Original Article

Temporary Sigmoid Colostomy versus the Hartmann's Procedure for Sigmoid Colon Perforation: A Retrospective Study

Alvin Chen[1]
Ying-Wei Chen[2]
Min-Hsuan Yen[2]
Tung-Cheng Chang[2]
Kee-Thai Kiu[2]
[1]*Department of Surgery,*
[2]*Division of Colorectal Surgery, Department of Surgery, Taipei Medical University, Shuang-Ho Hospital, New Taipei City, Taiwan*

Key Words
Sigmoid perforation;
Diverticulitis;
Colostomy;
Hartmann's procedure

Background. For sigmoid perforation, the Hartmann procedure (HP) has been traditionally applied as emergent surgery. However, the high morbidity rates, poor quality of life (QoL), and relatively low stoma reversal rates of HP encourage surgeons to discover less invasive types of surgical treatment. We aimed to introduce temporary sigmoid colostomy (TSC) as emergent surgery for septic conditions and compare the outcomes of TSC and HP.

Methods. This retrospective study included patients who underwent TSC or HP as emergent surgery for sigmoid perforation from November 2018 to August 2022. Preoperative factors, postoperative mortality, morbidity, reversal rates, and timing for stoma closure were analyzed by type of surgery.

Results. A total of 46 patients were included in this study. In the first emergent surgery, the TSC group had shorter operative time (81 vs. 153 min, respectively; $p < 0.001$) and extremely short stoma reversal time (6 vs. 132 days, respectively; $p < 0.001$) than the HP group. However, the two groups did not differ in terms of other perioperative outcomes, specifically mortality, morbidity, reoperation, re-admission, or definite stoma rates.

Conclusions. For selective patients, TSC may be an optimal surgical treatment to deal with the emergency septic situation and lead to an elective sigmoid resection during the same hospital stay. Considering the extremely short stoma reversal time and better QoL, TSC is a potential alternative to nonrestorative colon resection for sigmoid perforation.

[*J Soc Colon Rectal Surgeon* (*Taiwan*) *2023;34:146-154*]

Acute abdomen with lesions at the sigmoid colon is often diagnosed with perforation caused by diverticulitis or colon cancer. Perforated colonic diverticulitis is the most common cause of sigmoid perforation, accounting for 3 to 4/100,000 people per year,[1] whereas colon cancer with perforation accounts for 3%-10% of the initial presentation of colon cancer.[2] Both conditions may lead to purulent or fecal peritonitis requiring emergency surgical treatment; however, the proper surgical management of sigmoid perforation remains debated.[3,4] In this population, the necessary emergency surgery in response to a life-threatening condition is associated with substantial morbidity and mortality.[5]

Traditionally, surgeons performed two-staged surgeries with the resective Hartmann procedure (HP)

Received: February 17, 2023. Accepted: May 16, 2023.
Correspondence to: Dr. Kee-Thai Kiu, Division of Colorectal Surgery, Department of Surgery, Taipei Medical University, Shuang-Ho Hospital, No. 291, Zhongzheng Rd., Zhonghe Dist., New Taipei City 23561, Taiwan. Tel: 886-2-2249-0088 ext. 8123; E-mail: 10305@s.tmu.edu.tw

first followed by colostomy closure a few months later to prevent anastomotic leakage; however, both interventions negatively affected the quality of life (QoL) of patients.[6,7] To date, primary anastomosis has been widely used globally and is considered a safe alternative for the treatment of sigmoid perforation; however, it has an unacceptably high complication rate in emergency situations when the general condition of the patient is suboptimal, and the bowel is not prepared.[8,9]

For the abovementioned situation, we provided an interim strategy between primary anastomosis and HP, which is temporary sigmoid colostomy as emergent surgery and subsequently combined with standard anterior resection for sigmoidectomy a few days later during the same hospital visit. This study aimed to compare the outcomes of temporary sigmoid colostomy (TSC) and HP in patients with sigmoid perforation and generalized peritonitis requiring emergent surgery.

Materials and Methods

Patients

This retrospective study included patients who were confirmed of sigmoid colon perforation and treated by emergent surgery within 24 h of admission at Shuang Ho Hospital, Taiwan. All patients were diagnosed using computed tomography (CT) before emergent surgery with pneumoperitoneum or intra-abdominal abscess formation, classified as Hinchey grade III (purulent peritonitis and an inflamed part of the colon) and grade IV (fecal contamination). Patients with Hinchey I-II (no free air within localized abscess in the abdomen) were excluded from this study. Since the first TSC was performed on November 2018, we enrolled patients from the said date to August 2022 and achieved an adequate follow-up period of at least 6 months postoperatively. Furthermore, we excluded patients who underwent sigmoid colon resection without diverting stoma or with a protective ileostomy or loop T-colostomy. All surgeries were performed by senior colorectal surgeons. The choice between TSC and HP was dependent on the general status of patients and the decisions of surgeons intraoperatively.

Data collection

Data regarding patient demographics, including sex, age, body mass index (BMI), American Society of Anesthesiologists (ASA) category, surgery history, and pathophysiology for acute abdomen, as well as preoperative laboratory data, including white blood cell (WBC) counts, hemoglobin, and C-reactive protein (CRP), were collected.

We collected intraoperative and postoperative data for primary and reversal surgery. Furthermore, the reversal rate, time to reversal, length of hospital stay, 30-day mortality, and morbidity were recorded. Cumulative postoperative major morbidity was assessed with a major surgical complication defined as grade III or more, including post-operative abscess formation required image-guide drainage or post-operative ileus cured by another surgical intervention. The postoperative complications included in the analysis were surgery-specific (leakage, surgical site infection, and reoperation rate) and general (intra-abdominal infections and pulmonary) complications.

Surgical procedures

All patients who underwent the first surgery were emergent cases without colon preparation. First, we started midline laparotomy for sigmoid lesion inspection. Subsequently, the operator decided whether the sigmoid colon is suitable for loop sigmoid colostomy at the incision wound or not (Fig. 1). The sigmoid length must be long enough to bring out the sigmoid colon to the midline skin for colostomy fixation to fascia without tension or sacrificed blood perfusion; if the surrounding tissue was not too fragile for stoma maturation, the perforation site was used for loop colostomy. Otherwise, we performed HP with sigmoidectomy and end colostomy at the left side of the abdomen. Peritoneal lavage and abdominal drain insertion were routinely employed in all patients. The postoperative care was performed according to local guidelines.

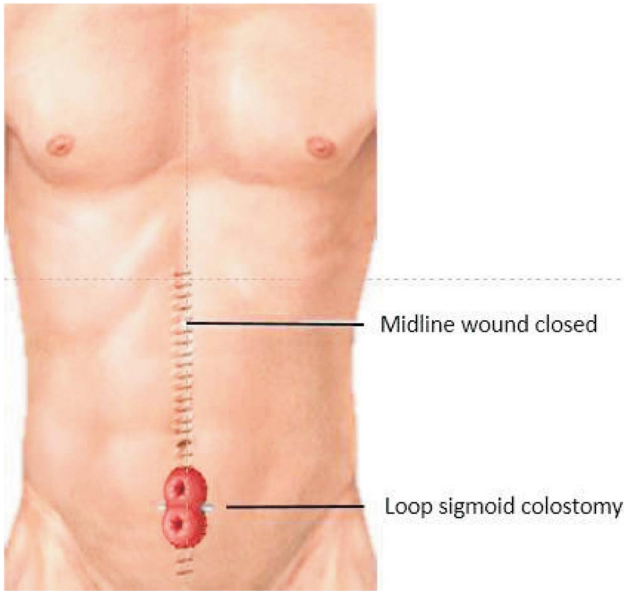

Fig. 1. The loop sigmoid colostomy is created at lower midline wound as temporary colostomy for stool diversion and control infection.

The second surgery was colostomy reversal surgery. To rule out residual pathology and check for the absence of fistula or stenosis at the level of the anastomosis, colonoscopy was performed in all patients before reversal. In the TSC group, after proper colon preparation and antibiotic treatment for approximately 1 week, we performed anterior resection with mobilization of the stoma entry followed by end-to-end anastomosis of the descending colon and rectum using a circular stapler. The skin wound was primarily closed with drain placement. For patients who underwent HP, the reversal surgery was arranged for at least 2 months according to the routine practices of the surgeon. For patients with severe comorbidity, surgeons refrained from colostomy reversal following discussion and agreement with the patients and their families.

Statistical analysis

Categorical variables were analyzed using Fisher's exact test, whereas continuous variables were analyzed using the Mann-Whitney U test. All statistical tests were two-tailed, and a p value of < 0.05 was considered statistically significant. All analyses were performed using Statistical Package for the Social Sciences (IBM SPSS Statistics, version 25; IBM, Armonk, NY, USA).

Results

Patient characteristics

From November 2018 to August 2022, a total of 46 patients underwent emergent surgery for sigmoid lesion-related acute abdomen. Of them, 12 and 34 patients underwent TSC and HP, respectively. The comparison of baseline characteristics between the TSC and HP groups is presented in Table 1. The two groups did not significantly differ in terms of sex, age, BMI, ASA score, previous abdominal surgery, and preoperative laboratory data, including hemoglobin, WBC, and CRP levels. Although the data exhibited nonsignificant differences, all cases of fecal peritonitis belonged to HP groups.

The pathophysiology of acute abdomen showed no difference in both groups. Of the four cases of colon perforation not related to cancer or diverticulitis, the first one had small sigmoid perforation related to severe ruptured appendicitis, the second one had severe sigmoid pressure ulcer leading to perforation, and the third one received radiation therapy for cervical cancer leading to perforation.

Results of the emergency surgery

The intraoperative data and results of the first procedure are presented in Table 2. The TSC group had a much shorter operative time than the HP group (81 vs. 153 min, respectively; $p < 0.001$) because colon resection could be omitted. The overall mortality and morbidity showed no significant differences between the two groups; however, all mortality cases were noted in the HP group. Of them, three died within 30 days owing to fecal peritonitis-related septic shock, two died of hospital-acquired pneumonia related to prolonged intubation of more than 30 days, and one developed ischemic bowel disease 2 weeks following HP and died. There is one case of upper rectal cancer

Table 1. Baseline characteristics

Parameters	Temporary sigmoid colostomy (n = 12)	Hartmann's procedure (n = 34)	*p* value
Sex, male [no. (%)]	8 (66.6)	21 (61.8)	0.762
Age [median (range)]	57 (39-90)	69 (37-93)	0.281
BMI [median (range)]	25.6 (15.6-34.7)	22.4 (16.4-34.3)	0.056
ASA category [no. (%)]			0.902
Low risk [class I-II]	8 (66.6)	22 (64.7)	
High risk [class > III]	45 (33.3)	12 (35.3)	
Previous abdominal surgery [no. (%)]	0 (0)	2 (5.9)	0.390
Diagnosis [no. (%)]			0.147
Diverticulitis [no. (%)]	9 (75.0)	21 (61.8)	
Cancer perforation [no. (%)]	1 (8.3)	12 (35.3)	
Other perforation [no. (%)]	2 (16.7)	2 (5.9)	
Pre-operative laboratory [no. (%)]			
Hb [median (range), g/dL]	12.2 (8.3-14.9)	12.5 (7.2-19.9)	0.738
WBC [median (range), 10^3/uL]	12.5 (3.6-18.6)	11.7 (5.8-32.2)	0.412
CRP [median (range), g/dL]	11.3 (0.8-28.8)	16.8 (0.4-36.4)	0.426
Fecal peritonitis [no. (%)]	0 (0)	6 (17.6)	0.119

Table 2. Intra- and postoperative data of first operation (emergency)

Parameters	Temporary sigmoid colostomy (n = 12)	Hartmann's procedure (n = 34)	*p* value
Operative time [median (range), min]	81 (56-184)	153 (88-298)	0.001
Overall morbidity [no. (%)]	0 (0)	11 (32.4)	0.024
Leakage [no. (%)]	0 (0)	0 (0)	1.000
Surgical site infection [no. (%)]	0 (0)	4 (11.8)	0.214
Intraabdominal abscess [no. (%)]	0 (0)	2 (5.9)	0.390
Postoperative ileus [no. (%)]	0 (0)	2 (5.9)	0.390
Others [no. (%)]	0 (0)	2 (5.9)	0.390
Major complication (Clavien-Dindo ≥ 3) [no. (%)]	0 (0)	10 (29.4)	0.034
Re-operation [no. (%)]	0 (0)	6 (17.6)	0.119
Mortality [no. (%)]	0 (0)	6 (17.6)	0.119
1st hospital stay [median (range), days]	11 (17-86)	13 (4-75)	0.804
Re-admission in 30 days [no/N. (%)]	1/12 (8.3)	5/28 (17.9)	0.440

perforation was managed by loop sigmoid colostomy for decompression, and anterior resection was operated as secondary surgery one week later for tumor excision and intestinal continuity restoration.

The overall morbidity and major complication rates were significantly higher in the HP cohorts, and only the patients in these groups presented with surgical site infection and intra-abdominal abscess. Four patients suffered from surgical site infection, and two of them needed operative debridement for wound closure. Two patients presented with an intra-abdominal abscess, of whom one was reoperated and the other one received CT-guided drainage. One patient in the HP group presented with postoperative ileus with a transition zone at the transverse colon; therefore, proximal loop ileostomy was created. For the other two patients who underwent reoperation within 30 days, the first one developed ischemic bowel disease at the terminal ileum 2 weeks following HP. The other one presented with intra-abdominal bleeding at the mesentery blood flow on the fifth postoperative day and was diagnosed by follow up computed tomography and controlled by re-operative suture ligation. The patient was subsequently discharged 3 weeks after successful control of the surgical bleeding.

Results of the second surgery

Of the 40 patients who survived the first surgery, 25 underwent elective stoma reversal (Table 3). For the patients who underwent TSC, we performed anterior resection with primary anastomosis without diverting stoma during the same hospital stay. In the HP group, the reverse HP was arranged during the second hospitalization following colonoscopy to check for the presence of a fistula or stenosis at the anastomosis level which were contraindication for reversal surgery. The reversal surgery was relatively uneventful, and most of the patients were discharged within 2 weeks postoperatively. Each group had one patient who presented with surgical site infection; however, no surgical debridement was needed for treatment. Two patients in the HP group had ventral hernia around the end colostomy and were repaired along with the reverse HP.

Overall outcomes

The TSC and HP groups did not differ in terms of hospital stay, overall mortality, and morbidity; however, the operative time in the patients who underwent TSC was much shorter (255 vs. 312 min, respectively; $p = 0.020$) (Table 4). The rates of definite stoma showed no significant difference following the exclusion of mortality cases. The 15 patients who did not receive a stoma reversal procedure were older (median age, 80 vs. 58 years; $p < 0.001$), had more comorbidities (ASA grade ≥ III: 60% vs. 8%; $p < 0.001$), higher WBC counts (13.5 vs. 9.3 10^3/uL; $p < 0.001$), and longer hospital stay following the first surgery (11 vs. 28 days; $p < 0.001$).

Table 3. Intra- and postoperative data of second operation (stoma reversal)

Parameters	Temporary sigmoid colostomy (n = 9)	Hartmann's procedure (n = 16)	*p* value
Operative time [median (range), min]	143 (96-276)	171 (82-282)	0.279
Ventral hernia [no. (%)]	0 (0)	2 (12.5)	0.269
Overall morbidity [no. (%)]	1 (11.1)	1 (6.3)	0.667
Leakage [no. (%)]	0 (0)	0 (0)	1.000
Surgical site infection [no. (%)]	1 (11.1)	1 (6.3)	0.667
Intraabdominal abscess [no. (%)]	0 (0)	0 (0)	1.000
Postoperative ileus [no. (%)]	0 (0)	0 (0)	1.000
Major complication (Clavien-Dindo ≥ 3) [no. (%)]	0 (0)	0 (0)	1.000
Re-operation [no. (%)]	0 (0)	0 (0)	1.000
Mortality [no. (%)]	0 (0)	0 (0)	1.000
2nd hospital stay* [median (range), days]		11 (9-16)	
Re-admission in 30 days [no. (%)]	0 (0)	0 (0)	1.000

* All patients in groups of temporary sigmoid colostomy underwent reversal surgery during first hospitalization.

Table 4. Overall outcomes combining the first and second interventions

Parameters	Temporary sigmoid colostomy (n = 12)	Hartmann's procedure (n = 34)	*p* value
Operative time [median (range), min]	255 (157-347)	312 (211-455)	0.020
Hospital stay [median (range), days]	17 (11-86)	21 (4-75)	0.560
Overall morbidity [no. (%)]	1 (8.3)	12 (35.3)	0.075
Mortality [no. (%)]	0 (0)	6 (17.6)	0.119
Major complication (Clavien-Dindo ≥ 3) [no. (%)]	0 (0)	9 (26.5)	0.047
Re-operation [no. (%)]	0 (0)	6 (17.6)	0.119
Re-admission in 30 days [no/N. (%)]	1/12 (8.3)	5/28 (17.9)	0.440
Definitive stoma [no/N. (%)]	9/12 (75.0)	16/28 (57.1)	0.285
Time for stoma closure, [median (range), days]	6 (3-8)	116 (77-353)	0.001

The main difference in our study was the timing for stoma closure between the two groups. The TSC group had a much shorter stoma reversal time (6 vs. 132 days, respectively; $p < 0.001$) than the HP group, without an increase in the morbidity or re-admission rates. Only one patient presented with surgical site infection, and no patient developed parastomal hernia during the second surgery.

Discussion

In cases of perforated sigmoid colon-related peritonitis, the HP remains the standard surgical practice for resecting the deceased rectosigmoid colon with distal rectal stump closure and construction of an end colostomy.[10] In 1921, a French surgeon, Henri Albert Hartmann, introduced this procedure during the 30th meeting of the French Surgical Association.[11] To date, its use is limited to emergency surgery when immediate anastomosis is impossible and to avoid the risk of anastomotic leakage. However, the HP negatively affects the QoL of patients and their caregivers owing to the complicated care of colostomy, and patients are forced to change their dietary style.[12] Additionally, HP reversal is reported to have high morbidity rates of up to 41% and mortality rates of up to 3.6%.[10,13,14] In most published studies, the reversal rates of eligible patients tend to be lower than half.[14,15] Large numbers of older and comorbid patients are left with a permanent stoma. Since the year 2000, surgeons have challenged the traditional surgical dogma to reduce both patient and socioeconomic burdens.

In the last decade, several randomized controlled trials (RCTs) have demonstrated alternative treatments for perforated diverticulitis. The Scandinavian Diverticulitis (SCANDIV) and "Diverticulitis — LAparoscopic LAvage vs resection (Hartman procedure) for acute diverticulitis with peritonitis" (DILALA) trials both focused on laparoscopic lavage as the initial treatment for Hinchey grade III diverticulitis; however, the conclusion was controversial.[16,17] Laparoscopic lavage was performed by rinsing at least 3 L of warm saline to all four quadrants or until drainage fluid was intracorporeally clear. The DILALA trial proved that laparoscopic lavage was feasible for purulent peritonitis and was a better option than HP.[18] In the SCANDIV trial, no significant difference in terms of severe complication or QoL was noted between laparoscopic lavage and HP; however, owing to diverticulitis recurrence, laparoscopic lavage was associated with higher reoperation rates in the long-term follow-up.[19] Other RCTs compared primary anastomosis with diverting ileostomy to HP in patients with perforated diverticulitis (Hinchey grade III or IV). Both the "Primary vs. Secondary Anastomosis for Hinchey Stage III-IV Diverticulitis" (DIVERTI) and "Laparoscopic peritoneal lavage or resection for purulent peritonitis" (LADIES) trials confirmed the safety of primary anastomosis with similar survival and overall morbidity rates in hemodynamically stable, immunocompetent patients.[20,21] Likewise, the 12-month stoma-free rates for diverting ileostomy were superior to end colostomy in the HP group owing to the less challenging closure procedure. Regarding long-term outcomes, primary anastomosis with diverting ileostomy resulted in lower parastomal hernia, reoperation, and overall hospitalization rates than HP, which became a novel strategy for perforated divierticulitis.[22,23]

Although colorectal cancer screening has been performed as public health policy worldwide,[24,25] up to 33% of patients with colorectal cancer require acute or emergent surgical intervention when symptoms present.[26] Colonic perforation caused by colorectal cancer is not a common complication, and the sigmoid colon is the most frequent perforation site.[27] No standardized protocol is available for cancer perforation; traditionally, two-staged surgeries have been performed in this emergency situation. The first stage is oncologic resection with end stoma creation. Stoma reversal surgery is arranged for intestinal continuity restoration following adjuvant chemotherapy. Like perforated diverticulitis, several studies have concluded that primary anastomosis with protective ileostomy is preferred over HP; however, most of them are small single-center series.[28-30]

Regarding emergent peritonitis, we develop a modified technique as a bridge for elective colon resection. By creating a temporary colostomy at the sigmoid, the feces can be diverted for better control of sepsis and to reduce the anastomotic leakage rate dur-

ing subsequent resection surgery. Moreover, we performed intraoperative lavage to drain the abscess and cleanse the peritoneum, thereby decreasing the possibility of pelvic adhesion. In our study, the TSC group had a significantly shorter operative time, which probably reflects the less extensive surgical procedure at the first colostomy formation. Following proper colon preparation, sigmoid resection surgery can be operated as a standard procedure. The technical challenges of reversal HP, including dense pelvic adhesions, difficult identification, and difficult anastomosis to a short rectal stump, are not confronted by surgeons. Although our data did not show a difference in definitive stoma percentage between groups, several patients were left with a permanent stoma following HP owing to the complexities of the reversal procedure.[10,31]

The biggest advantage of TSC is the extremely short stoma reversal time compared with traditional HP. Most of the patients had reversal surgery in 1 week following TSC, whereas those who underwent the HP underwent reversal surgery at least 2 months later; previous studies have reported that the reversal time could prolong to several years later.[10,13] Reversal surgery is arranged during the same hospital stay; therefore, stoma care training is not required, dramatically ceasing the burden of colostomy.[12,32] Although the colostomy was created at the midline, the surgical site infection and parastomal hernia rates were relatively low. Only one of the nine patients suffered from wound infection, which was managed using a wet dressing. No patients in the TSC group developed ventral hernia because a short-term colostomy does not weaken the fascial strength, which is another advantage over HP, since a previous study reported that the parastomal hernia rate was 15%-46% for HP.[33]

Furthermore, we performed TSC to treat sigmoid volvulus and foresee its potential. In this study, the three patients who had failed primary emergency treatment of colonoscopic derotation underwent TSC for decompression. All of them underwent reversal surgery 1 week after and were subsequently discharged without stoma or complication. According to previous studies, the concept of TSC is similar to percutaneous endoscopic colostomy in managing recurrent sigmoid volvulus.[34,35] By using the standard technique of percutaneous endoscopic gastrostomy, percutaneous endoscopic colostomy can be safely applied by a gastrointestinal specialist in older adult and frail patients who are unfit for or refusing surgery.

Our study had some limitations. First, the retrospective nature of this study may have introduced patient selection bias. Second, the sample size was relatively small and several confounding factors may not be highly significant. Third, owing to the retrospective study design, we could not obtain some data, including patient's underlying disease, Charlson comorbidity index, procalcitonin level, QoL, and peritonitis severity. In this study, the significant worsening of the major complication of the patients who underwent HP may be related to the poor outcome of fecal peritonitis. Lastly, the follow-up duration was insufficiently long. The inherent bias associated with comparisons between two different techniques and the evaluation of long-term oncological outcomes could not be overcome in our study.

Conclusions

Among patients with likely perforated sigmoid peritonitis undergoing emergency surgery, the use of TSC provides a relatively short operative time and early reversal of colostomy without sacrificing mortality and morbidity. Patients can restore intestinal continuity during the same hospital stay. Considering the technical challenges of HP reversal and the QoL of the patients, TSC may be suggested as an alternative strategy for patients with sigmoid perforation. A prospective large-scale RCT may be needed.

Conflict of Interest Statement

The authors declare no conflicts of interest in the study.

Role of Funding Source

The authors declare no role of funding source in the study.

References

1. Morris CR, et al. Incidence of perforated diverticulitis and risk factors for death in a UK population. *Br J Surg* 2008; 95(7):876-81.
2. Biondo S, et al. A prospective study of outcomes of emergency and elective surgeries for complicated colonic cancer. *Am J Surg* 2005;189(4):377-83.
3. Singhal R, Hull P, Budhoo M. Management of left sided colorectal emergencies. Results of a postal questionnaire. *Minerva Chir* 2007;62(6):437-41.
4. Joo Y, et al. Prognostic factors and management for left colonic perforation: can Hartmann's procedure be preventable? *Ann Coloproctol* 2020;36(3):178-85.
5. Ng HJ, et al. Current outcomes of emergency large bowel surgery. *Ann R Coll Surg Engl* 2015;97(2):151-6.
6. Masoomi H, et al. Trends in diverticulitis management in the United States from 2002 to 2007. *Arch Surg* 2011;146(4):400-6.
7. Vermeulen J, Lange JF. Treatment of perforated diverticulitis with generalized peritonitis: past, present, and future. *World J Surg* 2010;34(3):587-93.
8. Constantinides VA, et al. Primary resection with anastomosis vs. Hartmann's procedure in nonelective surgery for acute colonic diverticulitis: a systematic review. *Dis Colon Rectum* 2006;49(7):966-81.
9. Salem L, Flum DR. Primary anastomosis or Hartmann's procedure for patients with diverticular peritonitis? A systematic review. *Dis Colon Rectum* 2004;47(11):1953-64.
10. Hallam S, Mothe BS, Tirumulaju R. Hartmann's procedure, reversal and rate of stoma-free survival. *Ann R Coll Surg Engl* 2018;100(4):301-7.
11. Sanderson ER. Henri Hartmann and the Hartmann operation. *Arch Surg* 1980;115(6):792-3.
12. Zewude WC, et al. Quality of life in patients living with stoma. *Ethiop J Health Sci* 2021;31(5):993-1000.
13. Horesh N, et al. Reversal of Hartmann's procedure: still a complicated operation. *Tech Coloproctol* 2018;22(2):81-7.
14. Richards CH, Roxburgh CS. Surgical outcome in patients undergoing reversal of Hartmann's procedures: a multicentre study. *Colorectal Dis* 2015;17(3):242-9.
15. Cellini C, et al. Association between operative approach and complications in patients undergoing Hartmann's reversal. *Br J Surg* 2013;100(8):1094-9.
16. Schultz JK, et al. Laparoscopic lavage vs primary resection for acute perforated diverticulitis: the SCANDIV randomized clinical trial. *JAMA* 2015;314(13):1364-75.
17. Angenete E, et al. Laparoscopic lavage is feasible and safe for the treatment of perforated diverticulitis with purulent peritonitis: the first results from the randomized controlled trial DILALA. *Ann Surg* 2016;263(1):117-22.
18. Kohl A, et al. Two-year results of the randomized clinical trial DILALA comparing laparoscopic lavage with resection as treatment for perforated diverticulitis. *Br J Surg* 2018; 105(9):1128-34.
19. Azhar N, et al. Laparoscopic lavage vs primary resection for acute perforated diverticulitis: long-term outcomes from the Scandinavian diverticulitis (SCANDIV) randomized clinical trial. *JAMA Surg* 2021;156(2):121-7.
20. Bridoux V, et al. Hartmann's procedure or primary anastomosis for generalized peritonitis due to perforated diverticulitis: a prospective multicenter randomized trial (DIVERTI). *J Am Coll Surg* 2017;225(6):798-805.
21. Lambrichts DPV, et al. Hartmann's procedure versus sigmoidectomy with primary anastomosis for perforated diverticulitis with purulent or faecal peritonitis (LADIES): a multicentre, parallel-group, randomised, open-label, superiority trial. *Lancet Gastroenterol Hepatol* 2019;4(8):599-610.
22. Loire M, et al. Long-term outcomes of Hartmann's procedure versus primary anastomosis for generalized peritonitis due to perforated diverticulitis: follow-up of a prospective multicenter randomized trial (DIVERTI). *Int J Colorectal Dis* 2021;36(10):2159-64.
23. Edomskis PP, et al. Hartmann's procedure versus sigmoidectomy with primary anastomosis for perforated diverticulitis with purulent or fecal peritonitis: three-year follow-up of a randomised controlled trial. *Int J Surg* 2022;98:106221.
24. Bresalier RS. Colorectal cancer screening in a changing world. *Gastroenterol Clin North Am* 2022;51(3):577-91.
25. Sano Y, et al. Colorectal cancer screening of the general population in East Asia. *Dig Endosc* 2016;28(3):243-9.
26. Barnett A, et al. Colorectal cancer emergencies. *Journal of Gastrointestinal Cancer* 2013;44(2):132-42.
27. Tan KK, et al. Surgery for perforated colorectal malignancy in an Asian population: an institution's experience over 5 years. *Int J Colorectal Dis* 2010;25(8):989-95.
28. Breitenstein S, et al. Emergency left colon resection for acute perforation: primary anastomosis or Hartmann's procedure? A case-matched control study. *World J Surg* 2007;31(11):2117-24.
29. Tan KK, et al. Predictors of outcome following surgery in colonic perforation: an institution's experience over 6 years. *J Gastrointest Surg* 2011;15(2):277-84.
30. Otani K, et al. Colon cancer with perforation. *Surg Today* 2019;49(1):15-20.
31. Tan WS, et al. Reversal of Hartmann's procedure: experience in an Asian population. *Singapore Med J* 2012;53(1):46-51.
32. Stavropoulou A, et al. "Living with a stoma": exploring the lived experience of patients with permanent colostomy. *Int J Environ Res Public Health* 2021;18(16).
33. Mäkäräinen E, et al. Incidence of parastomal and incisional hernia following emergency surgery for Hinchey III-IV diverticulitis: a systematic review. *Scand J Surg* 2022;111(2): 14574969221107276.
34. Jackson S, Hamed MO, Shabbir J. Management of sigmoid volvulus using percutaneous endoscopic colostomy. *Ann R Coll Surg Engl* 2020;102(9):654-62.
35. Frank L, Moran A, Beaton C. Use of percutaneous endoscopic colostomy (PEC) to treat sigmoid volvulus: a systematic review. *Endosc Int Open* 2016;4(7):E737-41.

原　著

暫時性乙狀結腸造口與哈特曼氏手術對乙狀結腸破裂治療之比較：回朔性實驗

陳平[1]　陳穎韋[2]　顏珉玄[2]　張東晟[2]　丘基泰[2]

[1]臺北醫學大學部立雙和醫院　外科部

[2]臺北醫學大學部立雙和醫院　大腸直腸外科

背景　傳統上乙狀結腸破裂由哈特曼氏手術作為緊急治療，但其低生活品質、高併發症及永久腸造口比率讓外科醫師想找出相對低侵入性的治療方式，本研究比較暫時性乙狀結腸造口與哈特曼氏手術的治療成效。

研究方法　此研究比較 2018 年 11 月至 2022 年 08 月所有接受緊急手術治療的乙狀結腸破裂病患。我們將患者分為暫時性乙狀結腸造口組和哈特曼氏手術組，並收集病歷資料包括病人術前生理狀態、術後死亡率與併發症，腸造口閉合比率與時間間隔以進行分析。

結果　共 46 名病患在本次研究中。暫時性乙狀結腸造口組有較短的緊急手術時間，同時也具有極短的腸造口閉合時間 (6 vs. 132 天；$p < 0.001$)。在其他比較結果如術後死亡率、併發症、再次手術率、再次住院率或永久腸造口比率，兩組之間並無顯著差異。

結論　對於適當病人，暫時性乙狀結腸造口可以作為乙狀結腸破裂的緊急手術治療，同時也能在當次住院時進行腸造口閉合手術。考量到其極短的腸造口閉合時間與較好的生活品質，暫時性乙狀結腸造口是一個有潛力發展的手術

關鍵詞　乙狀結腸破裂、憩室炎、大腸造口、哈特曼氏手術。