Section: General Surgery

Original Research Article

COMPARATIVE STUDY ON THE EFFECTIVENESS OF ENHANCED RECOVERY AFTER SURGERY (ERAS) WITH STANDARD CARE IN PATIENTS UNDERGOING EMERGENCY GASTROINTESTINAL SURGERY

Ankita Mandal[1], Pankaj Bodra[2], Mukesh Kumar[3], Krishna Murari[4], Zenith Harsh Kerketta[5], Khushboo Rani[5], Nikhil Kumar[6], Shreya[6]

[1]Junior Resident, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.
[2]Professor, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.
[3]Associate Professor, Department of Anaesthesiology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.
[4]Associate Professor, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.
[5]Assistant Professor, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.
[6]Junior Resident, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand India.

Received : 12/08/2024
Received in revised form : 01/10/2024
Accepted : 16/10/2024

Keywords:
Enhanced recovery after surgery; Emergency laparotomy; Fast tract surgery

Corresponding Author:
Dr. Ankita Mandal,
Email: ankitamandal8@gmail.com

DOI: 10.47009/jamp.2024.6.5.104

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (5); 548-555

Abstract

Background: Although Enhanced Recovery After Surgery (ERAS) protocols have demonstrated significant advantages in elective surgical operations, there is still a lack of research on their use in emergency laparotomy settings. Goal-directed fluid management, early mobilization, early enteral feeding, and multimodal analgesia were important ERAS components. **Materials and Methods:** From October 2023 to June 2024, a prospective cohort study was conducted at Rajendra Institute of Medical Sciences (RIMS), Ranchi. Patients who met the inclusion and exclusion criteria were chosen. Each group comprised of 45 patients. Standard care was given to the control group and the treating team decided whether or not to have the intervention group follow ERAS protocols. The length of hospital stay was the primary outcome; functional recovery markers and postoperative complications were among the secondary outcomes. **Result:** Demographic and clinicopathological characteristics were comparable between the two groups. There was a significant reduction in the length of hospital stay in ERAS patients by 9.7(4.14) days vs 13.27(5.28) days in the standard care group (p-value <0.001). Compared with the standard care group, the ERAS protocol significantly improved postoperative recovery through earlier nasogastric tube removal, drain removal, bowel sounds, bowel motion, and oral intake. The incidence of overall postoperative complications was significantly higher in the standard care group. In the ERAS group, 24 (53.33%) patients had no complications compared to four (8.89%) patients in the standard care group which showed a significant difference (p-value < 0.001). **Conclusion:** ERAS protocols provide a safe, practical, and efficient way to reduce the duration of hospital stay. They also speed up the recovery of gastrointestinal function and lower the risk of surgical complications.

INTRODUCTION

Emergency laparotomy involves surgical exploration of the acute abdomen to identify various underlying pathologies.[1-6] Common causes include intestinal obstruction, perforation, and exploratory laparotomy with or without debridement or abscess drainage.[1-5] The patients undergoing emergency laparotomy present in a state of physiological derangement,[2-6] are often older,[3-5] have co-morbidities and 30-50% of patients have systemic inflammatory response syndrome (SIRS) or septic shock.[2,3,5-9] Most patients undergo open rather than laparoscopic procedures.[10] The mortality rate after emergency laparotomies usually falls between 10% and 18% in different research, which is noticeably higher than the rate for

elective surgeries.[11] Just under ten years ago, major cohort studies revealed a 30-day mortality rate of 14-18.5% for emergency laparotomy, which increased to over 25% in patients aged over 80 years. Complications are common, and mortality rates increase for at least one year.[12] Functional outcomes and the return to independence are poor for survivors.[13]

The Enhanced Recovery After Surgery (ERAS) includes evidence-based protocols to reduce post-operative stress, maintain postoperative physiological function, and fasten recovery after surgery. The utilization of a stress-reducing approach that incorporates multiple methods has demonstrated a reduction in morbidity rate, enhancement in recovery, and a shortened length of stay. The concept of "fast-track surgery" was introduced by Henrik Kehlet in the 1990s. By applying evidence-based perioperative principles to open colonic surgery, the post-operative length of hospital stay was reduced by two to three days. [13,14] Several studies conducted on the Indian population have examined the efficacy of the ERAS protocol. The Enhanced Recovery After Surgery (ERAS) strategy was found to considerably reduce the duration of hospital stay for patients receiving emergency laparotomy in recent research by Sharma et al. [15] Additionally, there was a lower incidence of postoperative complications such as chest and surgical site infections.

At Rajendra Institute of Medical Sciences (RIMS) Ranchi, both ERAS and conventional care pathways are utilized, but there is currently no available data on the effectiveness of this protocol. This study aims to evaluate the effectiveness of the ERAS protocol for individuals undergoing emergency laparotomy at RIMS Ranchi. The goal is to determine whether the ERAS protocol reduces the duration of hospital stay, the compliance of patients with the ERAS protocol, and the impact of ERAS on postoperative complications.

MATERIALS AND METHODS

Study design and sampling: This prospective cohort study was conducted over eight months from 1st October 2023 to 30th June 2024 in the Department of General Surgery at Rajendra Institute of Medical Sciences (RIMS), Ranchi. The study was approved by the Rajendra Institute of Medical Sciences, Ranchi's Institutional Ethics Committee (MEMO NO 198, dated 20.09.2023). The inclusion and exclusion criteria are discussed in [Table 1]

Table 1: The inclusion and exclusion criteria for the study

Inclusion criteria	Exclusion criteria
Patients undergoing Emergency Laparotomy at our institution	Patients with refractory septic shock at presentation
Age more than 18 years	Pregnant patients
ASA Class I, II and III	Readmitted and Relaparotomy patients

Sample size calculation: The study's primary outcome was the duration of hospital stay. On average, around 600 exploratory laparotomy surgeries occur yearly at Rajendra Institute of Medical Sciences (RIMS), Ranchi. With the help of the study by Sharma et al,[15] as a reference, the sample size of 45 in each group was calculated with a difference between two means (length of stay) of 3.19 days and a standard deviation of 5.37 days using a two-sided t-test with 5% alpha error and 80% power. Sample size = 16 s2 / d2, s = standard deviation of the conventional care group, D = difference of mean. Sample Size in Number: In this study, 45 patients who received Enhanced Recovery After Surgery (ERAS) were taken and compared with 45 patients who received standard care.

All patients admitted to the surgery unit from the emergency department and fulfilling the eligibility criteria were counselled regarding the study protocol and recruited. They were given handouts in their native language, which were explained in detail. Proper written consent was taken from all participants. The guidelines for ERAS protocol in emergency surgery shown in [Table 2], were prepared based on the available guidelines. [16-18] The ERAS protocol was followed at the discretion of the treating team. All patients underwent the standard preoperative assessment, including comprehensive history taking, a general and local abdominal examination, and routine preoperative laboratory tests. The diagnosis was confirmed by radiological assessment (abdominal radiography, ultrasound, computed tomography). Our anaesthesia team assessed the patients, and their physical status was classified according to the 'American Society of Anaesthesiologists classification system' (ASA).[19]

Statistical Analysis: Categorical variables were expressed as frequency and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate.

Continuous variables were expressed as Mean, Median and Standard Deviation and compared across the groups using the Mann-Whitney U test since the data did not follow a normal distribution.

The data entry was done in the Microsoft Excel (Microsoft® Corp., Redmond, WA) spreadsheet, and the final analysis was done with the use of the Statistical Package for Social Sciences (SPSS) version 25.0 (IBM SPSS Statistics, Armonk, NY).

An alpha level of 5% has been taken, i.e. if any p-value is less than 0.05 it has been considered significant.

RESULTS

Both groups had 45 patients each. The primary outcome of the study was the length of hospital stay. The secondary outcome parameters were parameters of functional recovery and postoperative morbidity. The parameters of functional recovery were time to

ISSN (O): 2687-5365; ISSN (P): 2753-6556

removal of nasogastric tube, urinary catheter, and abdominal drain, time to first fluid diet, time to first semi-solid diet, time to first flatus and stools, and time to start of ambulation. Morbidity parameters included the requirement for reinsertion of NG tubes, the need for extra analgesia, postoperative complications including postoperative nausea and vomiting (PONV), surgical site infections (SSI), urinary tract infections, pulmonary complications, re-operations, re-admissions, and mortality. Postoperative complications were classified using the Clavien-Dindo classification.[21]

1. Demographic parameters:

The mean age among the standard care group was 38.16 ± 19 years, compared to 40.82 ± 17.37 years in the ERAS group. 14 (31.11%) patients were females; 31 (68.89%) patients were male in the ERAS group; in the standard care group, 11 (24.44%) were females, while 34 (75.56%) were males [Table 3].

Six patients (13.33%) had comorbidities in the ERAS group, and four patients (8.89%) had comorbidities in the standard care group. Eight patients (17.78%) in the ERAS group and 21 (46.67%) patients in the standard care group had a history of addiction. They were addicted to tobacco, alcohol, or both. Regarding the patient's physical status according to ASA, five patients (11.11%) in the ERAS group, four patients (8.89%) in the standard care group belonged to ASA grade II, 40 (88.89%) patients in the ERAS group and 41 (91.11%) patients in the standard care group belonged to ASA grade III. As shown in Table 3, the previous parameters had no significant difference. 14 (31.11%) patients in the ERAS group presented with acute intestinal obstruction and 11 (24.44%) patients in the standard care group presented with antral perforation [Table 4].

2. Effectiveness and Adherence to the ERAS Protocol:

2.1 Primary outcome: 87 patients were evaluated as three had died during the postoperative period. The mean (standard deviation) duration of hospital stay in the ERAS group was 13.27 (5.28) days, while in the standard care group, it was 9.7 (4.14) days. A significant difference was found ($p < 0.001$) using the Mann-Whitney U test of significance [Table 5].

2.2 Secondary outcomes:

2.2.1 Functional recovery parameters: In our study, the patients in the ERAS group had a significantly early return of bowel functions in terms of time to first stool, and early resumption of a solid diet, and these patients had early removal of a nasogastric tube, abdominal drain, and urinary catheter (Table 5). There were no significant differences between the groups regarding the time to passage of the first flatus (p-value = 0.755), time to ambulation, and the start of fluids [Table 5].

2.2.2 Morbidity Parameters: In the ERAS group, 24 (53.33%) patients had no complications compared to four patients (8.89%) in the standard care group, which showed a significant difference using the Fisher Exact test (p-value < 0.001) [Table 6]. The majority of patients in both groups had Grade I complications: 17 (37.78%) in the ERAS group and 34 (75.56%) in the standard care group; three patients (two in the ERAS group and one in the standard care group) had Grade 5 complications and one patient belonging to the ERAS group had Grade 3 complications [Table 6].

Table 2: Comparison between the ERAS and standard care group; qSOFA- quick sequential organ failure assessment; IV- Intravenous; PPIs- protein pump inhibitor; PEEP- Positive end-expiratory pressure; H2O – water; PRBCs- Packed red blood cells; NSAIDs- Non-steroidal anti-inflammatory drugs; TAP- Transversus abdominis block; POD- Post-operative day; NPO- Nil per mouth; OPD- Out-patient department.

	ERAS PROTOCOL	STANDARD CARE PROTOCOL
PREOPERATIVE		
1.	Immediate identification of physiological derangement and intervention	For all patients
2.	Screen and monitor for sepsis – using (qSOFA) score and management using Surviving sepsis guidelines [20]	For all patients
3.	Early imaging, surgery, and source control of sepsis	For all patients
4.	Non-opioid multimodal analgesia (IV paracetamol and lumbar epidural analgesia) Opioids will be used for breakthrough pain. (Injection Tramadol 50mg)	Opioid analgesia (Injection Tramadol 50mg)
5.	Preoperative glucose and electrolyte management	For all patients
6	Preoperative nasogastric intubation for all patients	Nasogastric intubation for all patients
INTRAOPERATIVE		
7	Rapid Sequence Induction of Anaesthesia- Fast-acting muscle relaxants such as succinylcholine or rocuronium	Anaesthesia at discretion of consultant anaesthetist
8	Postoperative nausea and vomiting reduction	For all patients
9	Lung ventilation strategy- low tidal volume (6–8 ml/kg predicted body weight) and PEEP ≥ 5 cm H2O with titration according to flow-volume loops and clinical evaluation.	Standard anaesthetic protocol
10	Measurement of core body temperature and use of active warming device and warm intravenous fluids	No routine monitoring of body temperature and warmers
11	Intravenous fluid and electrolyte replacement – goal directed	Fluid resuscitation and electrolyte replacement
12	Goal-directed hemodynamic Therapy (GDHT)- Use of arterial lines and/or central venous pressure catheters. MAP of 60–65 mmHg and Cardiac Index > 2.2 L/min/m2 using appropriate vasopressors and inotropes as needed.	No goal directed hemodynamic therapy
13	Management of blood glucose-7.7–10 mmol/l, with the use of a variable rate insulin infusion.	At discretion of treating team

ISSN (O): 2687-5365; ISSN (P): 2753-6556

14	Transfusion of PRBCs should be restrictive (Hb 7-9 g/dl), with exceptions based on individualized clinical status and comorbidities.	At discretion of treating team
15	Multimodal systemic analgesia- IV acetaminophen/ NSAIDs, transversus abdominis plane block, epidural anaesthesia	No routine use of TAP block or epidural anaesthesia
POSTOPERATIVE		
16	Non-opioid multimodal analgesia and/or epidural bupivacaine infusion for 24 hours.	Injection Tramadol/Diclofenac/Paracetamol. Oral doses once feeds are started
17	Mobilisation- early ambulation within 24 hours	Mobilization- Ambulate after 24 hours
18	Removal of the urinary catheter within 72 hours postoperatively in stable patients.	Urinary catheter removed at treating surgeon's discretion
19	Removal of abdominal drains when output is less than equal to 100ml/day	Abdominal drains- when unrestricted liquid diet tolerated for 24 hours
20	Removal of Ryle's tube when output is less than 400 ml/day.	Ryle's tube— ≤ 100 ml/day
21	NPO till resolution of ileus (the first advent of bowel sounds)	Resumption of oral feeds- NPO till resolution of ileus (passage of first flatus).
22	Liquid diet as tolerated after resolution of ileus	Liquid diet as tolerated after resolution of ileus
23	Unrestricted fluids followed by normal diet as tolerated within the next 24 hours.	Semi-solid diet as tolerated followed by normal diet.
24	Follow up at 2 weeks and 30 days in OPD	At discretion of treating team

Table 3: Demographic and clinicopathological characteristics at admission; ERAS- Enhanced recovery after surgery; ASA- American Society of Anesthesiology; SD- standard deviation.@: unpaired t-test of significance #: Pearson's chi-square test of significance

	ERAS group	Standard care group	p-value
Age in years, mean (SD)	40.82 (17.37)	38.16 (19)	0.307[@]
Sex, n (%)			0.480[#]
Male	31(68.89%)	34 (75.56%)	
Female	14 (31.11%)	11 (24.44%)	
BMI in kg/m2, mean (SD)	28.9 (5.6)	28.1 (6.4)	0.587[@]
ASA Grade, n (%)			0.725[#]
Grade II	5 (11.11%)	4 (8.89%)	
Grade III	40 (88.89%)	41 (91.11%)	

Table 4: Clinical diagnosis of both groups; ERAS- Enhanced recovery after surgery

		Group		Total, n (%)
		Standard care, n (%)	ERAS, n (%)	
DIAGNOSIS	Acute intestinal obstruction	8(17.78)	14(31.11)	22(24.44)
	Antral perforation	11(24.44)	7(15.56)	18(20)
	Appendicular perforation	2(4.44)	4(8.89)	6(6.67)
	Blunt trauma abdomen	7(15.56)	3(6.67)	10(11.11)
	Duodenal perforation	0(0)	2(4.44)	2(2.22)
	Large bowel perforation	0(0)	1(2.22)	1(1.11)
	Mesenteric vascular occlusion	4(8.89)	2(4.44)	6(6.67)
	Obstructed hernia	4(8.89)	2(4.44)	6(6.67)
	Penetrating injury	2(4.44)	2(4.44)	4(4.44)
	Perineal injury	0(0)	1(2.22)	1(1.11)
	Primary peritonitis	1(2.22)	1(2.22)	2(2.22)
	Ruptured liver abscess	1(2.22)	0(0)	1(1.11)
	Small bowel perforation	3(6.67)	1(2.22)	4(4.44)
	Strangulated hernia	2(4.44)	4(8.89)	6(6.67)
	Uterine perforation	0(0)	1(2.22)	1(1.11)
Total		45(100)	45(100)	90(100)

Table 5: Composite table showing the primary and major secondary outcomes; ERAS: Enhanced recovery after surgery; SD: standard deviation; $: Mann Whitney U test of significance; *: significant p-value (p-value < 0.05)

Outcome parameter	ERAS group			Standard care group			p-value[$]
	Mean	Median	SD	Mean	Median	SD	
Length of hospital stay (days)	9.7	9.00	4.14	13.27	12.00	5.28	<0.001*
Nasogastric tube withdrawal (days)	2.09	2.00	1.10	2.80	2.00	1.59	0.038*
Time to ambulation (days)	2.29	2.00	0.92	2.38	2.00	0.98	0.597
Time to first flatus (days)	2.49	2.00	0.92	2.53	3.00	0.92	0.755
Time to first stool (days)	2.98	3.00	1.44	3.64	4.00	1.57	0.031*
Time to start of fluid diet (days)	2.36	2.00	0.88	2.76	3.00	1.23	0.086
Time to start of solid diet (days)	3.02	2.00	1.41	3.87	4.00	1.53	0.006*
Time to urinary catheter removal (days)	2.24	2.00	0.91	2.76	2.00	1.23	0.025*
Time to abdominal drain removal (days)	4.04	4.00	1.46	5.56	6.00	2.47	0.001*

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 6: Distribution of complications according to the Clavien-Dindo classification; ERAS: Enhanced recovery after surgery; &: Fisher exact test of significance; *: significant p-value (p-value < 0.05)

		Group		Total, n (%)	p-value[&]
		Standard care, n (%)	ERAS, n (%)		
Clavien Dindo Complication	Grade 1	34(75.56)	17(37.78)	51(56.67)	<0.001*
	Grade 2	6(13.33)	2(4.44)	8(8.89)	
	Grade 3b	0(0)	1(2.22)	1(1.11)	
	Grade 5	1(2.22)	2(4.44)	3(3.33)	
	None	4(8.89)	23(51.11)	27(30)	

Table 7: Distribution of various complications between the two groups; SSI: surgical site infection; PONV: postoperative nausea and vomiting, ERAS: Enhanced recovery after surgery; &: Fisher exact test of significance; *: significant p-value (p-value < 0.05)

		Group		Total, n(%)	p-value[&]
		Standard care, n (%)	ERAS, n (%)		
Complications	Anastomotic leak	1(2.22)	0(0)	1(1.11)	0.312
	Hemorrhage	1(2.22)	0(0)	1(1.11)	0.312
	Burst abdomen	9(20)	2(4.44)	11(12.22)	0.020*
	Death	1(2.22)	2(4.44)	3(3.33)	0.556
	Deep SSI	5(11.11)	4(8.89)	9(10)	0.725
	Organ space SSI	1(2.22)	1(2.22)	2(2.22)	1.000
	Paralytic ileus	4(8.89)	2(4.44)	6(6.67)	0.396
	PONV	2(4.44)	0(0)	2(2.22)	0.148
	Pulmonary complications	4(8.89)	0(0)	4(4.44)	0.036*
	Stoma complication	0(0)	2(4.44)	2(2.22)	0.148
	Superficial SSI	13(28.89)	8(17.78)	21(23.33)	0.209
	None	4(8.89)	24(53.33)	28(31.11)	<0.001*

Table 8: Comparison between the two groups concerning secondary outcomes like NG tube reinsertion, reoperation, and readmission; NG tube: nasogastric tube; ERAS: Enhanced recovery after surgery; &: Fisher's exact test of significance

		ERAS n (%)	Standard care n (%)	Total n(%)	p-value[&]
NG tube reinsertion	Present	2(4.4)	4(8.89)	6(6.67)	0.398
	Absent	43(95.56)	41(91.11)	84(93.33)	
Reoperation	Present	1(2.22)	0(0)	1(1.11)	0.315
	Absent	44(97.78)	45(100)	89(98.89)	
Readmitted within 30 days	Present	1(2.22)	0(0)	1(1.11)	0.315
	Absent	44(97.78)	45(100)	89(98.89)	

The incidence of burst abdomen and pulmonary complications was significantly reduced in the ERAS group (p-values: 0.020 and 0.036) [Table 7]. Superficial surgical site infection (SSI) was present in eight patients (17.78%) in the ERAS group and 13 (28.89%) patients in the standard care group. Paralytic ileus occurred in two patients (4.44%) in the ERAS group and four patients (8.89%) in the standard care group. However, none of these differences were statistically significant [Table 7]. Fisher's exact test was used for calculating the p-value.

In our study, four patients (8.89%) in the standard care group and two patients (4.4%) in the ERAS group required nasogastric tube (NG) reinsertion. One patient (2.22%) in the ERAS group required reoperation due to an anastomosis leak. One patient (2.22%) in the ERAS group was readmitted within 30 days for wound dehiscence. However, the above findings were not significant [Table 8]. Fisher's exact test was used for calculating the p-value.

DISCUSSION

The ERAS protocol is a multimodal treatment route designed to expedite the patient's recovery and reduce the stress reaction following surgery. To this date, ERAS has been applied to only elective surgery. Still, there is no evidence that high-risk surgical patients undergoing emergency laparotomy can also benefit from an ERAS approach. When assessing the effectiveness of the ERAS protocol, parameters such as the length of hospital stay and complications in the postoperative period were considered. This study included 90 patients undergoing emergency laparotomy, 45 receiving standard care, and 45 receiving the ERAS protocol. These patients were followed up in the postoperative period and up to their one-month outpatient visit. Both groups had similar demographic parameters and important clinicopathologic features upon presentation at the emergency department.

In our study, there was a significant reduction in the length of hospital stay with the implementation of the ERAS protocol from 13.27+5.28 days to 9.7+4.14 days. In Purushothaman V et al,[22] trauma patients who underwent emergency laparotomy significantly reduced from 5+1.7 days to 3.3+1.3 days, p-value <0.01. This finding was consistent with similar studies on patients undergoing emergency laparotomy by Rida et al,[23] 10.5+1.1 days vs 5.9+1.7 days, p-value <0.001. A meta-analysis conducted by Hajibandeh et al,[24] comprising five studies, demonstrated that ERAS protocols resulted in

ISSN (O): 2687-5365; ISSN (P): 2753-6556

reduced duration of hospital stay compared to non-ERAS protocols (P < 0.00001).

In this study, the ERAS group had a significantly earlier removal of the NG tube compared to the standard care group at 2.09 vs 2.80 days (p-value 0.038). Lohsiriwat,[25] removed the NG tube within POD two and Gonenc et al,[26] removed the NG tube in the immediate postoperative period.

The time to remove the abdominal drain was 4.04+1.46 days vs. 5.56+2.47 days, and the time to remove the urinary catheter was 2.24+0.91 days vs. 2.76+1.23 days. There was a significant difference between the ERAS and standard care groups. These results were consistent with other studies. In Purushothaman et al. the urinary catheter was removed 2.4 days earlier, and the abdominal drains were removed 2.3 days earlier in the ERAS group.[22] Catheters impede patient mobilization, affecting postoperative recovery of bowel function, deep vein thrombosis (DVT), and lung-related complications. Early catheter removal prevents postoperative complications and enhances ambulation.

We found that the time to start fluids was 2.36+0.88 days in the ERAS group vs. 2.76+1.23 days in the standard care group, p-value = 0.086, which was not statistically significant. This finding was not consistent with the findings of other studies. Moshina et al,[27] reported early intake of fluids, with a mean duration of 1.52+0.76 days vs. 4.24+2.64 days (P<0.001). The time to initiation of a solid diet in our study was 3.02+1.41 days vs 3.87+1.53 days, p-value =0.006, which was statistically significant. This finding was consistent with other studies. Chndan et al,[28] reported a similar finding with the mean duration of the start of a solid diet 3.1+0.48 days vs 5.72+0.95 days (P<0.0001). In a meta-analysis by Hajibandeh et al,[24] an analysis of two studies demonstrated that ERAS protocols led to an earlier commencement of the oral liquid diet compared to non-ERAS protocols (P < 0.00001). Similarly, an analysis of four studies showed that ERAS protocols resulted in an earlier initiation of the oral solid diet compared to non-ERAS protocols (P < 0.00001).

In this study, the time to passage of flatus was 2.49 ± 0.92 days in the ERAS group compared to 2.53 ± 0.92 days in the standard care group. The p-value was 0.755, which was not significant. The time to passage of the first stool was 2.98 ± 1.44 days in the ERAS group compared to 3.64 ± 1.57 days in the standard care group. The p-value was 0.031, which showed a significant difference. This result was consistent with other studies. ERAS protocols have been shown to improve the recovery of bowel function. Lohsiriwat,[25] reported an earlier passage of flatus by 1.2 days in the ERAS group, but there was no difference in the time to passage of stool. In the study by Mohsina et al,[27] there was a reduction of 1.5 days in the passage of flatus and 2.3 days in the passage of stools. In the study by Shang et al,[29] there was a reduction of 1.4 days in flatus passage and 1 day in stool passage. In a meta-analysis by Hajibandeh et al,[24] an analysis of three studies reported that ERAS protocols resulted in less time to first flatus compared to non-ERAS protocols (p <0.00001). Similarly, an analysis of three studies showed that ERAS protocols resulted in a shorter time to first defecation compared with non-ERAS protocols (P = 0.02).

In our study, one patient from the ERAS group and none from the standard care group required reoperation. The p-value was 0.315, which was not statistically significant. In a meta-analysis by Hajibandeh et al,[24] an analysis of five studies showed that ERAS protocols and non-ERAS protocols were comparable in terms of the need for re-operation (P = 0.50). In our study, one patient from the ERAS group and none from the standard care group required re-admission. The p-value was 0.315, which was not statistically significant. In a meta-analysis by Hajibandeh et al,[24] an analysis of six studies showed that ERAS protocols and non-ERAS protocols had a similar rate of re-admission (P = 0.50).

In this study, 24 (53.33%) patients in the ERAS group and four patients (8.89%) in the standard care group had no complications. The p-value was <0.001, which was statistically significant. This result was comparable to other studies. In the study by Mohsina et al,[27] there was a significant reduction in the incidence of superficial SSI, pulmonary complications, urinary tract infection(UTI) and postoperative nausea and vomiting(PONV) with ERAS protocols. Chndan et al,[28] reported a significant reduction in the rates of surgical site infections (14.29%), pulmonary complications (4.76%), and incidence of PONV rate (19.05%) in the ERAS group. In a study by Rida et al,[23] the incidence of total postoperative complications was 36.7% in the conventional group versus 13.3% in the ERAS group (P=0.034). Lohsiriwat,[25] reported a non-significant reduction in the overall complication rates in patients undergoing urgent colectomy managed with the ERAS protocol compared to conventional care. In a study by Gonenc et al,[26] there was no significant difference in terms of postoperative complications, re-admission, or reoperation rates.

In our study, eight patients (17.78%) in the ERAS group vs. 13 (28.89%) in the standard care group had superficial SSI the p-value was 0.209, which was not significant. Four patients (18.89%) in the ERAS group vs. five (11.11%) in the standard care group patients developed deep SSI, the p-value was 0.725, which was not significant and two patients (4.44%) in the ERAS group vs. nine patients (20%) in the standard care group patients had burst abdomen, the p-value was 0.020, which was significant. These findings were consistent with other studies. Sharma et al,[15] reported a significant difference between the two groups in terms of surgical site infections (SSIs) 18 (36.7%) vs. 30 (61.2%) p-value <0.015, with the conventional group having more incidence of SSIs. Moshina et al,[27] findings were consistent with our study, surgical site infection occurred in 29% of conventional patients vs. only 10% of the ERAS

ISSN (O): 2687-5365; ISSN (P): 2753-6556

patients, which was statistically significant (P=0.21). In a meta-analysis by Hajibandeh et al,[24] analysis of three studies showed that ERAS protocols resulted in a lower rate of surgical site infection compared with non-ERAS protocols (P = 0.0001).

In this study, two patients (4.44%) in the ERAS group vs. four patients (8.89%) in the standard care group developed paralytic ileus which was more common in the standard care group though the p-value was 0.396, which was not significant. This finding was consistent with other studies. Rida et al,[23] showed a comparable incidence of postoperative ileus in the two groups (3.3% and 6.7% in the conventional and ERAS groups respectively). Shida et al,[30] reported that paralytic ileus occurred in 5% and 3.8% of conventional and ERAS patients respectively (P = 0.545). Additionally, Shang et al,[29] reported that the same complication occurred in 24.2% and 22.6% of patients in the ERAS and conventional groups respectively (P=0.35). Sharma et al,[15] reported a significant difference between both groups (p < 0.026), 8.0% of the patients in the ERAS group had paralytic ileus as compared to 24.5% in the conventional care group.

In our study, two patients (4.44%) in the standard care group developed postoperative nausea and vomiting (PONV) as compared to none in the ERAS group, the p-value was 0.148 which was not significant. In Mohsina et al,[27] nine patients (18%) in the ERAS group vs 31 (63%) in the control group developed PONV (p-value < 0.0001), this was significant. In Sharma et al,[15] no significant difference was seen between the two groups in terms of the incidence of PONV (p < 0.204).

In this study, four patients (8.89%) in the standard care group developed pulmonary complications and none in the ERAS group, the p-value was 0.036 which was significant. In Sharma et al,[15] a higher rate of pulmonary complications was seen in the conventional care group (p < 0.028), which was significant. In Mohsina et al,[27] two patients (4%) in the ERAS group vs. eight patients (16%) in the control group had pulmonary complications (p = 0.049), which was significant. In a meta-analysis by Hajibandeh et al,[24] an analysis of four studies showed that ERAS protocols resulted in a lower rate of pulmonary complications in comparison to non-ERAS protocols (p = 0.0003).

In our study the 30-day mortality was seen in two patients (4.44%) in the ERAS group vs. one patient (2.22%) in the standard care group, the p-value was 0.556, which was not significant. In a meta-analysis by Hajibandeh et al,[24] an analysis of six studies showed that ERAS protocols and non-ERAS protocols had similar 30-day mortality risks (p = 0.94).

Limitations of this study: The sample size of our study was small hence statistical significance could not be reached for various post-operative complications even though a difference was observed in results. This was a comparative observational study and not a randomised control trial, hence protocols were not strictly implemented and had variations based on surgeon's preference. The data collected was not normally distributed hence non-parametric tests were used. This fact, along with the already smaller sample size, resulted in a reduction of statistical power. The high-risk patients in ASA IV and patients in refractory septic shock were excluded from the study, which might have resulted in more encouraging outcomes. This study was unable to assess the cost savings associated with the early functional recovery in the adapted ERAS group. This is because the study was conducted in a tertiary hospital setting under public health care, where the services incurred minimal charges.

CONCLUSION

In our study, the implementation of the ERAS protocol in patients undergoing emergency gastrointestinal surgery resulted in a reduced length of hospital stay, faster recovery of gastrointestinal function, and a lower rate of complications. This did not result in an increased need for readmission following discharge, and there was also no increase in 30-day mortality. Hence tailored ERAS protocol is safe, effective, and feasible and can be implemented in patients undergoing emergency gastrointestinal surgery. We recommend developing a standardized ERAS protocol tailored for emergency surgeries. This would improve patient outcomes and help reduce the economic burden caused by high hospitalization costs due to the associated morbidity of these conditions.

Acknowledgements: All the authors would like to thank Prof Dr Shital Malua, Head of the Department of General Surgery, RIMS, Ranchi for allowing us to conduct this study.

REFERENCES

1. Symons NRA, Moorthy K, Almoudaris AM, Bottle A, Aylin P, Vincent CA, et al.: Mortality in high-risk emergency general surgical admissions. Br J Surg. 2013, 100:1318-1325. 10.1002/bjs.9208
2. Shafi S, Aboutanos MB, Agarwal S Jr, Brown CVR, Crandall M, Feliciano DV, et al.: Emergency general surgery: definition and estimated a burden of disease. J Trauma Acute Care Surg. 2013, 74:1092-1097. 10.1097/TA.0b013e31827e1bc7
3. Al-Temimi MH, Griffee M, Enniss TM, Preston R, Vargo D, Overton S, et al.: When is death inevitable after emergency laparotomy? Analysis of the American college of surgeons national surgical quality improvement program database. J Am Coll Surg. 2012, 215:503-511. 10.1016/j.jamcollsurg.2012.06.004
4. Lee KC, Sturgeon D, Lipsitz S, Weissman JS, Mitchell S, Cooper Z: Mortality and health care utilization among medicare patients undergoing emergency general surgery vs those with acute medical conditions. JAMA Surg. 2020, 155:216-223. 10.1001/jamasurg.2019.5087
5. NELA project team: The fifth patient report of the national emergency laparotomy audit - full patient report. (2019). https://www.nela.org.uk/downloads/The%20Fifth%20Patient%20Report%20of%20the%20NELA%202019%20-%20Full%20Patient%20Rep....
6. Peden C, Scott MJ: Anesthesia for emergency abdominal surgery. Anesthesiol Clin. 2015, 33:209-221. 10.1016/j.anclin.2014.11.012

ISSN (O): 2687-5365; ISSN (P): 2753-6556

7. Gale SC, Shafi S, Dombrovskiy VY, Arumugam D, Crystal JS: The public health burden of emergency general surgery in the United States: a 10-year analysis of the nationwide inpatient sample-2001 to 2010. J Trauma Acute Care Surg. 2014, 77:202-208. 10.1097/TA.0000000000000362
8. Scott JW, Olufajo OA, Brat GA, Rose JA, Zogg CK, Haider AH, et al.: Use of national burden to define operative emergency general surgery. JAMA Surg. 2016, 15:10.1001/jamasurg.2016.0480
9. Ingraham AM, Cohen ME, Raval MV, Ko CY, Nathens AV: Comparison of hospital performance in emergency versus elective general surgery operations at 198 hospitals. J Am Coll Surg. 2011, 212:20-28. 10.1016/j.jamcollsurg.2010.09.026
10. Roulin D, Blanc C, Muradbegovic M, Hahnloser D, Demartines N, Hubner M: Enhanced recovery pathway for urgent colectomy. World J Surg. 2014, 38:2153-2159. 10.1007/s00268-014-2518-y
11. Barazanchi AWH, Xia W, MacFater W, Bhat S, Macfater H, Taneja A, et al.: Risk factors for mortality after emergency laparotomy: scoping systematic review. ANZ J Surg. 2020, 90:1895-1902. 10.1111/ans.16082
12. Cooper Z, Mitchell SL, Gorges RJ, Rosenthal RA, Lipsitz SR, Kelley: Predictors of mortality up to 1 year after emergency major abdominal surgery in older adults. J Am Geriatr Soc. 2015, 63:2572-2579. 10.1111/jgs.13785
13. Kehlet H, Wilmore DW: Evidence-based surgical care and the evolution of fast-track surgery. Ann Surg. 2008, 248:189-198. 10.1097/SLA.0b013e31817f2c1a
14. Breuer JP, von Dossow V, von Heymann C, Griesbach M, von Schickfus MC, Mackh EC, et al.: Preoperative oral carbohydrate administration to ASA III-IV patients undergoing elective cardiac surgery. Anesth Analg. 2006, 103:1099-1108. 10.1213/01.ane.0000237415.18715.1d
15. Sharma J, Kumar N, Huda F, Payal YS: Enhanced recovery after surgery protocol in emergency laparotomy: A randomized control study. Surg J. 2021, 7:10.1055/s-0041-1725156
16. Peden CJ, Aggarwal G, Aitken RJ, Anderson ID, Foss NB, Cooper Z, et al.: Guidelines for perioperative care for emergency laparotomy Enhanced Recovery After Surgery (ERAS) Society recommendations: Part 1—Preoperative: Diagnosis, rapid assessment and optimization. World J Surg. 2021, 45:1272-1290. 10.1007/s00268-021-05994-9
17. Scott MJ, Aggarwal G, Aitken RJ, Anderson ID, Balfour A, Foss NB, et al.: Consensus guidelines for perioperative care for emergency laparotomy enhanced recovery after surgery (ERAS®) society recommendations Part 2—Emergency laparotomy: intra- and postoperative care. World J Surg. 2023, 47:1850-1880. 10.1007/s00268-023-07020-6
18. Saurabh K, Sureshkumar S, Mohsina S, Mahalakshmy T, Kundra P, Kate V: Adapted ERAS pathway versus standard care in patients undergoing emergency small bowel surgery: A randomized controlled trial. J Gastrointest Surg. 2020, 24:2077-2087. 10.1007/s11605-020-04684-6
19. Mayhew D, Mendonca V, Murthy BVS: A review of ASA physical status − historical perspectives and modern developments. Anaesthesia. 2019, 74:373-379. 10.1111/anae.14569
20. Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al.: Surviving sepsis campaign: international guidelines for management of sepsis and septic shock. Intensive Care Med. 2016, 43:304-377. 10.1007/s00134-017-4683-6
21. Dindo D, Demartines N, Clavien PA: Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004, 240:205-13. 10.1097/01.sla.0000133083.54934.ae
22. Purushothaman V, Priyadarshini P, Bagaria D, Joshi M, Choudhary N, Kumar A, et al.: Enhanced recovery after surgery (ERAS) in patients undergoing emergency laparotomy after trauma: a prospective, randomized controlled trial. Trauma Surg Acute Care Open. 2021, 27:000698. 10.1136/tsaco-2021-000698
23. Rida RR, Abdallah AB, Helmy AA, AA Abdelmotaleb: Conventional versus enhanced recovery after surgery protocols in emergency gastrointestinal tract surgery: a randomized clinical trial. The Egyptian Journal of Surgery. 2024, 43:330-336. 10.4103/ejs.ejs_221_23
24. Hajibandeh S, Hajibandeh S, Bill V, Satyadas T: Meta-analysis of enhanced recovery after surgery (ERAS) protocols in emergency abdominal surgery. World J. Surg. 2020, 44:1336-1348. 10.1007/s00268-019-05357-5
25. Lohsiriwat V: Enhanced recovery after surgery vs conventional care in emergency colorectal surgery. World J Gastroenterol. 2014, 20:13950-13955. 10.3748/wjg.v20.i38.13950
26. Gonenc M, Dural AC, Celik F, Akarsu C, Kocatas A, Kalayci MU, et al.: Enhanced postoperative recovery pathways in emergency surgery: a randomised controlled clinical trial. American journal of surgery. 2014, 207:807-814. 10.1016/j.amjsurg.2013.07.025
27. Mohsina S, Shanmugam D, Sureshkumar S, Kundar P, Mahalakshmy T, Kate V: Adapted ERAS pathway vs. standard care in patients with perforated duodenal ulcer-a randomized controlled trial. Journal of gastrointestinal surgery. 2018, 22:107-116. 10.1007/s11605-017-3474-2
28. Chndan, M.N., Khakholia, M. & Bhuyan, K: Enhanced recovery after surgery (ERAS) versus standard care in patients undergoing emergency surgery for perforated peptic ulcer. Indian J Surg. 2020, 82:1044-1049. 10.1007/s12262-020-02195-x
29. Shang Y, Guo C, Zhang D: Modified enhanced recovery after surgery protocols are beneficial for postoperative recovery for patients undergoing emergency surgery for obstructive colorectal cancer: A propensity score matching analysis. Medicine. 2018, 97:12348. 10.1097/MD.0000000000012348
30. Shida D, Tagawa K, Inada K, Nasu K, Seyama Y, Maeshiro T, et al.: Modified enhanced recovery after surgery (ERAS) protocols for patients with obstructive colorectal cancer. BMC Surg. 17:18. 10.1186/s12893-017-0213-2.

ISSN (O): 2687-5365; ISSN (P): 2753-6556