

# Laparoscopic-Assisted Subtotal Colectomy Combined With Modified Duhamel Procedure for Mixed Constipation

Xinyong Zhu, MD, Jiye Li, MM, Tinghuan Fu, MD, Pengjun Sun, MB, Yuanyuan Jing, MB, Wen Tian, MD

## ABSTRACT

**Background and Objectives:** To evaluate the effects of subtotal colectomy combined with the modified Duhamel procedure on mixed constipation.

**Methods:** A total of 16 female patients with mixed constipation were enrolled and underwent subtotal colectomy combined with the modified Duhamel procedure under laparoscopy from April 2010 to April 2012. Before surgery, physical examinations such as the gastrointestinal transit test, barium enema, and defecography were performed for all the patients. After surgical treatment, 2-year follow-up was performed using questionnaires to assess the effect of treatment.

**Results:** All 16 cases were treated successfully, with a mean operation time of 230 minutes (range, 180–290 minutes). No intraoperative or postoperative complications were found, and no deaths occurred. Constipation and relevant symptoms were relieved, and all patients were satisfied with their quality of life. The gastrointestinal quality-of-life score was significantly increased 6 months postoperatively (mean, 102) compared with preoperatively (mean, 75).

**Conclusion:** Subtotal colectomy combined with the modified Duhamel procedure under laparoscopy is effective and safe for the treatment of mixed constipation.

**Key Words:** Mixed constipation, Subtotal colectomy, Modified Duhamel procedure.

## INTRODUCTION

Constipation is a common condition, most prevalent in women and persons aged >65 years.<sup>1</sup> It is related to many factors, including a patient's lifestyle, slow colonic motility, and fecal evacuation disorders.<sup>2</sup> On the basis of the changes in gastrointestinal structure and function, constipation can be divided into slow-transit constipation, outlet obstructive constipation, and mixed constipation (slow-transit constipation and outlet obstructive constipation). In Taiwanese women, the prevalence rate of constipation has reached 24.5%.<sup>3</sup> The high prevalence rates and negative effects on patients' health state and quality of life make constipation a major health problem.<sup>4,5</sup>

In most patients with constipation, the condition represents different pathologic processes<sup>6,7</sup> and causes various symptoms, including infrequent or difficult evacuation, abdominal pain, and bloating. However, some patients with acute constipation are resistant to medical therapy or dietary manipulation.<sup>8</sup> The traditional surgical approaches for slow-transit constipation are total colectomy, segmental colectomy, or subtotal colectomy; for outlet obstructive constipation, they are stapled transanal rectal resection, rear amputation of the puborectalis muscle, or obturator internus muscle autoplasty. These procedures play a limited role in highly selected patients, and the efficacy is limited with high recurrence rates. Therefore diverse combinations of surgical procedures have begun to be used for constipation intervention.<sup>2</sup> For example, total colectomy with ileorectal anastomosis has been reported as a standard option for the management of refractory chronic constipation and has shown favorable surgical outcomes.<sup>9</sup> On the other hand, leaving a portion of the colon is advocated by many researchers (anastomosis after subtotal colectomy). The left side of the colon could serve as a reservoir and decrease the incidence of severe diarrhea. However, this operative method is not widely performed because of the unstable therapeutic effects. It has been reported that approximately 50% of patients undergoing ileosigmoid anastomosis have recurrent constipation, and most of them require reoperation with abdominal colectomy and ileorectal anastomosis.<sup>10,11</sup> In contrast, a 79% success rate has been found in 14 patients undergoing subtotal colectomy and cecorectal anastomosis after a

Department of Gastrointestinal Surgery, First Hospital Affiliated to General Hospital of PLA, Beijing, China (all authors).

Address correspondence to: Xinyong Zhu, MD, Department of Gastrointestinal Surgery, First Hospital Affiliated to General Hospital of PLA, No. 51, Fucheng Road, Haidian District, Beijing, 100048 China. Telephone: +86 010-66848624, E-mail: zxy304@126.com

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mean follow-up period of 10.5 years, and no constipation recurrence occurred.<sup>12</sup> Therefore safe and effective surgery with a low recurrence rate in patients with constipation is necessary. The laparoscopic Duhamel procedure has mainly been used for different localizations of Hirschsprung disease and is considered to be safe, with good results.<sup>13</sup>

The purpose of this study is to review our 2-year experience with subtotal colectomy combined with the modified Duhamel procedure in mixed constipation cases from April 2010 to April 2012. A total of 16 female patients were enrolled to undergo the operation. The postoperative state over the course of follow-up was investigated through questionnaires. The findings of this study might contribute to a better understanding of subtotal colectomy combined with the modified Duhamel procedure and lead to improved treatment of mixed constipation.

## MATERIALS AND METHODS

### Patients

A total of 16 female patients were diagnosed with mixed constipation according to Rome III criteria<sup>14</sup> between April 2010 and April 2012. These patients received subtotal colectomy combined with the modified Duhamel procedure under laparoscopy at our hospital. Their disease courses ranged from 10 to 20 years, and they had been treated with many strategies, including colectomy in 6 patients, traditional Chinese medicine and acupuncture in 3 patients, and enema in 12 patients.

The Ethical Committee of the First Hospital Affiliated to General Hospital of PLA, Beijing, China, approved the study protocol, and detailed informed regarding the procedures was obtained from all of the patients or their family members.

### Diagnostic Criteria

Patients were included if they met the following criteria: (1) The duration of mixed constipation exceeded 10 years. (2) The stool frequency was <3 times per week for at least 3 months in 1 year. All the patients in this study had abdominal distension and abdominal pain. (3) The gastrointestinal transit test showed that the time of colonic transit was >72 hours. (4) Digital rectal examination suggested that the patients had fecal impaction accompanied by anal stenosis, hemorrhoid, and rectal prolapse. (5) It was invalid for long-term medical treatment.

Patients were excluded if they met either of the following criteria: (1) patients had gastrointestinal organic diseases or metabolic or endocrine diseases and (2) patients had undergone any surgery for mixed constipation before.

### Preoperative Preparation

Patients received many physical examinations including the gastrointestinal transit test, barium enema, and defecography before surgery. After that, patients were given a nutritional plan that included a high-energy, non-residue diet. In addition, 1 day before surgery, patients were treated with oral applications of tinidazole (2 g) and cleaning of the intestines with gentamicin (280 000 U) 5 times.

### Surgical Methods

All patients were operated on by the same surgical team. Patients were in the lithotomy position after general anesthesia. A median abdominal incision around the umbilicus was adopted. Pneumoperitoneum was established with a 10-cm trocar. The trocar was placed at the right upper quadrant, right lower quadrant, left upper quadrant, and left lower quadrant, respectively, to establish pneumoperitoneum. An ultrasonic scalpel was used to divide the peritoneum, mesentery of the sigmoid colon, transverse mesocolon, gastrocolic ligament, and ascending mesocolon, respectively. Besides, the rectum was downward along the presacral space until the rectal posterior wall and reached the levator ani muscle (the peritoneal reflection before the rectum was reserved). After complete division of the entire colon, the appendix was removed and a transverse surgical incision (8 cm) was made in arcus pubis for 2 cm. After that, the entire colon and terminal ileum were taken out completely through the incision. Colonic resection was performed by preserving about 8 cm of the ascending colon from the ileocecal valve. Rapid dissection of the rectum was performed with closure at 5 cm of the peritoneal reflection. In addition, a tubular stapler was installed at the anus, and its inner core went through the dentate line for a distance of 2 to 4 cm from the rectal posterior wall. Then, the ascending colon was rotated counterclockwise 180° and placed into the pelvic cavity to make the colon anastomosed. After anastomosis, a 0.5-cm transverse incision was made in the posterior rectal wall and the retrorectal space. One arm of a linear stapler was inserted into the rectum and the other arm was inserted into the ascending colon to establish the side-to-side ascending colorectal anastomosis (approximately 6–8 cm). Finally, a drainage tube was placed near the pelvic anastomotic stoma, and the enterocele was closed. A barium enema was carried out at 6 months after

surgery; the method was in accordance with a previous study.<sup>15</sup> The progression of surgery included the barium column, and colon distention was monitored on fluoroscopy. Carbon dioxide was used to create distention. Radiographs of the rectum, sigmoid, spleen, and cecum were obtained with posteroanterior and anteroposterior views of the abdomen, a craniocaudal view of the sigmoid colon with a tilt of 30°, and a lateral view of the rectum.

**Questionnaires**

After surgery, follow-up was continued for 2 years. Patients were followed up in person at 3, 6, and 12 months postoperatively and in person or by telephone at 2 years postoperatively. A 7-item questionnaire about preoperative and postoperative events was used to assess each patient’s condition; this questionnaire recorded the timing of bowel movements (per day), defecating time, stool character, state of residual, frequency of bulge and pain conditions in the abdomen and perineum, application of antidiarrheal agents, and mean score for gastrointestinal quality of life (GQL). The GQL was assessed according to previously published methods.<sup>16</sup> It is determined using a 36-item questionnaire on aspects of emotional, social, and physical states and gastrointestinal health. The score for each item on the questionnaire is calculated using a 5-point Likert scale for each item, ranging from 0 (least desirable) to 4 (most desirable), with a maximum score of 144.

**RESULTS**

**Patient Characteristics**

On the basis of the inclusion and exclusion criteria, a total of 16 patients with mixed constipation were enrolled from April 2010 to April 2012. Among them, 9 patients were found to have mild rectocele and 4 patients had rectal intussusception before the operation. The characteristics of the patients are shown in **Table 1**. The mean operative time was 230 minutes (range, 180–290 minutes). The mean length of hospitalization after the operation was 12 days (range, 10–15 days).

**Effects of Surgery**

Complications and adverse events are given in **Table 2**. Nine patients had mild rectocele, and 4 patients had rectal intussusception.

Preoperative and postoperative events are shown in **Table 3**. There was no recurrence at 2 years after surgery. In ad-

Parameter	Data
Age at operation (y)	44 (32–63)
Weight at operation (kg)	63 (48–71)
Operation time (min)	230 (180–290)
Fasting time after operation (d)	4 (3–6)
Time in hospital (d)	12 (10–15)

Data are given as median (range).

Complication/adverse event	n (%)
Mild rectocele	9 (56.25)
Rectal intussusception	4 (25.00)

dition, constipation and relevant symptoms were relieved. Specifically, before surgery, the timing of bowel movements was once per week and the defecating time was 30 minutes. The situation was improved because the number of bowel movements was 2 to 3 per day at 6 months after surgery and the defecating time was 5 to 6 minutes at 1 year of follow-up. Before surgery, the stool was hard and patients reported defecation straining, as well as bulge and pain in the abdomen and perineum. Two years after surgery, all stool was soft and the bulge and pain in the abdomen and perineum had disappeared. The mean GQL score was higher 6 months postoperatively (102) than preoperatively (75) and gradually increased as follow-up continued. At 2 years after surgery, 18.8% of the patients (3 of 16) were satisfied with the result of laparoscopic-assisted subtotal colectomy combined with the modified Duhamel procedure and 81.2% (13 of 16) were very satisfied.

**Detection of Barium Enema**

As a result of barium enema, the residual ascending colon and cecum were developed. A swollen ampulla-like structure was formed in front of the sacrum side-by-side anastomosis of the colon and cecum, and the ileocecum and ileocecal valve were located in the entrance of pelvis (**Figure 1**).

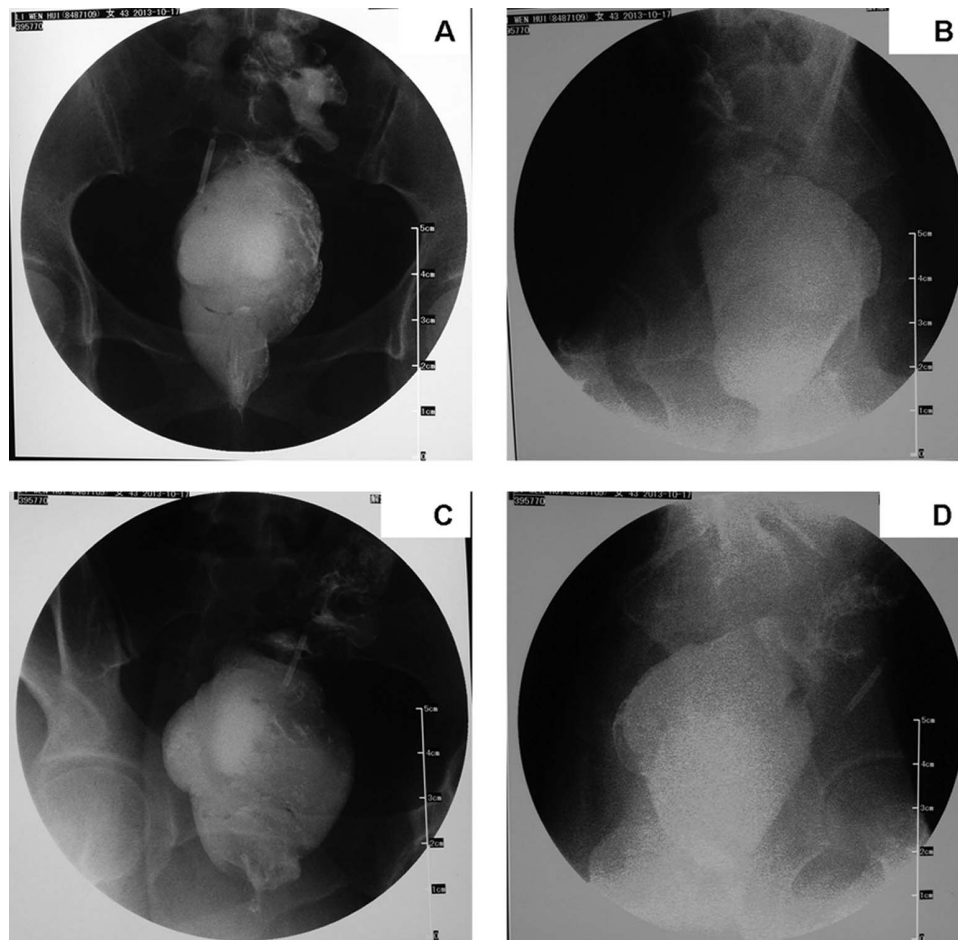
**DISCUSSION**

Constipation is a common disease with a prolonged medical history caused by a complex etiology. In this study we

**Table 3.**  
Preoperative and Follow-Up Questionnaire Data

Index	Before Surgery	1 mo After Surgery	3 mo After Surgery	6 mo After Surgery	1 y After Surgery	2 y After Surgery
TB <sup>a</sup>	1 per week	6–8 per day	4–6 per day	3–4 per day	2–3 per day	1–2 per day
DT <sup>a</sup>	30 min	1–1.5 min	2–3 min	5 min	5–6 min	5–6 min
SC <sup>a</sup>	Hard	Watery, without stool	Watery, with stool	Shapeless	Pasty	Soft
SOC <sup>a</sup>	No	Unconscious	Conscious	Could control	Normal	Normal
BP <sup>a</sup>	Frequent	Usual	Occasional	Rare	Never	Never
AA <sup>a</sup>	Required	Required	Required	Not required	Not required	Not required
GQL <sup>a</sup>	75	82	96	102	115	118

<sup>a</sup>AA = application of antidiarrheal agent; BP = frequency of bulge and pain in abdomen and perineum; DT = defecating time; GQL = mean score for gastrointestinal quality of life; SC = stool character; SOC = state of coprocrasia; TB = timing of bowel movement.



**Figure 1.** Detection of barium enema 6 months after surgery. A, Front side. A swollen ampulla-like structure was formed in the rectum. B, Right oblique side. The swollen ampulla-like structure was formed by anastomosis of the ascending colon and rectum. C, Left side. The ascending colon was located behind the rectum. D, Left oblique side. The ascending colon was located above the rectum.



applied a novel procedure, laparoscopic-assisted subtotal colectomy combined with the modified Duhamel procedure, for the treatment of mixed constipation. After treatment, patients obtained good therapeutic effects, such as an ideal postoperative course, no life-threatening residual disability or recurrence, a 100% satisfied rate, and favorable long-term effects. Moreover, the GQL score was significantly increased 6 months postoperatively. As outlined in a previous report, subtotal colectomy with antiperistaltic cecorectal anastomosis has been used in the treatment of slow-transit constipation, and compared with an open approach, it has better postoperative outcomes regarding pain and ileus.<sup>17</sup> Anorectal biofeedback therapy has also been reported to be safe and effective in the treatment of constipation with improved clinical and anorectal physiological outcomes.<sup>18</sup> In addition, sacral neuromodulation therapy has been successfully applied in adolescents with refractory functional constipation.<sup>19</sup> Although satisfactory outcomes regarding function have been reported in the long-term follow-up of these studies, the incidence of complications is still unknown. The use of subtotal colectomy combined with the modified Duhamel procedure, named the Jinling procedure, has been reported for the treatment of adult Hirschsprung disease, and this procedure is effective in improving the constipation scale, bowel function score, and GQL index. However, 17 major complications were found in 11 patients.<sup>20</sup> The Jinling procedure has also been used for the treatment of combined slow-transit constipation and obstructive defecation. Although the procedure was effective and safe for 4 years of follow-up, 28 complications and adverse events in 117 procedures were found.<sup>21</sup> In this study 13 complications were found in 16 patients. The findings seem to indicate that the laparoscopic-assisted modified Duhamel procedure is promising in the treatment of mixed constipation. However, long-term follow-up and more patients undergoing this procedure are needed to verify our hypothesis.

To sum up, the described surgical procedure had several advantages. First, compared with traditional surgery, it has less trauma, a quicker recovery, a shorter hospital stay, and fewer complications. Second, achieving complete resolution of constipation in patients by performing simple removal of part of the colon or subtotal colon was shown to be difficult, and the recurrence rate was high after long-term follow-up.<sup>22</sup> In this surgical procedure, anastomosis of the ascending colon and rectum changed the disordered anatomic structure around the rectum. The rectum and perineum were effectively fixed, and the rectum sensory area was significantly improved.<sup>23</sup> Besides,

retention of the sensory area of the rectal anterior wall and internal sphincter muscle of the anus will protect the pelvic plexus.<sup>23</sup> Third, retention of the ileocecum and ileocecal valve could delay the emptying of the small intestine; protect the absorption of water, electrolytes, bile salts, and vitamin B12; prevent reflux of cecal contents; and improve the symptoms of diarrhea after surgery.<sup>22</sup> Fourth, retention of the cecum and part of the ascending colon could absorb redundant water and avoid diarrhea.<sup>22</sup> Fifth, this operation was easy to perform and showed good efficacy.

In conclusion, laparoscopic-assisted subtotal colectomy combined with the modified Duhamel procedure in the treatment of mixed constipation in our study was shown to be safe and effective after long-term follow-up. It may be a potential alternative therapy for patients with mixed constipation. However, the number of patients selected in our study is limited, and randomized studies with longer-term follow-up are needed to verify our hypothesis.

#### References:

1. Higgins PD, Johanson JF. Epidemiology of constipation in North America: a systematic review. *Am J Gastroenterol.* 2004; 99(4):750–759.
2. Kumar A, Lokesh H, Ghoshal UC. Successful outcome of refractory chronic constipation by surgical treatment: a series of 34 patients. *J Neurogastroenterol Motil.* 2013;19(1):78–84.
3. Chen GD, Hu SW, Chen YC, Lin TL, Lin LY. Prevalence and correlations of anal incontinence and constipation in Taiwanese women. *NeuroUrol Urodyn.* 2003;22(7):664–669.
4. Talley NJ. Definitions, epidemiology, and impact of chronic constipation. *Rev Gastroenterol Disord.* 2004;4(2):S3–S10.
5. Dennison C, Prasad M, Lloyd A, Bhattacharyya SK, Dhawan R, Coyne K. The health-related quality of life and economic burden of constipation. *Pharmacoeconomics.* 2005;23(5):461–476.
6. Hassan I, Pemberton JH, Young-Fadok TM, et al. Ileorectal anastomosis for slow transit constipation: long-term functional and quality of life results. *J Gastrointest Surg.* 2006;10(10):1330–1337.
7. Zutshi M, Hull T, Trzcinski R, Arvelakis A, Xu M. Surgery for slow transit constipation: are we helping patients? *Int J Colorectal Dis.* 2007;22(3):265–269.
8. Han EC, Oh H-K, Ha H-K, et al. Favorable surgical treatment outcomes for chronic constipation with features of colonic pseudo-obstruction. *World J Gastroenterol.* 2012;18(32):4441–4446.
9. Choe EK, Park S-H, Park KJ. Colonic pseudo-obstruction with distinct transitional zone in adult constipation patients:

pathological analysis and results of surgical treatment. *Am Surg.* 2011;77(6):736–742.

10. Nyam DC, Pemberton JH, Ilstrup DM, Rath DM. Long-term results of surgery for chronic constipation. *Dis Colon Rectum.* 1997;40(3):273–279.

11. Wong SW, Lubowski DZ. Slow-transit constipation: evaluation and treatment. *ANZ J Surg.* 2007;77(5):320–328.

12. Marchesi F, Sarli L, Percalli L, et al. Subtotal colectomy with antiperistaltic cecorectal anastomosis in the treatment of slow-transit constipation: long-term impact on quality of life. *World J Surg.* 2007;31(8):1658–1664.

13. van der Zee DC. Laparoscopic Duhamel procedure. In: *Atlas of Pediatric Laparoscopy and Thoracoscopy.* Philadelphia, PA: Saunders; 2008:109–113.

14. Mackenzie I, Gao Z. Patterns of cytokeratin expression in the epithelia of inflamed human gingiva and periodontal pockets. *J Periodontal Res.* 1993;28(1):49–59.

15. Gluecker TM, Johnson CD, Harnsen WS, et al. Colorectal cancer screening with CT colonography, colonoscopy, and double-contrast barium enema examination: prospective assessment of patient perceptions and preferences. *Radiology.* 2003;227(2):378–384.

16. Borgaonkar MR, Irvine EJ. Quality of life measurement in gastrointestinal and liver disorders. *Gut.* 2000;47(3):444–454.

17. Marchesi F, Percalli L, Pinna F, Cecchini S, Ricco M, Roncoroni L. Laparoscopic subtotal colectomy with antiperistaltic ceco-

rectal anastomosis: a new step in the treatment of slow-transit constipation. *Surg Endosc.* 2012;26(6):1528–1533.

18. Shim LS, Jones M, Prott GM, Morris LI, Kellow JE, Malcolm A. Predictors of outcome of anorectal biofeedback therapy in patients with constipation. *Aliment Pharmacol Ther.* 2011;33(11):1245–1251.

19. van Wunnik BP, Peeters B, Govaert B, Nieman FH, Benninga MA, Baeten CG. Sacral neuromodulation therapy: a promising treatment for adolescents with refractory functional constipation. *Dis Colon Rectum.* 2012;55(3):278–285.

20. Wang L, He Q, Jiang J, Li N. Long-term outcomes and quality of life after subtotal colectomy combined with modified Duhamel procedure for adult Hirschsprung's disease. *Pediatr Surg Int.* 2014;30(1):55–61.

21. Li N, Jiang J, Feng X, Ding W, Liu J, Li J. Long-term follow-up of the Jinling procedure for combined slow-transit constipation and obstructive defecation. *Dis Colon Rectum.* 2013;56(1):103–112.

22. Kovacs M, Muller KE, Papp M, Lakatos PL, Csondes M, Veres G. New serological markers in pediatric patients with inflammatory bowel disease. *World J Gastroenterol.* 2014;20(17):4873–4882.

23. Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery.* 1992;111(5):518–526.