

Outcomes of emergency colorectal surgery in elderly population

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ABSTRACT

الأهداف: تقييم نتائج جراحات القولون والمستقيم الطارئة للمرضى المسنين الذين تزيد أعمارهم عن 65 عاماً.

المنهجية: أجريت هذه دراسة استيعابية لمراجعة الرسم البياني. اشتملت على 99 مريضاً فوق عمر 65 عاماً و 142 مريضاً تقل أعمارهم عن 65 عاماً خضعوا لعملية جراحية طارئة في القولون والمستقيم. في هذه الدراسة، أجرينا تحليل التركيبة السكانية للمريض، والنتائج الجراحية، ومدة الإقامة في المستشفى، والبقاء على قيد الحياة.

النتائج: أجريت جراحة القولون والمستقيم الطارئة على 145 رجلاً و 96 امرأة. وجدنا أن المرضى الذين تزيد أعمارهم عن 65 عاماً لديهم نسبة أكبر بكثير من أمراض الرئة والقلب والغدد الصماء المصاحبة (27.3% و 84.8% و 65.7% على التوالي). كان متوسط مدة الإقامة في المستشفى 26.0 ± 32.1 يوماً في مجموعة المرضى المسنين و 17.8 ± 22.0 يوماً في مجموعة المرضى الذين تقل أعمارهم عن 65 عاماً، القيمة الاحتمالية (0.00). كانت مدة الإقامة في المستشفى في وحدة العناية المركزة 8.86 ± 17.1 يوماً، وهي أطول في مجموعة المرضى المسنين، بينما كانت 3.65 ± 11.4 يوماً لمجموعة المرضى الأصغر سناً. ومع ذلك، بعد تطبيق الانحدار اللوجستي، لم يكن الفرق في طول المستشفى بعد الجراحة ووحدة العناية المركزة بين المرضى المسنين وغير المسنين ذو دلالة إحصائية مهمة في المرضى المسنين.

الخلاصة: تشير دراستنا إلى أن كبار السن مرتبطون بإقامة أطول في المستشفى ومعدلات أعلى لمضاعفات القلب والأوعية الدموية بعد الجراحة مقارنة بأولئك الذين تقل أعمارهم عن 65 عاماً. ومع ذلك، بعد الانحدار اللوجستي، لم يظهر العمر بحد ذاته ليكون خطراً مستقلاً عاملاً لنتيجة أسوأ تشير إلى أن الأمراض المصاحبة للمريض ككل تزيد من خطر حدوث نتائج أسوأ. لذلك، يجب أن تكون رعاية المرضى المسنين الذين يخضعون لجراحة القولون والمستقيم الطارئة فردية بناءً على عدة عوامل بدلاً من العمر وحده.

Objectives: To assess the outcomes of emergency colorectal surgeries in elderly patients over the age of 65 years.

Methods: This is a retrospective chart review study. We studied 99 patients over the age of 65 years and 142 patients younger than 65 years who underwent emergency colorectal surgery at our institute. In this study, patient demographics, operative results, length of hospital stay, and survival were analyzed.

Results: Emergency colorectal surgery was performed on a total of 145 men and 96 women. Patients over the age of 65 years were found to have a significantly

greater proportion of pulmonary, cardiac, and endocrine comorbidities (27.3%, 84.8%, and 65.7%, respectively). The mean length of hospital stay was 26.0 ± 32.1 days in the group of elderly patients and 17.8 ± 22.0 days in the group of patients under the age of 65. The length of postoperative hospital stay was significantly greater in the group of elderly patients with a *p*-value (0.00). The length of hospital stay in the intensive care unit was 8.86 ± 17.1 days, which was longer in the group of elderly patients, while it was 3.65 ± 11.4 days for the group of younger patients. However, after logistic regression, the difference in the length of post-operative hospital and intensive care unit stays between elderly and non-elderly patients was not statistically significant in elderly patients.

Conclusion: Our study suggests that the elderly population are associated with longer hospital stay and higher rates of postoperative pulmonary and cardiovascular complications compared to those under the age of 65. However, after logistic regression, age by itself was not found to be an independent risk factor for worse outcome indicating that patient comorbidities as a whole increase the risk of worse outcomes. Therefore, the care of elderly patients undergoing emergency colorectal surgery should be individualized based on several factors rather than age alone.

Keywords: elderly, colorectal surgery, emergency, life expectancy, postoperative outcomes

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Life expectancy has increased with advances in medicine, health awareness, and preventive medicines. As a result, the elderly population is expanding, with most of the increase noted in developing countries. Elderly population growth is considerably faster all around the globe than population growth as a whole.¹ As reported by the World Health Organization and the National Institute of Health, the number of elderly population over the age of 64 years in 2010 is projected to grow by an estimated rate of 28 times the number by 2050.² The elderly population in the Kingdom of Saudi Arabia follows the global increase; the Saudi statistics showed an increase in the elderly from 2.97% in 2010 to 3.5% in 2020.³ The consensus on who to define as elderly varies, however, per the Ministry of Health, the elderly are people over the age of 65 years.² A number of clinical guidelines do not define 'elderly' by any useful mean (85%) and otherwise employ chronological age as a definition (15%). However, one guideline describes a person as elderly if they are 75 years or older, and two guidelines support the WHO definition of the elderly as those aged 65 or older.⁴

With the global increase in the elderly population, more elderly patients are presenting for surgical interventions. Surgical interventions within this age group is associated with postoperative morbidity and mortality due to multiple factors, one of which is the physiologic process of aging, since the functional and structural capacity of organs degenerate progressively over time.⁵ Diminished cardiopulmonary reserve in particular is a leading cause of morbidity and mortality in surgical elderly patients, especially those with congestive heart failure.⁶ Elderly patients are the most common among other age groups to present with multiple comorbidities and are usually on multiple medications. Therefore, most of the elderly surgical patients are scored at 2 or greater by the American Society of Anesthesiology (ASA), a well-known risk-stratifying system that predicts postoperative complications and mortality.⁷ These complications are poorly tolerated in elderly surgical patients as a consequence of their limited compensatory capacity and diminished organ reserves.⁶ Hence, a thorough perioperative general condition evaluation and optimization are essential to minimize the perioperative complication risk.

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A huge database from the National Anesthesia Clinical Outcomes Registry (NACOR) showed an increase in colorectal surgeries among elderly patients, with most of the increase noted in those over the age of 90 years.⁸ As the incidence of colorectal malignancies has increased within the elderly population, an even greater estimate is expected to present for surgical intervention. Consequently, an increase in emergency colorectal surgeries is predicted. Insufficient preoperative preparation carries the greatest risk of mortality regardless of age. The reported mortality rate in emergency surgical intervention in the elderly is 15-30%, with the highest reported risk in surgeries involving the thorax and abdomen.⁹ With the growing elderly population, early detection and management are crucial to potentially reduce emergency presentation and thus morbidity and mortality.

The expansion of the elderly population leads to the expansion of surgical intervention. Knowledge and surgical experience in this special age group is limited. There are insufficient nonlocal studies that review emergency surgical intervention, and most of these studies show an increased burden of morbidity and mortality. Understanding the physiology changes, perioperative behavior, and postsurgical outcomes in this age group may help improve this burden. This study aims to examine the outcomes of emergency colorectal surgeries in Saudi Arabia.

Methods. A retrospective chart review of 65 patients was adopted as our study design. All charts reviewed from the medical records department and (BestCare) system, Hospital Information Electronic System; at King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia. We included all patients aged 65 years old and above, who underwent emergency colorectal surgical intervention. Ethical approval was obtained from King Abdullah International Medical Research Center. All demographics and clinical characteristics were tabulated and compared between the study groups using parametric and nonparametric statistics as appropriate.

Statistical analysis. All statistical analysis was performed using the Statistical Package for Social Sciences, version 25.0 (IBM Corp, Armonk, NY, USA) software. Categorical variables were described by frequencies and percentages compared by the Chi-square test to examine the differences between elderly patients and those under age 65, in terms of patients and hospital characteristics. Continuous variables were presented as mean and \pm standard deviation (SD) and analyzed by the independent t-test. To determine the significance of the predictors, unadjusted linear regression and binary

logistic regression were carried out. Linear regression was used for continuous variables, while binary logistic regression was used for categorical variables. All variables analyzed in the univariate analysis with a p -value of <0.05 were included in a multiple regression. A p -value of <0.05 and 95% confidence intervals (CI) were used to report the statistical significance and precision of results.

Results. A total of 241 patients were included and analyzed in this retrospective study. Of these patients operated on, (n=142) were younger than 65 years of age, while (n=99) were older than 65 years of age. **Table 1** shows the patient demographics by age group. Emergency colorectal surgery was performed on a total of 145 men and 96 women. **Table 1** shows the patient demographics by age group. Emergency colorectal surgery was performed on a total of 145 men and 96 women. There were no significant differences between the two groups of age in terms of gender, diagnosis, type of intervention, procedure, steroid, surgeon specialty, type of resection, urgency, white blood cell (wbc), pre-operation sepsis, smokers, amount of blood loss, and stoma. In contrast, body mass index (BMI) has a statistically significant difference between age groups. Elderly patients have a higher percentage of 37.1% who were at healthy weight compared to younger patients ($p=0.01$). Patients who are younger than 65 years old have a better physical status by 50.7% than those who are older than 65 where the elderly group have more severe systematic disease by 87.8%, which was statically significant ($p=0.001$).

Elderly patients have a higher proportion of using anticoagulation drugs compared to younger patients (31.6% vs 16.9%) and there are statistically significant differences between the two groups ($p=0.00$). Regarding comorbidities, patients older than 65 have a significantly greater proportion of comorbidities in pulmonary, cardiac, and endocrine (27.3%, 84.8%, and 65.7%) respectively. There are statistically significant differences in the 2 groups ($p=0.00$).

The postoperative outcomes are shown in **Table 2**. The mean length of hospital stay was 26.0 ± 32.1 days in the group of elderly patients and 17.8 ± 22.0 days in the group of patients under age 65. The length of the postoperative hospital stay was significantly greater in the group of elderly patients with a p -value (0.00), however; after the logistic regression (**Table 3**) it showed no statistical significance in elderly patients length of hospital stay (adjusted in length of stay of 0.009 (95% CI-7.10-8.11) ($p=0.89$)). The length of hospital stay in intensive care unit (ICU) was 8.86 ± 17.1 days,

Table 1 - Patients characteristics who treated by emergency colorectal surgery, according to age (N=241).

Characteristics	<65 n (%)	>65 n (%)	P-value
Gender			
Male	88 (62.0)	57 (57.6)	0.49
Female	54 (38.0)	42 (42.4)	
Body mass index			
18.5–24.9	57 (40.4)	36 (37.1)	0.01
25.0–29.9	44 (31.2)	27 (27.8)	
30.0–34.9	32 (22.7)	16 (16.5)	
≥ 35	8 (5.7)	18 (18.6)	
Diagnosis			
Malignance	79 (55.6)	59 (59.6)	0.54
Non-malignance	63 (44.4)	40 (40.4)	
ASA class			
ASA Class 1 (0,1,2)	72 (50.7)	12 (12.2)	0.00
ASA Class 2 (3,4,5)	70 (49.3)	86 (87.8)	
Anticoagulation			
Yes	24 (16.9)	31 (31.6)	0.00
No	118 (83.1)	67 (68.4)	
Type of intervention			
Open	106 (74.6)	76 (76.8)	0.70
Laparoscopic	36 (25.4)	23 (23.2)	
Procedure			
Right hemicolectomy	36 (25.4)	26 (26.3)	0.90
Left hemicolectomy	37 (26.1)	32 (32.3)	
Subtotal and total proctocolectomy	10 (7.0)	6 (6.1)	
Hartmann-procedure	20 (14.1)	13 (13.1)	
Stoma formation	32 (22.5)	18 (18.2)	
Others	7 (4.9)	4 (4.0)	
Steroid			
Yes	6 (4.2)	6 (6.1)	0.50
No	136 (95.8)	92 (93.9)	
Non-colorectal surgeon			
Yes	90 (63.4)	54 (54.5)	0.16
No	52 (36.6)	45 (45.5)	
Type of resection			
Total	8 (5.6)	5 (5.1)	0.53
Segmental	100 (70.4)	76 (76.8)	
Stoma	34 (23.9)	18 (18.2)	
Urgency			
<48 hours	108 (76.1)	83 (83.8)	0.14
>48 hours	34 (23.9)	16 (16.2)	
WBC (mean \pm SD)	10.9 \pm 6.1	11.9 \pm 9.4	0.15
Pre-operative sepsis			
Yes	34 (24.5)	29 (30.2)	0.32
No	105 (75.5)	67 (69.8)	
Smoker			
Yes	19 (13.7)	11 (11.3)	0.59
No	120 (86.3)	86 (88.7)	

ASA: American Society of Anesthesiology, SD: standard deviation

which was longer in the group of elderly patients, while the group of younger patients was 3.65 ± 11.4 days but logistic regression results showed that ICU length of hospital stay in Patients older than 65 years

Table 1 - Patients characteristics who treated by emergency colorectal surgery, according to age (N=241) (continuation).

Characteristics	<65 n (%)	>65 n (%)	P-value
Comorbid			
Pulmonary			
Yes	19 (13.4)	27 (27.3)	0.00
No	123 (86.6)	72 (72.7)	
Cardiac			
Yes	58 (40.8)	84 (84.8)	0.00
No	84 (59.2)	15 (15.2)	
Endocrine			
Yes	55 (38.7)	65 (65.7)	0.00
No	87 (61.3)	34 (34.3)	
Hepatic			
Yes	10 (7.0)	9 (9.1)	0.56
No	132 (93.0)	90 (90.9)	
Renal			
Yes	17 (12.0)	25 (25.3)	0.00
No	125 (88.0)	74 (74.7)	
Hematology			
Yes	15 (10.6)	15 (15.2)	0.28
No	127 (89.4)	84 (84.8)	
Neurology			
Yes	15 (10.6)	21 (21.2)	0.02
No	127 (89.4)	78 (78.8)	
No comorbid			
Yes	17 (12.0)	3 (3.0)	0.013
No	125 (88.0)	96 (97.0)	
Other comorbid			
Yes	10 (7.0)	6 (6.1)	0.76
No	132 (93.0)	93 (93.9)	
Amount BL (mean±SD)	157.3±250.0	155.4 (269.7)	0.15
Stoma			
Yes	107 (75.4)	74 (74.7)	0.91
No	35 (24.6)	25 (25.3)	

SD: standard deviation

is not statically significant ($p=0.44$) (95%CI:5.29-2.34). There were no significant differences in 30-day mortality, surgical site infection, readmission, and reoperation among the two groups of age. There was a difference in 30-day complications in terms of cardiovascular (8.1% versus [vs] 1.4%) and pulmonary (8.1% vs 2.1%), with elderly patients having a higher proportion than younger patients ($p=0.01$, 0.02). In contrast, logistic regression showed that elderly patients had an increased risk of cardiovascular complication by 89% (95% CI 0.42-8.43), which was not statistically significant ($p=0.06$) and patients above the age of 65 have a lower chance of developing a pulmonary problem (62% [0.08-1.64]) with $p=0.19$.

Multivariable logistic regression was performed to adjust for a possible correlation between the patient age groups and postoperative outcomes (Table 3). After adjustment, logistic regression revealed that

Table 2 - Post-operative outcomes according to age group.

Outcome	Non-elderly patients n (%)	Elderly patients n (%)	P-value
Length of stay (LOS) (mean ± SD)	17.8± 22.0	26.0 (± 32.1)	0.00
Intensive care unit LOS (mean ± SD)	3.65± 11.4	8.86 (± 17.1)	0.00
30-Day mortality	13 (9.2)	15 (15.2)	0.15
Surgical site infection	27 (19.6)	17 (17.5)	0.69
Readmission	13 (9.2)	9 (9.1)	0.98
Reoperation	22 (15.5)	22 (22.2)	0.18
Complications			
Septic shock	9 (6.3)	9 (9.1)	0.42
Cardiovascular	2 (1.4)	8 (8.1)	0.01
Pulmonary	3 (2.1)	8 (8.1)	0.02
Gastrointestinal	11 (7.7)	6 (6.1)	0.61
Genitourinary	8 (5.6)	10 (10.1)	0.19
Endocrine	0 (0.0)	1 (1.0)	0.23
Neurological	2 (1.4)	1 (1.0)	0.78
Peritonitis	2 (1.4)	2 (2.0)	0.71

the difference in length of stay between elderly and non-elderly patients is not statistically significant (adjusted in length of stay of 0.009 (95% CI-7.10-8.11) ($p=0.89$) in elderly patients. Patients older than 65 years were 0.049 (95%CI-5.29-2.34) in ICU length of hospital stay, is not statically significant ($p=0.44$). Patients above the age of 65, on the other hand, have a 17% lower risk of 30-day mortality than patients under the age of 65. There was no statistically significant difference ($p=0.79$).

In addition, elderly patients were 2.38 (95%CI: 0.86-6.58) times more likely to have a surgical site infection than patients younger than 65 years. The correlation is not statistically significant ($p=0.09$). Furthermore, patients over the age of 65 have a 10% reduced chance of being readmitted to the hospital (95% CI 0.36-2.29) than younger patients ($p=0.85$).

Reoperation was 1.24 (95%CI: 0.54-2.83) times more likely in elderly patients than in younger patients, although the difference was not statistically significant ($p=0.59$). In terms of complications, there was no difference between the two age groups in septic shock 1.0 (95%CI: 0.33-3.06) ($p=0.97$). Elderly patients had an increased risk of cardiovascular complication by 89% (95%CI: 0.42-8.43), which was not statistically significant ($p=0.06$). Patients above the age of 65 have a lower chance of developing a pulmonary problem (62% (0.08-1.64). Elderly patients were 31% more likely than non-elderly patients to develop a GI complication (95%CI: 0.39-4.33) and 2.32 (95%CI: 0.64-8.39) times more likely to develop a genitourinary (GU) complication ($p=0.19$).

Table 3 - Po

Postoperative outcomes	Unadjusted Estimate (95%CI)	P-value	Adjusted estimate (95% CI)	P-value
Mean difference (B) length of stay (LOS)	-0.15 (-15.0- -1.25)	0.02	0.009 (-7.10- 8.11)	0.89
Mean difference (B) Intensive Care Unit Length of Stay (ICU LOS)	-0.17 (-8.84- -1.56)	0.00	-0.049 (-5.29- 2.34)	0.44
30 Days Mortality	0.56 (0.25- 1.24)	0.15	0.83 (0.21- 3.22)	0.79
Surgical Site Infection (SSI)	1.14 (0.58- 2.24)	0.69	2.38 (0.86- 6.58)	0.09
Readmission	1.0 (0.41- 2.45)	0.89	0.91 (0.36- 2.29)	0.85
Reoperation	0.64 (0.33- 1.23)	0.18	1.24 (0.54- 2.83)	0.59
Complication				
Septic shock	0.67 (0.25- 1.77)	0.42	1.0 (0.33- 3.06)	0.97
Cardiovascular	0.16 (0.03- 0.78)	0.02	1.89 (0.42- 8.43)	0.06
Pulmonary	0.24 (0.06- 0.95)	0.04	0.38 (0.08- 1.64)	0.19
Gastrointestinal	1.30 (0.46- 3.64)	0.61	1.31 (0.39- 4.33)	0.65
GU	0.53 (0.20- 1.39)	0.20	2.32 (0.64- 8.39)	0.19

Unadjusted and adjusted postoperative outcome according to age group of elderly >65 versus <65. CI: confidence interval, GU: genitourinary

Discussion. The study aimed to compare the outcomes of emergency colorectal surgeries in elderly and non-elderly populations. Results of the study showed that elderly patients were more likely to be on anticoagulants and had comorbidities such as pulmonary, cardiac, endocrine, renal, and neurological diseases. On the other hand, patients under the age of 65 years old had fewer comorbidities. The study also found that elderly patients had higher ASA classifications, with 87.8% being in class 2 or more compared to the younger population with only 50.7% in class 1. This difference was statistically significant with a *p*-value of 0.00. The results of the study were consistent with a previous study that examined patients aged 81 and older and showed that more than 65% of the patients had ASA class 3 or 4.

Our study indicates that elderly patients who undergo emergency colorectal surgeries have a higher chance of being hospitalized for longer, as well as being admitted to the ICU than younger patients. The longer hospital stay and ICU admission can be due to pre-existing health conditions and complications following the surgery in elderly patients. In line with our findings, Bircan et al¹⁰ reported that patients aged over 80 years had extended hospital stays, while patients aged between 70 to 79 years had a similar length of stay compared to younger patients. Similarly, Schwander et al¹¹ found that older patients above 70 years of age had significantly longer postoperative hospitalizations, which aligns with our results.

Our analysis measures various outcomes and complications, and the results indicate that older patients have a significantly higher incidence of cardiovascular and pulmonary complications. We found that within

30 days, elderly patients exhibit a greater proportion of complications associated with cardiovascular and pulmonary issues compared to the younger patients. This *p*-values being 0.01 and 0.02 show that there is a statistically significant difference. Additionally, Isbister et al¹² studied the age factor in terms of complication rates, dividing patients into 2 groups; patients under 80 and those over 80. Their findings suggest that patients aged 80 and over have higher rates of cardiopulmonary complications than the younger group.

In 2017, a study was carried out on a population of 697 people who were categorized into 3 groups based on their age. Group A consisted of patients who were 74 years old or younger (n=420), Group B included patients between 75-89 years old (n=261), and Group C comprised people who were 90 years old or older (n=16). The study found that postoperative cardiovascular complications were not significantly different among the groups, which contrasts with our results.¹³

Our study may have yielded different results from others due to its limited sample size compared to their larger population. Nevertheless, we did find a notable rise in postoperative pneumonia risk with increasing age, which agrees with our previous observations. In contrast, a different study by Schwander et al¹¹ did not detect any significant age-related variations in postoperative complication rates among 3 age categories (<50, 51-70, >70 years).

The logistic regression results revealed that both groups had similar postoperative outcomes (Table 3). Therefore, age alone is not an independent factor that increases the risk for poor postoperative outcomes. Instead, comorbidities and other factors present at the

time of diagnosis that require emergency colorectal intervention are more likely to affect the outcomes.

As research in the field of colorectal surgery for older patients continues to expand, there is increasing evidence to suggest that a patient's chronological age may not be the most accurate indicator of their surgical outcome. Rather, it is important to also consider a patient's biological age and any pre-existing health conditions they may have. This is supported by the findings of a study conducted by Bircan and colleagues, which focused on emergency colorectal surgeries in elderly patients and found no significant differences in surgical outcomes compared to younger patients.¹⁰

Study limitation. The study's design, which was retrospective and observational, could have some confounding factors that were not measured. In addition, the researchers' data collection was limited in terms of taking into consideration a broader range of variables, such as performance status and other factors that could have had an impact on the results. If these variables were included, it would give a more comprehensive analysis and allow for better comparison within the elderly group.

In conclusion, our study suggests that elderly patients undergoing emergency colorectal surgeries are more likely to have a prolonged length of stay in the hospital and ICU. Furthermore, elderly patients were associated with higher rates of pulmonary and cardiovascular complications compared to those under the age of 65 years. However, age by itself was not found to be an independent risk factor for worse outcomes, but it was rather patient comorbidities as a whole that increased the risk of worse outcomes. Therefore, the care of elderly patients undergoing emergency colorectal surgery should be individualized based on several factors rather than age alone. Studying the elderly population could offer a view into possible specialized staffing, training, and resource allocations. Future research can

include multiple institutes which might have an effect on the outcomes.

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