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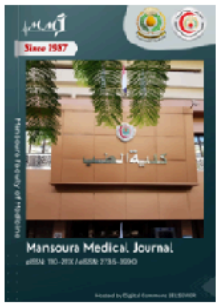

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One Stage Procedure versus Two Stages Procedure in Management of Obstructed Non-Perforated Cancer Colon

Magdy Basheer

General Surgery Department, Faculty of Medicine, Mansoura University, magdymogazy@mans.edu.eg

Mahmoud NeamatAllah

Resident of General Surgery, Faculty of Medicine, Mansoura University

Ashraf Abbas

Professor of General Surgery, Faculty of Medicine, Mansoura University

Mohamed Shetiwy

Lecturer of General Surgery, Faculty of Medicine, Mansoura University

ORIGINAL STUDY

One Stage Procedure Versus Two Stages Procedure in Management of Obstructed Non-Perforated Cancer Colon

Magdy Basheer*, Mahmoud NeamatAllah, Ashraf Abbas, Mohamed Shetiwy

Department of General Surgery, Faculty of Medicine, Mansoura University, Mansoura, Egypt

Abstract

Background: **The surgical management of large bowel emergency patients remains controversial. However, there has been an increasing trend toward primary reconstructive surgery.**

Objective: **To evaluate one-stage procedure versus two-stage procedure in cases presented with obstructed non-perforated cancer colon in terms of operative time, hospital stay, postoperative complications, peri-operative mortality, and quality of life.**

Patients and methods: **A prospective randomized study was conducted at Emergency Mansoura University Hospitals. A total of 50 cases diagnosed with obstructed nonperforated cancer colon were randomly allocated into two groups; the first group included 25 cases who underwent the one-stage approach, and the second one included the remaining 25 cases who underwent the two-stage approach.**

Results: **Although the two-staged approach showed an increase in operative time compared to the single-stage approach (174.88 vs. 163.84 min, respectively), that difference was statistically insignificant ($P = 0.102$). Hospital stay showed significant prolongation in the single-stage group (5.8 vs. 3.88 days in the two-stage group − $P < 0.001$). No significant difference was detected between the study groups regarding postoperative complications. Mortality was encountered only in one case in the one-stage group (4%) due to pulmonary embolism. The prevalence of patient dissatisfaction was significantly higher in the two-stage group (48%) compared to the single-stage group (12%).**

Conclusion: **We concluded no significant increase in perioperative morbidity or mortality rates in the one-stage procedure compared to the staged one when applied for obstructed cancer colon patients.**

Keywords: Cancer colon, Obstruction, One stage, Two stages

1. Introduction

Colorectal cancer (CRC) is the third most common diagnosis and second deadliest malignancy for both sexes combined (Rodriguez-Bigas et al., 2017). In spite of widespread screening for CRC, large bowel obstruction is the initial presenting symptom in up to 30 percent of cases, particularly for more distal colon and rectal tumors, which tend to obstruct earlier due to the smaller size of the colonic lumen (Biondo et al., 2004).

Obstruction due to cancer is a sort of mechanical obstruction, which can be partial or complete. Depending upon the time course of development of the obstruction, symptoms related to colorectal obstruction can present acutely with abdominal pain and obstipation, or more chronically as a progressive change in bowel habits (Yeh et al., 2016).

Perforation occurs at the tumor site in almost 70% of cases and proximal to the tumor site in around 30% of cases (Biondo et al., 2008; Anwar et al., 2006). When perforation occurs at the tumor site, peritoneal contamination is usually localized; on the

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* Corresponding author at: General Surgery Department, Faculty of Medicine, Mansoura University, El-Gomhouria, Street, El-Mansoura, 35516, Egypt. Fax: +20503937070.
E-mail address: magdymogazy@mans.edu.eg (M. Basheer).

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opposite, when perforation is located proximal to the tumor site, the fecal spread results in diffuse peritonitis and septic shock (Melstrom and Sentovich, 2017).

The surgical management of large bowel emergency patients remains controversial, especially for the left side. There has been an increasing trend toward primary reconstructive surgery. The main dilemma remains the appropriate patient selection for primary anastomosis (Vogel et al., 2017).

There are different strategies to avoid diverting stoma and its associated problems. With improved facilities in patient care and proper use of antibiotics, surgeons nowadays are including more primary repair of the colon (Gavriilidis et al., 2021). Furthermore, the current trend and recent guidelines seem to favor one-stage procedures for malignant colonic obstruction. Therefore, focusing clinical research on the optimization of one-stage procedures seems to be justified and necessary (Malakorn et al., 2019).

The current study aims to evaluate one-stage procedure versus two-stage procedure in cases presented with obstructed nonperforated cancer colon.

2. Patients and methods

The current prospective randomized study was conducted at Emergency Mansoura University Hospitals aiming to evaluate one-stage procedure versus two-stage procedure in cases presented with obstructed nonperforated cancer colon regarding intraoperative and postoperative parameters. We included a total of 50 cases diagnosed with obstructed nonperforated cancer colon who were randomly allocated into two groups; the first group included 25 cases who underwent the one-stage approach, and the second one included the remaining 25 cases who underwent the two-stage approach. Informed written consent was obtained from all of the participants after a complete explanation of the details and drawbacks of each procedure.

All patients were informed about the possibility of performing fecal diversion, and this was recorded in another consent form. The study was approved by the local ethical committee and institutional review board (IRB) of the faculty of medicine, Mansoura University.

All included patients were diagnosed with obstructed non-perforated cancer colon, ASA (American Society of Anesthesiologists) class I or II and had no organ failure. On the other hand, patients with colonic perforation with peritonitis, ASA class > II, palliative ileostomy or colostomy for non-resectable tumors, disseminated disease or critical illness, colonic stent, rectal cancer, pregnancy, metastatic tumor, septic shock, organ failure were excluded from this work.

All patients were subjected to full history taking, thoughtful general and abdominal examination, laboratory investigation, and radiological examination to confirm the diagnosis of obstruction and assess the tumor extent.

All cases received conservative treatment for 24 h before the operation, including nasogastric tube, intravenous fluids, urinary catheterization, and IV antibiotics.

All operations were performed by the same surgical team with the standard surgical procedure. All cases were performed under general anesthesia. Abdominal exploration was performed via a lower midline incision. Medial-to-lateral or lateral-to-medial techniques were done according to surgeon preference. Lymphovascular clearance, negative proximal and distal cut margins, and avoiding breaching the colorectal wall were our absolute needs. After tumor resection, the intestinal content was evacuated into a sterile container, this was helped by squeezing the colon from the ileocecal valve towards the proximal cut end. This helped to relieve abdominal distension and decrease anastomotic tension. The surgical specimen was sent to the pathology laboratory for histopathological examination. Meticulous anastomotic technique was done to avoid dehiscence. Tension-free anastomosis was also a must. Flexures whenever needed were adequately mobilized to achieve free mobility of the anastomosis. Different methods of anastomosis were used, but most cases had one-layer anastomosis, in an interrupted manner using vicryl 3/0 sutures. Some surgeons preferred double-layered or stapled anastomosis. For the hand-sewn anastomosis, posterior layer knots were kept inside; anterior layer knots were placed outside. We kept in mind that sutures must pass through the submucosa as it is the strongest layer of the bowel wall. Mesenteric defect was closed by interrupted absorbable (vicryl) sutures. Contamination was avoided by using occlusion clamps, irrigation, and decompression. Fluid collection like blood and serous fluid was avoided by prophylactic drainage, and that was done in all cases. In group 2, a covering loop ileostomy was performed 25–30 cm proximal to the ileocecal valve. It was fixed to the abdominal wall skin by Vicryl 3/0 sutures. The previous step was omitted in group 1. Finally, the abdominal wound was closed in layers over SC Redivac.

Patients were admitted to the intensive care unit (ICU) during the early postoperative period, then they were transferred to the internal ward if no complications anticipated. IV fluids (2000 ml of ringer lactate and 1000 ml glucose 10%) and analgesia (IV nalbuphine 10 mg which was switched to IV paracetamol or NSAIDs) were commenced daily. Frequent monitoring of vital signs, CBC, and serum electrolytes were done in all patients. Oral fluids were allowed when the patient passed flatus and had good intestinal sounds, with unremarkable abdominal examination. In group 2, resumption of oral fluids was allowed after the evidence of stoma discharge for mucous and stool and after auscultation of bowel sounds. Post-operative complications were noticed and recorded. Patients were asked to report his satisfaction regarding the surgical management as satisfied or not satisfied.

Regular follow-up visits were scheduled for all cases at 2 weeks, 1, 3, 6, and 12 months after the operation. Clinical evaluation was done for all cases, while laboratory and radiological investigations were ordered according to the patient's condition. In group 2, Distal loopogram with gastrografin enema were done before ileostomy closure.

2.1. Statistical analysis

The collected data were coded, processed, and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi 2$) and Fisher exact were used to calculate the difference between qualitative variables as indicated. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples *t*-test was used to compare two independent groups of normally distributed variables (parametric data) while Mann Whitney U test was used for non-normally distributed Data (non-parametric data). Significance test results are quoted as two-tailed probabilities. For all the above-mentioned tests, the level of significance was tested, expressed as the probability of (*P* value) and the results were explained as follows; non-significant if the *P* value is > 0.05, significant if the *P* value is ≤ 0.05, and highly significant if the *P* value < 0.001.

3. Results

The mean age of the included cases was 54.4 and 56.92 years in the one and two-stage groups respectively. Body mass index (BMI) had mean values of 27.24 and 29.08 kg/m2 in the same groups respectively. Males represented 60% and 44% of cases in the same groups respectively. All the previous demographic data showed no significant difference between our study groups ($P > 0.05$). Hypertension was the most common comorbidity (32%) encountered in the two groups. All preoperative routine laboratory parameters showed no significant difference between the two study groups ($P > 0.05$).

When it comes to the preoperative clinical data (Table 1), the duration of obstructing symptoms

Table 1. Complaint and preoperative data in the two studied groups.

Items	One stage $n = 25$	Two stages $n = 25$	Test of significance
Duration of obstruction	1.5 (1–3)	1.5 (1–4)	$z = -0.824$ $P = 0.410$
Previous abdominal surgeries			
Upper abdomen	1 (4%)	1 (4%)	FET = 1.562 $P = 0.347$
Lower abdomen	5 (20%)	8 (32%)	
Both	1 (4%)	2 (8%)	
Weight loss	7 (28%)	11 (44%)	$\chi 2 = 1.389$ $P = 0.139$
Preoperative blood transfusion	3 (12%)	3 (12%)	FET = 0 $P = 1$
Surgeon experience			
A	4 (16%)	9 (36%)	FET = 1.585 $P = 0.104$
B	5 (20%)	6 (24%)	
C	10 (40%)	4 (16%)	
D	6 (24%)	6 (24%)	
Liver condition			
Normal	23 (92%)	23 (92%)	FET = 0.894 $P = 0.523$
Cirrhotic	1 (4%)	0 (0%)	
Fatty	1 (4%)	1 (4%)	
Fibrotic	0 (0%)	1 (4%)	
Locally advanced	5 (20%)	5 (20%)	$\chi 2 = 0$ $P = 1$

$\chi 2$, Chi-square test; FET, Fisher's exact test; Z, Mann–Whitney *U*-test.
*: significant value < 0.05.

dated back to 1.5 days in both groups. Weight loss was reported in 28% and 44% of cases in the two study groups respectively, with no significant difference between the two groups ($P = 0.139$). Preoperative blood transfusion was needed in 12% of cases in the two groups. No significant difference was detected between the two groups regarding the history of previous abdominal surgeries ($P = 0.347$). Also, there was no significant difference between the two groups regarding the surgeon or the operator ($P = 0.104$). On surgical exploration, most cases had normal liver (92% of cases in the two groups). Locally advanced tumors were detected in five cases (20%) in each of the two groups.

Although the two-staged approach showed an increase in operative time compared to the single-stage approach (174.88 vs. 163.84 min respectively), that difference was statistically insignificant ($P = 0.102$). Additionally, no significant difference was noted between the two groups regarding mass size, intraoperative blood loss, or blood transfusion (Tables 2 and 3).

Most anastomoses were performed manually (92 and 96% of cases in the two groups), while the remaining cases were created by staplers ($P = 0.522$). End-to-end anastomosis was preferred by the study surgeons (92 and 88% of cases in the two groups), whereas the remaining cases were performed in a side-to-end fashion. Intraoperative complications occurred only in one case in the single-stage group (4%). It was a case of bladder injury during its dissection from the obstructing tumor. It was repaired by interrupted vicryl sutures (3/0), and the bladder catheter was kept in place for 2 weeks. No further complications were anticipated.

Surgical specimen pathological examination revealed no significant difference between the two groups, neither regarding tumor type ($P = 0.259$) nor the presence of lymphovascular invasion ($P = 1$). Adenocarcinoma was the most common pathology encountered in the two groups (88 and 84% of cases in the two groups respectively). In addition, lymphovascular invasion was reported in 3 cases in either of the two groups (12%) (Table 2). Neither

Table 2. Intraoperative data in the two studied groups.

Items	One stage $n = 25$	Two stage $n = 25$	Test of significance
Operative time (minutes)	163.84 ± 16.04	174.88 ± 17.80	$t = 1.548$ $P = 0.102$
Blood loss (ml)	150 (75–600)	150 (100–500)	$z = -0.286$ $P = 0.775$
Mass size (cm^3)	7 (3–12)	6 (3–14)	$z = -0.840$ $P = 0.401$
Intraoperative blood transfusion	3 (12%)	2 (8%)	FET = 1.389 $P = 0.139$
Anastomotic technique			
Hand sewn	23 (92%)	24 (96%)	FET = 0.355 $P = 0.522$
Stapler	2 (8%)	1 (4%)	
Anastomotic configuration			
End to end	23 (92%)	22 (88%)	FET = 0.222 $P = 0.637$
Side to end	2 (8%)	3 (12%)	
Intraoperative complications			
No	24 (96%)	25 (100%)	$\chi2 = 1.021$ $P = 0.312$
Yes (Bladder injury)	1 (4%)	0 (0%)	

χ2, Chi-square test; t, independent samples *t*-test.
*: significant value < 0.05.

Table 3. Postoperative data in the two studied groups.

Items	One stage $n = 25$	Two stage $n = 25$	Test of significance
Postoperative pathology			
Adenocarcinoma	22 (88%)	21 (84%)	FET = 1.023 $P = 0.259$
Mucinous	1 (4%)	3 (12%)	
Signet ring	2 (8%)	1 (4%)	
LV invasion	3 (12%)	3 (12%)	FET = 0 $P = 1$
Free safety margin	25 (100%)	25 (100%)	$\chi2 = 0$ $P = 1$
Postoperative WBCs (10^3/ml)	14.08 (6.82–33.57)	14.91 (8.41–21.79)	$z = -1.329$ $P = 0.184$
Ryle amount/day (ml)	403 (50–1250)	343 (30–1050)	$z = -1.156$ $P = 0.248$
Day or Ryle removal	2 (1–3)	1 (1–3)	$z = -3.897$ $P < 0.001$[a]
Day or oral intake	4.32 ± 0.690	2.52 ± 0.653	$t = 9.462$ $P < 0.001$[a]
Hospital stay (Days)	5.80 ± 0.816	3.88 ± 0.781	$t = 8.946$ $P < 0.001$[a]

χ2, Chi-square test; FET, Fisher's exact test; Z, Mann–Whitney *U*-test.
[a] Significant value < 0.05.

post-operative leucocytic count or Ryle discharge was significantly different between the two groups. Conversely, NGT was removed earlier in the 2nd group compared to the single-stage cases (1 vs. 2 days respectively – $P < 0.001$). Likewise, oral intake was significantly delayed in the first group (4.32 vs. 2.52 days respectively–$P<0.001$). Hospital stay showed significant prolongation in the single-stage group (5.8 vs. 3.88 days in the two-stage group–$P<0.001$).

Postoperative complications like ileus, wound infection, leakage fever, and electrolyte imbalance were detected in both groups respectively. However, no significant difference was detected between the study groups regarding these parameters (Table 4). Mortality was encountered only in one case in the one-stage group (4%) due to pulmonary embolism. In the two-stage group, stomal retraction was encountered in 4% of cases, while skin erosions were reported in 20% of cases. On the assessment of patient satisfaction (Fig. 1) after the operation, it showed a significant improvement in the single-stage group compared to the two staged one ($P < 0.001$). the prevalence of patient dissatisfaction was significantly higher in the latter (48%) compared to the former (12%).

4. Discussion

Approximately 2%–5% of CRC patients have an obstruction. To the best of our knowledge, there is a paucity of studies comparing the impact of diverting ileostomy on perioperative outcomes in obstructed colon cancer. Here we aimed to evaluate one-stage

Table 4. Postoperative complications in the two studied groups.

Items	One stage $n = 25$	Two stage $n = 25$	Test of significance
Postoperative ileus	3 (12%)	2 (8%)	FET = 0.222 $P = 0.637$
Wound infection	5 (20%)	6 (24%)	$\chi2 = 0.953$ $P = 0.342$
Fever	7 (28%)	3 (12%)	FET = 2.002 $P = 0.157$
Leakage	2 (8%)	0 (0%)	FET = 1.08 $P = 0.149$
Electrolyte imbalance	1 (4%)	3 (12%)	FET = 1.187 $P = 0.136$
Total number of patients experiencing complications	7 (28%)	9 (36%)	$\chi2 = 0.368$ $P = 0.544$
Mortality	1 (4%)	0 (0%)	FET = 1.02 $P = 0.312$
Stomal complications			
No complications	25 (100%)	19 (76%)	FET = 6.248 $P < 0.001$[a]
Retraction	0 (0%)	1 (4%)	
Skin erosions	0 (0%)	5 (20%)	

P: probability.
Categorical data expressed as Number (%).
$\chi2$, Chi-square test; FET, Fisher's exact test.
[a] Significant value < 0.05.

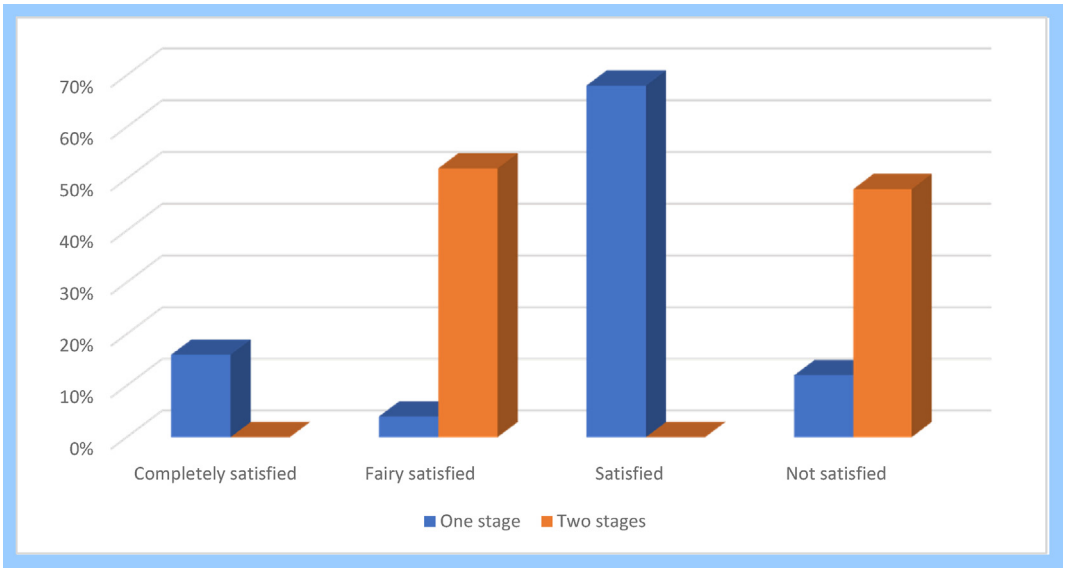

Fig. 1. Patient satisfaction in the two study groups.

procedure versus two-stage procedure in cases presented with obstructed nonperforated CRC regarding the following parameters: operative time, hospital stay, postoperative complications, perioperative mortality, and quality of life.

In the current study, in general, there was no significant difference between the two groups between our two study groups regarding preoperative demographic and clinical criteria, and that should nullify any bias that may have skewed results in favor of one group rather than the other.

When it comes to operative time, it had mean values of 163.84 and 174.88 min in the one and two-stage groups respectively. The extra time was needed for ileostomy reconstruction, and it showed no statistically significant difference in statistical analysis.

Shwaartz and his associates reported that operative time had mean values of 157.4 and 180.7 min in the one and two-stage groups, respectively. However, statistical analysis revealed a significant difference between the two groups ($P = 0.02$) (Shwaartz et al., 2017). Moreover, another study reported a significant prolongation of operative time in the multi-stage group, which had a mean value of 246.5 compared to 154.25 min in the single-staged group ($P < 0.001$) (El-Din et al., 2018). It is expected to find some differences in operative time between different studies, and that could be attributed to the difference in surgical experience, tumor criteria, and resource facilities.

In our study, no significant difference was noted between the two groups regarding the incidence of postoperative ileus. It was encountered in 12 and 85 of the cases in the one and two-stage groups respectively ($P = 0.736$). In agreement with our findings, other authors reported no significant difference between the two approaches regarding the incidence of postoperative ileus ($P = 0.41$), which was encountered in 23.6 and 27.4% of cases in the one and two-stage groups, respectively (Shwaartz et al., 2017).

In the current study, wound infection was encountered in 20 and 24% of cases in the one and two-stage groups respectively, with no significant difference between the two groups. Likewise, another study reported no significant difference between the two approaches regarding wound infection rates ($P > 0.05$). Superficial surgical site infection occurred in 8.4 and 7.3% of cases, while the deep one occurred in 2.8 and 3.9% of cases in the one and two-stage groups respectively (Shwaartz et al., 2017). On the contrary, another study showed that proximal diversion was associated with deep wound infection and sepsis/septic shock in patients that underwent elective colectomy for diverticular disease (Wise et al., 2015).

Our incidence of anastomotic leakage in the single-stage group (8%) lies within the normal range reported in the literature. The overall incidence of anastomotic dehiscence and subsequent leaks is 2–8% when performed by experienced surgeons (Slieker et al., 2012; Kingham and Pachter, 2009; Hyman et al., 2007; Park et al., 2013), which also agrees with our findings.

Some points must be considered when dealing with such cases of malignant colonic obstruction presented at the emergency department. One of the reasons why emergency surgery is felt to be associated with higher leaks is that these operations are performed on the unprepared colon. The 'loaded colon' has been reported to have up to a threefold increase in anastomotic leaks (Smallwood et al., 2014; Salem and Flum, 2004); thus, a diverting stoma may specifically be indicated in the setting of obstructing tumors (Smothers et al., 2003; Saliangas et al., 2004; Ng et al., 2015). These patients are often underresuscitated and did not receive bowel prep, and the bowel proximal to the obstruction site is often dilated (Tham et al., 2021; Hong et al., 2017).

This is contradictory to the most recent studies on mechanical bowel preparation that have concluded that it can be safely omitted (Smallwood et al., 2014; Kolovrat et al., 2012). Methods such as intraoperative colonic lavage have been shown to have a positive effect on anastomotic integrity and collagen metabolism and can allow for primary anastomosis to be performed without diversion in emergency operations for colonic obstruction (Chiappa et al., 2000; Samaan et al., 2010).

In our opinion, until additional evidence to the contrary emerges, it is recommended that colonic lavage be performed when distal colon and rectal anastomoses are created in the 'loaded colon'.

Furthermore, the effectiveness of proximal diversion, whether a loop colostomy or loop ileostomy, is highly debated (Smallwood et al., 2014). Most studies have focused on whether proximal diversion can prevent anastomotic leaks. Some have suggested that proximal diversion does not prevent, but only minimizes the clinical impact of leaks (Wong and Eu, 2005; Montedori et al., 2010). In a similar study handling the same perspective as ours, anastomotic leakage was encountered in 5 and 3.4% of cases in the single and two-stage groups respectively, with no significant difference between the two groups ($P = 0.43$) (Shwaartz et al., 2017). Contrarily, Mrak et al. reported a significant increase in leakage rates when diverting stoma was omitted ($P = 0.04$). Leakage was encountered in 16.3% of cases without ileostomy compared to only 5.8% of cases who underwent diversion (Mrak et al., 2016).

In the current study, electrolyte abnormalities were encountered in 4 and 12% of cases in the one and two-stage groups respectively. Although diversion was associated with an increased rate of imbalance, that difference was statistically insignificant. Another study reported that electrolyte imbalance was encountered in 5.8% of the included cases (Muneer et al., 2007). Other authors reported that the same complication was encountered in 20.1% of cases (Hayden et al., 2013). Ileostomy effluent contains significant amounts of sodium and potassium. Patients should also be taught the signs and symptoms of fluid-electrolyte imbalance and the importance of prompt treatment should these symptoms occur (Cuyle et al., 2018).

As regards other stomal complications encountered in the second group in our study, skin erosions were encountered in 20% of cases while retraction occurred in only one case (4%). Another study was conducted to assess the stomal complication rates after emergency bowel surgery. Dermatitis was the most common complication (42%), followed by bleeding from stoma (14%), and stomal retraction (12%) (Roy et al., 2011). Although skin irritation can occur at any time during the course of the stoma, dermatologic conditions are most commonly seen in the early postoperative period as the ostomate learns proper stoma care techniques. Up to 70% of new ostomates may have peristomal dermatitis, which is often unrecognized by the patient (Erwin-Toth et al., 2012; Herlufsen et al., 2006; Alvey and Beck, 2008). Another review stated that the incidence of stomal retraction was up to 22% (McGee and Cataldo, 2016). Our incidence rate lies within the previously reported ranges.

In the current study, hospital stay showed significant prolongation in the single-stage group (5.8 vs. 3.88 days in the two-stage group – $P < 0.001$). As patients with ileostomy showed early bowel movements, earlier oral intake was allowed compared to cases with primary anastomosis, which encouraged earlier discharge of these patients. In contrast, in the one-stage group, gradual oral intake was allowed with strict patient monitoring for early detection of anastomotic leakage, if happened.

On the contrary, other authors reported significantly earlier discharge with the one-staged approach. The duration of hospitalization had mean values of 10 and 18.85 days in the single and multi-stage groups respectively ($P < 0.001$) (El-Din et al., 2018). There is a reason to explain that finding, several studies suggested that the complication rate of ostomy is up to 50% including high output stoma, dehydration, renal failure, parastomal hernia, and small bowel obstruction (Wise et al., 2015; Jafari et al., 2013).

In the current study, mortality was encountered in only one case in the single-stage group (4%), with no significant difference compared to the other group. A previous Egyptian study reported that mortality was encountered in only one case 5%) in the staged group, with no other cases encountered. Mortality was explained by pulmonary embolism (El-Din et al., 2018). Other authors reported that mortality was encountered in 6.7 and 4.5% of cases in the one and two-stage groups respectively, without any significant difference between the two groups (Shwaartz et al., 2017).

In our study, patient satisfaction showed a significant improvement in the single-stage group compared to the two staged one. This is mainly to the lifestyle changes and complications associated with an ileostomy.

Retrospective studies have demonstrated that the involvement of an ostomy nurse specialist has a significant impact on long-term positive outcomes and reduced complication rates, as does involvement in ostomy support groups such as the United Ostomy Association of America (Lyons, 2001; Haugen et al., 2006). In addition to the improved overall quality of life, preoperative counseling is associated with decreased stoma-related postoperative complications (Arumugam et al., 2003), improved postoperative patient stoma proficiency, and earlier discharge from the hospital (Forsmo et al., 2016).

The current study has some limitations. First, it is a single-center study that included a relatively small sample size. Therefore, the obtained results could not be generalized.

4.1. Conclusion

Based on the results of our study, it could be included no significant increase in perioperative morbidity or mortality rates in the one-stage procedure compared to the staged one when applied for obstructed cancer colon patients. However, one should keep in mind that the single-stage procedure was associated with an increased incidence of leakage, though being nonsignificant. It is the operator's choice to suit every approach for each clinical setting according to the center protocol and surgeon experience. Nevertheless, global guidelines should be confirmed regarding this perspective.

Conflict of interest

None declared.

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