

Total Laparoscopic Modified Duhamel Operation in Combination With Transanal Endoscopic Microsurgery

Yi Han, MD, Mou-Bin Lin, MD, Ya-Jie Zhang, MD, Lu Yin, MD

ABSTRACT

Introduction: Laparoscopic-assisted colonic resection has been well described for multiple surgical indications and typically requires an abdominal incision for specimen removal that is associated with most of the postoperative pain. We report the total laparoscopic modified Duhamel operation for megacolon in combination with transanal endoscopic microsurgery for transanal specimen retrieval and anastomosis to avoid the additional abdominal extraction incision.

Case Description: Two cases are presented: case 1 was a 15-year-old boy who presented with intermittent abdominal distention, pain, and constipation for 3 years' duration and was diagnosed with Hirschsprung disease, and case 2 was a 60-year-old man who presented with repeated attacks of incomplete intestinal obstruction for 2 years' duration and was diagnosed with adult megacolon. They were treated by the total laparoscopic modified Duhamel operation without an abdominal extraction incision in combination with transanal endoscopic microsurgery. The operations were successfully accomplished without conversion to open surgery. The patients tolerated the procedure well, complained of minimal postoperative pain, and did not require narcotics beyond the day of the operation. No surgical complications occurred. Discharge from the hospital occurred on the ninth postoperative day in case 1 and the 13th postoperative day in case 2.

Discussion: The total laparoscopic modified Duhamel operation in combination with transanal endoscopic microsurgery is a feasible and minimally invasive technique for idiopathic megacolon and adult megacolon. This advanced surgical technique was developed by combining laparoscopy with the concept of natural orifice transluminal endoscopic surgery.

Key Words: Adult megacolon, Hirschsprung disease, Modified Duhamel operation, No abdominal incision, Natural orifice transluminal endoscopic surgery.

INTRODUCTION

Laparoscopic procedures have increasingly developed over the last 20 years. Compared with open surgery, minimally invasive colorectal procedures have been shown to have better outcomes, such as improved cosmetic results, less postoperative pain, and a rapid recovery, all of which improve the patient's comfort and satisfaction.¹⁻⁴ Laparoscopy has become a proven and often preferred method for even the most complex operative problems. However, the requirement of an abdominal incision for specimen retrieval in laparoscopic colorectal procedures can limit the advantages of this modality, especially with regard to postoperative pain and recovery.

Since the concept of natural orifice transluminal endoscopic surgery (NOTES) was first presented in 2004,⁵ it has attracted a great deal of interest from surgeons and endoscopists.⁶⁻⁸ The anus is a natural orifice that is anatomically in continuation with the colon and the rectum, and transanal removal of specimens during laparoscopic colorectal procedures is an appealing concept in terms of its minimally invasive nature and its similarity to the concept of NOTES. We have performed 34 cases of total laparoscopic sigmoid and rectal resection in combination with transanal endoscopic microsurgery (TEM) and proved that it is safe and feasible with no notable increase in operative difficulty.⁹ Furthermore, Lamas-Pinheiro et al¹⁰ have reported a hybrid natural orifice transluminal endoscopic Duhamel operation assisted by a transrectal port. Thus we believe that an additional abdominal extraction incision in the laparoscopic modified Duhamel operation can be avoided by combining laparoscopy with TEM for transanal specimen retrieval and anastomosis.

CASE DESCRIPTION

Case 1 was a 15-year-old boy who presented with intermittent abdominal distention, abdominal pain, and con-

Department of General Surgery, Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, China (all authors).

Address correspondence to: Lu Yin, MD, Department of General Surgery, Ruijin Hospital, Shanghai Jiaotong University School of Medicine, No. 197, Ruijin No. 2 Road, Shanghai, China. Telephone: +8613818062344; Fax: +8602164333045; E-mail: yindalu@yahoo.com.cn

DOI: 10.4293/108680813X13693422520288

© 2014 by JSLS, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

stipation for 3 years' duration and was diagnosed with Hirschsprung disease according to colonoscopy and biopsy (**Table 1**). Case 2 was a 60-year-old man who presented with repeated attacks of incomplete intestinal obstruction for 2 years' duration and was diagnosed with adult megacolon by double-contrast barium enema (**Figure 1a**), colonoscopy, and biopsy. The patient had previously undergone a laparoscopic intraperitoneal onlay mesh technique because of an umbilical hernia.

After complete preoperative evaluation, the 2 patients were offered the total laparoscopic modified Duhamel operation in combination with TEM. Polyethylene glycol electrolyte solution was administered 1 day before the operation for bowel preparation. Prophylactic antibiotics (cefuroxime, 2.25 g; metronidazole, 200 mg) were intravenously administered before the operation.

The patients were placed in a modified lithotomy position with the head tilted downward, and general anesthesia was administered, after which a pneumoperitoneum was created. A camera port was created in the supraumbilical region, and the laparoscope was inserted through this port. Three 5-mm surgical ports were created in the upper right, upper left, and lower left abdominal quadrants; a 12-mm surgical port was created in the right lower quadrant.

After mobilization of the colon, the ileocecal region, and the rectum at the level of peritoneal reflection was completed, the sacral hollow was opened. The ascending colon 10 cm from the ileocecal region was marked. Then, the resectoscope shaft (diameter, 40 mm) for TEM was inserted into the rectum through the anus after gentle dilatation while the intestine was maintained in an extended state by insufflation (carbon dioxide at a

pressure of 12–15 mm Hg). After the proximal and distal mesocolon was trimmed, a circumferential incision of the rectum at the level of peritoneal reflection was made with a Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, Ohio). The proximal end of the bowel was ligated by use of hemp rope to prevent the outflow of intestinal contents and prevent contamination in the peritoneal cavity. The mobilized colon and rectum were exteriorized through the TEM resectoscope shaft (**Figure 2**), and the proximal colonic resection (**Figure 1b**) was performed extracorporeally at the marked location by first creating a purse-string suture and then inserting a circular stapling anvil into the proximal end of the bowel. The ascending colon was then replaced in the abdominal cavity, after which we performed iodine solution lavage of the abdominal and pelvic cavity. The distal stump of the rectum was transversely clamped with a stapler (Endo GIA Reticulator 60–3.5 Sulu; Covidien, Mansfield, Massachusetts). Then, a circular stapler (DST Series EEA, 31 mm; Covidien) was inserted transanally and penetrated out about 0.5 cm above the dentate line in the posterior rectal wall, and an end-to-side anastomosis was laparoscopically created with the proximal end of the normal ascending colon. The spur between the rectum and the normal ascending colon was then divided with a stapler (Proximate Linear Cutter 100; Ethicon Endo-Surgery).

RESULTS

The 2 operations were successfully accomplished without conversion to open surgery. The operative time was 240 minutes in case 1 and 450 minutes in case 2. The patients tolerated the procedure well, complained of minimal post-

Table 1.
Demographic and Perioperative Data

	Case 1	Case 2
Age at operation (y)	15	60
Gender	Male	Male
Time from diagnosis to operation (y)	3	2
Main symptoms	Abdominal distention, abdominal pain, and constipation	Incomplete intestinal obstruction
Operative time (min)	240	450
Estimated blood loss (mL)	200	350
Time to regular diet (d)	6	7
Length of postoperative hospitalization (d)	9	13



Figure 1. a, A double-contrast barium enema showed a narrowed distal segment of the descending and sigmoid colon and dilated proximal colon. b, The resected specimen showed a narrowed segment of the descending and sigmoid colon and dilated proximal colon.



Figure 2. The specimen was exteriorized through the TEM resectoscope shaft through the anus.

operative pain, and did not require narcotics beyond the day of the operation. No surgical complications occurred. The patients were started on a regular diet 6 days (case 1) and 7 days (case 2) after the operation and were discharged from the hospital on the ninth and 13th postoperative days, respectively. The diagnosis was confirmed by postoperative pathologic examination.

DISCUSSION

Hirschsprung disease is a congenital malformation characterized by the absence of ganglion cells in the distal bowel beginning at the internal anal sphincter and ex-

tending proximally for various lengths. The main symptoms include constipation that gradually worsens, abdominal distention, and pain in older patients and include delayed passage of meconium and vomit in neonates.^{11,12} The diagnosis is mainly made based on a barium enema and histologic examination of rectal wall biopsy specimens. Barnes et al¹³ divided patients with Hirschsprung disease into 2 subgroups: patients with idiopathic megacolon whose symptoms start in childhood and patients with adult megacolon in whom the onset of clinical features occurs during adulthood. Among patients in whom symptoms associated with a megacolon develop during adulthood, the treatment for constipation may be ineffective and most such patients are offered surgical treatment. The 3 most commonly performed operations for definitive treatment of patients with Hirschsprung disease are the Swenson, Duhamel, and Soave procedures, as well as their various modifications; the principal goal of surgery is to remove or bypass the poorly functioning aganglionic bowel with anastomosis of normally innervated intestine to the distal rectum.

Megacolon is a serious condition, but it is not a malignant disease in the usual sense of the term. It is difficult and technically demanding to complete radical procedures (eg, Swenson operation and pull-through procedure) to resect all the aganglionic segments of the rectosigmoid colon, which may lead to a high incidence of various immediate- and long-term complications, especially enterocolitis and incontinence. The trend in treatment for megacolon has become less invasive over the years. Duhamel¹⁴ devised his modification to sim-

plify the operation and to avoid complications related to excision of the rectum. Travassos et al¹⁵ have completed 30 laparoscopic Duhamel operations by everting the rectum through the anus, and the outcome has been satisfactory. The characteristic of the modified Duhamel operation is to resect the proximal dilated colon, retain part of the aganglionic rectum, and divide the spur between the aganglionic rectum and ganglionic proximal colon. At the same time, the anastomosis is low enough to prevent residual symptoms of megacolon. It has been shown that the modified Duhamel operation yields a significant improvement in individual functional outcome scores.^{15–17}

In the emerging era of natural orifice surgery, patients are willing to accept novel surgical techniques if they provide superior cosmetic outcomes and reduce pain. The total laparoscopic modified Duhamel operation in combination with TEM is a sublimation of a less invasive trend in treatment for megacolon and an advancement, by amalgamating the concept of NOTES with laparoscopic techniques. Although the procedure requires a longer operative time (the longer operative time in the second case was mainly because of the separation of the extensive adhesion), there are benefits in terms of minimal invasiveness, better cosmetic outcomes, and less postoperative pain. Furthermore, this report shows that colon specimen retrieval through the anus is an acceptable alternative to a cutaneous extraction incision or everting the rectum through the anus with no notable increase in operative difficulty. However, the long-term effects and functional outcome of our technique still need to be investigated.

References

1. Lacy AM, Delgado S, Castells A, et al. The long-term results of a randomized clinical trial of laparoscopy assisted versus open surgery for colon cancer. *Ann Surg*. 2008;248:1–7.
2. Faiz O, Warusavitarne J, Bottle A, et al. Laparoscopically assisted vs open elective colonic and rectal resection: a comparison of outcomes in English National Health Service Trusts between 1996 and 2006. *Dis Colon Rectum*. 2009;52:1695–1704.
3. Champagne BJ, Makhija R. Minimally invasive surgery for rectal cancer: are we there yet? *World J Gastroenterol*. 2011;17:862–866.
4. Bonjer HJ, Hop WC, Nelson H, et al. Transatlantic laparoscopically assisted vs open colectomy trials study group. laparoscopically assisted vs open colectomy for colon cancer: a meta-analysis. *Arch Surg*. 2007;142:298–303.
5. Kalloo AN, Singh VK, Jagannath SB, et al. Flexible transgastric peritoneoscopy: a novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. *Gastrointest Endosc*. 2004;60:114–117.
6. Kantsevov SV, Jagannath SB, Niiyama H, et al. Endoscopic gastrojejunostomy with survival in a porcine model. *Gastrointest Endosc*. 2005;62:287–292.
7. Merrifield BF, Wagh MS, Thompson CC. Peroral transgastric organ resection: a feasibility study in pigs. *Gastrointest Endosc*. 2006;63:693–697.
8. Kavic MS. Natural orifice transluminal endoscopic surgery: “NOTES.” *JLS*. 2006;10:133–134.
9. Han Y, He YG, Zhang HB, et al. Total laparoscopic sigmoid and rectal surgery in combination with transanal endoscopic microsurgery: a preliminary evaluation in China. *Surg Endosc*. 2013;27:518–524.
10. Lamas-Pinheiro R, Henriques-Coelho T, Carvalho JL, et al. Duhamel pull-through assisted by transrectal port: a hybrid natural orifice transluminal endoscopic surgery approach. *J Pediatr Surg*. 2012;47:1962–1965.
11. Kenny SE, Tam PK, Garcia-Barcelo M. Hirschsprung’s disease. *Semin Pediatr Surg*. 2010;19:194–200.
12. Doodnath R, Puri P. A systematic review and meta-analysis of Hirschsprung’s disease presenting after childhood. *Pediatr Surg Int*. 2010;26:1111–1115.
13. Barnes PRH, Lennard-Jones JE, Hawley PR, et al. Hirschsprung’s disease and idiopathic megacolon in adults and adolescents. *Gut*. 1986;27:534–541.
14. Duhamel B. A new operation for the treatment of Hirschsprung’s disease. *Arch Dis Child*. 1960;35:38–39.
15. Travassos DV, Bax NM, Van der Zee DC. Duhamel procedure: a comparative retrospective study between an open and a laparoscopic technique. *Surg Endosc*. 2007;21:2163–2165.
16. Elliot MS, Todd IP. Adult Hirschsprung’s disease: results of the Duhamel procedure. *Br J Surg*. 1985;72:884–885.
17. Conway SJ, Craigie RJ, Cooper LH, et al. Early adult outcome of the Duhamel procedure for left-sided Hirschsprung disease—a prospective serial assessment study. *J Pediatr Surg*. 2007;42:1429–1432.