

Oncological outcomes of elective versus emergency surgery for colon cancer: A tertiary academic center experience

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Abstract

Background: In this study, we aimed to identify the oncological outcomes in colon cancer patients who underwent elective versus emergency curative resection.

Methods: All patients who underwent curative resection for colon cancer between July 2015 and December 2019 were retrospectively reviewed and analyzed. Patients were divided into two groups based on the presentation into elective and emergency groups.

Results: A total of 215 patients with colon cancer were admitted and underwent curative surgical resection. Of those, 145 patients (67.4%) were elective cases, and 70 (32.5%) were emergency cases. Family history of malignancy was positive in 44 patients (20.5%) and significantly more common in the emergency group ($P = 0.016$). The emergency group had higher T and TNM stages ($P = 0.001$). The 3-year survival rate was 60.9% and significantly less in the emergency group ($P = 0.026$). The mean duration from surgery to recurrence, 3-year disease-free survival, and overall survival were 1.19, 2.81, and 3.11, respectively.

Conclusion: Elective group was associated with better 3-year survival, longer overall, and 3-year disease-free survival compared to the emergency group. The disease recurrence rate was comparable in both groups, mainly in the first two years after curative resection.

Keywords: Colon cancer, oncological outcomes, overall survival, prognostic variables

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INTRODUCTION

Colorectal cancer (CRC) is a significant cause of morbidity and mortality worldwide. It is the third most common cancer and the second most common cause of death globally.^[1] In Saudi Arabia, CRC remains the second most common cancer, according to the Saudi Cancer Registry Report.^[2] However, the incidence of CRC cancer in Saudi Arabia has increased significantly in the last two decades,

which can be justified by the increased consumption of Western diet and partially by the natural increase in the elderly population.^[3,4]

Despite ongoing efforts in prevention, screening, and early detection, previous studies from the region have shown that emergency presentations of CRC, including intestinal

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obstruction, perforation, and hemorrhage have ranged from 21% to as high as 45%.^[5-9] Arguably, recent studies have shown that optimal levels of awareness regarding CRC have not been reached, and intensive efforts coupled with focused strategies need to be implemented.^[10-13] This also could account for the low survival rate (44.6%) in Saudi Arabia, in comparison to the survival rate worldwide (70% to 90%), as patients tend to have a late presentation, which might be attributed to the lack of a national program for screening of CRC.^[3,4,14] In terms of short and long-term oncological outcomes in emergency presentations of CRC, contradictory results are reported in the literature.^[15-20] This study aims to identify the oncological outcomes in elective versus emergency presentation of colon cancer in patients who underwent curative resection.

PATIENTS AND METHODS

With the approval of the Institutional Review Board (IRB) at King Saud University, we retrospectively reviewed the medical records of all patients with colon cancer at King Saud University Medical City (KSUMC), an academic medical institution in Riyadh, Saudi Arabia.

Patients who underwent curative resection between July 2015 and December 2019 were included in the study. Patients managed palliatively and patients with peritoneal metastasis who underwent curative cytoreductive surgery and hyperthermic intraperitoneal chemotherapy were excluded. Patients were divided into two groups, based on the presentation, into elective and emergency groups.

Data abstracted included the stage at presentation, baseline demographics, clinical and laboratory data, and clinical and pathological oncological parameters. In addition, prognostic variables toward survival were also collected and analyzed.

Management pathway

All elective cases were investigated and presented in our center by the colorectal team to the multidisciplinary tumor board meeting for the oncological plan. All elective cases were operated on and followed by qualified colorectal surgeons.

On the other hand, cases presenting in an emergency manner were approached and managed initially by the general surgery on-call team. Then, if needed, the colorectal consultant on-call was involved in the management. Next, the colorectal team reviewed and managed all emergency cases the following working day. Finally, the colorectal team presented all cases in the multidisciplinary tumor board meeting for further management plan.

Postoperative follow-up

All cases were followed for five years by the colorectal team for surveillance. The medical oncology team were involved in the follow-up if the patient received medical therapy. The patients were followed with clinical and laboratory assessment every three months for the first two years, then every six months for the third year. For the last two years, patients were evaluated once yearly. CT chest, abdomen, and pelvis were done annually for five years. Colonoscopy was performed in the first, third, and fifth years. Early colonoscopy at 3 to 6 months was performed if the patient did not have a complete colonoscopy upon presentation. Lastly, the patients were discussed in the tumor board for any suspicion or presence of recurrence.

Power analysis

We calculated the statistical power to compare between emergency ($n = 70$) and elective ($n = 145$) groups. Based on our results, given the sample of each group with a minimum value of 0.80, the *post hoc* test of power ($1-\beta$ err prob) has a result of 0.928% or 92.8%, which was above the minimum limit. Hence, the achieved power for this particular statistical test with a parameter of 2-tailed and medium effect size with alpha 0.05, the sample size of emergency cases equaling 70, and the sample size of elective cases 145 are sufficient.

Statistical analysis

Descriptive statistics were summarized as numbers, percentages, and mean $\pm$ standard deviation. Between comparisons, the Chi-square test, Fischer Exact, independent sample *t*-test, and Mann-Whitney U-test were applied. Univariate and multivariate regression analyses were performed among the significant cross-tabulation results to determine the prognostic variables for overall survival with corresponding odds ratios and a 95% confidence interval. Normality tests were performed using the Shapiro-Wilk test and the Kolmogorov-Smirnov test. A *P* value of < 0.05 was considered statistically significant. The data were analyzed using Statistical Packages for Social Sciences (SPSS) version 26 (Armonk, NY: IBM Corp).

RESULTS

Between July 2015 and December 2019, 215 patients with colon cancer were admitted and underwent curative surgical 145 (67.4%) underwent elective surgery, and 70 (32.5%) were admitted through the emergency department and underwent surgery. Of those, 61 patients presented with colonic obstruction, and nine presented with perforation.

Baseline patients' characteristics are given in Table 1. Patients diagnosed through screening colonoscopy without symptoms constituted 12 cases (5.6%). Family history of malignancy was positive in 44 patients (20.5%) and significantly more common in the emergency group ($P = 0.016$). The most common tumor site was sigmoid colon in both groups (38.6%). However, ascending colon cancer was significantly lower in the emergency group ($P = 0.048$). Synchronous colon cancers were present in 12 patients (5.6%). Twenty-four (11.2%) presented with metastasis. Laparoscopic surgery was done in 160 patients (74.4%) and was significantly higher in the elective group ($P < 0.001$).

Oncological parameters are presented in Table 2. The emergency surgery group had a higher T stage ($P = 0.001$). TNM Stage 2 was significantly higher in the emergency group ($P = 0.001$), while TNM stage 3 was similar between both groups.

Oncological outcomes are given in Table 3. The local and distant recurrence rate was 22.3%. The 3-year survival rate was 60.9% and significantly less in the emergency group ($P = 0.026$). The mean duration in years of surgery to recurrence, 3-year disease-free survival, and overall survival were 1.19, 2.81, and 3.11, respectively. Elective surgery patients were associated with longer overall survival and 3-year disease-free survival. Kaplan-Meier survival curves for survival and disease-free survival are displayed in Figures 1 and 2. The overall survival was significantly longer

in the elective surgery group (4.93 years) compared to the emergency group (4.13 years), $P = 0.025$ as seen in Figure 1.

Baseline factors of survival on univariate analysis are shown in Table 4. The significant factors on univariate analysis were analyzed in multivariate regression model, as shown in Table 5. Compared to TNM stage 1, the chance of survival for patients with TNM stage 3 was predicted to decrease by at least 71% (OR = 0.29; 95% CI = 0.09–0.89; $P = 0.032$) and 77% in stage 4 patients (OR = 0.23; 95% CI = 0.07–0.74; $P = 0.014$). In addition, patients with lymphovascular invasion were found to have a decreased chance of survival by 72% (OR = 0.28; 95% CI = 0.11–0.69; $P = 0.006$). Also, a slight increase in the chance of survival was observed with increasing age by at least 1.05 times (OR = 1.05; 95% CI = 1.01–1.09; $P = 0.006$). However, these results did not reach statistical significance after conducting a multivariate regression model. Moreover, patients who used neo-adjuvant therapy were also found to have decreased survival by almost 85% (OR = 0.15; 95% CI = 0.04–0.49; $P = 0.002$) and by at least 84% after adjustment to the regression model (AOR = 0.16; 95% CI = 0.03–0.79; $P = 0.026$). Finally, increasing ASA level was associated with a decreased chance of survival, which was significantly different in univariate regression among severe cases (OR = 0.25; 95% CI = 0.09–0.68; $P = 0.007$); after conducting a multivariate regression model, the results did not reach statistical significance ($P > 0.05$).

Table 1: Baseline characteristics of the patients according to presentation

Parameters	Overall (n=215)	Emergency (n=70)	Elective n (n=145)	P
Age (years)	59.6±13.4	58.9±14.2	56.9±13.1	0.300
Gender				
Male	128 (59.5%)	38 (54.3%)	90 (62.1%)	0.276
Female	87 (40.5%)	32 (45.7%)	55 (37.9%)	
BMI (kg/m ²)	27.8 ± 5.49	27.9±5.87	27.7±5.31	0.718
ASA score	2.25 ± 0.71	2.41±0.75	2.18±0.69	0.031 **
Smoking	20 (9.3%)	04 (5.7%)	16 (11.0%)	0.316
Screening colonoscopy	12 (5.6%)	0	12 (8.3%)	0.010 **
Family history of cancer	44 (20.5%)	21 (30.0%)	23 (15.9%)	0.016 **
CEA	40.1 ± 173.7	61.6±190.9	30.9±5.61	0.264
Tumor site*				
Rectal sigmoid junction	37 (17.2%)	11 (15.7%)	26 (17.9%)	0.847
Sigmoid colon	83 (38.6%)	33 (47.1%)	50 (34.5%)	0.074
Descending colon	39 (18.1%)	15 (21.4%)	24 (16.6%)	0.385
Transverse colon	15 (7.0%)	04 (5.7%)	11 (7.6%)	0.778
Ascending colon	26 (12.1%)	04 (5.7%)	22 (15.2%)	0.048 **
Cecum	27 (12.6%)	05 (7.1%)	22 (15.2%)	0.096
Metastasis upon presentation	24 (11.2%)	07 (10.0%)	17 (11.7%)	0.707
Site of distant metastasis				
Liver	19 (8.8%)	05 (7.1%)	14 (9.7%)	0.739
Lung	01 (.50%)	0	01 (0.70%)	
Liver and lung	04 (1.9%)	02 (02.9%)	02 (1.4%)	
Surgical approach				
Laparoscopic	160 (74.4%)	40 (57.1%)	120 (82.8%)	<0.001**
Open	55 (25.6%)	30 (42.9%)	25 (17.2%)	
Follow up in years	3.31±1.69	2.80±1.76	3.26±1.86	0.085

Data presented as n (%), or mean ± standard deviation. *Some patients have multiple tumor sites. **Significant at $P < 0.05$ level

Table 2: Oncological parameters according to the presentation (n=215)

Parameters	Overall (n=215)	Emergency (n=70)	Elective (n=145)	P
T stage				
T1	07 (3.3%)	0	07 (4.8%)	0.001*
T2	38 (17.7%)	05 (7.1%)	33 (22.8%)	
T3	135 (62.8%)	48 (68.6%)	33 (22.8%)	
T4	35 (16.3%)	17 (24.3%)	18 (12.4%)	
Lymph dissected	21.7±10.2	20.8±8.97	22.1±10.7	0.357
<12 nodes	13 (6.0%)	06 (8.6%)	07 (4.8%)	0.280
≥12 nodes	202 (94.0%)	64 (91.4%)	138 (95.2%)	
Positive nodes	99 (46.0%)	30 (42.9%)	69 (47.6%)	0.514
TNM Stage				
Stage 1	34 (15.8%)	03 (4.3%)	31 (21.4%)	0.001*
Stage 2	76 (35.3%)	35 (50.0%)	41 (28.3%)	
Stage 3	81 (37.7%)	25 (35.7%)	56 (38.6%)	
Stage 4	24 (11.2%)	07 (10.0%)	17 (11.7%)	
Radial margin involvement	03 (1.4%)	02 (2.9%)	01 (0.70%)	0.248
Proximal and distal margin involvement	01 (0.50%)	01 (1.4%)	0	0.326
Lymphovascular invasion	61 (28.4%)	20 (28.6%)	41 (28.3%)	1.000
Perineural invasion	51 (23.7%)	22 (31.4%)	29 (20.0%)	0.086
Differentiation				
Well	04 (1.9%)	0	04 (2.8%)	0.068
Moderate	203 (94.4%)	65 (92.9%)	138 (95.2%)	
Poor	08 (3.7%)	05 (7.1%)	03 (2.1%)	
Mucinous	27 (12.6%)	13 (18.6%)	14 (9.7%)	0.064
Signet ring cell	05 (2.3%)	03 (4.3%)	02 (1.4%)	0.333
Chemotherapy				
Neo-adjuvant therapy	13 (6.0%)	04 (5.7%)	09 (6.2%)	1.000
Adjuvant therapy	124 (57.7%)	45 (64.3%)	79 (54.5%)	0.188

##Data presented as n (%), or mean ± standard deviation. *Significant at $P < 0.05$ level

DISCUSSION

Emergency presentation of colon cancer is documented to have unfavorable oncological outcomes.^[21] Many studies have found that emergency presentations are more likely to be encountered in older patients with advanced TNM stage, histologic grade, lymphovascular invasion, and who receive care from a non-specialist surgeon.^[15-20] Furthermore, emergency resection is associated with a higher risk of recurrence and death.^[21-24] Therefore, the main goal of our study is to identify the oncological outcomes of emergency and elective presentation of colon cancer.

Previous local studies showed that emergency presentations of CRC, including intestinal obstruction, perforation,

and hemorrhage, have ranged from 21% to as high as 45%.^[5-9] The latest study by Albalawi *et al.*,^[5] showed that 30.6% of patients with CRC had an emergency presentation, of which 40% had advanced disease with metastasis compared to 25.2% for elective presentation. In this study, 32.5% of the patients were in the emergency group. T stage was significantly higher in the emergency group ($P = 0.001$); however, the lymph node metastasis was comparable in both groups. Although we included only patients who underwent curative resection, there were 24 patients (11.2%) who presented initially with distant metastasis.

The published literature has shown mixed results regarding short and long-term survival in emergency presentations in

Table 3: Oncological outcome according to presentation

Parameters	Overall (n=215)	Emergency (n=70)	Elective (n=145)	P
Recurrence				
Local	02 (0.90%)	02 (2.9%)	0	0.105
Distant	46 (21.4%)	18 (25.7%)	28 (19.3%)	0.292
Site of distant metastasis				
Liver	26 (12.1%)	09 (12.9%)	17 (11.7%)	0.826
Lung	16 (7.4%)	05 (7.1%)	11 (7.6%)	1.000
Peritoneum	06 (2.8%)	03 (4.3%)	03 (2.1%)	0.394
Ovaries	03 (1.4%)	01 (1.4%)	02 (1.4%)	1.000
3-year survival rate	131 (60.9%)	35 (50.0%)	96 (66.2%)	0.026*
Surgery to recurrence in years	1.19 ± 1.02	1.29 ± 1.18	1.11 ± 0.90	0.600
3-year disease-free survival	2.81 ± 1.93	2.49 ± 1.83	2.97 ± 1.96	0.087
Overall survival in years	3.11 ± 1.83	2.57 ± 1.48	3.12 ± 1.51	0.085

Data presented as n (%), or mean ± standard deviation. *Significant at $P < 0.05$ level

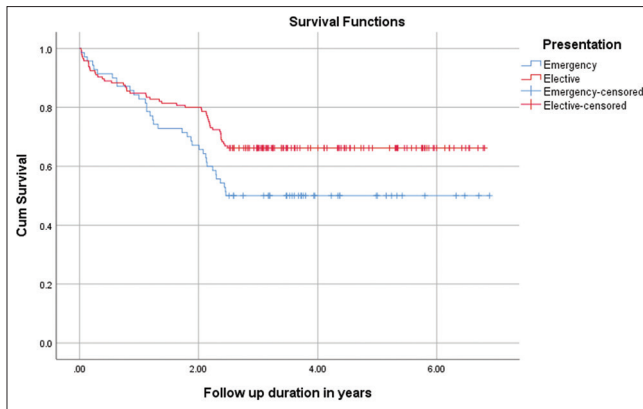


Figure 1: Survival plot according to presentation. The mean survival time for emergency patients was 4.13 years, while elective patients' mean survival time was 4.93 years ($P = 0.025$)

patients with CRC.^[17,21,24,25] In this study, the 3-year survival rate of colon cancer was 60.9%, and significantly less in the emergency group (50%) in comparison to the elective group (66.2%, $P = 0.026$). When comparing emergency to elective cases, elective patients were associated with longer

Table 4: Clinical and histological factors of survival (n=215)

Factor	Survival (n=193)	Non-survival (n=22)	P
Age (years)	56.7±13.2	65.2±13.8	0.005*
Smoking	19 (9.8%)	01 (4.5%)	0.701
Type of Presentation			
Emergency	59 (30.6%)	11 (50.0%)	0.065
Elective	134 (69.4%)	11 (50.0%)	
Site of tumor			
Rectal sigmoid junction	34 (17.6%)	03 (13.6%)	0.774
Sigmoid colon	71 (36.8%)	12 (54.5%)	0.112
Descending colon	34 (17.6%)	05 (22.7%)	0.562
Transverse colon	14 (7.3%)	01 (4.5%)	1.000
Ascending colon	25 (13.0%)	01 (4.5%)	0.486
Cecum	26 (13.5%)	01 (4.5%)	0.323
Type of surgery			
Laparoscopic	146 (75.6%)	14 (63.6%)	0.300
Open	47 (24.4%)	08 (36.4%)	
TNM stage			
Stage 1	34 (17.6%)	0	0.005*
Stage 2	68 (35.2%)	08 (36.4%)	
Stage 3	74 (38.3%)	07 (31.8%)	
Stage 4	17 (8.8%)	07 (31.8%)	
Margin	0	01 (4.5%)	0.102
Lymphovascular invasion	49 (25.4%)	12 (54.5%)	0.010*
Perineural invasion	46 (23.8%)	05 (22.7%)	1.000
Mucinous	26 (13.5%)	01 (04.5%)	0.323
Positive nodes	86 (44.6%)	13 (59.1%)	0.259
Differentiation			
Well	04 (2.1%)	0	0.236
Moderate	183 (94.8%)	20 (90.9%)	
Poor	06 (3.1%)	02 (9.1%)	
Chemotherapy			
Neo-adjuvant therapy	08 (4.1%)	05 (22.7%)	0.005*
Adjuvant therapy	112 (58.0%)	12 (54.5%)	0.821
ASA classification			
Normal (ASA-1)	25 (13.1%)	02 (9.1%)	0.014*
Mild (ASA-2)	105 (55.0%)	06 (27.3%)	
Severe (ASA ≥3)	61 (31.9%)	14 (63.6%)	

Data presented as n (%), or mean ± standard deviation. *Significant at $P < 0.05$ level

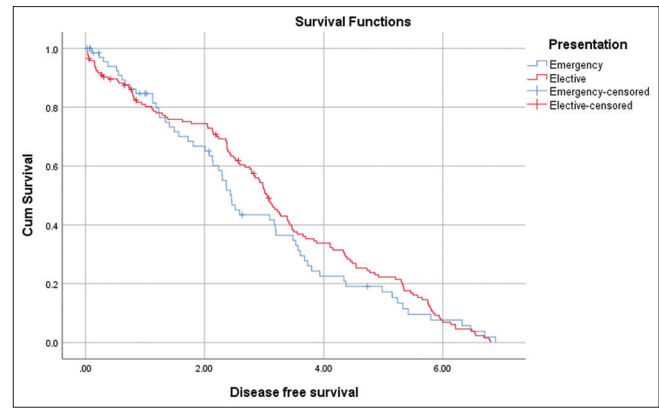


Figure 2: Survival plot for disease-free survival according to presentation. The disease-free survival for emergency surgery patients was 2.86 and 3.17 years for elective patients ($P = 0.464$)

overall survival (3.12 years versus 2.57 years, $P = 0.085$) and 3-year disease-free survival (3.12 years versus 2.57 years, $P = 0.087$). Similarly, Wanis *et al.*^[21] evaluated the impact of emergency resection for colon cancer on disease-free and overall patient survival and found that the 5-year disease-free survival for those who had emergency surgery was 63% (95% CI 54%–72%) compared to 83% (95% CI 81%–86%) for patients who had elective surgery. In addition, those who had emergency resection had poorer 5-year overall survival [50% (95% CI 42%–59%) versus 72% (95% CI 69%–75%)]. Another study by Xu *et al.*^[17] showed that the 5-year overall survival was 64.0% for those with an elective resection versus 57.7% for those with an emergency resection. A recent systematic review and meta-analysis showed that tumor location, differentiation, stage, lymphovascular invasion, perineural invasion, ethnicity, and ASA grade differed significantly between the elective and emergency surgery groups.^[26] Our results have shown similar differences between the two groups in terms of TNM stage, lymphovascular invasion, impact of neoadjuvant chemotherapy, age, and ASA score.

On the contrary, a study by Lavanchy *et al.*^[24] investigated long-term outcomes in patients undergoing emergency versus elective resection for CRC and showed that five-year survival (aHR 1.38; 95% CI 0.81–2.37, $P = 0.237$) or local tumor recurrence (aHR 1.48; 95% CI 0.47–4.66, $P = 0.500$) were not significantly different in patients undergoing emergency versus elective surgery for CRC. Nevertheless, in-hospital mortality was significantly higher in the emergency CRC versus the elective CRC group (8.4% versus 3%, $P = 0.023$). However, when adjusting for the effect of ASA score, tumor localization, operative strategy, and neoadjuvant chemo- and radiotherapy, in-hospital mortality was not significantly different. Additionally, Weixler *et al.*^[25] revealed that after

Table 5: Multivariate analysis of prognostic variables for overall survival (n=215)

Factor	OR (95% CI)	P	AOR (95% CI)	P
Age	1.05 (1.01-1.09)	0.006**	1.03 (0.99-1.07)	0.187
TNM stage				
Stage 1	Ref		Ref	
Stage 2	-	-	-	-
Stage 3	0.29 (0.09-0.89)	0.032**	0.98 (0.23-4.27)	0.980
Stage 4	0.23 (0.07-0.74)	0.014**	0.50 (0.13-1.99)	0.326
Lymphovascular invasion	0.28 (0.11-0.69)	0.006**	0.18 (0.01-28.6)	0.508
Neo-adjuvant therapy	0.15 (0.04-0.49)	0.002**	0.14 (0.03-0.70)	0.016**
ASA classification				
Normal (ASA-1)	Ref		Ref	
Mild (ASA-2)	0.35 (0.07-1.65)	0.183	0.47 (0.07-2.94)	0.420
Severe (ASA ≥3)	0.25 (0.09-0.68)	0.007**	0.32 (0.09-1.09)	0.070

AOR - Adjusted Odds ratio; CI - Confidence Interval. ** Significant at $P < 0.05$ level

the adjustment for potential confounding risk factors, clinical circumstances cause worse oncologic outcomes after an urgent operation for CRC and not due to the urgent operation itself.

This study has several limitations. One of these limitations is that this study is a retrospective cohort study; thus, potential bias exists. Furthermore, this study only included patients from one tertiary care institution. Therefore, multi-center studies with larger sample sizes are warranted to generalize these results.

In conclusion, patients who present electively have a significantly better 3-year survival rate and prolonged 3-year disease-free survival compared to the emergency group. Older patients, higher ASA scores, advanced TNM stage, presence of lymphovascular invasion, and patients who received neo-adjuvant therapy were associated with worse overall survival. Initiating a national colon cancer screening program might help in early cancer detection and improving oncological outcomes.

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Conflicts of interest

There are no conflicts of interest.

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