Conventional versus enhanced recovery after surgery protocols in emergency gastrointestinal tract surgery: a randomized clinical trial

Ramy R. Rida, Abdallah B. Abdallah, Ashraf A. Helmy, Abdelmotaleb A. A.

General Surgery Department, Faculty of Medicine, Assiut University, Assiut, Egypt

Correspondence to Ramy R. Rida, MSc, General Surgery Department, Faculty of Medicine, Assiut University, Assiut 71631, Egypt. Tel: +0111 196 1657; e-mail: ramyraouf69@gmail.com

Received: 28 September 2023
Revised: 19 October 2023
Accepted: 30 October 2023
Published: 31 January 2024

The Egyptian Journal of Surgery 2024, 43:330–336

Background
Compared with elective operations, emergency abdominal surgery is more likely to result in perioperative morbidity and mortality. Implementation of care programs could be beneficial for such patients to decrease complication rates. Enhanced recovery after surgery (ERAS) is a complex perioperative approach that has proven its efficacy in multiple elective procedures. Nonetheless, its efficacy in emergency abdominal surgery has been questioned. Herein, we compared the ERAS and conventional approaches in the management of such patients.
Patients and methods
Sixty adult patients were enrolled in our randomized prospective trial, and they were assigned to two groups; the conventional and ERAS groups. The duration of hospitalization was the main outcome.
Results
Preoperative characteristics, presentation, and surgical operations were comparable between the two study groups. A perforated duodenal ulcer was the most common diagnosis and was treated by through and through suture with the omental patch (36%) followed by resection anastomosis (36%) in patients with ischemic loop or patients with severely injured loops, and primary repair in simple injury (28%). The hospitalization period decreased significantly in ERAS patients (5.9 vs. 10.5 days in the conventional group $P<0.001$). The ERAS protocol had a significant beneficial impact on postoperative recovery, which manifested in earlier nasogastric tube removal, drain removal, bowel sounds, bowel motion, and oral intake compared with the conventional group. The incidence of postoperative complications especially surgical site infection increased significantly with the conventional perioperative regimen (36.7% vs. 13.3% after ERAS $P=0.034$).
Conclusion
ERAS has multiple advantages over the conventional approach when implemented in emergency surgery patients and is recommended in emergency surgical practice.

Keywords:
conventional, emergency abdominal surgery, enhanced recovery after surgery

Egyptian J Surgery 43:330–336
© 2024 The Egyptian Journal of Surgery
1110-1121

Introduction

Emergency abdominal surgery is one of the crucial components of hospital services, and patients with acute surgical abdomen requiring surgical intervention are frequently encountered in daily emergency practice [1,2]. However, these procedures carry a high risk of perioperative morbidity and mortality (about 80% of all mortality after surgical intervention occurs after emergency operations) [1]. Complex care programs should be applied to such patients to enhance their perioperative outcomes [3].

'Enhanced recovery after surgery' (ERAS) is a globally acknowledged approach that aims to preserve the physiological function of body systems, decrease perioperative stress responses, and facilitate postoperative recovery in surgical patients [4]. That program consists of multiple pre, intra, and postoperative components [5,6], and its beneficial impact has been proven in patients undergoing colorectal [7,8] and other elective abdominal operations [9–13].

However, its efficacy in emergency abdominal operations is still under debate [4,14]. Also, we did find a clear paucity of trials evaluating the beneficial role of ERAS in emergency surgical procedures in the Egyptian settings. The aim of this study is to compare ERAS to the conventional approach in the

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

management of cases requiring emergency abdominal surgery.

Patients and methods

The current prospective randomized study was conducted between April 2022 and October 2022 at Assiut University Hospitals following ethical approval from the ethical scientific committee of our medical school. The study was designed for adult patients who came to our emergency department with manifestations of acute surgical abdomen that required immediate surgical intervention.

The G*power software was used to calculate our proper sample size. We used the data previously published by Gonenc and colleagues who reported that the hospitalization period had mean values of 6.9+2.2 and 3.8±1.9 days in the conventional and ERAS groups, respectively [15]. We needed 30 patients enrolled in each group to achieve an 80% power and a 5% significance level (total number of included cases=60).

All participants received the standard preoperative evaluation, including detailed history taking, a general and local abdominal examination, and routine preoperative laboratory investigations. Also body mass index (BMI) was calculated and recorded. In addition, the diagnosis was confirmed by radiological assessment (abdominal radiography, ultrasound, and/or computed tomography). The patients were also reviewed by our anesthetic team, and their physical status was classified according to the 'American Society of Anesthesiologists classification system' (ASA) [16].

Patients with liver failure, renal failure, chronic steroid use, acute appendicitis, or acute cholecystitis were excluded. Also, patients with septic shock and /or those who needed invasive mechanical ventilation for more than 12h after the surgery were also excluded.

Our 60 patients were randomly divided into two groups (30 patients in each one) via the 'sealed envelope method': the conventional group included patients who received standard perioperative care, and the ERAS group included the remaining patients who received the ERAS protocol.

Patients in both groups had a nasogastric tube (NGT) inserted in all of them for bowel decompression. Additionally, a urinary catheter was applied to monitor urine output in such critical cases. All operations were performed under general anesthesia, with no administration of perioperative sedatives.

Abdominal exploration was done via a midline incision, through which the abdominal and pelvic cavities were explored. A broad-spectrum antibiotic (IV cefepime 1 g) was commenced for all cases at the time of the skin incision. After the pathology was identified, it was treated as recommended (through and through omental patch for perforated duodenal ulcer, resection and anastomosis for extensive bowel injuries with unhealthy ends, and primary repair for bowel injuries with healthy cut edges). Then, the peritoneal cavity was irrigated with warm saline, and a surgical drain was inserted in relation to the operative bed. Finally, the abdominal wound was closed in layers.

Following surgery, patients were sent to the recovery room before being transferred to the internal surgical ward, where they were closely monitored. Frequent abdominal examinations were done, and the time to hearing bowel sounds, passing flatus, and passing stool was recorded in both study groups. Prophylaxis against venous thromboembolism was achieved by prophylactic dose of low molecular weight heparin (LMWH) daily and elastic leg stockings. Analgesia was achieved with IV paracetamol (1 g/8 h) in addition to IV ketorolac (30 mg/12 h) except for patients with perforated peptic ulcer in which ketorolac is contraindicated. If the patient reported distressing pain, an incremental dose of IV nalubuphine (2 mg) was commenced. Early mobilization was encouraged in both groups, and the time to the first mobilization episode was recorded in both groups. The urinary catheter was removed after mobilization.

The nasogastric tube was removed within the first 24 h in the ERAS group, while it was removed after 2–3 days in the conventional group. Postoperative oral intake was delayed to the third postoperative day in the conventional group, while it was allowed after 24 h in the ERAS group. Oral intake was initiated with small fluid sips (20 mL every 2 h), and the amount was gradually increased with gradual withdrawal of IV fluids until achieving full oral fluid intake (2 l/day), where, IV fluid administration was stopped, and solid food intake was allowed. The days of starting oral fluid and solid intake were recorded in both groups.

The incidence of postoperative complications, including ileus, anastomotic leakage, surgical site infection, or wound dehiscence, was recorded in each study group. Reoperation, readmission, and mortality rates were also recorded. Patients were

discharged from the hospital when they achieved full oral intake, passing stool and flatus, with no signs of sepsis (fever, leucocytosis or abdominal pain), drains removed and had adequate analgesia with oral medications. The total duration of hospitalization was recorded, and that was the primary outcome of this study. Other outcomes included the duration of the first mobilization, bowel function, and oral intake, in addition to the incidence of complications.

The SPSS software was used to analyze the data that had been collected. While categorical data were expressed as percentages and numbers, numerical data were expressed as mean, standard deviation, and range. In order to compare numerical data across the conventional and ERAS groups, we utilized the independent sample-t test. For categorical data, we employed the chi-square test. Statistical significance was defined as a *P*-value less than 0.05.

Results

The age of the patients in the conventional group ranged between 19 and 59 years (mean=41.5), while it ranged between 21 and 56 years in the ERAS group (mean=39.7). Men had a higher prevalence than women in both study groups, as they formed 63.3% and 56.7% of patients in the conventional and ERAS groups, respectively. The body mass index (BMI) of the included participants had mean values of 29.1 and 29.9 kg/m^2 in the same groups, respectively. Regarding the physical status according to the ASA, most patients had class I, as they formed 50% and 56.7% of patients in the same groups, respectively. The remaining patients had either class II or III. As shown in Table 1, the previous parameters showed no statistical difference between our two groups.

As illustrated in Table 2, both groups expressed comparable findings regarding the diagnosis and the surgical intervention. Perforated duodenal ulcer was the most common diagnosis in both groups, as it was present in 33.3% and 40% of cases in the conventional and ERAS groups, respectively. Other presentations included strangulated hernia, mesenteric vascular occlusion, penetrating abdominal injury, road traffic accident, firearm injury, and iatrogenic injury.

As regard the operative procedure, all patients diagnosed with perforated duodenal ulcers were managed by omental patch repair in both groups. In addition, a resection anastomosis was performed in 43.3% and 30% of patients, whereas a primary repair was done in 23.3% and 30% of patients in the conventional and ERAS groups, respectively, with no statistical significance.

As shown in Table 3, the ERAS protocol was associated with a significant beneficial impact on postoperative recovery, which was manifested in

Table 1 Preoperative data

	Conventional	ERAS	*P* value
Age (y)			0.566
Mean±SD	41.5±11.9	39.7±12.2	
Range	19–59	21–56	
Sex			0.598
Women	11 (36.7%)	13 (43.3%)	
Men	19 (63.3%)	17 (56.7%)	
BMI (kg/m^2)			0.587
Mean±SD	29.1±6.4	29.9±5.6	
Range	18.5–40	20–39.5	
ASA Grading			0.866
Class I	15 (50%)	17 (56.7%)	
Class II	10 (33.3%)	9 (30%)	
Class III	5 (16.7%)	4 (13.3%)	

Table 2 Clinical diagnosis and surgical intervention in both study groups

	Conventional		ERAS		
	Frequency	Percentage	Frequency	Percentage	*P* value*
Presentation					0.938
Perforated PU	10	33.3	12	40	
Strangulated Hernia	5	16.7	3	10	
Mesenteric Vascular Occlusion	2	6.7	1	3.3	
Penetrating Injury	4	13.3	5	16.7	
Road Traffic Accident	6	20	6	20	
Firearm Injury	2	6.7	1	3.3	
Iatrogenic Injury	1	3.3	2	6.7	
Operative Procedure					0.560
Omental Patch/Repair	10	33.3	12	40	
Resection/Anastomosis	13	43.3	9	30	
Primary Repair	7	23.3	9	30	

Table 3 Patient recovery and the duration of hospitalization in the two groups

	Conventional				ERAS				
	Mean	SD	Min	Max	Mean	SD	Min	Max	*P* value*
NG Tube Removal (d)	2.4	0.3	2	2.96	0.5	0.3	0	1	0.000
Drain Removal (d)	9.1	1.3	7	11	5.5	0.2	5	6	0.000
Catheter Removal (h)	12.5	1.1	10	15	12.2	0.9	8	16	0.998
Ambulation (h)	18	9	8	30	12	9	3	22	0.012
First Bowel Sound (h)	10.9	2.3	8	16	9.9	2.4	6	16	0.105
First Flatus (h)	16.2	3.1	12	24	15.8	3.3	9	24	0.630
First Stool (d)	4.0	1.5	2.5	4	3	1	1.5	3.5	0.003
First Oral Slips (d)	3.2	0.5	2.5	4.0	1.2	0.2	0.8	1.5	0.000
First Fluid Diet (d)	4.1	0.7	3	5	2.5	0.5	2	3	0.000
First Solid Diet (d)	7.2	1.7	5	10	4.1	0.8	3	5	0.000
Stoppage of IV Fluids (d)	4.5	1.2	3	6	2.5	0.5	2	3	0.000
Duration of hospitalization (d)	10.5	1.1	9	12	5.9	0.7	5	7	0.000

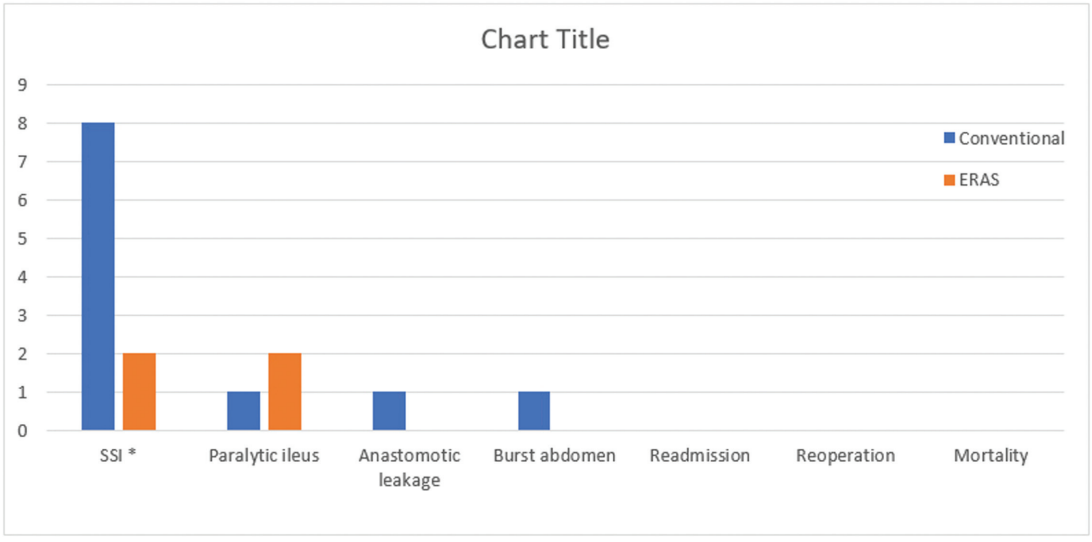
earlier NGT removal, drain removal, passage of stool and oral fluid and solid intake, compared with patients in the conventional group ($P<0.001$).

The duration of hospitalization showed a significant decline in association with the ERAS protocol ($P<0.001$). ERAS patients had a mean hospitalization period of 5.9±0.7 days (range, 5–7), while the same parameter had a mean value of 10.5±1.1 days (range, 9–12).

The incidence of total postoperative complications was 36.7% in the conventional group versus 13.3% in the ERAS group ($P=0.034$). Nonetheless, the incidence of each individual complication was comparable between our two groups ($P>0.05$), apart from surgical site infection that increased significantly in the conventional group (26.7% vs. 6.7% in ERAS group $P=0.038$).

Anastomotic leakage occurred in 3.3% and 0% of cases (P value=0.313), while ileus was encountered in 3.3% and 6.7% of patients (P value=0.640) in the conventional and ERAS groups, respectively. Moreover, subacute burst abdomen occurred in only one patient in the conventional group (3.3%) (P value=0.313) (Fig. 1). All have no statistical significance. No patients required readmission or reoperation in our study. Moreover, no mortality was encountered in our patients.

Figure 1



*SSI = surgical site infection

Postoperative complications.

Discussion

In our trial, we intended to elucidate whether the application of the ERAS protocol to emergency surgical patients would be beneficial or not. We included 60 patients with an acute surgical abdomen who were divided into the conventional group and the ERAS group. All preoperative and intraoperative parameters were statistically equivalent between the two groups.

Our findings showed earlier postoperative mobilization in the ERAS group (12 vs. 18 h in the conventional patients $P<0.012$). Our findings are consistent with Saurabh and colleagues as the mean time to ambulation was 1.6 days in ERAS patients compared with 2.63 days in the conventional group ($P<0.001$) [17].

In our study, patients in the ERAS group showed earlier fluid and solid food intake compared with the conventional approach ($P<0.001$), that's comparable to a study by Lohsiriwat who reported similar findings in his study in 2014 [18]. Moshina and colleagues also reported earlier intake of both oral fluids and solids ($P<0.001$). The mean duration to the first oral fluid intake was 1.52 days in ERAS patients compared with 4.24 days in conventional cases. Regarding solid intake, it started after mean durations of 2.64 and 4.24 days in the same groups, respectively [19].

Our study showed that ERAS implementation led to earlier stool passage, compared with the conventional approach. That could be explained by the earlier enteral feeding in the ERAS group, and it is already established that enteral feeding is a powerful stimulator for bowel movements [20,21]. Earlier mobilization could also play a role [22]. Comparable with our findings, Shang and his colleagues reported that the application of ERAS led to earlier defecation compared with the conventional approach ($P=0.008$). It occurred after 2.5 and 3.5 days in the ERAS and conventional groups, respectively [23]. Moshina and colleagues reported similar findings regarding the duration to the first stool [19].

Our findings showed a significant increase in total postoperative complication rates in the conventional approach (36.7% vs. 13.3% in the ERAS group $P=0.034$), which is consistent with study by Shang *et al.* as the conventional approach led to a significant increase in the incidence of postoperative complications compared with ERAS (37.1% vs. 29.6%, respectively $P=0.026$) [23]. Contrarily, Gonenc and colleagues reported a comparable incidence of postoperative morbidity between the two approaches ($P=0.807$). Postoperative morbidity was encountered in 26.92% and 23.81% of patients in the conventional and ERAS groups, respectively [15].

In our study, we encountered only one patient with postoperative anastomotic leakage who was in the conventional group (3.33%) with no significant statistical difference between the two groups ($P=0.313$). Shida and colleagues reported that the same complication occurred in 15% and 10% of patients in the conventional and ERAS groups, respectively, which was equivalent in statistical analysis ($P=0.48$) [24]. The difference between results can be explained by the small number of patients encountered in our study.

Our results showed a comparable incidence of postoperative ileus in our two groups (3.3% and 6.7% in the conventional and ERAS groups, respectively). Shida and his coworkers reported that ileus occurred in 5% and 3.8% of conventional and ERAS patients, respectively ($P=0.545$) [24]. Additionally, Shang and colleagues reported that the same complication occurred in 24.2% and 22.6% of patients in the ERAS and conventional groups, respectively ($P=0.35$) [23].

We noticed a significant increase in surgical site infection in the conventional group (26.7% vs. 6.7% in the ERAS group $P=0.038$). That may reflect the subtle immune system changes associated with ERAS compared with the traditional approach. Moshina and colleagues is consistent with our study as surgical site infection occurred in 29% of conventional patients, versus only 10% of the ERAS participants, which was statistically significant in the statistical analysis ($P=0.21$) [19]. A previous meta-analysis also confirmed the association between ERAS implementation and the decreased risk of postoperative wound infection (OR: 0.39, $P<0.001$) [4]. In contrast, Wisely and Barclay reported no significant difference between the two approaches regarding the incidence of postoperative wound infection ($P=0.12$), which was encountered in 21% and 14% of patients in the conventional and ERAS groups, respectively [14].

In our study, a burst abdomen occurred in only one patient in the conventional group (3.3%), versus no cases in the ERAS group, with no significant difference in the statistical analysis ($P=0.313$). No previous studies have evaluated the impact of the ERAS

approach on such a complication. However, our incidence lies near the reported range in the literature that ranges between 0.2% and 3% after abdominal procedures [25].

Regarding our primary objective (the hospitalization period), it showed a significant decrease in the ERAS group (5.9 vs. 10.5 days in the conventional group $P<0.001$). The decreased hospitalization period in the ERAS group could be secondary to earlier bowel recovery, earlier enteral intake, and a lower incidence of postoperative complications. The previous factors make ERAS patients meet our discharge criteria earlier than conventional patients. An additional study reported that the hospitalization period ranged between 3 and 22 days in ERAS patients (median=6), while it ranged between 7 and 27 days in the traditional group (median=9). There was a significant prolongation in that parameter in association with the conventional approach ($P<0.001$) [23]. Moshina and colleagues reported that ERAS patients had a mean hospitalization period of 4.667 days, which was significantly lower than the conventional approach (5.86 days $P=0.002$) [19]. Other studies also reported similar findings, confirming the association between ERAS implementation and decreased hospitalization periods [18,24].

In our study, no patients required readmission in both groups. Wisely and colleagues reported that readmission was needed in 8% and 10% of the conventional and ERAS protocols, respectively ($P=0.88$) [14]. Differences between studies could be explained by different complication rates and readmission criteria among different centers and small number of patients in our study.

We did not encounter any mortality cases in our study. Shida and colleagues reported that ERAS implementation did not have a significant impact on perioperative mortality that occurred in 2.5% of conventional patients, compared with no patients in the ERAS group ($P=0.344$) [24]. Also, Teeuwen and colleagues reported no mortality rates among ERAS group versus 1.6% among the conventional group, who died due to medical causes. ($P=0.55$) [26].

Conclusion

According to the preceding findings, the application of the ERAS protocol is of great benefit to patients undergoing emergency abdominal surgery. It is associated with faster patient recovery, a shorter hospitalization period, and lower complication rates, compared with the conventional approach. The implementation of ERAS should be encouraged in the emergency surgical setting.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Paduraru M, Ponchietti L, Casas IM, Svenningsen P, Zago M. Enhanced Recovery after Emergency Surgery: A Systematic Review. Bull Emerg Trauma 2017; 5:70–78

2 Peden CJ, Aggarwal G, Aitken RJ, Anderson ID, Bang Foss N, 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.

3 Foss NB, Kehlet H. Challenges in optimising recovery after emergency laparotomy. Anaesthesia 2020; 75(Suppl 1):e83–e89.

4 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.

5 Ban KA, Berian JR, Ko CY. Does Implementation of Enhanced Recovery after Surgery (ERAS) Protocols in Colorectal Surgery Improve Patient Outcomes? Clin Colon Rectal Surg 2019; 32:109–113.

6 Scott MJ, Baldini G, Fearon KC, Feldheiser A, Feldman LS, Gan TJ, *et al.* Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 1: pathophysiological considerations. Acta Anaesthesiol Scand 2015; 59:1212–1231.

7 Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, *et al.* Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS(®)) Society Recommendations: 2018. World J Surg 2019; 43:659–695.

8 Yeung SE, Hilkewich L, Gillis C, Heine JA, Fenton TR. Protein intakes are associated with reduced length of stay: a comparison between Enhanced Recovery After Surgery (ERAS) and conventional care after elective colorectal surgery. Am J Clin Nutr 2017; 106:44–51.

9 Azhar RA, Bochner B, Catto J, Goh AC, Kelly J, Patel HD, *et al.* Enhanced Recovery after Urological Surgery: A Contemporary Systematic Review of Outcomes, Key Elements, and Research Needs. Eur Urol 2016; 70:176–187.

10 Hughes MJ, McNally S, Wigmore SJ. Enhanced recovery following liver surgery: a systematic review and meta-analysis. HPB (Oxford) 2014; 16:699–706.

11 Pisarska M, Małczak P, Major P, Wysocki M, Budzyński A, P□dziwiatr M. Enhanced recovery after surgery protocol in oesophageal cancer surgery: Systematic review and meta-analysis. PLoS ONE 2017; 12:e0174382.

12 de Groot JJ, Ament SM, Maessen JM, Dejong CH, Kleijnen JM, Slangen BF. Enhanced recovery pathways in abdominal gynecologic surgery: a systematic review and meta-analysis. Acta Obstet Gynecol Scand 2016; 95:382–395.

13 Stenberg E, Dos Reis Falcão LF, O'Kane M, Liem R, Pournaras DJ, Salminen P, *et al.* Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations: A 2021 Update. World J Surg 2022; 46:729–751.

14 Wisely JC, Barclay KL. Effects of an Enhanced Recovery After Surgery programme on emergency surgical patients. ANZ J Surg 2016; 86:883–888.

15 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. Am J Surg 2014; 207:807–814.

16 Mayhew D, Mendonca V, Murthy BVS. A review of ASA physical status – historical perspectives and modern developments. Anaesthesia 2019; 74:373–379.

17 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.

18 Lohsiriwat V. Enhanced recovery after surgery vs conventional care in emergency colorectal surgery. World J Gastroenterol 2014; 20: 13950–13955.

19 Mohsina S, Shanmugam D, Sureshkumar S, Kundra P, Mahalakshmy T, Kate V. Adapted ERAS Pathway vs. Standard Care in Patients with Perforated Duodenal Ulcer-a Randomized Controlled Trial. J Gastrointest Surg 2018; 22:107–116.

20 van Barneveld KW, Smeets BJ, Heesakkers FF, Bosmans JW, Luyer MD, Wasowicz D, *et al.* Beneficial Effects of Early Enteral Nutrition After Major Rectal Surgery: A Possible Role for Conditionally Essential Amino Acids? Results of a Randomized Clinical Trial. Crit Care Med 2016; 44:e353–e361.

21 Powell JJ, Murchison JT, Fearon KC, Ross JA, Siriwardena AK. Randomized controlled trial of the effect of early enteral nutrition on markers of the inflammatory response in predicted severe acute pancreatitis. Br J Surg 2000; 87:1375–1381.

22 Hu Y, McArthur A, Yu Z. Early postoperative mobilization in patients undergoing abdominal surgery: a best practice implementation project. JBI Database System Rev Implement Rep 2019; 17:2591–2611.

23 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 (Baltimore) 2018; 97: e12348.

24 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 2017; 17:18.

25 Begum B, Zaman R, Ahmed M, Ali S. Burst abdomen-A preventable morbidity. Mymensingh Med J 2008; 17:63–66.

26 Teeuwen PHE, Bleichrodt RP, Strik C, Groenewoud JJM, Brinkert W, Van Laarhoven CJHM, *et al.* Enhanced Recovery After Surgery Versus Conventional Postoperative Care in Colorectal Surgery. J Gastrointest Surg 2010; 14:88–95.