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ORIGINAL ARTICLE

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# Small bowel obstruction following low anterior resection: the impact of diversion ileostomy

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**Abstract** *Background:* The incidence of small bowel obstruction following rectal cancer surgery has not been well documented in the era of sphincter-preserving surgery. This report aimed to study the incidence, aetiologies and outcomes of small bowel obstruction in patients after low anterior resection for rectal cancer. The factors that might affect the incidences of small bowel obstruction were analysed. *Methods:* Consecutive patients who had undergone low anterior resection for rectal cancer from August 1993 to March 1999 were studied. Patients with unplanned admissions, with the diagnosis of small bowel obstruction, were reviewed. The aetiologies and outcome of small bowel obstruction were documented. *Results:* Two hundred and fourteen patients were included, with a median follow-up time of 39 months; 22 patients presented with 30 episodes of small bowel obstruction, and operations were necessary in nine patients (40.9%). Malignant obstruction occurred in two patients (10.3%). Obstruction within 6 weeks of surgery (including closure of stoma) occurred in 13 patients (6.1%). Early obstruction occurred at a higher incidence in those patients who had had an ileostomy than in those who did not (9.1% vs 2.9%, $P$=0.048). *Conclusion:* Small bowel obstruction following rectal cancer surgery occurred in 10.3% of patients. The majority of the obstruction was benign in nature. The presence of diversion ileostomy was associated with an increased incidence of early obstruction, and the use of loop ileostomy for proximal diversion should be further assessed.

**Keywords** Small bowel obstruction · Ileostomy · Rectal surgery

## Introduction

Small bowel obstruction (SBO) is a common and significant complication in patients after abdominal or pelvic surgery. The majority of the SBOs are due to benign adhesions. Ellis reported that 3.3% of all major laparotomies were performed for adhesive SBO [1]. The occurrence of SBO has been reported to create substantial morbidity in patients as well as workload for clinicians [1, 2, 3]. Colorectal operations are, among different types of abdominal surgery, particularly liable to cause post-operative SBO [3, 4]. Edna and Bjerkeset [5] reported that the incidence of SBO following surgery for colorectal cancer was 9%.

Surgery for rectal cancer is one of the most commonly performed operations in developed countries. Low anterior resection (LAR) with sphincter preservation is now the treatment of choice for most patients with mid- and low rectal cancers. There are a few risk factors that might predispose patients who have undergone LAR to develop post-operative SBO. These include the creation of raw areas in the pelvis by extensive dissection; the subsequent intra-abdominal sepsis and the increased practice of proximal diversion as a result of a high rate of anasto-

motic leakage; local or intra-abdominal recurrence; and the use of adjuvant radiation therapy.

The incidence and risk factors of SBO following LAR, however, have not been adequately documented. This study aimed to review the incidence, aetiologies and outcomes of SBO following LAR for mid- and distal rectal cancers. Factors that might predispose patients to post-operative SBO were also analysed.

## Patients and methods

In this study, consecutive patients who had undergone LAR from August 1993 to March 1999 were included. The patients' demographic characteristics and operation details, the histology of the tumour, the operative outcomes and the follow-up data were collected in a prospective manner, contributing to the database of rectal cancer. Charts of patients with unplanned readmission after LAR because of SBO were retrieved and reviewed. Data concerning the date and the number of episodes of SBO, as well as the treatment and outcome, were reviewed. For those in whom operations were performed for SBO, the exact causes of the obstruction, the operative details and the outcomes were recorded.

During the study period total meso-rectal excision was utilised as the standard technique for the treatment of mid- and distal rectal cancers. Details of the surgical technique have been described previously [6]. Selective proximal diversion was performed for high-risk anastomoses in the initial period, and a diversion stoma was created in patients with poor medical risk, difficult pelvic dissection, previous pelvic irradiation, positive leakage test and incomplete doughnut. Our preferred mode of diversion was a loop ileostomy [7]. This was created at the pre-marked site at the right iliac fossa, and we did not rotate the ileum in fashioning the ileostomy. Loop transverse colostomy was performed only in patients with concomitant total cystectomy and reconstruction of ileal conduit, or when the ileum was damaged by previous radiation. After our review on risk factors for anastomotic leakage [6], proximal diversion was performed routinely in male patients.

Closure of the stoma was performed after the gastrografin enema did not demonstrate any anastomotic leakage. The stomas were closed with a circumstomal incision. In the case of an ileostomy, the stoma site was resected and a suture anastomosis was performed. In the case of a transverse colostomy, the anterior wall was closed with interrupted sutures without resection.

SBO is defined as the clinical presentation with abdominal distension, abdominal pain and constipation with or without vomiting. The clinical diagnosis was confirmed by the presence of dilated small bowel loops with multiple fluid levels in the plain abdominal X-rays. On initial presentation, all patients diagnosed with post-operative SBO received conservative treatment unless there were clinical features of strangulation. The treatment regime included nil by mouth, intravenous fluid resuscitation, nasogastric tube decompression and parenteral analgesia. Operative treatment was offered to those who failed to improve after 48 h of conservative treatment. As an ongoing trial, from July 1999, patients with adhesive obstruction were randomised to either a trial of gastrografin meal and follow through or surgery if the obstruction had failed to respond within 48 h.

Categorical variables were compared with the chi-square test or Fisher's exact test when appropriate and continuous variables were analysed with Student's $t$ -test. A $P$ value of less than 0.05 was considered to be statistically significant.

## Results

Two hundred and fourteen patients (129 men and 85 women) underwent LAR during the study period. The mean age was 63.9±11.5 years (range 32–89 years). The patients' demographic details and tumour characteristics are shown in Table 1. A diversion stoma (ileostomy: $n$=101; transverse colostomy: $n$=14) was performed for 115 patients, while the other 99 patients did not have proximal diversion in the initial operation. Clinical anastomotic leakage occurred in 21 (9.8%) patients (five with diversion and 16 without). As a treatment for anastomotic leakage, laparotomy, with the creation of a loop ileostomy, was performed in eight of the 16 patients who did not have diversion during the initial operation. Hence, 109 patients underwent ileostomy at certain stages of their treatment. The flow chart which summarises the treatment of the patients is shown in Fig. 1.

During a median follow-up period of 39 months, 22 patients (10.3%) developed 30 episodes of SBO. Sixteen patients had only one episode of SBO, whereas six patients had more than one episode. The median time to the occurrence of the first SBO was 4.1 months (range 0.4–53.0 months). Eight patients developed SBO within 6 weeks of the initial operation, and five had SBO within 6 weeks following closure of the stoma. These were considered as having early SBO, and the incidence was 6.1%. The characteristics of the patients with SBO are shown in Table 2.

Thirteen patients with 20 episodes of SBO were treated conservatively. Nine patients underwent surgery for SBO. The operative rate was 40.9% when the number of patients was considered, and was 30% when the number of obstruction episodes was used as the denominator. Seven patients had surgery during their first episode of SBO, while two patients were operated on during

**Table 1** Demographic details of patients with LAR. Figures in parenthesis are percentages

| Parameter | Detail |
|---|---|
| Gender | |
| Male | 129 (60.3) |
| Female | 85 (39.7) |
| Mean age (years) | 63.9±11.5 |
| Mean level of tumour (cm) | 7.2±2.3 |
| Mean level of anastomosis (cm) | 3.7±1.2 |
| No. of curative operations performed | 201 (93.9) |
| Stage of tumour | |
| I | 34 (15.9) |
| II | 71 (33.2) |
| III | 93 (43.5) |
| IV | 13 (6.1) |
| Incidence of anastomotic leak | 21 (9.8) |
| Presence of proximal diversion | 115 (53.7) |
| Ileostomy | 101 (47.2) |
| Transverse colostomy | 14 (6.5) |
| Radiation therapy | 13 (6.1) |

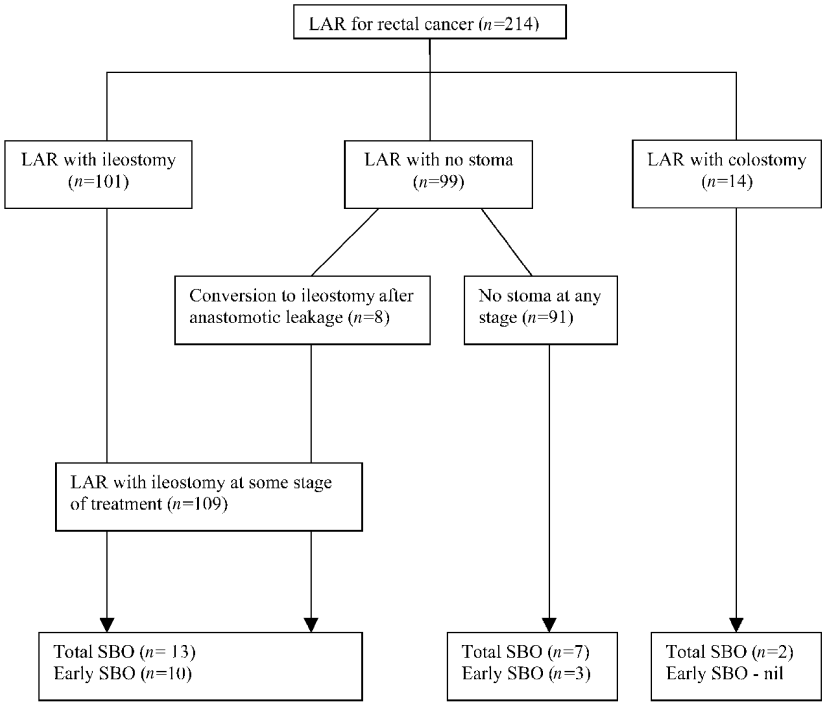


**Fig. 1** Flow chart of patients with SBO after LAR

**Table 2** Characteristics of patients with SBO after LAR for rectal cancer

| | Diversion stoma after LAR | Anastomotic leak age | Ileus after LAR | Time to onset of first SBO | Episodes of SBO | Treatment |
|---|---|---|---|---|---|---|
| 1 | No | No | No | 2.4 Weeks post-LAR | 1 | Conservative |
| 2 | No | No | No | 4.9 Weeks post-LAR | 2 | Conservative |
| 3 | No | No | No | 3.7 Weeks post-LAR | 3 | Conservative |
| 4 | No | No | No | 98.0 Weeks post-LAR | 1 | Conservative |
| 5 | No | No | No | 176.9 Weeks post-LAR | 1 | Conservative |
| 6 | No | Yes, with drainage | No | 7.4 Weeks post-LAR | 1 | Operative |
| 7 | Colostomy | No | No | 188.4 Weeks post-LAR | 1 | Operative |
| 8 | No | No | No | 277.0 Weeks post-LAR | 1 | Conservative |
| 9 | Colostomy | No | No | 43.3 Weeks post-LAR | 1 | Conservative |
| 10 | Ileostomy | No | No | 2.4 Weeks post-LAR | 1 | Conservative |
| 11 | Ileostomy | No | No | 1.9 Weeks post-LAR | 3 | Operative |
| 12 | Ileostomy | No | No | 5.9 Weeks post-LAR | 1 | Conservative |
| 13 | Ileootomy | No | No | 4.8 Weeks post-LAR | 1 | Conservative |
| 14 | Ileostomy | No | Ileus | 5.9 Weeks post-LAR | 1 | Operative |
| 15 | Ileostomy | No | No | 1.9 Weeks after stoma closure | 1 | Operative |
| 16 | Ileostomy | No | No | 4.8 Weeks after stoma closure | 3 | Conservative |
| 17 | Ileostomy | No | No | 1.0 Week after stoma closure | 1 | Operative |
| 18 | No | Yes, with ileostomy | No | 5.9 Weeks after stoma closure | 2 | Operative |
| 19 | Ileostomy | No | No | 1.5 Weeks after stoma closure | 1 | Conservative |
| 20 | Ileostomy | No | No | 103.9 Weeks post-LAR | 3 | Conservative |
| 21 | Ileostomy | No | Ileus | 8.7 Weeks post-LAR (before closure of stoma) | 1 | Operative |
| 22 | Ileostomy | No | No | 149.7 Weeks post-LAR | 1 | Operative |

a recurrent episode of SBO. In two patients, the obstruction was due to carcinomatosis, while the other seven suffered obstruction due to benign causes. Of these seven patients who were operated on for benign causes, four had obstruction that could be attributed to the presence of an ileostomy: a patient had adhesions to the ileostomy wound after closure, while the other three had obstruction due to twisting of the small bowel around the ileostomy. Among the three patients with benign SBO not related to the presence of the ileostomy, two had

**Table 3** Comparison of patients with and without SBO following LAR

| Parameter | Patient with SBO (*n*=22) | Patients without SBO (*n*=192) | *P* |
|---|---|---|---|
| Male:female | 14:8 | 115:77 | 0.821 |
| Median age (years) | 63.5 (39–80) | 65 (32–89) | 0.994 |
| Stage | | | |
| I | 1 | 34 | 0.509 |
| II | 10 | 61 | |
| III | 10 | 83 | |
| IV | 1 | 12 | |
| Median blood loss (ml) | 450 (200–2,500) | 400 (50–4,500) | 0.327 |
| Median duration of operation (min) | 150 (110–300) | 180 (90–500) | 0.187 |
| Median day of hospital stay | 11 (7–70) | 13.5 (8–60) | 0.081 |
| Prolonged ileus | 2 (9.1%) | 2 (1.0%) | 0.053 |
| Anastomotic leak | 2 (9.1%) | 19 (9.9%) | 1.000 |
| Radiation therapy | 1 (4.5%) | 21 (10.9%) | 1.000 |

dense adhesions between the small bowel loops and the other had a single adhesion band from small bowel to mesentery.

Four patients died as a consequence of SBO. One patient refused surgery and subsequently died of pneumonia, while the other died of acute renal failure following surgery for adhesive obstruction. The other two patients who had carcinomatosis died on day 7 and day 47 following surgery because of advanced malignancy.

*Risk factors for SBO:* comparison between patients with and without SBO is shown in Table 3. There were no differences in the age, gender, amount of blood loss, duration of operation and incidence of radiation therapy between the two groups. The incidences of SBO in patients with and without ileostomy are summarised in Table 4. Patients with LAR and protective stoma had a higher incidence of SBO than those without an ileostomy (Table 4). The difference was, however, not statistically significant.

Among the patients with post-operative SBO, in 13 (59%) the SBO occurred within 6 weeks of the initial LAR or after closure of the stoma. Of 109 patients with loop ileostomy, ten (9.1%) had early obstruction. However, early obstruction occurred in only three patients (2.9%) who did not have an ileostomy. The difference was statistically significant ($P$=0.048, Fisher's exact test).

## Discussion

Post-operative SBO is a common complication following colorectal surgery [8, 9, 10]. There have been a few reports on SBO following colorectal surgery [1, 5, 11, 12]. However, these usually included patients with different pathological conditions or different types of operations. The incidences of SBO following some specific colorectal operations have also been reported. Nieuwenhuijzen et al. reported an incidence of 11% of SBO following total/subtotal colectomy [11]. Moreover, SBO following restorative proctocolectomy for chronic ulcerative colitis has also been well documented [12, 13, 14].

Surgery for rectal cancer is certainly one of the commonly performed major operations. Since Sannella's report on early and late SBO after abdomino-perineal resection [15], there has been no recent study on SBO following rectal surgery. Over the years, major changes have occurred in the management of rectal cancers. Reduction of local recurrence has been brought about by improved surgical techniques such as total meso-rectal excision [16] and the use of adjuvant radiation therapy. Additionally, sphincter-preserving surgery has been made possible in more patients by the advent of stapling devices and better knowledge of the spread of the disease. This, however, has led to an increased incidence of anastomotic leak, as well as the practice of proximal diversion. All these might increase the risk of postoperative SBO. Moreover, intra-abdominal recurrence is also an important cause of later SBO.

This report studied SBO in a homogenous group of patients with similar pathological conditions and operated on by similar surgical techniques. Our results showed that SBO occurred in 10.3% of patients over a median follow-up time of 39 months. The incidence is comparable to others' results on colorectal surgery [5, 15]. Edna and Bjerkeset reported that, over a median follow-up period of 5.5 years, SBO that necessitated surgery occurred in 10% and 4% of patients, following, respectively, curative and palliative operations for colorectal cancers [5].

Malignant obstruction occurred in only 9.1% of the patients. This is much lower than that reported by Edna and Bjerkeset [5]. Although all the patients had a malignant disease, the majority of subsequent SBOs were due to benign causes. Malignant obstruction was due to advanced disseminated malignancy in our series, and both patients died shortly after surgery for SBO. The management of malignant obstruction is a dilemma for most

**Table 4** Incidence of SBO (overall and early) in patients with and without ileostomy

| Parameter | LAR without ileostomy (*n*=105) | LAR with ileostomy at some stage of treatment (*n*=109) | *P* |
|---|---|---|---|
| No. (%) of patients with SBO | 9 (7.0) | 13 (12.8) | 0.281 |
| No. (%) of patients with early SBO | 3 (2.9) | 10 (9.2) | 0.048 |

surgeons. The mortality rate is usually high, especially in the presence of carcinomatosis [17, 18]. However, surgery is usually the only means to relieve the obstruction so that a limited symptom-free period can be obtained [17].

The follow-up time of the patients in the present study was obviously not long enough for us to document all adhesive or malignant obstructions. However, this study shows that early intestinal obstruction is not uncommon following rectal resection and closure of ileostomy. The incidence of early obstruction was 6.1%. This is similar to the incidence of early obstruction in a series of patients with ileal pouch anal anastomosis (IPAA) [14, 19]. In this study, we showed that the presence of loop ileostomy is associated with increased early postoperative SBO. Moreover, in patients with operations for benign SBO, 57.2% of the cases could be attributed to the creation of an ileostomy.

In the management of mid- and distal rectal cancer with total meso-rectal excision with sphincter preservation, the low anastomosis is associated with a higher rate of anastomotic leakage [6, 20]. The use of proximal diversion is usually suggested for low anastomosis [20]. Both ileostomy and colostomy have been shown to be effective in proximal diversion [21]. Williams et al. showed that ileostomy was associated with better patients' acceptance and a lower incidence of wound sepsis post-closure [21]. Thereafter, ileostomy has been increasingly used for proximal diversion. In a randomised controlled trial to compare loop ileostomy and loop transverse colostomy, Gooszen et al. showed that more complications occurred in patients after construction of the loop ileostomy, and the majority of the complications were ileus or intestinal obstruction [22]. In our study, we found that the incidence of early SBO was significantly higher in patients who had had an ileostomy during the treatment process. The presence of an ileostomy in the infra-colic compartment can lead to the twisting of the small bowel around the stoma.

Loop ileostomy has been shown to be associated with a higher incidence of intestinal obstruction in patients after restorative proctocolectomy [23, 24]. The presence of an ileostomy has also been reported to be a significant risk factor for early SBO in a report by MacLean et al on SBO following IPAA [14]. SBO following ileostomy closure is a well-recognised complication [25, 26]. Thus, the use of the ileostomy as the preferred mode of proximal diversion should be further assessed in view of the high incidence of SBO.

In conclusion, we found that postoperative SBO occurred in 10.3% of patients, following LAR for rectal cancer. SBO occurred more commonly in patients who had undergone an ileostomy during the treatment. Complications of loop ileostomy have a strong impact on the outcome of patients with LAR. It is an important cause of post-operative SBO in our patients, and accounted for 44.4% of the SBO that required laparotomy. A significantly higher incidence of early post-operative SBO is also found in patients with loop ileostomies.

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