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A comparative analysis of preoperative, intraoperative, and tumor characteristics in emergency and elective right-sided colonic surgery

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ABSTRACT

Objective: This study aimed to compare preoperative, intraoperative, and tumor characteristics between patients undergoing emergency and elective surgery for right-sided colon cancer. Despite the worsened prognosis of emergency colorectal cancer cases, studies on right colon cancer remain limited.

Material and Methods: This retrospective study included 356 patients who underwent surgery for right-sided colon cancer between January 2015 and April 2023. Patients were categorized into emergency (n=93) and elective (n=263) groups. Demographic data, tumor characteristics, and surgical details were analyzed. Binary logistic regression was applied to identify independent predictors of emergency surgery.

Results: Age (p=0.435) and gender distribution (p=0.853) were similar between groups. However, American Society of Anesthesiologists (ASA) scores were higher in the emergency group (p=0.001), while Charlson comorbidity index (CCI) scores showed no significant difference (p=0.169). T4 (p<0.001), N1 (p=0.008), and M1 stages (p<0.001) were significantly more frequent in the emergency group, along with higher tumor perforation rates (34.4% vs. 1.9%, p<0.001). Open surgery was more common in the emergency group (p=0.005). While total lymph node yield was similar (p=0.501), the number of metastatic lymph nodes was higher in the emergency group (p=0.008). Logistic regression identified higher ASA score, advanced T, N, M stages, tumor perforation, and tumor size as predictors of emergency surgery.

Conclusion: Patients undergoing emergency surgery for right colon cancer have more advanced disease, higher tumor perforation rates, and poorer prognostic factors. Laparoscopic surgery was less utilized, which indicates technical challenges. Early diagnosis and screening strategies may reduce emergency interventions and improve outcomes.

Keywords: Right-sided colon cancer, emergency surgery, elective surgery, tumor stage, tumor perforation, prognostic factors

INTRODUCTION

Colorectal cancer is among the most frequently diagnosed malignancies worldwide, significantly contributing to cancer-related morbidity and mortality. According to GLOBOCAN 2022 data, it is the third most commonly detected cancer globally (1). Similarly, in Türkiye, colorectal cancer ranks as the third most prevalent malignancy (2). Despite continuous advancements in diagnostic techniques and therapeutic interventions, a substantial number of cases still present as emergencies, which are associated with poorer clinical outcomes (3).

Right-sided and left-sided colorectal cancers exhibit distinct biological and pathological characteristics (4,5). Research indicates that right-sided colon cancers are often diagnosed at more advanced stages and are associated with worse prognoses, including lower five-year survival rates compared to left-sided tumors (6-8). Differences in molecular pathways, tumor progression patterns, and symptom onset between these subtypes contribute to their diverse clinical presentations and prognostic implications.

The objective of this study is to investigate the differences between emergency and elective surgeries in patients with right-sided colon cancer, with a specific focus on preoperative demographic characteristics, intraoperative findings, and tumor pathology. While the adverse outcomes of emergency colorectal cancer surgeries have been well documented, there remains a lack of specific data on emergency right-sided colon cancer cases. This study aims to fill that gap by identifying prognostic

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factors and key distinctions between emergency and elective surgeries, thereby contributing to improved clinical decision-making and patient management strategies. We hypothesized that patients undergoing emergency surgery for right-sided colon cancer would present with more advanced tumor stages, higher tumor perforation rates, and worse prognostic indicators compared to those undergoing elective surgery.

MATERIAL and METHODS

This research was designed as a retrospective observational study and carried out in the general surgery department of a tertiary-level university hospital. The study population included patients who underwent surgery due to right-sided colon tumors between January 2015 and April 2023. Ethical approval was obtained from the Ethics Committee of Gazi University Faculty of Medicine in accordance with the principles outlined in the Declaration of Helsinki (approval no: 17.07.2023-597, date: 17.07.2023).

A total of 392 patients were initially identified. Clinical data were gathered through hospital digital record systems and patient charts. After reviewing the dataset, 36 patients were excluded based on the following criteria: Patients younger than 18 years or older than 90 years, patients with missing preoperative clinical or pathology data, and patients who underwent surgery for non-malignant indications. This process resulted in a final study group of 356 patients.

Among the participants, 93 patients (25.7%) underwent emergency surgery, while 263 patients (72.7%) had elective operations. Emergency surgery was defined as operative intervention needed within 48 hours of hospital admission, typically due to acute clinical presentations such as bowel obstruction, gastrointestinal perforation, or significant bleeding. Elective surgeries were performed following standard preoperative evaluation and optimization protocols, including imaging and staging workup.

For each patient, data on demographics [age, gender, ASA classification, Charlson comorbidity index (CCI)], tumor characteristics (anatomical site, histological subtype, differentiation, TNM stage), and surgical parameters (approach, procedure type, lymph node evaluation) were systematically collected and compared between the two groups.

Statistical Analysis

All statistical analyses were performed using SPSS version 26.0. Since the data did not follow a normal distribution, non-parametric tests were used. Continuous variables were reported as median (min-max) and compared with the Mann-Whitney U test. Categorical variables were summarized as counts and percentages, and comparisons were made using the chi-square test.

To identify factors independently associated with emergency surgery, binary logistic regression was conducted. Only variables with $p<0.05$ in univariate analysis were included in the model. A significance threshold of $p<0.05$ was applied for all statistical tests.

RESULTS

Out of 356 patients, 93 (26.12%) underwent emergency surgery and 263 (73.87%) underwent elective surgery. There were no significant differences in age (p=0.435) or gender distribution (p=0.853). Emergency cases had significantly higher ASA scores (p=0.001), while CCI scores were comparable (p=0.169) (Table 1).

Tumor localization did not differ significantly (p=0.067), but poorly differentiated tumors were more frequent in emergency cases (p=0.001). T4, N1, and M1 stages were significantly more common in this group (p<0.001, p=0.008, and p<0.001, respectively), as was tumor perforation (34.4% vs. 1.9%, p<0.001). No difference was found for angiolymphatic (p=0.054) or perineural invasion (p=0.950) (Table 2).

Open surgery was more frequent in the emergency group (p=0.005), whereas the use of laparoscopy was lower. Although

Table 1. Demographic and clinical characteristics of patients undergoing emergency and elective surgery

	Total	Emergency (n=93)	Elective (n=263)	p
Age, median (range), year	64 (22-90)	66 (24-89)	63 (22-90)	0.435
Sex, n (%) Female Male	 133 (37.6%) 223 (62.6%)	 34 (36.6%) 59 (63.4%)	 99 (37.6%) 164 (62.4%)	 0.853
ASA, n (%) I II III IV	 87 (24.4%) 140 (39.3%) 122 (34.3%) 7 (2.0%)	 18 (19.4%) 33 (35.5%) 36 (38.7%) 6 (6.5%)	 69 (26.2%) 107 (40.7%) 86 (32.7%) 1 (0.4%)	 **0.001**
CCI, median (IQR)	3 (1-6)	3 (1-6)	3 (1-6)	0.169

n: Number, p: Value, CCI: Charlson comorbidity index, IQR: Interquartile range, ASA: American Society of Anaesthetiologist, bold values indicate statistically significant p-values (p<0.05)

total lymph node yield was similar (p=0.501), metastatic node count was higher in emergency cases (p=0.008). Median tumor size was also larger (7 cm vs. 5 cm, p<0.001) (Table 3).

Multivariate analysis showed that higher ASA score, advanced T, N, M stages, tumor perforation, tumor size and operation performed were independently associated with emergency surgery (Table 4).

DISCUSSION

Although emergency-diagnosed colorectal cancer cases are known to have worse prognoses, studies focusing specifically on this patient population remain relatively scarce. In this study, we analyzed right-sided colon cancer patients by comparing preoperative clinical characteristics, intraoperative findings, and pathological outcomes between emergency and elective surgery groups. Through this comparison, we aimed

Table 2. Tumor characteristics and staging in emergency and elective surgery groups

	Total	Emergency (n=93)	Elective (n=263)	p
Localization Cecum Ascending colon Hepatic flexura	 124 (34.8%) 145 (40.7%) 87 (24.4%)	 28 (30.1%) 34 (36.6%) 31 (33.3%)	 96 (36.5%) 111 (42.2%) 56 (21.3%)	 0.067
Tumor differentiation, n (%) Well differentiated Moderately differentiated Poorly differentiated	 153 (43.0%) 165 (46.3%) 38 (10.7%)	 30 (32.3%) 44 (47.3%) 19 (20.4%)	 123 (46.8%) 121 (46.0%) 19 (7.2%)	 **0.001**
T stage, n (%) T1 T2 T3 T4	 15 (4.2%) 51 (14.3%) 183 (51.4%) 107 (30.1%)	 0 (0.0%) 2 (2.2%) 47 (50.5%) 44 (47.3%)	 15 (5.7%) 49 (19.6%) 136 (51.7%) 63 (24.0%)	 **<0.001**
N stage, n (%) N0 N1 N2	 162 (45.5%) 141 (39.6%) 53 (14.9%)	 31 (33.3%) 49 (52.7%) 13 (14.0%)	 131 (49.8%) 92 (35.0%) 40 (15.2%)	 **0.008**
M stage, n (%) M0 M1	 304 (85.4%) 52 (14.6%)	 66 (71.0%) 27 (29.0%)	 238 (90.5%) 25 (9.5%)	 **<0.001**
Angiolymphatic invasion, n (%) Negative Positive	 188 (52.8%) 168 (47.2%)	 41 (44.1%) 52 (55.9%)	 147 (55.9%) 116 (44.1%)	 0.054
Perineural invasion, n (%) Negative Positive	 294 (82.6%) 62 (17.4%)	 77 (82.8%) 16 (17.2%)	 217 (82.5%) 46 (17.5%)	 0.950
Tumor perforation, n (%) Negative Positive	 319 (89.6%) 37 (10.4%)	 61 (65.6%) 32 (34.4%)	 258 (98.1%) 5 (1.9%)	 **<0.001**

n: Number, p: Value, bold values indicate statistically significant p-values (p<0.05)

Table 3. Comparison of surgical techniques, lymph node dissection, and operative findings

	Total	Emergency (n=93)	Elective (n=263)	p
Operation performed, n (%) Right hemicolectomy Right hemicolectomy+ileostomy İleostomy, no resection	 319 (89.6%) 32 (9.0%) 5 (1.4%)	 58 (62.4%) 30 (32.3%) 5 (5.4%)	 261 (99.2%) 2 (0.8%) 0 (0.0%)	 **<0.001**
Surgical access, n (%) Laparoscopic Open Laparoscopic converted to open	 29 (8.1%) 299 (84.0%) 28 (7.9%)	 4 (4.3%) 75 (80.6%) 14 (15.1%)	 25 (9.5%) 224 (85.2%) 14 (5.3%)	 **0.005**
Total lymph nodes, median (range), number	35.5 (12-82)	34 (15-68)	36 (12-82)	0.501
Metastatic lymph nodes, median (range), number	1 (0-31)	1 (0-31)	0 (0-16)	**0.008**
Tumor size, median (range), cm	5.2 (0.3-19)	7 (2.8-11.5)	5 (0.3-19)	**<0.001**

n: Number, p: Value, cm: Centimetres, bold values indicate statistically significant p-values (p<0.05)

Table 4. Independent risk factors associated with emergency surgery (logistic regression analysis results)

	B	p	Exp (B)	CI	
ASA	-1.618	**<0.001**	0.198	0.094	0.417
Tumor differentiation	0.007	0.985	1.007	0.492	2.059
T stage	-1.020	**0.005**	0.361	0.177	0.734
N stage	0.924	**0.044**	2.520	1.025	6.192
M stage	-1.427	**0.014**	0.240	0.077	0.745
Tumor perforation	-5.021	**<0.001**	0.007	0.002	0.025
Operation performed	-6.253	**<0.001**	0.002	0.000	0.015
Surgical access	-0.877	0.141	0.416	0.130	1.336
Metastatic lymph nodes	-0.080	0.261	0.923	0.802	1.062
Tumor size	-0.220	**0.008**	0.803	0.683	0.943

p: Value, CI: Confidence interval, ASA: American Society of Anaesthetiologist, bold values indicate statistically significant p-values (p<0.05)

to identify factors that may influence prognosis and surgical outcomes.

Our findings indicate that 26.12% of patients undergoing right-sided colon cancer surgery required emergency intervention, which aligns with prior studies (9-11). The median age of our study population was 64 years (range: 22-90), with female patients accounting for 37.6% of the total. No significant differences were observed between the emergency and elective groups regarding age and gender distribution, which is consistent with the results of Banks et al. (9). However, previous studies suggest that elderly patients are more prone to emergency colorectal cancer presentations due to late-stage symptom onset and delayed diagnosis (12).

In terms of preoperative characteristics, we found that ASA scores were significantly higher in the emergency group, whereas CCI scores did not differ significantly between the groups. Banks et al. (9) reported similar findings regarding CCI scores, while noting no significant differences in ASA scores, which could be attributed to demographic variations among different study populations. A similar trend has been observed in studies conducted in Western European cohorts (13).

Surgical approaches differed significantly between the groups. In the elective surgery cohort, right hemicolectomy was the primary procedure (99.2%), whereas the rate of ileostomy procedures was notably higher in emergency cases (p<0.001). Regarding surgical access, emergency cases exhibited a higher frequency of open surgeries and a lower utilization of laparoscopic techniques (p=0.005). Additionally, laparoscopic-to-open conversion rates were higher among emergency surgeries. These findings align with established surgical trends, as emergency cases often present technical challenges that limit the feasibility of minimally invasive approaches. Conversely, laparoscopic surgery is more commonly performed in elective procedures due to enhanced preoperative preparation and patient optimization. Vallance et al. (14) reported a progressive increase, reaching 30%, in laparoscopic colorectal surgeries over six years, while in our study, the laparoscopic surgery rate among emergency cases was 19.35%, indicating relatively low utilization.

Lymph node dissection plays a critical role in colorectal cancer surgery. Although total lymph node counts did not differ significantly between groups, metastatic lymph node counts were significantly higher in the emergency cohort (p=0.008). Azin et al. (15) previously highlighted the higher likelihood of inadequate lymph node dissection in emergency colorectal surgeries. While our findings did not indicate a disparity in the total number of retrieved lymph nodes, the increased presence of metastatic lymph nodes in emergency cases suggests a more advanced disease state in these patients. Similar patterns have been observed in prior research (16). The absence of a difference in total lymph node counts between the groups may indicate a high level of surgical proficiency at our institution.

When tumor staging was analyzed, T4 tumors were significantly more prevalent in emergency cases (p<0.001), with higher frequencies also observed for N1 (p=0.008) and M1 stages (p<0.001). These findings are consistent with prior studies, which have demonstrated that emergency-diagnosed colorectal cancer cases are more likely to present at an advanced stage due to delayed detection (17,18). Interestingly, no significant difference was observed in CCI scores and perineural invasion rates between the emergency and elective groups. This finding suggests that the acute clinical presentation of right-sided colon cancer may be more closely associated with tumor aggressiveness and anatomical complications than with baseline comorbid status or perineural spread.

Our findings indicate that emergency colorectal cancer patients not only have lower survival rates but also exhibit higher frequencies of advanced tumor stages and metastatic disease. Most patients undergoing emergency surgery present with

complications such as intestinal obstruction, perforation, or severe bleeding, which delay diagnosis and worsen prognosis (19,20). Furthermore, inadequate lymph node dissection in emergency settings has been reported as a key factor negatively impacting survival outcomes (20). From a public health perspective, these findings underscore the importance of implementing effective colorectal cancer screening programs. Early detection through screening may reduce emergency presentations and allow for more favorable outcomes through timely elective interventions.

These results suggest that both the late-stage diagnosis of emergency colorectal cancer cases and the constraints of urgent surgical intervention contribute to poorer prognoses (12). Early detection remains a critical factor in reducing emergency surgeries and improving patient outcomes. Tumor perforation rates were markedly higher in emergency cases (34.4%) compared to elective cases (1.9%) ($p<0.001$), consistent with previous findings by Banks et al. (9).

Binary logistic regression analysis identified several independent factors significantly associated with emergency surgery. A higher ASA score was a strong predictor of emergency intervention [$p<0.001$, odds ratio (OR): 0.198, 95% confidence interval (CI): 0.094-0.417]. Additionally, advanced T stage ($p=0.005$, OR: 0.361, 95% CI: 0.177-0.734) and higher N stage ($p=0.044$, OR: 2.520, 95% CI: 1.025-6.192) were significantly correlated with emergency presentation. The presence of metastatic disease (M stage) was also associated with an increased likelihood of emergency surgery ($p=0.014$, OR: 0.240, 95% CI: 0.077-0.745). Tumor perforation was the strongest predictor of emergency surgery ($p<0.001$, OR: 0.007, 95% CI: 0.002-0.025). Additionally, the type of surgical procedure performed was found to be significantly linked to the likelihood of emergency intervention ($p<0.001$, OR: 0.002, 95% CI: 0.000-0.015). Lastly, larger tumor size was also associated with an increased need for emergency surgery ($p=0.008$, OR: 0.803, 95% CI: 0.683-0.943).

This study has several notable strengths and limitations. One of its key strengths is the relatively large sample size (n=356), which enhances statistical power. Additionally, it provides a comprehensive comparison of emergency and elective colorectal surgeries, focusing not only on clinical factors but also on pathological outcomes, thereby making a significant contribution to the literature. The inclusion of multivariate logistic regression analysis further strengthens the study by identifying independent risk factors associated with emergency surgery, offering valuable insights into high-risk patient profiles.

Study Limitations

The study also has certain limitations. As a retrospective analysis, it is inherently susceptible to selection bias and potential missing data. Moreover, the study was conducted at a single center, which may limit the generalizability of its findings. Another significant limitation is the lack of long-term oncologic outcomes, as survival data were unavailable. Consequently, the impact of emergency and elective surgical approaches on long-term prognosis remains unclear. Future prospective, multicenter studies with extended follow-up periods are needed to validate these results and provide deeper insights into emergency colorectal cancer management.

CONCLUSION

This study highlights the differences in clinical, intraoperative, and pathological outcomes between emergency and elective right-sided colon cancer surgeries. Patients undergoing emergency surgery had more advanced tumors, higher rates of tumor perforation, and greater metastatic lymph node involvement. Additionally, laparoscopic surgery was significantly less common, while open surgery was more frequently performed in emergency cases. These findings suggest that right-sided colon cancer patients requiring emergency intervention present with worse prognostic features and pose greater challenges in surgical management.

According to multivariate analysis, higher ASA score, advanced T, N, M stages, tumor perforation, tumor size and the type of surgical procedure performed were significantly associated with emergency surgery. These results emphasize the importance of optimal surgical techniques, even in cases where emergency intervention is unavoidable.

Early detection of colorectal cancer can significantly improve survival and oncologic outcomes by reducing the proportion of patients requiring emergency surgery. The implementation of regular screening programs and optimized management of high-risk patients can enhance surgical outcomes and long-term prognosis. Future prospective, multicenter studies are necessary to validate these findings and explore additional strategies for improving emergency colorectal cancer management.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Ethics Committee of Gazi University Faculty of Medicine in accordance with the principles outlined in the Declaration of Helsinki (approval no: 17.07.2023-597, date: 17.07.2023).

Informed Consent: Signed informed consent forms were obtained from all patients.

Footnotes

Author Contributions

Surgical and Medical Practices - Y.F.A., E.G., Ç.B., M.A.; Concept - Y.F.A., Ç.B., M.A.; Design - E.G., Ç.B.; Data Collection or Processing - Y.F.A., E.G.; Analysis or Interpretation - Y.F.A., Ç.B.; Literature Search -Y.F.A., E.G., Ç.B.; Writing - Y.F.A., E.G.

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