Intestinal Rehabilitation after Extensive Bowel Resection in Post-Gastrectomy Patients

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Purpose: Surgical complications requiring massive bowel resection after gastrectomy are rare. However, when such an event occurs the patient may develop short bowel syndrome and intestinal failure. We report our experience of intestinal rehabilitation in four post-gastrectomy patients.

Materials and Methods: From January 2011 to June 2014, four cases of short bowel syndrome were identified in post-gastrectomy patients. All patients were managed by a multidisciplinary team specialized in the care of intestinal failure patients. Patients' medical records were reviewed retrospectively.

Results: The original diagnosis was early gastric cancer in all patients. One patient had synchronous esophageal cancer. Patients required extensive bowel resection due to bowel strangulation from internal herniation (3 cases), superior mesenteric artery torsion (1 case). Remnant small bowel length ranged from 10 cm to 80 cm and partial resection of the colon was performed in three cases. One patient received serial transverse enteroplasty (STEP) and one patient is receiving continuous enteral feeding via surgical gastrostomy. There were no cases of intestinal failure-associated liver disease. Two patients are receiving home parenteral nutrition in varying degrees. Two patients have been weaned off parenteral nutrition.

Conclusion: Four post-gastrectomy patients with short bowel syndrome were managed. Despite application of various medical and surgical measures, weaning off parenteral nutrition was difficult in these patients. (*Surg Metab Nutr* 2015;6:33-37)

Key Words: Intestinal rehabilitation, Short bowel syndrome, Intestinal failure

INTRODUCTION

Short bowel syndrome (SBS) results from extensive resection of small bowel due to various causes, including congenital anomaly in children, volvulus or thrombosis of mesenteric vessels and recurrent bowel resection conditions eg, Crohn's disease.[1] Unanticipated massive bowel resection leading to SBS is associated with low quality of life.[2] Although the incidence of SBS from post-

operative complication of gastrectomy is unclear, it could be a rare but devastating condition. Intestinal obstruction is the most common cause for postoperative SBS after abdominal surgery, either from adhesions or volvulus.[3] Internal herniation is an uncommon complication of gastrectomy and is reported to be 0.08~5.3%, depending on the type of gastrectomy and reconstruction.[4] However, internal herniation in post-gastrectomy patients may lead to massive bowel resection and SBS. Reports on the experience of adult SBS due to complications after gastrectomy for gastric cancer are seldom found in the literature. Our aim was to report our experience of intestinal rehabilitation in patients undergone extensive bowel resection due to complications after gastrectomy

Received October 27, 2015. Accepted November 1, 2015.

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for gastric cancer.

MATERIALS AND METHODS

From January 2011 to June 2014, we performed a retrospective review of our database of patients in the Intestinal Rehabilitation Team (IRT) at Samsung Medical Center and found four patients who were referred for short bowel syndrome-intestinal failure (SBS-IF) from surgical complication after gastrectomy for gastric cancer. In order of our experience, we reviewed demographic data such as gender, age, primary disease, operation as well as other patient characteristics related to the cause and severity of the SBS, treatment and result of the intestinal rehabilitation.

All patients' managements were done by the multi-disciplinary IRT consisting of general surgeons, dieticians and pharmacists. After the patients were referred to our team, our management was started by analyzing the remaining bowel function and assessment of nutrition status with collecting data on malabsorption of macronutrients (ie, protein, lipids, and carbohydrates) and micronutrients (ie, vitamins and trace elements). Once treatment started, parenteral nutrition (PN) was given for nutritional support along with enteral feeding. The composition of PN was altered according to patients' laboratory results and body weight by our pharmacists. The weaning of PN was decided by the meeting of Intestinal Rehabilitation Team conducted each week.

RESULTS

Table 1 shows the demographics of patients of intestinal failure after gastrectomy (Fig. 1).

Case 1 was a 55 year old male who received total gastrectomy, esophagectomy and esophagocolojejunostomy for early gastric cancer (EGC) and synchronous esophageal cancer. At postoperative 3 months internal herniation and bowel strangulation occurred and the patient underwent massive bowel resection and jejunioileal anastomosis. Remnant bowel was 60 cm of proximal jejunum and 50% of the colon. The ileocecal valve (ICV) was intact (Fig. 1A). The patient had severe weight loss after surgery and was referred to the IRT 18 months after development of SBS. The patient received intensive intestinal rehabilitation including serial transverse enteroplasty (STEP) 11 months after IRT referral. The patient was weaned off PN 5 months after STEP.

Case 2 was 70 year old male who received total gastrectomy with Roux-en-Y esophagojejunostomy for EGC. Internal herniation and strangulation occurred at postoperative 22 months and the patient underwent massive bowel resection and end jejunostomy. Bowel continuity was eventually restored with jejunocolostomy. The patient had 60 cm remnant proximal jejunum and 80% of colon without an ICV (Fig. 1B). He was referred to IRT 4 months after diagnosis of SBS. The patient received continuous enteral feeding via nasoenteric feeding tube to enhance intestinal absorption of nutrients. Enteral feeding

Table 1. Demographics of patients referred to intestinal rehabilitation

	1	2	3	4
Sex/ Age	M/55	M/70	M/56	M/64
Diagnosis	EGC with esophageal cancer	EGC	EGC	EGC
Operation	Total gastrectomy, esophagectomy with ECJ	Total gastrectomy	LADG (Billroth -II)	Total gastrectomy
Catastrophic event	Internal herniation	Internal herniation	Internal herniation	SMA torsion
Event time (from initial OP)	3 months	22 months	15 months	48 months
SBS type	Jejuno-ileostomy	Jejuno-colostomy	Jejuno-colostomy	End Jejunostomy
Remnant SB Length	60 cm from JJ	60 cm from JJ	80 cm from GJ	10 cm from JJ
IC valve	Intact	No	No	No
Remnant colon	50% of colon	80% of colon	50% of colon	50% of colon

EGC = early gastric cancer; ECJ = esophago-colo-jejunostomy; LADG = laparoscopic assisted distal gastrectomy; SMA = superior mesenteric artery; SBS = short bowel syndrome; SB = small bowel; JJ = jejuno-jejunostomy; GJ = gastro-jejunostomy; IC = ileo-cecal; OP = operation.

Fig. 1. Illustrations of abdominal anatomy of patients after massive bowel resection. (A) Case 1, Jejunostomy and serial transverse enteroplasty (STEP) with total gastrectomy, esophagectomy and esophagojejunostomy for synchronous early gastric cancer (EGC) and esophageal cancer, (B) Case 2, Jejunocolostomy with total gastrectomy with Roux-en-Y esophagojejunostomy for EGC, (C) Case 3, Jejunocolostomy with Billroth-II laparoscopic assisted distal gastrectomy (LADG) for EGC feeding via gastrostomy, (D) Case 4, End jejunostomy with total gastrectomy with Roux-en-Y esophagojejunostomy for EGC.

was gradually overlapped with oral bolus feeds and the patient was weaned off PN 8 months after IRT referral.

Case 3 was a 56 year old male who received laparoscopy-assisted distal gastrectomy for EGC. Internal herniation and bowel strangulation occurred at 15 months and the patient had 80 cm of remnant jejunum and 50% of colon and no ICV (Fig. 1C). The patient was referred to IRT 1 month after diagnosis of SBS. Bowel continuity was restored 2 months after IRT referral with jejunocolic anastomosis and feeding gastrostomy. PN weaning is ongoing with continuous enteral feeding via gastrostomy during 6 months after intestinal rehabilitation.

Case 4 was a 64 year old male who received total gastrectomy for EGC. At postoperative 4 months SMA torsion lead to massive bowel strangulation and the patient re-

Fig. 2. Change of body weight of 4 patients after intestinal rehabilitation. SBS = small bowel syndrome; IRT = intestinal rehabilitation team.

ceived extensive bowel resection and end jejunostomy. Remnant jejunum was 10 cm distal to the jejunocolic anastomosis.

Table 2. Outcome of patients after intestinal rehabilitation

	1	2	3	4
SBS type	Jejuno-ileostomy	Jejuno-colostomy	Jejuno-colostomy	End Jejunostomy
Remnant SB Length	60 cm from JJ	60 cm from JJ	80 cm from GJ	10 cm from JJ
IRT referral after SBS	18 months	4 months	1 month	1 month
Interventions	STEP	CEF	CEF viagastrostomy	–
Outcome	Wean	Wean	EN with PN	Home TPN
Time to wean*	16 months	8 months	Ongoing [†]	– [†]
IFALD	No	No	No	No
CLABSI	2	No	No	No

SBS = short bowel syndrome; SB = small bowel; JJ = jejuno-jejunostomy; GJ = gastro-jejunostomy; IRT = intestinal rehabilitation therapy; STEP = serial transverse enteroplasty; CEF = continuous enteral feeding; EN = enteral nutrition; PN = parenteral nutrition; TPN = total parenteral nutrition; IFALD = intestinal failure-associated liver disease; CLABSI = central line-associated blood stream infection.

*Interval time from intestinal rehabilitation therapy to completely enteral autonomy. [†]During 6-month follow-up period from referred to intestinal rehabilitation team (IRT). [‡]During 4-month follow-up period from referred to IRT.

tomy (Fig. 1D). He was referred to IRT 1 month after SBS. The patient is undergoing intestinal rehabilitation and has weaned PN to 50% of total calorie requirement during 4 months after intestinal rehabilitation.

After interventions by the IRT all patients had body weight gain ranging from 3.7% to 55.5% (Fig. 2). There were no cases of intestinal failure-associated liver disease (IFALD). Two episodes of central line-associated blood stream infection (CLABSI) occurred in one patient and were controlled with intravenous antibiotics (Table 2).

DISCUSSION

Intestinal failure (IF) results from surgical resection, congenital anomaly, or loss of absorption capacity and is characterized by the inability to maintain nutrition, electrolyte, or trace element balance, necessitating parenteral nutrition for survival.[5] SBS is the most common cause of IF and associated with low life quality of life. Although there was no exact current data, the incidence of severe SBS is estimated to be 1~2 per 100,000 persons.[6] Thompson et al.[3] reported the incidence of postoperative SBS as 25%, compared to 14~28% of prevalence of postoperative SBS in other studies, and the most common causes for resection was intestinal obstruction such as adhesion or volvulus. However, there are few reports regarding management of IF in adult SBS, compared to children. Therefore, we reported our experience of in-

testinal rehabilitation team by the multidisciplinary IRT in patients undergone extensive bowel resection after gastrectomy for gastric cancer. Several authors show that a multidisciplinary approach to intestinal failure may be associated with a reduced rate of mortality, successful enteral feeding advancement and improved liver function. [7,8]

During 3 years of follow-up, we observed no mortality cases in 4 patients and 2 of 4 patients achieve enteral autonomy after 8 and 16 months. In other series, 68% (15/22) patients were off PN for 42 (7~82) months during median 3.3 (0.6~8.0) years postoperatively, even in children and adult patients with SBS.[9]

There are several well-known factors associated with better outcomes in SBS, such as longer residual bowel length, presence of terminal ileum, ileocecal valve, presence of colon, presence of ileum than jejunum, older age in children, absence of IFALD and absence of central line infection.[10-13] Amiot et al.[14] reported less than 75 cm of remnant small bowel in adult decreased the likelihood of PN weaning. In present study, we could also observe that patients with more than 60 cm of remnant small bowel showed better outcome (2 off PN, 1 decreasing ratio of dependence for PN) than one patient with 10 cm small bowel. PN support leads to a longer survival in SBS, however, it could be associated life-threatening complications including liver disease and catheter related sepsis. The PN-associated liver disease is a condition

leading to cirrhotic change due to severe steatosis in adults and more typically cholestasis in children.[11] IFALD and CLABSI are major complication and factors associated with mortality in pediatric and adult IF patients. [11,15,16] Although we observed 2 CLABSI in one patient, there was no IFALD.

We performed STEP in one patient, leading to complete wean off PN 16 months later. There are several surgical interventions for SBS, including intestinal valve, anti-peristaltic segments, colon interposition, longitudinal intestinal lengthening (LILT) by Bianchi and STEP. Recently, several studies demonstrated the excellent outcomes in weaning off PN or improvement of PN dependency rate for IF patients with surgical lengthening intervention. [17,18] Rege and Sudan [19] recommended to consider surgical intervention in 3 situations: 1) any patients with SBS who suffer from new onset of malabsorption or complication of PN, 2) application of lengthening at initial surgery in infants with atresia or in adult with dilatation due to the obstruction, 3) progression with intestinal adaptation for several months. Although these lengthening procedures have several complications (intestinal necrosis due to damage in mesentery of small bowel, staple line perforation and redilatation of bowel), these procedures improve the absorption and alleviate bacterial overgrowth by correcting the dilatation and dysmotility in intestine, leading to a decrease in possibility of intestinal transplantation.[19]

In summary, 4 patients with SBS-IF due to post-gastrectomy complications underwent intestinal rehabilitation with a multidisciplinary IRT. We have used various surgical and non-surgical methods to enhance intestinal adaptation in these patients and initial PN weaning was achieved in 2 patients.

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