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Original Article

Outcomes of Elective vs. Emergency Right Colectomy in Octogenarians – An Important Aspect for Decision Making in Older Adults

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SUMMARY

Objectives: To depict and compare short- and long-term outcomes of elective vs. emergency right colectomy of octogenarian patients.
Methods: A retrospective cohort study of octogenarians who underwent elective or emergency right colectomy for cancer. Post-operative outcomes as well as long-term survival were compared between the two groups.
Results: Overall, 107 patients underwent surgery (21 urgent, 86 elective). Patients at the emergency surgery group were older than at the elective group (median age of 86.9 vs. 83.3 y, respectively, p = 0.004). More patients in the emergency surgery group had dementia (19% vs. 5.8%, p = 0,058), were living in long-term care facilities (19% vs. 2.3% respectively; p = 0.013), were functionally dependent (57.1% vs. 19.0%, p = 0.021) and had advance disease stage (p = 0.001). They had higher rates of post-operative mortality (19% vs. 1.2%, p = 0.009) and complications (71.4% vs. 31.6%, p = 0.002) rates. Mean survival was 31.2 ± 4.6 months in emergency surgery and 60.9 ± 3.3 months in elective surgery (p < 0.001). Surgery timing, stage of disease and functional status were associated with lower survival on multivariate analysis.
Conclusion: Short- and long-term outcomes of emergency surgeries in octogenarians operated for right colon cancer were significantly worse as compared to outcomes of elective surgeries. Unsurprisingly and yet, these grim outcomes should be highlighted when discussing treatment options with patients in this age group and their families.

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1. Introduction

Cancer and aging share common biology and metabolism which may explain the increase incidence of cancer among older people.[1,2] Decrease functional reserve status and emergency surgery have been recognized as major risk factors for poor surgical outcomes and mortality.[3] There is often a dilemma how to pursue diagnosis and treatment of cancer in older adults, as for some cases, increased risk of postoperative morbidity and mortality have led surgeons and care-givers to delay and even avoid surgery when needed for best cancer care.[4]

Colorectal cancer is the fourth most common type of cancer in the general population and is a heterogeneous disease.[5] There is a controversy as to whether tumor location in the colon affects the prognosis.[6–8] Data regarding oncological outcome of right versus left colon cancer are equivocal. Warschkow et al. reported a better survival rate in right-sided tumors compared to left-sided ones.[6] On the other hand, Lee et al. recently reported on a large series of colectomies and demonstrated a lower survival rate after right colectomies for cancer.[7] These differences in survival rates are attributed to differences in underlying genetic mutations or may be due to different surgical techniques regarding the level of vascular ligation and the number of dissected lymph nodes.[6,7] Therefore, when evaluating the outcomes of colectomies in older patients we can reduce some of these biases by choosing a more homogenous group of patients with right-sided colon cancer only.

Acute presentation of colon cancer may affect the prognosis due to a potentially higher post-operative mortality and a higher rate of complications that may deny patients from adjuvant chemotherapy if needed.[9] In addition, surgery in older adults and specifically in octogenarians with reduced physiological reserve may have an increased risk of complications and reduced quality of life. In recent years, an emphasis had been made on having standard conversations and shared decision treatment plans in order to make sure that the surgery aligns with the patients' goals of care.[1,2] Currently, the guidelines advocate screening colonoscopies in adults aged 76–85 according to patient preferences, life expectancy, health status, and prior screening history. In addition, clinicians discourage individuals older than 85 years from continuing colorectal cancer screening.[10,11] As so, most colonoscopies in advanced age are performed for a diagnostic purpose and not as part of a screening plan.

We have previously shown that acute presentation due to obstruction or perforation is more frequent in older patients, with

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emergency right colectomy surgery performed in 30% of older patients compared to 9.5% in a younger cohort.[12] These findings concur with the results of other studies, which emphasize the strong negative influence of emergency surgery on clinical outcomes.[3]

The importance of addressing and discussing patients' preferences and goals as part of the process of decision-making is being increasingly acknowledged in recent years.[13] It is particularly important in older patients with cancer where the issues of longevity, quality of life and preserving independence after surgery are paramount for informed decision-making.[14]

In this study, we evaluated the short- and long-term outcomes of octogenarians who underwent elective right colectomy for cancer as compared to emergency surgery.

2. Patients and methods

2.1. Study design

This is a retrospective cohort study of all patients aged 80 years and above who underwent surgery for right colon cancer between January 2012 and December 2018 at Rabin Medical Center. The study was approved by the Rabin Medical Center Institutional Review Board (IRB) (RMC 0441-17). Due to the minimal risk nature of this study, the need for informed consent was waived by the IRB. We kept patients' confidentiality through data collection and analysis by replacing protected personally identifiable information with research identification codes (ID codes).

2.2. Patient population

All patients aged 80 years and above with a diagnosis of primary right colon cancer, who underwent any surgery (curative or palliative) in any approach (open or minimal-invasive approach) were included in the analysis. Exclusion criteria: patients with cancer of the left colon, sigmoid colon or rectum; those with recurrent malignancy; and those who had undergone a colectomy for a non-cancer etiology.

Right colectomy was defined as any resection extending from the terminal ileum to the left transverse colon. Surgery included reconstruction of the GI tract by an ileo-colic anastomosis when feasible or a creation of an end ileostomy. Postoperative complications were classified according to the Clavien-Dindo Classification.[15] Peri-operative mortality was defined as any in-hospital death or death occurring within 30 days after operation. Peri-operative outcomes analysis included patients' demographics, co-morbidities, functional status, mode of presentation, stage of disease, type of operation, post-operative morbidity and mortality, and need for prolonged nursing care. Long-term follow-up (up to 79 months) analysis included adjuvant oncological treatment, overall survival and cause of death.

The study group included patients who underwent surgery on an emergency basis and the control group included patients who underwent a planned elective surgery. Resections were designated as emergency surgeries in patients who had been admitted with obstructed or perforated colon cancer. These patients underwent a surgical procedure within 24 hours of admission.

2.3. Endpoints

Primary endpoint was the occurrence of postoperative complications and mortality. Secondary endpoint was long-term survival after surgery.

2.4. Statistical analysis

Data was analyzed using the Statistical Package for the Social Sciences (IBM SPSS Statistics 25) statistical program.

Chi-square test of independence was used to test for an association between two categorical variables. For small samples it was replaced by Fisher's exact test. The Kolmogorov-Smirnov normality test was used to test if a variable followed a normal distribution. Student's t-test was used to test for a difference between the means of two groups on a normal continuous dependent variable. In the case of non-normal distribution, the Mann-Whitney U test was used instead. Univariable logistic regressions tested the associations between the long-term survival and preselected by clinical relevance variables: (1) cancer stage, (2) functional status, (3) comorbidities, (4) home residency prior to surgery. Inclusion into the multivariable analysis was based on predetermined variables considered to be clinically relevant with the exclusion of variables that presented with a very low (< 5) event rate, and consequently led to unstable estimates due to overestimated standard deviation. The Kaplan-Meier method was used to calculate survival distributions and to compare the survival distributions of independent groups. Cox regression was used to compare the survival distributions of independent groups while controlling for other variables and estimating their effect on the survival distribution. P-values were corrected for multiple comparisons using the Benjamini-Hochberg (BH) procedure. A p-value $\leq$ 0.05 was considered statistically significant.

3. Results

A total of 107 consecutive octogenarian patients (mean age 84 $\pm$ 3.8 years) with right colon cancer were operated on during the study period. Follow-up period was 3–79 months (mean 28.7 $\pm$ 21.3 months). Twenty-one (19.6%) patients who underwent an emergency operation (15 patients due to obstruction and 6 due to perforation) were compared to 86 (80.4%) patients who were scheduled for an elective surgery. The group that underwent emergency surgery had significantly older patients with a median age of 86.9 years as compared to the median age in the elective surgery group that was 83.3 years (p = 0.004).

Baseline characteristics of the study groups are summarized in Table 1. There were more patients with a diagnosis of dementia in the emergency surgery group compared to the elective surgery group (19% versus 5.8%, respectively; p = 0.058). There were no differences in baseline comorbidities including: diabetes, hypertension, ischemic heart disease, congestive heart failure, atrial fibrillation, cerebrovascular disease, chronic kidney disease and chronic obstructive lung disease between the two groups (all p > 0.05). Patients in the emergency surgery group were more likely to come from a nursing home as compared to the elective surgery group (19% versus 2.3% respectively; p = 0.013) and were less independent in basic function of daily living (42.9% versus 70.9%, respectively; p = 0.021). Pre-operative hemoglobin level was higher in the emergency surgery group compared to the elective surgery group (11.7 g/dL versus 10.8 g/dL, respectively, p = 0.042). Nutritional variables such as body mass index and albumin were similar between the groups.

Operative characteristics are summarized in Table 2. Surgical approach (open vs. laparoscopic surgery) was significantly different between the two groups. While only one patient (4.8%) in the emergency surgery group underwent laparoscopic surgery, 64 patients in the elective surgery group (74.4%) had laparoscopic surgery (p < 0.001). There was no significant difference in operation length between the two groups. Peri-operative mortality was significantly

Table 1
Baseline pre-operative characteristics.

	Emergency operations (n = 21)	Elective operations (n = 86)	p value*
Median age (range) in years	86.9 (80–100)	83.3 (80–92)	0.004
Female/male ratio	14/7	39/47	NS
With no co-morbidities, n (%)	4 (19%)	20 (23.3%)	NS
Co-morbidities, n (%)			
Dementia	4 (19%)	5 (5.8%)	0.058
Hypertension	14 (66.7%)	59 (68.6%)	NS
Ischemic heart disease	8 (38.1%)	24 (27.9%)	NS
Atrial fibrillation	7 (33.3%)	17 (19.8%)	NS
Congestive heart failure	2 (9.5%)	7 (8.1%)	NS
Diabetes mellitus	7 (33.3%)	23 (26.7%)	NS
Chronic lung disease	0	10 (11.6%)	NS
Chronic kidney disease	1 (4.8%)	10 (11.6%)	NS
Cerebral-vascular disease	3 (14.3%)	6 (7%)	NS
Residency, n (%)			0.013
Home	17 (81%)	84 (97.7%)	
Institution	4 (19%)	2 (2.3%)	
Functional status (based on ADL), n (%)			0.021
Independent	9 (42.9%)	61 (70.9%)	
Partially dependent	7 (33.3%)	15 (17.4%)	
Nursing home resident	5 (23.8%)	10 (11.6%)	
Other, mean ± SD			
BMI	27.3 ± 6.0	26.0 ± 3.9	NS
Albumin	3.7 ± 0.4	3.6 ± 0.6	NS
Hemoglobin	11.7 ± 1.7	10.8 ± 1.9	0.042
WBC	10.4 ± 4.6	9.6 ± 3.9	NS

ADL, activities of daily living; BMI, body mass index; WBC, white blood count.
* Results are considered statistically significant at $p < 0.05$.

Table 2
Operation characteristics.

	Emergency (n = 21)	Elective (n = 86)	p value*
Surgical approach, n (%)			< 0.001
Laparoscopic surgery	1 (4.8%)	64 (74.4%)	
Open surgery	20 (95.2%)	22 (25.6%)	
Operative time, mins (mean ± SD)	151 ± 58	162 ± 63	NS
Post-operative mortality, n (%)	4 (19%)	1 (1.2%)	0.009
Obstructing tumor (n = 15)	2 (13.35%)	n/a	
Perforated tumor (n = 6)	2 (33.3%)	n/a	
Post-operative complications, n (%)	15 (71.4%)	28 (32.6%)	0.002
Clavien-Dindo 1–2 (n, % of comp.)	7 (46.7%)	17 (60.7%)	NS
Clavien-Dindo 3–5 (n, % of comp.)	8 (53.3%)	11 (39.3%)	NS
Re-operation, n (%)	7 (33.3%)	7 (8.1%)	0.009
Permanent stoma, n (%)	6 (28.6%)	0	< 0.001
Length of stay in hospital, days (mean ± SD)	18.7 ± 12.1	10.1 ± 8.9	< 0.001
Discharged home, n (%)	13 (61.9%)	74 (86.0%)	0.150

* Results are considered statistically significant at $p < 0.05$.

higher in the emergency surgery group (4 patients, 19%) as compared to the elective surgery group (one patient, 1.2%; p = 0.009). Overall, the post-operative complication rate was significantly higher in the emergency surgery group compared to the elective surgery group (71.4% versus 31.6%, respectively; p = 0.002). The rate of severe complications (Clavien-Dindo grades 3–5) was similar between the groups ($p > 0.05$). Patients in the emergency surgery group had higher rates of re-operation during the same admission due to post-operative complications (33.3% in the study group and 8.1% in the control group; p = 0.009). Six (28.6%) patients in the emergency surgery group and none in the elective surgery group required a stoma creation during surgery ($p < 0.001$). All the stomas performed were an end ileostomy. There were no cases where an anastomosis with a protective stoma were performed. Mean post-operative length of stay was 18.7 days in the emergency surgery group and 10.1 days in the elective surgery group ($p < 0.001$). Thirteen (61.9%) patients in the emergency surgery group and 74 (86.0%) in the elective surgery group were able to return to their homes after surgery ($p > 0.05$).

The oncology variables are summarized in Table 3. Early disease (pathological stage 0–2) was diagnosed more frequently in the elective surgery group (72.5% vs. 57.2% p = 0.001). There were no cases of stage 0 (high-grade dysplasia) in the emergency surgery group. Only very few patients in both groups were referred to adjuvant oncological treatment (4.8% in the emergency surgery group and 5.8% in the elective surgery group ($p > 0.05$).

Overall mean survival of the entire cohort was 54.9 ± 3.2 months. Mean survival of the emergency surgery group was 31.2 ± 4.6 months, while mean survival of the elective surgery group was 60.9 ± 3.3 months (Figure 1, $p < 0.001$). In a multivariable analysis the following variables significantly affected survival: timing of surgery (urgent versus elective, HR = 1.42, 95.0% CI = 1.803–9.495, p = 0.001), stage of disease (≤ 2 versus > 2, HR = 0.807, 95% CI = 1.061–4.729, p =

Table 3
Post-operation characteristics.

	Emergency (n = 21)	Elective (n = 86)	p value*
Pathological stage of disease, n (%)	21	84**	0.001
0	0	16 (19.0%)	
1	2 (9.5%)	18 (21.4%)	
2	10 (47.6%)	27 (32.1%)	
3	5 (23.8%)	22 (26.2%)	
4	4 (19.0%)	1 (1.2%)	
Adjuvant chemotherapy, n (%)	1 (4.8%)	5 (5.8%)	NS
Causes of death, n (%)	11	17	
Cancer	4 (19%)	5 (5.8%)	
Other causes	4 (19%)	11 (12.8%)	
Post-operative	3 (14.3%)	1 (1.2%)	

* Results are considered statistically significant at $p < 0.05$. ** 2 cases missing data.

0.056), functional status (dependent versus independent, HR = 0.842, 95.0% CI = 1.083–4.729, p = 0.056), and the occurrence of post-operative complications (HR = 2.032, 95.0% CI = 0.971–4.252, p = 0.06). For more details on the univariable and multivariable analyses, see Tables 4 and 5.

4. Discussion

The aim of this study was to show the major differences in post-operative outcomes in octogenarian patients operated for right colon malignancy in elective vs emergency settings. Even though it has been previously shown that emergency surgery has worse outcomes, we aim to emphasis not only the lower survival and higher morbidity in emergency surgeries, but also, the overall promising perioperative and long-term outcomes of elective procedures in this older population.

In our study, the overall survival of octogenarian patients operated on for right colon cancer was 55 months. Factors most strongly affecting survival were the timing of surgery (emergency versus elective surgery), stage of the disease (stage 2 and above), and functional status of patients (dependent versus partially dependent or completely dependent in activities of daily living). This correlates with previous reports in which functional status and cancer stage were found to be the most significant predictors of one-year mortality.[16,17] Indeed, patients in the emergency group had lower functional status and higher rate of dementia. This may have contributed to worse outcomes observed in this group. Nevertheless, these factors may have also contributed to the late presentation of the disease which has led to worse outcome. We believe these outcomes could have been mitigated by planed elective procedures, even in this high-risk group. In addition, post-operative complications were associated with higher mortality as previously shown[18] and since these were significantly higher in the emergency surgery group, it may have been another modifiable risk factor for mortality in this population.

The overall 5-year survival rate in our study was approximately

Table 4
Univariate analysis of long-term survival.

	HR	95% CI	p value*
Cancer stage above 1	0.772	0.723–6.482	0.168
Cancer stage above 2	0.728	0.971–4.370	0.056
Functionally dependent	0.756	0.982–4.624	0.056
> 3 comorbidities	0.984	0.460–2.085	0.966
Home residency	0.247	0.399–4.107	0.678

* Results are considered statistically significant at $p < 0.05$.

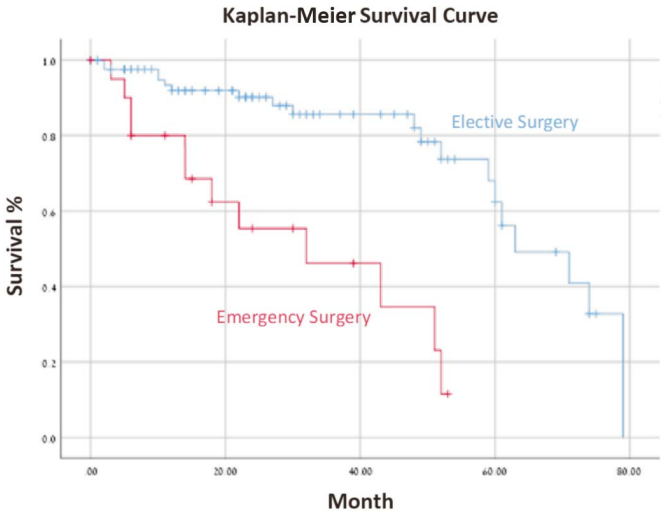

Figure 1. Long-term survival of octogenarians who underwent elective versus emergency right colectomies for cancer.

60% for those who underwent elective surgery and less than 20% in those who underwent emergency surgery. These 5-year survival rates are in accordance with the literature[18,19] regarding survival rates of all colorectal cancers as well as reports on survival rates of right colon cancers.[6–8]

In our study, almost 20% of patients were operated on in an emergency setting. Risk factors for emergency surgery included: older age, diagnosis of dementia, advanced stage of disease (above stage 2), functional dependency and nursing home residency, which suggest a delay in diagnosis. The fact that almost all patients with a stage 4 disease were operated in the emergency setting additionally suggests a delay in diagnosis and most probably contributed to the significant difference in survival of these patients. Surprisingly, the patients in the emergency surgery group had higher hemoglobin levels compared to the elective surgery group, a finding that can further explain the delay in diagnosis and treatment in this group. As expected, emergency surgery was associated with less favorable outcomes. Post-operative mortality was very high (19%) in emergency surgery and reasonable (1.2%) in elective surgery. The etiology of emergency surgery also affected the outcomes. One third of the patients who underwent emergency surgery due to perforated tumor died within 30 days of surgery. Post-operative mortality was also high (13%) when the cause for emergency surgery was obstructing cancer.

This further emphasizes the need for early detection and treatment of colon cancer in older patients, as age alone should not be the sole criteria for determining cancer treatment.[3,20]

Recent guidelines from the American College of Surgery and American Geriatrics Society have advocated for having conversations on treatment options and personal goals of care prior to surgery in older adults[14,21,22] In addition, pre-operative care should include shared decision-making that is personalized to the patient and

Table 5
Multivariate analysis of long-term survival.

	HR	95% CI	p value*
Emergency surgery	1.42	1.803–9.495	0.001
Cancer stage above 2	0.807	1.061–4.729	0.056
Functionally dependent	0.842	1.083–4.729	0.056
Post-operative complications (any)	2.032	0.971–4.252	0.06
Gender (F)	1.005	0.476–2.121	0.990
Age over median (84y)	0.769	0.342–1.470	0.356

* Results are considered statistically significant at $p < 0.05$.

takes into account all the different risks, frailty and personal goals.[23] When advocating shared decision making with the patients, the discussion should also include what can happen when deferring surgery is chosen and what this can mean to the patient. This will ensure that the patient has a central role in the decision-making process regarding his care.[24,25] Our study did not involve a share decision-making. Nevertheless, this study supports such an approach with additive information about surgery outcomes in octogenarians.

This study has several limitations. First, as a retrospective analysis there may be a selection bias of the elective surgery group, as all were found suitable for surgery by the surgical team. Second, this study was conducted in a single medical center and the results may have been affected by the sample size. Third, the data was collected retrospectively from electronic medical records so the data regarding co-morbidities was based on previous diagnoses and was not confirmed for the current study. Finally, the emergency surgery group and elective surgery group differed in baseline characteristics and this may have influenced the outcomes. Nevertheless, this represents real world data, showing that older adults from nursing homes and lower functional status are often declined from early diagnosis of cancer and elective treatments.

We suggest utilizing the information from our study to assist decision-making discussions, when contemplating treatment options for octogenarians who are diagnosed with right colon cancer.

5. Conclusions

This study demonstrates major differences in outcomes of elective vs. emergency right colectomies in octogenarian patients. These differences can be further emphasized when discussing diagnosis and treatment plan in this age group. In addition, it may help physicians to address the grim consequences of avoiding elective surgery for right colon cancer in this population, even when the patient has low functional status but a reasonable life expectancy. Furthermore, we suggest discussing surgical treatment if this aligns with the patient's health goals and advance care planning.

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Declarations of interest

None.

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