

Risk Factors for Mortality in Cases of Obstructed Left Colonic Carcinoma

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ABSTRACT

Background: Emergency surgery for colon cancer is associated with high morbidity and mortality rates. Herein, this study was conducted to estimate the incidence and to detect the risk factors leading to mortality in cases of obstructed left colonic carcinoma.

Methods: This prospective research included 150 patients diagnosed with obstructed left colon cancer and underwent surgical intervention. Based on the incidence of early mortality, they were divided into two groups; the survival and the deceased ones.

Results: Mortality was encountered in 19 patients (12.67%). The deceased group showed older age and higher male predominance compared to the survived one. Likewise, the prevalence of heart and kidney disease was higher in the same group. The deceased patients expressed higher ASA and APACHE II scores before operation. These cases had a higher prevalence of shock and a longer duration of symptoms. The surgical intervention did not differ between the two groups. However, the incidence of perforation and intraabdominal free fluid was significantly increased in the deceased cases. In addition, the incidence of post-operative complications and duration of ICU admission significantly increased with mortality.

Conclusion: Old age, male gender, ischemic heart disease, chronic kidney disease, ASA class III, shock, increased symptom duration, intraabdominal free fluid, tumor perforation, post-operative complications, and ICU admission were significant risk factors for mortality in such cases. Patients with one or more of the previous factors should be well evaluated to decrease the mortality risk.

Key words: Obstructed left colon cancer – Mortality - Predictors.

INTRODUCTION

Around the world, colorectal cancer is the 3rd most common malignant neoplasm, and it is the 2nd most common etiology of cancer-related death in both human genders (1). In Egypt, it ranks 7th among other malignant neoplasms. It represents 3.47% and 3% of malignancies in male and female gender, respectively (2). About 3000 Egyptians were diagnosed with colon cancer in 2015 after rectal cancer cases had been excluded (3).

Although colon cancer usually develops with no manifestations at early

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disease stages, some patients may present with cancer-related emergencies, including obstruction, bleeding, and perforation (4,5). In fact, colorectal cancer is the most common etiology of large bowel obstruction (6). At the same time, bowel obstruction is the most common emergency consequence of colorectal cancer, as it complicates 8 to 29% of patients with colorectal cancer and represents 80% of their emergency presentations (7). The location of obstruction is located distal to the splenic flexure in about 75% of cases, and the sigmoid colon is the most affected site (8).

Although most surgeons agree to perform resection anastomosis in obstructing right-sided lesions, multiple options are present for left-sided lesions, including defunctioning stoma, Hartmann procedure, resection with primary anastomosis with or without diversion (9,10).

Whatever the surgical option is, the management of these cases is usually challenging. Patients usually present with complications like electrolyte disturbance, dehydration, intraabdominal sepsis, or perforation. Additionally, obstruction often occurs in older individuals with multiple systemic comorbidities that may affect perioperative outcomes (11,12). This explains the fact that emergency colorectal surgery is associated with higher morbidity, mortality, and permanent stoma rates (13).

Multiple trials have evaluated the possible risk factors or created prognostic scores for mortality after colorectal surgery, and emergency surgery was found to be a strong predictor for post-operative mortality (14-16). Nonetheless, these studies included patients with elective and emergency colorectal cancer patients.

To improve patient care and surgical management, it is crucial to identify specific risk factors for post-operative mortality in patients with obstructed colon cancer. Based on our literature research, studies handling these risk factors in patients with obstructing left sided lesions are lacking. This was a motive for us to conduct the present study.

PATIENTS AND METHODS

This prospective clinical trial was conducted at the Emergency Surgery Unit, Mansoura University Hospitals, after obtaining ethical approval from the Institutional Review Board (IRB) and the local scientific committee of our medical school. The study was designed for adult patients who were operated on in our department for obstructing left colonic carcinoma during the period between July 15th, 2019, and July 15th, 2021. We excluded patients who had non-surgical

intervention (endoscopic stenting), caused by other etiology rather than colon cancer, or who had spontaneous relief of obstruction with conservative management.

The sample size calculation was based on the 19.0% mortality incidence among cases with left colon cancer after operation retrieved from the previous research conducted by Bušić et al (17). Using G*power software to calculate the difference between 2 proportions, one expected a difference of 6%, 2-tailed, with an α error of 0.05, an 80% power, and an effect size of 0.06. A minimal sample size of 100 patients was required. However, we included the whole 150 patients who presented to us during the previous period to increase the strength of our study.

All patients were subjected to the standard evaluation, including history taking, general and local abdominal examination, perrectal examination, preoperative laboratory investigations (including electrolytes), and radiological assessment (erect abdominal X-ray to diagnose obstruction, and pelviabdominal computed tomography with IV and oral contrast to identify the cause). After confirming the diagnosis, informed consent was signed by all subjects after explaining the benefits and possible complications of surgery. Patients were also evaluated by the anesthetic team, and they were classified according to the American Society of Anesthesiologists (ASA) class (18) and APACHE II score (19).

Before the operation, any laboratory abnormality was corrected, and adequate patient hydration was ensured. All cases were performed under general anesthesia via an exploratory lower midline incision. The type of operation depended on operator choice, experience, general patient condition, and anesthetic consultation. In patients with locally advanced tumors, critical hemodynamic conditions, for whom the anesthesiologists recommended short and rapid intervention, only a diverting colostomy was done. In patients with stable general condition, surgical resection was performed with either Hartmann procedure or primary anastomosis.

After the operation, patients were transferred either to the ICU or the internal ward based on their general condition. They were kept NPO, and oral fluids were allowed when the patient passed flatus (or passed stool through the stoma), had good intestinal sounds, with unremarkable abdominal examination. Any post-operative complications were recorded and managed.

The incidence of mortality was our primary outcome, and it was defined as death within 30 days after the operation or within the same hospital admission if

longer than 30 days (20). Risk factors for mortality after such operations were our secondary outcomes.

SPSS software for Mac was used for data tabulation and analysis. Categorical data were presented as number and percentages, and chi-square or Fischer's exact tests were used to compare two groups of these data. The quantitative data of normal distribution were expressed as mean and standard deviation, and compared using the independent samples t-test, whereas non-parametric data were expressed as median and range, and compared using the Mann-Whitney U test. Univariate regression analyses were used to assess the dependent and independent predictors of binary outcomes. A p-value less than 0.05 was considered significant in all of the applied statistical tests.

RESULTS

According to our 30-day mortality rate (19 patients – 12.67%), we divided the included 150 patients into two groups; the Survival (131 cases) and the Deceased (19 cases) groups. The mean age of the included patients was 66.5 and 70.84 years, respectively, with a significant increase in the deceased group ($p = 0.035$). Male patients represented 58.8% and 84.2% of patients in the survival and deceased group, while the remaining participants were females. It was evident that the male gender was significantly more prevalent in the

deceased group ($p = 0.033$). Although diabetes mellitus and hypertension showed a comparable prevalence between the two groups, the prevalence of ischemic heart disease or renal disease was statistically increased in the deceased group. *Table 1* summarizes the previous data.

Both ASA and APACHE II scores expressed significantly higher values in the deceased group. Shock was detected in one (0.8%) and six (31.6%) patients in the survival and deceased groups, respectively, with a significant rise in the latter group. There was a significant increase in the duration of symptoms in association with the deceased group (4.53 vs. 3.21 days – $p = 0.005$). *Table 2* shows the previous data.

There was no significant difference in the type of procedures performed between the two study groups. ($p = 0.254$). Resection with diversion was performed in 100 (76.3%) and 12 (63.2%) cases, while resection anastomosis was done in 21 (16%) and six (31.6%) patients in the survival and deceased groups, respectively. The remaining cases had an only colostomy. Intraabdominal free fluid, along with tumor perforation, was detected more significantly in the deceased group. Nevertheless, the incidence of metastasis or need for perioperative blood transfusion did not differ between the study groups, as shown in *table 3*.

The incidence of post-operative complications showed a significant increase in the deceased group (84.2% vs. 14.5% in the survival group). Moreover, the

Table 1 - Demographic characteristics of the studied sample

	All patients (n = 150)	Survival (n = 131)	Deceased (n = 19)	P
Age (years)	67.05 ± 6.505	66.50 ± 6.378	70.84 ± 6.256	0.035
Gender				0.033
Male	62.0% (93)	58.8% (77)	84.2% (16)	
Female	38.0% (57)	41.2% (54)	15.8% (3)	
History of Diabetes Meletus	32.7% (49)	32.8% (43)	31.6% (6)	0.914
History of Hypertension	44.0% (66)	41.2% (54)	63.2% (12)	0.072
History of Ischemic heart disease	24.0% (36)	19.1% (25)	57.9% (11)	< 0.001
History of Renal disease	22.0% (33)	13.7% (18)	78.9% (15)	< 0.001

Table 2 - Admission criteria of the studied sample

	All patients (n= 150)	Survival (n= 131)	Deceased (n= 19)	P
ASA				< 0.001
I	27.3% (41)	31.3% (41)	0.0% (0)	
II	48.7% (73)	55.7% (73)	0.0% (0)	
III	20.0% (30)	13.0% (17)	68.4% (13)	
IV	4.0% (6)	0.0% (0)	31.6% (6)	
APACHE	13.71 ± 6.594	12.23 ± 5.678	23.95 ± 0.705	< 0.001
Shock on presentation	4.7% (7)	0.8% (1)	31.6% (6)	< 0.001
The time interval between onset of symptoms and admission (days)	3.38 ± 1.536	3.21 ± 1.409	4.53 ± 1.896	0.005

Table 3 - Surgical procedure and intraoperative events of the studied sample.

		All patients (n = 150)	Survival (n = 131)	Deceased (n = 19)	P
Surgical procedure	Resection & colostomy	74.7% (112)	76.3% (100)	63.2% (12)	0.254
	Resection & anastomosis	18.0% (27)	16.0% (21)	31.6% (6)	
	Colostomy only	7.3% (11)	7.6% (10)	5.3% (1)	
Intra-abdominal free fluid		16.7% (25)	12.2% (16)	47.4% (9)	< 0.001
Distant metastases		0.7% (1)	0.8% (1)	0.0% (0)	0.702
Tumor or cecal perforation		15.3% (23)	11.5% (15)	42.1% (8)	0.001
Perioperative blood transfusion		11.3% (17)	11.5% (15)	10.5% (2)	0.905

Table 4 - Postoperative recovery profile of the studied patients

	All patients (n = 150)	Survival (n = 131)	Deceased (n = 19)	P
Post- operative complications	23.3% (35)	14.5% (19)	84.2% (16)	< 0.001
ICU admission	18.0% (27)	7.6% (10)	89.5% (17)	< 0.001

need for ICU admission was significantly associated with post-operative mortality (89.5% vs. 7.6% in the survival group) (*table 4*).

On regression analysis to identify the risk factors of mortality for these cases, old age, male gender, ischemic heart disease, chronic kidney disease, ASA class III, shock at presentation, increased duration of symptoms, intraabdominal free fluid, tumor or cecal perforation, post-operative complications and ICU admission were significant risk factors for mortality in such cases (*table 5*).

In the current study, the cause of mortality among the deceased 19 cases was as follows; pulmonary complications (six cases), cardiac complications (five cases), septic complications (4 cases), and multiorgan failure (4 cases) (not shown in the tables).

DISCUSSION

The current study was conducted to detect the risk factors leading to mortality in cases of obstructed left colonic carcinoma. We included a total of 150 patients. Mortality was encountered in 19 of them, with an incidence rate of 12.67%. This is in line with the current literature, which reported mortality rates between 12% and 35% after emergency colorectal surgery (21-23). Besides, Biondo et al. reported a mortality rate near to ours (47/320 – 14.68%) (24).

Other authors reported lower incidence. Tanis et al reported that the in-hospital mortality rate was 6.9% for patients who underwent acute resection, while it was 3.7% for patients who underwent stoma followed

Table 5 - Univariate regression analysis for the occurrence of mortality

	Odds ratio	Exp(B)	P
Age (years)	6.93	1.12	0.008
Male gender	4.07	3.74	0.044
History of Diabetes Meletus	-	-	0.914
History of Hypertension	-	-	0.078
History of Ischemic heart disease	11.71	5.83	0.001
History of Renal disease	26.18	23.54	< 0.001
ASA I	-	-	0.998
ASA II	-	-	0.997
ASA III	23.02	14.53	< 0.001
ASA IV	-	-	0.999
APACHE	-	-	0.977
Shock on presentation	13.4	60.0	< 0.001
Duration of symptoms	10.05	1.78	0.002
Intra-abdominal free fluid	12.35	6.47	< 0.001
Distant metastases	-	-	1
Tumor or cecal perforation	10.24	5.62	0.001
Perioperative blood transfusion	-	-	0.906
Post- operative complications	26.0	31.44	< 0.001
ICU admission	32.18	102.85	< 0.001

by resection (25). The difference between studies could be explained by different patient criteria, the operation performed, and the level of surgical care.

In the current study, old age was a significant risk factor for mortality (OR 6.93 – p = 0.008). This is in accordance with other previous reports which confirmed the relationship between old age and mortality after surgical intervention for complicated colorectal cancer (26). In addition, Álvarez and his associates reported that

mortality was encountered in 19% of patients older than 70 years, while it was encountered in 2.4% of patients younger than 70 years. Old age was a significant risk factor for mortality after obstructed colon cancer ($p = 0.029$) (20). Nevertheless, other studies have denied any association between old age and poor post-operative prognosis (27, 28).

In our study, the male gender was significantly associated with mortality (OR 4.07 – $p = 0.044$). After intensive literature research, we did not find any study that confirmed the previous perspective, and this could be attributed to different sample sizes and gender distributions between different studies.

Álvarez et al. reported that mortality was encountered in six out of 28 female patients (21.4%) compared to three out of 55 male patients (5.5%). Although the incidence of mortality was higher in female patients, that difference was statistically insignificant ($p = 0.055$) (20). Another study reported that the female gender was a significant risk factor for mortality in patients with obstructed cancer colon ($p = 0.002$) (29).

Our findings showed that the prevalence of diabetes was statistically comparable between the two study groups ($p = 0.914$). In a similar previous study, mortality was encountered in 5.6% and 7.1% of patients with and without diabetes, with no significant difference between them ($p = 0.54$) (12).

In the current study, ischemic heart disease was a significant predictor of mortality on regression analysis ($p = 0.001$). Similarly, another study reported that previous history of myocardial infarction was a significant risk factor for post-operative mortality (OR = 1.05-1.48 – $p = 0.009$) (29).

In our study, hypertension was not a significant risk factor on regression analysis ($p = 0.078$). Similarly, Manceau et al. denied any significant impact of cardiovascular comorbidity ($p = 0.13$) on post-operative mortality. Mortality was encountered in 7.8% and 6% of cases with and without cardiovascular comorbidity, respectively (12). Contrarily, van den Bosch et al. reported that hypertension was a significant risk factor for the same outcome (29).

In our study, chronic kidney disease was significantly associated with post-operative mortality (OR 26.18 – $p < 0.001$). Likewise, Biondo et al. reported that the presence of preoperative renal failure was a significant risk factor for mortality after obstructing colon cancer operations ($p = 0.0005$) (30). Contrarily, Mege et al. also denied any significant impact of renal comorbidity on mortality after surgery for the same pathology ($p = 0.33$) (31).

Our findings revealed a significant relationship

between high ASA class and post-operative mortality ($p < 0.001$). Longo et al. reported that ASA classes III and IV were significant predictors of post-operative mortality (OR = 2.221 and 4.715 respectively – $p = 0.0023$ and 0.0001 respectively) (32).

In the current study, the APACHE II score was significantly increased in the deceased group (23.95 vs. 12.23 in the survival group – $p < 0.001$). Another study confirmed the previous findings. Higher APACHE scores were associated with higher mortality rates following surgery for obstructed colon cancer ($p = 0.004$). Mortality was encountered in 31.6% of patients with a score equal to or more than 8, compared to only 4.7% in patients with scores less than eight (20).

In our study, the deceased group reported more prolonged duration of symptoms (4.53 vs. 3.21 days – $p = 0.005$). Of course, delayed presentation increases the risk of proximal ischemia, perforation and dehydration, and electrolyte imbalance. This should have a negative impact on the patient's general condition. Contrarily, Kızıltan et al. denied the previous findings, as they did not detect any significant difference between the mortality and no-mortality groups regarding the same perspective (62 vs. 86 hours respectively – $p = 0.93$) (33). The previous study was not conducted in obstructed cases, and that should explain the difference detected.

In the current study, shock was a significant risk factor for post-operative mortality (OR 13.4 – $p < 0.001$). Other authors reported a significant increase in mortality in patients with hemodynamic failure on presentation ($p < 0.001$), as mortality was encountered in 26.4% and 5.9% in obstructed cases with and without hemodynamic failure, respectively (12). Other authors confirmed the previous findings ($p < 0.001$) (31).

Our findings showed no significant impact on the type of surgery on post-operative mortality ($p = 0.254$). Bakker et al. confirmed our findings, as the extent of resection did not have a significant impact on post-operative mortality ($p = 0.071$) (34). However, the same authors reported higher mortality rates with ileostomy creation (CI = 1.361–3.406 – $p = 0.001$). Another study, on the other hand, found a significant relationship between the type of surgery performed and mortality ($p = 0.005$). Mortality was higher in cases undergoing subtotal colectomy (13%) and Hartmann procedure (9%) compared to segmental colectomy (6%) and primary diverting colostomy (4%) (31).

There is a current debate regarding the best management option for obstructed left colon cancer (25). Multiple options exist including only diversion, Hartmann procedure, segmental resection with or

without diversion, subtotal or total colectomy (35, 36).

We think that surgical expertise, along with good patient preparation, and good patient selection will have their positive impacts on post-operative outcomes.

In the current investigation, intraabdominal free fluid was detected in 16 (12.2%) and nine (47.4%) patients in the survival and deceased groups, respectively, with a significant rise in the latter ($p < 0.001$). Longo et al. reported that the presence of intra-abdominal ascitic fluid was a significant predictor of post-operative mortality after colorectal surgery ($OR = 3.231 - p = 0.0003$) (32). This is consistent with our findings.

Regarding tumor or cecal perforation in our study, it was significantly increased in association with mortality ($OR 10.24 - p = 0.001$). Another study reported that the presence of peritonitis or ischemic lesions at the proximal colon was significantly associated with in-hospital mortality ($p = 0.0007$ and 0.0049 , respectively). Mortality was encountered in 13.6% and 6.5% of patients with and without peritonitis, respectively, whereas the same outcome was encountered in 13.1% and 6.5% of patients with and without proximal ischemic lesions, respectively (12).

In the current study, distant metastasis was detected only in one patient in the survival group (0.8%), with no significant difference between the two groups. In collaboration with our findings, Manceau et al reported a statistically comparable incidence of mortality in patients with and without metastasis ($p = 0.69$). Mortality was encountered in 6.5% and 6% of patients in the same groups, respectively (12).

In our study, perioperative blood transfusion was statistically comparable between the two groups ($p = 0.905$). Another study denied any significant impact of perioperative blood transfusion on post-operative mortality following surgery for obstructed colon cancer ($p = 0.722$). Mortality was encountered in 12.9% of patients receiving blood transfusion compared to 9.6% in patients who did not (20).

In the current study, the incidence of post-operative complications was a significant risk factor for post-operative mortality ($OR 26.0 - p < 0.001$). In agreement with our findings, Tanis and his associates reported that post-operative complications were significant risk factors for post-operative mortality ($CI 4.672-15.516 - p < 0.001$) (25). On the other hand, Mege et al. denied any significant impact of post-operative complications on early post-operative mortality in such cases ($p = 0.21$). Post-operative complications were encountered in 3.04% and 5.49% of patients in the survival and

deceased groups, respectively (31).

In the current study, the cause of mortality among the deceased 19 cases was as follows; pulmonary complications (six cases), cardiac complications (five cases), septic complications (4 cases), and multiorgan failure (4 cases). Another study reported that the main causes of death following colorectal surgery were bronchopneumonia, myocardial infarction, anastomotic leakage, pulmonary embolism, and cerebrovascular accident (37).

In another recent study, the most frequent cause of mortality was pulmonary complications (25%), followed by cardiac adverse events (18%), multiorgan failure (15%), sepsis (13%), and hemorrhagic shock (5%). Other causes included intestinal ischemia, neurogenic shock, hepatic failure, and sliding syndrome (12). It is expected to find some differences across studies, according to the criteria of the patients included, pre-existing comorbidities, post-operative care, and nature of surgical complications.

Our study has some limitations; it was conducted in a single center. Additionally, it lacks intermediate and long-term outcomes. The previous drawbacks should be well covered in the upcoming studies.

CONCLUSION

The incidence of post-operative mortality in our series was 12.67%. Old age, male gender, ischemic heart disease, chronic kidney disease, ASA class III, shock at presentation, increased duration of symptoms, intraabdominal free fluid, tumor or cecal perforation, post-operative complications, and ICU admission were significant risk factors for mortality in such cases.

Conflict of interest

All authors declare no conflict of interest.

Ethical approval

For this study was approval from Clinical Trials was obtained.

Clinical trials registration code: CT04823416

Informed written consent

Was taken from all cases before being enrolled in this work.

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