A multidisciplinary approach to short bowel syndrome

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Short bowel syndrome is a complex clinical picture, characterized by signs and symptoms of malabsorption and subsequent malnutrition, which often occurs after extensive bowel resections.
Short bowel syndrome's treatment must begin together with the planning of the first surgery, especially for disease that may need multiple interventions. Patients with short bowel should be individually managed because they all are different in diagnosis, length of the remaining bowel and in psychosocial characteristics. For all these reasons, a multidisciplinary approach between the various specialists is therefore needed.

KEY WORDS: Crohn's disease, Extensive surgery, Malabsorption, Malnutrition, Short bowel syndrome

Introduction

Short bowel syndrome is a complex clinical picture that occurs after extensive bowel resection surgery, characterized by signs and symptoms of malabsorption and subsequent malnutrition. The classical picture of the disease involves diarrhea, dehydration and weight loss. This presentation is associated frequently with electrolyte imbalance, abnormal metabolism of fats, proteins and sugars as well as vitamins, minerals and trace elements deficit[1]. Various definitions of short bowel are present in literature: some Authors believe that short bowel syndrome should be defined according to the type and extension of resection surgery, while other support that parenteral nutrition dependency for more than 1-3 months post-resection surgery represents an adequate diagnostic criterion. Other definitions are based on the residual bowel length (Fig. 1). For instance, a residual small bowel length of less than 25% of the expected for age is considered as short bowel syndrome [2]. Both of these definitions lack of specificity, the former because there are

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many different types of intervention that can be performed and the latter because the symptoms are not dependent on residual bowel length. The severity of symptoms is determined primarily by the anatomic location of the portion of bowel resected, by the type of reconstruction performed and the type and quality of nutritional, medical and surgical treatment rather than by the extent of resection. The causes that lead to carry out extensive bowel resection surgery are various and numerous. In adults, in particular, these include bowel infarction, strangulated hernia, volvulus, trauma, Crohn's disease, tumours of the small bowel and mesentery, radiation enteritis, complications during bariatric surgery. On the other hand, in children, the most frequent causes were intestinal atresia, gastroschisis, volvulus from malrotation, meconium ileus and necrotizing enterocolitis [3].

Pathophysiology and classification of short bowel syndrome

The extent of resection is not a criterion to predict the onset of short bowel syndrome. Normal human small bowel length varies from about 275 cm to 850 cm, and tends to be shorter in women. Despite it's not a reliable marker of development of short bowel syndrome,

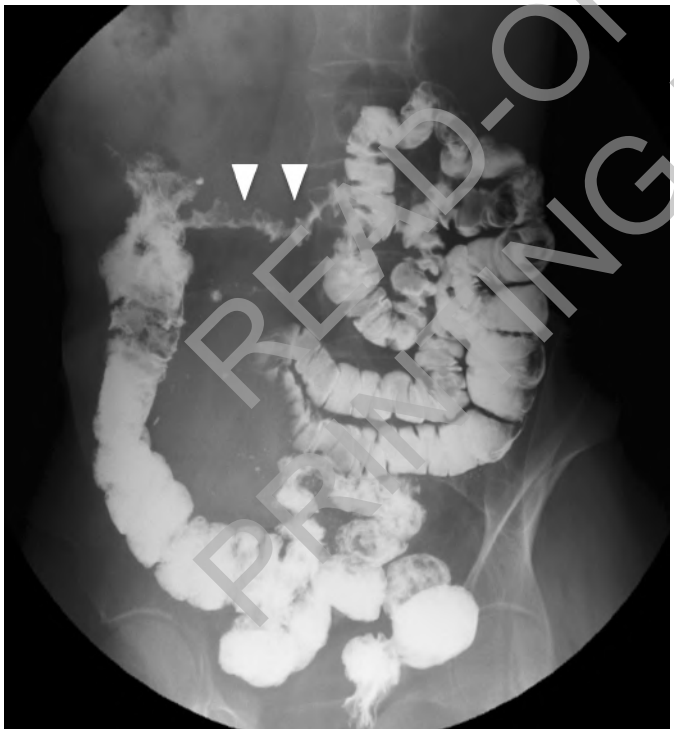

Fig. 1: Radiographic examination of a 54-years-old woman operated several times for Crohn's disease: previous segmental resections of the small bowel and ileocolic resection with sub-stenosing recurrence disease on the ileal side of the anastomosis (arrowheads). Neo-terminal ileum's mucosa takes on the appearance of typical ulcerative nodular Crohn's disease's recurrence. The measurement of the residue small bowel is useful and accurate with conventional X-ray examination.

it is important to refer to the remaining length of small intestine after a resection. In general, nutritional/fluid supplements are likely to be needed if less than 200 cm of small bowel remains [7]. The main issue in case of extensive bowel resection is the loss of small intestine's functions. Gut, in fact, is not designed exclusively to nutrients' absorption, but it performs many functions such as secretion, motor activity, endocrine activity, immune activity, regulation of metabolism of lipids, sugars, proteins, minerals, trace elements, vitamins, homeostasis, acid-base balance, electrolyte and adaptability. Considering the pathophysiological basis of short bowel syndrome can help to predict the development of short bowel syndrome [8]. The severity of the clinical picture and prognosis of patients with short bowel syndrome depends on many factors such as the length of the remaining intestinal segment, the type of residual intestine (ileus or jejunal), the extent of ileal resection (greater than or less than 100 cm), terminal ileum preservation with ileo-caecal valve and possible extension to the colon; other factors that can determine the symptoms are the size of the adaptive response (compensatory hypertrophy) with the development of valves, villi and microvilli, the anatomical and functional integrity of remaining bowel, the associated lesions or the excision of the remaining intestinal segments. The type of surgery, the need of multiple or urgent intervention, the patient characteristics and comorbidity also affect the onset of short bowel syndrome.

Despite the length of the excision do not predict the development of symptom, some general consideration can be made.

The excision of approximately 75% of the total length of the small intestine determines in most cases the onset of malnutrition and malabsorption symptoms. Generally the conservation of at least 10% of the total length of the small intestine or the preservation of the ileo-caecal valve and the last 30-40 cm of terminal ileus is enough for survival. Ileal resection results in more severe consequences than jejunal for various reasons such as frequent requests to associate with the ileal resection also ileocecal valve's resection and ascending colon, which is important to slow intestinal transit and prevent bacterial overgrowth in the small intestine. While the ileum have specific absorptive function, the absorptive function of the jejunum can be replaced by duodenum and ileum. This latter segment have specific transporter for vitamin B12, salts and bile. The removal of this segment leads to malnutrition and deficiencies that must be supplemented.

Concerning the extent of ileal resection two different conditions can occur. The removal of a shorter tract of ileum (within 100 cm of ileum) decreases absorption of bile acids reaching the colon that are dehydroxylated and deconjugated by intestinal bacteria to secondary bile acids (deoxycholic acid and lithocolic acid) and determine morphological and functional mucosal injury resulting in lower absorption and increased secretion of water and

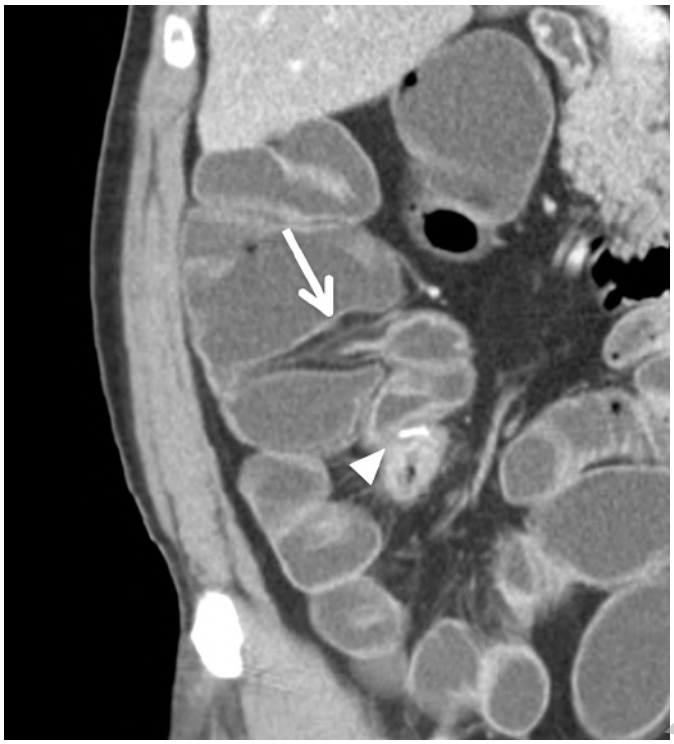

Fig. 2: Barium-TC of the ileocecal region in a 43-years-old woman affected by Crohn's disease: metalclip (arrowhead) in previous pre-terminal ileum segmental resection with entero-enteric anastomosis. The afferent ileal loop is characterized by hyperemia and wall thickening compatible with recurrent inflammation. The ileocecal valve (arrow), intact and continent, prevents bacterial contamination of the last ileal loop.

electrolytes resulting in a condition of watery diarrhea. If the ileal resection exceed 100 cm, fecal loss of bile acids overcomes the capacity of hepatic synthesis of the same, resulting in reduced pool of bile acids. This condition is responsible for the lower concentration of bile acids in the intestinal lumen and the distal small intestine resulting in deficit and inadequate training of the "micelle", insufficient solubilization of dietary fat with inevitable maldigestion and malabsorption of fats, both responsible for a condition called steatorrhea [9]. The removal of Ileocecal, on the other hand, increases the speed of transit of intestinal contents with malabsorption. Moreover, the absence of the ileocecal valve determines backscattering of microorganisms in the small intestine and intestinal mucosal lesions caused by secondary bile acids resulting in diarrhea. The preservation of ileo-caecal valve, therefore, appears to be a positive prognostic factor for the onset of short bowel syndrome in extensive bowel resection [10] (Fig. 2).

Another interesting mechanism that is observed in these patients is the adaptation of the residual bowel portion, so-called "compensatory hypertrophy". The residual intestine is able to increase the absorption surface by increasing the size of the villous and by the hyperplasia of epithelial cells. This phenomenon is prevalent in ileal resection and is less frequently observed in jejunal resection.

The size and location of resection as well as the time elapsed after surgery determine the level of adaptation. Intestinal adaptation may include morphological changes and functional changes that increase the absorptive capacity of single ileal and colic epithelial cells and changes colonic production and absorption of short-chain fatty acids. The result of adaptation is an improved intestinal vitality and efficiency of energy and fluid absorption. Mediators of this process may be the increased exposure of the intestine to increased amounts of residual intraluminal nutrients, bile and pancreatic secretions, hormones as well as vascular and neural factors. All these factors lead to structural changes in residual bowel [11]. The process of intestinal adaptation is complex and multifaceted. The changes are progressive and require several years to complete. A study conducted years ago at Harvard University showed that mucosal atrophy after a period of malnutrition can come back to normal after proper nutrition [12].

Total parenteral nutrition can be life-saving for many patients with short bowel syndrome although it may be associated with nutritional deficiencies, septic complications, high health care costs, and life-threatening organ failure. Total parenteral nutrition is used to rehabilitate short bowel syndrome patients to achieve enteral autonomy. Bowel rehabilitation therapy, including recombinant human growth hormone (rhGH), nutrition support, glutamine, and dietary fiber, promote intestinal adaptation in patients with short bowel syndrome [13]. Glucagon-like peptide 2 is a nutrient-dependent, proglucagon-derived gut hormone that stimulates intestinal adaptation. The treatments with glucagon-like peptide 2 induces differential growth of duodenal and jejunal mucosa. Significant differences in villus height, crypt depth, dry mass and concentrations of proteins and DNA were observed. Combinated treatment with supplemental enteral nutrients and glucagon-like peptide 2 induces a synergistic response resulting in higher mucosal cellularity and digestive capacity in parenterally fed rats with short bowel syndrome. This shows that supplemental enteral nutrients improve the trophic response to exogenous glucagon-like peptide 2, possibly by stimulating enterocyte proliferation and differentiation [14].

The Glp-2 analogue Teduglutide is a promising agent in short bowel syndrome [15, 16] with a better half-life than Glp-2 due to its resistance to Dipeptidil Peptidase IV. The long term efficacy and safety are not well estabilished and some reports showed an enhanced growth of colon cancer in mice due to Glp-2 [17, 18]. Despite this, Glp-2 agonist appear the most promising farmacological therapy for short bowel syndrome. Other trophic factors, such as recombinant human growth hormone, may enhance intestinal adaptation and decrease total parenteral nutrition requirements [19]. Epidermal growth factor receptor stimulation enhances intestinal adaptation after massive small bowel resections, measured by taller villi, deeper crypts, and augmented enterocyte proliferation. The mechanism

for epidermal growth factor receptor-induced proliferation of enterocytes does not appear to involve a transcriptional role for beta-catenin. The effects of epidermal growth factor receptor signaling on beta-catenin-mediated cell adhesion remain to be investigated [20].

Recent evidences suggest that also bombesin is involved in modulation of growth and differentiation of normal small intestine. In a rat model of short bowel syndrome, bombesin enhanced enterocytes turnover and stimulated structural intestinal adaptation [21].

The most effective therapy to stimulate the adaptive capacity of the intestine, however, appears to be aggressive nutritional support [22]. A study conducted in children with short bowel syndrome showed that an aggressive medical/surgical approach can allow patients with intestinal failure and advanced liver disease to avoid transplantation [22]. Others studies showed improved liver function and nutritional parameters with the ability to discontinue total parenteral nutrition and maintaining growth [23]. Finally another study found that continuous enteral supplementation of L-arginine can stimulate intestinal adaptation in a rat model of short bowel syndrome. L-Arginine can significantly increase fat absorption, plasma level of free fatty acids, ileal mucosal weight and DNA content, jejunal and ileal mucosal protein content, jejunal and ileal villus length, crypt depth and mucosal thickness. L-arginine supplementation also increased enterocyte's proliferation, decrease enterocyte's apoptosis while continuous enteral supplementation of L-arginine can stimulate intestinal adaptation [24].

Several markers have been found to be related with intestinal function in short bowel syndrome. Serum citrulline, a product of glutamine metabolism, is positively correlated with intestinal absorptive area and capacity in short bowel syndrome patients. It represents a potential marker for evaluating the severity of intestinal failure and the efficacy of rehabilitative therapy in these patients [25]. Plasma citrulline and glutamine concentrations are biomarkers of residual small intestinal length and nutrient absorptive functions in short bowel syndrome adult patients and seem to be indicators of small intestinal length in adult short bowel syndrome [26].

In our experience, patients undergoing surgery for extensive bowel resection who developed short bowel syndrome showed different symptoms depending on the time elapsed after surgery. 4-6 weeks after surgery patients developed diarrhea, dehydration, weight loss, edema, hypovitaminosis, increased gastric secretion as well as infectious complications. In the following months (stabilization period), there was a decrease in diarrhea and an increase in gastric secretion, weight recovery but also the development of liver disease, kidney stones and anemia. The latest phase was represented by the adaptation to the new bowel length with constant body weight, disappearance of diarrhea and gradual recovery of the habits prior to surgery [27, 28]. The compensatory mechanisms probably act in this latter phase. Not all patients, however, are able to achieve good control. Many, in fact, develop a whole amount of complications including lack of nutrients, hydro-electrolyte deficiency, hypovitaminosis, anemia, osteoporosis, peptic ulcer, kidney stones, cholelithiasis, liver disease [29-33]. All these complications have an interesting pathophysiological basis: for example, peptic ulcers can be caused by an increase of gastrin secretion after resection of the distal ileum [34].

Medical therapy

The goals of therapy are correction and prevention of malnutrition and the achievement of normal growth process in children, avoiding long term complications of parenteral nutrition and maintaining a good quality of life. The most important way to reach these targets is to achieve enteral autonomy, but this is difficult to obtain in most patients. The hallmark of the management are parenteral nutrition and total parenteral nutrition, which are expensive and may be associated with some well-known issues such as liver diseases and sepsis. Cessation of parenteral nutrition at the earliest possible stage is desirable but enteral autonomy has to be achieved first. Factors such as intraluminal nutrients, gastrointestinal secretions and hormones facilitate adaptation. Enteral nutrition should be started as soon as the clinical situation permits. Some drugs are thought to increase intestinal adaptation as discussed before. In some cases surgical bowel lengthening procedures can be performed to increase the absorptive surface area. In selected case, liver transplantation can be necessary if liver has suffered irreversible damage but intestinal autonomy seems achievable; small bowel transplantation [2] can be considered if the patient cannot sustain the long-term parenteral nutrition. Obviously these procedures are rarely performed due to complexity of procedure and shortage of donors.

Treatment of short bowel syndrome is above all in preventing it. The surgical strategy is obviously influenced by the underlying disease, by the way the resection performed should be as short as possible. Even few centimeters can be important to avoid short bowel syndrome and maintain enteral nutrition: in patients at risk for short bowel syndrome (e.g. Crohn's disease) a length saving strategy must be performed and, if possible, ileo-caecal valve must be preserved [35].

Medical treatment of short bowel syndrome has numerous aids. The ideal would be to achieve a controlled enteral nutrition within six months after surgery. In the immediate post-operative period, fluid and electrolyte require reinstatement with parenteral nutrition that can be decreased and gradually integrated and replaced by enteral nutrition. Progressively, the processes underlying compensatory hypertrophy should take place and lead to parenteral nutrition suspension.

Guidelines are available for nutritional and pharmacological treatment of patients with short bowel syndrome[36]. Dietary modifications have an established role in the management of short bowel syndrome. Diet must be tailored to the individual patient. The determination of the appropriate amount of carbohydrates is based on the presence of the colon, because carbohydrates are processed in the colon by bacterial fermentation.

Patients with a jejunostomy rapidly become dehydrated because they lose more sodium and fluids than the amount absorbed enterally. The jejunum rapidly absorbs solutions with high salt concentrations, such as the WHO-recommended oral rehydration solution. In patients with short bowel syndrome and preserved colon, replacement of long-chain fatty acids with water-soluble medium-chain fatty acids increases the energy intake. Extra attention should be given to electrolytes, trace elements and vitamins.

Patients with preserved colon are at risk for oxalate nephropathy. For these patients, a low oxalate diet is recommended [37]. Other treatment options are available. Appropriate agents include acid inhibitors, bile-salt binders, inhibitors of motility and secretion, antibiotics, pre-biotics and probiotics.

A number of intestinotrophic factors have also been identified that are reported to enhance the functional adaptation of the intestine following surgery or illness as discussed before [38]. Parenteral nutrition and hydration can be used to supplement the enteral nutrition if an adequate intake cannot be reached [39]. Therefore it is desirable, when possible, to switch to oral diet for short bowel syndrome patients. Patients education and motivation are key factors in successful enteral nutrition switch. Caloric intake must be increased if tolerated, considering that absorption rarely equals intake. If there is lactose intolerance is recommended to reduced intake of lactose or use an exogenous lactase. It is appropriate to reduce the intake of oxalates in case of hyperoxaluria (in case of suspected steatorrhea and integrity of the colon) and ultimately would be useful to introduce the fibers in relation to individual tolerance. Other factors include the length and health of the remaining bowel, the conservation of the colon, and bowel adaptation development [40]. Enteral nutrition is a cost-effective method for maintaining the nutritional status in patients with short bowel syndrome, but proper management in clinical practice to avoid diarrhea or other complications should be ensured [41, 42].

The dietary treatment of steatorrhea requires knowledge of the cause and treatment of the primary disease, limitation of fat intake, nutritional support, or pancreatic-enzyme replacement depending on the disease process [43]. Malnutrition is often a major clinical problem in patients with multiple surgical resections. Assessment of nutritional status should be routinely carried out in these patients and, in case of severe malnutrition, artificial nutrition should be used. Parenteral nutrition has a primary role in more severe cases of malnutrition when the need of restoring rapidly the hydroelectrolitic and nitrogen/caloric balance prevails, but its use must not be prolonged in time because of complications (primarly infections). In case of integrity of the small bowel and tolerance of the patient, enteral nutrition is preferable to parenteral nutrition for its lower costs and reduced related complications [44]. Octreotide is an effective therapeutic option in controlling secretory diarrhea of various etiology. Octreotide is well tolerated; principal side effects are transient injection site pain and gastrointestinal discomfort. For many patients octreotide therapy is expected to improve the overall health and quality of life and in the long term will reduce health care costs [45].

Probiotics, due to their positive effects on the gastrointestinal tract (improving gut barrier function, motility, facilitation of intestinal adaptation and decreasing pathogen load and inflammation) may have a therapeutic role in the management of short bowel syndrome [46].

The pharmacological application of intestinal growth factors has been recognized because of their protective and reparative actions in the intestinal tract. Keratinocyte growth factor (KGF), IGF-1 and glucagon-like peptide 2 (GLP-2) may play a role in management of intestinal damage. In particular, GLP-2 has been assessed in preclinical and clinical investigations for its capacity to prevent or treat an increasing number of intestinal diseases, including short bowel syndrome, chemotherapy-induced intestinal mucositis and inflammatory bowel disease [47].

Particular devices can be made in specific patients: patients with enterostomy should follow a diet high in fat and low in carbohydrate content integrating oral solutions with high concentrations of mineral salts. On the other hand, patients with integrity of the colon must introduce less fat and higher content of polysaccharides (which are fermented in the colon).

Careful monitoring of nutritional status is required because rarely patients are able to absorbe all of the nutrients contained in given foods. Drug treatment consists, as already mentioned, in the administration of vitamin B12, fat-soluble vitamins, loperamide, codeine phosphate, cholestyramine, pancreatic enzymes, H2 blockers or PPIs, antibiotics, octreotide, GH, glutamine. By the way evidences for recommendation in administration of these therapies are controversial up to date.

Greater attention should be paid in the study of patients during the active phase of intestinal adaptation rather than in the setting of chronic intestinal failure. For example, the role of GH in pediatric short bowel syndrome remains unknown [48]. A new approach is represented by teduglutide, that seems to be safe and well-tolerated and demonstrates restoration of structural and functional integrity of the remaining intestine with significant intestinotrophic and proabsorptive effects, facilitating a reduction of diarrhea and an equivalent reduction of the requirement for parenteral support in patients affected by short bowel syndrome [49, 50]. Patients with short bow-

el syndrome often present steatorrhea with content of fat greater than 7 grams in the stools of 24 h [27]. Intestinal rehabilitation regimens whereby patients are treated with specialized oral diets, soluble fiber, oral rehydration solutions and trophic factors to enhance absorption are important resources to use [51]. There are also studies amied to identify substances that may potentiate the natural adaptation process following intestinal resection. In fact, Michopoulou et al. have reported that Benzalkonium Chloride (BAC) application to the serosal surface of rat's jejunum in short bowel syndrome is a simple method that within only 4 weeks can topically augment the natural adaptation process noticed following intestinal resection. Further research are need to find an application on people affected by short bowel syndrome [52]. There are finally a variety of surgical techniques available to preserve intestinal length [53].

Surgical therapy

Surgical treatment of short bowel syndrome consist of several procedures such as bilateral simpathectomy to increase splanchnic blood flow, the creation of a loop of circulation through the interposition of a gastric tubule or a segment of colon aiming at decreasing the intestinal transit and increase the absorption surface, or the reversal of the intestinal loop, the creation of an intraluminal valve, the denervation of a segment of bowel and myotomy. In fact, even if in presence of massive resections of the small intestine, exist methods of functional compensation [54]. Studies on this topic have begun many years ago [55].

The Bianchi's technique, the serial transvers enteroplasty procedure and the intestinal transplant are other techniques that can be used to extend the bowel or increase the absorption surface. All these techniques, however, are not free of complications: inversion loop can lead to twisting or face a dehiscence while the loop can predispone to stasis and bacterial overgrowth that can affect the absorption already in deficit.

The most accepted techniques are those elongating the bowel that may be applied only on dilated bowels [35]. Although experience is greater with Bianchi's technique, short-term outcomes of serial transversal enteroplasty seems to be positive and may be applied even to bowels previously elongated by the Bianchi's technique [56-58]. Surgical lengthening with both Bianchi and serial transvers enteroplasty procedures result in improvement of enteral nutrition, reverses complications of total parenteral nutrition and can avoid intestinal transplantation in the majority of patients with few surgical complication [59].

Intestinal transplantation is the rescue therapy for those who cannot reach intestinal indipendencyeor develop life-threatening complications from parenteral nutrition or fail to switch from total parenteral nutrition [60]. Patients failing to achieve the stabilization and continuing to show severe symptoms of intestinal failure, particularly those following a prolonged total parenteral nutrition, develop serious complications such as severe liver disease (hyperbilirubinemia, increased transaminases, splenomegaly, thrombocytopenia, coagulopathy, fibrosis or cirrhosis) or sepsis and should undergo bowel or multivisceral transplantation.

Selection criteria for elegibility of patients for intestinal transplant are life-threatening complications of parenteral nutrition, lack of venous access for parenteral nutrition, locally invasive tumors of the abdomen, chronic intestinal failure with a high risk of mortality, primary disease-related poor quality of life despite optimal parenteral nutrition [61, 62].

The evolution of small bowel transplantation has been significant over the past 20 years to the point at which it can now be considered a viable and often successful option in the treatment of many forms of short bowel syndrome. A refinement of surgical techniques, improved immunosuppression, enhanced understanding of gut immunology, and better treatment and prevention of complications have contributed to a marked improvement in graft and patients' survival. Whereas this transplanted population is still threatened by many potential complications after isolated bowel or multivisceral transplantation and long-term graft survival (like with other solid organ transplants) remains a challenge, the future holds promise for a continuation of the current positive trend of improvement in several areas [63].

Intestinal transplantation became clinically successful in the 1990s and for a period of time largely replaced surgical lengthening for treatment of patients with serious complications related to parenteral nutrition. Intestinal transplantation, although promising and potentially life-saving for short bowel syndrome, should be reserved to patients with failed autologous gastrointestinal reconstruction or those who have no prospect for autologous enteral autonomy [64]. Autologous intestinal reconstruction surgery can provide long-term survival, independence of parenteral nutrition, and satisfactory general health in selected children with severe short bowel syndrome [65].

Despite the improved survival, intestinal transplantation is associated with a high risk of infection, rejection, and other complications related to immunosuppression [66]. For this reason, when medical and surgical alternatives are available for the treatment of patients with intestinal failure, these should be maximized before submitting the patient to the risks of long-term immunosuppression. In fact chronic rejection and systemic sepsis with failure of the graft must be considered and indicate that at present this procedure cannot be offered to every patient but will be a potential form of therapy in future [67].

Conclusions

The treatment of short bowel syndrome begins together with the planning of the first surgical intervention, especially for those patients that may need multiple intervention (Crohn's disease). The high incidence of post-operative recurrence in Crohn's disease, for exemple, is mandatory to a strict follow-up (clinical, laboratory and instrumental monitoring), to identify patients at increased risk fo developing a short bowel syndrome. This attidue enable physicians to implement a rational pharmacological prophylaxis and prevent, with more effective therapy, short bowel syndrome [68]. These patients, in fact, are at high risk of large bowel, small bowel, extraintestinal and hemopoietic cancers, and in North Europe, selected patients with extensive colonic disease, which has been present from a young age, could be undergo to prophylactic colectomy [69]. The breakdown of short bowel syndrome in the classic 3-stages clinical and therapeutic significance is only approximate, since it frequently does not respond to the clinical reality of the individual patient. Each patient goes beyond strict schematic and therefore constitutes a case study in itself for what concerns the symptoms, prognosis and therapy [70, 71]. Patients with a short bowel should each be managed as an individual: they are all different in diagnosis, remaining bowel length/function, and psychosocial characteristics. Intestinal failure manifests with diarrhea, fluid and electrolyte imbalance and malabsorption related to surgical resection of small intestine or very rarely due to malfunction of large segments of bowel. Management of short bowel syndrome requires better understanding of the site and extent of resected segment, pathophysiology of the remaining segment and of the time of adaptation. Initial management includes control of diarrhea with adequate fluid and electrolyte management which is critical to stabilize the patient. Multidisciplinary approach is needed for these patients [72]. A correct management of these patients can lead to an improved quality of cares and to considerable costs saving [73]. Sometimes, patients thought to be in need of long term parenteral nutrition may be weaned from it with appropriate advice. Nowadays, despite the limitations of total parenteral nutrition, we can provide an optimal treatment in post-operative phase, but a long way have to be made regarding the transition from parenteral nutrition to oral feeding to obtain good survival rates and an acceptable quality of life [74].

Riassunto

La sindrome da intestino corto è un quadro clinico complesso caratterizzato da segni e sintomi di malassorbimento e successiva malnutrizione, che spesso si verifica dopo interventi di resezione intestinale estesi. Il trattamento della sindrome dell'intestino corto deve iniziare al momento della pianificazione del primo intervento chirurgico, soprattutto per patologie che possono richiedere plurimi interventi chirurgici. Il trattamento dei pazienti con intestino corto dovrebbe essere individualizzato, poiché ogni paziente presenta diverse caratteristiche per quel che riguarda la diagnosi, la lunghezza dell'intestino residuo e le caratteristiche psicosociali. Un approccio multidisciplinare a questi pazienti tra i vari specialisti è necessario.

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