



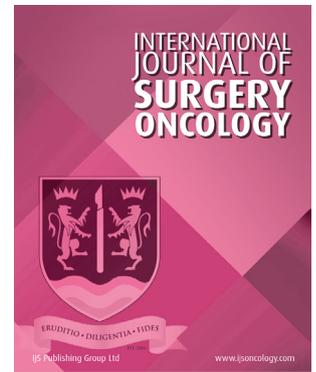
Risk Factors for Development of Complications Following Surgical Resection in Cases of Obstructed Colorectal Cancer: Case Series Study

MOHAMED RABEI ABDELFATTAH

MOHAMED SAMIR KAMEL

MOHAMED ABDALLAH SHARAAN

*Author affiliations can be found in the back matter of this article



CASE SERIES



IJS Press

Part of the IJS Publishing Group

ABSTRACT

Purpose: To describe the incidence of obstructed colorectal cancer (CRC), to report complications in patients managed by resection with primary anastomosis, and to identify the risk factors predisposing to these complications.

Methods: Fifty-eight consecutive adult patients presented to our tertiary referral center with obstructed CRC during the period from January 2018 to December 2020. Only patients managed by resection and primary anastomosis were assessed for incidence of complications according to Clavien-Dindo classification. They were grouped into obstructed right colon cancer (ORCC), obstructed left colon cancer (OLCC) according to tumor location. Patients were followed on outpatient basis for at least three months after discharge.

Results: During the study period, 221 adult patients underwent colorectal resections for the presence of CRC, colorectal resections for benign disease and non-obstructed CRC were excluded. Obstructed CRC was present in 58 patients (22.9%). Out of these 58 patients, nine-patients refused emergency resection and were managed by diverting stoma. The remaining 49 patients underwent emergency colorectal resections, 7 patients were managed by Hartman's procedure or temporary end colostomy, the remaining 42 patients underwent primary anastomosis and were divided to ORCC (13 patients) and OLCC (29 patients). Morbidity and mortality rates were 21.4% and 4.8% respectively. Two thirds of reported complications were major. ORCC did not significantly differ from OLCC as regard mortality, anastomotic leak, burst abdomen, reoperation, and ICU readmission. DM, and BMI > 35 Kg/m² were significantly related to the incidence of complications. Anastomotic leak was significantly related to the presence of colonic perforation, closed loop obstruction and cecal dilatation >10 cm.

Conclusions: DM and BMI > 35 Kg/m² significantly predisposed to complications compared to patient's age. Results of the current study highlight a more significant role of prolonged bowel obstruction sequelae on incidence of anastomotic leak compared to tumor location.

CORRESPONDING AUTHOR:

Mohamed Rabei Abdelfattah MD

Department of Surgery,
University of Alexandria,
Faculty of Medicine,
Alexandria, Egypt

mohamad.rabie@gmail.com

KEYWORDS:

Colorectal Cancer; Bowel Obstruction; Postoperative Complications; Risk Factors; Colorectal Resections; Case Series

TO CITE THIS ARTICLE:

Abdelfattah MR, Kamel MS, Sharaan MA. Risk Factors for Development of Complications Following Surgical Resection in Cases of Obstructed Colorectal Cancer: Case Series Study. *International Journal of Surgery: Oncology*. 2021; 6(1), 88–97. DOI: <https://doi.org/10.29337/ijsonco.132>

Highlights

- Colorectal cancer presents with bowel obstruction in 22.9% of patients with CRC
- Obstructed CRC was associated with a mortality rate of 4.8%
- DM & obesity significantly predisposed to complications compared to patients' age
- Sequelae of prolonged obstruction predisposed significantly to anastomotic leak

INTRODUCTION

In the year 2018; global cancer statistics reported colorectal cancer (CRC) as the third most common cancer worldwide [1, 2]. CRC is the 6th most common cancer in Egypt. Its crude incidence rate is estimated to be around 4 cases /100.000 population in 2011 [3].

CRC is the leading cause of large bowel obstruction. Approximately 15%–25% of CRC patients manifest with bowel obstruction, which mostly necessitate an emergency operation. Emergency operation is associated with a substantial risk of death and complications in this peculiar set of patients [4–6]. In Egypt, studies to identify risk factors predisposing to complications following resection and primary anastomosis in case of obstructed CRC are generally lacking. Consequently, this increasingly reported surgical problem requires further study and reporting.

METHODS

The study was approved as retrospective, single center, case series study by ethical research committee of faculty of medicine, Alexandria university, Alexandria, Egypt. It was registered under the number 11/6/9/2/2020. Approval obtained before starting the study.

The study was also registered in [researchregistry.com](https://www.researchregistry.com) with the following Unique Identification Number(UIN):researchregistry7364, the study registration can be found here: <https://www.researchregistry.com/browse-the-registry#home/>.

Charts of patients presenting with obstructed CRC were retrospectively reviewed. Fifty-eight consecutive adult patients were admitted to our center with a diagnosis obstructed CRC during the period from January 2018 to December 2020. Our center is a tertiary referral university-based teaching hospital serving four governorates located at the north of Egypt.

These patients were diagnosed with contrast abdominal CT study as part of the workup for patients presenting with bowel obstruction. TNM staging was not mandatory at the emergency stage and accurate TNM staging was done prior to patient discharge from the hospital using triphasic abdominal CT and contract chest CT.

All the 58 patients were managed in emergency department intermediate care unit, they underwent NPO regimen, NG tube suction, volume replacement,

correction of PH and electrolyte imbalances and blood transfusion if the Hb was <7 g/dl. Central line insertion was mandatory in these cases together with the insertion of urinary catheter.

All of patients were started empirically on Piperacillin/tazobactam (4g/0.5 g) combination every 8 hours and this was routinely upgraded to Imipenem/cilastatin at a dose of 1 gram/8 hours in cases of suspected or diagnosed bowel perforation. Metronidazole at a dose of 500 mg/8 hours was routinely added in all cases. Intravenous route was used for drug administration in all cases.

Pain control and proton pump inhibitors were additional part of preoperative optimization plan. Preoperative anticoagulation was started using Enoxaparin sodium at a prophylactic dose of 0.5 mg/kg/day given on two divided subcutaneous doses. The abovementioned medications were adjusted or substituted according to renal profile of the patients or in case of known drug allergy. Acute kidney injury was defined according to Kidney Disease Improving Global Outcomes (KDIGO) Clinical Practice Guideline for Acute Kidney Injury [7].

Out of Fifty-eight patients presenting with obstructed CRC, nine-patients refused to give a consent for emergency colorectal resections. These patients were managed by emergency colostomy/ileostomy and were excluded from the study. The remaining 49 patients underwent colorectal resections.

According to the location of obstructing tumor, colonic tumors at or distal to splenic flexure were considered as left sided. Patients managed by resection and primary anastomosis were grouped into obstructed right colon cancer (ORCC) and obstructed left colon cancer (OLCC).

Colorectal resections and primary anastomosis were performed by M.D category general surgeon with at least 2 years of surgical experience post M.D. His general surgical training involved the care of patients with bowel obstruction, decision making and extensive training in the performance of different types of bowel resections specially on urgent basis for at least 5 years prior to M.D degree. The operating surgeon had previously performed the intended type of colorectal resection more than 20 times during training period.

Following surgical intervention all patients were managed initially in the setting of intensive care unit on routine basis. Patients were then discharged to a step-down care unit. Postoperative complications within 30 days from operative procedures were reported using the Clavien-Dindo classification. All complications of

Clavien-Dindo grade III b or higher were defined as major complications [8]. The results of this study have been reported in line with the PROCESS 2020 criteria [9]. Patients were observed on outpatient basis for at least three months following discharge.

Quality of the data used for the analysis were ensured by obtaining radiology and pathology reports signed by two M.D. consultants with specific experience in the field. Quality and standardization of medical management was ensured for surgical, anesthetic and ICU teams by double checking the privileges of treating physicians.

Continuous variables were described by the mean and standard deviation. Univariate analysis was done using T test in case of continuous variables, while Fisher’s exact test was used to compare categorical variables, $p < 0.05$ was considered statistically significant. Variables with P value < 0.1 on univariate analysis were included in a multivariate analysis using Cox regression model.

RESULTS

During the period from January 2018 to December 2020, 253 adult patients underwent colorectal resections at Alexandria university hospitals, colorectal resections for benign disease and non-obstructed CRC were excluded from the study, **Figure 1**. Among 221 of CRC patients presented to our center during the study period, there were fifty-five right sided tumors, seventy- nine left sided tumors and eighty-seven rectal tumors representing (24.9%, 35.7% and 39.4% respectively).

OVERALL DATA FOR PATIENTS PRESENTING WITH OBSTRUCTED CRC (58 PATIENTS)

Obstructed CRC was present in 58 patients corresponding to 22.9% of those presenting with CRC. The rate of presentation with obstruction varied according to the location of the tumor, tumors involving the right colon,

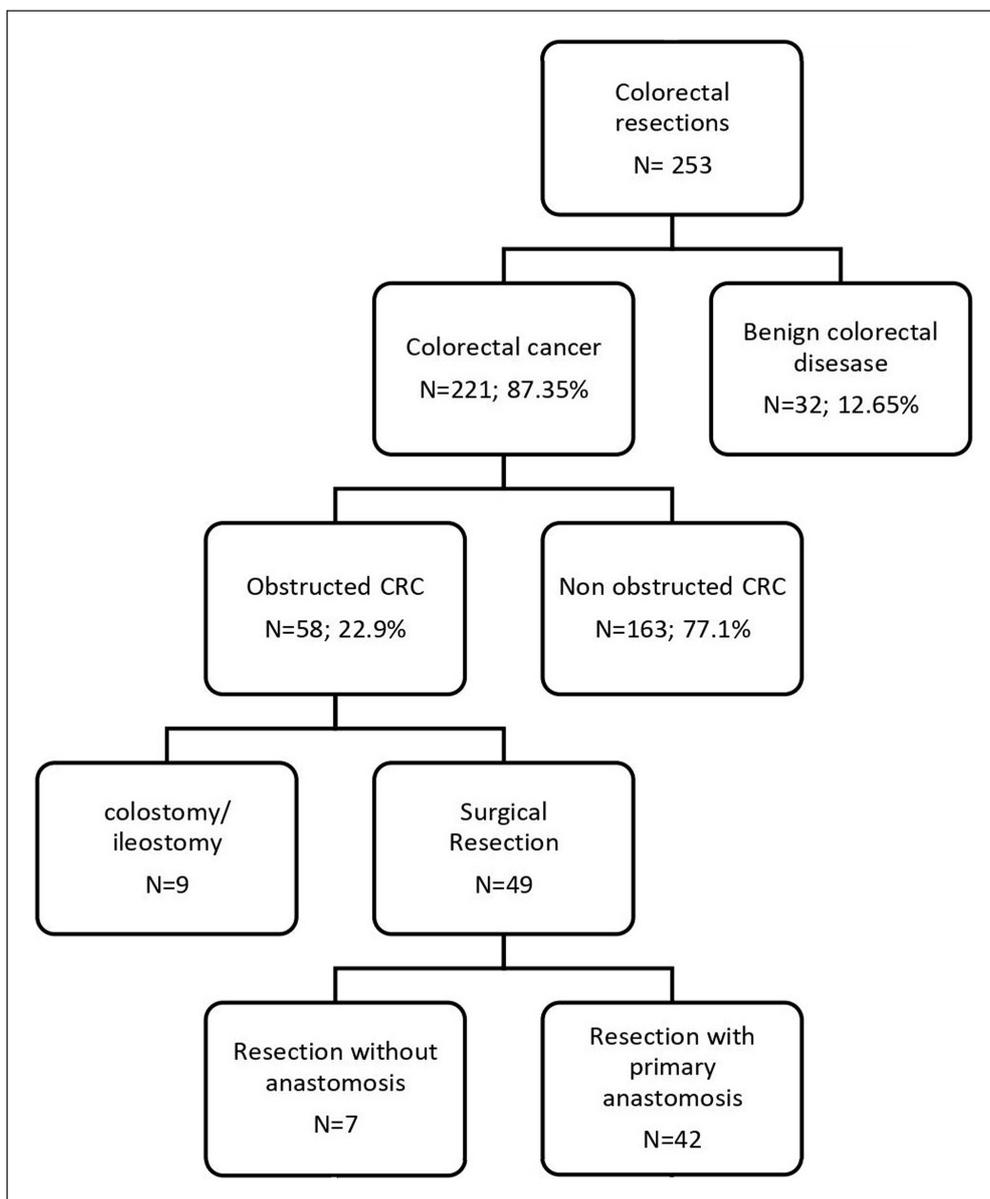


Figure 1 Flowchart of patients underwent colorectal resection during the study period.

left colon, and rectum, presented with obstruction in 29.1%, 49.4%, 3.5% respectively, **Figure 2**.

Cases with obstructed CRC were 23 males (38.8%) and 35 females (61.2%), their age ranged from 18–78 years with a mean of 54.4 ± 15.6 years. Eight patients were below 40 years (16.3%), 17 patients (34.7%) were between 40 and 60 years old, 14 patients were between 60 and 70 years old (28.6%) while those above 70 were 10 patients (20.4%). 35 patients were ≤ 60 years old and 23 were above 60.

The incidence of different comorbid conditions in the 58 patients presenting with obstructed CRC was as follows: DM (Diabetes Mellitus) were detected in 12 patients (20.7%), hypertension in 10 patients (17.2%), ischemic heart disease in 6 patients (10.3%), BMI > 35 kg/m² in 5 patients (8.6%), serum Albumin <2.8 g/dl in 9 patients (15.5%), and Hb < 7 g/dl in 6 patients (10.3%). ASA score was II in 24 patients (41.4%), III in 22 patients (37.9%) and IV in 12 patients (20.7%). Two-patients (3.4%) presented with stage 1 acute kidney injury according to (KDIGO) Clinical Practice Guideline for Acute Kidney Injury [7]. Another two patients (3.4%) presented with stage 3 acute kidney injury in the context of multiorgan failure following anastomotic leakage.

Out of Fifty-eight patients presenting with obstructed CRC, tumors were right sided in 16 patients (27.6%), left

sided in 39 patients (67.2%) and rectal in three patients only (5.2%). Taking in consideration the unavailability of self-expanding metallic stents (SEMS) at our center due to financial reasons, all the fifty-eight patients presented by obstructed CRC were managed surgically. Forty-two resections with primary anastomoses were performed in the acute setting (72.4%), covering stoma was needed in 16 patients of them (38.1%). Following initial resection, primary anastomosis deemed unsafe due to unstable vital signs and was not attempted in another seven patients (12%). The remaining nine-patients (3 cases of right sided tumors, 4 cases of left sided tumors and two cases of rectal tumors) refused to give a consent for emergency colorectal resections. These patients represented 15.5% of all patients presenting with obstructed CRC, they were managed by emergency colostomy/ileostomy and were excluded from the study.

DATA FOR PATIENTS WHO UNDERWENT EMERGENCY COLORECTAL RESECTIONS (49 PATIENTS)

Forty-nine patients were attempted for emergency colorectal resection with primary anastomosis. They were right sided in 13 patients, left sided in 35 patients and only one case of obstructed rectal cancer, **Table 1**.

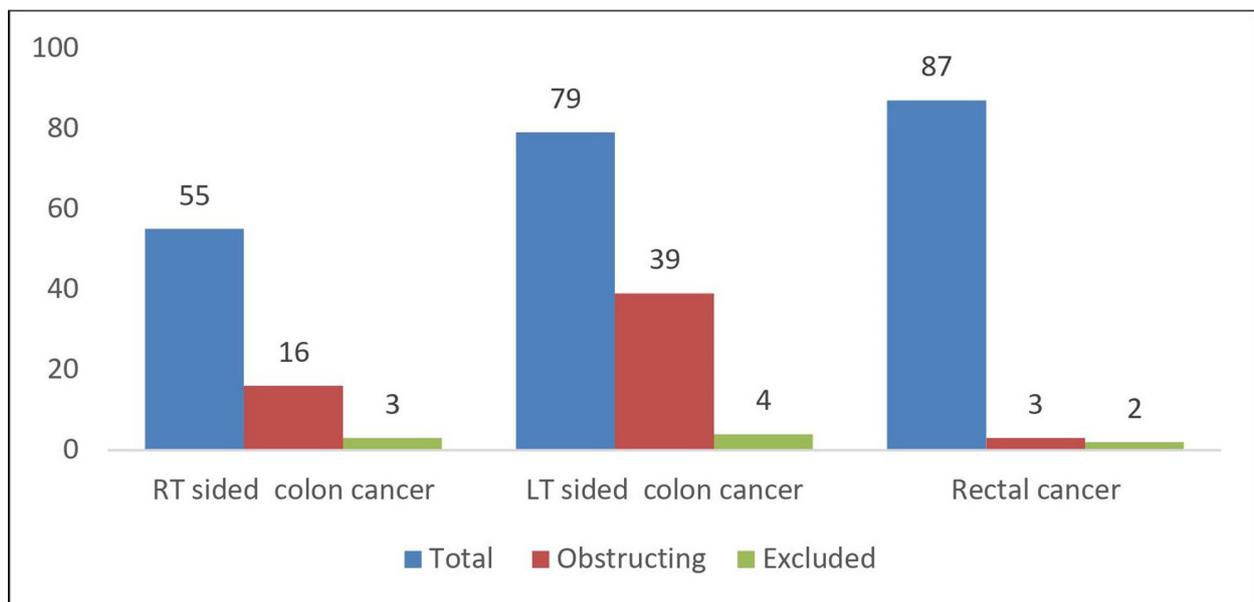


Figure 2 Categorization of CRC cases presented during the study period.

TUMOR LOCATION	TOTAL	OBSTRUCTED	RESECTED	RESECTION WITH PRIMARY ANASTOMOSIS
Right sided	55	16	13	13
Left sided	79	39	35	29
Rectal	87	3	1	0
Total	221	58	49	42

Table 1 Distribution of CRC at different anatomical locations according to clinical presentation and surgical management.

Tumor related variables for patients with obstructed CRC are shown in **Table 2**.

In these 49 patients, ten-patients (20.4%) presented with a picture of closed loop obstruction, this was manifested by impending or frank cecal perforation in seven patients. Frank cecal perforation was found in 3 patients (6.1%) while severe cecal dilatation(>10 cm) with impending perforation was found in the other 4 patients (8.2%).

Moderate cecal dilatation (8–10 cm) was found collectively in 23 patients (46.9%) most of them (20 patients, 40.8%) had incompetent ileocecal valve with resultant small bowel dilatation. the other three patients (6.1%) had competent ileocecal valve with resultant close loop obstruction.

Mild cecal dilatation (6–8 cm) was found in 19 patients (38.8%), the competency of ileocecal valve could not be assessed in these early cases of mechanical bowel

obstruction, details for CT findings of these patients are shown in **Table 3**.

All cases were successfully resected. Nevertheless, seven patients were managed by resection without primary anastomosis, Hartmann’s procedure was used in 4 of them (three cases of sigmoid cancer and one case of rectal cancer), while left colectomy with temporary end colostomy was used in the other three patients. Primary anastomosis was feasible in the remaining 42 patients. One stage procedure was feasible collectively in 26 patients, corresponding to 53.1% of those consented for surgical resection.

Rates for primary anastomosis were 100%, 82.4% and 0% for obstructed right sided, left sided and rectal cancer, respectively. The only patient presenting with obstructed rectal cancer did not undergo primary anastomosis and thus was excluded from further assessment of complications.

VARIABLE		NUMBER (%)
Tumor location	(RT) Right sided	Ascending colon 6(12.2%)
		Hepatic Flexure 4 (8.2%)
		Transverse colon 3 (6.1%)
		Total Right sided 13 (26.5%)
	(LT) Left sided	Splenic Flexure 5(10.2%)
		Descending colon 13(26.5%)
		Sigmoid colon 17(34.7%)
		Total Left sided 35 (71.4 %)
		Rectal 1 (2%)
Tumor stage	I 8 (16.3%)	
	II 14 (28.6%)	
	III 19 (38.8%)	
	IV 8 (16.3%)	
Tumor Pathology	Well Differentiated 6 (12.2%)	
	Moderately Differentiated 35 (71.4%)	
	Poorly Differentiated 8 (16.3%)	
	Mucinous Differentiation 6 (12.2%)	
	Positive Lymph nodes 19(38.8%)	
	Lympho-vascular Invasion 15 (30.6%)	
Surgical Margin	Free 46(93.9%)	
	Infiltrated 3 (6.1%)	

Table 2 Tumor related variables for cases with obstructed CRC treated by surgical resection.

VARIABLE EXCLUDED	ILEOCECAL VALVE		CLOSED LOOP OBSTRUCTION	TOTAL NUMBER (%)
	INCOMPETENT	COMPETENT		
Obstructive findings	Mild cecal dilatation (6–8 cm)	19 (38.8%)	Ileocecal valve cannot be assessed	None 19(38.8%)
	Moderate cecal dilatation (8–10 cm)	–	20(40.8%) 3(6.1%)	3 cases 23(46.9%)
	Severe cecal dilatation (>10 cm)	–	– 4(8.2%)	All cases 4(8.2%)
	Cecal perforation	–	– 3(6.1%)	All cases 3(6.1%)
Total Number (%)	19(38.8%)	20(40.8%)	10(20.4%)	

Table 3 Computed tomography findings for cases with obstructed CRC treated by surgical resection.

DATA FOR PATIENTS MANAGED BY COLORECTAL RESECTIONS AND PRIMARY ANASTOMOSIS (42 PATIENTS)

Out of 42 patients who underwent resection with primary anastomosis, Total colectomy was performed in 12 patients (28.6%) Extended right hemicolectomy in 6 patients (14.3%), Right hemicolectomy in 7 patients (16.6%), Left hemicolectomy in 11 patients (26.2%) and Sigmoidectomy in 6 patients (14.3%).

Formal colon resections (formal right, left, and sigmoid colectomy) were performed in 24 patients (57.1%). Extended resection of the colon was performed in 6 patients (14.3%). Total resection of the colon was performed in 12 patients (28.6%). The distribution of colectomy type and the use of covering ileostomy among different tumor location is tabulated in **Table 4**.

In cases with resection and primary anastomosis, covering ileostomy was performed in 16 patients (38.1%). Rates for creation of covering stoma differed significantly between ORCC and OLCC, (2 patients, 15.4%) versus (14 patients, 48.3%), respectively. P value = 0.02.

INCIDENCE OF MORTALITY, COMPLICATIONS, AND PREDISPOSING RISK FACTORS

According to Clavien-Dindo-classification, mortality was considered as Class V complications. In the current

study, two patients died during postoperative period corresponding to a mortality rate of 4.8%.

Single mortality (7.7%) was reported in patients presenting with ORCC. This patient died due to anastomotic leak and uncontrollable sepsis with resultant MOF. She was a 75-years old lady with history of DM and hypertension, her ASA score was IV. She presented with a closed loop obstruction complicated with cecal perforation and fecal peritonitis. The other mortality occurred in a patient presenting with OLCC corresponding to a mortality rate of 3.4%. Similarly, patient was complicated by anastomotic leak and uncontrollable sepsis. Mortality rate did not differ significantly between patient with ORCC or OLCC (single patient in each group with p value = 0.53).

Nine-patients experienced at least a single complication during 30-day postoperative period representing 21.4% of patients managed by resection and primary anastomosis. Various incidence of complications in patients who underwent resection with primary anastomosis are shown in **Table 5**. Two thirds of the reported complications in the current study were found to be of major type. ORCC did not significantly differ from OLCC as regard the incidence of anastomotic leak, burst abdomen, reoperation, and ICU readmission.

OPERATIVE VARIABLE			TUMOR LOCATION		TOTAL
			ORCC	OLCC	
Resection with covering stoma N = 16	Limited colonic resection (n = 13)	Formal resection with primary anastomosis (RPA)	1	11	12
		Extended resection with primary anastomosis (ERPA)	1	0	1
		Total colectomy with primary anastomosis (n = 3) (TCPA)	0	3	3
Resection without covering stoma. N = 26	Limited colonic resection (n = 17)	Formal resection with primary anastomosis (RPA)	6	6	12
		Extended resection with primary anastomosis (ERPA)	5	0	5
		Total colectomy with primary anastomosis (n = 9) (TCPA)	0	9	9

Table 4 Type of colectomy and the need for covering stoma according to tumor location in patients managed with resection and primary anastomosis.

TYPE OF COMPLICATIONS	INCIDENCE		MANAGEMENT (CLASS AND GRADE)				
	OVERALL INCIDENCE	INCIDENCE ACCORDING TO TUMOR LOCATION			P VALUE		
		ORCC N = 13	OLCC N = 29				
Mortality	2(4.8%)	1(7.7%)	1(3.4%)	0.53	-	V (6.1%)*	Major (66.7%)
ICU Readmission	5(11.9%)	2(15.4%)	3(10.3%)	0.64	-	IV (15.2)*	
Burst abdomen	5(11.9%)	1(7.7%)	4(13.8%)	1	Operative	III B (45.5%)*	
Reoperation	7(16.7%)	2(15.4%)	5(17.2%)	1	-		
Anastomotic Leakage	4(9.5%)	1(7.7%)	2(6.9%)	1	Operative		
		-	1(3.4%)		Conservative	II (33.3%)*	Minor (33.3%)
Wound Infection	4(9.5%)	1(7.7%)	3(10.3%)	1	Conservative		
Chest Infection	2(4.8%)	0	2(6.9%)	1	Conservative		
Postoperative Bleeding	4(9.5%)	0	4(13.8%)	0.3	Conservative		

Table 5 Incidence of different complications according to tumor location in patients managed by resection and primary anastomosis.

*: Percentage from all reported complications.

On the other hand, anastomotic leak was significantly related to the presence of colonic perforation, closed loop obstruction and cecal dilatation >10 cm. Additionally, colonic perforation was significantly related to the development of burst abdomen and the need for reoperation. ICU readmission was significantly related to age >60 years and ASA >II.

DM, and BMI > 35 Kg/m² were significantly related to incidence of anastomotic leak, burst abdomen, readmission to ICU and reoperation. Factors predisposing to major complication are tabulated in, **Table 6**.

DISCUSSION

The incidence of CRC is still on the rise across the world. Egypt is no exception [3, 10]. Recently, the incidence of CRC in USA is reported to decline by about 2% to 3% annually starting from 2005 [11, 12]. Obstructed CRC is not infrequently reported worldwide. A range of 15% to 25% is frequently quoted with more than 75% of tumors located distal to splenic flexure [4, 13–16].

The current study showed an incidence of obstructed CRC toward the high end of the reported range (22.3%) with 73.5% at or distal to splenic flexure. CRC presented to our center were left sided or rectal in more than 75% of cases. The rate of obstruction was the highest at left sided tumor (almost 50%) and lowest at the rectal tumors (3.5% only). This might be explained by earlier occurrence of tenesmus and bleeding in rectal cancers.

Furthermore, sigmoid colon and splenic flexure are reported to be the most common locations for obstruction by CRC [15, 16]. Sigmoid colon ranked the first as the most common site of obstruction by CRC in the current study, it was followed by descending colon, ascending colon and splenic flexure comprising 34.7%, 26.5%, 12.2% & 10.2% respectively.

In the current study, the mean age at diagnosis was 54.4 ± 15.6 years. This is more than a decade younger than the mean age in USA (69 in men and 73 in women) [2]. The younger age at diagnosis is also shown in other

studies from Egypt. Moreover, these studies reported a relatively more advanced tumors at diagnosis [3, 13, 14].

Anastomotic leak is the most serious and dreadful complication for resection with primary anastomosis. This can be disastrous specially if diagnosis and management were delayed and sepsis ensued. Factors predisposing to anastomotic leak in elective setting were thoroughly reported. It was frequently sub-grouped to preoperative, tumor-related, and intraoperative risk factors. Stomas were reported to minimize consequences but not the incidence of anastomotic leak [17].

In the context of bowel obstruction, many authors indicated the importance of tumor location and stage of intestinal obstruction on the incidence of leak. The more distal the tumor and the more decompensated bowel obstruction; the more is the chance for anastomotic leak [18, 19]. Moreover, it was reported that development of peritonitis is an independent risk for anastomotic leakage in these settings [19].

The duration and degree of mechanical bowel obstruction caused by CRC is usually shown by different types of sequelae including varying degrees of cecal dilatation, closed loop obstruction and colonic perforation. This is especially true when the ileocecal valve is competent. This usually leads to closed loop obstruction which is believed to be the precursor for cecal perforation. Otherwise, the pressure will be manifested by small bowel dilatation.

Colonic perforation was found in (6.1%) of forty-nine patients managed by surgical resection. All of them were cecal perforations secondary to close loop obstruction, perforation is reported to occur in a range of 3%–8% of obstructed CRC. The most common site of perforation in cases of obstructed CRC is the cecum followed by tumor site [20, 21].

In the current study, incidence of anastomotic leakage was not significantly affected by tumor location (right vs left sided). Conversely, colonic perforation and the degree of bowel decompensation -manifested by cecal dilatation and the presence of closed loop obstruction- were significantly related to leakage rates. This indicates

FACTORS	P VALUE				
	MORTALITY	ANASTOMOTIC LEAK	BURST ABDOMEN	REOPERATION	ICU READMISSION
Age > 60	0.2	1	0.4	0.4	0.007*
ASA Score > 2	0.5	0.6	0.2	0.1	0.05*
DM	0.5	0.004*	0.02*	0.01*	0.02*
BMI > 35	0.3	0.00004*	0.008*	0.002*	0.0002*
Colonic perforation	1	0.02*	0.001*	0.003*	0.3
Closed loop obstruction	1	0.01*	0.2	0.08	1
Cecal dilatation (>10 cm)	1	0.04*	0.4	0.1	1
Tumor location	0.5	1	1	1	0.6
Covering ileostomy	0.6	0.5	0.3	0.4	1

Table 6 Factors affecting incidence of major morbidities in patients of obstructed CRC managed by resection and primary anastomosis.

that duration of bowel obstruction and its sequelae were more influential in development of anastomotic leakage than simply the tumor location. Nevertheless, these results should be considered with caution due to small sample size.

Similarly, mortality rates in the current study did not differ significantly between ORCC and OLCC patients (7.7% and 3.4 respectively). The small number of ORCC patients in the current study might explain the higher leakage rate –7.7% of ORCC patients– than what is frequently stated in literature. Recently, few studies have shown a higher-than-expected leakage rate in ORCC, this was reported as high as 16.4% [22, 23]. Consequently; some authors are encouraging the use of protective stoma in high-risk patients [22–25]. Selection criteria for what to be considered a high-risk group ORCC is yet to be identified [22].

One stage resection with primary anastomosis has been believed to be safe and feasible for ORCC even in the sickest patient. Anastomotic leak rate was reported to be between 2.8% and 4.6% following formal and extended right hemicolectomy, respectively [22].

In the current study, covering ileostomy was performed in only two patients presenting with ORCC, single stage procedure was performed in remaining 11 patients (84.6%). Of these 11 patients only one patient had anastomotic leak with consequent sepsis, multiorgan failure and death.

On the other hand, single stage resection with primary anastomosis was always deemed hazardous in case of OLCC. The patient is usually old age with frail general condition compounded by the presence of bowel obstruction with subsequent dehydration and malnourishment. The picture is further gloomed by the varying occurrence of sepsis. Consequently, operative time is considerably expanded, and the overall burden on of surgery is greatly increased on critically ill patient. Therefore, complication rate is expected to increase substantially [22].

Despite this common belief, nonrandomized retrospective data have reported an anastomotic leak rate between 2.2% and 12% in case of OLCC, a much comparable range to what was documented for left sided colonic resections in elective setting, namely 1.9% to 8% [26]. This led to the endorsement of primary resection and anastomosis for OLCC in properly selected subset of patients by many guidelines and societies [16, 22, 25, 26].

Similarly, the current study showed that single stage procedure was feasible in 15 patients of those presenting with OLCC (51.7%). Our practice to select patients for this approach was based on the intraoperative stability of the patient and the judgment from both surgical and anesthesia team. Otherwise, covering stoma was used in almost half of OLCC patients.

Despite the later need for stoma closure, creation of stoma following resection with primary anastomosis

offered an option to decrease the incidence of anastomotic leak while avoiding the need for a major operative intervention as seen in reversal of Hartmann's procedure or closure of temporary end colostomy

Acute kidney injury was identified as an important prognostic factor to the outcome of patients presenting with bowel obstruction in general and those with obstructed CRC in specific [24]. The limited number of patients complicated with acute kidney injury in the current study prevented its further analysis as prognostic factor.

On the other hand, DM and obesity were frequently reported to predispose to anastomotic leakage and mortality in patients with obstructed CRC [19]. Similar findings are observed in the current study, DM and BMI > 35 Kg/m² were significantly related to anastomotic leakage rate, reoperation rate, ICU readmission and the development of burst abdomen.

The main limitations for the current study are the retrospective design and the small sample size specially the number of cases with ORCC. Future research should be designed in multicenter prospective study to further assess the risk factors predisposing to complications in a larger number of patients with obstructed CRC.

CONCLUSIONS

Acute bowel obstruction is an infrequent presentation of CRC in Egypt, this calls for immediate implementation of screening program. Obstructed CRC is associated with a mortality rate of 4.8% and predisposes to the development of complications which are frequently of major type.

Results of the current study indicated a more significant role of prolonged bowel obstruction sequelae (e.g., closed loop obstruction, and cecal dilatation >10 cm) in the development of anastomotic leakage compared to tumor location. DM and BMI > 35 Kg/m² significantly predisposed to anastomotic leakage rate, reoperation rate, ICU readmission and the development of burst abdomen.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR AFFILIATIONS

Mohamed Rabei Abdelfattah, MD  orcid.org/0000-0001-6170-6080

Department of Surgery, University of Alexandria, Faculty of Medicine, Alexandria, Egypt

Mohamed Samir Kamel, MD  orcid.org/0000-0002-6887-0235

Department of clinical and experimental Surgery, Medical research Institute, University of Alexandria, Faculty of Medicine, Alexandria, Egypt

Mohamed Abdallah Sharaan, MD  orcid.org/0000-0001-2147-5200

Department of Surgery, University of Alexandria, Faculty of Medicine, Alexandria, Egypt

REFERENCES

- Global cancer observatory, cancer fact sheets 2018. <https://gco.iarc.fr/today/data/factsheets/cancers/39-All-cancers-fact-sheet.pdf>. Accessed 5 January 2020.
- Siegel R, Miller KD, Jemal A.** Cancer statistic. *CA Cancer J Clin.* 2018; 68: 7–30. Accessed 7 Jan 2021. DOI: <https://doi.org/10.3322/caac.21442>
- Ibrahim AS, Khaled HM, Mikhail NN, Baraka H, Kamel H.** Cancer incidence in Egypt: results of the national population-based cancer registry program. *J Cancer Epidemiol.* 2014; 2014: 437971. DOI: <https://doi.org/10.1155/2014/437971>
- Gainant A.** Emergency management of acute colonic cancer obstruction. *J Visc Surg.* 2012; 149: e3–e10. DOI: <https://doi.org/10.1016/j.jviscsurg.2011.11.003>
- Hendren S, Birkmeyer DJ, Yin H,** et al. Surgical complication are associated with omission of chemotherapy for stage 3 colorectal cancer. *Dis Colon Rectum.* 2010; 53: 1587–1593. DOI: <https://doi.org/10.1007/DCR.0b013e3181f2f202>
- Aritinyan A, Orcutt TS, Anaya AD,** et al. Infectious postoperative complications decrease long term survival in patients undergoing curative surgery for colorectal cancer. A study of 12,075 patients. *Ann Surg.* 2015; 261: 497–505. DOI: <https://doi.org/10.1097/SLA.0000000000000854>
- Kidney Disease Improving Global Outcomes (KDIGO).** Clinical Practice Guideline for Acute Kidney Injury. *Kidney Int Suppl.* 2012; 2: 1–138.
- Dindo D, Demartines N, Clavien PA.** Classification of surgical complications. *Ann Surg.* 2004; 240: 205–213. DOI: <https://doi.org/10.1097/01.sla.0000133083.54934.ae>
- Agha RA, Sohrai C, Mathew G, Franchi T, Kerwan A, O'Neill N for the PROCESS Group.** The PROCESS 2020 Guideline: Updating Consensus Preferred Reporting Of Case Series in Surgery (PROCESS) Guidelines. *International Journal of Surgery.* 2020; 84: 231–235.
- El-Bolkainy T, Sakr M, Nouh A, El-Din N.** A comparative study of rectal and colonic carcinoma: demographic, pathologic and TNM staging analysis. *J Egypt Natl Cancer Inst.* 2006; 18: 258–63.
- Siegel RL, Ward EM, Jemal A.** Trends in colorectal cancer incidence rates in the United States by tumor location and stage, 1992–2008. *Cancer Epidemiol Biomarkers Prev.* 2012; 21: 411–416. DOI: <https://doi.org/10.1158/1055-9965.EPI-11-1020>
- Siegel RL, Miller KD, Jemal A.** Colorectal cancer mortality rates in adults aged 20 to 54 years in the United States, 1970–2014. *JAMA.* 2017; 318: 572–574. DOI: <https://doi.org/10.1001/jama.2017.7630>
- DeBernardo R.** Surgical management of malignant bowel obstruction: strategies toward palliation of patients with advanced cancer. *Curr Oncol Rep.* 2009; 11(4): 287–292. DOI: <https://doi.org/10.1007/s11912-009-0040-4>
- Roeland E, von Gunten CF.** Current concepts in malignant bowel obstruction management. *Curr Oncol Rep.* 2009; 11(4): 298–303. DOI: <https://doi.org/10.1007/s11912-009-0042-2>
- Frago R, Ramirez E, Millan M, Kreisler E, del Valle E, Biondo S.** Current management of acute malignant large bowel obstruction: a systematic review. *Am J Surg.* 2014; 207(1): 127–38. DOI: <https://doi.org/10.1016/j.amjsurg.2013.07.027>
- Pisano M, Zorcolo L, Merli C, Cimbanassi S, Poiasina E, Ceresoli M, Agresta F,** et al. 2017 WSES guidelines on colon and rectal cancer emergencies: obstruction and perforation. *World J Emerg Surg.* 2018; 13(1): 36–63. DOI: <https://doi.org/10.1186/s13017-018-0192-3>
- Zorcolo L, Covotta L, Carlomagno N,** et al. Safety of primary anastomosis in emergency colorectal surgery. *Colorectal Dis.* 2003; 5: 262–9. DOI: <https://doi.org/10.1046/j.1463-1318.2003.00432.x>
- Aslar AK, Ozdemir S, Mahmoudi H,** et al. Analysis of 230 cases of emergent surgery for obstructing colon cancer – lessons learned. *J Gastrointest Surg.* 2011; 15: 110–9. DOI: <https://doi.org/10.1007/s11605-010-1360-2>
- Grytsenko Y, Bedeniuk A, Grytsenko S,** et al. The evaluation of risk factors of anastomotic leakage in patients with colorectal cancer complicated by ileus. *Int J Surg Med.* 2017; 3(4): 205–210. DOI: <https://doi.org/10.5455/ijsm.risk-factors-anastomotic-leakage-colorectal-cancer-ileus>.
- Jaffe T, Thompson WM.** Large-bowel obstruction in the adult: classic radiographic and CT findings, etiology, and mimics. *Radiology.* 2015; 275(3): 651–663. DOI: <https://doi.org/10.1148/radiol.2015140916>
- Desai MG, Rodko EA.** Perforation of the colon in malignant tumors. *J Can Assoc Radiol.* 1973; 24(4): 344–349.
- Baer C, Menon R, Bastawrous S,** et al. Emergency Presentations of Colorectal Cancer. *Surg Clin North Am.* 2017; 97(3): 529–545. DOI: <https://doi.org/10.1016/j.suc.2017.01.004>
- Frago R, Biondo S, Millan M,** et al. Differences between proximal and distal obstructing colonic cancer after curative surgery. *Colorectal Dis.* 2011; 13: e116–22. DOI: <https://doi.org/10.1111/j.1463-1318.2010.02549.x>
- Biondo S, Pares D, Frago R,** et al. Large bowel obstruction: predictive factors for postoperative mortality. *Dis Colon Rectum.* 2004; 47: 1889–97. DOI: <https://doi.org/10.1007/s10350-004-0688-7>
- Ansalmi L, Andersson RE, Bazzoli F,** et al. Guidelines in the management of obstructing cancer of the left colon: consensus conference of the World Society of Emergency Surgery (WSES) and Peritoneum and Surgery (PnS) Society. *World J Emerg Surg.* 2010; 5: 29. DOI: <https://doi.org/10.1186/1749-7922-5-29>
- Tekkis PP, Kinsman R, Thompson MR,** et al. The Association of Coloproctology of Great Britain and Ireland study of large bowel obstruction caused by colorectal cancer. *Ann Surg.* 2004; 204: 76–81. DOI: <https://doi.org/10.1097/01.sla.0000130723.81866.75>

TO CITE THIS ARTICLE:

Abdelfattah MR, Kamel MS, Sharaan MA. Risk Factors for Development of Complications Following Surgical Resection in Cases of Obstructed Colorectal Cancer: Case Series Study. *International Journal of Surgery: Oncology*. 2021; 6(1), 88–97. DOI: <https://doi.org/10.29337/ijsonco.132>

Submitted: 19 October 2021 Accepted: 16 November 2021 Published: 09 December 2021

COPYRIGHT:

© 2021 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

International Journal of Surgery: Oncology is a peer-reviewed open access journal published by IJS Publishing Group.