

# Morbidity and Mortality Following Intraoperative Closure of Transverse Loop Colostomy\*

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Rosen L, Friedman IH. Morbidity and mortality following intraoperative closure of transverse loop colostomy. *Dis Colon Rectum* 1980;23:508-512. A retrospective analysis of 153 patients having intraoperative closure of transverse loop colostomies was performed. The mortality was 1.4 per cent. The morbidity rate was 15 per cent, including 7 per cent wound infections and 5.2 per cent fecal fistulas. The incidence of wound infection was not significantly improved by the use of systemic or nonabsorbable intestinal antibiotics. Intraoperative drainage alone or in combination with subcutaneous drainage resulted in the highest rate of wound infection. However, the use of intraoperative drains seems justified for the control of fecal fistula if it should occur. The lowest incidence of complication was noted when colostomies were closed in 2-4 months. Particular attention must be given to cases with diverticulitis as these have a greater morbidity. Factors which reduce morbidity appear to be directly related to clean and careful dissection of the bowel with a sound technique of anastomosis. [Key words: Colon, colostomy closure; Colostomy, closure complications; Complications, colostomy closure]

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THE SAFETY AND VALUE of proximal diverting transverse colostomy in colonic surgery is time-tested. Yet, the significant morbidity associated with closure of the colostomy (Table 1) has led some authors to suggest a more restrictive use of this procedure and place greater emphasis on avoidance of colostomy.<sup>7,12</sup> Garnjobst,<sup>16</sup> however, in an editorial stated that "While surgeons rightfully should be mindful of the added costs of colostomy, failure to provide a colostomy may exact a far greater cost both economic and human."

Our review of the recent literature, 1971-1978 (Table 1), revealed a morbidity rate of 29.4 per cent in 1,739 patients. In the belief that colostomy closure should be achieved with minimal morbidity and neg-

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TABLE 1. Morbidity and Mortality in Colostomy Closure Reported in 1739 Patients

Reference	Number of Patients	Complications (Per Cent)	Fistulas (Per Cent)	Infection (Per Cent)	Mortality (Per Cent)
Knox <i>et al.</i> , 1971 <sup>1</sup>	179	35.7	23.0	10.0	2.2
Thomson and Hawley, 1972 <sup>2</sup>	139	21.5	2.9	17.2	0
Thibodeau, 1974 <sup>3</sup>	83	25.0	7.0	—	1.2
Yakimets, 1975 <sup>4</sup>	71	49.0	2.8	38.0	2.8
Beck and Conklin, 1975 <sup>5</sup>	77	15.5	2.6	7.6	0
Adeyemo <i>et al.</i> , 1975 <sup>6</sup>	43	15.4	4.6	4.6	0
Yajko <i>et al.</i> , 1976 <sup>7</sup>	100	28.0	4.0	10.0	1.0
Finch, 1976 <sup>7</sup>	213	44.0	9.0	21.0	0.4
Tomlinson <i>et al.</i> , 1976 <sup>9</sup>	26	30.0	7.6	22.0	0
Wheeler and Barker, 1977 <sup>10</sup>	74	37.8	17.6	23.0	2.7
Jarrett <i>et al.</i> , 1977 <sup>11</sup>	82	35.0	11.0	17.0	1.5
Smit and Walt, 1978 <sup>12</sup>	167	29.9	3.6	17.5	0
Mitchell <i>et al.</i> , 1978 <sup>13</sup>	89	33.0	5.6	17.9	2.2
Mirelman <i>et al.</i> , 1978 <sup>14</sup>	118	49.0	9.3	25.2	4.2
Garnjobst <i>et al.</i> , 1978 <sup>15</sup>	125	5.6	0	1.6	0
Present study, 1980	153	15.0	5.2	7.0	1.4

TABLE 2. *Indications for Colostomy and Complications of Closure*

	Number of Patients	Complications of Closure	
		Number	Per Cent
Emergency			
Acute obstruction	28	4	14
To effect proximal diversion	29	6	20
To decompress emergency anastomosis	3	0	0
Total	60	10	17
Elective			
Diverticulitis	11	1	9
Carcinoma			
Dukes' A	41	7	17
Dukes' B	17	3	18
Dukes' C	24	4	17
Total	93	15	16

ligible mortality, we retrospectively reviewed our experience to identify those factors contributing to mortality and morbidity in an effort to recognize any modifications in technique or management which may prove beneficial.

**Patients and Methods**

The charts of 153 consecutive patients, private and service, having intraperitoneal closures of transverse colostomies between 1968 and 1979 at the Beth Israel Medical Center in New York City were reviewed retrospectively.

There were 74 men and 79 women, ranging in age from 22 to 86 years, with a mean of 62 years.

Sixty colostomies had been constructed as emergency procedures (Table 2). Twenty-eight of these were for proximal decompression of an acute obstruction, 29 to effect proximal diversion, and three to protect an emergency anastomosis.

Ninety-three colostomies had been created electively. Of these, 11 were complementary to resection for diverticulitis and 82 were complementary to resection for carcinoma. Forty-one cases were Dukes' A, 17 cases were Dukes' B, and 24 cases were Dukes' C.

In 114 patients colostomy was performed in conjunction with resection and closure was performed as a second stage procedure; in 39 patients colostomy was subsequently followed by resection, with colostomy closure being the third stage procedure.

In all patients the colostomy was constructed using a transverse incision, and none had primary maturation of the stoma. The time interval between colostomy and closure ranged from six weeks to 60 months with an average of 4.7 months (Table 3).

Barium enema, Gastrografin® enema, sigmoidoscopy or colonoscopy were performed in all patients prior to closure. All patients had routine mechanical preparation of the proximal and distal bowel using a fluid diet for 48 hours with irrigation of the proximal and distal loops and rectal enemas for three to four days prior to surgery. The use of antibiotics, either of the nonabsorbable intestinal variety or preoperative or postoperative systemic antibiotics, varied with the practice of the individual surgeon. The nonabsorbable intestinal antibiotics used were neomycin and kanamycin, alone or in combination with erythromycin base. The incidence of wound infection was determined in 147 patients in whom primary wound closure was performed (Table 4).

All closures were performed by the intraperitoneal method. The anterior colonic wall was closed in two layers after mobilization in 136 patients and resection with end-to-end anastomosis was performed in 17 patients. Subcutaneous and intraperitoneal drains alone or in combination were used in 147 patients with primary skin closure. Delayed skin closure without drainage was performed in six patients (Table 5). In 136 cases the fascial layers were closed with stainless steel monofilament wires, the remainder were closed with chromic catgut sutures.

**Results**

There were two deaths which were secondary to a pulmonary embolus and a ventricular arrhythmia, for a mortality rate of 1.4 per cent.

There were 23 complications in this series of 153 patients—a morbidity of 15 per cent. There were 11 wound infections, eight fecal fistulas, one myocardial

TABLE 3. Morbidity Related to Interval Between Colostomy and Closure

	Number of Patients	Wound Infections	Fecal Fistulas	Morbidity	
				Total	Per Cent
6 weeks	11	0	1	1	9.0
2-4 months	96	4	3	7	7.3
5-11 months	31	5	2	7	22.6
12-60 months	15	2	2	4	26.6

infarction, two instances of prolonged postoperative ileus and one upper gastrointestinal hemorrhage necessitating surgical intervention. In 60 patients having colostomy as an emergency procedure, closure resulted in ten complications (17 per cent) and in 83 colostomies constructed electively, closure resulted in 15 complications (16 per cent). There was no apparent difference in morbidity in relation to Dukes' classification (Table 2).

There were two deaths and 16 complications (15.8 per cent) in 114 patients whose closures were second-stage procedures and seven complications (18 per cent) in 39 patients whose closures were done as third-stage procedures. These seven complications were two wound infections and five fecal fistulas. The interval from creation to closure was under six weeks in 11 patients, two to four months in 96 patients, five to 11 months in 31 and longer than one year in 15. The latter two groups consisted predominantly of patients having had resections for diverticulitis complicated by abscess or fistula formation. The lowest morbidity (7.3 per cent) was in the two-to-four-month group, and the highest (26.6 per cent) was in the group closed after one year (Table 3).

Statistical analysis by chi square shows that the incidence of wound infection was not significantly lessened by the addition of systemic or nonabsorbable intestinal antibiotics. The higher rate of wound infection in the group with postoperative antibiotics is significant ( $P < .05$ ).

In 11 patients with infected wounds, four had received preoperative cephalosporin and ten had received postoperative cephalosporin. Microbial studies demonstrated predominantly *Escherichia coli* and enterococci; in five of 11 cases, the organisms were resistant to cephalosporin.

There was a 4 per cent incidence of wound infection in patients with subcutaneous drains, 6 per cent with intraperitoneal drains, and 8 per cent with both intraperitoneal and subcutaneous drains (Table 5).

In 136 patients in whom closure by inversion of the anterior wall was performed there were seven fecal fistulas, and in the 17 patients with end-to-end anastomosis a single anastomotic leak occurred. The average interval until closure was 6.7 months in the patients who developed a fistula. The lowest incidence of fecal fistula was in the group whose closures were performed two to four months subsequent to creation of the colostomy. All fistulas occurred in patients with intraperitoneal drains and all closed spontaneously within one month. There was no evidence of diffuse peritonitis, sepsis or intra-abdominal abscess in the group. In the 27 cases of colostomy for diverticular disease there were four wound infections and two fecal fistulas for a morbidity of 22 per cent.

The average time for a bowel movement was six days. Transient diarrhea occurred in seven patients. All of these patients had postoperative antibiotics and their interval from creation to closure averaged 3.2 months. All noncomplicated cases left the hospital

TABLE 4. Influence of Antibiotics on Wound Infection in 147 Patients with Primary Wound Closure

Number of Patients	Nonabsorbable Intestinal Antibiotics	Preoperative Antibiotics	Postoperative Antibiotics	Infections	
				Number	Per Cent
22	No	No	No	0	0
30	Yes	Yes	Yes	3	10.0
30	No	Yes	Yes	1	3.3
39	No	No	Yes	6	15.4
5	Yes	No	No	1	20.0
21	Yes	No	Yes	0	0

TABLE 5. Wound Infection and Type of Drainage

	Number of Patients	Infected Wounds	
		Number	Per Cent
Subcutaneous	25	1	4.0
Intraperitoneal	35	2	6.0
Intraperitoneal and subcutaneous	87	7	8.0
Delayed closure	6	1	17.0

within ten days. There were no cases of postoperative obstruction due to mechanical blockage at the site of stomal closure.

### Discussion

Although colostomy has been long-recognized as a valuable adjunct to colonic surgery, the surgical literature continues to document a significant morbidity associated with colostomy closure. Sigmoid loop colostomies, transverse colon colostomies, and end colostomies have generally been considered collectively. Finch<sup>8</sup> notes the higher incidence of complications following closure of sigmoid colostomies which he attributes to the more restricted mobility of the sigmoid colon and the solid nature of feces in this location. Wheeler and Barker<sup>10</sup> also note a similar high incidence of complications with sigmoid colostomies and suggest that they not be used unless one is contemplating a two-stage procedure with resection of the colostomy at the time of major resection. We feel that closure of sigmoid colostomies is associated with different problems and, accordingly, this report reviews only closure of loop colostomies constructed in the transverse colon.

Various factors continue to be analyzed as causes for this rather excessive morbidity. Both intra- and extraperitoneal closure techniques continue to have their advocates. With extraperitoneal closure, the colon is dissected down to the peritoneum and closed while the colon remains fixed to the posterior aspect of the anterior abdominal wall. With this technique, the likelihood of incomplete release of the spur and excessive tension in the intestinal suture line from inadequate mobilization of the bowel leads to greater incidence of fecal fistula<sup>8,11,17</sup> than is seen with intraperitoneal closure. However, the literature tends to support the merit of intraperitoneal closure.<sup>2,6,11,15,18</sup> Knox *et al.*<sup>1</sup> advocates of extraperitoneal closure, state that if a fistula does occur, the likelihood of fatal peritonitis is less than with the intraperitoneal method. In our eight cases of fistula, the presence of an intraperitoneal drain provided a controlled exit of feces which closed spontaneously.

Knowledge that the distal lumen was patent, provided by appropriate preoperative studies, offered security to the surgeon that this would occur. In both methods, the two common technical errors are disrupting the blood supply to the bowel and tearing the seromuscular layer. We suspect that in some of our cases, fecal fistulas resulted from just such a problem and, in cases where there is any question of injury to the bowel, resection with end-to-end anastomosis should be employed.

Studies of the distal bowel should be performed before closing the colostomy. The interpretation of radiographic contrast studies may be unreliable as the anastomosis may appear irregular due to antimesenteric slits or methods of reperitonealization. Certainly sigmoidoscopy and colonoscopy will clarify questionable situations and will lessen any concern regarding recurrent carcinoma.

The duration of morbidity from a colostomy is obviously lessened by early closure. However, closures performed in less than one month have an increased incidence of fecal fistula and wound infection.<sup>1,2,12</sup> This is attributed to bowel wall edema as well as collagen lysis.<sup>2,8,10,19</sup> In our series the lowest morbidity occurred when colostomies were closed between two and four months (7.3 per cent) and is consistent with other reports in the literature. The highest morbidity, 26 per cent, was present in colostomies closed after one year. This group of patients tended to be more debilitated with a higher incidence of diverticular disease. The group closed under six weeks was too small to evaluate statistically.

The use of pre- and postoperative systemic antibiotics as well as nonabsorbable intestinal antibiotics and colostomy closure remains controversial.<sup>1,2,5-8,10-15,20</sup> Chi square analysis of our results show that the incidence of wound infection was not significantly diminished by the use of systemic or nonabsorbable intestinal antibiotics. Of interest was the higher rate of infection when postoperative antibiotics alone were utilized. In an effort to decrease the incidence of wound infections, the use of intraoperative wound irrigation with iodine solutions has been suggested.<sup>20-22</sup>

The problem of drainage is unresolved in the literature.<sup>2,4,6,7,11,14,18</sup> Our results seemingly indicate that the lowest wound infection rate occurred with subcutaneous drainage only. The highest wound infection rate (8 per cent) occurred in patients with intraperitoneal and subcutaneous drains. Despite the fact that intraperitoneal drainage may contribute to a higher incidence of infection, it would seem worthwhile to have an intraperitoneal drain in the event of an anastomotic breakdown, thereby providing for a controlled fecal fistula. It should be noted that there was no incidence of intra-abdominal abscess or other reason for reoperation in our group of patients. It is the practice of the senior author always to employ a single intraperitoneal drain placed through the main wound so the drain lies between the liver and the transverse colon. Insofar as feasible, omentum is manipulated so it lies between the bowel and the drain in an effort to avoid the drain's being in contact with the bowel closure.

Knox *et al.*<sup>1</sup> and Jarrett *et al.*<sup>11</sup> report an increased morbidity with colostomy closure associated with diverticular disease, although Wheeler and Barker<sup>10</sup> deny any association. In our series there were six complications in 27 cases of diverticulitis with a resultant morbidity of 22 per cent. This is 50 per cent higher than seen in the remaining 126 cases with a morbidity of only 14 per cent.

The greater morbidity rate in this situation may be attributable to recognizable local problems. The bowel in diverticulitis is more susceptible to injury during mobilization due to the inherent nature of the bowel wall as well as to the greater adhesion and scar formation present because of the usual prolonged time until closure. Knox *et al.*<sup>1</sup> suggest that in these patients there is a physiological obstruction distal to the closure which perpetuates a high pressure state in the proximal colon leading to an increased likelihood of fecal fistula.

Diarrhea was transiently present in seven patients. Rapid transit in previously defunctionalized bowel has been implicated as the etiologic factor by Yajko *et al.*<sup>7</sup> Tilson *et al.*<sup>19</sup> report experimental evidence of a reduced capacity for the absorption of sodium and water in the distal colon which appears the second or third week following colostomy and which they suggest may cause diarrhea following closure. However, diarrhea is not uncommon after ileus and, in addition, all our patients with diarrhea had received

antibiotics postoperatively. Finally, the interval to closure in these patients averages 3.2 months which is less than the mean of 4.7 months. Reduced absorption with diarrhea may be anticipated in those cases with longer intervals to closure, but this was not borne out in our group.

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