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RESEARCH ARTICLE

Evaluation of Outcomes in Patients with Emergency Diverting or Decompressive Stoma

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ABSTRACT

Aim: The creation of permanent and temporary stomas holds a prominent place in emergency gastrointestinal surgical practice. This study aimed to evaluate the complications that developed after stomas were created in emergency cases for diversion or decompression and the factors that could be associated with these complications.

Method: Patients above the age of 18 for whom emergency stoma-creation surgery was indicated and who were operated on consecutively in a single tertiary hospital were included in this retrospective cohort study. Preoperative, perioperative, and early-period postoperative results and outcomes were analyzed accordingly.

Results: This study involved a total of 112 patients, and the findings showed a complication rate of 27.7%. The mean age of the patients was 62.8±15.2. The male/female ratio was 2.2:1. Patients with complications were found to be older (p=0.003), and a significant difference was observed in the American Society of Anesthesiologists scores (p=0.011). The complication rate was higher in open surgeries (p=0.035). The length of hospital stay was observed to be longer in patients with complications (p<0.001), and perioperative hemodynamic instability was more frequent in patients with complications (p=0.001).

Conclusion: Stoma creation in emergency gastrointestinal surgical cases can be lifesaving but can also lead to complications. This risk increases significantly in patients with advanced age, major comorbidities, and hemodynamic instability. This can lead to prolonged hospitalization and the need for intensive care unit admissions in this population, which may impose heavy burdens on patients and the healthcare system.

Keywords: Ileostomy, colostomy, intestinal obstruction, intestinal perforation, complications

Introduction

The process of creating a temporary or permanent opening in the abdominal wall for the small intestine and colon is frequently used in emergency gastrointestinal surgical practice. The first known ileostomy was conducted in 1879 by Dr. Wilhelm Baum for an obstructive colon tumor. Despite a century-long historical process and developing surgical techniques, stoma-related complications have continued at a considerable rate.[1]

The most common indications for stoma creation are known to be colorectal cancers, diverticulosis coli, and inflammatory bowel diseases. Complications that develop within the first month after stoma creation, such as mucocutaneous separation, retraction, ischemia, and necrosis, are classified as early-period complications, while complications that develop after the first month, such as parastomal hernia, prolapse, and stenosis, are classified as late-period complications.[2]

The incidence of stoma-related complications reported in the literature varies between 21% and 70%.[3] In different studies, the most common early-period complications observed have been mucocutaneous separation and peristomal skin complications.[4,5] Understanding the potential risk factors associated with complications is of great interest to both surgeons and stoma therapists for the management of the postoperative process, and a considerable number of studies have been conducted on the outcomes of individuals with a stoma. In several studies, systemic diseases, such as malignancy, obesity, and diabetes mellitus, are identified as increasing complication rates.[5,6] However, it is widely agreed in the literature that preoperative stoma site marking can lead to a significant reduction in postoperative complications.[7,8] In

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emergency surgery, the lack of stoma site marking and the inability to determine the optimal location for a stoma can result in permanent negative psychological and social effects on individuals, prolonged hospital stays, and increased costs for the healthcare system.[8]

In this study, we aimed to evaluate the complications that developed after stomas were created in emergency cases for diversion or decompression and the factors that could be associated with these complications.

Materials and Methods

Patient Recruitment

Patients with stomas were recruited from the department of general surgery. The study protocol was approved by the Local Ethics Committee of University of Health Sciences Turkey, Gülhane Training and Research Hospital (approval number: 2022/98, date: 01/07/2022). Informed consent was obtained from all patients for inclusion in the research.

Patients above the age of 18 with an indication for emergency stoma creation surgery, who were operated on consecutively between December 2018-2021 in a single tertiary hospital, were included in this retrospective cohort study after receiving ethical approval from the local committee. Elective cases, patients with missing hospital records and postoperative follow-up, and patients below the age of 18 were excluded from the study.

The demographic and clinical data of the patients were analyzed retrospectively, including age, gender, comorbidities, body mass index, the American Society of Anesthesiologists (ASA) scores, and preoperative history of chemotherapy and radiotherapy in malignant patients. Furthermore, data concerning emergency stoma creation diagnosis, stoma locations and types according to the intestinal segment, surgical procedures and durations, perioperative characteristics, lengths of hospital stay, and postoperative intensive care unit (ICU) admissions were analyzed. Patients were followed up for specific stomal complications, such as mucocutaneous separation, ischemia and necrosis, peristomal dermatitis, retraction, and parastomal infection, along with the stages of the complications, based on the Clavien-Dindo classification system. Preoperative laboratory results, such as white blood cell count ($x10^3/\mu L$), C-reactive protein level (mg/dL), neutrophil count ($x10^3/\mu L$), platelet count ($x10^6/\mu L$), and albumin level (g/dL), were also evaluated accordingly.

In this study, five different types of stomas (loop ileostomy, end ileostomy, double-barrel ileostomy, loop colostomy, and end colostomy) were created, and their localization was chosen as the left or right lower quadrant. Additionally, in cases of loop ileostomy and loop colostomy, the use of a stoma rod was based on the surgeon's preference.

Statistical Analysis

Statistical analyses were performed using SPSS Statistics (v.22.0) software. Descriptive statistics were expressed as a number, percentage, mean, standard deviation, and median (minimum-maximum). The conformity of the variables to the normal distribution was examined using visual (histogram and probability graphs) and analytical methods (the Kolmogorov-Smirnov and Shapiro-Wilk tests). Numerical variables showing normal distribution were analyzed using the independent samples t-test between the two groups, while those that did not show normal distribution were analyzed using the Mann-Whitney U test. Chi-square analysis and Fisher's exact test were used for the comparison of nominal data. In the statistical analyses of the study, comparisons with a p-value below 0.05 were considered statistically significant.

Results

The mean age of 112 patients who underwent surgery was 62.8±15.2 (22-95 years). The male/female ratio was 2.2:1. Among the patients, 61 (54.5%) had comorbidities, and the most observed comorbidities were hypertension (n=38, 33.9%) and diabetes mellitus (n=29, 25.9%; Table 1).

The most common causes of stoma creation were colorectal carcinoma (n=56, 50%), volvulus (n=12, 10.7%), and acute

Table 1. Descriptive characteristics of the patients included in the study

Characteristic	Result
Age*	62.8±15.2
Gender	
Female	35 (31.3)
Male	77 (68.8)
Body mass index (kg/m^2)*	25.6±3.7
American Society of Anesthesiologists score	
I	1 (0.9)
II	45 (40.2)
III	64 (57.1)
IV	2 (1.8)
Presence of comorbidity	61 (54.5)
Hypertension	38 (33.9)
Diabetes mellitus	29 (25.9)
Coronary artery disease	15 (13.4)
Chronic obstructive pulmonary disease	8 (7.1)
Preoperative CT/RT history	20 (17.9)

*: Mean ± standard deviation. CT: Chemotherapy, RT: Radiotherapy

Table 2. Reasons for stoma and stoma-related characteristics of the patients

Reason for stoma	Percentage (%)
Colorectal carcinoma	56 (50.0)
Volvulus	12 (10.7)
Acute diverticulitis	10 (8.9)
Inflammatory bowel disease	7 (6.3)
Ileus (other reasons)	5 (4.5)
Fournier's gangrene	5 (4.5)
Colorectal perforation	5 (4.5)
Anastomotic leak	4 (3.6)
Gunshot injury	3 (2.7)
Acute mesenteric ischemia	2 (1.8)
Lower gastrointestinal bleeding	1 (0.9)
Penetrating tool injury	1 (0.9)
Ischemic colitis	1 (0.9)
Stoma type	
Ileostomy	31 (27.7)
End ileostomy	15 (13.4)
Loop ileostomy	11 (9.8)
Double-barrel ileostomy	5 (4.5)
Colostomy	81 (72.3)
End colostomy	65 (58.0)
Loop colostomy	16 (14.3)
Stoma localization	
Left lower quadrant	80 (71.4)
Right lower quadrant	32 (28.6)

diverticulitis (n=10, 10.7%). Colostomy was performed on 81 (72.3%) patients, with end colostomy (n=58, 58.0%) and loop colostomy (n=16, 14.3%) being the most common types, while 31 (27.7%) patients underwent ileostomy, with end ileostomy (n=15, 13.4%), loop ileostomy (n=11, 9.8%), and double-barrel ileostomy (n=5, 4.5%) being the preferred types. Localization analysis showed that 71.4% (n=80) of the stomas were in the lower left quadrant, and 28.6% (n=32) were in the lower right quadrant (Table 2).

On evaluating the surgical procedures, it was found that 100 (89.3%) patients underwent open surgery. Complications were observed in 31 (27.7%) patients. The most common complications were mucocutaneous separation (n=16, 14.3%), ischemia and necrosis (n=5, 4.5%), and peristomal dermatitis (n=5, 4.5%; Table 3).

When the descriptive characteristics of the patients were analyzed according to the presence of complications, patients

Table 3. Preoperative, intraoperative, and early postoperative characteristics of the patients included in this study

Characteristic	Percentage (%)
Type of surgery	
Open	100 (89.3)
Laparoscopic	12 (10.7)
Surgical duration (minutes)*	140 (50-220)
Length of hospital stay (days)*	11 (4-33)
Perioperative characteristics	
Use of blood and blood products	36 (32.1)
Hemodynamic instability	17 (15.2)
Use of stoma rod	15 (13.4)
Intensive care unit admission	92 (82.1)
Preoperative laboratory tests	
White blood cell count**	13.4±5.1
Neutrophil count**	11.2±4.9
Platelet count*	286 (87-815)
Hemoglobin**	12.0±2.2
Albumin**	3.0±0.5
C-reactive protein*	88 (3.5-531)
Stomal complication	31 (27.7)
Mucocutaneous separation	16 (14.3)
Ischemia and necrosis	5 (4.5)
Peristomal dermatitis	5 (4.5)
Retraction	2 (1.8)
Parastomal infection	1 (0.9)
Hemorrhage	1 (0.9)
Metabolic (high-output stoma)	1 (0.9)
Surgical complications severity (The Clavien-Dindo Classification System)	
I	21 (67.7)
III	10 (32.3)

*Median (minimum-maximum), **: Mean ± standard deviation

with complications were found to be older (p=0.003), and a significant difference was observed in their ASA scores (p=0.011; Table 4).

When the stoma-related characteristics were analyzed according to the presence of complications, the complication rate was found to be significantly higher in patients who underwent end ileostomy compared to those who underwent loop ileostomy (p=0.036), but no significant difference was observed in terms of other stoma-related characteristics (Table 5).

Table 4. Analysis of descriptive characteristics according to the presence of complications

Characteristic	Complication (+), (n=31) n (%)	Complication (-), (n=81) n (%)	p-value
Age*	69.7±14.3	60.2±14.8	0.003†
Gender			0.292††
Female	12 (38.7)	23 (28.4)	
Male	19 (61.3)	58 (71.6)	
Body mass index (kg/m²)*	25.9±4.0	25.5±3.6	0.563††
American Society of Anesthesiologists score			0.011††
I	1 (3.2)	0	
II	6 (19.4)	39 (48.1)	
III	24 (77.4)	40 (49.4)	
IV	0	2 (2.5)	
Presence of comorbidity	17 (54.8)	44 (54.3)	0.961††
Hypertension	11 (35.5)	27 (33.3)	0.830††
Diabetes mellitus	8 (25.8)	21 (25.9)	0.990††
Coronary artery disease	3 (9.7)	12 (14.8)	0.554‡
Chronic obstructive pulmonary disease	3 (9.7)	5 (6.2)	0.683‡
Preoperative CT/RT history	5 (16.1)	15 (18.5)	0.768††

CT: Chemotherapy, RT: Radiotherapy, *Mean ± standard deviation, †: Independent samples t-test, ††: Chi-square test, ‡: Fisher's exact test

Table 5. Analysis of stoma-related characteristics according to the presence of complications

Characteristic	Complication (+), (n=31) n (%)	Complication (-), (n=81) n (%)	p-value
Stoma cause			
Colorectal carcinoma	13 (41.9)	42 (51.9)	0.348†
Volvulus	4 (12.9)	8 (9.9)	0.734††
Acute diverticulitis	2 (6.5)	8 (9.9)	0.724††
Stoma type			0.253†
Ileostomy	11 (35.5)	20 (24.7)	
Colostomy	20 (64.5)	61 (75.3)	
Comparison of stoma types			
Loop ileostomy	1 (11.1)	10 (58.8)	0.036††
End ileostomy	8 (88.9)	7 (41.2)	
Loop ileostomy	1 (50.0)	10 (40.0)	0.658††
Loop colostomy	1 (50.0)	15 (60.0)	
Loop colostomy	1 (5.0)	15 (24.6)	0.102††
End colostomy	19 (95.0)	46 (75.4)	
Stoma site			0.316†
Left lower quadrant	20 (64.5)	60 (74.1)	
Right lower quadrant	11 (35.5)	21 (25.9)	

†: Chi-square test, ††Fisher's exact test

When the surgery-related characteristics were analyzed according to the presence of complications, the complication rate was higher in open surgeries (p=0.035). Moreover, in patients with complications, hospital stays were observed to be longer (p<0.001), and perioperative hemodynamic instability was more frequent (p=0.001) (Table 6).

When complications were analyzed, superficial mucocutaneous separation (n=12, 10.7%), peristomal dermatitis (n=5, 4.5%), and peristomal infection (n=1, 0.9%) were found to be treated with regular stoma care, whereas deep mucocutaneous separation (n=4, 4.6%) and retraction (n=2, 1.8%) were treated with stoma revision. Hemorrhage and metabolic complications related to high-output stoma were treated with hemodynamic and systemic follow-up and regular stoma care.

Discussion

The creation of permanent and temporary stomas holds an important place in emergency gastrointestinal surgical practice. Temporary stoma creation can also be performed as a bridge to primary surgery, as in the case of intraluminal stenting.[9] Stomas are particularly preferred in cases of advanced age, male gender, high ASA score, and the presence of comorbidities, depending on the surgical pathology encountered. In most cases, stomas can be lifesaving. In clinical practice, stomas are most commonly

Table 6. Analysis of preoperative, intraoperative, and early postoperative characteristics according to the presence of complications

Characteristic	Complication (+), (n=31) n (%)	Complication (-), (n=81) n (%)	p-value
Type of surgery			0.035†
Open	31 (100)	69 (85.2)	
Laparoscopic	0	12 (14.8)	
Surgical duration (minutes)*	150 (90-220)	140 (50-220)	0.100††
Length of hospital stay (days)*	15 (7-33)	10 (4-29)	<0.001††
Perioperative characteristics			
Use of blood and blood products	13 (41.9)	23 (28.4)	0.170‡
Hemodynamic instability	11 (35.5)	6 (7.4)	0.001†
Rod usage	2 (6.5)	13 (16.0)	0.229†
Intensive care unit admission	30 (96.8)	62 (76.5)	0.012‡
Preoperative laboratory tests			
White blood cell count**	14.1±5.6	13.1±4.9	0.381‡‡
Neutrophil count**	12.0±5.4	10.9±4.7	0.306‡‡
Platelet count*	338 (109-685)	282 (87-815)	0.189††
Hemoglobin**	12.0±2.2	12.1±2.2	0.891‡‡
Albumin**	2.9±0.5	3.0±0.4	0.384‡‡
C-Reactive protein*	88 (14-489)	89 (3-531)	0.256††

*: Median (minimum-maximum), **: Mean ± standard deviation, †: Fisher's exact test, ††: Mann-Whitney U test, ‡: Chi-square test, ‡‡: Independent samples t-test

created in emergencies due to obstructive malignant lesions. In addition, considering the intestinal segments where the pathological conditions are observed, an end colostomy is reported as being performed more frequently in the lower left abdominal quadrant.[9,10] Similar demographic and clinical characteristics were found in this study.

Advanced age, the presence of major comorbidities, and a high ASA score are parameters that can increase the risk of complications, not only in surgical cases but also in stoma complications.[11] Hospitalization may be prolonged and ICU stay may be required in the presence of complications.[4] In this study, the risk of complications was observed to be higher as age and ASA score increased. In addition, the length of hospitalization was prolonged, and ICU stay was more frequent in the group with complications.

When patients with stomas were diagnosed separately, complications were more frequently observed in patients with malignancies. Additionally, it is reported in the literature that patients with colostomy are more prone to complications than those with ileostomy, and patients with a stoma on the left lower quadrant are more prone to complications than those with a stoma on the right lower quadrant.[12] In this study, when complications were analyzed according to the cause and location of the stoma, no significant difference was observed. However, statistically fewer complications were encountered in patients with a loop ileostomy.

When complications were examined, the observations were made that mucocutaneous separation was the most common early-period complication, and the risk increased particularly in emergency surgical cases. It is known that in later stages, mucocutaneous separation becomes deeper, does not respond to medical or conventional methods of treatment, and can lead to stoma revision.[13] In the current study, mucocutaneous separation was also found to be the most common stoma complication.

In the literature, perioperative factors may cause complications, such as stoma necrosis or peristomal hemorrhage, especially in hemodynamically unstable cases. It is also known that prolonged surgical duration and the increased use of blood products can increase stoma complications, such as systemic complications.[14] In this study, it was statistically determined that, among the preoperative factors, only hemodynamic instability was a significant predictor of complications. In addition, prolonged surgical duration and increased use of blood products did not have a statistically significant effect on stoma-related complications.

Mohan et al.[15] stated that the traditional use of a stoma rod had no significant effect on reducing the risk of retraction; however, it may increase the risk of dermatitis and necrosis. In this study, it was determined that the use of a rod in stoma maturation did not create a significant difference between the groups.

In emergency surgical cases, it has been reported that preoperatively increased acute-phase reactants or changes in laboratory parameters, such as low hemoglobin and albumin levels, may be predictive of the development of complications. These laboratory parameters are also used in the monitoring and management of complications, should they arise.[16,17] In this study, however, no preoperative laboratory parameters were found to be significant.

In their study of 50 patients with stomas, Hayashi et al.[18] found that fewer complications were encountered in laparoscopic cases, and patients in this group were switched

to early oral intake. However, in the present study, the surgical duration was longer in the laparoscopic group. In a study conducted by Zhang et al.[19], it is stated that the Hartmann procedure resulted in fewer complications in laparoscopic cases. However, the rate of conversion to open surgery remained high. In this study, it was also determined that laparoscopic cases had a statistically significantly lower rate of complications.

In a systematic review and meta-analysis study conducted by Ambe et al.[20], it was found that preoperative stoma site marking was associated with a significant decrease in complications in 3,458 patients whose results were evaluated; however, the study also included long-term complications, such as parastomal hernia and stenosis, as outcome criteria. In this study, only emergency stomas were included in the evaluation scope, no preoperative marking was performed in any case, and only early-period results were evaluated.

Study Limitations

This study has some limitations, including its retrospective design, the small number of laparoscopic cases, the diversity of the surgeons, and the lack of stoma site marking. However, the population consisted of only emergency cases, and the study was designed in a center with a high patient volume; these are considered major reasons for these limitations. Another limitation was the heterogeneity of the patient population, which included individuals with both malignant and non-malignant conditions, potentially introducing bias when comparing patients for stoma-related complications.

Conclusion

Stoma creation in emergency gastrointestinal surgical cases can be lifesaving, but it can also lead to complications. This risk increases significantly in patients with advanced age, major comorbidities, and hemodynamic instability. Complications can lead to prolonged hospitalization and the need for ICU admissions in this population, which may impose heavy burdens on them and the healthcare system. Moreover, loop ileostomy was found to have fewer complications than end ileostomy. Therefore, randomized prospective studies with large patient populations, comprehensive systematic reviews, and meta-analyses are needed to determine the factors that can reduce stoma-related complications in emergency cases.

Ethics

Ethics Committee Approval: The study protocol was approved by the Local Ethics Committee of University of Health Sciences Turkey, Gülhane Training and Research Hospital (approval number: 2022/98, date: 01/07/2022).

Informed Consent: Informed consent was obtained from all patients for inclusion in the research.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: M.Z.B., O.H., Concept: M.S.Ç., Design: M.Z.B., Data Collection or Processing: M.S.Ç., Analysis or Interpretation: B.U., Literature Search: M.Z.B., M.S.Ç., O.H., Writing: M.Z.B.

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