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Comparison of the Complications of Colon Anastomosis and Related Factors in Emergency versus Elective Surgery

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ABSTRACT

Background and Objective: Colon surgery is one of the important operations in the abdominal area, but according to the type and conditions of surgery and clinical conditions, they can have different results and complications. The aim of this study is to determine the complications and related factors in patients who underwent colon anastomosis in emergency and elective surgery.

Methods: In this cross-sectional study, 70 patients over 18 years of age and in need of colon anastomosis, who visited Kowsar Hospital in Sanandaj in 2017-2020, were examined in both emergency and elective groups. The patients were examined for complications such as bleeding, abscess, anastomotic leak, partial obstruction, fistula, and death, and the patients were followed up for six months, and if any of the complications occurred, the patient was hospitalized and examined further.

Findings: The patients of the two groups did not have statistically significant differences in terms of demographic variables of age and gender, and surgery time. The highest frequency of the cause of surgery in the emergency group was volvulus in 10 cases (28.7%) and in the elective group was colon cancer in 26 cases (74.3%); in this regard, a statistically significant difference was observed between the two groups ($p<0.001$). The most common anastomosis site in the emergency group was the descending colon region (13 [37.1%]) and in the elective group was the ascending colon region (14 [40%]). The most common complications during and after anastomosis surgery include bleeding, infection, anastomosis leak and death, and the death rate in the emergency group was 7 people. The most common cause of death was peritonitis with 3 cases, followed by cardiorespiratory failure, embolism, disseminated intravascular coagulation and COVID-19 with peritonitis, with 1 case each. The history of hypertension and intraoperative bleeding had a statistically significant relationship with the incidence of colon anastomosis complications in both study groups ($p=0.01$).

Conclusion: Based on the results of this study, the incidence of anastomosis complications is higher in the emergency group, including increased intraoperative bleeding, and in emergency situations, the decision to perform primary anastomosis should be made according to the patient's clinical conditions.

Keywords: *Anastomosis, Colon, Complications And Coutcomes, Anastomosis Leak.*

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Introduction

Colon diseases are one of the causes of acute abdominal surgery. Colorectal resections are used for various diseases including neoplasms, inflammatory bowel disease and other benign diseases (1). One of the major problems of colon surgery is the presence of feces and a large number of bacteria inside the lumen, which increases infectious complications following surgery (2). Emergency resection may be performed due to obstruction, intestinal perforation, or bleeding (3). In this situation, the intestine is often not ready and the patient may be unstable. Surgical options for colonic pathology include wide colon resection with a single anastomosis, simultaneous multiple segmental resection with multiple anastomoses, or a staged resection in which a colostomy is implanted for the patient and the surgery is performed in two stages (4). Removing too much of the colon may alter bowel function and affect quality of life. On the other hand, the risk of anastomotic leakage may increase with multiple colonic anastomoses (5). Therefore, when dealing with colon diseases as an emergency when the intestine is not ready and contains feces, there are two major choices: performing a colostomy and repairing or removing the involved part of the colon and primary anastomosis in an environment where intestinal washing has not been done (1). In performing the primary anastomosis operation without bowel preparation, one should pay attention to factors such as the general condition of the patient, the condition of the intestine and the experience of the surgeon. Due to the fact that there are many choices for surgery when dealing with a patient with intestinal obstruction problems caused by sigmoid volvulus, it is necessary to adopt a method that has the lowest mortality rate, complications and disorders and recurrence rate, considering all the conditions (5, 6).

Despite technical advances in surgery, anastomotic leakage is one of the severe complications after intestinal surgery, which leads to mortality (7, 8). In previous studies, it has been shown that anastomosis leakage is the most common and important complication after surgery, especially colon cancer, which is responsible for 1.3 of postoperative deaths and occurs in 5-19% of colon surgeries. The frequency of this complication is high in emergency colorectal surgeries, especially for bowel obstruction (13% for emergency versus 4% for elective). Due to visceral expansion and as a result, the inconsistency in the size of each of the stumps, as well as the lack of mechanical preparation and the risk of stool contamination during surgery (9, 10), if rapid diagnosis and appropriate treatment are not performed, peritonitis and sometimes death is inevitable (11).

In the study of Bayar et al., it was also shown that complications such as surgical site infection, evisceration, and anastomotic leakage rate were more in the patients of the emergency surgery group (12). However, in a study conducted by Shahmoradi et al., it was reported that the postoperative complications and mortality rates were not different between the two groups undergoing primary anastomosis surgery and Hartmann surgery, but the hospitalization period was less in the Hartmann surgery group (13). The role of systemic factors in the etiology of anastomotic leakage has not yet been fully defined, but according to studies, among systemic factors, at least three of them play an important role, which include: malnutrition (serum albumin level below 4 g/dL), anemia and excessive blood loss and advanced malignancy. For this reason, it is necessary to identify patients at increased risk of anastomosis failure for preoperative patient optimization and selective proximal deviation (10, 14).

Since colostomy can be psychologically and hygienically uncomfortable for patients (15) and most patients prefer primary anastomosis, early recognition of the complications of colectomy and primary anastomosis and the effective factors in their control is very important in informing the medical community and it improves the wellbeing of these patients. Considering the limitations of studies in this field and sometimes contradictory results, the present study was conducted with the aim of determining the complications of colon anastomosis in emergency and elective patients.

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Methods

After the approval of the ethics committee of Kurdistan University of Medical Sciences with the code IR.MUK.REC.1399.242, this cross-sectional study was conducted by reviewing the files and examining the patients referred to Kowsar Hospital in Sanandaj who underwent colon anastomosis in 2017-2020.

After providing explanations about the process of conducting the study and obtaining informed consent, the patients who met the conditions to enter the study were examined. Patients over 18 years of age who needed colon anastomosis were included in the study. Patients with inflammatory bowel disease (IBD) treated with corticosteroids, fecal peritonitis, immunodeficiency, unstable hemodynamics, diabetes, history of cytotoxic drug use, and corticosteroid use were excluded from the study.

The study sample size was determined as 35 people in each group, assuming 95% confidence interval and 90% power. Patients were divided into two groups: emergency (transfer to the operating room from the hospital emergency room) and elective (hospital admission from the clinic) based on the status of the visit during the study period. After recording the data of the last sample, the patients were followed up by visiting the clinic for 6 months.

Patients were compared in terms of complications after surgery according to the type of surgery performed. The anesthesia method was the same for all patients and the surgery was performed under general anesthesia. After the diagnosis and surgical order for anastomosis, primary manual anastomosis with VICRYL 0/2 Suture was used for all samples. Patients were evaluated and examined after surgery. Finally, the patients were followed up for six months, and at the end of six months, possible complications were examined again, and in case of complications, the patient was hospitalized and further examined. Collected information including age, gender, frequency of type of surgery, time of surgery, frequency of the number of anastomosis (in colon and small intestine), distribution of anastomosis site, history of underlying disease, history of drug use, mean duration of hospitalization, frequency of wound infection, frequency of abscess and fistula, frequency of fascia formation, frequency of unwanted bleeding during surgery (two units hemoglobin drop from the last hemoglobin before the operation to the first hemoglobin after the operation), bleeding frequency after the operation (two units hemoglobin drop from the first postoperative hemoglobin to the pre-discharge hemoglobin), early postoperative obstruction or failure to defecate were investigated and fully recorded. All data in the patients' files were also recorded and collected in a coded manner and in compliance with the principles of medical ethics.

The data were reported using STATA version 14 and using statistical methods to compare the demographic characteristics between the two study groups with tests of mean and frequency distribution of the desired variables in the study subjects and also to determine the univariate relationship of each of the variables. Chi-square test or t-test was used independently, and multivariate regression test was used to perform multivariate analysis and $p<0.05$ was considered significant.

Results

70 patients were examined based on the data analysis of the study. The mean age in the emergency group was 61.77±19.30 years and in the elective group was 58.29±12.27 years. Moreover, the frequency of men was 24 (68.6%) in the emergency group and 20 (57.14%) in the elective group. Based on the results, no statistically significant difference was observed between the mean distribution of age and gender in the two groups. The mean surgery time in the emergency and elective groups was 4.10±1.19 and 3.59±0.89 hours, respectively, and no statistically significant difference was observed between the two groups. Moreover, the patients in the two investigated groups did not have statistically significant differences in terms of the

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presence of comorbidities and the history of drug use. The mean hospitalization time in the emergency group was 12 days and in the elective group was 9 days, and according to the results of the t-test, there was no significant difference between the two groups.

The highest frequency of the cause of surgery in the emergency group was volvulus in 10 cases (28.7%) and in the elective group was colon cancer in 26 cases (74.3%), which showed a statistically significant difference between the two groups ($p<0.001$) (Table 1).

Among the studied samples, 61 people (87.1%) had one anastomosis (colon region), 8 people (11.4%) had two anastomoses, and 1 person (2.8%) had three anastomosis cases (second and third anastomosis related to other parts of the intestine other than the colon region, for example, penetrating trauma of the small intestine) in the intestine. According to the results of the chi-square test, there was no significant difference between the two groups in terms of the number of anastomoses.

The most common anastomosis site in the emergency group was the descending colon region in 13 cases (37.1%) and in the elective group was the ascending colon region in 14 cases (40%). According to the results of the chi-square test, no significant difference was observed between the two groups (Table 2).

The most common complications caused during and after anastomosis surgery were bleeding, infection, anastomosis leak and death, and 7 deaths were reported in the emergency group (Table 3).

The most common cause of death was peritonitis with 3 cases, followed by cardiorespiratory events, embolism, disseminated intravascular coagulation and COVID-19 with peritonitis with 1 case each. Based on the results of the independent t-test, there was no significant relationship between the incidence of colon anastomosis complications and age, gender, duration of surgery, duration of hospitalization, site of anastomosis, and number of anastomosis in any of these two groups (Table 4). However, based on statistical analysis, the presence of history of blood pressure and intraoperative bleeding had a statistically significant relationship with the incidence of colon anastomosis complications in both study groups ($p=0.01$).

Table 1. Frequency of the cause of surgery in emergency and elective patients

Cause of surgery / Group	Colon cancer (ascending, transverse, descending) Number(%)	Sigmoid cancer Number(%)	Cecum cancer Number(%)	Colon obstruction Number(%)	Volvulus Number(%)	penetrating trauma Number(%)	Intussusception Number(%)	Perforation due to colonoscopy Number(%)
Emergency	8(22.9)	5(14.4)	2(5.6)	6(17.2)	10(28.7)	2(5.6)	1(2.8)	1(2.8)
Elective	26(74.3)	7(20)	2(5.7)	0(0)	0(0)	0(0)	0(0)	0(0)
p-value	0.0001							

Table 2. Frequency distribution of anastomosis site in emergency and elective group patients

Anastomosis site / Group	Ileocolic Number(%)	Ascending colon Number(%)	Descending colon Number(%)	Transverse colon Number(%)	Sigmoid Number(%)
Emergency	9(25.7)	9(25.7)	13(37.1)	2(5.6)	2(5.6)
Elective	4(11.4)	14(40)	10(28.7)	5(14.3)	2(5.6)
p-value*	0.23	0.19	0.33	0.22	>0.999

*Chi-square test

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Table 3. Frequency of complications during and after anastomosis surgery in emergency and elective groups

Complication / Group	Surgical site infection Number(%)	Abscess Number(%)	Fistula Number(%)	Fascial dehiscence Number(%)	Early postoperative obstruction Number(%)	Bleeding during surgery Number(%)	Postoperative bleeding Number(%)	Anastomotic leak Number(%)	Death Number(%)
Emergency	8(22.9)	1(2.8)	0(0)	1(2.8)	3(8.6)	11(31.4)	8(22.9)	4(11.4)	7(20)
Elective	3(8.6)	0(0)	2(5.7)	0(0)	0(0)	4(11)	3(8.6)	1(2.8)	0(0)
p-value*	0.10	0.23	0.09	0.31	0.07	0.03	0.10	0.15	0005

*Chi-square test

Table 4. Frequency of complications according to the location of anastomosis in emergency and elective groups

Complication Group	Ileocolic Number(%)	Ascending colon Number(%)	Descending colon Number(%)	Transverse colon Number(%)	Sigmoid Number(%)	Total (n=35 in each group)
Emergency	4(23.5)	4(23.5)	8(47)	0(0)	1(6)	17(48.6)
Elective	0(0)	2(28.6)	4(57.1)	0(0)	1(14.3)	7(20)
p-value	0.08	0.19	0.23	>0.999	>0.999	0.04

Discussion

According to the results obtained in this study, the death rate in the group of emergency patients was equal to 20%, and the most common cause of death was peritonitis, followed by disorders of other organs, such as cardiorespiratory failure, embolism, disseminated intravascular coagulation. Furthermore, one patient died due to complications caused by COVID-19 with peritonitis, while no death was observed in the elective group. In a study by Sultan et al. (16), factors affecting anastomotic leak after colorectal anastomosis in patients without a protective stoma were investigated on 127 adult patients in two groups; patients with anastomosis leak and patients without leak. 16% of 19 patients who had an anastomosis leak died. However, death rate in the opposite group was less than 2%, the reasons affecting the anastomotic leak included the urgency of the surgery. In the study of Sanei et al. (17), the mortality rate in patients undergoing emergency colon surgery (trauma-volvulus) was reported to be about 16%. According to the report of this study, the frequency of mortality according to the type of surgery was as follows: 61.5% related to reduction and resection and primary anastomosis and 38.5% related to colostomy. In our study, the highest incidence of complications was in patients whose anastomosis was performed in the descending colon region. Although there was no statistically significant difference between the two studied groups, the rate of complications in patients with anastomosis in the descending colon region was higher in the patients of the emergency group than in the elective group. Considering that the descending colon usually has more bacteria and feces, it can be seen that according to the results of our study, the highest incidence of complications and deaths, especially in the emergency group (nearly 50%), was related to the anastomosis area of the descending colon.

Another complication reported in our study was surgical site infection, which was nearly 23% in the emergency group and less than 9% in the elective group. In a study by Bayar et al. (12), which was conducted to evaluate the results of colon cancer surgery in both emergency and elective procedures, the incidence of surgical site infection in the emergency and elective groups was 26.7% and 11%, respectively. Although the results of this study were consistent with our study, it can be said that maybe the number of samples and

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the type of surgery and the conditions of surgery play a role in the rate of this difference. Bleeding during and after surgery was another problematic complication observed in our study. The occurrence of anastomotic leak, which was the most serious complication leading to death in patients, was another important complication observed in our study. According to studies, the incidence of anastomotic leak is 4-13%, and in our study, anastomotic leak was observed in 4 patients (11.4%) of the emergency group and 1 patient (2.8%) of the elective group. In general, in patients who are not prepared before the surgery and the bowel is full of feces, the possibility of infectious complications and anastomotic leak is also higher. In our study, the amount of unwanted bleeding during surgery, which was defined as hemoglobin drop by two units from the last hemoglobin measurement before the operation to the first hemoglobin measurement after the operation, which was significantly higher in the emergency group than the elective group, and one can say that the nature of emergency operations could have been effective. According to the results of our study, there was a significant relationship between the amount of intraoperative bleeding and the incidence of anastomotic complications, especially anastomotic leak. In the study of Sultan et al. (16), it was reported that in patients who received more than 2 units of PRBCs during surgery, the incidence of anastomotic complications was higher. Although the definitions of the amount of bleeding between our study and the study of Sultan et al. (16) are different, it seems that, based on the results of both studies, bleeding can affect the occurrence of complications due to colon anastomosis. In the study of Calin et al. (14), bleeding during and after the operation is one of the important risk factors of anastomotic leak.

Another result of our study is the role of hypertension in the occurrence of complications after anastomosis, and in our study, it was shown that patients who mentioned the history of hypertension and diabetes, the incidence of complications such as infection, anastomosis leak and death was higher. This was more common in the emergency group. In the study of Sánchez-Guillén et al. (18), who investigated the factors affecting the occurrence of anastomotic leak and the complications caused by this type of surgery, high blood pressure was also reported as one of the risk factors, which is in line with the results of our study.

The results of our study showed that the incidence of anastomosis complications in the emergency group was about 48% and various complications were effective, including a history of high blood pressure and high blood pressure during surgery, an increase in unwanted bleeding during surgery, which is defined as hemoglobin drop by two units from the last hemoglobin before the operation to the first hemoglobin after the operation. According to the obtained results, it seems that in emergency situations, the decision to perform primary anastomosis or colostomy should be made according to the patient's clinical conditions and it should be done with more caution.

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