Nutrición Hospitalaria

Nutr Hosp. 2014;29(1):215-220
ISSN 0212-1611 • CODEN NUHOEQ
S.V.R. 318

Caso clínico

Use of a symbiotic supplement in a child with short bowel Syndrome; a case report

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Abstract

The short bowel syndrome (SBS) is due to loss of bowel after surgery. Characterized by generalized nutrients malabsorption, its signs and symptoms include electrolyte imbalance, deficiency of vitamins, minerals and nutrients that can lead to death. Parenteral and enteral nutrition have a key role in its treatment.

Objective: **To describe the clinical course of a patient with SBS during continuous use of enteral nutrition supplemented with symbiotic.**

Case report: **A seven-year-old male underwent an emergency laparotomy at 18 months old with a massive bowel resection, remaining about 20 cm of the small intestine and the entire colon. He was dependent of exclusive parenteral nutrition for over a year, leading to the occurrence of numerous infectious complications. Due to complications caused by prolonged use of central venous access, was unable to continue to receive the parenteral nutrition. Enteral nutrition by a nasogastric tube and supplemental symbiotic was the nutritional therapy option for him. The assessment of the volume of losses by the colostomy was measured daily.**

Results: **There was a significant reduction of losses by colostomy, especially in the first days after introduction of the enteral nutrition plus symbiotic supplementation, as well as significant decrease in gas production.**

Conclusion: **Despite the lack of evidence for a formal recommendation on the use of symbiotic for SBS patients, its use in the nutritional therapy of this patient resulted in reduced electrolyte loss electrolyte and consequent improvement of his clinical and nutritional condition.**

(*Nutr Hosp.* 2014;29:215-220)

DOI:10.3305/nh.2014.29.1.6888

Key words: *Short bowel syndrome. Nutritional therapy. Symbiotics.*

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Recibido: 8-VIII-2013.
Aceptado: 2-X-2013.

USO DE SUPLEMENTO SIMBIÓTICO EN UN NIÑO CON SÍNDROME DEL INTESTINO CORTO; CASO CLÍNICO

Resumen

El síndrome del intestino corto (SIC) se debe a una pérdida intestinal tras cirugía. Caracterizado por una malabsorción generalizada de nutrientes, sus signos y síntomas incluyen el desequilibrio electrolítico y la deficiencia de vitaminas, minerales y nutrientes que pueden acarrear la muerte. La nutrición parenteral y enteral tiene un papel clave en su tratamiento.

Objetivo: **Describir el curso clínico de un paciente con SIC durante el uso continuo de nutrición enteral suplementada con un simbiótico.**

Caso clínico: **Un chico de siete años fue sometido a una laparotomía urgente a los 18 meses de edad con una resección intestinal masiva, quedando sólo 20 cm de intestino delgado y el colon al completo. Dependió de nutrición parenteral exclusiva durante más de un año, lo que le produjo numerosas complicaciones infecciosas. Debido a las complicaciones causadas por el uso prolongado de un acceso venoso central, no pudo continuar recibiendo la nutrición parenteral. La opción terapéutica para él fue la nutrición enteral a través de una sonda nasogástrica y un suplemento simbiótico. Se evaluaron a diario las pérdidas de volumen a través de la colostomía.**

Resultados: **Hubo una reducción significativa de las pérdidas por la colostomía, especialmente en los primeros días de la introducción de la nutrición enteral y la suplementación simbiótica, así como un descenso significativo de la producción de gas.**

Conclusión: **A pesar de la falta de evidencia de una recomendación formal para el uso de simbiótico en pacientes con SIC, su empleo en la terapia nutricional de este paciente produjo una reducción de la pérdida de electrolitos y la consiguiente mejoría de su situación clínica y nutricional.**

(*Nutr Hosp.* 2014;29:215-220)

DOI:10.3305/nh.2014.29.1.6888

Palabras clave: *Síndrome del intestino corto. Terapia nutricional. Simbióticos.*

Introduction

Intestinal failure is characterized by the impairment of functional capacity of the bowel, compromising the adequate digestion and absorption of nutrients, which becomes insufficient to maintain a healthy nutritional state[1,2]. This condition can be caused by different disorders of the gastrointestinal tract, categorized into three main groups: anatomic, neuromuscular or mucosal disease[1].

Short bowel syndrome (SBS) is one of the causes of intestinal failure that leads to a state of malabsorption, usually as a result of an bowel resection (at least 30% of the small bowel)[3]. SBS is a functional definition of intestinal failure, characterized by an inability to maintain the balance of energy, protein, fluids, electrolytes and trace elements, under the intake of a conventional diet, and often needs to be associated with parenteral nutrition[2,4]. In most cases it results from a bowel resection during early childhood due to necrotizing enterocolitis, intestinal congenital anomalies (atresia, gastroschisis), ischemia, volvo, thrombosis, or even later in life, due to Chron's disease or abdominal trauma[1,2,5]. In addition to reducing the absorptive area, there is also a loss of the ability of the gastrointestinal immune function and of the secretion of intestinal regulating peptides and trophic hormones[3]. The prolonged malabsorption leads to a pronounced micronutrient deficiency and growth delay[2], which in turn can lead to death by severe malnutrition, if not properly treated.

SBS is the primary cause of intestinal failure in children. In these cases, the preservation of the colon plays a crucial role in the production of trophic factors and water and electrolytes absorption[6]. The impairment of the absorptive and digestive surface results in a decrease of the available digestive enzymes and transportation proteins[2].

Shortly after the bowel resection, the remaining portion of the intestine starts a process attempting to increase the absorption of water and nutrients. It includes muscle hypertrophy and mucosal hyperplasia. This is the point where enteral nutrition therapy plays a key role, since the presence of intraluminal nutrients has a stimulatory effect on epithelial cells and on the production of trophic hormones[2,3]. The success of intestinal adaptation is directly related to the ability of structural and functional changes in the remaining bowel, allowing the child with SBS to have adequate growth and development, while receiving oral and/or enteral nutritional therapy[2].

The clinical presentation of SBS is highly variable. The symptoms associated with the bowel resection depend on the functional ability of the remaining intestine[3]. It may include electrolyte imbalance, clinical symptoms of micronutrients (calcium, magnesium, zinc, iron, vitamin B12, fat-soluble vitamins) deficiency, diarrhea (carbohydrates, protein and fat malabsorption), gastric hyper secretion; generation of kidney or gall bladder stones, and weight loss[7]. Clinical manifestations depend on the size of the remaining bowel (especially the jejunum and ileum), the presence of enterostomy, the presence of the ileocecal valve, and functional size of the remaining colon, associated diseases and possible complications[2].

Several complications may occur during the outcome of these patients. Watery diarrhea is usually the earliest complication, particularly when the progression of the enteral nutritional therapy is possible[7]. Other complications such as sepsis, cholestasis related to catheter infection, and accidents from catheter obstruction also occur frequently. Hepatic disease related to parenteral nutrition occurs in about 30 to 60% of these patients[2]. Other complications such as gall bladder stones and ulcers at the site of surgical anastomosis are also likely to occur[7].

Bacterial overgrowth, defined as the increase in the number and species of bacteria in the small bowel leading to inflammation, is particularly problematic in patients with SBS. The excess of bacteria can exacerbate the poor absorption through different mechanisms. Clinical manifestations of bacterial overgrowth may be nonspecific, such as belching, flatulence, abdominal pain and watery diarrhea. It may also present by an increase in energy expenditure, weight loss, colitis and ileitis, which simulate Crohn's Disease. Moreover, the weaning from parenteral nutrition often is difficult, and favors the occurrence of bacterial infections[8].

The enteral nutritional therapy has proven to be effective in the treatment of these patients by inducing a most suitable process of intestinal adaptation, while the introduction of an efficient oral feeding for patients with SBS is difficult. The presence of nutrients in the remaining bowel contributes to the production of new crypt enterocytes, promoting a gradual growth of the villi, and resulting in an increased absorptive surface. This is crucial for improving the nutritional status of patients with SBS[9]. Nevertheless, the recommendations about the type and duration of enteral nutritional therapy are not a standard, and the patient's age is a key factor to make this decision. It is known, however, that the parenteral nutritional therapy is essential to achieve the nutritional needs of these patients right after the surgical procedure[2].

The goal and the main challenge of nutritional therapy in the SBS is to enable the patient to maintain adequate growth and development, as well as promote the adaptation of the remaining bowel[9,10]. Even today many controversies about what are the best nutritional interventions for patients with SBS remain. In different centers of the world, most practices are still mainly based on personal experience and not on medical evidence, due to the large heterogeneity among patients with SBS[11].

The enteral nutritional therapy is the cornerstone for the therapeutic management of patients with SBS. It promotes a combined stimulation of functional,

hormonal, biliary and pancreatic secretions. As the enteral nutritional therapy starts, improvements of the intestinal flora and intestinal immunity are triggered. The incidence of bacterial translocation also decreases with its beginning[3]. Topics still in debate among experts include: administration mode (continuous versus intermittent), timing for the introduction of enteral feeding, diet composition (polymeric, semi-elemental or elementary), timing for the introduction of oral diet and fiber supplementation[2].

It is recommended to give frequent small volume meals every two or three hours, with a balanced mix of proteins, carbohydrates, and at least 40% of the daily caloric intake from fats. Hypertonic drinks (juices) should be avoided, as much as carbohydrate-rich foods, because they may cause major fecal losses, osmotic dehydration, and promote bacterial overgrowth[3]. It is interesting to select the nutrients so that they are simple, easy to digest and absorb, and are not harmful, especially regarding their osmolality. The introduction of enteral nutritional therapy and oral diet on the following, should be gradual, initially in small volumes, and always guided by the individual tolerance of the patient.

Case description

On october 29th, 2002, a male patient was born with anorectal malformations. A colostomy was performed during the neonatal period. At 18 months, he developed an acute abdomen, and underwent an emergency laparotomy procedure, performed in another hospital. A massive small bowel resection was performed, with only about 20 cm of the remaining small intestine and the entire colon, but there was no further information available from this surgical procedure.

He developed parenteral nutrition dependence for over a year, which led to the occurrence of numerous infectious complications, thrombosis of cava and iliac veins, chylothorax, incarceration and paquipleuris of left lung, oxygen therapy dependence and hypogammaglobulinemia. During this period, the patient also received a diet with complete restriction of fibers, lactose and sucrose, in order to ensure an appropriate nutritional intake, since he presented with large fecal volume gas formation in the colostomy bag. As most of the complications were caused by prolonged use of central venous access, this patient became unable to continue receiving parenteral nutritional therapy. At this point, exclusive enteral nutritional therapy by a nasogastric feed tube was the only option left to nourish this patient.

The chosen diet was a complete polymeric hypercaloric diet (1.5 kcal/mL) with fiber mix, administered by an infusion pump, with a total caloric amount of 1,200 mL/day. A restricted oral food supply (lactose and sucrose-free diet) was associated in order to decrease the fecal volume and gas formation inside the colostomy bag.

A symbiotic supplementation was introduced at the dosage of 6 g/day (LACTOFOS®/SIMBIOFLORA®) comprising fructooligosaccharide and four probiotic strains (*Lactobacillus paracasei Lpc-37 SD 5275, Lactobacillus rhamnosus HN001 SD 5675, Lactobacillus acidophilus N CFM SD 5221 10,⁹ UFC each strain Bifidobacterium bifidum*), aiming to reduce fecal volume, discourage overgrowth and bacterial translocation and reduce the gas overproduction observed in the colostomy bag.

The patient received a daily symbiotic supplementation for 43 days. During this period, the water balance was assessed every day, through the calculation of the difference between the ingested liquid volume (oral/enteral diet and water) and the volume represented by diuresis and fecal losses. Also, the accumulation of gases in the colostomy bag was observed.

Results

Significant reduction of fecal losses by colostomy, especially in the early days after the introduction of the symbiotic supplementation therapy and the enteral feeding occurred (Fig. 1). A significant decrease in gas production in the colostomy bag was also observed.

Discussion

SBS is a very heterogeneous condition regarding its causes at different ages, length and anatomy of the remaining bowel (presence of enterostomy, preservation of the ileum, colon and ileocecal valve) and its motor function. All these factors strongly influence the intestinal adaptation, and therefore its prognosis[12].

The removal of the ileum usually causes a much more difficult outcome than when the jejunum is removed and the ileum is preserved. In addition to having a larger adaptive capacity than the other portions of the small bowel, the ileum has a major role in the reabsorption of bile salts and vitamin B12. It also plays a role regulating the intestinal transit velocity by slowing down the bolus coming from the stomach and proximal small bowel, promoting a greater absorption of nutrients from the diet.

The ileocecal valve works as a physiological sphincter, controlling the velocity with which the chyme is released from the small bowel into the colon. It also avoids bacterial overgrowth in the small bowel, which could make it more difficult to deconjugate bile salts and cause fat and fat-soluble vitamins malabsorption.

The presence of the colon, whose main function is the reabsorption of water and electrolytes, also slows down the intestinal transit, due to its extension. The fermentation of undigested complex carbohydrates by the colonic bacterial flora produces short chain fatty acids (SCFA) which are an important source of energy and trophic stimuli to the intestinal mucosa.

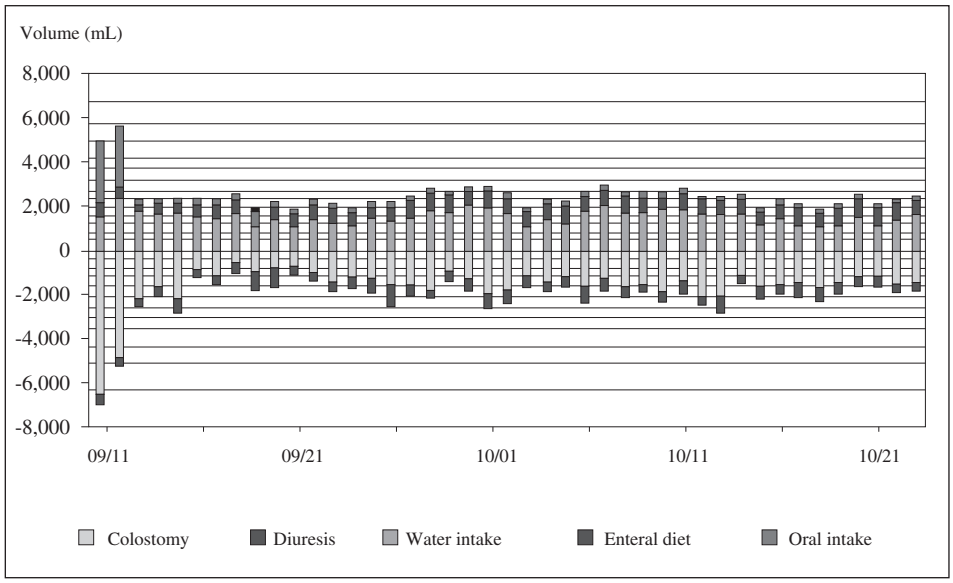

Fig. 1.—Patient's daily water balance.

In clinical practice, the nutritional management of SBS involves three stages. The first stage lasts from immediately after resection until about three months later. During this period, severe diarrhea and dehydration may occur with loss of electrolytes and nutrients. The main concern is the parenteral fluid replacement[13], with special attention to the proper adjustment of serum potassium, calcium, phosphorus and magnesium.

The second stage can last several weeks or months, corresponding to a stabilization period and intestinal adaptation, during which usually occur the transition from parenteral to enteral nutritional therapy (oral or tube feeding). The introduction of enteral nutritional therapy should be initiated as soon as possible, since the presence of nutrients in the remaining intestinal lumen plays a key role in adaptive bowel hyperplasia[2].

The third stage corresponds to the time when the patient has already achieved an adequate enteral intake that meets his/her nutritional needs, and the gradual weaning from the parenteral nutrition is possible.

Recently, the efficacy of treatment with probiotic, prebiotic and/or symbiotic supplements enhancing the balance of the intestinal bacterial flora, preventing bacterial translocation and improving the nutritional status of patients with SBS has been described. However, little is known about the effects of these products on the immune system of patients with SBS[12].

Probiotics are live microorganisms that beneficially affect its host by suppressing the proliferation of pathogenic bacteria and also by improving the balance of intestinal bacterial flora. *Bifidobacteria, Lactobacilli* and Gram-positive *cocci* are the most common microorganisms found in the bowel. Their beneficial effects have been described in several clinical situations in animal models, such as diarrhea, food allergies, immune disorders, inflammatory bowel disease, and prevention of intestinal tumors[12].

Prebiotics are non-digestible fibers from the diet that stimulate growth and activity of a limited number of colon bacteria, providing benefits to the host. Prebiotics tend to reduce the number of pathogenic bacteria and increase the proliferation of *Bifidobacteria* and *Lactobacillus*. Galactooligosaccharides, fructooligosaccharides and lactulose are amongst the most common prebiotics[12].

Combined treatment with probiotic and prebiotic is called symbiotic therapy, and it has attracted the attention of many experts because of their possible effectiveness in the therapeutic management of patients with SBS[12].

Our patient has undergone a massive resection of the small bowel and despite the presence of the colon, which is an important organ for water and electrolyte absorption and also for the production of trophic factors, still had large fluid losses after one year of surgery, suggesting a failure in the adapting process of the remaining intestine, which significantly compromised his growth, weight gain and global nutritional status.

Despite the fact that the parenteral nutritional therapy is strictly necessary in this situation, its suspension was inevitable since the patient had superior cava and iliac veins thrombosis, preventing the possibility of any central venous access and therefore the continuity of the parenteral nutritional therapy. The only alternative left was to focus on an effective enteral nutritional therapy, with the association of a polymeric hypercaloric enteral diet with a mix of fibers and a symbiotic supplement for this patient. The goal was to reduce fecal and electrolyte losses, improve the absorptive

process (promoting a better intestinal adaptation) and decrease gas production, ensuring a more efficient nutritional recovery.

The major complication secondary to the SBS seems to be the bacterial overgrowth and bacterial translocation, that contribute to many of the SBS symptoms (intestinal mucosal lesions and consequent malnutrition)[14,15]. Experimental studies with animal models and clinical trials have shown promising results of oral administration of symbiotic supplementation in modulating the severity of bacterial translocation.

The main positive effects of probiotics are assigned to promote these changes in intestinal bacterial flora, since they compete for nutrients and adhesion to the mucosa with pathogenic bacteria. Additionally, the SCFA produced by probiotics stimulate the proliferation of epithelial cells and bowel motility, the production of intestinal mucin and pancreatic enzymes secretion, besides decreasing epithelial cells' apoptosis[12,16].

Prebiotics aim to provide a healthier composition of the bacterial flora, working as a nutritional substrate for probiotic bacteria, making the host more resistant to bowel infections, and giving immunomodulatory properties to these compounds. Furthermore, prebiotics are an energy source to bowel epithelial cells and also to other tissues, since they are the ones who enable the colonic production of SCFA[17].

Symbiotics are a combination of probiotics and prebiotics, promoting a synergistic action between the two. This appears to have a further positive effect in the treatment of bowel diseases when compared to the separate administration of prebiotics or probiotics. Scientific evidence of this therapy in humans is still limited though.

Kanamori et al.[18,19] showed a similar outcome to this report, and described their experience with the symbiotic supplementation therapy in two studies. In the first study, symbiotic supplements were prescribed for over a year in seven patients with SBS, and changes in the composition of the intestinal flora with a predominance of anaerobic bacteria and suppression of pathogenic bacteria, associated to an increase of fecal SCFA was observed. All patients, except one, showed weight gain. Five of them increased serum protein levels[18]. In the second study, the same authors described a significant improvement of the absorptive function and motility of a four year old patient with SBS and treated with symbiotics supplementation (*B. breve*, *L. casei* and galactooligosaccharides)[19].

Conclusions

Nutritional management of children with SBS is very complex and challenging. The main objectives of the nutritional therapy are: the maintenance of a good nutritional status and with satisfactory growth velocity; minimizing fecal losses of water, electrolytes and nutrients to maintain adequate hydro-electrolytes stability; and maximizing the intestinal adaptation process. For this purpose, it seems that the wiser therapeutic management is the adoption of an individual strategy for each situation, always considering its effectiveness, the physiological principles of the disease and the patient's tolerance.

Despite the lack of evidence for a formal recommendation on the use of symbiotic supplementation for the treatment of SBS, its use in the dietary treatment of our patient resulted in a significant reduction of water and electrolyte fecal losses, with consequent improvement of their clinical and nutritional status.

References

1. Goulet O, Ruemmele F, Lacaille F, Colomb V. Irreversible intestinal failure. *J Pediatr Gastroenterol Nutr* 2004;38:250-69.
2. Olieman JF, et al. Enteral Nutrition in Children with Short-Bowel syndrome: Current Evidence and recommendations for the Clinician. *J Am Diet Assoc* 2010;110:420-6.
3. Cardoso AL, Romaldini CC. Síndrome do Intestino Curto. In: Delgado AF, Cardoso AL, Zamberlan P. Nutrologia Básica e Avançada. Barueri: Ed Manole; 2010. pp. 169-86.
4. Vanderhoof JA, Pauley-Hunter RJ. Management of the Short-Bowel Syndrome in Children. Available at: http://www.uptodate.com/contents/management-of-the-short-bowel-syndrome-in-children?source=search_result&search=short+bowel+ syndrome &selectedTitle=3%7E79
5. DiBaise JK, Young RJ, Vanderhoof JA. Intestinal rehabilitation and the short bowel syndrome: part 1. *Am J Gastroenterol* 2004;99:1386-95.
6. Goulet O, Colomb-Jung V, Joly F. Role of the colon in short bowel syndrome and intestinal transplantation. *J Pediatr Gastroenterol Nutr* 2009;48 (Supl. 2):S66-71.
7. Vanderhoof JA, Pauley-Hunter RJ. Chronic Complications of the Short-Bowel Syndrome in Children. Available at: http://www.uptodate.com/contents/chronic-complications-of-the-short-bowel- syndrome-in-children?source=see_link
8. Vanderhoof JA, Pauley-Hunter RJ. Clinical Manifestations and Diagnosis of Small Intestinal Bacterial overgrowth. Available at: http://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-small-intestinal-bacterial-overgrowth?source=see_link
9. Goulet O, Baglin-Gobet S, Talbotec C, Fourcade L, Colomb V, Sauvat F, et al. Outcome and long-term growth after extensive small bowel resection in the neonatal period: a survey of 87 children. *Eur J Pediatr Surg* 2005;15:95-101.
10. Miyasaka EA, Brown PI, Kadoura S, Harris MB, Teitelbaum DH. The adolescent child with short bowel syndrome: new onset of failure to thrive and need for increased nutritional supplementation. *J Pediatr Surg* 2010;45:1280-6.
11. Olieman JF, Poley MJ, Gischler SJ, Penning C, Escher JC, van den Hoonaard TL, et al. Interdisciplinary management of infantile short bowel syndrome: resource consumption, growth, and nutrition. *J Pediatr Surg* 2010;45:490-8.
12. Uchida K, et al. Immunonutritional effects during synbiotics therapy in pediatric patients with short bowel syndrome. *Pediatr Surg Int* 2007;23:243-8.
13. American Gastroenterological Association medical position statement: short bowel syndrome and intestinal transplantation. *Gastroenterology* 2003;124:115-1110.
14. Gonzalez HF, Perez NB, Malpeli A, Martínez MI, Del Buono B, Viteri FE. Nutrition and immunological status in long-term follow up of children with short bowel syndrome. *JPEN J Parenter Enter Nutr* 2005;29:186-91.
15. Wessel JJ, Kocoshis SA. Nutritional management of infants with short bowel syndrome. *Semin Perinatol* 2007;31:104-11.

16. Guarner F, Malagelada JR. Gut flora in health and disease. *Lancet* 2003;361:512-9.
17. Gibson GR, Probert HM, Loo JV, Rastall RA, Roberfroid MB. Dietary modulation of the human colonic microbiota: updating the concept of prebiotics. *Nutr Res Rev* 2004;17:259-75.
18. Kanamori Y, Sugiyama M, Hashizume K, Yuki N, Morotomi M, Tanaka R. Experience of long-term synbiotic therapy in seven short bowel patients with refractory enterocolitis. *J Pediatr Surg* 2004;39:1686-92.
19. Kanamori Y, Hashizume K, Sugiyama M, Morotomi M, Yuki N. Combination therapy with Bifidobacterium breve, Lactobacillus casei, and galactooligosaccharides dramatically improved the intestinal function in a girl with short bowel syndrome: a novel synbiotics therapy for intestinal failure. *Dig Dis Sci* 2001;46:2010-6.