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RESEARCH ARTICLE

The Factors Effecting Mortality in Emergency and Elective Colorectal Cancer Surgery

Acil ve Elektif Kolorektal Kanser Cerrahisinde Mortaliteye Etki Eden Faktörler

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ABSTRACT

Aim: Colorectal cancers (CRC) are amongst the most commonly encountered cancers. The symptoms associated with CRCs depend on the tumour localization, stage and the presence of complications during diagnosis. In this study we aimed to reveal the mortality rates and factors affecting mortality of patients who undergone emergency and elective operation due to CRCs.
Method: Patients that undergone surgery after being diagnosed with CRC were sorted into two groups: emergency cases (group 1) and elective cases (group 2). Groups were compared in terms of gender, comorbid disease history, liver metastases, presence of anastomotic leaks, tumoural colon segments with tumour, mortality rates, preoperative and postoperative urea, creatinine and haemoglobine values.
Results: The mean age of the 308 patients was 62.4±11.9 and the male/female ratio was 1.4. Emergency operation was performed for 53 patients. Two-hundred-sixteen patients had tumours located on the rectosigmoid junction. Seventeen patients had mortality on early postoperative 30 day. Mean age, mortality rate and liver metastases were higher in patients who undergone emergency operation (p=0.037, p=0.007 and p<0.001). The patients who were electively operated and had mortality had higher mean age, liver metastasis rate, preoperative and postoperative urea and creatinine rates than living elective cases (p=0.003; p<0.001; p=0.003; p=0.002 and p=0.044). The patients who undergone emergency operation and had mortality had higher postoperative creatine level and postoperative pulmonary embolism development risk (p=0.040 and p=0.013).
Conclusion: The patients who undergone emergency operation because of CRC were observed to have higher mortality rates due to pulmonary embolism development risk with emergency operation conditions and higher levels of creatinine. Mortality amongst electively operated patients was found to be dependent on many factors.
Keywords: Colorectal cancer, emergency surgery, elective surgery, mortality

ÖZ

Amaç: Kolorektal kanserler (KRK), en sık görülen kanser tiplerindendir. KRK bulguları tümör lokalizasyonu, evre ve tanı sırasında oluşabilecek komplikasyon varlığına bağlıdır. Çalışmamızda KRK nedeniyle acil ve elektif şartlarda opere edilen hastalarda mortalite ve mortaliteye etki eden faktörleri ortaya koymayı amaçladık.
Yöntem: KRK tanısı ile opere edilen hastalar acil opere edilenler (grup 1) ve elektif opere edilen hastalar (grup 2) olarak 2 gruba ayrıldı. Gruplar arasında cinsiyet, komorbid hastalık öyküsü, karaciğer metastazı, anastomoz kaçağı varlığı, tümörlü kolon segmenti, mortalite oranları, preoperatif ve postoperatif üre, kreatinin ve hemoglobin değerleri karşılaştırıldı.
Bulgular: Çalışmaya dahil edilen 308 hastanın yaş ortalaması 62,4±11,9 olup erkek/kadın oranı 1,4 idi. Hastaların 53'ü acil şartlarda opere edilmişti. İki yüz on altı hastada tümör rektosigmoid bileşkede yerleşimli idi. On yedi hastada postoperatif 30 günlük erken dönemde mortalite gözlendi. Acil opere edilen hastalarda, yaş ortalamasının, mortalite oranının ve karaciğer metastazının daha fazla olduğu gözlendi (p=0,037, p=0,007 ve p<0,001). Elektif şartlarda opere edilen ve mortalite saptanan hasta grubunda yaş ortalamasının, karaciğer metastazı oranının, preoperatif ve postoperatif üre ve kreatinin düzeylerinin yaşayan hastalardan daha yüksek olduğu gözlendi (p=0,003; p<0,001; p=0,003; p=0,002 ve p=0,044). Acil şartlarda opere edilen ve mortalite saptanan hasta grubunda sadece postoperatif kreatinin düzeyinin ve postoperatif pulmoner emboli gelişme riskinin daha yüksek olduğu gözlendi (p=0,040 ve p=0,013).
Sonuç: KRK nedeniyle acil opere edilen hastalarda acil operasyon koşullarının, postoperatif kreatinin yüksekliği ile birlikte pulmoner emboli gelişme riskinin mortaliteyi artırdığı gözlendi. Elektif şartlarda operasyonda mortalitenin birçok faktöre bağlı olduğu saptandı.
Anahtar Kelimeler: Kolorektal kanser, acil cerrahi, elektif cerrahi, mortalite

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Introduction

Colorectal cancers (CRC) are the most frequent tumor type among the gastrointestinal system cancers and the third most frequent tumor type worldwide; after lung and breast cancer in women, and after lung and prostate cancer in men.[1,2] In the course of disease, many factors are effective, like tumor size and location, type of metastasis and grade, presence of possible complications.[3] Prognosis and survival are directly related to tumor localization, presence of operation in emergency condition, comorbid factor existence, nutrition status and histopathological grading.[4] Of the colorectal region cancers which constitute 85% of colon emergencies, 11-43% of them are presented as acute colonic obstruction.[5] For the colorectal emergencies having no possibility to set a gold standart treatment, it is well-known that the prognosis is worse than the elective operations.[6] In our study, we tried to uncover the variety of factors affecting mortality by comparing the 30 day-early stage mortality rates of patients operated in emergency conditions.

Materials and Methods

Following the approval of local ethics committee, our study was planned retrospectively between dates January 2012-June 2015 at Kars Government Hospital, Kafkas University Faculty of Medicine and Dışkapı Yıldırım Beyazıt Education and Research Hospital. Files of consequent 345 patients who had prediagnosis of mechanical intestinal obstruction with diagnosis of CRC, who contacted emergency department and general surgery departments with complaints of stomachache, nausea, vomiting, abdominal distention, anal bleeding, weight loss and inability to remove gas-stool. From the records of patient files; age, gender, comorbid factor history, preoperative nutrition supply, colon segment with tumor, the applied surgery protocol, tumor stage, postoperative anastomosis leak and pulmonary embolism history, preoperative and postoperative first day urea, creatinine, hemoglobin levels and posroperative 30 days-early stage mortality rates were all obtained and recorded. Histopathological staging was performed based on TNM (Tumor, lymph node and metastasis) staging system in terms of standardization. Low molecular weight heparin dose was applied to the patients with age of sixty five and over and the patients with possible postoperative mobilization limitation. Pulmonary embolism diagnosis was determined according to blood gas values and contrast-enhanced computed tomography findings. Patients were divided into two groups as emergently operated patients (group 1) and as electively operated patients (group 2). Hemoglobin value was measured via Coulter® LH 780 Hematology Analyzer, (Beckman Coulter Inc., Brea, CA, USA), while the reference value was taken as 10.8-15.1 g/dL. Urea and creatinine measurements were performed via Erba Mannheim XL 1000 (Mannheim, Germany) device and reference values were accepted as 15-50 mg/dL for urea and 0.6-1.3 mg/dL for creatinine. As a number of 37 patients including patients whose files were unreached, the patients with renal failure and hemathological disease history, the patients having a history of blood transfusion during last week were all excluded from the study; so the remaining 308 patients were included in the study.

Statistical Analysis

Statistical analysis of the data was performed by using SPSS Windows 22 package program. Complementary statistics were shown for continuous variables as deviation and standard deviation or mean (minimum, median, maximum); and categorical variables as case number and (%) in shape. Distribution graphics for continuous variables were analysed by using Kolmogorov Smirnov test. The significance of the difference between the groups in terms of average values were analysed with student's *t*-test, while the significance in terms of mean values were analysed by Mann-Whitney U test. Categorical variables were evaluated via Pearson's chi-square test. Common effect of independent variables on mortality in emergency colorectal surgery was measured via regression analysis by taking confidence interval (CI) as 95%. Pearson was used for parametric variables, and Spearman correlation analysis was used for non-parametric values. P values <0.05 were accepted to be significant.

Results

The average age of 308 patients included in our study was 62.4±11.9, with a male/female ratio of 1.4. Comorbid disease history was detected in 143 (46.4%) patients, while, 53 (17.2%) patients were operated in emergency conditions with a prediagnosis of obstruction caused by tumor. In thirty one patients, it was detected that there was a weight loss more than 10% of their body weights, so immuno-nutritional supply has been provided for them. In the histopathological assessment, most frequently stage 2A (27.9%), then stage 3B (23.7%) and stage 3C (18.8%) tumors were detected. Pulmonary embolism developed during postoperative 30 days period in 22 (7.1%), mortality was observed in 17 patients (5.5%) (demographic characteristics are given in Table 1). In group 1 patients, it was observed that the colon segment was located in left colon in 52.8% of the patients and right colon was the following (26.4%) which was followed by rectum (9.4%); while in the electively operated patients' group, the most frequent location of tumor was respectively rectal (42.7%), left colon (25.9%) and right colon (21.2%) and it was detected that tumor locations were significantly different between groups (p=0.002). When the

operations were examined according to tumor locations; it was observed that Hartman procedure was preferred in much higher rates for the emergency surgeries (p<0.001).

As the gender characteristics among the operated patients were distributed homogenously (p=0.994), average age of group 1 patients was higher (p=0.037). As the mortality rate in group 1 was more than group 2 (p=0.007), mortality risk in operations due to urgent colonic obstruction was increased by 3.7 times (p=0.011; CI 95%: 1.350-10.297). In group 1 patients, although the preoperative and postoperative urea, creatinine levels were higher, and hemoglobin levels were lower; there has been no significant difference between the groups about these parameters detected (p>0.05). Liver metastasis frequency and comorbid disease history in group were significantly higher than electively operated patient group (p<0.001 and p=0.011), there was no significant difference between the groups about postoperative pulmonary embolism and anastomosis leak risk (p=0.060 and p=0.131).

When the factors affecting the mortality of the patients who had been operated in elective conditions; in the mortality-developed group, the frequency of liver metastasis, average age, preoperative and postoperatively controlled creatinine levels were detected to be higher (p<0.001, p=0.003, p=0.003, p=0.002 and p=0.044). The characteristics of the measured parameters are given in Table 2. It was detected that the preoperative urea levels and postoperative creatinine levels could be predictive for mortality as independent factors (p=0.002 and p=0.027).

When the factors affecting the mortality rate of the patients operated in emergency conditions with a prediagnosis of tumor ileus were examined; only the creatinine level at the time admission and postoperative pulmonary embolism rates were observed to be more in the mortality-developed group (p=0.040 and p=0.013); whereas increased creatinine level in postoperative period, being independent from all other parameters, was detected to be predictive for the mortality (p=0.042) (Table 3).

Table 1. Demographic features of patients

Parameters		Ratio and number of patients (n)
Age (year)		62.4±11.9
Gender (Male/Female)		1.4
Rate of patients with additional systemic disease		46.4% (n=143)
Rate of ex patients		5.5% (n=17)
Rate of patients operated in emergency condition		17.2% (n=53)
Rate of patients getting preoperative colon cleansing		71.1% (n=219)
Rate of patients with preoperative nutritional support history		10.1% (n=31)
Rate of patients with lymph node positivity		52.9% (n=163)
Rate of patients with liver metastasis		5.2% (n=16)
Rate of postoperative pulmonary embolism		7.1 (n=22)
Colon segment with tumor	Right colon	22.1% (n=68)
	Transverse colon	5.2% (n=16)
	Recto sigmoid region	67.5% (n=208)
	Anal canal	2.6% (n=8)
	Whole colon	2.6% (n=8)
Postoperative histopathological staging (TNM)	Stage 1	13% (n=40)
	Stage 2A	27.9% (n=86)
	Stage 2B	5.2% (n=16)
	Stage 3A	5.8% (n=18)
	Stage 3B	23.7% (n=73)
	Stage 3C	18.8% (n=58)
	Stage 4	5.5% (n=17)

TNM: Tumor size/location, lymph node involvement and metastasis

Table 2. Factors affecting mortality in patients operated in elective conditions

Characteristics and parameters	Mortality detected patients	Alive patients	p value
Age	72.2±8.7	61.4±11.4	**p=0.003**
Gender (Male/Female)	7/3	142/103	p=0.449
Postoperative pulmonary embolism	1/9	14/231	p=0.572
Presence of liver metastasis	3/7	0/245	**p<0.001**
Preoperative nutrition	0/1	26/52	p=0.481
Preoperative comorbid factor	5/5	105/140	p=0.655
Preoperative hemoglobin	11.3 (8.4-15.0)	12.2 (6.3-17.3)	p=0.155
Preoperative urea	57.0 (21.8-168.0)	33.0 (9.0-85.0)	**p=0.003**
Preoperative creatinine	1.0 (0.6-2.0)	0.9 (0.1-1.8)	p=0.060
Postoperative urea	45.0 (24.0-120.0)	29.0 (6.0-107.0)	**p=0.002**
Postoperative creatinine	1.1 (0.7-2.2)	0.9 (0.4-2.2)	**p=0.044**

Table 3. Factors affecting mortality in patients operated in emergency conditions

Characteristics and Parameters	Mortality detected patients	Alive patients	p value
Age	70 (54-74)	67.5 (26-87)	p=0.847
Gender (Male/Female)	4/3	27/19	p=0.938
Postoperative pulmonary embolism	3/4	4/42	**p=0.013**
Presence of liver metastasis	3/4	10/36	p=0.226
Preoperative nutrition	2/0	3/4	p=0.151
Preoperative comorbid factor	4/3	29/17	p=0.764
Preoperative hemoglobin	11.7±2.3	12.5±2.2	p=0.495
Preoperative urea	39.0 (12.0-68.0)	38.0 (12.0-126.0)	p=0.888
Preoperative creatinine	1.1 (0.8-2.1)	0.9 (0.2-2.3)	**p=0.040**
Postoperative urea	19.6 (10.0-178.0)	32 (11.0-181.9)	p=0.416
Postoperative creatinine	1.2 (0.6-4.5)	0.8 (0.4-2.6)	p=0.189

The average age, liver metastasis frequency and postoperative pulmonary embolism developing risk in the mortality-developed patients were detected to be higher than the alive patients (p=0.006, p<0.001 and p=0.007). When the correlation between age and mortality was evaluated, there has been detected a positive Pearson correlation of +0.147 in p=0.010 value. It was detected that the mortality of patients with liver metastasis and postoperative pulmonary embolism was increased by 15.33 (p<0.001, CI: 95%; 4.72-49.77) times and 4.67 (p=0.013, CI: 95%; 1.38-15.77) times.

Discussion

Although the endoscopic scanning methods have been commonly widespread, colorectal region cancers are still considered as an important oncological problem with high incidence, morbidity and mortality rates. Especially the increase in morbidity and mortality rates after the emergency surgical operations due to colonic tumor obstructions have directed us, as clinicians, to new research horizons to decrease these rates. As a result of our study which aimed to examine the factors affecting the morbidity and mortality rates in emergent and elective CRC surgery, we concluded that the average age, liver metastasis with comorbid factor existence and mortality in urgently operated patients were higher than elective CRC surgery cases and increased postoperative creatinine level in both the elective and the emergent cancer surgery, could be predictive for mortality as being independent from all parameters. As there had been many studies in medical literature intending to detect the factors affecting mortality in emergency and elective surgery of colorectal region cancers, the fact that we have also checked laboratory tests beside the survey parameters and the number of patients convenient to include the study was sufficient in our study, the hospitals performing the

operations were busy regional (Kars Government Hospital 30. Regional Hospital) and tertiary hospitals receiving high number of patients from the peripheric centers, reflects the power of our study in terms of patient resources and patient variety. However the fact that our study has been planned based on the retrospective records from the files of operated patients, was the reason for being unable to check all laboratory parameters of all patients, and being unable to obtain preoperative nutritional status of the cases from the files. Besides, being unable to perform endoscopic procedure on time in our hospital became a reason for inability to go further than prediagnosis and inability to make initial preparation for the required cancer surgical operation. Therefore, prospectively planned studies in the future would obviously provide much more contribution to the literature.

In a study by Aykan et al.[1] which was performed at 21 different regions of Turkey comprehending the largest geographic region, it was observed that the incidence of colorectal region cancers with an average age of 59 was increased when the age was 50 and over. In our study in which we detected the mean age as 62.4±11.9, we suppose that the reason why it was higher than Turkey average is because our hospital's being considered as tertiary reference hospital, so most of the older advanced age patients with high comorbid factors are being sent to our hospital. In many various literature studies that suggest age as related to prognosis; data showing that postoperative 30 days period mortality rates are higher under age 40, in geriatric patient population and over age 70.[2] Also in our study, it was observed that average age in mortality detected group was significantly higher (p=0.006).

While it is known that colorectal region cancers are more common in male gender, as well as there are studies showing that male gender is bad prognostic factor, there are also some data showing that gender has no effect on mortality.[7,8] In our study, we have reached to the conclusion that there's no correlation between gender and mortality. As a reason for that, we convince that minority of female patients because there is no gynecology department in our hospital where the operations have been performed, so female patients with high mortality risk were not sent to us as a preference.

It is well known that colorectal region cancers lead to emergency surgery with acute colonic obstruction at a high rate of more than 11%.[2] As convenient to the literature, appropriate emergency surgical operation rate in our study was 17.2%. It is well known that the patients who are operated in emergency conditions have worse prognosis. Ghazi et al.,[9] in a study with 976 patients who had emergency operations due to colonic obstruction, reported that the average age and liver metastasis detection rates were higher, 5 year survival rates were lower. And Ming-Gao et al.[6] specified that complications and mortality rates are higher after operations performed in emergency conditions. Osler et al.,[10] in the study they performed, have reported the 30 days mortality rates as 22.1% in emergency colorectal surgical operations. As being parallel to the data showing mortality risk in emergent operations to be 5 times more,[11] also in our study in the patient group which had been operated in emergency conditions, it was observed that the patients were older in age and they had more comorbidity factors, the number of patients with liver metastasis detected during intraoperative period was higher and the mortality rates were also higher in the group which included the patients operated emergently and urgent operation increased the mortality rate by 3.7 times.

The incidence of CRC locations from the most to the least are respectively rectum, left colon and right colon.[12] As we observed in our study that the data of tumor locations were compatible with the literature; we reached to a conclusion that tumor location has no effect on prognosis which is parallel to the data of study results by Park et al.[7]

For the operations performed in emergency conditions in colorectal region cancer cases, there has been no consensus reached about a standard operation technique specific to tumor segment, yet. While resection and anastomosis is accepted as standard procedure in right colon tumors currently, no gold standard surgical method has been determined for the left colon and rectum tumors.[5] In our research, we detected that; while the standard hemicolectomy operation in emergent and elective right colon tumors was preferred, Hartman procedure was more preferable in emergency conditions in left colon and rectum tumors compared to operations performed in elective conditions. We suppose that this is preferred in order to provide anastomosis safety to avoid tension risk and inability to feed patients in left colon anastomoses.

The most common tumor of liver is known to be gastrointestinal system malignant metastasis. And the most common among these are known to be colorectal region cancer metastases. Mortality rates of colorectal region cancers with detected liver metastasis are higher than the ones with no detected metastasis.[13,14] As being compatible with the literature, mortality rates of the cases with detected liver metastasis were significantly higher in our study.

Fluid, electrolyte imbalance develops in tumor obstructions.[5] Following the developed obstruction, the fluid-electrolyte balance completely gets disrupted due to nausea and vomiting accompanying the acute abdomen condition. This resultant fluid loss leads to deterioration in renal functions by the time. When the occurring mortality cases are examined, cardiopulmonary, renal and thromboembolic causes are the most commonly seen reasons for mortality.[15] And in our study, both in the elective and the emergently

operated patient groups, while urea elevation at admission was remarkable, also we detected that the postoperative creatinine elevation was predictive for mortality, as being independent from all parameters.

Conclusion

Despite some defects in our study which had been planned as a retrospective one; while we observed that mortality risk was higher in patients with high preoperative urea and high postoperative creatinine having colorectal surgical operations in emergency conditions, we also detected that the mortality in elective colon surgery was related to advanced age, liver metastasis existence, high preoperative plus postoperative urea levels and high postoperative creatinine levels.

Ethics

Ethics Committee Approval: The study was approved by the Kafkas University Faculty of Medicine Ethics Committee, Informed Consent: It was taken.

Peer-review: External and Internal peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Hakan Güzel, Gülay Özgehan, Şahin Kahramanca, Concept: Şahin Kahramanca, Design: Şahin Kahramanca, Data Collection or Processing: İsmail Emre Gökçe, Ali Cihat Yıldırım, Analysis or Interpretation: Turgut Anuk, Literature Search: Gülşen Çığşar, Ali Cihat Yıldırım, Turgut Anuk, Writing: Şahin Kahramanca.

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