MEDICAL UNIVERSITY – Pleven

Faculty of Medicine

DEPARTMENT OF PROPEDEUTICS OF SURGICAL DISEASES

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Possibilities of Fast-Track Protocols in Emergency Abdominal Surgery

AUTHOR'S ABSTRACT

of a dissertation for awarding the educational and scientific degree of Doctor

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Pleven

2025

The dissertation is written on 88 standard typewritten pages and is illustrated with 6 tables and 13 figures. One hundred and twenty-six (126) literary sources were used.

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He has acquired a specialty in surgery.

The public defense of the dissertation will take place on 10.07.2025 at 12.00 hours at the Ambroise Pare Hall, MU – Pleven.

The materials for the defense are available to those interested on the website of MU – Pleven, www.mu-pleven.bg

Contents

I. Introduction

A period of fasting (“nil by mouth”) is a common practice after gastrointestinal surgery. The stomach is decompressed with a nasogastric tube and intravenous fluids are infused, with oral feedings introduced when gastric dyskinesia resolves. The rationale for this practice is to prevent postoperative nausea and vomiting and to protect the anastomosis, if one has been constructed, by allowing time for healing before it is subjected to food stress. It is unclear whether delaying enteral feeding is beneficial. Contrary to popular belief, evidence from clinical trials and animal experiments suggests that early feeding is beneficial. Postoperative dyskinesia primarily affects the stomach and the colon, with the small intestine recovering its normal function 4–8 hours after laparotomy. Feeding within 24 hours of laparotomy is tolerated and food is absorbed (1).

The concept of “fast-track surgery” or “enhanced recovery after surgery” (ERAS), initiated by Kellet (2) in the 1990s, has been described in numerous studies over the past decade. The main goal of this concept is to reduce the postoperative length of hospital stay. The main aspects are: no perioperative fasting, optimal nutrition, less use of tubes and drains, optimization of pain control and early mobilization.

Enhanced Recovery after Surgery (ERAS) is a multidisciplinary structured approach that follows standardized components for the care of patients undergoing various types of surgical treatment. To date, ERAS protocols are largely implemented in elective surgery. Emergency surgery is a key hospital activity with the highest percentage of cases in General Surgery, with mortality rates reaching 80%. There are currently strong recommendations that the emergency surgery model must be changed to improve the efficiency and quality of care. One of the proposed measures to improve outcomes is the implementation of ERAS protocols (3). There is already evidence that they can be applied to a large extent in patients undergoing emergency surgical treatment (emergency laparotomy) (4–10). The term "emergency laparotomy" encompasses surgical exploration of an acute abdomen for a variety of underlying pathologies. Common causes include: intestinal obstruction, perforation of a hollow abdominal organ, drainage of an intra-abdominal abscess, etc. (11)

The ERAS protocols include combinations of various perioperative patient preparation methods, using a multidisciplinary team approach that is based on evidence that reduces surgical stress, maintains postoperative

physiological functions, and accelerates the recovery of patients undergoing surgical interventions (10).

Recommendations for the elements of the ERAS protocols are presented in 4 groups: pre-hospitalization, preoperative, intraoperative and postoperative (24).

II. Objective and Tasks

1. Objective

To study the applicability and effectiveness of protocols for rapid recovery of patients after surgical intervention in emergency abdominal surgery

2. Tasks

1. To conduct a literature analysis on the application of protocols for rapid recovery of patients after surgical interventions in emergency abdominal surgery
2. To analyze the application of various elements of the fast-track protocols in patients-candidates for emergency surgical intervention
3. To analyze the obstacles to the application of some of the elements in emergency abdominal surgery
4. To analyze the results of the application of the various elements and their number on the indicators - mortality, complications and days spent in hospital
5. To investigate the application of various laboratory and other indicators for early detection of tight and complicated course in the postoperative period, which could affect the application of some of the elements of the fast-track protocols
6. To compare our results with the world literature

III. Materials and Methods

1. The cohort studied

The prospective study included 154 patients aged 22 to 89 years, treated in the ward of Coloproctology and Purulent-Septic Surgery of "Dr. Georgi Stranski" MHAT - Pleven. The study covered the period January 2020 - May 2023. The included patients were operated on urgently by a team with my participation, and were divided into three diagnostic groups: ileus, peritonitis and intra-abdominal abscess. Patients operated on for abdominal trauma and

impaired mesenteric circulation were excluded, as well as those who died by the 3rd postoperative day.

2. Elements of the fast-track protocol

The following elements of the fast-track protocol were studied:

1. Preoperative elements:
    1) Patient awareness/Informing the patient about the upcoming treatment
    2) Preoperative carbohydrate loading
    3) Preoperative antibiotic therapy
    4) Correction of water-and-electrolyte balance
    5) Avoidance of anxiolytics in the patient's premedication before surgery
2. Intraoperative elements:
    1) Minimally invasive surgery
    2) Monitoring of sedation and muscle relaxation
    3) Use of TIVA (total intravenous anesthesia)
    4) Use of short-acting opioids
    5) Prevention of nausea and vomiting with dexamethasone 8 mg
    6) Volume of intraoperative fluid infusion
    7) Prevention of hypothermia
3. Postoperative elements:
    1) Removal of the nasogastric tube before 24 hours
    2) Early removal of the urethral catheter
    3) Early discontinuation of intravenous fluid therapy when sufficient oral fluid intake is possible
    4) Prevention of thrombus formation
    5) Postoperative analgesia
    6) Feeding started before 24 hours
    7) Patient mobilization on the first postoperative day

A standard panel of blood tests was studied upon admission of patients to the ward, and additionally the glycemic control was monitored postoperatively, as well as the level of serum albumin on the third and fifth postoperative days and the level of C-reactive protein on the third and fifth postoperative days. The duration of hospital stay, including the days of stay in the intensive care unit, the in-hospital and early (up to the 30th day) mortality, the survival of patients from the date of surgery to September 20, 2024, the complications by type and classified according to Clavien-Dindo were studied.

3. Statistical methods

The following statistical methods were used for data processing:

1. Descriptive analysis – the frequency distribution of the considered features, broken down by study groups, presented in tabular form.
2. Cross tabulation – to search for a relationship between categorical features.
3. Graphical analysis – to visualize the obtained results.
4. The $\chi 2$ test – to test hypotheses about the existence of a relationship between categorical variables.
5. The Fisher's exact test – to test hypotheses about the existence of a relationship between categorical variables.
6. The parametric Student's T-test – to test hypotheses about the difference between the arithmetic means of two independent samples.
7. ANOVA – to compare the means of more than 2 variables.
8. Correlation analysis – to discover a relationship between 2 quantities.

IV. Results

1. Description of the cohort

One hundred and fifty-four (154) patients, aged 22 to 89 years, who were treated in the ward of Coloproctology and Purulent-Septic Surgery at the First Clinic of Surgery, "Dr. Georgi Stranski" UMHAT - Pleven, were included. The study covered the period January 2020 - May 2023.

In terms of gender, the study included 92 men (59.7%) and 62 women (40.3%).

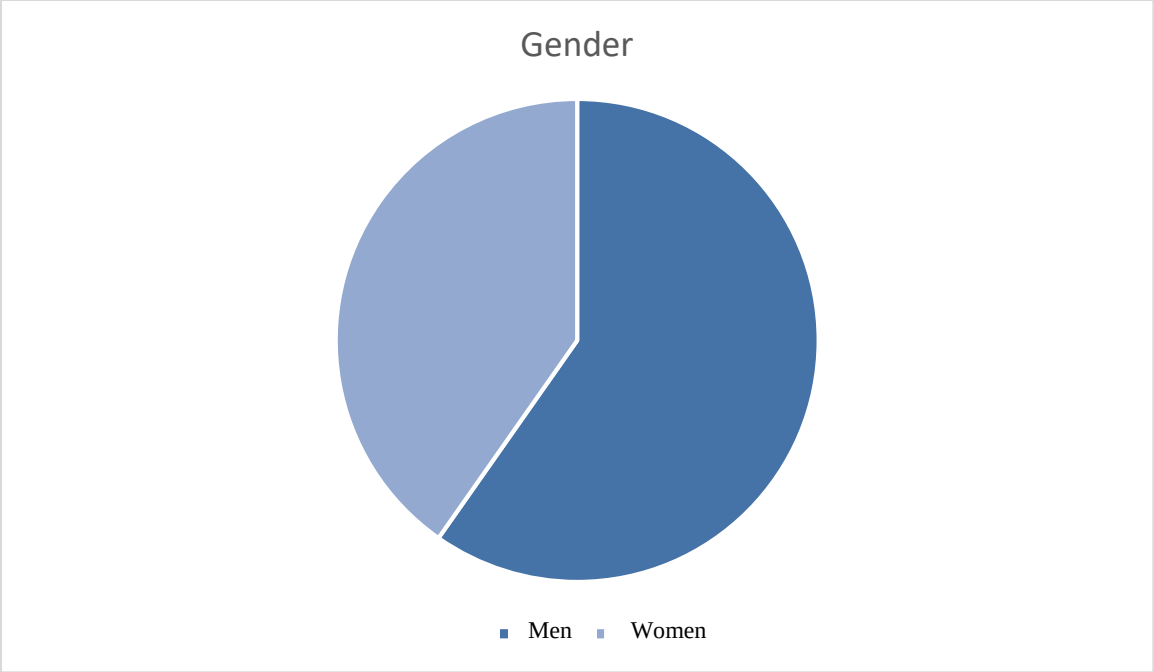

Figure 1 Distribution by gender

In terms of age, the mean age of the patients was 64 years +/-14 years. For men, it was 64 years +/-13 years, and for women, it was 63 years +/-15 years.

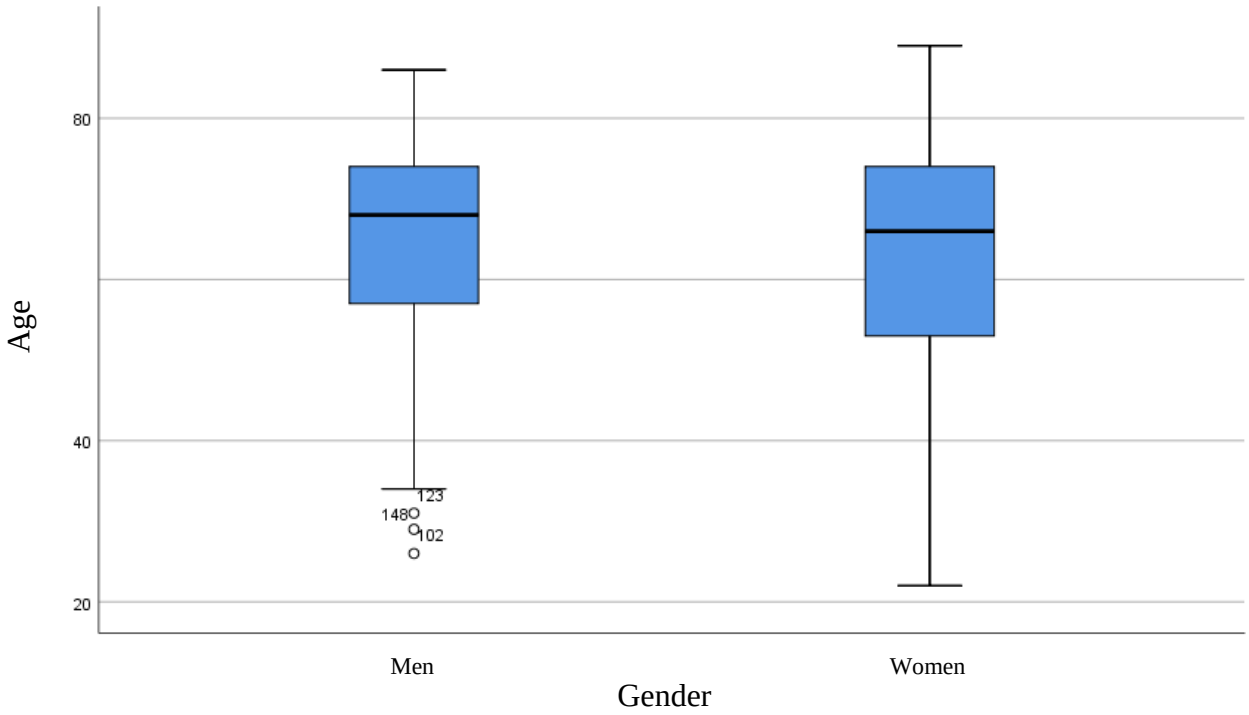

Figure 2 Distribution by age and gender

Due to the non-Gaussian distribution of the groups, the Mann-Whitney test was performed, which showed that there was no statistically significant difference in the distribution by age and gender of the patients (p 0.861).

The mortality rate in the ward among patients was 9.1% (14 patients). The early mortality rate up to 30 days was 10.4%. The mortality rate in the ward for both genders was 8.7% in men and 9.7% in women, respectively, and no statistically significant difference was observed (χ^2 0.043, df 1, p 0.835).

Table 1 presents the patients' diagnoses.

Diagnosis	Incidence	Percentage	Diagnosis	Incidence	Percentage
Abscessed tumor of the sigmoid colon	1	0.6%	Adhesion ileus	4	2.6%
Biliary ileus	2	1.3%	Crohn's disease	1	0.6%
Volvulus and perforation of the sigmoid colon	1	0.6%	Volvulus of the jejunum	1	0.6%
Volvulus of the	6	3.9%	Gangrenous appendicitis	4	2.6%

sigmoid colon					
Gangrenous cholecystitis	14	9.1%	Diverticula of the sigmoid colon	2	1.3%
Diverticula of the cecum	1	0.6%	Incarcerated ventral hernia	4	2.6%
Incarcerated inguinal hernia	1	0.6%	Incarcerated femoral hernia	2	1.3%
Intra-abdominal abscess	2	1.3%	Carcinoma of the ascending colon	3	1.9%
Carcinoma of descending colon	5	3.2%	Carcinoma of the sigmoid colon	17	11%
Carcinoma of the sigmoid colon with infiltration of the small intestine	1	0.6%	Carcinoma of the transverse colon	3	1.9%
Carcinoma of the rectum	9	5.8%	Carcinoma of the lienal flexure	4	2.6%
Carcinoma of the hepatic flexure	3	1.9%	Carcinoma of the cecum	7	4.5%
Small intestinal metastasis from malignant melanoma	1	0.6%	Perforation of the appendix	4	2.6%
Acute biliary peritonitis	1	0.6%	Periappendicular abscess	1	0.6%
Perforation of duodenal ulcer	1	0.6%	Perforation of the gallbladder	3	1.9%
Perforation of the ascending colon	1	0.6%	Perforation of the sigmoid colon	4	2.6%
Perforation of the transverse colon	1	0.6%	Perforation of pyloric ulcer	3	1.9%
Perforation of	9	5.8%	Perforation of the	3	1.9%

gastric ulcer			small intestine		
Perforation of the cecum	1	0.6%	Perforated carcinoma of the sigmoid colon	2	1.3%
Perforated carcinoma of hepatic flexure	1	0.6%	Perforated carcinoma of the cecum	1	0.6%
Perforated diverticula of the sigmoid colon	7	4.5%	Strangulation ileus	9	5.8%
Incarcerated epigastric hernia	1	0.6%	Phlegmon of the sigmoid colon	1	0.6%
Phlegmonous cholecystitis	1	0.6%			

Table 1. Diagnoses

Due to the heterogeneous diagnoses of the operated patients, we grouped them into three diagnostic groups: first diagnostic group – ileus (intestinal obstruction), second diagnostic group – acute peritonitis, and third diagnostic group – intra-abdominal abscess.

Diagnostic group	Patients
Ileus	84
Acute peritonitis	48
Intra-abdominal abscess	22

Table 2. Diagnostic groups

Figure 3 presents the distribution by gender in the diagnostic groups. There was no statistical difference in the distribution (χ^2 4.23; df 2; p>0.05).

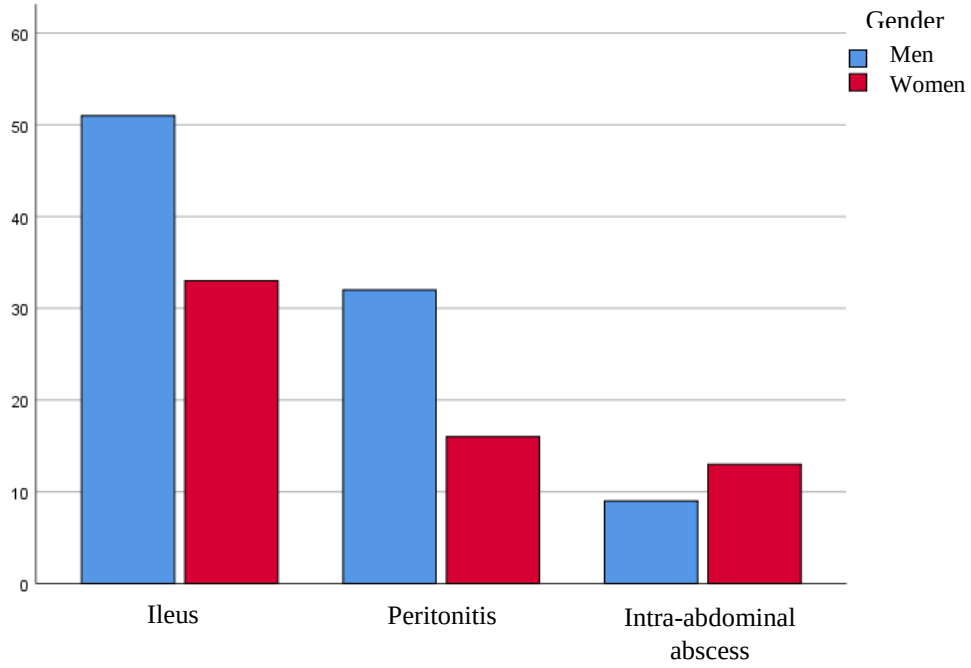

Figure 3. Distribution by gender in the diagnostic groups

There was no statistical difference in the mean age of the patients by diagnostic group (p 0.380): ileus – 66 years +/-13 years, acute peritonitis – 62 years +/-14 years, intra-abdominal abscess – 61 years +/-16 years.

2. Included elements of the protocols for rapid recovery of patients after surgical interventions

Nineteen (19) elements of the protocols for rapid recovery of patients after surgical interventions were included, divided into three groups presented in Table 3.

Preoperative	Intraoperative	Postoperative
Patient awareness	Minimally invasive access	Removal of the nasogastric tube <24 hours
Correction of water-and-electrolyte balance	Prevention of hypothermia	Early discontinuation of intravenous fluid therapy when sufficient oral fluid intake is possible
Avoidance of anxiolytics	Volume of intraoperative fluid infusion (avoiding the use of NaCl (0.9%))	Early removal of the urethral catheter

Preoperative carbohydrate loading	Monitoring of sedation and muscle relaxation	Prevention of thrombus formation
Preoperative antibiotic therapy	TIVA	Opioid-free analgesia
	Prevention of vomiting with dexamethasone 8 mg	Feeding started <24 hours
	Use of short-acting opioids	Mobilization on the 1st POD

Table 3. Fast-track elements

Preoperative elements	Percentage of application
Patient awareness	100%
Correction of water-and-electrolyte balance	79.2%
Avoidance of anxiolytics	100%
Preoperative carbohydrate loading	0%
Preoperative antibiotic therapy	15.6%

Table 4. Percentage of application of preoperative elements

Intraoperative	Percentage of application
Minimally invasive access	9.7%
Prevention of hypothermia	0%
Volume of intraoperative fluid infusion (avoiding the use of NaCl (0.9%))	22.1%
Monitoring of sedation and muscle relaxation	0%
TIVA	42.9%
Prevention of vomiting with dexamethasone 8 mg	49.4%
Use of short-acting opioids	100%

Table 5. Percentage of application of intraoperative elements

Postoperative	Percentage of application
Removal of the nasogastric tube <24 hours	62.3%
Early discontinuation of intravenous fluid therapy when sufficient oral fluid intake is possible	11.7%
Early removal of the urethral catheter	18.8%
Prevention of thrombus formation	100%
Opioid-free analgesia	75.3%
Feeding started <24 hours	71.4%
Mobilization on the 1st POD	48.7%

Table 6. Percentage of application of postoperative elements

3. Effect on the length of hospital stay, ward mortality and postoperative complications of each element of the fast-track protocol

3.1 Patient awareness

This element of the fast-track protocol was met in all 154 patients; therefore, no assessment of the criterion could be made.

3.2 Correction of water and electrolyte imbalance

The element was observed in 122 (79.2%) of the patients, while in 32 (20.8%), it was not applied. The water-electrolyte balance was not corrected in those patients who had no deviations from the latter or had minor deviations and the surgical intervention was immediately after the patient's hospitalization. The average duration of hospital stay was 9±5 days and 8±5 days, respectively. No statistically significant difference was observed in the two groups (p 0.286). The patients, in whom this element was applied and who died in the ward were 11 (9%), and the rest patients were 3 (9.4%). No statistically significant difference was found (p 0.950), as well as in the postoperative complications (surgical wound infection, surgical wound dehiscence and anastomotic dehiscence).

3.3 Preoperative carbohydrate loading

This element of the fast-track protocol was not met in any of the patients; therefore, no assessment of the criterion could be made. All patients included in the study had intestinal obstruction and this particular element was not applicable.

3.4 Preoperative antibiotic therapy

Preoperative antibiotic therapy was initiated in 24 (15.6%) of the patients. In 130 of the patients, antibiotics were not administered preoperatively due to the lack of indications for preoperative inflammation or because the patients were operated on immediately after hospitalization with antibiotic therapy initiated intraoperatively. Regarding the hospital stay in the two groups, the median was 6±8 days and 8±4 days, respectively. The Mann-Whitney test was performed and no statistically significant difference was found (p 0.073). No difference was found in the ward mortality rate for the two groups (χ^2 0.400, df 1, p 0.527). Surgical wound infection was observed in 16% in both groups.

3.5 Avoidance of anxiolytics in patient premedication

This element of the fast-track protocol was adhered to in all 154 patients; therefore, no assessment of the criterion could be made. All patients in the premedication before the surgical intervention did not use anxiolytics at the discretion of the anesthesia team.

3.6 Minimally invasive surgery

The type of surgical intervention (open or minimally invasive surgery) was at the discretion of the operator based on experience and the specific case. A minimally invasive approach was applied in 15 (9.7%) of the patients. The hospital stay for them was 6 days (IQR2) compared to the patients operated with open surgery, where the hospital stay was 8 days (IQR5). Due to the non-Gaussian distribution of the groups, the Mann-Whitney test was performed, which showed that there was a statistically significant difference (p 0.001). Regarding the ward mortality, which was 6.7% and 9.4%, respectively, no statistically significant difference was found (χ^2 0.118, df 1, p 0.731). There was also no statistically significant difference in postoperative complications.

3.7 Use of total intravenous anesthesia (TIVA)

The use of this element was at the discretion of the anesthesia team. TIVA was used in 66 (42.9%) of the patients. It did not affect the duration of hospital stay in both patient groups, 9 days±4 and 9 days±5, respectively (p 0.694). In the patients undergoing this type of anesthesia, a lower incidence of infections and dehiscence of the surgical wound was observed (χ^2 4.333, df 1, p 0.037 and χ^2 9.761, df 1, p 0.002). No statistically significant difference was observed in terms of the post-operative complication of anastomotic dehiscence.

3.8 Use of short-acting opioids

This element of the fast-track protocol was followed in all 154 patients; therefore, no assessment of the criterion could be made. At the discretion of the anesthesia team, short-acting opioids were used in all patients during the surgical intervention.

3.9 Volume of intraoperative fluid infusion

The volume of intraoperative infusions was at the discretion of the anesthesia team. Patients, in whom intraoperative infusions were 5 ml/kg/h and NaCl 0.9% infusions were below 500 ml, were considered to have complied with this element of the fast-track protocol. Accordingly, their number was 34 (22.1%). The average hospital stay for these patients was 9 days±5 and for the rest, it was 9 days±4 (p 0.620). No statistically significant difference was observed in ward mortality and postoperative complications.

3.10 Monitoring of sedation and muscle relaxation

This element of the fast-track protocol was not observed in any of the patients at the discretion of the anesthesia team; therefore, no assessment of the criterion could be made.

3.11 Prevention of nausea and vomiting with dexamethasone 8 mg

The use of dexamethasone for the prevention of postoperative nausea and vomiting was at the discretion of the anesthesiologist. It was used in 76 (49.4%) of the patients, of whom 4 (5.3%) patients had nausea and vomiting in the postoperative period. In the rest 78 patients, 14 (17.9%) had nausea and vomiting in the postoperative period. The use of dexamethasone reduced postoperative nausea and vomiting (χ^2 6.001, df 1, p 0.014).

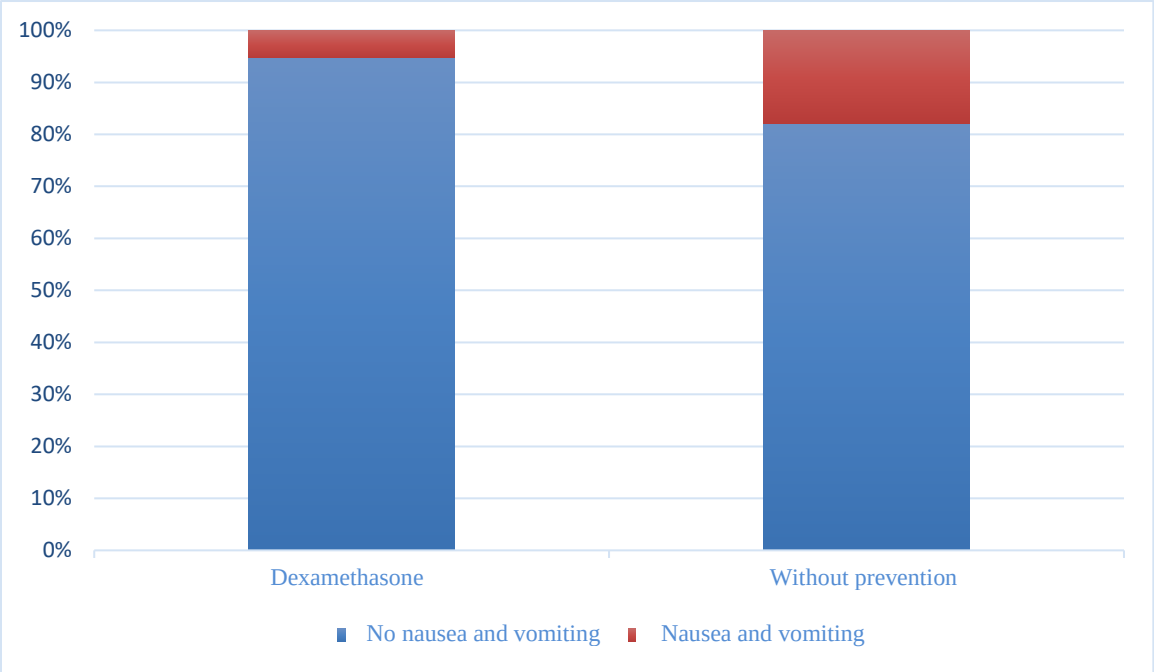

Figure 4. Prevention of nausea and vomiting with dexamethasone 8 mg

The average hospital stay for the patients medicated with dexamethasone was 9 days±5 and for the other patients, it was 9 days±4. No statistically significant difference was observed (p 0.972), as well as for ward mortality and postoperative complications.

3.12 Prevention of hypothermia

This element of the fast-track protocol was not met in any of the patients due to the lack of the specific equipment required. The criterion could not be assessed.

3.13 Removal of the nasogastric tube within 24 hours after the surgical intervention

The element of early removal of the nasogastric tube was considered to be complied with, even when it was removed up to 24 hours after the surgical intervention and/or when less than 200 ml was excreted in 24 hours. The latter was reported to be complied with in 96 (62.3%) of the patients. These patients were fed on the 1st postoperative day (median 1, IQR 1), the rest patients were fed on the 3rd postoperative day (median 3, IQR 1). Due to the non-Gaussian distribution of the groups, the Mann-Whitney test was performed, which reported a statistically significant difference (p 0.001). Patients, in whom the element was complied with, defecated on the 4th day (IQR 1), the rest patients on the 5th day (IQR 2). The Mann-Whitney test was again applied, reporting a

statistically significant difference (p 0.001). There was a significant difference in the length of hospital stay of the patients (p 0.001) - 7 days (IQR 3) and 10 days (IQR 6), respectively. No statistically significant difference was found in terms of ward mortality and anastomotic insufficiency. Surgical wound infection (χ^2 6.343, df 1, p 0.012) was observed in 10.4% of the patients in whom the element was reported as being complied with and in 25.9% of the rest, as well as in case of dehiscence of the surgical wound (χ^2 7.728, df 1, p 0.005), 3.1% and 15.5%, respectively.

3.14 Early discontinuation of postoperative intravenous fluid therapy

The element was considered to be complied with in patients in whom postoperative infusions were stopped by the 2nd postoperative day. In 18 of the patients (11.7%), the element was reported as met. Their hospital stay was 5 days (IQR 1) and 8 days (IQR 5) for the rest. The Mann-Whitney test was applied, showing a statistically significant difference (p 0.001). No statistically significant differences were found for postoperative complications and ward mortality.

3.15 Early removal of the urethral catheter

The element was considered met if the patient was mobilized by the second postoperative day and the catheter was removed. 29 patients (18.8%) met this criterion.

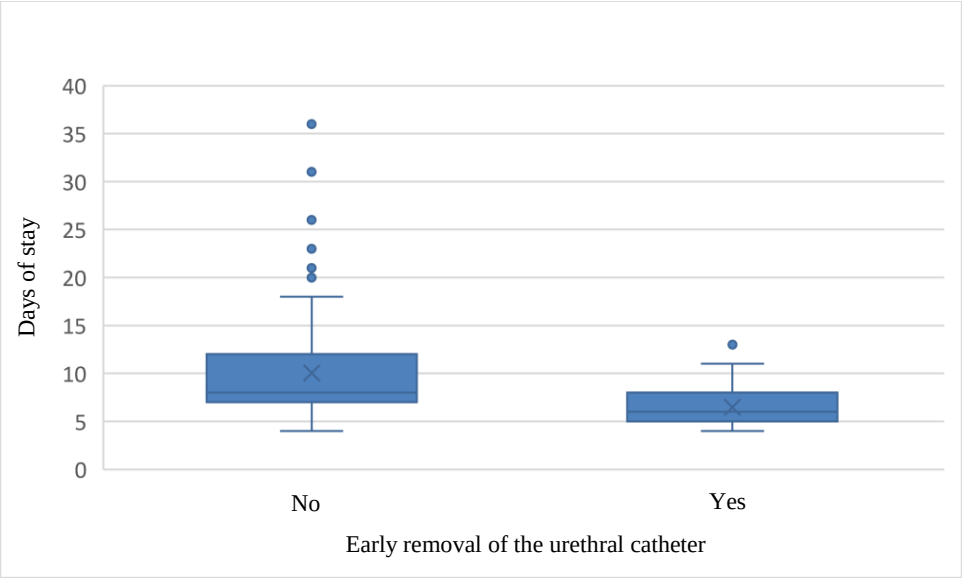

Figure 5. Hospital stay of the patients

The hospital stay of the patients in whom the element was observed was 6 days (IQR 3), in the rest patients it was 8 days (IQR 5). Due to the non-Gaussian distribution of the patients visible in Figure 4, the Mann-Whitney test was

applied, showing a statistically significant difference (p 0.001). No complications related to the urethral catheter were registered in both patient groups. No statistically significant differences were observed in the two groups in terms of ward mortality and postoperative complications.

3.16 Prevention of thrombus formation

This element of the fast-track protocol was observed in all 154 patients; therefore, the criterion could not be assessed. All patients were prophylactically treated with low molecular weight heparin at doses according to the patient's weight and concomitant diseases. In none of the patients complications, such as deep venous thrombosis of the lower extremities and pulmonary thromboembolism, were registered.

3.17 Postoperative analgesia

The element was considered to be complied with in 116 patients (75.3%) with postoperative analgesia with NSAIDs or in combination with epidural analgesia. It was considered not complied with in 38 patients (24.7%), when opioid medications were used for analgesia for various reasons.

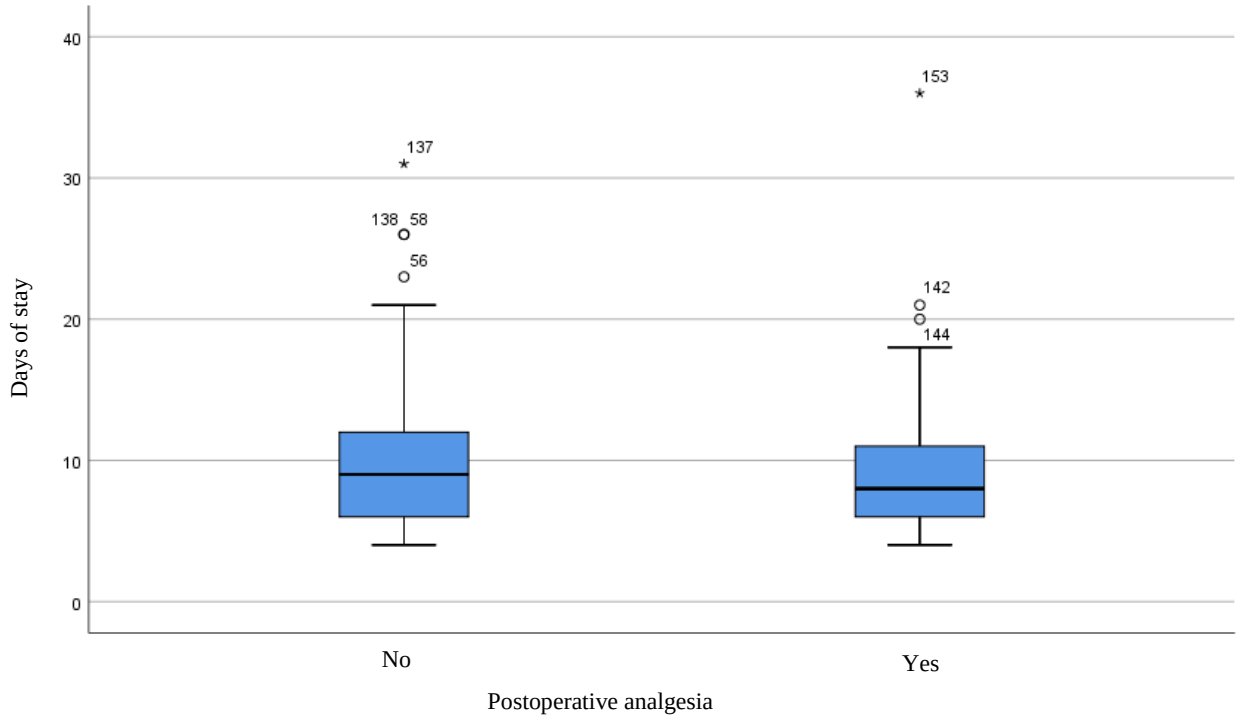

Figure 6. Hospital stay of the patients with the postoperative analgesia element

The hospital stay of the patients in whom the element was observed was 8 days (IQR 5), in the rest patients it was 9 days (IQR 6). Due to the non-Gaussian distribution of patients, visible in Figure 5, the Mann-Whitney test was applied, showing the lack of a statistically significant difference (p 0.220). No effect was found in the observance of elements on ward mortality. An effect was found on

the postoperative complication - anastomotic insufficiency. Only 1.7% of the patients had this complication when the criteria were observed versus 10.7% when the criteria were not observed (χ^2 5.932, df 1, p 0.015). No statistically significant difference was found for the other postoperative complications.

3.18 Feeding on the patient before 24 hours after the surgical intervention

Exclusion factors for patient inclusion in this element are: discharge of the nasogastric tube >500 ml in 24 hours and intolerance of fluid and food intake by the patient. Patients in whom this element was considered to be complied with were 110 (71.4%). In these patients, defecation was reported on average on 3.8±1.4 postoperative days, in the rest patients on the 5th±2.4 postoperative day (p 0.001). Hospital stay was 8 days±4 and 11 days±6, respectively (p 0.003). A lower incidence of surgical wound infections was observed in patients fed up to 24 hours, 8.2% compared to 36.4% of the rest patients (χ^2 18.356, df 1, p 0.001), as well as in the incidence of anastomotic insufficiency, 1.8% versus 9.1% (χ^2 4.440, df 1, p 0.035). No statistically significant difference in patient mortality was observed.

3.19 Early mobilization

The element of early patient mobilization was considered to be met in patients who started their mobilization on the first postoperative day. The element was met in 75 (48.7%) of the patients, with a shorter hospital stay of 6.7 days ±1.8 compared to the rest patients, who had a reduced hospital stay of 11.8 days±5.8 (p 0.001).

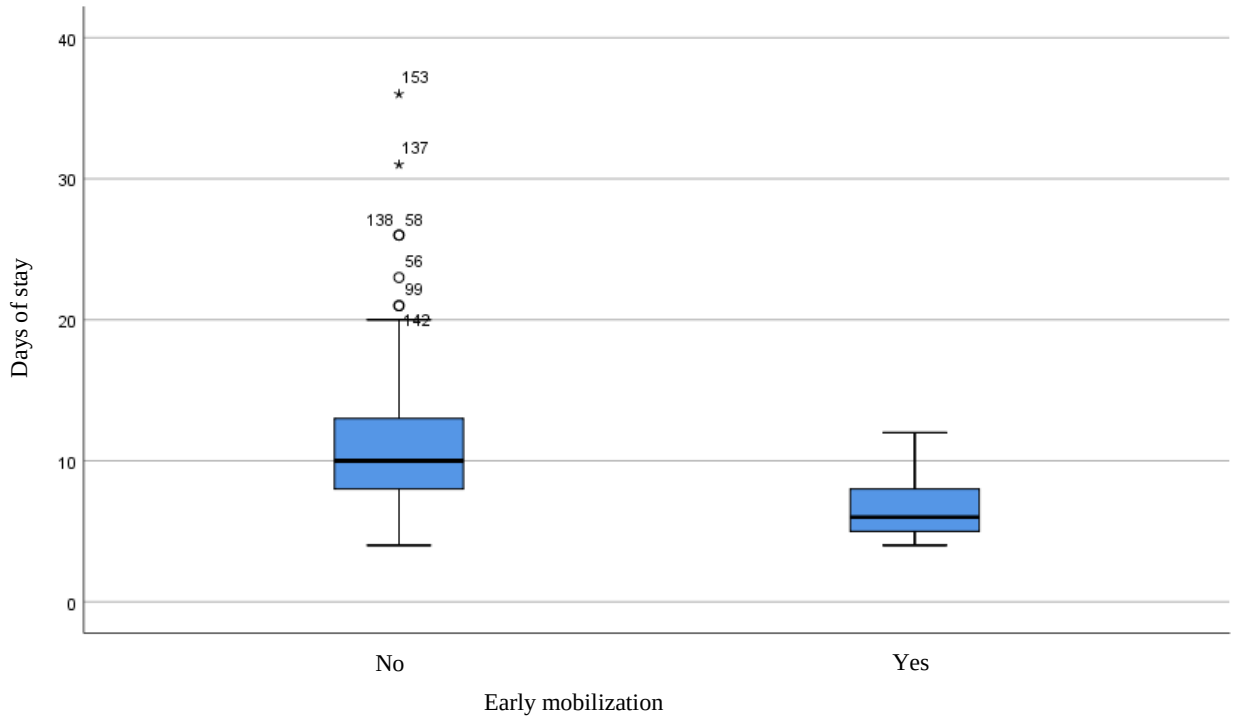

Figure 7. Hospital stay with the early mobilization element

A lower rate of the postoperative complication dehiscence of the surgical wound was observed in patients who met the criteria, 2.7%, compared to 12.7% of the rest patients. (χ^2 5.346, df 1, p 0.021). An anastomosis was constructed in 26 of the 76 patients who met the criteria and in 28 of the patients who did not. There was a significantly lower incidence of anastomotic insufficiency, 0% with met criteria versus 7.6%. (χ^2 5.927, df 1, p 0.015). There was no statistically significant difference in the postoperative complication of surgical wound infection. Such was observed in the ward mortality rate of 2.7% versus 15.2% (χ^2 7.301, df 1, p 0.007).

4. Effect on the length of hospital stay, ward mortality and postoperative complications by the three groups of elements of the fast-track protocol

4.1 Preoperative elements

In patients who had 3 or more elements out of a total of 5, the preoperative criteria were considered met. Their number was 123 (79.9%) and their hospital stay was 9 days±5, while in the rest patients, it was 8 days±4.

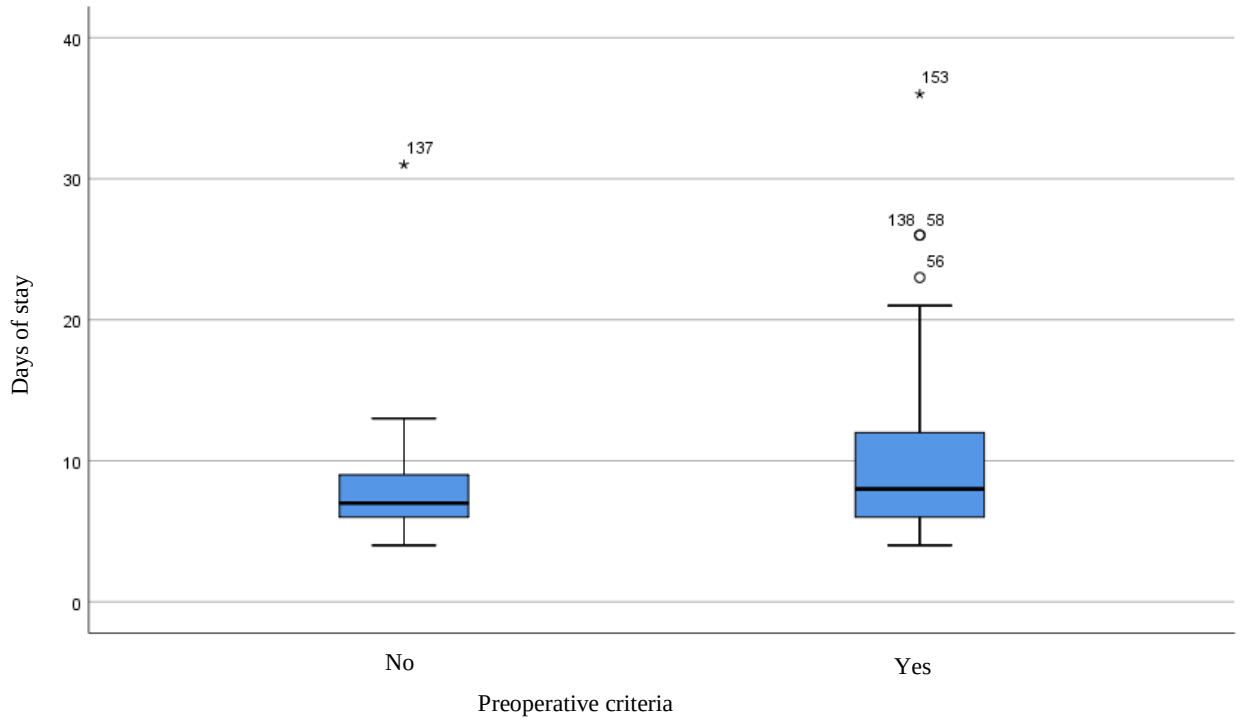

Figure 8. Hospital stay when preoperative criteria were met.

Due to the non-Gaussian distribution of the patients, the Mann-Whitney test was applied, in which no statistically significant difference was found. No significant difference was also observed in postoperative complications and ward mortality in the two patient groups.

4.2 Intraoperative elements

In patients who had 4 or more elements out of a total of 7, the intraoperative criteria were considered met. Their number was 23 (14.9%) and their hospital stay was 6 days±4, while in the rest patients, it was 8 days±5 (p 0.040). Due to the non-Gaussian distribution of the patients, the Mann-Whitney test was applied. The mortality in the groups was 8.7% versus 9.2% (χ^2 0.005, df 1, p 0.943). No significant differences were observed in postoperative complications.

4.3 Postoperative elements

In patients who had 4 or more elements out of a total of 7, the postoperative criteria were considered met. Their number was 88 (57.1%) and their hospital stay was 7 days±3 and 11 days±6 in the rest patients (p 0.001).

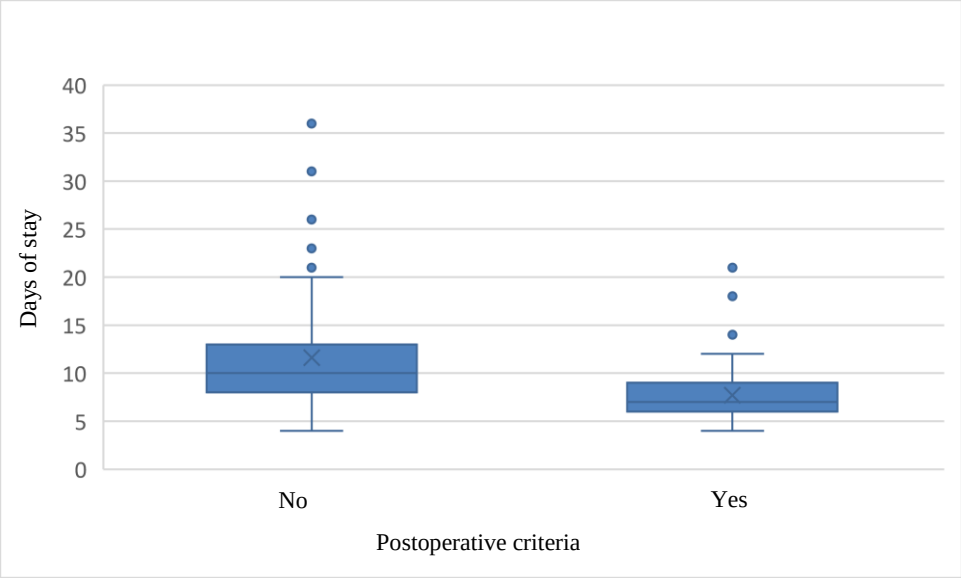

Figure 9. Hospital stay when postoperative criteria were met.

There was no statistically significant difference in ward mortality between the two groups. The incidence of surgical wound infections was 9.1% versus 25.8%. (χ^2 7.704, df 1, p 0.006). There was a statistically significant difference in the incidence of surgical wound dehiscence: 3.4% in the group of patients who met the postoperative criteria of the fast-track protocol and 13.6% in the rest patients (χ^2 5.490, df 1, p 0.019). Such was not found for anastomotic insufficiency.

5. Effect on the length of hospital stay, ward mortality and postoperative complications in patients meeting the criteria for the fast-track protocol

Patients, in whom we used 10 or more elements out of a total of 19, were included in the fast-track group; the rest patients were a control group. Accordingly, 63 patients (40.9%) were included in the fast-track group. A statistically significant difference was observed in the hospital stay of the patients (p 0.001): it was 7 days ± 3 in the fast-track group versus 10 days±5 in the control group.

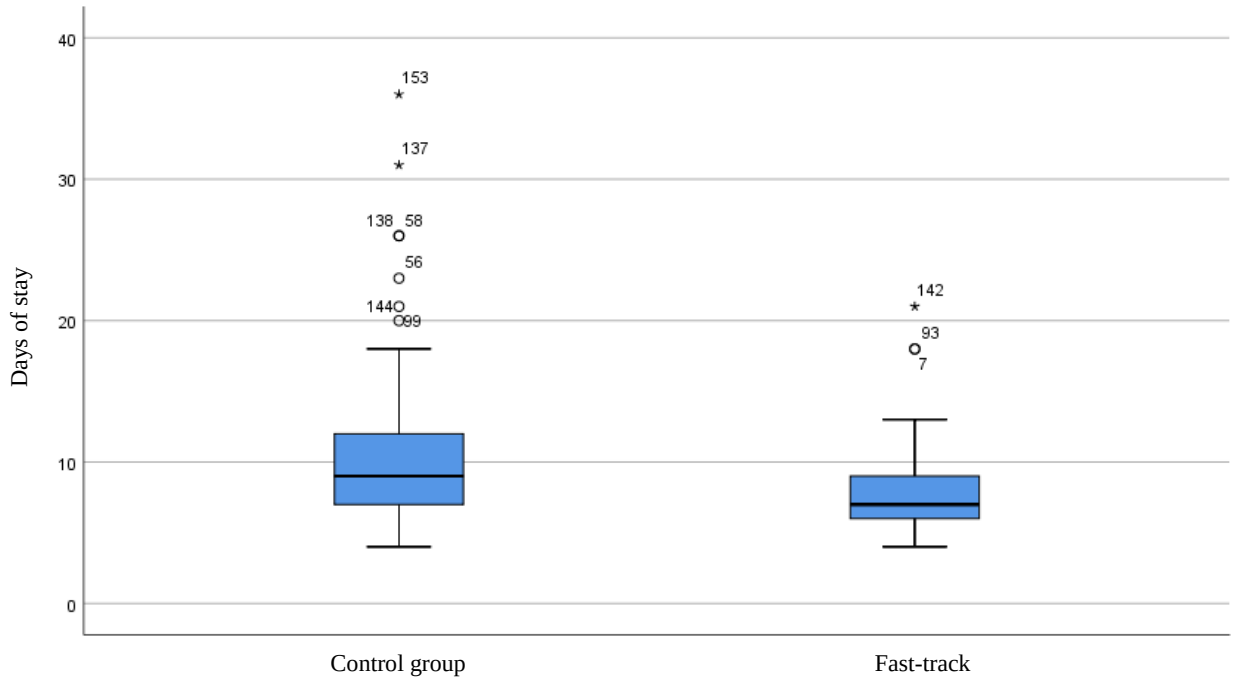

Figure 10. Comparison of hospital stays of the two patient groups

In the fast-track group, a significantly lower incidence of surgical wound infections was observed (7.9%) versus 22.0% (χ^2 5.389, df 1, p 0.020) in the rest patients.

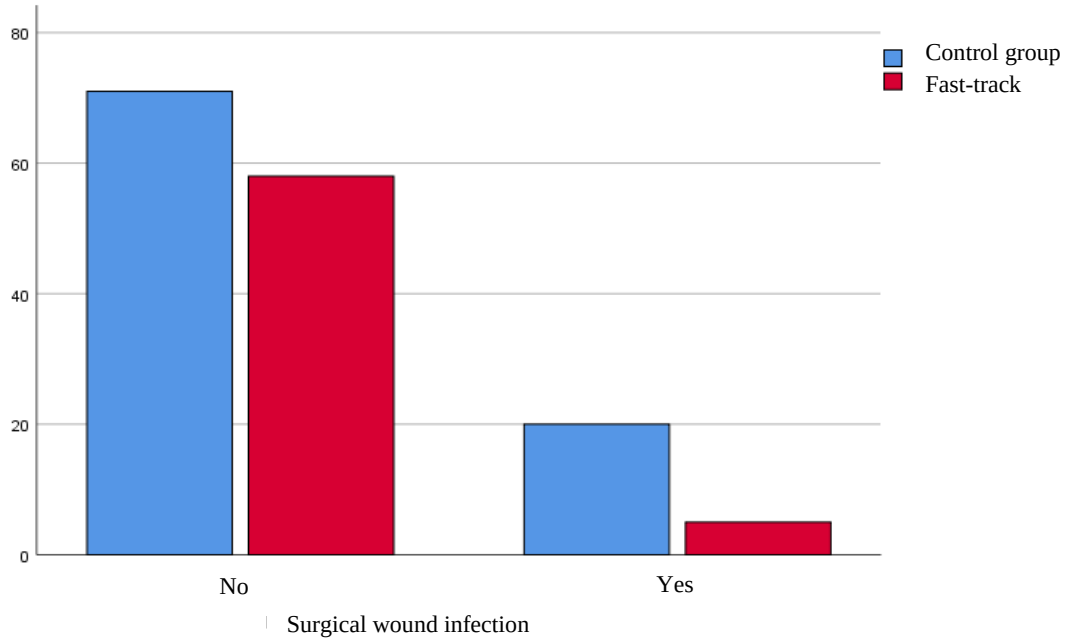

Figure 11. Surgical wound infection in the two patient groups.

Statistically significant differences were observed in the postoperative complication of surgical wound dehiscence. In the fast-track group it was 0% while in the control group, it was 13.2% (χ^2 9.010, df 1, p 0.003). An

anastomosis was constructed in 23 of the patients in the fast-track group and 31 of the patients in the control group. The postoperative complication of anastomotic insufficiency was 0% in the fast-track group versus 6.3% in the control group (χ^2 4.322, df 1, p 0.038). There was no statistically significant difference in ward mortality. In the fast-track group it was 6.3% versus 11% in the control group (χ^2 0.970, df 1, p 0.325). Early postoperative mortality (up to 30 days) and frequency of rehospitalizations did not differ significantly in the two groups.

6. Effect of the fast-track protocol on serum albumin and C-reactive protein levels

6.1 Effect on C-reactive protein

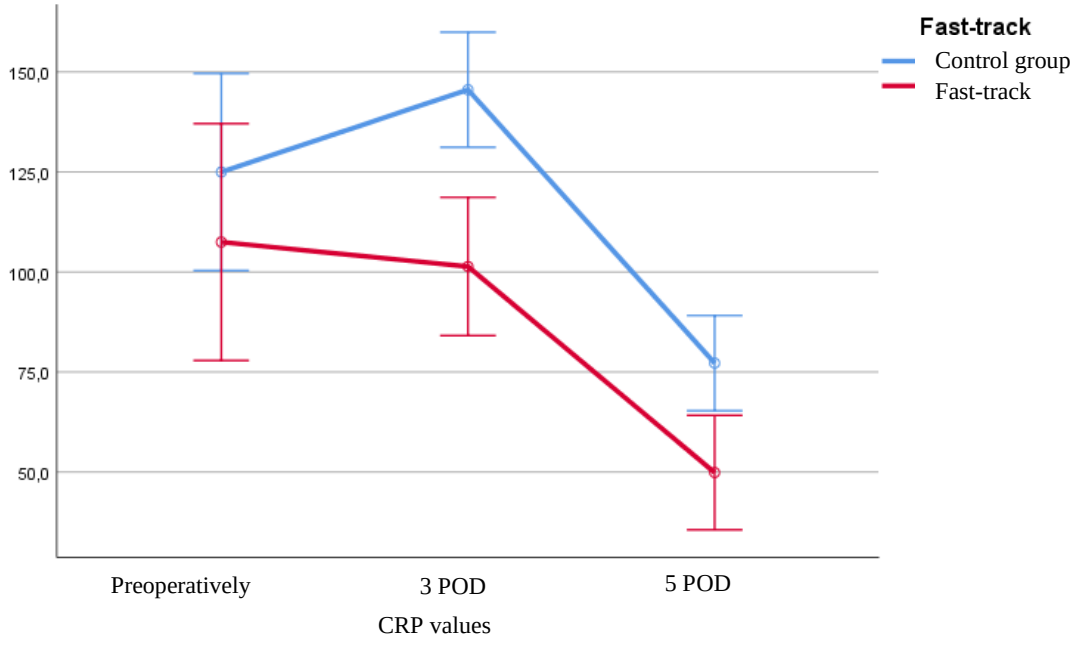

Figure 12. Changes in C-reactive protein values

In patients who met the criteria for the fast-track protocol, a difference was found in the change in CRP values on the third postoperative day compared to the control group. Tukey's post hoc test was applied, which showed that there was a difference in the magnitude of the changes in C-reactive protein between the two groups with regard to preoperative values and these on the fifth postoperative day and those between the third and fifth postoperative days.

6.2 Effect on serum albumin

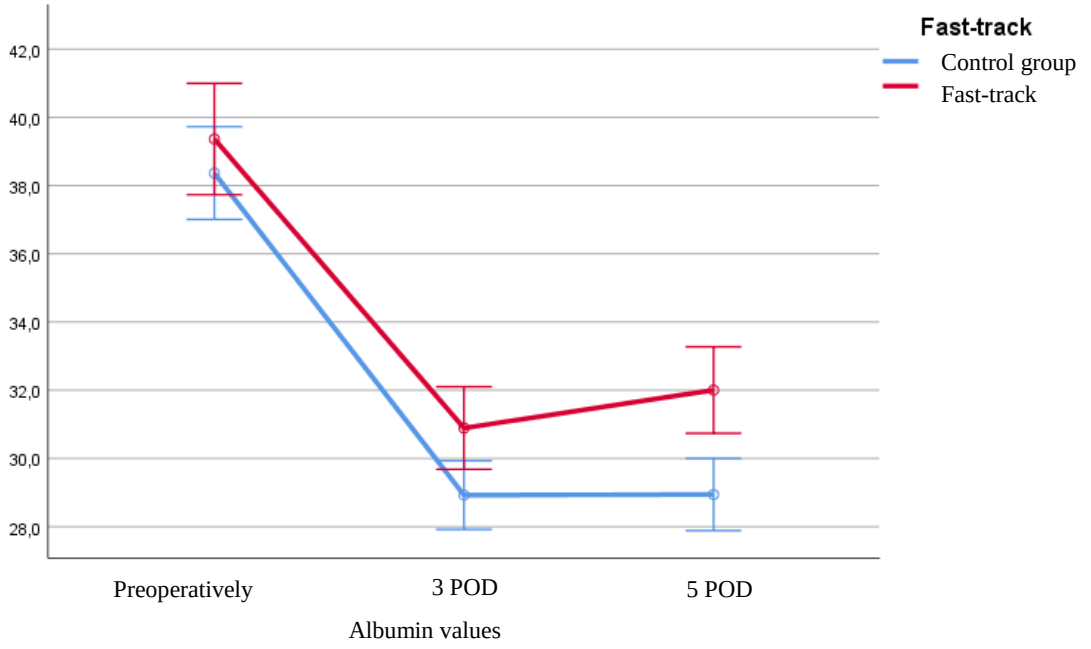

Figure 13. Changes in albumin values

In patients who met the criteria for the fast-track protocol, no difference was found in the change in albumin values postoperatively compared to the control group. Tukey's post hoc test was applied, which showed that there was a difference in the amount of albumin changes between the two groups with regard to preoperative values and these on the fifth postoperative day. A trend for an increase in albumin values on the fifth postoperative day was observed in the fast-track patient group compared to the control group, without a statistically significant difference.

V. Discussion

The ERAS protocols are a standard in elective surgery, leading to a reduction in postoperative complications, reduced hospital stay and accelerated recovery period. The ERAS group in 2013 and the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal Surgeons in 2017 recommend them as a proven algorithm of behavior in elective surgery. Many authors have started studies on the application of modified ones so that they can be applied partially and to the extent possible of the number of elements in emergency abdominal surgery. An important difference between patients undergoing elective abdominal surgery and those undergoing emergency laparotomy is the manifestation of disturbances in physiological functions. Patients are commonly older, have comorbidities, and systemic

inflammatory response syndrome (SIRS) is present in 30-50%, sepsis, and septic shock. Despite continuous improvements in the treatment, patients after emergency laparotomy remain one of the most at-risk groups with about one in ten dying within 30 days of such surgery, with the ratio increasing to one in four after the age of 80 years (79).

Lohsiriwat et al. conducted the first study investigating the results of the application of ERAS in emergency colorectal surgery, published in 2014. They compared the results of the treatment of colorectal carcinoma complicated by malignant intestinal obstruction in 20 patients managed with the ERAS protocol versus 40 patients treated with the conventional protocol. The study design did not include patients with intestinal perforation and peritonitis. Compared with conventional postoperative care, the use of ERAS in emergency resection of obstructive colorectal carcinoma was associated with a significantly shorter hospital stay (5.5 days versus 7.5 days); a significantly shorter time to recovery of GIT functionality; a significantly shorter time interval to the start of adjuvant chemotherapy (mean 37 days versus 49 days); a slightly lower rate of postoperative complications (25% versus 48%); no increase in 30-day mortality and rehospitalizations (80).

A randomized clinical trial in Russia in 2020 included 89 patients with malignant colonic obstruction, divided into two groups: 45 in whom the ERAS protocol was used and 44 on conventional treatment. The study did not include patients with peritonitis, multiple organ failure and complications related to the tumor process, such as bleeding, perforation and abscessation. The ERAS group showed faster recovery of gastrointestinal functions, shorter postoperative hospital stay (8.67+/-1.7 vs. 14+/- 2.3 days) and lower mortality (14% vs. 25%) (85).

Viñas et al. (87) from Spain conducted a study published in 2020 on the feasibility and effectiveness of the ERAS program in patients with left colon perforation. They included 50 patients, of whom 29 were in the ERAS protocol group and 21 patients in the control group, who received conventional care. The two groups did not differ significantly in demographic data and surgical characteristics. The ERAS group reported a lower incidence of postoperative complications (20.7% vs. 38%) and a shorter hospital stay (7.7+/-3.85 vs. 10.9+/-5.6 days). No 90-day mortality was observed in either group, and the rate of rehospitalizations within 90 days was relatively similar.

A Swiss team in a prospective cohort study using the interactive ERAS audit system compared clinical outcomes in 28 patients undergoing emergency colectomy referred to 63 elective colectomies in an ERAS-certified surgical

clinic. Patients requiring more than 2 days in the intensive care unit and those undergoing rectal resection were excluded from the study. The authors reported a significantly lower rate of intraoperative adherence to the ERAS protocol in the group of patients undergoing emergency surgery (57% vs. 77%), with relatively good adherence to the preoperative and postoperative ERAS algorithm. No statistically significant difference in the rate of postoperative complications was reported between the two groups (64% vs. 51%), despite more comorbidities and higher operative risk in the emergency surgery group. Emergency surgery in the study was associated with a significantly longer length of hospital stay (8 days vs. 5 days). The authors believe that the ERAS protocol can be used in emergency colorectal surgery (6).

Gonenc conducted a randomized controlled clinical trial to analyze the applicability of ERAS in emergency laparoscopic surgery for perforated ulcers in patients with ASA I and II. In cases of the ERAS group, the nasogastric tube was removed by the anesthesiologist at the end of the operation after aspiration of gastric contents. The results showed that there were no significant differences in complications and mortality, while the length of hospital stay was significantly shorter. In these cases, routine nasogastric decompression and delayed oral feeding were found to be unnecessary (8).

Paduraru conducted a systematic review of the use of ERAS in emergency surgery over the past ten years and found a limited number of such studies. He evaluated the use of ERAS in 311 emergency patients compared with 605 patients, of whom 235 emergency patients received conventional care and 370 scheduled patients who received the ERAS. The complication rate and length of stay were lower in patients who received the ERAS, and the rate of readmission was the same. The ERAS is feasible, safe, and has better outcomes in patients undergoing emergency surgery, but it needs to be adapted for this group of patients, as compliance with all elements of ERAS is difficult to implement (81).

Shang investigated the postoperative benefits of modified ERAS protocols in patients undergoing emergency surgery for obstructive colorectal carcinoma. The study included 839 patients undergoing surgery for obstructive colorectal carcinoma, 356 of whom received the modified ERAS protocol and 483 who were treated conventionally. He noted a faster recovery of gastrointestinal function (flatulence and defecation) in patients receiving the modified ERAS protocol. Postoperative nausea and vomiting did not differ between the two groups. Patients receiving the ERAS protocol experienced a rapid decrease in CRP by the fifth postoperative day compared with the other group of patients. Among patients undergoing emergency colorectal resection, the incidence of

general postoperative complications (pneumonia, surgical wound infection, abdominal infection, and systemic infection) tended to decrease with the modified ERAS protocol (P = 0.002). There were no significant differences in the rates of surgical complications such as sepsis, anastomotic dehiscence, wound infection, and intra-abdominal abscesses. There was no significant difference in relaparotomy (P = 0.50) or rehospitalization (P = 0.39) between the two groups. The median hospital stay was 6 (3–22) days in the ERAS group, significantly less than the 9 (7–27) days in the conventional group (P<0.001) (82).

Preoperative preparation of patients undergoing emergency laparotomy aims to correct changes in their homeostasis. Correction of disturbances in the patient's physiological functions is performed in parallel with diagnostic examinations. Surgery remains a key component of the treatment of the underlying pathology that led to these disorders (88). Delaying surgical intervention increases mortality in patients requiring emergency laparotomy. A study in Denmark found in patients with perforated peptic ulcer an increase of 2.4% in mortality for each hour of delay in surgical treatment after the patient's admission to hospital. Another study from 2018 focused on patients with small bowel obstruction found an increase in mortality in patients with a delay in surgical treatment of more than 72 hours. In patients with sepsis and septic shock, it is appropriate to operate, with the aim of controlling the source, by the third hour (89,90).

The goal of preoperative optimization is to achieve a central venous pressure of 8-12 cmH20, mean arterial pressure ≥65 mmHg, and an hourly diuresis of at least 0.5 ml/kg/h (91). Perioperative glycemic control is crucial for the outcome of treatment in patients with diabetes and essential in patients without concomitant diabetes mellitus. Blood glucose management should aim for serum glucose levels between 7.7-10 mmol/l (92). Adequate intra- and postoperative organ perfusion depends on the effectiveness of goal-directed fluid therapy (GDFT). The precision of intravenous infusion, transfusion of blood products, and administration of vasopressor medications is determined by changes in heart rate, mean arterial pressure, and central venous pressure.

Disturbances in the electrolyte balance are common in patients requiring emergency laparotomy due to the redistribution of fluids in the body and their external losses. Hypokalemia, hypomagnesemia, and hypophosphatemia are common and are risk factors for the development of cardiac arrhythmias, especially in older patients. The most common cardiac arrhythmia is atrial fibrillation. Attempts should be made to correct electrolyte imbalance

preoperatively by intravenous infusions and monitoring to reduce the risk of cardiac arrhythmias (25).

All patients undergoing emergency laparotomy are at risk of developing sepsis and should be assessed for it. A study in England in 2017 found a rate of over 20% of sepsis or septic shock in patients undergoing emergency surgery in surgical units (94). The three main risk factors for sepsis are age over 60 years, concomitant diseases and urgent surgical intervention. In case of clinical suspicion of sepsis, it is recommended to start empirical administration of a broad-spectrum antibiotic until the microbiological results are available and to start water-salt resuscitation. In case of diagnosed sepsis, lactate monitoring is appropriate to evaluate the initiated treatment. In recent years, lactate monitoring has also been considered as a marker for assessing the response to resuscitation treatment (95,96).

Patients over 65 years of age undergoing emergency surgery are at increased risk of developing delirium and perioperative cognitive impairment. The onset of delirium is associated with increased mortality, complications, and long-term cognitive decline. Delirium can be prevented in almost 40% of patients by avoiding the use of benzodiazepines and anticholinergics (97).

Patients receiving long-term antiplatelet and anticoagulant therapy are increasingly common. These patients are at higher risk of perioperative or postoperative life-threatening hemorrhage or thrombosis. The management of such patients requiring emergency laparotomy is more complex. Vitamin K antagonists are common, despite the introduction of newer direct-acting oral anticoagulants. It is recommended that the coagulation status of such patients be assessed preoperatively, including prothrombin time (PT), activated partial thromboplastin time (APTT), and international normalized ratio (INR). In patients with impaired coagulation status, the use of vitamin K and/or plasma transfusion is recommended preoperatively to reduce the risk of intra- and postoperative bleeding (98,99). To reduce the risk of bleeding in patients taking antiplatelet agents, platelet transfusion may be considered, due to the lack of an antidote and the inability to wait the necessary time for their effect to wear off, which is usually 5 to 7 days (100).

Preoperative carbohydrate loading is recommended in most ERAS protocols for elective surgery to reduce dehiscence and improve insulin sensitivity (25). Patients requiring emergency surgery are already under physiological stress, and giving carbohydrates in this setting may further increase glucose levels without any effect on insulin sensitivity. No studies were

found on the use of preoperative carbohydrate loading in patients undergoing emergency abdominal surgery.

A 2021 study, analyzing data from NELA, included 11,753 patients undergoing emergency laparoscopic surgery and 23,506 patients undergoing emergency open laparotomy (ratio 1:2). The most commonly performed laparoscopic procedures were colectomy, adhesiolysis, lavage, and suture of perforated ulcer. The laparoscopic approach is associated with lower blood loss, shorter hospital stay, and lower mortality (101). The choice of surgical approach and technique should be based on an assessment of factors related to the patient, the underlying surgical pathology, preoperative imaging studies, the surgeon's preferences and experience, and an assessment of the risk/benefit ratio. In recent years, there has been an increase in the use of diagnostic laparoscopy due to increased experience and training of surgeons (102).

Intestinal anastomotic insufficiency is a serious postoperative complication that frequently necessitates operative revision, prolonged hospital stay, prolonged patient recovery, and shorter survival in patients without oncological disease. Risk factors for intestinal anastomotic insufficiency include emergency surgery, patient assessment according to the American Society of Anesthesiologists (ASA) criteria, elderly patient, low serum albumin levels, intraoperative blood loss and hypotension, extraperitoneal anastomosis, duration of surgery, and vasopressor support. For many years in emergency abdominal surgery, the risk of anastomotic insufficiency was considered so high that surgeons preferred to construct an intestinal stoma rather than anastomosis when intestinal resection was necessary. There are many published reports of primary anastomosis, and emergency surgery per se is not an absolute contraindication to anastomosis (104).

Damage control surgery (DCS) is a surgical strategy to control life-threatening bleeding and/or the source of sepsis in critically ill patients who are not expected to survive a lengthy definitive operation. DCS in abdominal sepsis is achieved by eliminating the source of infection and reducing bacterial spread into the peritoneal cavity while delaying intestinal anastomoses and temporarily closing the abdominal cavity. The decision to perform DCS and reoperation should be individualized based on the patient's condition after resuscitation. The introduction of DCS in the treatment of abdominal sepsis results in a reduction in the in-hospital mortality rate (105). Methods for temporary abdominal wall closure are divided into two main groups: passive visceral coverage and negative pressure wound therapy (NPWT). Numerous techniques for temporary abdominal wall closure have been described in the literature, but no gold

standard has yet been established. There are insufficient controlled randomized trials comparing methods for temporary abdominal wall closure. However, there are studies in patients with abdominal sepsis treated with NPWT that have reported reduced mortality, complications, and time to final abdominal wall closure (106,107).

The need for abdominal drainage after emergency colorectal surgery for malignant bowel obstruction is controversial. There is currently insufficient evidence to support the routine use of drainage after emergency bowel resection (108). Many authors recommend avoiding intra-abdominal or pelvic drainage except in cases of massive intraoperative bleeding, purulent or stercoral peritonitis, and risk of anastomotic compromise (109).

All patients undergoing emergency laparotomy are at high risk of developing postoperative nausea and vomiting due to physiological disorders and gastrointestinal damage. It is a major reason for the delay in enteral nutrition. The frequent use of opioids in these patients is one of the main risk factors for the occurrence of postoperative nausea and vomiting. Their use should be minimized by replacing them with multimodal analgesia. The use of dexamethasone for the prevention of nausea and vomiting is recommended and has been shown not to increase the risk of surgical wound infections (110).

Patients requiring emergency laparotomy are at risk of hypothermia due to environmental factors, the effects of anesthesia, and cold intravenous fluids. Hypothermia leads to disturbances in drug metabolism, impairs coagulation, increases bleeding, the risk of wound infection and cardiovascular morbidity. Air warming systems and/or warming pads can be used to prevent hypothermia. Intravenous fluids should be administered using warming systems (111).

Intravenous fluid administration during and after operation is crucial for the management of patients undergoing emergency abdominal surgery. Fluid overload can lead to complications, such as organ dysfunction, mechanical ventilation dependence, intestinal edema, and impaired wound healing. Inadequate intravenous fluid intake leads to reduced organ perfusion and related consequences, such as renal failure. The assessment of intravenous fluid volume is difficult in patients requiring emergency laparotomy. Intraoperative fluid administration should be titrated by bolus infusions based on hemodynamic parameters. Fluid balance should be carefully recorded intraoperatively and postoperatively. Postoperative fluid balance should be in the range of 0-2 L (112,113). Patients receiving 0.9% saline, compared with patients infused with Ringer lactate for hemorrhagic shock, had a higher incidence of hyperchloremic metabolic acidosis, electrolyte disturbances, coagulopathy, and higher volume

resuscitation requirements. Solutions with high chloride content have a negative impact on renal function. Recommendations are to minimize infusions of 0.9% saline (114).

The multimodal approach to pain management primarily uses non-opioid analgesics and various techniques, which are recommended to be used whenever possible to reduce the intake of opioids, which can delay the patient's recovery. Minimizing the use of opioids improves respiratory function and the restoration of gastrointestinal motility. Unlike elective surgery, an epidural catheter or abdominal wall block cannot always be placed in an emergency abdominal surgery. The latter are inappropriate in patients with coagulation disorders or suspected bacteremia (115). Acetaminophen (paracetamol) up to 15 mg/kg every 6 hours (with a maximum dose of 4 g in 24 hours) is a good choice in all patients except those with hepatic insufficiency. Nonsteroidal anti-inflammatory drugs (NSAIDs) should be used with caution in the preoperative period due to the risk of platelet dysfunction with subsequent bleeding. NSAIDs can be used postoperatively in patients with good renal function (116).

Compared with patients after elective abdominal surgery, patients undergoing emergency surgery are at higher risk of venous thromboembolism and prophylaxis (mechanical and/or pharmacological) should be initiated as early as possible. Pharmacological prophylaxis with low molecular weight heparin is preferred, but the patient should be assessed for bleeding. If pharmacological prophylaxis is not possible, mechanical prophylaxis should be administered first. Intermittent compression devices are preferred over elastic compression stockings. Combination prophylaxis may be considered in patients at high risk of developing venous thromboembolism. The risk may remain elevated for up to 12 weeks after surgery, particularly in patients with malignancies. Extended pharmacological prophylaxis for 4 weeks with low-molecular-weight heparin is recommended in patients at increased risk after abdominal surgery (117).

Urethral catheterization is routinely performed in patients after major abdominal surgery to monitor water balance, decompress the bladder, and prevent urinary retention. The ERAS protocols recommend early removal of the urethral catheter in elective surgery to promote patient mobilization, improve patient comfort, and reduce the incidence of catheter-associated urinary tract infections, which increase with prolonged catheterization, and thus, in turn prolong patient hospital stay. In patients after emergency abdominal surgery, the urethral catheter may need to be left in place for a longer period of time to closely monitor urine output and to assess fluid balance. It is appropriate to

remove the urethral catheter as early as possible in patients after emergency abdominal surgery and encourage early mobilization, except in conditions that require close monitoring of urine output (118,119).

Nasogastric tube (NGT) is an important part of the management of patients with malignant intestinal obstruction due to colorectal cancer. It relieves intraluminal pressure proximal to the obstruction and provides physiologic rest for the GI tract. A published meta-analysis of seventeen randomized trials found no clinically significant benefit of NGT after abdominal surgery. NGT causes adverse effects, such as discomfort and delayed return to fluid and food intake. NGT is indicated in patients with postoperative ileus or intestinal edema (120). There is still no consensus on the use of NGT in emergency abdominal surgery. There is a trend among surgeons to remove the NGT early on the 1st or 2nd postoperative day (6).

There is no doubt that early enteral nutrition in elective colorectal surgery reduces postoperative complications and hospital stay without significantly changing the incidence of anastomotic insufficiency, postoperative pneumonia, and reintroduction of NGT (123). Patients undergoing emergency surgery for malignant intestinal obstruction are more likely to have persistent postoperative ileus (6,124). A retrospective study of 84 patients undergoing emergency bowel resection showed a significantly shorter hospital stay in patients with early enteral nutrition (125).

VI. Conclusions

1. The elements of the protocols for enhanced recovery of patients after surgical interventions are largely applicable to patients undergoing emergency abdominal surgery.
2. The time for preoperative optimization of homeostasis is limited given the "urgency" factor. The element of preoperative carbohydrate loading is inapplicable and risky due to disturbances in the intestinal passage.
3. The implementation of the complete protocol for patient recovery after emergency abdominal surgery requires a multidisciplinary approach and collaboration with specialists from different specialties.
4. A streamlined organization is needed for adequate management, consistent with the fast-track protocol for patients requiring emergency surgery, applicable 24/7.
5. The implementation of the protocol for enhanced recovery of patients after emergency abdominal surgery is associated with shortened hospital stay and reduced incidence of postoperative complications. We found no change in the incidence of in-hospital and early (up to the 30th day) mortality.
6. The application of the fast-track protocol to patients after emergency abdominal surgery leads to faster recovery, near-normal serum albumin values, and a decrease in C-reactive protein values.

VII. Contributions

1. An analysis of the application of fast-track protocols in elective and emergency abdominal surgery was conducted based on guidelines and multicenter studies in the available medical literature.
2. A modified ERAS protocol is proposed for patients with intestinal obstruction and abdominal infection.
3. For the first time in Bulgaria, a modified protocol has been applied in emergency abdominal surgery.
4. Shorter hospital stays have been reported, which is associated with lower financial costs.

VIII. Practical Application

ERAS Protocol	Recommendation
Preoperative phase **Informing and detailed consulting**	Patients should be informed about their disease and upcoming treatment
Correction of water-and-electrolyte imbalance	Early detection and correction of hypovolemia and metabolic abnormalities are recommended.
Premedication	Avoidance of anxiolytics in patient premedication
Intraoperative phase **Surgical approach**	Use of minimally invasive access when possible
Volume of intraoperative fluid infusion	Saline infusions up to 5 ml/kg/h in hemodynamic patients and good preoperative optimization. Avoidance of infusions of more than 500 ml 0.9% NACl.
Anesthesia	Use of total intravenous anesthesia
Prevention of postoperative nausea and vomiting	Administration of dexamethasone 8 mg
Intraoperative analgesia	Use of short-acting opioids
Postoperative phase **Analgesia**	NSAIDs alone or in combination with epidural analgesia. Avoidance of opioids
Early removal of the nasogastric tube	The NGT can be safely removed on the 1st-2nd postoperative day, unless paralytic ileus is present.
Prevention of thrombus formation	Use of low molecular weight heparins alone or in combination with mechanical thromboprophylaxis
Postoperative fluid therapy	Early discontinuation of intravenous infusions in patients tolerating fluid intake
Early enteral nutrition	Oral intake may be resumed in stabilized patients and should be progressed moderately, as tolerated by the patient. If enteral nutrition is not possible, start tube feeding.
Early removal of the urethral catheter	The urethral catheter can be safely removed on the 1st-2nd postoperative day.
Early mobilization	Patients are encouraged for early independent mobilization as part of the physiotherapy and rehabilitation program.

IX. Publications Related to the Dissertation

1. Dimitrov V. Application of Enhanced Recovery after Surgery Protocols in Colorectal Cancer, Complicated by Malignant Bowel Obstruction: a Review of the Literature. Journal of Biomedical and Clinical Research, 2021, 14(1): 10-15; ISSN: 1313-6917
2. S. Iliev, P. Vladova, A. Gabarski, V. Dimitrov NUTRITIONAL STATUS AND NUTRITIONAL SUPPORT OF PATIENTS WITH MALIGNANT INTESTINAL OBSTRUCTION FROM COLORECTAL CARCINOMA., сборник с доклади СД XVIII НАЦИОНАЛЕН КОНГРЕС ПО ХИРУРГИЯ С МЕЖДУНАРОДНО УЧАСТИЕ 06 - 08 ОКТОМВРИ 2022Г., ПЛЕВЕН, с. 547-552; ISBN-978-954-756-299-8
   (PROCEEDINGS OF REPORTS, CD, XVIII NATIONAL CONGRESS OF SURGERY WITH INTERNATIONAL PARTICIPATION, OCTOBER 6 – 8, 2022, PLEVEN, pp. 547-552; ISBN-978-954-756-299-8)
3. Димитров В., Илиев С., Владова П., Габърски А. ERAS протоколите в спешната дебелочревна хирургия - пожелание или реалност. СБОРНИК доклади от национален конгрес по хирургия – София: Бълг. хирург. д-во, 2021, с 121-123; ISSN: 2603-4034
   (Dimitrov V., Iliev S., Vladova P., Gabarski A. ERAS protocols in emergency colorectal surgery - wishful thinking or reality. PROCEEDINGS of reports from the national congress of surgery - Sofia: Bulgarian Surgical Society, 2021, pp. 121-123; ISSN: 2603-4034)