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Original Research Article

Surgical intervention for mechanical large bowel obstruction at a tertiary hospital: Which patients receive a stoma and how often are they reversed?

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ABSTRACT

Background: The surgical management of large bowel obstruction (LBO) is heterogeneous and influenced by multiple variables. The aim of this study was to analyze and compare the surgical interventions and outcomes of patients necessitating surgery for LBO.

Methods: Patients with LBO between 2000 and 2017 were included. Main outcomes measures are intraoperative findings, operative management, post-operative outcomes and stoma closure rates.

Results: 133 patients were included with predominately left-sided obstruction (82%). The most common etiology was colorectal cancer (44%) followed by extrinsic malignant compression (29%). The most common operation performed was fecal diversion without resection (46%). This group had significantly more stage 4 carcinoma, carcinomatosis and had the lowest stoma closure rate (16%).

Eighty-six percent of the operated patients underwent fecal diversion, of these, 27% had stoma reversal at 6 months. Patients that had a resection and anastomosis with diverting loop ileostomy were most likely to undergo stoma reversal ($p = 0.005$) and had the lowest number of patients with stage-IV carcinoma.

Conclusions: In this single institution analysis, the management of LBO entails high operative and stoma rates, with less than 30% of patient undergoing stoma closure. Resection, anastomosis and DLI had the highest chance of stoma reversal.

Background

The surgical management of mechanical large bowel obstruction (LBO) is heterogeneous and influenced by multiple variables such as etiological factors, site of obstruction, patient stability, and intraoperative findings.[1] The majority of LBO cases are caused by primary colorectal cancer (CRC), which is responsible for more than 50% of all cases.[2] Obstructing CRC usually represents advanced disease and has been associated with a higher incidence of distant metastasis compared with non-obstructing cancers.[3]

Management of LBO is often treated with emergent surgery to relieve the obstruction. The most common procedures used to manage LBO include exploration and stoma alone for fecal diversion, resection and anastomosis (with or without proximal diversion), and resection with end stoma. A large number of the patients that undergo an operation necessitate a stoma as part of their management and a significant proportion of them are never reversed.[4] The aim of this study was to analyze and compare the various surgical interventions, stoma creation and reversal rates, and outcomes of patients requiring surgery for mechanical LBO that presented to a large tertiary level academic center.

Methods

Patient selection

Patients who presented with a mechanical LBO at a tertiary level academic hospital colorectal surgery department between 2000 and 2017 were retrospectively queried from the electronic medical

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record. LBO was defined based on clinical characteristics (abdominal pain and distension, nausea or vomiting, and absence of bowel function) and radiological evaluation (computed tomography scan and/or plain films). Location of the obstruction was defined as "right" when the obstructive site was proximal to the splenic flexure and "left" when it was at or distal to the splenic flexure (including rectal etiologies). Diagnosis of colonic volvulus, pseudo-obstruction, anastomotic stricture, and hernia were excluded from the analysis.

All patients included in the study were managed by a member of the colorectal surgery department at our institution. The timing and choice of operation depended on the site of obstruction, general condition of the patient, intraoperative finding, and surgeon preference.

Statistical analysis

Main outcome measures included intraoperative findings, operative management, post-operative outcomes and stoma closure rates. Univariate analysis was performed to compare patient demographics with Pearson's Chi-square test. Additionally, surgical management and outcome variables were analyzed and compared to each of the five surgical procedure types by utilizing Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 133 patients presented with mechanical LBO. The mean age of the cohort was of 65 years (range 31–100) and 57% (n = 76) were female. The most frequent site of obstruction was the left side in 82% of the cases (n = 109), specifically the sigmoid colon in 53% (n = 70) followed by the right side in 18% (n = 24) (Fig. 1). The most common cause of LBO was primary CRC in 44% followed by extrinsic malignant compression in 29%, and diverticular stricture in 18% (Table 1).

One hundred and ten of the 133 patients (83%) underwent operative intervention. Twenty-three patients were managed non-operatively: 11 underwent self-expandable metallic stent (SEMS) and the remaining 12 underwent observation and/or palliative measures only. The various surgical procedures performed included were the following: fecal diversion only; resection and anastomosis with diverting loop ileostomy (DLI); resection with end ileostomy; resection with end colostomy; and resection with primary anastomosis (Table 1). There were no significant differences in gender, age, and BMI between the groups in regards to the operation performed.

The most common operation performed in the cohort was fecal diversion only without resection in 51 patients (46%). This group had significantly more stage IV carcinoma (69%, p = 0.001) as well as carcinomatosis at the time of surgery (47%, p < 0.001) when compared to the other surgical procedure groups. Additionally, these patients also had the lowest stoma closure rate (n = 8; 16%), significantly higher Charlson comorbidity index (p = 0.012) and highest number of patients with rectal obstruction (n = 12; 24%). The most frequent etiology of obstruction in this group was neoplastic extrinsic compression (n = 26; 51%) followed by primary CRC (n = 17; 33%) (Table 1).

Location of the obstruction was most frequently left sided in all groups except in the patients that underwent resection with primary anastomosis, in which in 9 of the 16 patients (56%) the obstruction was located on the right side.

In total, 94 of the 110 patients (85%) underwent some form of fecal diversion, of these, 27% (n = 25) had their stoma reversed at a median time of 6 months (range 0.75–27 months). Patients that had a resection and anastomosis with DLI were most likely to undergo stoma reversal (62%, p = 0.005) and had the lowest number of patients with stage IV carcinoma (n = 3; 23%) (Table 1). Patients that underwent resection and end ileostomy had the longest duration between stoma formation and reversal with a median of 9 months (range 4–10 months) and the second lowest stoma closure rate (20%) (Table 1).

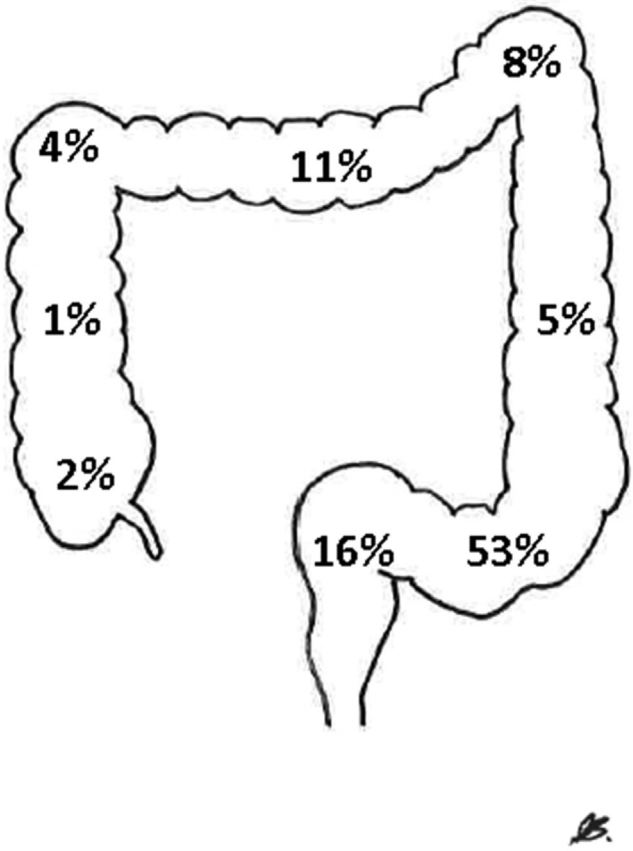

Fig. 1. Anatomical location of large bowel obstruction.

The 30-day post-operative complication rate was 40% (n = 44), surgical complications occurred in 22% (n = 24) and medical complications in 26% (n = 29) of the patients. The group that underwent resection and end ileostomy had significantly higher rate of deep incisional surgical site infection (SSI) (p = 0.005). The surgical complications by procedure is outlined in the Table. The overall in-hospital mortality rate was 12%.

Discussion

The management of large bowel obstruction is a challenging dilemma and multiple variables are involved in deciding on the best approach for optimal and timely care of the individual patient. The key factors that should be taken into consideration include the clinical condition of the patient, stage of disease if malignant etiology, resectability of the obstructing lesion, and the site and severity of obstruction.[5]

Operative intervention is often required to relieve the obstruction. In our series 83% of the patients underwent a surgical procedure, with the rest of the cases managed non-operatively (endoscopically or conservatively), which is consistent with previous reports in the literature where a high operative rate of 75% is seen for LBO compared to the lower rate of operative treatment of

Table 1
Different surgical procedures for large bowel obstruction.

Column 1	Diversion only (N = 51)	Resection anastomosis + DLI* (N = 13)	Resection + End Ileostomy (N = 15)	Resection + End colostomy (N = 15)	Resection + Anastomosis (N = 16)	p-value
Age	64.4 ± 15.5	66.9 ± 12.1	61.6 ± 13.2	68.7 ± 13.7	67.1 ± 14.8	0.66
Gender (Female)	27 (53)	9 (69)	12 (80)	6 (40)	8 (50)	0.169
BMI	25.8 [23.2,29.7]	23.3 [20.7,30]	27.1 [21.6,29.3]	27 [25,29.8]	26.1 [23,34.7]	0.727
Etiology						***<0.001 (a)***
- Colorectal cancer	17 (33%)	5 (38%)	7 (47%)	9 (60%)	11 (69%)	
- Extrinsic compression	26 (51%)	1 (8%)	2 (13%)	1 (7%)	1 (6%)	
- Diverticular disease	5 (10%)	6 (46%)	2 (13%)	4 (26%)	4 (25%)	
- Radiation/ ischemic/other	3 (6%)	1 (8%)	4 (27%)	1 (7%)	0	
Median CCI**	8 [6,9]	6 [4,6]	4 [3,8]	6 [3,8]	5.5 [4,8]	***0.012 (b)***
Intraoperative findings						
- Perforation	5 (10%)	1 (8%)	2 (13%)	2 (13%)	0	0.65 (c)
- Fecal contamination	3 (6%)	1 (8%)	1 (7%)	0	0	0.88 (c)
- Bowel ischemia	0	1 (8%)	7 (47%)	0	2 (13%)	***<0.001 (c)***
- Carcinomatosis	24 (47%)	0	1 (7%)	1 (7%)	2 (13%)	***<0.001 (c)***
Stage IV Carcinoma	35 (69%)	3 (23%)	5 (33%)	5 (33%)	4 (25%)	***0.001(c)***
Surgical Complications						
- Deep Incisional SSI	0	1 (8%)	3 (20%)	0	0	***0.005 (c)***
- Organ Space SSI	2 (4%)	2 (15%)	3 (20%)	0	1 (6%)	0.10 (c)
- Wound disruption	5 (10%)	2 (15%)	6 (40%)	1 (6%)	2 (12%)	0.072 (c)
- Postop Sepsis	2 (4%)	1 (8%)	1 (7%)	1 (6%)	0	0.58 (c)
- Leak	–	1 (8%)	N/A	N/A	0	0.13 (c)
Mortality	7 (14%)	1 (7%)	2 (13%)	2 (13%)	1 (6%)	0.8 (c)
Stoma Closure (%)	8 (16%)	8 (62%)	3 (20%)	6 (40%)	N/A	***0.009 (c)***

Legend: *DLI: Diverting loop ileostomy. **CCI: Charlson Comorbidity Index. Statistics: Median [P25, P75], a = Pearson's chi-square test, b = Kruskal-Wallis, c = Fischer's exact test. BMI: Body mass index.

30% for small bowel obstructions.[6] In terms of location, left sided lesions and specifically the sigmoid colon is the most frequent location for LBO, which was also found in our series, where 82% of the cases were left sided and 53% were secondary to a sigmoid obstruction.[7]

Regarding etiological factors, our study found malignancy to be the leading cause of obstruction in 73% of cases. Primary CRC was responsible for 44% of the cases and malignant extrinsic compression (by carcinomatosis or non-colorectal locally advanced tumors) accounted for an additional 29%. In fact, malignant extrinsic compression constituted the second most common cause of LBO in our series, which is not consistent with previous publications, which report it as a less common cause of obstruction, representing only 6–12% of patients presenting with LBO.[2,7] This large number of patients with advanced malignancy may be related to the overall higher complexity of the patients that present or are transferred to a large, tertiary level institution.

At the time of the operation, the obstructive lesion(s) were resected in 54% of the cases and the remaining patients underwent only fecal diversion without resection. Fecal diversion without resection was the most commonly performed procedure in this study secondarily to tumors that were fixed to adjacent structures, critically ill state of the patient which precluded a more extensive operation, or advanced extra-colonic disease and obstruction caused by diffuse carcinomatosis. Additionally, this diversion only group had the highest number of patients with the obstruction located in the rectum (24%). This can be explained by the fact that obstructing lesions which are located deep in the pelvis are usually not approached surgically in an acute setting due to the need for proper staging, possible neoadjuvant treatment and the complexity and duration of the surgical procedure. When compared to the rest of the surgical approaches, the patients from the diversion only group had significantly higher Charlson Comorbidity Index and higher rates of stage IV carcinoma as well as carcinomatosis at the time of surgery. This points to higher surgical risk and more advanced disease which could explain the decision of performing only fecal diversion rather than an extensive operation in fragile and critically-ill patients. When obstruction secondary to malignancy were analyzed separately, we found a high rate of patients with stage IV disease (65%) and carcinomatosis (35%). This differs with other publications where only 22–30% of the patients that present with a LBO are reported to be stage IV.[8,9] In these patients with advanced disease, extensive surgery should be minimized to reduce often unnecessary perioperative morbidity and mortality which may preclude the patient from receiving systemic treatments in a timely fashion and may make further surgical resection(s) more difficult and extensive.[5] Although there may be an inclination towards resection and primary anastomosis in LBO (akin to perforated diverticulitis scenarios), there is controversy about performing a colo-colonic or colorectal anastomosis for left-sided obstructing lesions due to the technical factors of an unprepped and dilated proximal colon and the potential risk of anastomotic leak compared to right-sided obstructions. In this study, the group that underwent resection and primary anastomosis was mostly performed when the obstruction was on the right side, accounting for 56% of all cases. This is consistent with Faucheron et al.'s report in which most of the patients with primary anastomosis in the setting of LBO had right sided obstructions even when the most

frequent location was on the left side.[8] In our series, it is notable that the group that underwent resection and end ileostomy had significantly higher rates of deep incisional surgical site infection (SSI). These patients that underwent resection and end ileostomy also had a significantly higher rate of bowel ischemia that was found during exploration (Table 1). The authors speculate that due to the higher ischemia rates (and thus, potential bowel injury) in these patients, there may be a higher likelihood of bacterial translocation into the peritoneal cavity and hence, a possibility of increased deep SSI rates.

In this series, 85% of patients underwent some type of fecal diversion, which is much higher compared to previously published data, wherein about 16–47% of patients received a stoma for LBO.[5,8,9] Additionally, less than a third of our patients (26%) underwent reversal of their stoma, and the group that underwent fecal diversion only had the lowest reversal rate of 16%. This is a low rate of stoma takedown not previously reported in the literature, and likely reflects the patient type that is referred to a tertiary institution. Although evidence shows that up to 32% of temporary stomas end up being permanent and about half of the patients undergoing Hartmann's procedure will never be reversed,[4] we report a much lower reversal rate. The group that underwent resection and anastomosis with DLI had the highest reversal rate at 62%. This may be explained by the fact a DLI reversal is often a less morbid procedure and usually technically easier to perform. Also, these patients were less frequently affected by stage IV carcinoma and none of them had carcinomatosis, which supports the possibility that individuals with less advanced disease may be more prone to have their stoma reversed.

Patients that underwent resection and end ileostomy had the second lowest stoma closure rate at 20%. Although this group was not affected by more advanced oncologic disease, the low rate of patients reversed could be explained by the complexity and morbidity that a reversal surgery implies in these type of patients, which usually require laparotomy and ileocolonic or ileorectal anastomosis with non-optimal functional results, making the proper patient selection for reversal surgery critically important.

Operative intervention in patients with LBO has traditionally been associated with high morbidity and mortality rates. The 30-day post-operative complication rates range in the literature from 32 to 64%[8] similar to our overall complication rate of 40% and surgical complication rate of 21.8%. The group that underwent resection and end ileostomy had significantly higher rate of deep incisional SSI, however we did not find any other differences in morbidity (Table 1). The overall hospital mortality rate was 11.8% with no difference between the operative approaches. This relatively high rate of complications and mortality reported in the literature and in our series may be inherent to the nature and profile of the patient with LBO, in which factors like poor nutritional state, advanced age, dehydration, electrolyte imbalance and potentially advanced malignancy portends the patient to have a high risk of postoperative complications and potential mortality.

Our study population has a very high rate of stage IV disease and carcinomatosis, a high stoma rate and low stoma reversal rate. We believe that in these settings it is reasonable to offer surgery, even if it is palliative in nature. This would relieve the obstruction in order to potentially improve quality of life and make other therapeutic options viable in the future. Resection may be considered the most effective procedure but the high rate of major complications of 37% reported by Shariat-Madar et al.[10] in patients with carcinomatosis may justify performing only fecal diversion to alleviate the obstruction.

This study has limitations owing to both the retrospective nature of the electronic medical record data collection as well as the inherent bias associated with patients presenting to a large colorectal surgery academic institution. The cohort of patients in this series may not be reflective of the true incidence and operative characteristics of similar patients with LBO presenting in the general population. Additionally, the decision making process of when and who to operate on and what procedure to be performed was decided upon by the attending surgeon and detailed information could not be extrapolated from the electronic medical record. Likewise, the decision to perform surgery versus non-operative intervention such as endoluminal stenting could not be addressed. Additionally, data on the use of systemic chemotherapy or radiotherapy at the time of surgery, which may have an influence on treatment options, could not be extrapolated from the medical records due to a high amount of incomplete and inaccurate data, owing to the fact that many patients did not receive initial oncological care at the author's institution and were transferred in for prompt surgical evaluation Despite these limitations, this study provides a comprehensive analysis on a large number of patients with mechanical LBO that underwent operative intervention and their subsequent outcomes.

Conclusions

In this single institution analysis, a large proportion of patients with mechanical LBO were found to have advanced malignant disease. The management entails high operative and stoma rates, with less than 30% of patients undergoing eventual stoma closure. Resection and anastomosis plus DLI had the highest chance of stoma reversal potentially due to less advanced disease.

Declaration of competing interest

Authors Rodrigo Capona, Tarek Hassab, Ipek Sapci, Alexandra Aiello, David Liska, Stefen Holubar, Amy L. Lightner, Scott R. Steele, Michael A. Valente have no financial disclosures or conflicts of interest related to this work.

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