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Effect of Malignancy on Morbidity and Mortality in Left-Sided Emergency Colorectal Resections

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ABSTRACT

Introduction: Despite technological developments, morbidity and mortality in emergency colorectal surgery remain high. Despite efforts to diagnose colorectal cancer early, more than 20% of patients still undergo emergency surgery. How do outcomes in these patients differ from outcomes in patients with benign disease? Very few studies provide information on this subject; therefore, the aim of our study was to determine the effects of malignancy in patients who have undergone left-sided emergency colorectal resections.

Methods: Patients undergoing emergency left-sided colectomy at a single tertiary hospital were included in this observational study. Demographics, Charlson comorbidity index, perforation, duration of surgery, preference for primary anastomosis or end colostomy, and benign or malignant etiologies were all examined. Morbidity was defined as a Clavien–Dindo grade III or higher complication. Risk factors for both morbidity and mortality were first evaluated using univariate analyses. Multivariable logistic regression analyses were then performed for both morbidity and mortality.

Results: The study included 76 patients, 46 (60.5%) of whom were men. The mean age was 61.5 years, and the most common cause was colorectal cancer (n=46, 60%). Perforation was observed in 32.8% of patients (n=25), and obstruction in 38.1% of patients (n=29). The morbidity rate was 27.6% and the 90-day mortality rate was 15.7%. In univariate tests and multivariable regression analyses, malignancy was not associated with morbidity (p=0.879, p=0.711) or mortality (p=0.416, p=0.453). In both univariate and multivariable analyses, perforation was the only factor significantly related to morbidity and mortality.

Conclusion: Malignancy was not identified as a direct cause of morbidity and mortality in emergency left-sided colectomies. Perforation was significantly associated with morbidity and mortality. In these high-risk surgeries, multicenter studies with larger patient groups are needed to detect causes of deterioration and to improve outcomes.

Keywords: Colorectal cancer, emergency surgery, morbidity, mortality, diverticulitis

Introduction

Emergency colorectal surgery occupies a prominent place in the emergency practice of general surgery (1,2). Despite technological and other recent advancements in emergency colorectal surgery, the high morbidity and mortality rates remain a subject of numerous studies (3-5). Naturally, patients in emergency service due to colorectal etiologies are not a uniform category and include various disease processes such as diverticulitis, ischaemia, volvulus, cancer etc., each of which possesses distinct characteristics (6).

Colorectal cancer constitutes a critical subgroup within these etiologies. Despite the efforts made for early diagnosis, approximately 20% of the colorectal cancer patients are still operated on under emergency conditions (7-9). Since the principles of oncological surgery are also applied when addressing the urgent problem of the patient taken to emergency surgery for colorectal cancer, the procedure may differ in some respects from other surgeries. These include high ligation, attempts to obtain sufficient negative surgical margins, and efforts to perform resection without compromising the integrity of the mesocolon. However, it is also noted that a significant proportion of mortality in colorectal surgery occurs in patients who require emergency surgery (10,11).

Overall, can it be concluded that the presence of malignancy in emergency left colorectal surgery results in worse outcomes? Or inversely, as mentioned in another study, do benign groups which include

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etiologies such as ischaemia, have worse outcomes? (2). The objective of the present study was to ascertain the impact of malignancy on the morbidity and mortality rates among patients who had undergone left-sided emergency colorectal resection.

Methods

This retrospective observational study was conducted at University of Health Sciences Türkiye, Kanuni Sultan Süleyman Training and Research Hospital between January 2023 and May 2024. The study population included, consecutively during the study period, patients aged 18 years or older who underwent emergency left-sided colorectal resection for isolated colorectal pathology. Patients with diseases originating from a colonic segment proximal to the left colon or from a rectal segment distal to the rectosigmoid junction, patients who underwent surgery for combined organ pathologies of various benign and malignant causes, and those undergoing reoperation due to complications of elective abdominal surgery were excluded from the study.

Patients were operated on by general surgeons, two of whom specialized in colorectal surgery. Assistant surgeons provided support during all surgeries. The majority of surgeries were performed outside of regular working hours. The decision to perform end colostomy or an anastomosis after resection was made by the surgeon based on the patient's overall condition. Sepsis, the need for vasopressor support, advanced age, and the presence of numerous comorbidities are among the leading factors influencing the operating surgeon's decision.

The data from patients were obtained via the hospital software system. The demographic data, Charlson comorbidity index score, baseline characteristics, operative and postoperative results, type of surgery (primary anastomosis or end colostomy), length of hospital stay, presence of perforation, and benign vs. malignant etiologies were investigated. Morbidity was defined as a Clavien-Dindo (CD) grade III or higher complication.

Ethical approval for this study was obtained from University of Health Sciences Türkiye, Kanuni Sultan Süleyman Training and Research Hospital Scientific Research Ethics Committee (decision number: 166, date: 07.08.2024). Informed consent was obtained from all the patients participating in the study, which was registered with the Clinical Trials Protocol Registration and Results System (Trial ID: NCT06958900, registration date: 07.04.2025). The study also adhered to the STROBE Statement and complied with the principles of the World Medical Association's Declaration of Helsinki.

Statistical Analysis

Univariate analyses were employed to evaluate risk factors for morbidity and mortality. For univariate analysis of morbidity, patients were divided into two subgroups: those who experienced morbidity and those who did not. Following this initial categorisation, a comprehensive comparison was conducted between the two subgroups across all variables. A similar approach was adopted for univariate mortality analysis, with patients once again divided into two subgroups: those who succumbed within the first 90 days postoperatively and those who survived. These mortality and survival subgroups were then investigated across all variables. The appropriate statistical tests employed were Pearson chi-square, the independent-samples t-test, and Mann-Whitney U test. The Kolmogorov-Smirnov test was utilised to assess the normality of the variables. For variables with a normal distribution, the mean ± standard deviation was reported. Categorical variables were expressed as numbers and percentages. Variables with non-normal distributions were reported as medians and interquartile ranges (25^{th}-75^{th} percentiles). The effects of risk factors on morbidity and mortality were expressed as odds ratios with 95% confidence intervals. The statistical significance level was set at 0.05. After univariate analyses, multivariable logistic regression tests were performed. The data were compiled and analysed using SPSS for Windows, version 29.0 (SPSS, Chicago, IL, USA).

Results

The study included 76 patients, of whom 46 (60.5%) were male. The morbidity rate was 27.6%, and the 90-day mortality rate was 15.7%. The mean age was 61.5 years. The most common cause was colorectal carcinoma (n=46, 61%) (Figure 1); diverticulitis was the most common benign etiology (Table 1). Perforation was observed in 32.8% of patients (n=25), while obstruction was detected in 38.1% (n=29) (Table 1).

The Hartmann procedure was preferred for 41 patients (53.9%). Primary anastomosis was performed in 46% of patients (n=35). The procedures were: extended left hemicolectomy (n=4), left hemicolectomy (n=3), anterior resection (n=22), and low anterior resection (n=6). A diverting loop ileostomy was performed in 20% of patients (n=7). The anastomotic leak rate was 11% (n=4).

Two patients underwent laparoscopic surgery; one of these was converted to open surgery to complete the procedure. All other procedures were performed using conventional open surgery techniques. The overall complication rate was 35.5% (n=27). Six patients experienced CD Grade II complications [surgical site infection (n=4), pneumonia (n=2)].

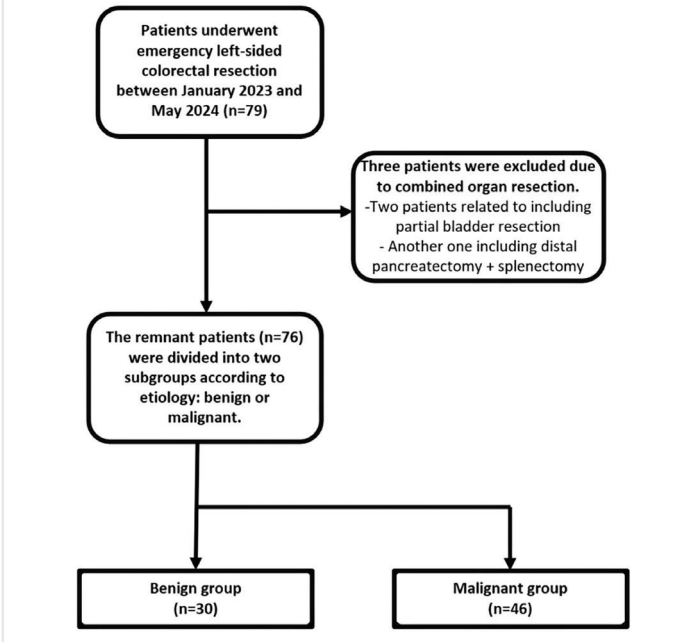

Figure 1. Flowchart diagram of the study

CD Grade III complications were detected in 9 patients: anastomotic leak (n=4), evisceration (n=3), and stoma retraction with intra-abdominal abscess (n=2). Two cases of anastomotic leakage were managed non-operatively using endoscopic interventions. Twelve patients died within the first 90 days after surgery, primarily due to sepsis related to their late arrival at the hospital (CD Grade 5).

By tumor stage, the stage 3 group included the most patients; tumor characteristics are presented in Supplementary Table 1. The majority of colorectal cancer patients (76%) were Grade II (Supplementary Table 1).

In both univariate and multivariable analyses, malignancy was not associated with morbidity: p=0.879 and p=0.711, respectively (Table 2), and p=0.416 and p=0.453, respectively (Table 3). The type of surgery was significantly related to morbidity in the univariate analysis; however, this was not supported by the multivariable logistic regression analysis. The impact of the type of surgery was found to be non-significant in both univariate and multivariable mortality analyses.

The duration of the operation was not significantly associated with either morbidity (p=0.369) (Table 2) or mortality (p=0.932) (Table 3). Mortality was not related to the type of surgery (p=0.111). Length of hospital stay did not change significantly between groups (p=0.208).

Both univariate and multivariable analyses revealed a significant relationship between perforation and morbidity (p=0.025 and p=0.027, respectively). Similarly, univariate and multivariable logistic regression analyses for mortality showed that perforation was significantly associated with outcomes (p=0.007 and p=0.015, respectively).

Table 1. Baseline characteristics of patients

Variable	n (%)
Age, mean ± SD	61.5±14.5
Sex **Male** **Female**	 46 (60.5) 30 (39.4)
Charlson comorbidity index, median (IQR[25-75])	2 (1-4)
Duration of operation (min), median (IQR[25-75])	120 (100-172)
Perforation	25 (32.8)
Length of hospital stay (days), median (IQR[25-75])	10 (8.2-15.7)
Type of surgery **Resection + end stoma** **Resection + anastomosis**	 41 (53.9) 35 (46.0)
Etiology **Malignancy** **Diverticulitis** **Volvulus** **Iatrogenic** **Trauma**	 46 (61.3) 15 (19.7) 12 (15.7) 2 (2.6) 1 (1.3)
Stage of malignancy patients **I** **II** **III** **IV**	 1 (2.1) 16 (34.7) 18 (39.1) 11 (23.9)

SD: Standard deviation, IQR: Interquartile range

Discussion

In the present study, colorectal cancer was identified as the most common indication for emergency colorectal resections, a finding that aligns with the findings of other studies (5,12). However, malignancy was not found to be associated with statistically different rates of morbidity and mortality in both univariate and multivariable analyses. Although cancer itself is a more complicated disease, it did not result in worse perioperative outcomes. Although the characterization of "benign" may suggest a simpler disease presentation to some, inflammatory conditions that follow many benign etiologies are closely related to patient morbidity and mortality. This "worsening" inflammatory background may play a role in balancing possible negative outcomes because of the effects of the extensive dissection required for oncological resection and of findings secondary to obstructive symptoms, which may be more frequently encountered in the cancer subgroup. However postoperative course following emergency colorectal resection may be influenced more by the severity of acute illness, than by the complexity of the underlying disease process itself and its surgical requirements (13). Patients presenting with perforation, sepsis, diffuse peritoneal contamination, or hemodynamic compromise are exposed to substantial operative risk, regardless of whether the underlying pathology is benign

Table 2. Univariate analyses and multivariable logistic regression for morbidity

Variable	No-morbidity (n=55)	Morbidity (n=21)	Univariate p value	Multivariable p value	OR (CI 95%)
Age mean ± SD	61.7±13.7	61.0±16.8	0.847	0.818	0.99 (0.95-1.04)
Sex Male Female	 35 (63.6) 20 (36.4)	 11 (52.4) 10 (47.6)	0.369	0.535	1.41 (0.47-4.20)
Charlson comorbidity index median (IQR[25-75])	2 (2)	2 (5)	0.604		
Duration of operation (min) median (IQR[25-75])	130 (80)	120 (48)	0.369	0.243	0.99 (0.98-1.01)
Perforation	14 (26.4)	11 (52.4)	**0.025**	**0.027**	3.60 (1.15-11.26)
Length of hospital stay (days) median (IQR[25-75])	10 (6)	10 (8)	0.604		
Type of surgery Resection + end stoma Resection + anastomosis	 26 (47.3) 29 (52.7)	 15 (71.4) 6 (28.6)	**0.046**	0.947	0.96 (0.30-3.01)
Malignancy	33 (60)	13 (61.9)	0.879	0.711	1.25 (0.37-4.16)

CI: Confidence interval, IQR: Interquartile range, OR: Odds ratio, SD: Standard deviation

Table 3. Univariate analyses and multivariable logistic regression for mortality

Variable	No-mortality (n=64)	Mortality (n=12)	Univariate p value	Multivariable p value	OR (95% CI)
Age mean ± SD	61.2±13.9	63.0±17.6	0.688	0.422	1.02 (0.97-1.07)
Sex Male Female	 39 (60.9) 25 (39.1)	 7 (58.3) 5 (41.7)	 0.866	 0.867	 0.88 (0.22-3.51)
Charlson comorbidity index median (IQR^{25-75})	2 (2)	3.5 (5)	0.236		
Duration of operation (min) median (IQR^{25-75})	120 (100-180)	135 (105-172)	0.932	0.921	1.00 (0.98-1.01)
Perforation	17 (26.4)	8 (66.7)	**0.007**	**0.015**	5.07 (1.40-23.8)
Length of hospital stay (days) median (IQR^{25-75})	10.5 (7)	10 (12)	0.208		
Type of surgery Resection + end stoma Resection + anastomosis	 32 (50) 32 (50)	 9 (75) 3 (25)	 0.111	 0.974	 1.02 (0.24-4.36)
Malignancy	40 (62.5)	6 (50)	0.416	0.453	0.57 (0.13-2.44)

CI: Confidence interval, IQR: Interquartile range, OR: Odds ratio, SD: Standard deviation

or malignant. Our finding that perforation remained an independent predictor of both morbidity and mortality supports this interpretation. In another studies by Ellensen et al. (3) and Leong et al. (14), similarly to our findings, morbidity and mortality rates did not differ significantly depending on whether the aetiology was benign or malignant. In the study by Leong et al. (14), this was interpreted as a contribution of much greater involvement on the part of a consultant surgeon to the surgery, in the event of challenging operations. Despite the presence of similar outcomes (15-17), there remains other investigators who have reported worse outcomes among patients with colorectal malignancy, in the emergency colorectal surgery (4).

Our study found that perforation development was the most influential factor on morbidity and mortality among the variables and literature data supports this finding (7,18). Colonic perforation can result in bacterial translocation and faecal contamination of the peritoneal cavity. This triggers a profound systemic inflammatory response that can rapidly progress to sepsis, septic shock and multiple organ dysfunction syndromes (19). In addition to the physiological burden imposed by sepsis itself, perforation is often associated with delayed presentation, severe disturbances of fluid and electrolyte balance, and impaired nutritional status. These factors can all negatively impact postoperative recovery. Furthermore, extensive intra-abdominal contamination often necessitates more complex surgical procedures and may limit the feasibility of primary anastomosis, thereby influencing operative strategy and postoperative outcomes (20,21). Taken together, these factors may explain why perforation is a consistent predictor of mortality in emergency colorectal surgery. In the study conducted by Leong et al. (14), the presence of perforation was observed in 80% of postoperative deaths, while in our study, this rate was detected at 50% (n=6). The perforation rate in our study was 32%, which is similar to the 31% rate reported in another study of emergency colorectal surgery (22). However, the WSES guidelines state that the perforation rate in colorectal cancer is 20% (7). The higher rate of perforation in patients with benign disease is likely related to complicated diverticulitis. That the prognostic importance of perforation exceeds that of malignancy suggests that the severity of the acute surgical presentation may outweigh disease-specific factors in determining short-term outcomes. This is consistent with previous reports indicating that physiological status and acute clinical deterioration are stronger predictors of outcomes following emergency colorectal surgery, than the underlying diagnosis (23,24).

Emergency colorectal surgery can be performed for etiologies such as malignant or benign such as diverticulitis, volvulus, etc. and the outcome may depend on many factors such as comorbidities and preferred surgical approach (22,25). As previously mentioned, a significant proportion of colorectal surgeries performed in emergency condition achieve a high morbidity and mortality (7,15). Notwithstanding this, a significant percentage of surgeons in a Delphi process endorsed the benefit of formal cancer resection in emergencies for improving disease-free and overall survival. Although the strengthening of antibiotic options and the increase in centers and equipment, where patients can be closely monitored, have increased the possibility of conservative follow-up in benign diseases such as ischemic colitis and diverticulitis, surgery continues to play an inevitable role for many benign patients in whom serious peritoneal contamination occurs (25).

The overall morbidity rate was 27.6%, and the 90-day mortality rate was 15.7% in our study, while postoperative morbidity and mortality rates were found to be 48% and 15.3%, respectively, in another multicenter study (10). Similar rates have been reported in other studies (26). In general, emergency colorectal surgery represents a high-risk for a patient (3). Various factors have been identified as contributing to increased morbidity and mortality in emergency colorectal surgery. These include age and co-morbidities, then the preoperative health status, the surgeon who performs the surgery, the type of surgery, and the time at which the surgery is performed are some factors mentioned as the leading causes (2). Insufficient time for patient optimisation and lack of bowel preparation have also been identified as contributing factors to high morbidity in emergency colorectal surgery. In this study, the anastomotic leak rate was 11% (n=4). This outcome is consistent with that of a large multicentre trial that included patients who underwent colorectal resection (27).

In the present study, age was not found to significantly change morbidity and mortality in multivariable analyses, which is similar to other reports (1,14,15,25). Indeed, one point that has been emphasized frequently is that chronological age alone is not a sufficient predictor of mortality and morbidity; age-related changes across multiple physiological systems provide more meaningful information (13). The lack of an independent association between chronological age and adverse outcomes further supports the notion that physiological reserve and acute clinical status may be more relevant than demographic characteristics when assessing operative risk. Physiological reserve clearly illustrates that chronological age alone is not an independent factor apart from other causes and effects. This concept, defined as the organism's ability to cope with stress factors, should be considered as a patient characteristic that we do not have the opportunity to improve prior to emergency surgery (28). Male patients constituted the majority in our study, as in a Norwegian study (3), with a contrasting finding in a similar Korean study (15). Sex was not found to be directly associated with morbidity or mortality in either univariate or multivariable analyses results in our study, similar to some other reports in the literature (29,30).

Anastomotic leakage remains one of the most dreaded complications following colorectal surgery and is associated with substantial increases in postoperative morbidity, mortality, length of hospital stay, reoperation rates and healthcare costs (31). The risk may be even greater in emergency settings, where patients frequently present with bowel obstruction, perforation, peritoneal contamination, sepsis, malnutrition and physiological derangement (32). These factors can impair tissue perfusion and healing, thereby increasing the likelihood of anastomotic failure. Although the anastomotic leak rate in the present study was comparable to rates reported in large multicentre series (32), the potential consequences of leakage often influence intraoperative decision-making and contribute to a more cautious approach regarding primary anastomosis. Recent studies suggest that, in carefully selected patients with adequate physiological reserve and limited contamination, primary anastomosis can be performed safely, even in emergency situations (33). Nevertheless, surgeons must balance the benefits of avoiding a likely permanent stoma against the potentially devastating consequences of an anastomotic leak. This dilemma continues to represent one of the most challenging aspects of emergency colorectal surgery and highlights the importance of individualized patient assessment and risk stratification (34).

Although the majority of patients in our study underwent the Hartmann procedure, an anastomosis was performed in almost half of the cohort (46%). This rate is compatible with other literature examples (25,35). However, this finding may be affected by a relatively high perforation rate at initial presentation. It should be noted that including only left-sided colorectal diseases in our study is an obvious contributing factor to the preference for the Hartmann procedure in this context. It is also noted as beneficial in terms of preventing delay to systemic therapy, particularly among metastatic patients (35). The possibility that critically ill patients may be more severely affected and that life-threatening conditions may occur following a potential anastomotic leak, is compelling surgeons to contemplate their interventions in a more scrutinized and protective manner (27). However, the decision to perform a Hartmann procedure should be made with caution and for in particular in patients with a clear indication, such as those with haemodynamic instability, multiple comorbidities or sepsis (36). It is noteworthy that fewer than half of patients may be eligible to eventually undergo a reversal of the colostomy (37). Additional risks of these stoma reversal procedures must also be kept in mind (7,35,38-40).

Study Limitations

The retrospective nature of the study constitutes its primary limitation. The relatively small number of patients constitutes another limitation, particularly for establishing a multivariable logistic regression model. The limited number of mortality events relative to the number of variables included in the multivariable model may have increased the risk of overfitting and thus reduced the reliability of the estimated associations. For these reasons, the results should be interpreted with caution. If qualifying details for the surgeon are not included, the surgeon's status as a trainee, a registrar, or a consultant can also be mentioned. Nevertheless, the emphasis on a problem associated with high morbidity, mortality, and significant costs enhances the significance of the content. Studies on this topic, which focus on one of the most demanding patient groups from the perspectives of the surgeon, the surgical team, and the entire emergency department, represent significant steps towards improving efficiency.

Conclusion

This study examined emergency colorectal surgeries performed on 76 patients. The total morbidity rate was found to be 27.6%, while the 90-day mortality rate was found to be 15.7%. Colorectal cancer was the most common malignant cause; diverticulitis was the most common benign cause. The study found no association between malignant etiology and morbidity or mortality. The presence of perforation was associated with morbidity and mortality in both univariate and multivariable analyses. These findings suggest that short-term outcomes after emergency colorectal resection are driven more by acute physiological derangement, particularly perforation, than by the underlying pathology itself. While the Hartmann procedure was preferred, a significant proportion of patients underwent an anastomosis. The study once again revealed the high-risk nature of emergency colorectal surgery. Randomised controlled studies involving larger, multicentric patient groups in our country would provide stronger evidence to determine the factors.

Ethics

Ethics Committee Approval: Ethical approval for this study was obtained from University of Health Sciences Türkiye, Kanuni Sultan Süleyman Training and Research Hospital Scientific Research Ethics Committee (decision number: 166, date: 07.08.2024). The study adhered to the STROBE Statement and complied with the principles of the World Medical Association's Declaration of Helsinki.

Informed Consent: Informed consent was obtained from all the patients participating in the study, which was registered with the Clinical

Trials Protocol Registration and Results System (Trial ID: NCT06958900, registration date: 07.04.2025).

Footnotes

Authorship Contributions: Surgical and Medical Practices - Y.M.K., H.A., H.Y., E.S., S.Y., A.K.; Concept - Y.M.K., H.Y., E.S., S.Y.; Design - Y.M.K., H.A., E.S., A.K.; Data Collection or Processing - Y.M.K., H.A., H.Y.; Analysis or Interpretation - Y.M.K., H.A., H.Y., E.S., S.Y., A.K.; Literature Search - Y.M.K., H.A., H.Y., E.S., S.Y., A.K.; Writing - Y.M.K., H.A., H.Y., E.S., S.Y., A.K.

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Supplementary Table Link: https://d2v96fxpocvxx.cloudfront.net/bfe6b059-1982-481c-8e2f-073cbc0b054a/content-images/cb4fe15d-f3c4-4a06-8c78-42ede770eb3b.pdf

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