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ORIGINAL ARTICLE

Outcome of Enhanced Recovery after Surgery (ERAS) in pediatric population undergoing gastrointestinal surgery.

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ABSTRACT… Objective: To know the outcome of ERAS in pediatric population undergoing gastrointestinal surgical procedures in terms of time of bowel function recovery, postoperative intravenous nutrition time, total hospital stay and complication rate. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Pediatric Surgery, Mayo Hospital, Lahore. **Period:** January 2022 to September 2022. **Material & Methods:** This study included children (n=89) who had pyloromyotomy, appendectomy, reduction of intussusception, resection of Meckel's diverticulum and stoma closure in Surgical outcome was compared among children who underwent surgery using standard perioperative protocols (control group, n=46) and those in which ERAS protocols were followed (ERAS group, n=43). **Results:** In the ERAS group compared to the control group, the recovery times for bowel function ($p < 0.001$), postoperative intravenous nutrition time ($p < 0.001$) and postoperative hospital stay ($p < 0.001$) were all noticeably shorter than control group. There was no discernible intergroup variation in the complication rate. **Conclusion:** Our study shows that using ERAS protocols in paediatric gastrointestinal surgery results in less use of intravenous nutrition, shortened time of bowel function recovery and early discharge.

Key words: Children, Enhanced Recovery after Surgery (ERAS), Gastrointestinal Surgery.

INTRODUCTION

Early hospital discharge following surgery was the initial goal of 'fast-track surgery', the term used in 1990's by kehlet in order to improve perioperative care.[1] Many elements of the fast-track surgery included early commencement of postoperative oral nutrition, early mobilisation, avoidance of tubes and drain. Later, this programme generated the basis of ERAS.

Enhanced recovery after surgery (ERAS) is the implementation of an evidence based, patient centered, multidisciplinary strategy to improve perioperative care. Studies shows that following the ERAS protocol is linked to shorter hospital stays, quicker recovery time, and fewer postoperative problems by decreasing the metabolic stress response in surgical patients.[2,3] An effective ERAS protocol improves the surgical care quality. The key elements of eras are shown in Figure-1.[4]

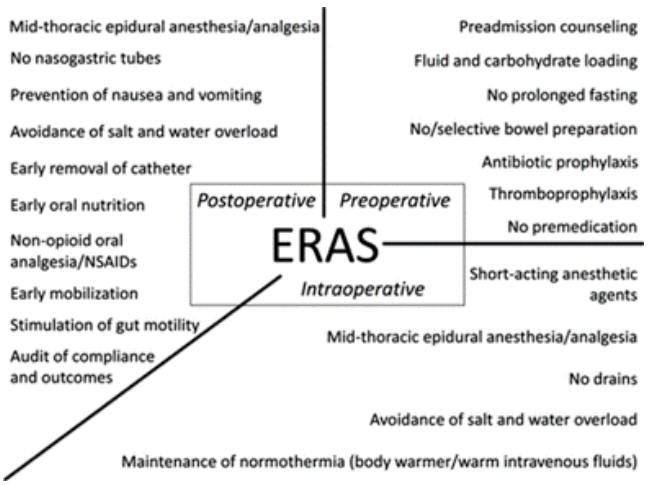

Figure-1. Key elements of enhanced recovery after surgery (ERAS).

ERAS involves members from surgical team, anesthesiology, nutrition and nursing staff. It engages patients and their family in surgical care.

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Successful Implementations of enhanced recovery strategies in adults has led to introduction of this concept in pediatric surgical care though evidence is still developing.[5]

We implemented and analyzed ERAS protocol in gastrointestinal surgery of pediatric patients in our study with the aim to know the benefits and safety of pediatric ERAS protocols.

MATERIAL & METHODS

This Randomized Controlled Trial (RCT) was conducted in Pediatric Surgery Department of Mayo Hospital, Lahore from January 2022 to September 2022. Ethical approval was taken from Institutional Review Board (IRB) of King Edward Medical University/Mayo Hospital Lahore (dated 23-05-22 No 501/RC/KEMU).

Pediatric patients (age 2 month to 12 years) who had gastrointestinal surgery done at pediatric surgery department of mayo hospital Lahore were included in the study.

Patients with shock, peritonitis, multiple organ failure or tumor were excluded from study.

Sample size of 89 was calculated by taking confidence level of 95% and absolute precision as 7%.

Five abdominal procedures including open appendectomy, pyloromyotomy, Meckel diverticulum resection, reduction of intussusception, stoma closure were selected. Elective and emergency both cases were included in our study. All procedures were done by same group of surgeons.

After fulfilling inclusion and exclusion criteria, informed consent was taken, and patients were randomly allocated in two groups using already specified computer generated numbers for both groups. Group 1(control) included the patients who were managed according to conventional perioperative pathway. Group 2 included the patients in which ERAS protocols were implemented.

We collected all patient information, including demographics, clinical indicators and outcomes.

According to guidelines of ERAS society in adult patients, we made ERAS protocol for pediatric patients undergoing gastrointestinal surgery which included

- counselling of parents regarding whole perioperative care
- short mechanical bowel preparation
- less use of intraoperative fluids
- short duration of preoperative fasting,
- avoiding use of nasogastric tubes and surgical drains
- early postoperative mobilization
- early commencement of postoperative oral feeding
- early (within 24 hours) removal of tubes and drains.

Parents were counselled and informed regarding protocols of ERAS, surgical intervention, and criteria of discharge. Preoperative fasting time was reduced to 2 hours for high carbohydrate drinks, 4 hours for breast milk, 6 hours for solid diet. Nasogastric tubes and urinary catheters were avoided in all five cases, and early removal was done where tubes and drains were used. In postoperative period oral intake was started with liquids within 24 hours of surgery. Within 24 hours of surgery, urine catheters and nasogastric tubes were withdrawn. Early mobilization was ensured just after recovery from anesthesia.

The criteria for discharge were overall good condition, complete oral nutrition, full mobility without any help, normal defecation, and urination. A consultant coordinated the discharge, and all patients were instructed to get in touch with their doctor in case of any help after discharge.

The primary outcomes which we measured were postoperative bowel motility recovery time in hours, tolerance of oral feeding in hours, postoperative intravenous fluid duration in days, length of postoperative hospital stay in days and postoperative complications including vomiting, wound infection, and incisional defect.

All the data was entered in SPSS version 22. Data was expressed as percentage, Mean and standard deviation. A p value of<0.05 was taken significant. Statistical significance was calculated by student's t-test for continuous variable. Association between variables was analyzed by chi-square test.

RESULTS

Total 89 children were included in the study. 46(51.6%) underwent surgery according to standard perioperative protocols (Group 1), and 43(48.3%) were placed in group 2 (ERAS). The demographic and clinical information for both groups is shown in Figure-2. Age, gender, weight, and surgical data did not significantly differ across groups.

Without a statistically significant rise in the frequency of complications, group 2 showed a faster time to bowel function recovery (p 0.001) and a shorter number of days spent in the hospital following the operation (p < 0.001). The typical length of a hospital stay following surgery in days (2.14 vs 3.52) time to first pass flatus in hours (14.72 vs. 29.91 hours), time to first defecation in hours (22.63 vs. 46.54 hours), ERAS group members experienced considerably less postoperative intravenous feeding time (1.26 vs. 2.14 days) than control group members (all p <0.001) as shown in Table-I.

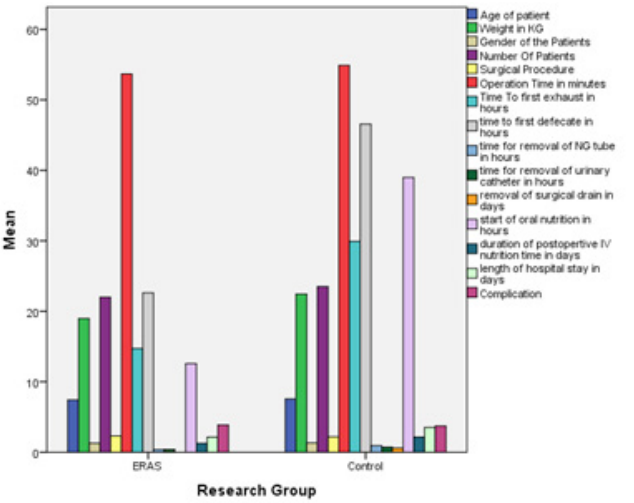

Figure 2: Comparison of clinical variables between control group and ERAS group.

Group Statistics						
	Research Group	N	Mean	Std. Deviation	Std. Error Mean	P-Value
Age of patient	ERAS	43	7.421	4.2106	.6421	0.871
	Control	46	7.563	4.0515	.5974	
Weight in KG	ERAS	43	18.98	8.855	1.350	0.094
	Control	46	22.45	10.376	1.530	
Gender of the Patients	ERAS	43	1.28	.454	.069	0.634
	Control	46	1.33	.474	.070	
Number of Patients	ERAS	43	22.00	12.557	1.915	0.588
	Control	46	23.50	13.423	1.979	
Surgical Procedure	ERAS	43	2.30	1.456	.222	0.733
	Control	46	2.20	1.485	.219	
Operation Time in minutes	ERAS	43	53.67	26.723	4.075	0.836
	Control	46	54.89	28.461	4.196	
Time To first exhaust in hours	ERAS	43	14.72	3.936	.600	0.000
	Control	46	29.91	12.607	1.859	
time to first defecate in hours	ERAS	43	22.63	8.875	1.353	0.000
	Control	46	46.54	20.280	2.990	
time for removal of NG tube in hours	ERAS	43	.37	.489	.075	0.006
	Control	46	.93	1.218	.180	
time for removal of urinary catheter in hours	ERAS	43	.40	.495	.075	0.034
	Control	46	.74	.929	.137	
removal of surgical drain in days	ERAS	43	.00	.000	.000	0.000
	Control	46	.61	1.000	.147	
start of oral nutrition in hours	ERAS	43	12.58	6.846	1.044	0.000
	Control	46	39.00	34.663	5.111	
duration of post operative IV nutrition time in days	ERAS	43	1.2623	1.08807	.16593	0.004
	Control	46	2.1467	1.66047	.24482	
length of hospital stay in days	ERAS	43	2.14	.990	.151	0.000
	Control	46	3.52	1.516	.224	
Complication	ERAS	43	3.86	.639	.097	0.348
	Control	46	3.72	.779	.115	

Table-I. Data presentation as mean, standard deviation and p value

DISCUSSION

Improved postoperative recovery calls for perioperative multidisciplinary, patient-centered care.

Applying an evidence-based and standard strategy to all patients undergoing surgery is the aim of Enhanced recovery programme. An efficient ERP applies an ERAS guideline to enhance surgical care quality and effectiveness while lowering costs and modulating the normal physiologic response of human body to surgical induced stress.[6] This needs a team-based effort which also includes patients and parents of pediatric patients.

Implementation of ERAS protocols provide benefit of early feeding, short length of hospital stay, early mobilization, and early discharge, improved outcomes in mortality and morbidity and cost savings.[7,8,9] Adult colorectal surgery was the first area of surgery where ERAS Society criteria were established. Later, they were expanded to include orthopaedics, obstetrics, and cardiac surgery.[10]

A growing interest in developing an ERAS protocol for pediatric patients is a result of the success of Enhanced recovery techniques in adults. A review of the literature reveals a dearth of prospective and randomized control studies of pediatric ERAS.[11,13] Studies have shown benefits in reducing hospital stays and narcotic use when only a few ERAS protocols were implemented.[12] But there is very small data in impact of ERAS protocols in children and more work is needed in this field. Retrospective and prospective cohort studies in children having urological, gastrointestinal, and thoracic surgery were found in the literature review.[13]

Our study has shown that ERAS protocols have been successfully used for children having gastrointestinal surgery. We selected five gastrointestinal surgical procedures for analysis. Parents in the ERAS group were better equipped to assist with their children's perioperative care because they were more aware of each step of post-operative recovery. Patient comfort improved in the ERAS group due to a shorter preoperative fasting period without any noticeable complication such as aspiration or postoperative gastric distention.

Rapid postoperative recovery was observed in ERAS group by early mobilization, early oral feeding commencement and decrease use of intravenous fluids which matched the outcomes observed in previous studies.[14,15]

Literature review shows that implementing several ERAS protocols is beneficial and safe in pediatric population which include use of opioid sparing analgesics, avoidance of routine mechanical bowel preparation, early mobility in postoperative period, early start of oral feeding and avoidance of surgical drains and catheters.[16-23] A survey showed that ERAS components may be implemented safely in practice though not all components of ERAS are practiced.[24]

One component of ERAS includes limited bowel preparation. In our study limited use of mechanical bowel preparation for stoma closure was not linked to increased risk of anastomotic leaking or wound infection which is consistent with studies on children who have had intestinal surgery.[25,26]

Postoperative intestinal edema brought on by excessive intravenous fluid delivery can impede the recovery of gastrointestinal function. When the children could eat and tolerate a regular meal in the current study, intravenous fluid administration was stopped and the children in the ERAS group began receiving oral nourishment after a mean of 12.58 hours.

Also, refraining from using different tubes, such as urinary catheters, nasogastric tubes, and surgical drains encouraged early mobilization which quickened the recovery of gastrointestinal function and we noticed mean time to first defecate was 22.63 hours in ERAS group and 46.54 hours in control group with p value less than 0.05.

Similar to this, study by Mattioli et al.[23] demonstrated that avoiding the use of nasogastric tubes, surgical drains and urinary catheters as well as providing effective pain management while minimizing the use of systemic opioids

can result in good bowel function recovery, early feeding and quick mobilization.[27]

ERAS includes minimally invasive surgery as a crucial part. Laparoscopic procedures are associated with less blood loss and pain, improved cosmesis, and an earlier hospital discharge when compared to open surgery. Our study has limitation of not including laparoscopic surgery due to non-availability of laparoscopic equipment. we can further enhance the study design by collecting larger samples, take into account additional variables and create more precise ERAS protocols for various patient characteristics.

So, in order to promote a quicker postoperative recovery, a mix of perioperative multimodal therapies as opposed to a single intervention alone may be helpful. More randomized controlled studies are needed in order to promote and execute ERAS protocol.

CONCLUSION

Implementation of ERAS protocols can improve patient's surgical care by early recovery of bowel function and shorter hospital stay without causing an increase in complication rate.

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1	Sadaf Noureen	Drafting, Data acquisition, Final approval, assemtabily agrement.	
2	Muhammad Sharif	Critical review, Final approval, assemtabily agrement.	
3	Fatima Naumeri	Critical review, Final approval, assemtabily agrement.	
4	Nimra Fatima	Data analysis, Final approval, assemtabily agrement.	
5	Mahwish Noor-ul-Haq	Data acquisition, Final approval, assemtabily agrement.	