ENHANCED RECOVERY AFTER SURGERY (ERAS) IN EMERGENCY COLORECTAL SURGERY

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Abstract

Introduction: Enhanced recovery after surgery (ERAS) programs for elective colorectal surgery have been shown to decrease postoperative complication, shorten hospital stay, facilitate patient recovery, and lower healthcare cost. The question if ERAS programs applied in emergency colorectal surgery can have the same benefits still awaits a definitive answer. Material and method: We performed a prospective analysis of patients with complicated colorectal cancer admitted to our department between 2020 and 2023. ERAS protocol measures were applied to all patients. We studied the compliance with each item of the protocol. We selected the patients with a minimum of 12 ERAS measures applied. We compared them with a similar group selected from previous addmitions through a matching case process. We followed: GI recovery time, hospital stay, postoperative complications, overall morbidity, and mortality rates. Results: The rates of compliance were significantly lower for preoperative and postoperative measures in emergency when compared to elective surgery but similar for intraoperative measures. 63 patients that had a minimum of 12 ERAS measures applied. We compared them with the matched cases group. There was a significantly lower GI recovery time for patients in the ERAS group compared to non-ERAS patients. (mean values 54.4 hours vs. 75.2 hours). Also, the hospital stay was significantly lower for the ERAS Group (mean values 7.4 days vs. 10.8 days). Postoperative morbidity and mortality were similar in the two Groups. Conclusion: The ERAS program is associated with a faster GI recovery time and shorter length of hospital stay – without increased rates of morbidity and mortality after emergency colorectal surgery. Compliance with ERAS program in emergency surgery appears to be lower than in elective operations.

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Introduction

Enhanced recovery after surgery (ERAS) programs for elective colorectal surgery have been shown to decrease postoperative complication, shorten hospital stay, facilitate patient recovery, and lower healthcare cost. High compliance to ERAS program was also associated with better short-term and long-term outcomes including

improved disease-free survival and overall survival in patients with resectable colorectal cancer [1]-[3]. ERAS program for elective colorectal surgery is noted in the 2017 recommended guidelines for perioperative care of the American Society of Colon and Rectal Surgeons, the Society of American Gastrointestinal and Endoscopic Surgeons and since 2013 in the guidelines of ERAS Society [4].

But, up to 33% of colorectal operations are performed in emergency condition. Patients undergoing emergency colorectal surgery usually have longer hospitalization and higher rates of morbidity and mortality than those in an elective setting [5]-[8]. Therefore, the question if ERAS programs applied to patients having emergency colorectal surgery can have the same benefits as in an elective setting has been asked and still awaits a definitive answer.

According to ERAS Society Recommendations from 2018, the guidelines for perioperative care in elective colorectal surgery include 24 measures, most with strong quality of evidence, that are divided into three categories: pre-operative, intra-operative and post-operative items. The pre-operative items are represented by measures that need to be addressed before patient admission to the hospital and strictly pre-operative measures. Information, optimization, prehabilitation, nutrition and anemia screening need to be addressed before the patient admission to the hospital. The day before surgery the pre-operative measures need to be considered: prevention of nausea and vomiting, selective premedication, prophylactic antibiotics, no bowel preparation, maintaining euvolemia, no fasting and carbohydrate drink 2 hours before surgery. The intraoperative measures are represented by standard anesthetic protocol, fluid euvolemia, normothermia, minimally invasive surgery and no drainage. Post-operative items of the ERAS protocol are: no gastric drainage, multimodal analgesia, thromboprophylaxis, fluid euvolemia, urinary catheter removal after 1-3 days, prevention of hyperglycemia, postoperative nutrition and early mobilization [9], [10].

Of course, in case of emergency colorectal surgery we need to consider and analyze all these items and the possibility of their implementation in the short time before surgery. Moreover, their benefits in emergency surgery patients are still not very well documented.

Materials and Method

We performed a prospective analysis of patients with complicated colorectal cancer admitted to our department with subsequent emergency surgery between 2020 and 2023.
The study took into consideration the ethical tenets specified in the World Medical Association Declaration of Helsinki. All subjects provided written informed consent. Approval for the study protocol was obtained from the Ethics Committee of the University of Medicine and Pharmacy of Craiova.

Inclusion criteria were represented by emergency admission, a confirmed diagnosis of complicated colorectal cancer and emergency surgery. Exclusion criteria were diagnoses of benign colorectal pathology and the presence of abdominal sepsis.

ERAS protocol measures were applied to all patients. We studied the compliance with each item of the protocol. We used the ERAS Society recommendations from 2018 as reference protocol. This includes 24 items:

1. Information
2. Optimization
3. Prehabilitation
4. Nutrition
5. Anemia screening
6. Prevention of nausea and vomiting
7. Selective premedication
8. Prophylactic antibiotics
9. No bowel preparation
10. Maintaining euvolemia
11. No fasting and carbohydrate drink 2 hours before surgery

12. Standard anesthetic protocol
13. Fluid euvolemia
14. Normothermia
15. Minimally invasive surgery
16. No peritoneal drainage
17. No gastric drainage
18. Multimodal analgesia
19. Thromboprophylaxis
20. Fluid euvolemia
21. Urinary catheter removal after 1-3 days
22. Prevention of hyperglycemia
23. Postoperative nutrition
24. Early mobilization.

We selected the patients that had a minimum of 12 ERAS measures applied and formed a study group. We compared this group of patients with a similar group selected from previous years' admissions through a matching case process.

The matching criteria were: age, ASA score, topography, interval between symptoms onset and hospital presentation, surgical procedure performed.

The variables that we followed were GI recovery time and the hospital stay. Additional studied variables comprised of postoperative complications, overall morbidity, and mortality rates. Categorical variables were presented as absolute values with their corresponding percentages.

Research data was uploaded to the electronic database and the statistical analysis was performed using Microsoft Excel (Microsoft, Redmond, USA). For normally distributed values, the t-Student's test and chi2 test were used to assess potential statistically significant differences between the two groups. The statistical significance level was considered for $p < 0.05$.

Results

There were 87 patients that underwent emergency colorectal surgery in our department between 2020 and 2023. ERAS protocol measures were applied to all patients. We studied the compliance rate for each of the items in the ERAS protocol. We compared the compliance of ERAS measures in emergency surgery with that of elective surgery from a previous study conducted in our clinic.

The rates of compliance for preoperative measures of ERAS were: detailed information and preoperative counselling were given to 64 patients, representing 73.5% of cases. Optimization of general condition was achieved in 35 patients (40.2%) while prehabilitation was possible for only 7 patients (8%). Nutrition management was obtained in 14 cases, representing 16% of cases. Anemia screening and correction was noted in 58 patients that represent 66.7% of cases. Preventing of nausea and vomiting was attempted in 76 patients (87.3%) and selective premedication was administered in 34 cases (39%). Prophylactic antibiotics were used in 96.5% of cases (84 patients). None of the patients underwent preoperative bowel preparation. Euvolemia was maintained in 45 patients (51.7%) and only 34 patients were noted with no fasting and carbohydrate drink 2 hours before surgery (39%). When compared to the compliance for ERAS items in elective colorectal surgery, the values for emergency surgery ERAS compliance for preoperative measures were significantly lower ($p<0.05$ on chi2 test). This data is presented in Table 1.

The rates of intra-operative items' compliance were much higher than for preoperative measures. We registered 83 patients that received standard ERAS anesthetic protocol, representing 95.4%. Fluid euvolemia was achieved for 84 patients (96.5%) while normothermia was possible for all 87 patients. Minimally invasive surgery was performed only in 7 cases (8%) and only 11 surgeries did not use any peritoneal drainage (12.6%). Compared to elective surgery compliance we found no significant differences for emergency surgery ($p>0.05$ on chi2 test) (Table 2).

ERAS Item	Compliance – ERAS in emergency (87 patients)		Compliance – ERAS in elective (56 patients)	
	No. of pts	%	No. of pts.	%
Preoperative Items				
1. Information	64	73.5%	56	100%
2. Optimisation	35	40.2%	56	100%
3. Prehabilitation	7	8%	50	89.28%
4. Nutrition	14	16%	54	96.42%
5. Anaemia screening	58	66,7%	56	100%
6. Prevention of nausea and vomiting	76	87.3%	56	100%
7. Selective premedication	34	39%	56	100%
8. Prophylactic antibiotics	84	96.5%	56	100%
9. No bowel preparation	87	100%	26	46.42%
10. Maintaining euvolaemia	45	51.7%	54	96.42%
11. No fasting and carbohydrate drink	34	39%	56	100%
p (chi2 test)	= 9.06933E-70 < 0.05 – statistically significant			

Table 1 – ERAS preoperative items' compliance

Regarding postoperative ERAS measures we registered 34 patients without postoperative NG tube (39%), 82 patients with multimodal analgesia (94.2%) and 87 patients (100%) with postoperative thromboprophylaxis. Fluid euvolemia was obtained in 81 patients (93.1%), urinary catheter was removed in the first 3 days for 76 patients (87.3%) and hyperglycemia was prevented for 82 patients (94.2%). Postoperative early nutrition was administered in 54 patients (62%) and early mobilization was possible for 62 patients (71.2%). The comparison with elective surgery postoperative measures compliance showed significantly lower rates for emergency surgery ($p<0.05$ on chi2 test) (Table 2).

ERAS Item	Compliance – ERAS in emergency (87 patients)		Compliance – ERAS in elective (56 patients)	
	No. of pts	%	No. of pts	%
Intraoperative Items				
12. Standard anesthetic protocol	83	95.4%	56	100%
13. Fluid euvolaemia	84	96.5%	56	100%
14. Normothermia	87	100%	56	100%
15. Minimal invasive surgery	7	8%	11	19.64%
16. No drainage	11	12.6%	5	8.92%
p (chi^2 test)	=0.067635 > 0.05 – non significant			
Postoperative Items				
17. No NG tube	34	39%	56	100%
18. Multimodal analgesia	82	94.2%	56	100%
19. Thromboprophylaxis	87	100%	56	100%
20. Fluid euvolaemia	81	93.1%	54	96.42%
21. Urinary catheter 1-3 days	76	87.3%	54	96.42%
22. Prevent hyperglycemia	82	94.2%	51	91.07%
23. Postoperative nutrition	54	62%	48	87.50%
24. Early mobilization	62	71.2%	51	91.07%
p (chi^2 test)	= 2.21449E-21 <0.05 – significant			

Table 2 – ERAS intraoperative and postoperative items' compliance

We selected 63 patients that had a minimum of 12 ERAS measures applied. We compared this group of patients with a similar group selected from previous years' addmitions through a matching case process. The matching criteria were: age, ASA score, topography, interval between symptoms onset and hospital presentation, surgical procedure performed.

The primary variables monitored in this study were gastrointestinal (GI) recovery time and the duration of hospital stay. Additionally, we examined postoperative complications, overall morbidity, and mortality rates.

Our main focus was on gastro-intestinal (GI) recovery time and hospital stay. For our ERAS Group we registered a mean value of 54.4 hours for the GI recovery time with a standard deviation of 17.91 and a variation coefficient of 32.9%. In comparison, the mean value for GI recovery time in the non-ERAS Group was 75.2 hours with a standard deviation of 17.97 and a variation coefficient of 23.8%. This resulted in a significant difference between the two groups regarding GI recovery time (student test). The hospital stay had a mean value of 7.4 days for the ERAS Group (standard deviation of 1.4 and 18.9% variation coefficient) and 10.8 days for the non-ERAS Group (standard deviation of 3.2 days and 28.8% variation coefficient). The comparison also showed a significant difference between the 2 groups (student test) (Table 3).

ERAS and Non-ERAS groups compared					
		Mean value	**Std. Dev.**	**Var. Coef**	**p**
GI recovery time (hours)	ERAS	54.4	17.91	32.9%	<0,01
	Non-ERAS	75.2	17,97	23.8%	
Hospital stay (days)	ERAS	7.4	1.4	18.9%	<0,01
	Non-ERAS	10.8	3.2	28.8%	

Table 3 – Comparison between ERAS and non-ERAS groups

Postoperative morbidity was compared between the ERAS and non-ERAS Groups. We registered 5 patients with anastomotic leaks in the ERAS Group (7.9%) and 6 patients with anastomotic leaks in the non-ERAS Group (9.5%). There were 2 cases of postoperative peritonitis in the ERAS Group (3.1%) and 3 cases in the non-ERAS Group (4.7%). 3 cases in the ERAS Group had poor evolution with sepsis and death. One more patient died through a massive pulmonary embolism thus establishing a 6.3% mortality rate. Mortality rates for the non-ERAS Group were 4.7% (3 cases). Other mild complications (grade I and II on Clavien-Dindo classification) included wound infection (17 cases for ERAS Group – 26.9%, 20 cases for non-ERAS Group – 31.7%%) pneumopathies (3 cases for both ERAS and non-ERAS Groups) and urinary infection (13 cases in the ERAS Group – 20.6% and 10 cases in the non-ERAS Group – 15.8%) (Table 4).

Complication	**ERAS Group 63 patients**		**Non-ERAS Group 63 patients**	
Wound infection	17	26.9%	20	31.7%
Anastomotic leak	**5**	**7.9%**	**6**	**9.5%**
Peritonitis	**2**	**3.1%**	**3**	**4.7%**
Urinary infection	13	20.6%	10	15.8%
Pulmonary complications	4	6.3%	3	4.7%
Sepsis	3	4.7%	2	3.1%
Global morbidity	29	46%	27	42.8%
Mortality	**4**	**6.3%**	**3**	**4.7%**
p (chi^2 test)	**= 0.869348 > 0.05 – non significant**			

Table 4 – Morbidity and mortality comparison for ERAS and non-ERAS Groups

Discussions

There are few studies regarding the implementation of ERAS in emergency colorectal surgery. Two types of study can be encountered in literature: studies of ERAS vs. conventional care in emergency colorectal surgery or studies of ERAS in emergency surgery vs. ERAS in elective surgery.

The studies of ERAS vs. conventional care in emergency colorectal surgery seem to agree that ERAS program can safely be applicable to emergency colorectal surgery with similar benefits of those shown in an elective setting such as lower postoperative complications and shorter hospital stay, without a significant difference in 30-d mortality and readmission rate. Also, ERAS protocol is associated with decreased GI recovery time and shorter interval from surgery to beginning of adjuvant chemotherapy [11]-[15].

Our study registered a significantly lower GI recovery time for patients that underwent at least 12 measures of the ERAS protocol compared to non-ERAS patients. (mean values 54.4 hours vs. 75.2 hours). Also, the hospital stay was significantly lower for the ERAS Group when compared with the non-ERAS Group (mean values 7.4 days vs. 10.8 days). In addition, postoperative morbidity and mortality were similar in the two Groups.

Regarding studies of ERAS in emergency surgery vs. ERAS in elective surgery, the authors found that patients undergoing emergency surgery had a significantly longer hospitalization and a considerably higher rate of unplanned reoperation than those undergoing elective surgery. There was no difference in readmission rate and anastomosis leakage rate between elective and emergency colorectal surgery [16].

In a prospective cohort study using the ERAS® Interactive Audit System from a university hospital in Switzerland, the investigators compared clinical outcomes between 28 urgent colectomies and 63 elective colectomies in a well-established ERAS surgical unit. They found that patients undergoing urgent operations had a significantly lower rate of overall compliance with ERAS protocol (57% vs. 77%). Preoperative and postoperative compliance with ERAS was significantly lower in urgent colectomies – but not intraoperative compliance. There was no significant difference in the rate of postoperative complication between groups (64% vs. 51%). Emergency operations were associated with a significantly longer length of postoperative stay (8 d vs. 5 d) [17].

The rates of compliance with the ERAS protocol in our research showed a significantly lower compliance with the preoperative and postoperative measures in emergency when compared to elective surgery but similar rates of compliance for intraoperative measures, thus registering similar results with literature.

The authors suggested that the application of ERAS for urgent colectomy was feasible and beneficial. Also, many of the ERAS recommended measures can be applied in the emergency situation especially intraoperative measures. In their conclusion, they suggested that ERAS protocol for elective surgery needed to be modified before effectively applying in emergency colorectal surgery [16], [17].

There are many challenges in the implementation of ERAS in emergency colorectal surgery including patient's acute condition, limited resources and healthcare personals in an emergency setting, and difficulty in optimizing patient's general condition. Any ERAS items used in emergency colorectal surgery should be guided by the concept of reducing the stress responses to surgery and promoting the function recovery of surgical patients.

In the future, an ERAS protocol may further be tailored based on the indications of emergency surgery – which could be divided into 2 main categories: presence of

intraabdominal infection (e.g., ruptured colonic diverticulitis, perforated colorectal cancer, acute fulminant colitis) - may require damage control surgery rather than definite treatment; absence of intraabdominal sepsis (e.g., obstructed colorectal cancer and massive lower gastrointestinal bleeding). Preoperative ERAS items might be unable to apply in patients with intraabdominal sepsis, so the intraoperative and postoperative items may be utmost important.

So far, there are a very limited number of studies evaluating the effects of ERAS program in intraabdominal sepsis - especially with the origin of infection from colon and rectum. A small cohort study, by Lohsiriwat from Thailand, evaluating the results of ERAS program in emergency colorectal resection between patients with intraabdominal sepsis (n = 14) and those without (n = 46) found that patients with intraabdominal sepsis had lower adherence to ERAS items (50% vs 78%) and significantly lower compliance with preoperative optimization, scheduled removal of urinary catheter and early mobilization than those without intraabdominal infection [18]-[19].

Conclusions

There is growing evidence demonstrating the safety, feasibility and benefits of ERAS program on surgical outcome following emergency colorectal surgery (more so for cases with no abdominal sepsis). The ERAS program is associated with a faster GI recovery time and shorter length of hospital stay – without increased rates of morbidity and mortality after emergency colorectal surgery. Compliance with ERAS program in emergency surgery appears to be lower than in elective operations. There is limited evidence regarding the benefits of individual ERAS measures used in emergency colorectal surgery – many surgeons have adopted and applied several recommended ERAS items form guidelines for elective colon and rectal surgery into the emergency setting – modified ERAS.

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