

The STEP procedure in an adult patient with short bowel syndrome: A case report

Muhittin YAPRAK, Okan ERDOĞAN, Mehmet OĞUS

Department of General Surgery, Akdeniz University School of Medicine, Antalya

The serial transverse enteroplasty procedure is an autologous intestinal reconstruction technique defined and used originally in pediatric patients. In this paper, we describe the serial transverse enteroplasty method and outcomes in an adult male patient who underwent extensive bowel resection after mesenteric artery embolism and later developed short bowel syndrome. He was diagnosed with mesenteric artery embolism and related extensive bowel necrosis and underwent extensive bowel resection including the right colon. The remaining 60 cm was diverted to the proximal jejunum as the end stoma. He received total parenteral nutrition for five months and underwent serial transverse enteroplasty in the fifth postoperative month. The jejunum of 60 cm in length was elongated to 100 cm using the serial transverse enteroplasty method. The patient was 80% total parenteral nutrition-dependent preoperatively, but became totally total parenteral nutrition-free in the third month after the procedure, and nutrition needs could be met enterally. The serial transverse enteroplasty procedure can be used as an effective and reliable autologous intestinal reconstruction method in adult patients with intestinal insufficiency due to short bowel syndrome, just as in pediatric patients.

Key words: Serial transverse enteroplasty, adult patient, mesentery vascular disease, short bowel syndrome

Kısa barsak sendromlu erişkin bir hastaya uygulanan STEP ameliyatı: Olgu sunumu

Seri transvers enteroplasti ameliyatı ilk olarak çocuk hastalarda tanımlanılıp kullanılmış olan bir otolog intestinal rekonstrüksiyon tekniğidir. Bu makalede, mezenter arter embolisi sonrası uygulanan geniş barsak rezeksiyonu nedeniyle kısa barsak sendromu gelişmiş olan erişkin bir erkek hastaya uygulanan seri transvers enteroplasti ameliyatını ve sonuçlarını irdledik. Hastaya mezenter arter embolisi ve buna bağlı olarak gelişen barsak nekrozu tanısı konup, sağ kolonu da içine alacak şekilde geniş barsak rezeksiyonu uygulandı. Kalan 60 cm'lik jejunum ile end stoma olacak şekilde diversiyon sağlandı. Hastaya beş ay boyunca total parenteral beslenme uygulandı ve ilk ameliyattan sonraki beşinci ayda hasta ikinci kez ameliyat edildi. Bu ameliyatta, kalan 60 cm'lik jejunum seri transvers enteroplasti tekniği ile 100 cm'ye uzatıldı. Seri transvers enteroplasti ameliyatı öncesinde %80 oranında total parenteral beslenmeye bağımlı olan hasta, seri transvers enteroplasti ameliyatı sonrasında üçüncü ayda tamamen total parenteral beslenmeden bağımsız hale geldi ve beslenme gereksiniminin tamamı enteral olarak karşılanabiliyordu. Seri transvers enteroplasti ameliyatının, çocuk hastalarda olduğu gibi kısa barsak sendromuna bağlı intestinal yetmezliği olan erişkin hastalarda da efektif ve güvenli bir otolog intestinal rekonstrüksiyon tekniği olarak kullanılabileceğini düşünüyoruz.

Anahtar kelimeler: Seri transvers enteroplasti, erişkin hasta, mezenter vasküler hastalık, kısa barsak sendromu

INTRODUCTION

Intestinal insufficiency can be defined as failure of absorption of the required elements for normal growth and development and for weight protection following intestinal loss. The most important surgical alternatives of multi-visceral or isolated in-

testinal transplantation in the treatment of intestinal insufficiency are the methods used for autologous intestinal reconstruction. The most common alternative surgical treatments are Bianchi and the serial transverse enteroplasty (STEP) pro-

cedures. The Bianchi procedure was first described by Bianchi in 1980, while the STEP procedure was described by Kim *et al.* (1) in 2003. Both methods are used for bowel elongation, and are usually preferred in pediatric patients. The aims of these methods are to increase the bowel length and prolong the intestinal transit time by narrowing the luminal diameter, thus saving patients from total parenteral nutrition (TPN) dependence. The majority of applications of these methods have been in pediatric patients and the data in adults are scarce. There is no reported study in the literature on the efficacy and reliability of these methods in mesenteric vascular disease, which is one of the most important causes of short bowel syndrome in adults.

CASE REPORT

A 44-year-old male patient presented to the emergency clinic of our hospital with the complaint of abdominal pain and high fever persisting for two days. On the physical examination, blood pressure was 100/70 mmHg, pulse 110/minute and axillary temperature 38°C. Diffuse tenderness and distension in the abdomen and decreased bowel sounds were noted. On computerized tomography (CT) angiography, it was found that the superior mesenteric artery (SMA) was totally occluded due to embolism, and the patient was operated. During the exploration, ischemia and necrosis were observed in all of the small bowel and the right colon, except for the first 30 cm of the jejunal loop. The SMA was found from the radix of the mesentery of the transverse colon. The artery had no pulsation or flow. Transverse arteriotomy and embolectomy were performed. Partial arterial flow was maintained and after waiting for almost an hour, perfusion of the proximal 60 cm of the jejunum improved. The necrotic distal intestine and right colon were resected. With concern about the inadequate safety of anastomosis, the stump of the transverse colon was closed primarily; the 60 cm long jejunum with improved perfusion was anastomosed to the skin in the left anterior abdominal wall. The origin of the embolism was investigated, but the focus could not be defined. Anticoagulant therapy was administered with fractionated heparin in the postoperative period. The flow through the stoma was measured as 4500-8000 ml/day in the early postoperative period. Parenteral nutrition (35 kcal/kg) was administered to the patient. He was discharged on the 13th postoperative day, and con-

tinuation of TPN was recommended at home. He was allowed to consume an elementary diet with enteral fluid intake. Almost all the caloric need (80%) was provided parenterally (Oliclinomel N7 and Omegaven; Baxter, USA). He was hospitalized three times due to catheter sepsis. Liver and renal function tests, hemoglobin, hematocrit, total protein, serum albumin levels, and body weight were monitored in this period. The liver function tests were minimally elevated in the fourth month. As there was no possibility of intestinal transplantation and due to the presence of recurrent catheter sepsis, autologous intestinal reconstruction was planned. Following preparations, laparotomy was performed, and it was found that there was no adaptive dilatation in the jejunal loop. The jejunal diameter was measured as 3.5 cm. The STEP procedure was performed on the 60 cm proximal jejunal loop using a total of 15 linear incisive staplers (GIA Ethicon Endosurgery 45 mm - 3.5 mm, USA), beginning from a point 5 cm distal to the Treitz ligament with 2 cm intervals in a zig-zag pattern with consecutive mesenteric and anti-mesenteric sides. After the procedure, the length of the jejunum was measured as 100 cm. The measurement was made using the standard anti-mesenteric soaked 1/0 silk suture. The staple line was not supported with additional sutures. The defects in the mesenteric side were left open. The jejunal end was anastomosed end-to-end to the proximal transverse colon and the continuity of the intestine was maintained. He was re-explored on the 10th postoperative day due to prolonged ileus. The staple line appeared normal. Adhesiolysis was performed for the adhesions. Passage was provided two days after this procedure. The number of defecations was 10-12 times per day in the early postoperative period, and bowel movement was controlled using cholestyramine and loperamide. On day four, enteral nutrition was initiated with an elementary diet in a stepwise manner. The tolerance towards enteral nutrition was tested with a short bowel diet and enteral nutritional solutions (Isosource MCT, Nova source, Resource glutamine; Nestle, Sweden). In a period of four weeks, while enteral calorie support was increased based on the number of daily defecations, body weight, serum albumin, total protein, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and gamma glutamyl transpeptidase (GGT) values, TPN calorie support was decreased. TPN was stopped at the end of the eighth week and he was followed for

the number of daily defecations and body weight. The patient was totally TPN-independent, tolerated enteral nutrition, had no marked weight loss (after STEP procedure 3 kg in the first month, 1 kg in the second month), and had 4-6 defecations per day in the second postoperative month (Table 1).

DISCUSSION

Intestinal insufficiency is the leading cause of death in short bowel syndrome. The most common cause of short bowel syndrome in adults is mesenteric vascular disease. The mortality rate for mesenteric vascular disease secondary to embolism has been reported as 70-90%. The majority of patients are lost due to sepsis and multi-organ failure in the early postoperative period (2). The most important cause of death in surviving patients with short bowel syndrome is the associated intestinal insufficiency. These patients with advanced age and concomitant medical problems cannot tolerate long-term parenteral nutrition. The treatment options for this problem mainly include intestinal transplantation, parenteral nutritional support and autologous intestinal reconstruction with medical preventive measures. The success of intestinal transplantation is far from satisfactory. Long-term survival cannot be achieved with parenteral nutritional support and medical preventive measures due to developing complications, which have been reported as hepatic failure and sepsis.

Autologous intestinal reconstruction methods are preferred as they are alternative options for intestinal transplantation (3,4). The most common methods today are the STEP and the Bianchi methods. They are usually used in pediatric patients. A case report of a patient with short bowel syndrome secondary to mesenteric thrombosis, similar to our patient, was published without detailed clinical data (5).

The STEP method is one of the most common alternatives to autologous intestinal reconstruction

surgery today. It was defined by Heung Bae Kim (1) and was used in 38 patients according to the records of 2007 (6). The method is based on incomplete resection of the intestinal segment at 2 cm intervals consecutively with the aid of a linear incisive stapler placed at the anti-mesenteric and mesenteric ends. Using this method, a bowel segment can be obtained with a decreased intraluminal diameter, but with an increased length. In contrast to the previously described methods, the risk of peritoneal contamination in enterotomy is minimized, and the transit time is prolonged by protecting the mucosal surface area without impairing the natural blood flow of the bowel. One of the most important advantages is that it does not require adaptive dilatation (7). Furthermore, it creates the possibility to re-perform the procedure in more than one session (8). In their series with 38 pediatric patients, Modi et al. (9) reported complications related to the procedure, namely leakage from the staple line in two patients and intestinal obstruction in two patients. Three patients died due to progressive hepatic failure and sepsis. Multi-visceral transplantation was required in three patients. One of the advantages of this method is that it reverses the progression of hepatic failure with TPN, because hepatic failure is accepted as one of the most important causes of death in patients receiving TPN (10).

The Bianchi method described in 1980 has been used in more than 100 patients, most of whom were of pediatric age. The rate for becoming independent of parenteral nutrition with this method was reported as 67% and the overall survival rate as 76% (5). The most important disadvantages of this method were late-term re-dilatation, stricture at the anastomosis line, and the inability to be re-performed. The number of patients reported in the STEP method is 38. The rescue rate from TPN was similar to that of the Bianchi method and was reported as 67%. Another advantage of the STEP method is the practicality of this method in patients who have undergone the Bianchi method. Both methods are contraindicated in the presence

Table 1. Progression of clinical and laboratory findings of the patient

	Pre-STEP	Post-STEP 1 st month	Post-STEP 2 nd month
Body weight (kg)	80	77	76
Total protein (g/ml)	6.8	6.06	6.5
Serum albumin (g/ml)	3.8	4.06	4.1
ALT (IU/ml)	56	43	38
ALP (IU/ml)	210	200	186

of signs suggesting hepatic failure. The most important advantage of the STEP method is the possibility to perform the procedure in different sessions and the better one-year survival rate compared to the Bianchi method (92% versus 80%).

Data on the applicability of the STEP method in adults are scarce. One of the reasons for preference of this method in our patient was that the patient had almost no chance for intestinal transplantation based on the frequently recurring catheter sepsis starting from the third month, the high flow rate (4500-8000 ml/day) for the stoma in spite of all precautions, and meeting almost all caloric need from parenteral nutrition. With adequate calorie support, the patient did not experience significant weight loss. There is no report regarding application of the STEP method in intestinal insufficiency developing after mesenteric artery embolism. Although Sudan et al. (5) reported in their study of 64 patients that mesenteric thrombosis was found in only four of 14 adult patients, detailed assessment of the etiology was not provided. Only one patient had undergone the STEP procedure, while three had undergone the Bianchi method. The reason for our preference of the STEP method was its easy application and appearance of no dilatation in the bowel segment. The patient did not need parenteral nutrition by the end of second month (Figure 1).

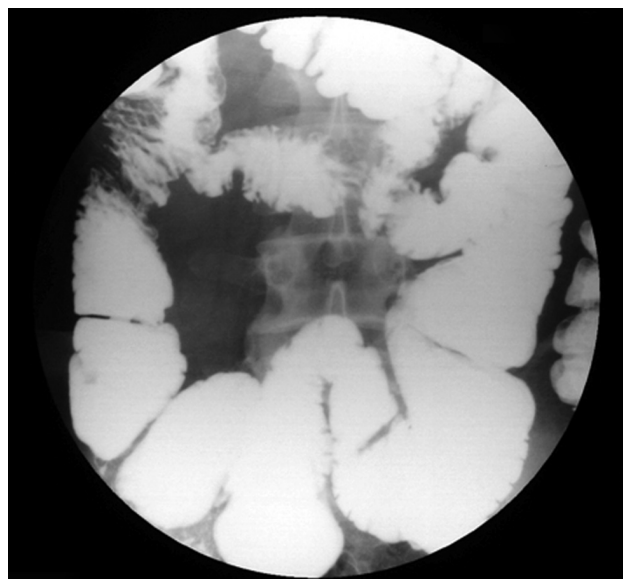


Figure 1. Small bowel passage X-ray in the third month following STEP. Note that the small intestine displayed slight uniform dilation.

The success in returning to normal life, free from TPN, in the short-term with the use of the STEP method in this patient may be an indicator of the reliable use of this method in adult patients. Longer follow-ups and increased numbers of patients will provide objective data for the true success of this method in adult patients.

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