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CASE REPORT

Refeeding syndrome in the severe malnourished: The nutricional challenges.

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Refeeding syndrome, Hypophosphatemia, Malnutrition.

Abstract

Introduction: Refeeding Syndrome (RS) is a set of signs and symptoms that occur in a situation of abrupt nutrient supply in malnourished or starving children and adults. Its incidence in pediatrics is unknown and is underreported due to underdiagnosis or insufficient monitoring. Hypophosphatemia is the most characteristic analytical finding of SR, although it is not always present. Hydro-electrolyte disturbances such as hypokalemia and hypomagnesemia can produce cardiac, muscular, and neurological changes with a risk of serious complications. **Objective:** To warn of the severity of this syndrome and to identify patients at risk. **Case report:** A 3-year and 5-month-old patient with chronic nonprogressive encephalopathy (CPE), BMI: 10.9 (Z-score -4.76) sought emergency care due to irresponsiveness and pallor. He was hypotheremic, hypoglycemic, and had isochoric and punctiform pupils. After initial management, the patient evolved with eye movement and limb mobility. Laboratory tests were ordered with mild anemia, hospital admission was requested, and a polymeric diet was started via gastrostomy 180ml every 3/3 hours. The patient evolved with hypokalemia, hypomagnesemia, and severe hypophosphatemia. A diagnosis of SR was made and thiamine replacement, correction of hydroelectrolytic disturbances and reduction of the diet was initiated with slow progression. **Conclusion:** The main tool to avoid SR is to perform an adequate prevention. To do this, one should initially identify patients at risk, perform a biochemical evaluation, and progress the diet carefully and slowly. Vitamin supplementation is necessary, especially thiamine.

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INTRODUCTION:

It is not easy to define Refeeding Syndrome (RS). The difficulty lies in the wide spectrum of gradation of this clinical condition, ranging from asymptomatic cases to very severe cases[1]. RS is a set of signs and symptoms that can occur in a situation of abrupt supply of nutrients to malnourished or starving children and adults, particularly in those receiving enteral or parenteral nutrition[2,3].

Its incidence in pediatrics is unknown. The low incidence may be the result of underdiagnosis or insufficient monitoring. Symptoms of RS are variable and unpredictable, and may be delayed, depending on the type and severity of the biochemical abnormality present. Clinical deterioration can occur rapidly if the cause is not established and appropriate treatment is not instituted, and it can be lethal.

This study reports the case of a child with chronic non-progressive encephalopathy (CNPE) and severe malnutrition who developed refeeding syndrome. The recognition of prone individuals, the understanding of their compensatory physiological mechanisms and their resulting nutritional implications are crucial to avoid the morbidity and mortality associated with this disorder[4].

CASE DESCRIPTION:

BRV, Patient aged 3 years and 5 months, with chronic non-progressive encephalopathy due to a history of severe perinatal asphyxia, with tracheostomy and gastrostomy, sought emergency care due to irresponsiveness and pallor.

On examination, the patient appeared emaciated, hypertonic, with fixed gaze, isochoric and punctate pupils. With the following vital signs: BP 93x61mmHg, HR: 130bpm, TEC 4 seconds, Tax: 34.3oc and capillary blood glucose of 40mg/ml. She received initial care with bag-valve-mask ventilation and oxygen therapy, volume expansion with glucose replacement. Then, midazolam was administered to reverse the seizure, placed on a thermal blanket and coupled to BIPAP. The patient improved with eye movement and limb mobility.

In anthropometry, the patient weighed 5.785 kg (weight-for-age -5.5 on the Z-score according to the WHO curve), and had a height of 72.4 cm (height-for-age -5.71 on the Z-score according to the WHO curve).) and BMI of 10.9 (-4.76 by Z-score) and triceps crease of 3mm. Mother reported using dairy compound 6x a day 180ml and soup 2x a day and irregular follow-up at the pediatrics and nutrition outpatient clinic, with difficult adherence to the guidelines recorded during consultations.

Laboratory tests showed normal electrolytes, blood count with mild normochromic and normocytic anemia with hemoglobin of 11.5mg/dl, normal leukogram and CRP. The following tests were ordered: CT scan of the skull which demonstrated bilateral frontotemporal subdural hematoma (suggestive of previous bleeding) and abdominal ultrasound demonstrating organized hematoma. The investigation was expanded, requiring a chest x-ray that demonstrated bronchopneumonia and an x-ray of the long bones that demonstrated a previous fracture in the left tibia and a consolidated fracture in the right clavicle. Abdominal tomography confirmed hepatic hematoma.

The patient was hospitalized and a normocaloric and normoprotein polymeric diet was started via gastrostomy with 180ml every 3/3 hours in addition to antibiotic therapy. Furthermore, the guardianship council was contacted to initiate an investigation into mistreatment.

The following day, he developed a fluid and electrolyte disorder with hypokalemia (2.8mg/dl), hypomagnesemia (1.7mg/dl) and severe hypophosphatemia (0.6mg/dl) in addition to an increase in C-reactive protein to 79mg/dl.

Due to the fluid and electrolyte disorders associated with the patient's malnutrition, an evaluation was requested from the pediatric nutrition team, which diagnosed severe malnutrition and Refeeding Syndrome. Thiamine replacement was initiated, in addition to corrections of fluid and electrolyte disorders and reduction of the normocaloric enteral diet to 5mL/hour continuously.

The patient improved in fluid and electrolyte disorders and promptly accepted the diet. A 20% volume progression was made every 3 days with an intermittent infusion of 3/3h with an infusion time of 1 hour and 30 minutes. The patient showed an improvement in infectious parameters after the end of antibiotic therapy. The diet continued to progress until reaching a volume of 180 ml every 3 hours with a caloric supply of 133 kcal per weight. He presented weight gain and was discharged at 6.3 kg with a triceps crease of 5 mm.

He was discharged from hospital after 2 months, with a court decision for institutional care with the possibility of a maternal visit. The patient was followed up at the Pediatric Nutrology outpatient clinic for nutritional recovery.

DISCUSSION:

ECNP is the most common disability during childhood, with a prevalence of approximately 2-3.5 cases per 1,000 live births, and a peak of up to 65 per 1,000 live births, particularly in preterm infants weighing <1,500 g at birth (5). According to data from the "North American Growth in Cerebral Palsy Project", 58% of children with moderate to severe Cerebral Palsy (CP) had feeding problems, which in 23% of cases were severe and often required alternative feeding, such as gastrostomy[6].

Malnutrition is one of the main risk factors for Refeeding Syndrome, as well as reduced intake in the last 14 days, weight loss > 10% in the last 2 months, NEC, conditions that lead to malabsorption or increased energy expenditure and child neglect. 3The risk factors are described in the annex in table 1[2].

During fasting, glucose and insulin levels are reduced in the first 24 hours, while glucagon levels are increased. This leads to a rapid conversion of glycogen to glucose. As a result,

gluconeogenesis begins as well as lipolysis and proteolysis to maintain energy production. As a result, muscle proteins are consumed and through lipolysis, ketone bodies are formed. At the same time, serum concentrations of potassium, phosphorus and magnesium are decreased. This does not always happen as intracellular reserves can compensate for variations[3].

When starting to provide a diet to a child who is starving, several clinical and metabolic changes may be observed: increased blood glucose levels with insulin release, water and sodium retention followed by a reduction in glucagon[7]. Phosphorus, potassium and magnesium will undergo an intracellular influx with a consequent drop in their serum levels.

The drop in electrolyte and vitamin levels arises mainly due to a lack of thiamine. Thiamine is an important cofactor in carbohydrate metabolism, allowing the conversion of glucose to ATP. In cases of thiamine deficiency, glucose is converted to lactate by lactate dehydrogenase, leading to metabolic acidosis[8].

The symptoms that should lead to the suspicion of RS are edema, confusion and tachycardia at rest, and this is associated with hypophosphatemia[9]. This is the most characteristic analytical finding of RS, although it is not always present. The rapid consumption of intracellular phosphorus in a situation of anabolism produces a defect in the inorganic phosphorus of red blood cells, which gives rise to hemolysis, anemia and inadequate oxygen distribution. This leads to the appearance of tissue ischemia, mainly in the central nervous and gastrointestinal systems. Likewise, lower phosphorus availability without the ability to produce energy through ATP synthesis is responsible for muscle and kidney symptoms[10].

Hydroelectrolyte disorders such as hypokalemia and hypomagnesemia can produce cardiac, muscular and neurological changes. The appearance of arrhythmias is a very common finding whose main manifestation is arrhythmia[11].

Symptoms of RS are variable and unpredictable, and may be delayed, depending on the type and severity of the biochemical abnormality present. If the disorders are mild, there may be no symptoms. Clinical deterioration can occur quickly if the cause is not established and adequate treatment is not instituted[1].

Table 2 describes the clinical signs and symptoms most commonly found in RS[1]. These are variable and often unpredictable symptoms, delayed or not, depending on the type and severity of the biochemical abnormality present.

Electrolyte disturbances are the main problems in RS. If they are diagnosed before starting feeding, they must be corrected beforehand[2]. Treatment must be carried out according to flowchart 1[12].

Asymptomatic patients: do not increase the diet until phosphorus is normalized. If the diet has been increased, return to the initial value. It is recommended to perform an electrocardiogram, in addition to correcting phosphorus levels orally or intravenously, depending on the severity.

Symptomatic patients: perform an electrocardiogram and measure electrolytes. Admission to an intensive care unit should be considered for monitoring, reducing (or suspending) diet, checking electrolyte, albumin and glucose levels. Arrhythmias must be treated if they appear, as well as adequate electrolyte correction[13].

This report showed a chronically malnourished patient who developed RS due to the initiation of an abundant diet without vitamin replacement. The patient developed electrolyte disorders the following day, which were only reversed after electrolyte and vitamin replacement associated with a carefully planned diet progression.

CONCLUSION:

The main tool to avoid Refeeding Syndrome is to carry out adequate prevention. To do this, patients at risk must initially be identified as described in flowchart 2[12]. In those at higher risk, it is recommended to previously carry out a medical and nutritional assessment of the child, ensure hemodynamic stability and correct possible disorders[14,15].

Before starting feeding and during the first 3-5 days, a careful assessment of the following parameters is necessary:

1. Hydration and nutritional status. Early weight gain may be secondary to fluid retention.

2. Serum parameters: glucose and albumin. It is not necessary to monitor glucose levels unless there are symptoms of hypoglycemia. The values of electrolytes such as sodium, potassium, urea, creatinine, phosphate, magnesium and calcium must be taken daily for 5 days. The decrease in phosphate usually appears 48-72 hours after starting feeding.

3. Cardiac status: pulse (compensatory tachycardia), electrocardiogram and echocardiogram. The appearance of a prolonged corrected QT should be especially monitored.

Furthermore, the diet should start with a caloric intake of 50%, according to the patient's age.

- < 7 years: 40-60kcal/kg/day
- 7-10 years: 35-50kcal/kg/day
- 11-14 years: 30-45kcal/kg/day
- 15-18 years: 25-40kcal/kg/day

If the diet is well tolerated, without causing fluid and electrolyte repercussions, it should be increased by 10-15% per day in subsequent days. It is recommended to feed more frequently and in small quantities, with a density of less than 1kcal/ml to minimize volume overload. The caloric intake must be balanced with 60% carbohydrates, 30-40% lipids and 20% proteins[14,15].

4. Supplementation: recommendations for electrolyte intake in patients at risk.

- Sodium: 1mmol/kg/day (1mEq/kg/day), max 150mEq/day;

• Potassium 2-3mmol/kg/day (2-3 mEq/kg/day), max 150mEq/day;

• Magnesium: 0.6mmol/kg/day (1.2mEq/kg/day), m x 10mEq/day;

• Phosphorus:

- 1st year of life: 0.5mmol/kg/day (1mEq/kg/day)

- >1st year: 0.2mmol/kg/day (0.4mEq/kg/day)(14, 16).

Vitamin supplementation must be done through food, ensuring the supply of folic acid, riboflavin, ascorbic acid and pyridoxine, as well as fat-soluble vitamins A, D, E and K. Trace elements, such as selenium, can also be deficient, therefore, should be included in the diet[14].

There is widespread debate about whether thiamine should be administered before eating. In general, evidence suggests administering 100 to 300 mg/day of oral thiamine (50-100 mg intravenously) before food because it is well tolerated with no upper daily limit. At this dosage, thiamine should be administered for 3 days[17].

Therefore, in order to increase early diagnoses and prevent RS, it is essential that the pediatrician is able to recognize the risk factors that lead to this condition. Those patients at risk, if approached with caution by starting the diet slowly with adequate replacement of vitamins and micronutrients, have a lower risk of developing this condition and the more serious forms.

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