Laparostomy for Severe Intra-Abdominal Infection Complicating Colorectal Disease

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PURPOSE: The aim of this study was to evaluate the use of laparostomy in the management of patients with severe intra-abdominal infection resulting from colorectal disease. METHODS: Seven patients, four with inflammatory bowel disease, two with colorectal carcinoma, and one with diverticular perforation, underwent laparostomy during a six-year period for postoperative, severe, intra-abdominal infection. RESULTS: The median age was 42 years, the mean Acute Physiology and Chronic Health Evaluation II score was 22.7, and the observed mortality was 28.6 percent (2/7 patients). In one patient the laparostomy was closed at 11 days; in all the others the wound was left to heal by granulation and contraction, and two of these later required reconstructive surgery. The median follow-up was three years and seven months. CONCLUSION: Laparostomy is an effective and practical method of managing patients with severe intra-abdominal infection as a result of colorectal disease. [Key words: Laparostomy; Colorectal disease; Intra-abdominal infection; SIRS]

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Laparostomy is the technique of leaving the abdomen open after laparotomy. It is used in the treatment of severe intra-abdominal infection in an attempt to reduce the well-recognized high mortality of this condition.[1-6] The commonest indication for laparostomy is in the treatment of necrotizing pancreatitis, but it can also be used in cases of severe intra-abdominal infection arising from the complications of colorectal disease.

Laparostomy allows regular inspection of the bowel and drainage of intra-abdominal collections without the need for transfers to an operating theater. It is a mechanical surgical technique that by regular abdominal exploration and drainage of collections aims to eradicate intra-abdominal infection to minimize or prevent systemic inflammatory response syndrome (SIRS).[5] We present seven cases, representing six years of experience in a colorectal tertiary referral center, of the use of laparostomy in the management of severe intra-abdominal infection resulting from the complications of inflammatory bowel disease or anastomotic breakdown.

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PATIENTS AND METHODS

Seven patients underwent laparostomy for postoperative peritonitis during a six-year period (1990–1996). There were four females in the group, and the median age was 42 (range, 24–66) years. The primary diseases were Crohn's disease,[3] ulcerative colitis,[1] sigmoid diverticulitis,[1] carcinoma of the sigmoid colon,[1] and carcinoma of the rectum[1] (Table 1).

The indication for laparostomy in all cases was postoperative peritonitis in patients in whom there was considered to be a substantial risk of continuing intra-abdominal infection with conventional closure. At admission to the intensive care unit (ICU), the Acute Physiology and Chronic Health Evaluation (APACHE) II score[7] was calculated for each patient.

Incision and Procedure

The midline incision from the previous operation was reopened; in one case the abdominal wall was necrotic, and wide debridement was undertaken. The abdomen was explored and collections drained. One patient required no bowel resection or diversion, one required a total colectomy and ileostomy, one had fistulas closed and refashioning of ileostomy, one had a transverse colostomy formed, one had an ileal resection and ileostomy, one had a Hartmann's procedure, and one had an ileal resection and anastomosis

Table 1.
Laparostomy Patients

Case	Gender	Age	Primary Disease	Previous Surgery	Indication for Laparostomy	APACHE II Score	Incision and Procedure	Ventilator Days	Outcome	Reconstructive Surgery
1 (Fig. 1)	F	41	Ulcerative colitis	Day 0, laparotomy, division of adhesions, small bowel resection, J-pouch formation, loop ileostomy	Fistula and intra-abdominal collection	3	Day 18, incision reopened	0	Alive and well	Enterocutaneous fistula resected; ileostomy taken down
2	M	26	Crohn's disease	Day 0, resection of fibrous stricture; Day 3, laparotomy and defunctioning colostomy	Postoperative peritonitis	21	Day 5, debridement of wound, total colectomy, ileostomy, Marlex® mesh	69	Died after 184 days	No
3	F	42	Crohn's disease	Day 0, panproctocolectomy and ileostomy; Day 30, laparotomy and resection of perforated terminal ileum and loop of ischaemic small bowel	Small bowel fistulas, intra-abdominal collection	20	Day 88, incision reopened, fistulas closed, ileostomy refashioned	14	Alive and well	No
4	F	46	Perforated sigmoid diverticulum	Day 0, laparotomy, Hartmann's procedure and removal of pedunculated fibroid	Postoperative peritonitis	24.5	Day 27, incision reopened, colostomy formed	8	Transfer back to United States	No
5	F	24	Crohn's disease	Day 0, laparotomy, division of adhesions, take down of enterocutaneous fistula and excision of hemorrhagic cyst from pelvis	Postoperative peritonitis	22.5	Day 8, incision reopened, ileal resection, repair of enterotomies, ileostomy formed	17	Died after 17 days	No
6	M	66	Sigmoid carcinoma	Day 0, sigmoid colectomy, primary anastomosis	Postoperative peritonitis, wound dehiscence	35	Day 9, Hartmann's procedure, Marlex® mesh to cover wound	0	Discharged, died 16 months later	Skin graft to wounds
7	M	66	Rectal carcinoma	Low anterior resection; Day 0, reversal of ileostomy	Postoperative peritonitis	33	Day 6, ileal resection and anastomosis	7	Alive and well	Wound closed at 11 days

APACHE = Acute Physiology and Chronic Health Evaluation.

(Table 1). Large saline-soaked gauze packs were then placed over the abdominal contents, followed by a layer of transparent self-adhesive dressing. In two cases Marlex® mesh (Phillips Sumika Polypropylene Co., Houston, TX) was sutured to the fascia at the wound edges to cover the defect.

All but one patient required postoperative ICU admission. Initially, patients were intubated, ventilated, and sedated, and as they recovered they were weaned back to pressure support. The abdominal cavity was examined daily or on alternate days, and the gauze packs and self-adhesive dressing were changed. In certain circumstances this required transfer back to operating theater, but the majority of these procedures took place on the ICU. During pack changes the surgeon gowned and masked, and the abdomen was draped. The abdomen was lavaged with saline and explored for collections; when a collection was found, loculations were broken down with a finger, and the contents were aspirated. There was no use of continuous lavage. During this period of repeat explorations of the abdomen, patients were kept sedated with midazolam and morphine. The Marlex® mesh was removed at 19 days in one patient and 71 days in the other. The laparostomy wound was left to heal by granulation and contraction in six cases (Fig. 1), and one underwent closure at 11 days. Two patients later required reconstructive surgery to the abdominal wall.

Initially, all patients received total parenteral nutrition. Antibiotics were withheld unless there was evidence of infection and not used to treat leukocytosis or fever alone.

RESULTS

The APACHE II score range for the study was 3 to 35, and the mean APACHE II score was 22.7. The probability of death can be obtained from the APACHE II score by performing a linear logistic regression analysis with death as the outcome variable.[7] The individual APACHE II scores were used to calculate predicted probabilities of mortality and the sum of these probabilities gave the expected deaths as 4.1. The observed mortality was 2, one male and one female. In both patients the primary disease was Crohn's disease, and their median age was 25.4 (survivors, 52) years.

One of the patients who died was a 26-year-old male, transferred to our care after wound debridement and laparostomy after anastomotic breakdown, fistula formation, and wound infection. Marlex® mesh had been used to cover the defect. The abdomen was explored, and collections were drained on four occasions. The Marlex® mesh was removed after 71 days, and no attempt was made to close the abdomen. The patient developed persistent multiple organ failure and died 184 days after laparostomy.

The other patient who died was a 24-year-old female who had undergone a procedure to take down an enterocutaneous fistula, divide adhesions, and remove a hemorrhagic pelvic cyst. She became septic in the postoperative period, and at laparotomy she was found to have multiple enterotomies and abdominal collections. These were drained, and the decision was made to leave the abdomen open. The abdomen was re-explored and collections drained on 13 occasions. She developed multiple organ failure and died 17 days postlaparostomy.

The median ICU stay was 12 days, with a median of 8 days ventilation. The mean number of repeat abdominal explorations on the ICU was 4.7.

The median follow-up time was three years and seven months (range, 1 year and 9 months to 5 years and 7 months). One of the patients died 16 months postlaparostomy from disseminated cancer, and one was lost to follow-up.

DISCUSSION

In all cases in this study, laparostomy was used as therapy for severe intra-abdominal infection caused by the complications of colorectal disease. Most previous reports of laparostomy have focused on cases of pancreatic necrosis. We used the APACHE II scoring system as a measure of disease severity, to evaluate the effectiveness of surgical technique, and to allow comparison with other studies.[8–12] The mean APACHE II score for our patients was 22.7, with a range of 3 to 35, and the severity of disease was similar to other studies of postoperative peritonitis (Table 2). The mortality in our patients was 28.6 percent, whereas previous studies using laparostomy for the management of intra-abdominal infection have shown mortality of between 7 and 64 percent.[6, 13, 16–23] Much of the variation in mortality may be because of variable patient selection for the procedure. In Steinberg's series of fourteen patients, there was a mortality rate of 7 percent, but 86 percent of patients had a laparostomy performed for first presentation peritonitis, many resulting from perforated appendicitis or diverticulitis.[17] This emphasises the importance of an illness severity score for comparison. Pre-

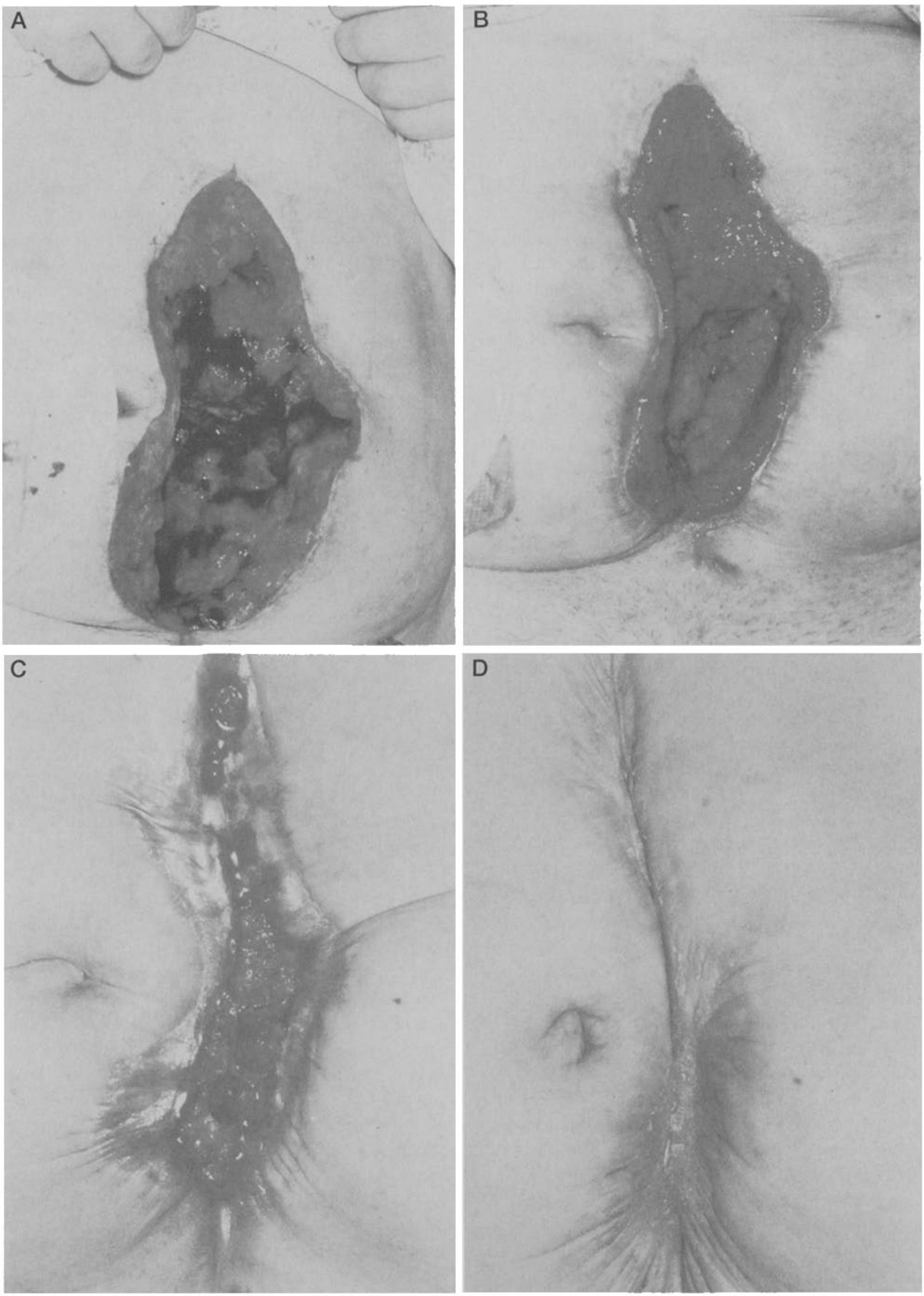

Figure 1. Laparasotomy performed on a 41-year-old female for postoperative intra-abdominal infection (Patient 1 in Table 1). A. One day postoperative. B. Nine days postoperative. C. Eight weeks postoperative. D. One year follow-up.

Table 2.
APACHE II Score and Mortality of Patients with Severe Intra-Abdominal Infection Secondary to Intestinal Disease Managed by Laparostomy

Study	Year	Mean APACHE II Score	Mortality (%)
Walsh *et al.*[13]	1988	17.2	11
Garcia Sabrido *et al.*[14]	1988	25	26.5
Ivatury *et al.*[15]	1989	15	64
Schein[16]	1991	14	55
Present study	2000	22.7	29

APACHE = Acute Physiology and Chronic Health Evaluation.

vious studies that have used APACHE II score and open management techniques for intra-abdominal infection secondary to intestinal disease are shown in Table 2. Using this form of standardization, our results compare favorably with other studies.

The aim of surgical intervention in severe intra-abdominal infection is to eradicate infection to minimize or prevent the development of SIRS. SIRS is defined as the systemic inflammatory response to a severe insult. The response is manifested by two or more of temperature >38°C or <36°C, heart rate >90 beats/minute, respiratory rate >20 breaths/minute or $Paco_2$ <4.3 kPa, white blood cell count >12,000 cells/mm^3 or <4,000 cells/mm^3, or >10 percent immature (band) forms.[24]

For severe intra-abdominal infection not effectively controlled by local or percutaneous drainage, the available techniques are on-demand laparotomy, planned relaparotomy, and laparostomy. The technique of radical peritoneal debridement is no longer advocated, because it has been found to be associated with an increase in mortality in a prospective, randomized, clinical trial.[25] On-demand laparotomy is dictated by the patient's clinical condition, is the technique by which most patients are managed, and has a mortality of 30 to 76 percent.[1–4] A prospective, nonrandomized study that compared open with closed management techniques reported no significant difference in mortality,[10] but a subsequent prospective study comparing patients at equal mortality risks found that the use of the open technique and staged closure of the abdomen was superior to more conventional techniques in terms of mortality.[26] The approach of planned or staged relaparotomy for patients with postoperative peritonitis is repeated exploration of the abdomen, with abdominal wall closure after each procedure. No prospective, randomized trial has been performed comparing this to the laparostomy technique, where the abdomen is left open after each procedure, because of the perceived complexity of constructing the study.[27] We have not used planned relaparotomy because there are several advantages to leaving the abdomen open. Laparostomy makes re-exploration easy to perform in the ICU, avoiding the risk of moving the patient to the operating room. It is an effective way to manage the multiple enteric fistulas, because these are allowed to drain externally, and any deep collections that do form within the abdominal cavity are located by careful exploration of the open abdomen. Leaving the abdomen open also prevents the generation of high intra-abdominal pressures, which can lead to intra-abdominal compartment syndrome.[28] Laparostomy avoids the repeated trauma of wound closure. Schein[16] reported that 60 percent of his patients treated for postoperative peritonitis by the planned relaparotomy technique required their abdomen to be left open because of the practical difficulties of wound closure. There have been reports of problems with evisceration, fluid and protein loss, fistula formation, and difficulty of wound healing, when using the laparostomy technique.[19, 22, 29] In our group of patients we had no problems with evisceration using the technique of placing packs on the abdominal contents followed by transparent self-adhesive dressing in five cases and using the Marlex® mesh in two, and this is supported by other studies.[6, 16] The energetic fluid replacement regimen guided by careful estimation of fluid losses ensured volume homeostasis. One patient had further surgery for an enterocutaneous fistula, and one patient developed an abdominal wall hernia that required a support truss.

The open abdomen technique can require prolonged hospitalization and the management of exteriorized bowel, and multiple leaking fistulas requires intensive nursing and stoma therapy care. The requirement for reconstructive surgery was low in our patients, and in our experience there was no major problem in allowing the wound to heal by granulation and contraction. Other studies have shown that if further surgery is required to close fistulas or refashion stomas, the optimum time is at least six months after laparostomy, by which time a neoperitoneal cavity has developed and adhesions have lost their vascularity, allowing bowel mobilization and resection.[30, 31]

This study presents the use of laparostomy in cases of severe intra-abdominal infection resulting from the

complications of inflammatory bowel disease or anastomotic dehiscence. The technique has been used on a group of sick patients as shown by APACHE II scoring, and we have achieved a low mortality. We recommend laparostomy for use in carefully selected cases of severe intra-abdominal infection as a practical and effective method of managing the patient.

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