Archives of Clinical & Experimental Surgery

Original Article

Arch Clin Exp Surg 2017;6:138-148

doi:10.5455/aces.20161017105054

Colectomy and immediate anastomosis versus on-table colonic lavage for the management of acutely obstructed left colon

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ABSTRACT

Objective: The purpose of this work was to compare primary resection and immediate reconstruction after either manual decompression only or on-table lavage in the management of acutely obstructed left colonic lesions.

Methods: This prospective study was conducted on 281 adult patients presenting to the Emergency Surgical Department of the Main Alexandria University Hospital, Faculty of Medicine, Alexandria University, Egypt, during the period from February 2011 to March 2016. Patients were randomly divided pre-operatively into two groups: group A, in which on-table colonic lavage was performed prior to anastomosis and group B, where immediate anastomosis was carried out after manual decompression.

Results: Both groups were similar with regards to demographic data and etiology of obstruction. Group B had shorter operation times, less respiratory complications, reduced need for intensive care admission, decreased wound infection and shorter hospital stays. No statistically significant difference was found between benign and malignant causes. The rate of anastomotic leak did not vary between either group.

Conclusions: In favorable situations, omission of on-table lavage may be preferred for immediate anastomosis in obstructed left colonic emergencies. The technique is reliable and well-tolerated with no additional morbidity or mortality.

Key words: *Acutely obstructed left colon, cancer colon, on-table colonic lavage, manual decompression, immediate anastomosis.*

Introduction

Acute left colonic obstruction is a common surgical emergency that occurs with subtle clinical manifestations preceding the full-blown manifestation of absolute constipation and massive abdominal distension [1]. Colonic obstruction is mostly caused by carcinoma of the left colon; up to 20% of patients with colonic cancer present with symptoms of acute obstruction [1,2], but diverticulitis of the sigmoid, colonic volvulus and endometriosis may also bring about acute obstruction [2].

Several options exist for the emergency management of obstructed left colonic lesions. Hartmann's procedure is performed in the case of a high risk of anastomotic dehiscence but up to 60% of stomas are never reversed, the expense and morbidity of the take-down procedure are significant and the patients have to make physical and psychological adjustments to live

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Received / Accepted : *July 02, 2016 / July 05, 2016*

with a stoma [3]. Subtotal and total colectomy should be attempted when caecal perforation is imminent or in situations of synchronous colonic neoplasm. However, reduced capacity rectal stump leads to frequent passage of stool, affecting quality of life. When the skills and equipment are available, colonic stents tend to be an acceptable option in the palliative setting, though a definitive solution cannot be arrived at if used alone [1].

Based on the successful experiences of urgent colon surgery for penetrating trauma and in elective colonic anastomosis without previous preparation, studies [4-7] have shown that primary colonic anastomosis is safe even though mechanical bowel preparation was not performed before surgery. Resection with immediate anastomosis has recently found its place in managing emergency presentations of diverticular disease, sigmoid volvulus and obstructed malignant colonic strictures. Simultaneous reconstruction after segmental resection can be performed by manual decompression (MD) either with or without on-table colonic lavage [4,8].

The idea of intra-operative lavage is to clean the bowel from any solid fecal matter and thereby decrease the chances of contamination. It also ameliorates the colonic distention, therefore facilitating abdominal closure and improving colonic blood supply. There is evidence that complete cleaning of the colon from fecal matter is not necessary to ensure anastomotic integrity [5,7]. On the other hand, there is a risk of spillage and contamination. Volumes of up to 7 liters may be necessary for a satisfactory lavage and this may cause considerable fluid shift with electrolyte abnormalities, such as hyponatremia, hypokalemia, hyperphosphatemia and water intoxication [7,9,10].

The aim of this study was to compare primary resection and immediate reconstruction after either manual decompression only or on-table lavage in the management of acutely obstructed left colonic pathology regarding operative time, hospital stay, post-operative complications and perioperative mortality.

Patients and Methods

Study population

This prospective study was conducted on 281 adult patients presenting to the Surgical Emergency Department and Gastrointestinal Surgery Unit of the Main Alexandria University Hospital, Faculty of Medicine, Alexandria University, Egypt, during the period from February 2011 to March 2016 with manifestations of acute left colonic obstruction. A systematic search for the cause was followed by taking the patients', clinical examination and routine laboratory investigations that also included examination of arterial blood gases and electrolytes (sodium and potassium). The mainstay of diagnosis was computed tomography (CT) scanning of the abdomen with intravenous and rectal contrast. In malignant lesions, CT scanning demonstrates the degree of local spread, attachment to nearby structures, peritoneal deposits and the presence of hepatic metastasis. The study protocol was approved by the medical ethics committee of the Faculty of Medicine, Alexandria University, Egypt. The study was registered at Pan African Clinical Trial Registry; the unique identification number for the registry is PACTR201604001587102.

Criteria of exclusion

Patients with irresectable or perforated tumors, hypoalbuminia (below 2.5g/dl), anemia (below 8 mg%), malignant ascites, ASA (American Society of Anaesthesiologists) score more than III because of severe co-morbidities or those with poor general risk factors affecting the integrity of anastomosis as well as obstructed rectal cancers below the peritoneal reflection and patients who had undergone a Hartmann resection or had a covering stoma were excluded from the study.

Pre-operative evaluation

Preoperative resuscitation by nasogastric tube, intravenous isotonic fluids, broad spectrum antibiotic (ceftriaxone 2gm/24 hours), metronidazole (500 mg/8hours) and urinary catheter were the initial approach. After obtaining informed consent from the patient, including that with respect to the research protocol and the possibility of creating a stoma, patients were brought to the operating theater. After premedication with fentanyl, induction of anesthesia was carried out using propofol, cisatracurium, intermittent positive pressure ventilation and endotracheal intubation. Anaesthesia was maintained with sevoflurene and controlled mechanical ventilation. Patients were then randomly divided preoperatively into two groups by the closed envelope technique. Both the operating surgeon and the patients were blinded.

Operative technique

A midline exploratory incision was chosen to enter the abdominal cavity. Full abdominal examination was performed and the condition of the segment proximal to the obstructed site, notably the caecum, was assessed before proceeding to colonic mobilization with the splenic flexure taken down to avoid uretric injury. All resections were conducted at or proximal to the peritoneal reflection.

Group A: On-table colonic lavage was completed after resection with a number of modifications from the original technique introduced by Duddly [11]. Appendectomy was performed and the stump was cannulated with a Foley catheter of appropriate size (12-14 F) 3 cm proximal to caecum and tied by a ligature. If the appendix had been previously removed, the Foley catheter was inserted through an enterotomy in the terminal ileum and secured in place with a purse string suture. Hepatic flexure mobilization was not necessary. Next, the balloon was inflated and saline irrigation with a Tommy syringe was repeatedly carried out with the distal end of the colon exteriorized to empty its contents in a container, such as a kidney dish. Saline irrigation (8 to 10 liters) was continued until a clear effluent was obtained facilitated by gentle manipulation of the colon. At that point, the catheter was removed and the stump of the appendix was ligated. Throughout the procedure, due care was taken to avoid fecal spillage. Finally, primary anastomosis was performed with interrupted full thickness inverting sutures of polyglactin (Vicryl) 3/0 between the colonic segments. The abdomen was closed with a tube drain in the pelvis after peritoneal lavage with saline in the event of fecal splash (Figures 1- 4).

Group B: In this group, primary anastomosis was conducted after MD. The obstructing lesion and the proximal dilated segment were mobilized till the splenic flexure and the obstructing lesion resected in between non-crushing bowel clamps. The mobilized colon was brought outside the field and stools manually emptied inside collecting dishes beside the abdominal cavity under control by the assistant and babcock forceps. The process continued till no more fecal matter could be exteriorized from the transected end. The divided colon end contaminated with feces was resected 10 cm proximally. The distal end was cleansed with swabs soaked in povidone iodine 10% solution. Primary anastomosis and abdominal closure were performed using the same technique as in group A.

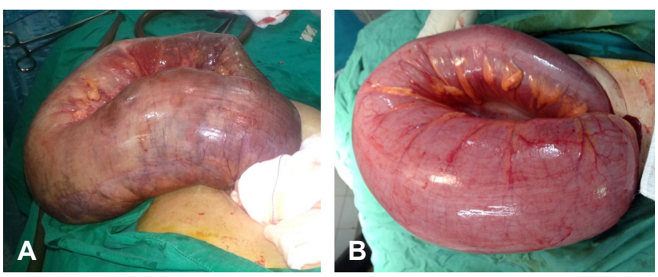

Figure 1. (A, B) Volvulus of the sigmoid colon causing intestinal obstruction managed by sigmoidectomy followed by on-table colonic lavage.

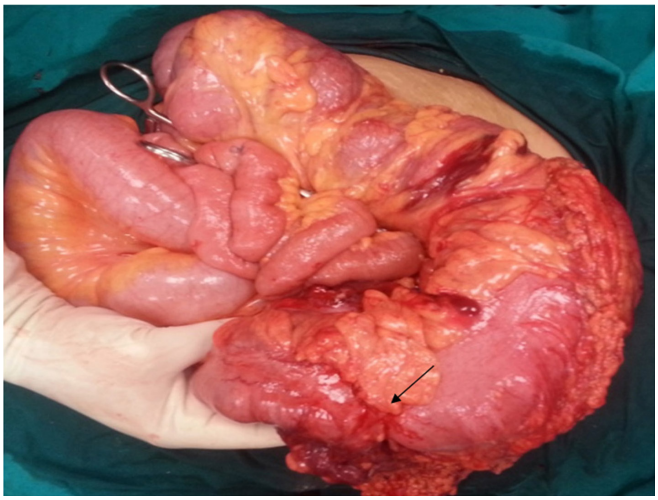

Figure 2. Cancer of the sigmoid colon (black arrow) causing intestinal obstruction managed by sigmoidectomy followed by on-table colonic lavage.

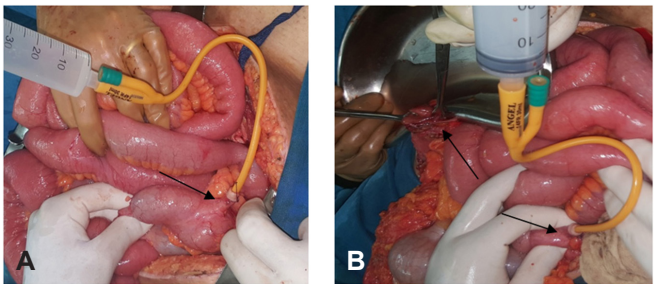

Figure 3. (A, B) On-table colonic lavage (black arrow) was carried out after resection of the sigmoid colon, appendectomy was performed and the stump was cannulated with a Foley catheter of appropriate size and tied by a ligature.

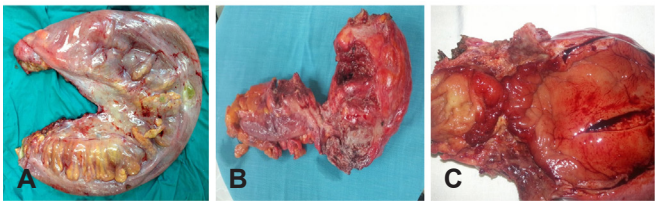

Figure 4. Postoperative specimens of the different common pathologies causing acutely obstructed left colon - resected sigmoid volvulus **(A)**, resected complicated diverticular disease of the sigmoid colon **(B)** and resected cancer of the left colon **(C)**.

Post-operative care and follow-up

Patients were admitted to the intensive care unit (ICU) during the early post-operative period in the case of prolonged operative time, excessive blood loss, hemodynamic instability during anesthesia, electrolyte disturbances and volume overload. Resumption of oral fluids was delayed for 3 days after passage of flatus and auscultating bowel sounds. In cases of ileus (delayed passage of flatus and stools for more than 3 days), total parental nutrition was initiated. Perioperative (thirty days) mortality and morbidity were recorded regarding wound infection, presence of intra-abdominal collection, sepsis, cardiopulmonary events, fistula formation, the need for re-exploration and hospital stay. Wound infection was diagnosed when there was suppurative inflammation around the surgical wound with pus oozing. Anastomotic leak was evident when a feculent material was seen emerging from the wound or from the abdominal drain. The primary endpoint was postoperative complication, mainly leakage, and secondary endpoints included operative time and hospital stay. Patients were discharged when their wounds were clean such that they could be re-examined in an outpatient clinic every week for the first month and then monthly for 6 months.

Statistical analysis

The raw data were coded and entered into Statistical Package for Social Sciences (SPSS) (Version 18.0, Chicago, USA, SPSS Inc) system files. Analysis and interpretation of the data were conducted. The following statistical measures were employed:

- The minimum total sample size required was 203 when the leakage rate was 5% in one group and to detect a difference of 3% and 5% level of significance and 80% power.
- Descriptive statistics, including frequency, distribution, mean and standard deviation, were used to describe different characteristics.
- The Kolmogorov – Smirnov test was utilized to examine the normality of the data distribution.
- Univariate analyses, including: 1) t-test (t) used to test the significance of the results of the quantitative variables; and 2) Chi-square test (X^2) and Fisher's exact test (FEP) were utilized to test the significance of the results of the qualitative variables.
- The significance of the results was at the 5% level of significance.

Results

281 patients were eligible for this study. 24 patients had one of the exclusion parameters and were not enrolled, managed by Hartmann's procedure. Moreover, nine patients refused to participate and were excluded.

248 patients presenting with acute left colonic obstruction that met the inclusion criteria were enrolled. Patients were allocated preoperatively into two equal groups (124 patients each) according to the adoption of colonic lavage after surgical resection of the obstructing lesion. In the first group (A), the continuity of the colon was restored by primary anastomosis after on-table colonic lavage, while in the second group (B), direct primary anastomosis was performed after MD only. 30 patients were further excluded intra-operatively because of ischemia in the proximal colon (with or without caecal perforation) or synchronous lesion; altering the surgical decision to total colectomy with ileorectal anastomosis protected by a defunctioning ileostomy, in addition to another six patients that were lost during follow-up. Therefore, 212 patients underwent the allocated procedure and were analyzed. Figure 5 depicts the CONSORT diagram of patients at each stage of the trial.

They were 117 men and 95 women. Their ages ranged from 44 to 71 years with a mean of 55.9 ± 7 years. There was no statistically significant difference between the two groups.

In 114 cases (53.7%), a malignant obstruction was found compared to 98 cases (46.2%), in which a benign etiology was present. Malignant causes included cancer at the rectosigmoid junction in 44 patients (20.7%), cancer in the descending colon or splenic flexure in 40 patients (18.9%) and cancer of the sigmoid colon in 30 patients (14.2%). Non-malignant pathologies included: 68 patients (32%) with volvulus of the sigmoid colon and 30 patients (14.2%) with diverticular disease of the sigmoid colon. Concerning the type of operation performed, the most common was sigmoidectomy in 128 patients followed by anterior resection in 44 patients and, lastly, left hemicolectomy in 40 patients. For malignant lesions (114 patients), curative resection was possible in 107 and in seven, palliative resection

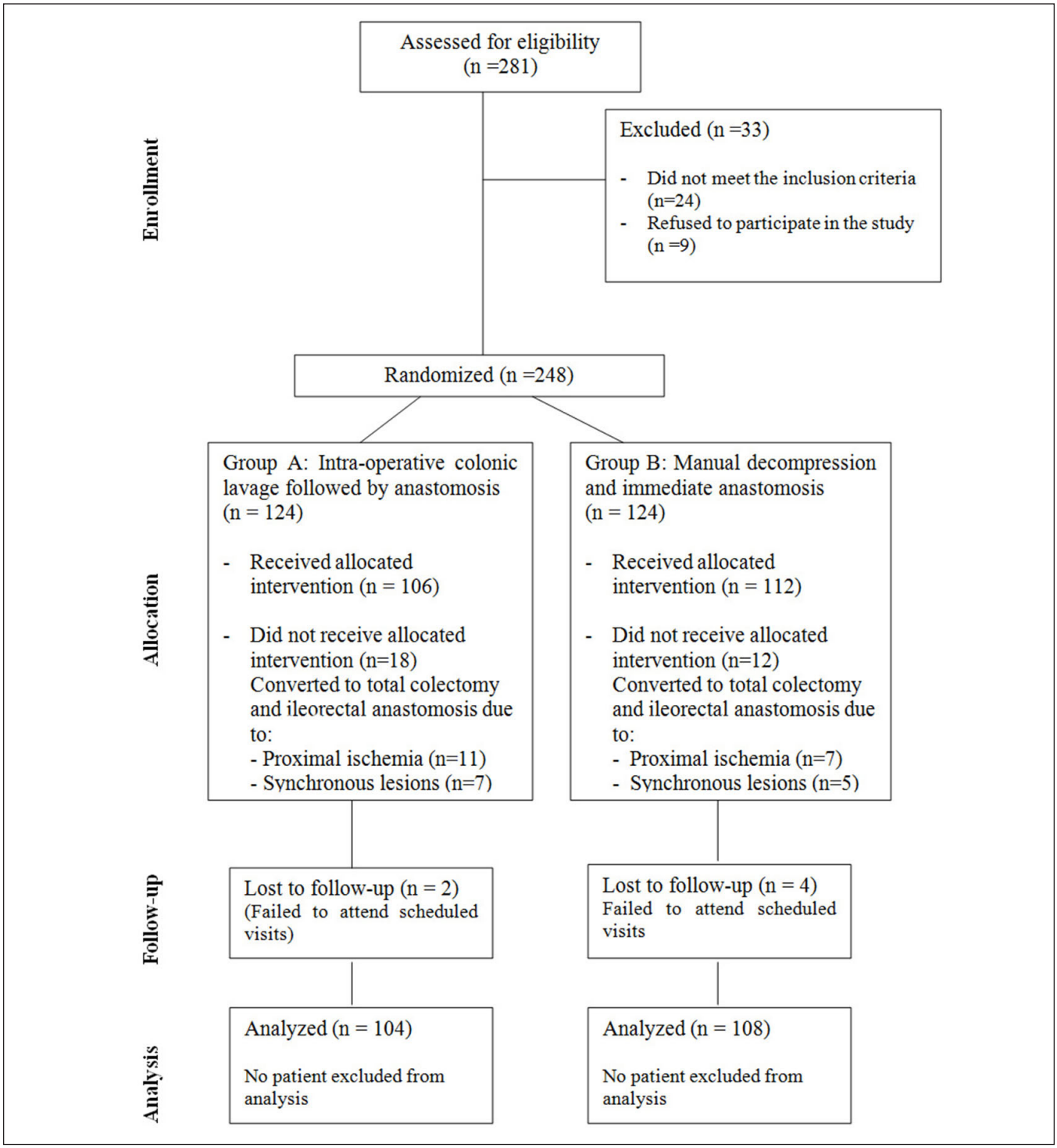

Figure 5. CONSORT diagram portraying the flow of participants through each stage of the trial.

was performed based on the co-existence of liver metastasis. No statistically significant difference between either group was found.

The operative time (from incision to skin closure) ranged from 125 to 245 minutes. The mean time was 190 min ± 25 minutes in group A and 155 ± 18 minutes in group B, and a statistically significant difference between the two groups was found. The demographic characteristics, associated co-morbidities and operative data of both groups are presented in Table 1.

In the immediate postoperative period, admission to the ICU was higher in group A - 36 cases (34.6%) - versus 20 cases (18.6%) in group B, and this was statistically significant (P=0.008). Respiratory complications (pneumonia, pulmonary edema) were more common in group A (65 patients, 62.5%) than in group B (22 patients, 20.4%) and this was statistically significant while cardiac events (myocardial infarction and

Table 1. Demographic and operative data of the studied patients with emergency obstructed left colonic lesions.

Patients Characteristics	Group A N. (%)	Group B N. (%)	Total N. (%)	Test of Significance
Gender				
Male	63(60.6)	54(50)	117	FEP = 0.079
Female	41(39.1)	54(50)	95	
Age (years)				
Min-max	44.0-71.0	44.0-70.0	-	t=1.25
Mean ± SD	56.5±7.1	55.3±7.1	-	P=0.213
Co-morbidities				
Hypertension	18(17.3)	16(14.8)		X^2=2.397, P=0.122
Diabetes mellitus	33(31.7)	37(34.3)		X^2=0.153, P=0.696
IHD*	12(11.5)	7(6.5)		X^2=1.661, P=0.198
Site of obstructing lesion				
Sigmoid colon	62 (59.6)	66 (61.1)	128 (60.4)	
Rectosigmoid junction	22 (21.2)	22 (20.4)	44 (20.7)	X^2 = 0.05
Descending colon/Splenic flexure	20 (19.2)	20 (18.5)	40 (18.9)	P = 0.976
Etiology				
Sigmoid volvulus	36 (34.6)	32 (29.6)	68 (32.0)	X^2 = 1.494
Rectosigmoid cancer	22 (21.2)	22 (20.4)	44 (20.7)	P = 0.828
Descending colon/Splenic flexure cancer	20 (19.2)	20 (18.5)	40 (18.9)	
Sigmoid cancer	12 (11.5)	18 (16.7)	30 (14.2)	
Diverticular disease of the sigmoid colon	14 (13.5)	16 (14.8)	30 (14.2)	
Operation performed				
Sigmoidectomy	62 (59.6)	66 (61.1)	128 (60.4)	FEP = 0.889
Anterior resection	22 (21.2)	22 (20.4)	44 (20.7)	FEP = 1.00
Left hemicolectomy	20 (19.2)	20 (18.5)	40 (18.9)	FEP = 1.00
Operative time (minutes)				
Min - max	155-245	125-200		t=1.4
Mean ± SD	190 ± 25	155 ± 18		p ≤ 0.05**
Total	104	108	212	

* Ischemic Heart Disease **significant at P≤0.05

angina) showed no statistically significant difference between the two groups. Postoperative leak occurred in four patients in group A that necessitated re-exploration in one patient because of high output leakage above 500ml\day with failure of conservative treatment and was managed by Hartmann procedure. In the remaining three patients, the leak stopped with conservative treatment in two patients but the third case developed a colo-cutanous fistula later. Anastomotic disruption developed in six patients in group B, and re-exploration and conversion to Hartman procedure was mandatory in three of them; conservative treatment was successful in one patient and the remaining two developed colocutanous fistula. Three patients in the group A and two in the group B returned to the operating theater to drain a multiloculated pelvic abscess diagnosed upon follow-up CT scanning in which percutaneous drainage failed to achieve complete evacuation. Two patients in group A were re-explored within six hours after surgery for bleeding. The mean follow-up was 2.1 months, ranging from one to six months. Postoperative follow-up parameters are summarized in Table 2.

The consequences of the application of both procedures in benign and malignant etiologies were analyzed and tabulated (Table 3). There was no statistically significant difference between either technique in the subgroup analysis of benign and malignant causes.

Patients in group A had a more prolonged hospi-

Table 2. Post-operative follow-up parameters of the studied patients with emergency obstructed left colonic lesions.

Post-operative Complications	Group A [N=104]		Group B [N=108]		Test of Significance	
	N.	%	N.	%		
General complications:						
Respiratory complications	27	26	15	13.9	X^2=7.0	FEP = 0.038*
Cardiac events	13	12.5	9	8.4		FEP = 0.511
Abdominal complications:						
Anastomotic leak	4	3.8	6	5.6		FEP=0.748
Wound infection (surgical site infection)	25	24.0	8	7.4	X^2=1.5	FEP = 0.001*
Intra-abdominal collection	7	6.7	9	8.4		FEP = 0.610
Re-exploration	6	5.8	5	4.6		FEP = 0.765

*significant at P≤0.05

Table 3. Post-operative assessment of the studied patients with emergency obstructed left colonic lesions according to nature of the lesion.

Post-operative assessment	Group A, On Table Lavage [n=104]				
	Benign [n=50]		Malignant [n=54]		Test of Significance
	N.	%	N.	%	
General complications:					
Respiratory complications	11	10.6	8	7.7	FEP = 0.448
Cardiac events	7	6.7	6	5.8	FEP = 0.77
Abdominal complications:					
Anastomotic leak	1	2.0	3	5.6	FEP=0.619
Wound infection	7	14.0	6	11.1	FEP=0.770
Intra-abdominal collection/abscess	0	0.0	3	5.6	FEP=0.244
Re-exploration and diversion	0	0.0	1	1.9	FEP=1.0

Post-operative assessment	Group B, Resection with Immediate Anastomosis [n=108]				
	Benign [n=48]		Malignant [n=60]		Test of Significance
	N.	%	N.	%	
General complications:					
Respiratory complications	13	12.0	10	9.3	FEP = 0.239
Cardiac events	5	4.6	4	3.7	FEP = 0.507
Abdominal complications:					
Anastomotic leak	3	6.3	3	5.0	FEP=1.0
Wound infection	2	4.2	6	10.0	FEP=0.296
Intra-abdominal collection/abscess	0	0.0	2	3.3	FEP=0.502
Re-exploration	1	2.1	2	3.3	FEP=1.0

tal stay (mean of 13.2 ± 2.55 days) than their counterparts in group B that were hospitalized for a mean of 9.7±1.4 days, and statistical analysis of the retrieved data proved there was a significant difference between the two groups (P < 0.0001*). This difference was attributed to the longer operative time increasing the risk for respiratory and cardiac complications as well as to technical factors associated with a higher risk of wound infections in group A.

30-day mortality was encountered in three cases (2.9%) in group A and two cases (1.9%) in group B without a statistically significant difference (Figure 6). Two patients in group A died after severe chest infection and respiratory failure and the third patient died from a massive myocardial infarction. One patient in group B died from sepsis from a large intra-abdominal pus collection, a 70-year-old lady without frank fecal leak (after exploration for drainage of a large multilocu-

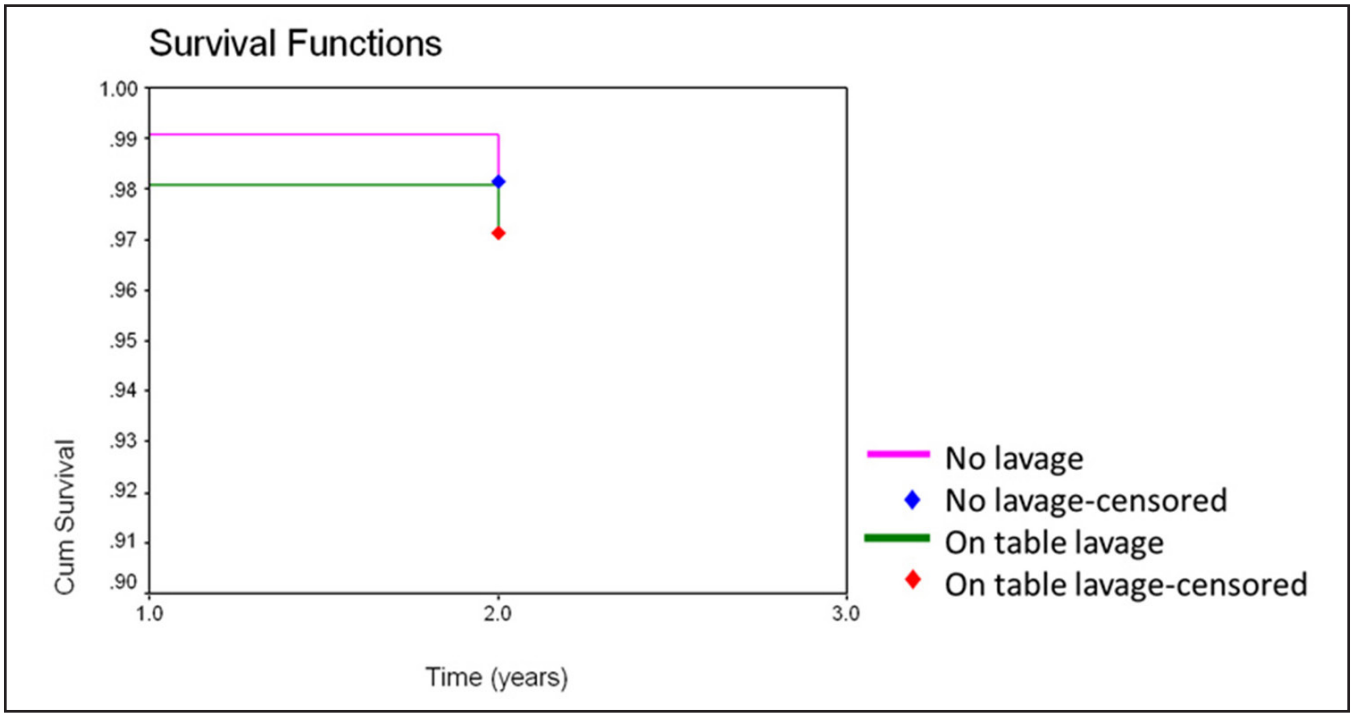

Figure 6. Kaplan-Meier survival curve for studied cases with emergency obstructed left colonic lesions undergoing primary resection with on-table lavage versus primary resection and immediate anastomosis.

lated pelvic abscess) and the second death was because of a massive pulmonary embolism secondary to deep venous thrombosis.

Discussion

Patients presenting with acutely blocked left colon pose a critical dilemma with regards to the best form of management. Different approaches are available and each has advantages and disadvantages [12]. The presence of proximal stoma does not prevent leakage from the anastomotic site, although it ameliorates the magnitude of the problem [12].

The reluctance to perform primary anastomosis in acute left colonic obstruction might appear surprising with the presence of favorable published results that should be a convincing proof for the surgical community [12].

This study presents the experience of a single center in one-stage management of patients with obstructing left colon lesions. It was applied to a large population as our center is a major tertiary referral center for Northern Egypt, serving the inhabitants of four heavily populated governorates with more than 20 millions citizen. 104 patients were prepared intraoperatively with saline irrigation; this washes the colon of its contents as if it was prepared preoperatively. Many investigators agree that the procedure is safe and recommend it in the emergency setting of left colon obstruction [13-20]. In line with this, Kam et al. [21], in a systemic review, reported the method is tedious and requires more proximal displacement of the colon. For these reasons, certain authors, in contradiction, suggested that this procedure might not be necessary [16-18, 22-25].

In the second group (108 patients), the colon was decompressed manually after adequate mobilization (required 10 minutes). Our opinion is consistent with that of Naraynsingh et al. [25] and De et al. [16] - early decompression improves the vascularity and viability of the colon that may become compromised with distension. Many authors have denied the existence of the relationship between the presence of residual colonic stools and anastomotic disruption [24,26].

Intraoperative colonic irrigation (ICI) prolonged the duration of surgery in this trial by an average of 40 minutes. This was longer than that of corresponding studies but it reflected the actual time spent for appendicular stump preparation, decompression and irrigation till obtaining clear effluent. The mean operative time ranged in different series from 140 to 227 minutes [19,20,27-31]. Kam et al. [21] observed that colon irrigation increased the operative time by an extra hour. Irrigation time was 30 minutes in median [27] with a mean of 18 minutes [32] and a range from 25-50 min-

utes [15]. This time was not diminished by increased learning curve as fixed times were needed for each step and this in contrast to the opinion of Konishi [33]. On the other hand, the mean decompression time in the series detailed herein was 10 minutes and was definitely statistically significant. Lim et al. [27] reported a mean MD time of 15 minutes while the mean total operative time was 120 minutes. Naraynsingh et al. [25] recorded a mean decompression time of 12 minutes while the mean total operative time in the study of Villar et al. [28] was 150 minutes.

The need for admission to the ICU in the postoperative period was higher for group A, consisting of 36 cases (34.6% of group A) versus 20 cases (18.6%) for group B, and this was statically significant (P=0.008*). Such a result was attributed to the longer operative time and the possible systemic effects of excessive saline irrigation and sepsis.

Although the number of anastomotic leakages was higher in the second group (six cases versus four cases in group A), this was not statistically significant. In fact, 99% of patients in group A and 97.2% of patients in group B were saved from living with a stoma. In general, leak occurred in 2.2 to 12% of patients after primary colonic anastomosis [3,8,28,34,35]. Decompression followed by 3 days fasting is another mechanism to minimize the risk of anastomotic disruption [36,37]. Similar reports found no statistically significant difference between the two methods [21,38] and even Lim et al. [27] found a lower risk of leakage in the MD group in the composite series they analyzed. Wound infection was significantly higher in the ICI group with an incidence of 12.5%. This was related to greater intraoperative liquified fecal spillage in group A. However, in the subgroup analysis between benign and malignant cases, no statistical difference was noted, especially in the complication rate. Our data lies within the universal range, from 6.2 to 23% for ICI and from 7.6 to 32% for MD [15,16,19,20,25,27,29,30,32,39,40]. In Kam et al.'s [21] meta-analysis, a statistically significant difference was not determined between the two methods. Villar et al. [28] recommended the employment of MD in proximal obstructions with less fecal load and ICI in distal obstructions at the rectosigmoid junction.

In 2009, Kam et al. [21] published a systematic review on ICI vs MD in left-sided colorectal emergencies and concluded that, although the power of the studies was poor and large-scale prospective randomized trials were required, no statistical significance could be demonstrated between the two procedures.

The present study has several limitations. Operations were performed by a different surgical team with variable surgical skills, there were heterogeneous participants with mixed benign and malignant causes and the sample size was small from a single center.

In conclusion, in properly selected patients, primary resection with immediate anastomosis without on-table lavage may be preferred as first line management of acutely obstructed left colonic lesions (either malignant or benign). The technique is safe and simple with a relatively shorter operative time, more peaceful immediate postoperative course, less wound infection and earlier discharge from the hospital. More randomized controlled studies with larger patient pools are recommended to confirm these data.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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