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Comparing the Enhanced Recovery Program with the Conventional Techniques in Patients Undergoing Intestinal Surgery: A Prospective Observational Study

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Abstract

Background: *There is limited adoption and paucity of research on ERAS in the Indian scenario despite plethora of literature in the Western world. Therefore, this study aimed to determine the efficacy of the ERAS program in the Indian population.*

Methods: *This prospective study involves 100 patients undergoing planned intestinal surgery, implementing ERAS program in 46 and traditional care in 54 patients. Primary outcomes were postoperative length of hospital stay and morbidity. Secondary outcomes were reinsertion of nasogastric tubes and urinary catheters, postoperative opioid consumption, time to first bowel sounds/flatus/stools, and factors jeopardizing the success of ERAS.*

Results: *ERAS without affecting the morbidity, decreases the median postoperative length of stay. Reinsertion was not affected post-early removal of nasogastric tubes and urinary catheters. Although, opioid consumption significantly decreased from 51.85% to 19.57%. Male gender and hypertensive patients were independent predictors of ERAS failure.*

Conclusion: *ERAS has significantly benefitted postoperative outcomes with improved quality of patient care and therefore, can be adopted across the health system.*

Keywords: *Enhanced recovery program, Fast track surgery, Intestinal surgery, ERAS failure.*

Abreviations

- ASA :- American Society OF Anaesthesiologist
- ERAS :- Enhanced Recovery After Surgery
- GI :-Gastro-Intestinal
- POD:- Post-Operative Day
- PONV :- Post-Operative Nausea &Vomiting
- LMWH :-Low Molecular Weight Heparin
- COPD :-Chronic Obstructive Pulmonary Disease
- SSI :-Surgical Site Infection
- RCT :-Randomised Control Trial
- UTI:- Urinary Tract Infections
- sd/SD :- Standard Deviation

Statements and Declarations

We declare that this manuscript is original and has not been published before and is not currently being considered for publication elsewhere.

We declare that there is no conflict of interest associated with this publication, and there has been no financial support for this work that could have influenced its outcome. As author, I confirmed that the manuscript has been read and approved for submission by all named authors.

Introduction

Major surgical procedures are associated with morbidity which may be related to the surgical or the anesthetic procedure or due to some complications that can occur indifferent to the applied procedure. The principal factor in post-operative morbidity is surgical stress which demands changes in organ functioning. These functional changes are mediated via trauma-induced endocrine metabolic changes and the activation of biological cascade systems such as cytokines, compliments, free oxygen radicals, and so forth. Furthermore, these changes include secretion of catabolic hormones, increased cardiac workload caused by the ANS, impaired pulmonary function, gastrointestinal side effects like nausea and ileus, changes in the coagulation and fibrinolytic system, and immune suppression **[**1**]**.

These responses are the cellular defense mechanisms and important for survival; however, if they are exaggerated and prolonged, they may cause harm to the body and physiological reserve capacity **[**1,2**]**. The responses include various elements such as anxiety, hypothermia, fluid shifts, pain, hypoxia, prolonged immobility, paralytic ileus, and cognitive imbalance **[**3,4**]**. The main element responsible for activation of stress response is the afferent neural stimuli from the surgical area. Blocking the afferent neural stimulus by using continuous extradural analgesia, and dynamic pain relief with multimodal pain therapy reduces the catabolic response to the surgery **[**1,6,7**]**. Unintended intraoperative heat loss is also a significant risk factor leading to an increased stress response mainly during the re-warming of patients. Therefore, conservation of the body heat and prevention of intraoperative hypothermia is tremendously crucial **[**1,5**]**.

Additionally, some other causes of postoperative morbidity are nausea, vomiting, and ileus; they delay recovery and start of early oral nutrition, and enhance catabolism **[**1,8**]**. Immobilization is practiced very commonly in traditional perioperative care, which adds to the postoperative morbidity because it increases the risk of thromboembolic and pulmonary complications; also, loss of muscle function **[**1,9**]**. The routine

use of nasogastric tubes after elective abdominal surgery is unnecessary and may contribute to pulmonary complications and may delay oral intake resulting in slow recovery [1,10]. The concept of 'Enhanced Recovery After Surgery' (ERAS) also known as 'Fast Track Surgery' was first introduced by Professor Henrik Kehlet in the 1990s. ERAS involves different components which may vary but can be applied during different phases of perioperative care to decrease surgically induced stress and enhances the regaining of physiological homeostasis [11,12].

Although several studies have been published on ERAS in the Western world, there is a paucity of such research in the Indian scenario. Therefore, this study is timely and immensely required to determine the efficacy of ERAS in patients undergoing planned intestinal surgery in the tertiary care hospital. The aim of this study was to assess the outcome of the Enhanced Recovery Program in patients undergoing intestinal surgeries; to determine the benefits ERAS in the postoperative period; to identify any factor/s which could jeopardize the success of the Enhanced recovery program.

Materials and Methods

This is a prospective observational study of patients conducted on patients of either sex and of age > 18 years, who underwent planned intestinal surgery in the tertiary care hospital from April 2018 to April 2020.

Patients who underwent emergency surgery or upper gastrointestinal surgery, patients with ASA grade 4-5, with severe mental illness, or who refused to participate were not included in this observational study. Ethical approval for the study was procured from the institutional ethical committee. Written and informed consents were taken from all included patients. Demographic profile, patient's clinical details, and detailed history of previous surgeries, comorbid conditions, type of surgery, and ASA grade were recorded.

The patients under the ERAS protocol, were informed about the perioperative plan, and their role in recovery was explained. Preoperatively, the patient fasted for 6 hours for solids and 2 hours for clear liquids (water, coconut water) before induction. Carbohydrate loading was done with carbohydrate-rich beverage starting 10 hours prior till 3 hours prior to surgery. Patients who underwent colonic resection above peritoneal reflections did not receive routine oral mechanical bowel preparation. No long-acting sedative/anxiolytic pre-anesthetic medications were given prior to surgery. Low dose anti-thrombotic

prophylaxis which is 0.4 ml subcutaneous LMWH started 12 hours prior to surgery and antibiotic prophylaxis effective against aerobic and anaerobic organisms was given 1 hour before incision.

Intraoperatively, warm air blankets and intravenous fluids were used during the procedure and recovery room to prevent hypothermia. Short-acting anesthetic agents (Desflurane, Propofol) with minimal doses of fentanyl were used during induction and maintenance of general anesthesia. Long-acting opioids were avoided. Thoracic epidural analgesia was preferred over systemic opioids. Intra-abdominal drains were avoided, if used they were removed early. Targeted fluid therapy was done with balanced crystalloid fluids at 1.5-2 ml/kg/h intraoperatively. Conventional intraoperative circulatory monitoring was done.

Nasogastric tubes were removed within 24 hours postoperatively. However, they were reinserted for patients who had persistent vomiting or postoperative paralytic ileus. Patients at moderate and high risk for postoperative nausea and vomiting (PONV) received prophylaxis like serotonin receptor antagonists and ranitidine during induction, and a combination of antiemetic (dexamethasone with serotonin receptors antagonists) respectively. Continuous epidural infusion and boluses of low-dose ropivacaine were given to control the episodes of breakthrough pain, which was continued for 48 hours postoperatively and then titrated down and removed later. Dose of epidural infusion was adjusted accordingly to alleviate the pain and to prevent the episodes of hypotension and lower limb weakness. Intravenous opioid analgesia use was limited. NSAIDs were used after the removal of the epidural to alleviate the pain. Removal of urinary catheters was done within 48 hours postoperatively. Sham feeding was initiated with chewing gum 6 hours post-surgery for early return of gastric motility. Oral feeding was started in the first 24 hours of surgery with sips of energy-dense liquids followed by 30-60 ml per 1-2 hours in the next 24 hours. Further intake was increased as per patient tolerance. The patients were mobilized out of bed for 2-3 hours on the POD-1 and 4-6 hours on subsequent days. Subcutaneous low-dose LMWH was given on POD-1.

The perioperative care, where ERAS protocol was not implemented, was according to the surgeon's preference. Thrombotic and antibiotic prophylaxis were given and the practice of bowel preparation was largely followed. Drains were frequently placed and early removal was not practiced. Enteral feeding used to be started after the return of bowel sounds. No carbohydrate preloading was given to the patient preoperatively. Urinary catheters and nasogastric tubes were also kept for a longer duration. Discharge criteria were adequate pain relief on oral analgesia, normal food intake, and return to preoperative mobility level.

Statistical Analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. The normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then a non-parametric test was used. Statistical tests were applied as- Quantitative variables and were compared using an Independent T-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups, Qualitative variables were correlated using the Chi-Square test/Fisher's Exact test and for univariate and multivariate logistic regression was used to find out significant risk factors for the failure of ERAS. A p-value<0.05 was considered statistically significant. The data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

A total of 100 patients were included in this study, 46 patients among them were in a study group and received perioperative care according to ERAS protocol while 54 patients were in a control group and received conventional perioperative care under distinct surgeons.

65.22% of patients were male in study group; whereas, in control group, there were 35 (64.81%) males while the rest were females. In the study, > 60 years of age patients were 50% in study group and 74% of in control group. Both the groups were compared and well-matched in terms of gender, age, associated co-morbidities, history of smoking and alcohol intake, and ASA grade as there was no significant difference. (Table 1).

		Group		P value
		Study group (n= 46)	Control group(n= 54)	
GENDER	*FEMALE*	16 (34.78%)	19 (35.19%)	0.966
	MALE	30 (65.22%)	35 (64.81%)	
AGE (in yrs.)	*<=40*	4 (8.70%)	3 (5.56%)	0.065
	41-50	8 (17.39%)	7 (12.96%)	
	51-60	11 (23.91%)	4 (7.41%)	
	61-70	9 (19.57%)	18 (33.33%)	
	71-80	14 (30.43%)	18 (33.33%)	
	>80	0 (0.00%)	4 (7.41%)	
CO-MORBIDITIES AMONG PATIENTS	*HYPERTENSION*	18 (39.13%)	29 (53.70%)	0.146
	DIABETES MELLITUS	10 (21.74%)	12 (22.22%)	0.954
	CARDIOVASCULAR DISEASES	3 (6.52%)	6 (11.11%)	0.501
	COPD/BRONCHIAL ASTHMA	2 (4.35%)	3 (5.56%)	1.000
SMOKER	*NON-SMOKER*	36 (78.26%)	43 (79.63%)	0.965
	SMOKER	5 (10.87%)	6 (11.11%)	
	SMOKER REFORMED	5 (10.87%)	5 (9.26%)	
ALCOHOLIC	*ALCOHOLIC*	7 (15.22%)	8 (14.81%)	0.293
	ALCOHOLIC REFORMED	3 (6.52%)	9 (16.67%)	
	NON-ALCOHOLIC	36 (78.26%)	37 (68.52%)	
ASA GRADE	*I*	3 (6.52%)	3 (5.56%)	0.789
	II	34 (73.91%)	43 (79.63%)	
	III	9 (19.57%)	8 (14.81%)	

Table 01

As per the defined ERAS protocol, a nasogastric tube was removed before 24 hours, a urinary catheter was removed after 48 hours, epidural insertion was done; enteral feeding and first ambulation was done within 24 hours. These parameters show a significant variation between the groups ($p<0.0001$) which signifies that the above parameters in the study group (as per protocol) were started early when compared with the conventional group. (Table 2)

Similarly, on analyzing time of first bowel sounds heard {60.9%, 35.2% (before 48 hours)}, first flatus passed {43.5%, 9.3% (before 48 hours)} and first stool passed {52.2%, 16.7% (before 72 hours)} shows significant difference between the groups as the p-value were 0.008, 0.0001, 0.0004 respectively. (Table 2)

		Group		P value
		Study group (n=46)	Control group (n= 54)	
DAY OF NASO-GASTRIC TUBE REMOVAL	< 24 Hrs.	41 (89.13%)	0 (0.00%)	<.0001
	24-48 Hrs.	4 (8.70%)	16 (29.63%)	
	48-72 Hrs.	0 (0.00%)	22 (40.74%)	
	> 72 Hrs.	1 (2.17%)	16 (29.63%)	
DAY OF URINARY CATHETER REMOVAL	< 24 Hrs.	3 (6.67%)	0 (0.00%)	0.001
	24-48 Hrs.	13 (28.89%)	2 (3.77%)	
	48-72 Hrs.	15 (33.33%)	20 (37.74%)	
	> 72 Hrs.	14 (31.11%)	31 (58.49%)	
EPIDURAL INSERTION	No	10 (21.74%)	40 (74.07%)	<.0001
	Yes	36 (78.26%)	14 (25.93%)	
TIME OF ENTERAL FEEDING STARTED	< 24 Hrs.	29 (63.04%)	0 (0.00%)	<.0001
	24-48 Hrs.	13 (28.26%)	5 (9.26%)	
	48-72 Hrs.	1 (2.17%)	13 (24.07%)	
	> 72 Hrs.	3 (6.52%)	36 (66.67%)	
TIME OF AMBULATION	< 24 Hrs.	43 (93.48%)	1 (1.85%)	<.0001
	24-48 Hrs.	3 (6.52%)	37 (68.52%)	
	48-72 Hrs.	0 (0.00%)	13 (24.07%)	
	> 72 Hrs.	0 (0.00%)	3 (5.56%)	
TIME OF FIRST BOWEL SOUNDS	< 24 Hrs.	6 (13.04%)	0 (0.00%)	0.008
	24-48 Hrs.	22 (47.83%)	19 (35.19%)	
	48-72 Hrs.	13 (28.26%)	21 (38.89%)	
	> 72 Hrs.	5 (10.87%)	14 (25.93%)	
TIME TO FIRST FLATUS PASSED	< 24 Hrs.	5 (10.87%)	0 (0.00%)	0.0001
	24-48 Hrs.	15 (32.61%)	5 (9.26%)	
	48-72 Hrs.	21 (45.65%)	28 (51.85%)	
	> 72 Hrs.	5 (10.87%)	21 (38.89%)	
TIME TO FIRST STOOL PASSED/ STOMA OUTPUT BEGINS	< 24 Hrs.	2 (4.35%)	0 (0.00%)	0.0004
	24-48 Hrs.	8 (17.39%)	0 (0.00%)	
	48- 72 Hrs.	14 (30.43%)	9 (16.67%)	
	> 72 Hrs.	22 (47.83%)	45 (83.33%)	

Table 2. Data are presented as number of patients as percent. <24 Hrs.- before 24 hours, 24-48 Hrs.- between 24 to 48 hours, 48-72 Hrs.- between 48 to 72 hours, >72 hrs.- after 72 hours

When we compared the reinsertion rate of the nasogastric tubes, episodes of PONV, and reinsertion of the urinary catheter; there was not much difference between both the groups. Patients having reinsertion of nasogastric tube {19.57% (study group); 12.96% (control group)}, had episodes of PONV {21.74%, 12.96%}, and need for reinsertion of urinary catheter {4.35%, 9.26%} signifies no statistical variation between the groups (p-value=0.369, 0.244, 0.477 respectively), which means early removal of nasogastric tubes and urinary catheters has no effect on reinsertion and episodes of PONV. Although, when we observed the requirement of opioid analgesics postoperatively {19.5%, 51.8%}, it shows a significant statistical variation. (p-value=0.001) (Table 3)

		Group		P value
		Study group (n= 46)	**Control group (n= 54)**	
REINSERTION OF NASO-GASTRIC TUBE	*NO*	37 (80.43%)	47 (87.04%)	0.369
	YES	9 (19.57%)	7 (12.96%)	
ANY EPISODE OF PONV	*NO*	36 (78.26%)	47 (87.04%)	0.244
	YES	10 (21.74%)	7 (12.96%)	
REINSERTION OF URINARY CATHETER	*NO*	44 (95.65%)	49 (90.74%)	0.447
	YES	2 (4.35%)	5 (9.26%)	
ANY NEED OF OPOID ANALGESICS	*NO*	37 (80.43%)	26 (48.15%)	0.001
	YES	9 (19.57%)	28 (51.85%)	

Table 03

With reference to the first bowel sound heard in failed enteral feeding (i.e. we had to withhold enteral feeds because of paralytic ileus or recurrent nausea/vomiting); we noticed that 33.33% (in the study group) and 66.7% (in the control group) of patients who had failed enteral feeding {n= 12, 15}, bowel sounds were heard after 72 hours which represents no statistical difference (p-value= 0.155) in between the groups (Table 4). On comparing the failed enteral feeding of a study group with the control group, we observed that hospital stay (9.33 ± 5.1 vs 8.2 ±2.69 respectively) was prolonged in patients with failed enteral feeds (study group) despite stopping the opioid analgesics at almost equal time i.e., 2.33 ± 1.15 vs 2.39 ± 0.92 respectively. Also in failed enteral feeding (study group), restarting the feeding through the oral route was also delayed by 0.62 days. There is no statistically significant variation between the groups showing that both groups were comparable. (Table 5)

		FAILURE OF ENTERAL FEEDS		P value
		Group		
		Study Group (n= 12)	Control Group (n= 15)	
TIME OF ENTERAL FEEDING STARTED	< 24 Hrs.	10 (83.33%)	0 (0.00%)	<0.0001
	24-48 Hrs.	1 (8.33%)	0 (0.00%)	
	48-72 Hrs.	0 (0.00%)	1 (6.67%)	
	> 72 Hrs.	1 (8.33%)	14 (93.33%)	
TIME OF FIRST BOWEL SOUNDS HEARD	< 24 Hrs.	1 (8.33%)	0 (0.00%)	0.155
	24-48 Hrs.	4 (33.333%)	1 (6.66%)	
	48-72 Hrs.	3 (25.00%)	4 (26.66%)	
	> 72 Hrs.	4 (33.33%)	10 (66.66%)	

Table 4

	Study group who failed on enteral feeds [n= 12] (Mean ± SD)	Control group [n= 54] (Mean ± SD)	p-value
Eventually Feeding Restarted (in days)	5.92 ± 3.60	5.30 ± 2.63	0.323
Stoppage of Analgesics (in days)	2.33 ± 1.15	2.39 ± 0.92	0.772
Length of Hospital Stay Post-Surgery (in days)	9.33 ± 5.1	8.2 ±2.69	0.16

Table 05

In the surgical complications, the number of patients with paralytic ileus dominated in both groups {19.57%, 27.78%}. The second most common complication seen was SSI in the study group while UTI in the control group. Both groups were comparable as there was no significant difference (Table 6).

The average postoperative hospital stay of the patient was 7.33 ± 3.71 days and 8.2 ± 2.69 days in the study and control groups respectively. This difference in the postoperative hospital stay was tested statistically and was found significant. (p-value= 0.012). (Table 7)

COMPLICATIONS	GROUP		TOTAL	p-value
	Study group (n= 46)	Control group (n= 54)		
PULMONARY COMPLICATIONS	2 (4.35%)	4 (7.41%)	6 (6.00%)	0.684
CARDIOVASCULAR COMPLICATIONS	2 (4.35%)	1 (1.85%)	3 (3.00%)	0.593
SURGICAL SITE INFECTION/ FEBRILE ILLNESS	6 (13.04%)	5 (9.25%)	11 (11.00%)	0.182
PARALYTIC ILEUS	9 (19.57%)	15 (27.78%)	24 (24.00%)	0.338
URINARY COMPLICATIONS				0.066
GASTROINTESTINAL COMPLICATIONS	1 (2.17%) 3 (6.52%)	7 (12.96%) 3 (5.56%)	8 (8.00%) 6 (6.00%)	1.000

Table 6

LENGTH OF HOSPITAL STAY POST-SURGERY	Study group (n= 46)	Control group (n=54)	P-value
Mean ± SD	7.33 ± 3.71	8.2 ± 2.69	
Median	6	7	**0.012**
Inter quartile Range	5 – 8	6 - 9	

Table 7

Various factors that lead to the failure of ERAS were studied and logistic regression was evaluated for each factor. The odds ratio for gender was female/male =1.00/3.800 and for being hypertensive was 4.018 which represents significant variation. (Table 8)

	S.E.	P-value	Odds ratio	95% C.I.for Odds ratio	
				Lower	Upper
AGE (in yrs)					
<50		.631			
50-70	.623	1.000	1.000	.295	3.389
>70	.683	.455	1.667	.437	6.358
GENDER					
Female			1.000		
Male	.659	.043	3.800	1.044	13.830
SMOKER					
Non-smoker			1		
Smoker	1.167	.199	.224	.023	2.202
Smoker reformed	1.167	.274	3.579	.364	35.233
ALCOHOLIC					
Non-alcoholic			1		
Alcoholic	.833	.730	.750	.146	3.841
Alcoholic reformed	-	-	-	-	-
HYPERTENSION	.653	.033	4.018	1.117	14.455
DIABETES MELLITUS	.767	.211	2.608	.580	11.716
ASA GRADE					
1			1		
2	1.272	.524	.444	.037	5.377
3	1.414	1.000	1.000	.063	15.988

Table 8. Univariate logistic regression for failure of ERAS

Discussion

Despite the advancements, major surgical procedures continue to be encircled by notorious medical complications like myocardial infarction, pulmonary dysfunction, thromboembolism, prolonged convalescence, and so forth. Surgical stress response by subsequently increasing the demand of organ functioning is the key pathophysiology factor in the pathogenesis of postoperative morbidity **[**1,2,13**]**.

The concept of ERAS consisting of multimodal interventions or techniques leads to a major reduction in an undesirable sequel of the surgical injury and post-operative morbidity by controlling the postoperative debilitation by reducing surgical stress and pain. Hence; it was observed that in any case, the modification of various components of the surgical stress response could improve the surgical outcome **[**1,2**]**.

In our study of 100 patients, we compared the ERAS group in which ERAS program was applied and CONTROL group in which traditional perioperative care was followed by distinct colorectal surgeons. Both groups were well-balanced and comparable with no difference in age, gender, co-morbidities, ASA classification, and risk factors like smoking and alcohol intake.

In the study when we compared both the groups in terms of need for re-insertion of the nasogastric tube and urinary catheter, episodes of PONV; we observed that there was no significant difference even with the early removal of nasogastric tubes and urinary catheters in study group according to the protocol. In conclusion, early removal of tubes and catheters are more advantageous as they help in the early functional recovery by less discomfort and early mobilization which was comparable to study done by Pascal et al on 183 patients, which showed that the reinsertion of nasogastric tube in the ERAS group was 19.7% as compared to 21.3% in control group had no significant difference (p-value=0.85) **[**14**]**. Similarly, prospective RCT done by Ionescu et al. showed that both the groups are similar {fast-track group vs control group; 34.7% vs 42.8%} in terms of the PONV (p-value=0.538) **[**15**]**.

With the significant compliance rate (78.26% for epidural insertion) in study group as per protocol, need for any postoperative opioid analgesia came down significantly from 51.85% of patients in the control group to 19.57% in the study group. The continuous use of thoracic epidural analgesia with intermittent boluses of low-dose ropivacaine in the study group helps in reducing episodes of breakthrough pain and resulting in early mobilization. Sarin et al did study on 524 patients and observed that median opioid consumption from POD-0 to POD-2 was markedly reduced from 1422 mg in pre-ERAS to 75 mg in ERAS group which was significant in the results (p-value<0.0001) **[**13**]**.

In our study, we contemplated first bowel sounds which appeared early in the patients of the study group, and they were able to pass flatus and stools early which was significant than the control group; although, 63.04% patients started early enteral feeding before 24 hours. The rest of the patients were shifted from the protocol because of episodes of paralytic ileus or prolonged intubation or recurrent nausea and vomiting. This significant variation revealed that patients under ERAS program had early restoration of functioning of GI tract irrespective of early or late enteral feeding. Even a slight deviation from protocol in one or two parameters, which can be tailored according to the patient's condition, can also guide the patient to an early recovery. Similar results by Šerclova et al. on 103 patients, revealed that the bowel movements and passing of stools occurred significantly early in fast-track group than in the non-fast track group {mean (sd) 1.3(0.8) days vs 3.1(1.0) days; p<0.001}{mean 2.1 POD vs 3.9 POD; p<0.001} **[**16**]**.

When we correlate the first bowel sound heard in failed enteral feeding among both groups, there was no significant variation (p-value=0.155) in the occurrence of bowel sounds among failed oral feed patients between both groups; which further implies that bowel sounds were an independent variable as appearing late in both groups with failed enteral feeding in spite of initiation of early enteral feeding in study group as compared to control group. Furthermore, there is no statistically significant variation in terms of eventually restarting the feeding, stoppage of analgesia, and length of stay when we compared the study group with failed enteral feeding to a control group in our study. This shows that both groups were comparable in terms of the above-mentioned parameters. Therefore, no extra harm was caused to the study group even after failure of the enteral feeds if the oral feeding was started early in comparison to the control group.

In reference to the various complications, there was no significant difference noted between both groups, and didn't affect the morbidities of both groups under study. No patients in either group had complications that led to mortality. Our results are comparable with Bakker et al. who demonstrated that the individual complications were not significantly different in the groups, however, there was a trend for fewer urinary tract infections and less pneumonia in the years with high adherence **[**17**]**.

In our study, we observed that the median hospital stay postoperatively decreased from 7 days (range;4-15 days) in control group to 6 days (range;5-8 days) in study group. This difference was statistically significant (p=0.012) and demonstrated the early discharge of patients under ERAS program in comparison to the control group which was similar to the results noted by Sarin et al. who recorded that the median post-procedure length of stay between the pre-ERAS group (6.0 days) and the ERAS group (4.1 days) had a significant difference (p<0.001) with the patients of ERAS group being discharged early **[**13**]**.

Lastly, by evaluating the factors responsible for the failure of ERAS, we noted there was a significant difference in the two variables i.e. gender and hypertension (p-value 0.043 & 0.033 respectively) when calculating the univariate logistic regression with reference to the different variables. Males were independent and significant predictors of ERAS failure (OR 3.80 (95% CI 1.044-13.83), p=0.043). Similarly, the hypertensive patients also had a direct independent association (OR = 4.02 (95% CI 1.117-14.455), p=0.033) and were the predictor of ERAS failure. But definitely, further studies are required to identify the reason for this observation.

In conclusion, our studies show that there is no difference in the rate of complication and mortality after implementation of the ERAS perioperative care pathway. In fact, it promotes the early discharge from the hospital with less hardship of the patients. It helps in early restoration of GI functioning and early ambulation giving a sense of well-being to the patient. Even if some patients deviate from the early recovery tract, evidently there is no additional harm to the patient's recovery. It is therefore important that this perioperative pathway is considered and should be implemented wherever possible to improve the quality of care given to patients by their care-givers.

Conclusion

This stream of perioperative care pathway needs more exploration and future intervention studies to improve its outcome. More work should be thoroughly scrutinized and integrated into system perspectives in order for the health care provider to focus on an evidence-based guideline. A systematic approach should be applied that links research and practice for building up a model which can help in expansion and sustainability of Enhanced Recovery strategies on a larger scale across the health system.

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