group of infants, the enteral nutrition is impossible, due to the immaturity of the digestive tract; the total parenteral nutrition in the management accounting nutrients needed for growth and development only intravenously. Installing venous lines for the total parenteral nutrition involves skills training health personnel, strict hygiene conditions (aseptic and local antisepsis) and is often marked by complications (pain, skin lesions, port of entry for pathogens).

The total parenteral nutrition comprising macronutrients (source of glucose solutions of carbohydrates, solutions of amino acids of the protein source, the fat source solutions fat), micronutrients (vitamins, minerals, metals). The partial parenteral nutrition is the intravenous administration of nutrients and suboptimal quantity, enteral (12).

The parenteral nutrition is carried out individually, depending largely on the age and weight of the newborn. Failure enteral feeding (due to immaturity or suffering) requires the introduction of total parenteral nutrition in a few clear categories newborns:

a) more than 30 weeks gestational age and / or weight below 1000g;

b) over 30 weeks of gestation with neonatal pathology that makes it impossible to achieve optimal nutritional potential;

c) intrauterine growth restriction;

d) digestive inflammatory disease (necrotizing enterocolitis);

e) metabolism in severe overload: congestive heart failure, acute renal failure;

f) congenital anomalies or gastrointestinal surgery: gastroschisis, omphalocele, intestinal atresia, intestinal volvulus, intestinal malrotation, intestinal obstruction, short bowel syndrome, meconium ileus, etc.

The study by Min Young Kim and his colleagues, Gachon University of Korea, in a group of 258 premature periada 2004-2007, comes to reveal metabolic changes during the first period of life, the extreme small premature infants (ELBW).

Their research results show that in the first 72 hours of life of extremely small premature infants often install hyperkalaemia non-oliguric a great threat to the lives of children and a challenge for neonatologists.

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The hyperkalemia can cause arrhythmias, intracerebral hemorrhage and periventricular leukomalacia, and sudden neonatal death. Conventional therapeutic interventions aimed at redistributing serum potassium (or sodium bicarbonate injection of insulin and glucose) increased removal of potassium in the body (diuretics, ion exchange resins, exchange transfusion, salbutamol or albuterol) or the treatment of hyperkalemia caused by arrhythmias may calcium (7).

A study conducted by Daniela Jacob and his collaborators in the Department Neonatal TI of Maternity Bega in 2012 and 2013, showed a prevalence of metabolic disorders 76.1% among extreme low birthweight preterms (ELBW). The study group consists of 46 extremely low birthweight infants with birth weight less than 1000 g and gestational age 24-30 weeks. All these premature conducted fluid and electrolyte therapy.

The cord transection disrupt the supply of nutrients to the newborn; this has a strong impact on prematurity in the first 24-72 hours of life; with hyperkalemia, hypocalcemia neonatal install. Using postnatal intravenous calcium compensate these losses, counters hyperkalaemia and antiarrhythmic effect (7).

THE WATHER BODY COMPOSITION NEWBORN

The body fluid composition varies inversely with gestational age; the body preterm gestational age of 23 weeks, with 90% water (60% extracellular and 40% intracellular). Healthy newborn body contains 75-80% water time (40% extracellular and 60% intracellular). Physiological decrease in the first week of life varies by gestational age: preterm lose 10-15% of birth weight and term newborn 5-10% (3).

THE FLUID THERAPY IN PRETERM INFANTS

Setting caloric needs (although there standard recommendations for energy needs) is the first step in the initiation of total parenteral nutrition.The nutrient management with 24 to 25 kcal/kg/day, immediately after birth, newborns with 24-40 weeks of gestation, provides energy balance. Energy requirements for providing bas 40 kcal/kg/day (3).

In order to ensure an increase in the daily 15 g/kg, in addition to the basal metabolism is needed 45-67 kcal/kg/day (3).

The heat distribution is as follows: 60-65% carbohydrate, 10-15% protein and 30-35% lipids, and the ratio of protein /energy must be 3-4 g /100 kcal.

In the total parenteral nutrition is necessary to achieve balance between fluid intake depending on the needs of premature loss of fluid (urine, stool, loss and loss insensitive pathological) and distribution of fluids in the body. On the first day of life will be given a quantity of liquid individualized 60-80 ml / kg / day and gradually increase depending on pathology, diuresis, level of hydration. At the end of the first week of life will ensure endovenous 150 ml / kg / day of fluid; this need is standardized tables hydric needs of infants, being present in all sections of neonatology.

The protein needs of premature depends on gestational age and birth weight, growth and catabolism is high. To ensure 15% of the energy needs of premature infants is necessary to introduce amino acid infusions, often from the first day of life, with 1-1.5 g/ kg/day initially; increase the intake of 1 g / kg / day up to a maximum of 3-3.5 g/kg/day for losses urinary, digestive and skin and provide age-appropriate growth.

The aminoacid solution will contain essential aminoacids (phenylalanine, histidine, leucine, isoleucine, lysine, methionine, threonine, valine) and the conditionally essential (arginine, cysteine, glycine, glutamine, proline, taurine, tyrosine).

The carbohydrate requirement of total parenteral nutrition is provided by glucose; glucose solutions also provide most of the energy substrate prematurely with cerebral role in metabilism. The very small infants (VLBW) and extremely low (ELBW) and in patients with respiratory distress or hypothermia need glucose soon after birth. Administer glucose solution (10% or 5%) with 4.6 mg/kg/min in preterm VLBW and 10.8 ml/kg/min in preterm ELBW providing 40-50 kcal/kg/day. After the normalization of the blood glucose, increase the glucose infusion rate to 0.5-1 mg/kg/min, up to a maximum of 12 to 13 mg/kg/ min (12). Detailed data are presented in the following table.

Table I. Macronutrients intake in the total parenteral nutrition of the newborn: Guidelines for initial therapy and supportive (after Wessel J, Kocoshis S. Nutritional Management of Infants with Short Bowel Syndrome. Semin Perinatol. 2007)

		Initial	Usually	Total
Premature < 32 weeks < 1000 grams	Dextrose	4 – 6 mg/kg/min	1 – 2 mg/kg/min	≤ 12 mg/kg/min
	Aminoacids	3 – 3.5 g/kg/d	0.5 - 1g/kg/d	4 g/kg/d
	Lipids	1 g/kg/d	0.5 - 1g/kg/d	3-3.5 g/kg/d
	Non-proteic calories	40 -50 kcal/kg/d	60 – 70 kcal/kg/d	85 – 95 kcal/kg/d
	Total Calories	50 – 60 kcal/kg/d	70 – 80 kcal/kg/d	90-100 kcal/kg/d

Premature < 32 – 36 weeks, > 1000 grams	Dextrose	4 – 6 mg/kg/min	1 – 2 mg/kg/min	≤ 12 mg/kg/min
	Aminoacids	3 – 3.5 g/kg/d		3.5 g/kg/d
	Lipids	1 g/kg/d	0.5 - 1g/kg/d	3 g/kg/d
	Non-proteic Calories	40 -50 kcal/kg/d	60 – 70 kcal/kg/d	85 – 95 kcal/kg/d
	Total Calories	50 – 60 kcal/kg/d	70 – 80 kcal/kg/d	90-100 kcal/kg/d
Newborn to term > 37 weeks	Dextrose	6 – 8 mg/kg/min	2 – 3 mg/kg/min	≤ 12 mg/kg/min
	Aminoacids	2 – 3 g/kg/d	0.5 - 1g/kg/d	2.5 – 3 g/kg/d
	Lipids	2 g/kg/d	0.5 - 1g/kg/d	2.5 – 3 g/kg/d
	Ca	40 – 50 kcal/kg/d	50 – 60 kcal/kg/d	70 – 80 kcal/kg/d
	Total Calories	50 – 60 kcal/kg/d	60 – 70 kcal/kg/d	80 – 90 kcal/kg/d

Necessary minerals, vitamins and trace elements will ensure the appropriate intravenous solutions, depending on the daily needs of specific pathology and daily losses of prematurity.

It is not generally necessary, to add Na, K, and Cl in the first 24 hours; if the diuresis is normal after the first day of the life, the need for sodium is 1-3 mEq / kg / day and potassium needs 1-2 mEq / kg / day (9).

The daily requirement of minerals is necessary chlorine 2-3 mEq / kg / day calcium requirement 150-200 mg / kg / day magnesium needs 15-25 mg / kg / day and phosphorus needs 20 to 25 mg / kg / day (8).

Daily vitamins are: vitamin A 1640 IU/kg/day, vitamin D 160UI/kg/day, Vitamin E 2.8 IU/kg/day, Vitamin K 80 mcg/kg/day, vitamin B6 180 mcg/kg/day, vitamin B12 0.3 mcg/ kg/day, vitamin C 25 mg/kg/day, folic acid 56 mcg/kg/day, biotin 6 mcg/kg/day, niacin 6.8 mg/kg/day thiamine 350 mcg/kg/day, riboflavin 150 mcg/kg/day (6).

The daily requirement of trace elements in premature is Zinc 400 mcg/kg/day, Cooper 20 mcg/kg/day, Selenium 2 mcg/kg/day, Chrome 0.2 mcg/kg/day, Manganese 1 mcg/kg/day, molybdenum 0.25 mcg/kg/day, Iodine 1 mcg/kg/day (12).

The therapy with fluids and electrolytes in the neonatal period is not without complications:

a) relating to the catheter: sepsis, extravasation of solutions, thrombosis, obstruction of the catheter;

b) related to treatment: hypo / hyperglycemia, azotemia, metabolic acidosis, cholestasis, hypertriglyceridemia, fluid and electrolyte disorders, liver problems, vitamin deficiencies and ologoelemente and osteopenia.

In the neonatal sepsis in premature infants and the court will begin fluid therapy with lower doses of aminoacids, the maximum dose of 2.5 g / kg / day protein (major risk of cholestasis).

The administration of glucose solutions in excess increases the basal metabolism, the fat deposition, the cholestasis, the hepatic steatosis and the overeating. ELBW infants often show hyperglycemia and therefore will ensure a glucose infusion rate below 4 mg/kg/day (7).

The routine use of lipid solutions is not supported in VLBW infants with severe and mechanically ventilated because of possible complications: fat intolerance, adverse effects on lung function, risk of chronic lung disease, interference in bilirubin binding to albumin, impaired function immunological and platelets. The rate of injection is using a solution of lipid in 0.5 g / kg / hr and slowly increases up to 3 g / kg / day.

After the stage of the total parenteral nutrition, the enteral nutrition is minimum phase (priming), and the enteral feeding of premature by digestive tolerance.

PREMATURE CATEGORIES REQUIRING A SPECIAL FLUIDS AND ELECTROLYTES THERAPY

Infants with the intrauterine growth restriction and hypoglycemia will be admitted to Neonatal Intensive Care Unit (NICU) and will be infused with 10% glucose initially 60-80 ml /kg/day (8.4 mg/kg/min); in severe hypoglycemia (blood glucose below 20 to 25 mg/dl) is given boluses of 2 ml/kg 10% glucose, then endovenos infusion 6-8 mg/kg/min, with monitoring of blood glucose in 30-60 minutes, to obtain values normal. The protein intake in these premature infants is 3 g/kg/day and fat intake of 0.5-1 g/kg/day (12).

Infants with lactose intolerance often require parenteral nutrition, achieving rebalancing electrolyte, and the introduction of enteral nutrition in parallel with increased digestive tolerance (11).

Mechanically ventilated infants requiring parenteral nutrition early in the first hour of life, and a necessary caloric 90-100 kcal / kg / day. Hussein and Rosenkrantz have conducted a review of studies casuistry extremely small preterm who received surfactant therapy with fluids and electrolytes: in infants with a gestational age of 22 weeks survived only 4%, 21% with 23 weeks of gestation and 46% with 26 weeks of gestation (5).

The cyanotic heart malformation preterm often develop congestive heart failure and pulmonary hypertension, with an impact on growth and development. Ensure caloric intake by 50% higher than that of healthy children (5).

A group of researchers at Rhode Island Hospital and Brown University School of Medicine studied fluid therapy in a group of 170 premature infants with birth weight of 751-2000 g and patent ductus arteriosus divided into two study groups: first group was made fluid restriction and the

second group were given the excess fluid (a 20 ml / kg / day versus daily fluid requirement for gestational age). The results are clear: 35 of the 85 preterm excess liquid had a heart murmur, marking the presence of a ductus arteriosus, and 11 of the 35 preterm developed congestive heart failure; only 9 of the 85 preterm fluid restriction had systolic susflu the ductus arteriosus and 2 of the 9 had premature cardiac insufficiency. They turned and necrotizing enterocolitis were more common in the group that received excess fluid (2).

Infants with metabolic disorders (abnormal carbohydrate metabolism, protein, urea cycle defects, abnormalities in fatty acid oxidation, organic acidemia, peroxisome and lactic etc.) requires early diagnosis and appropriate treatment. It requires dietary restriction metabolites incriminated in the disease, and supplementing deficient substances.

The acute and chronic renal insufficiency often marks the beginning stage of life prematurely. The appropriate caloric intake should be provided, taking into account the loss of urinary and gastro-intestinal organic and insensible losses (10).

The hepatic cholestasis, hepatic or extrahepatic obstruction caused by, associated with deficiencies in the drainage of the bile from the gall bladder. It will eliminate the fat and chromium solutions of intravenous fluid therapy (12).

Conclusions

The cord transection disrupt the maternal-fetal blood flow; at this point stop and newborn supplies nutrients. Most affected by this mechanism are the premature, which, depending on gestational age and birth weight often requires intensive care with fluids and electrolytes, nutrients necessary to ensure normal growth and development.

Needs of macronutrients (proteins, carbohydrates, lipids) and micronutrients (electrolytes, salts, vitamins, trace elements) will be provided about vein; will perform parenteral nutrition central venous or peripheral.

Often marked by intensive neonatal complications (lesions at the injection site, systemic disease). The specific neonatal pathology (especially complications of prematurity) requires prudent management and therapeutic nutrients often as necessary restrictions or liquid nutritional supplements.

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