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EVALUATION OF OUTCOME OF ENHANCED RECOVERY AFTER SURGERY (ERAS) VERSUS CONVENTIONAL METHOD IN COLOSTOMY CLOSURE IN CHILDREN

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Enhanced Recovery After Surgery (ERAS) is a multimodal perioperative care protocol that represents a fundamental shift from the conventional management of the gastrointestinal surgical patient. Although ERAS protocol has been shown to improve outcomes in the adult surgical population, its application is still limited in pediatric surgery. This prospective observational study was carried out in the Department of Pediatric Surgery of Dhaka Medical College Hospital, Bangladesh from July 2019 to June 2021 aiming to compare the outcomes between ERAS and conventional perioperative care protocol in colostomy closure in children. A total of 60 patients of both sexes admitted for elective colostomy closure were included in this study. The patients were divided in two groups; 30 patients in Enhanced Recovery After Surgery(ERAS) perioperative care group was considered as Group A and another 30 patients in Conventional Method group was considered as Group B. Statistical analyses of the results were obtained

by using Statistical Packages for Social Sciences (SPSS-22.0). We found Postoperative outcome (return of bowel movement and commencement of oral feeding) was 4.13 times better in group A than that of group B which was statistically significant ($p<0.05$). More than two third (66.7%) subjects needed only 7 days of postoperative hospital stay in group A whereas only 5(16.7%) subjects showed 7 days of postoperative hospital stay in group B. The difference was statistically significant ($p<0.05$) between two groups.

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INTRODUCTION

Perioperative stress is an important factor for early postoperative recovery in surgical patient. To reduce the perioperative stress responses and to accelerate the postoperative recovery in surgical patients the concept of Enhanced Recovery After Surgery (ERAS) was introduced by the Danish surgeon Henrik Kehlet in the 1990s. and it is also known as Fast-track surgery. [1] It is designed to achieve early recovery after surgical procedures by maintaining preoperative organ function and reducing the profound stress response following surgery. [2] It contributes to help in earlier return of bowel function, earlier resumption of normal activities and improvements in cardiopulmonary function; which ultimately leads to a reduction in post-operative complications and hospital stay and also reduces the financial and psychological impact on children as well as the parents. [3,4]

In Conventional Method we usually use pre-operative mechanical bowel preparation & long overnight fasting which is a cumbersome journey for the children. Here nasogastric decompression, surgical drain & urinary catheterization are used routinely which are kept more than 24 hours. These conventional approaches cause exaggerated aggravation of stress responses. It thereby delays the recovery of normal bowel function and prolongs the hospital stay and increases the financial burden on the family which accentuates the sufferings of both the patients and their parents. [5] The ERAS Protocol includes pre-operative, per-operative and post-operative components. The contents of this specific protocol may vary significantly, but all are designed to improve patient's outcomes. Avoidance of MBP & prohibition of prolong fasting are the integral part of preoperative component here. Clear liquids and breast milk or formula milk are allowed until 2 hours and 4 hours before operation respectively. Pre-operative carbohydrate loading given not more than 5ml/kg up to 2 hours before surgery. Preoperative fasting usually increases the metabolic stress, hyperglycemia and insulin resistance, which the body is already undergoing during the surgical process. Changing the metabolic state of patients by shortening preoperative fasting not only decreases insulin resistance but also reduces protein loss and improves muscle function. Furthermore, if patients are allowed to take solids up to 6 hours preoperatively and clear carbohydrate drinks up to 2 hours, there is no increase in complications, which forms the basis of preoperative guidelines adopted by the Royal College of Anesthetists and the American Society of Anesthesiologists. [2] The use of carbohydrate reduces nitrogen and protein losses preserves skeletal muscle mass, loading attenuates postoperative insulin resistance, and reduces preoperative thirst, hunger and anxiety. [6] In addition to the metabolic effects, it facilitates accelerated recovery through early return of bowel function and shorter hospital stay, ultimately leading to an improved perioperative well-being. [7] As a result, it is an important element of the nutritional aspects of ERAS and

should replace the practice of overnight fasting. Furthermore, No routine use of surgical drains and tubes is the beneficial part of preoperative component of ERAS protocol. Postoperative early mobilization, advancement to regular diet, early removal of drains & tubes (if used), stoppage of intravenous nutrition as soon as possible, prophylactic use of anti-emetic drugs & use of non-opioid analgesia are maintained in post-operative component. [5] In 2009 Mattioli et al. showed that by avoiding the use of drains, nasogastric tubes, and urinary catheters and by achieving acceptable pain control and early feeding can be achieved by. limiting the use of systemic opioid drugs good bowel movement, rapid mobilization. To more rapid postoperative recovery therefore, a combination of multimodal perioperative interventions rather than a single intervention on its own might contribute. [8] ERAS protocol explains several components necessary to optimize postoperative, recovery and minimize the hospital stay. A meta-analysis of eleven studies including 1021 adult patients on ERAS vs. standard care in colorectal surgery done by Gouvas N et al on 2009 has shown that primary hospital stay and total hospital stay were significantly lower for ERAS protocol. Morbidity was also lower in ERAS protocol group. Readmission rates were not significantly different. No increase of mortality was found. [9] Another scoping review of nine studies including 1269 patients on 'What is the role of enhance recovery after surgery in children' done by Pearson & Hall on 2017 has shown that ERAS protocol significantly reduced the duration of hospital stay in 6/7 studies, time to oral feeding in 3/3 studies and time to bowel movement in 2/3 studies, [10] Thus, various studies showed that implementation of ERAS protocols is safe and feasible in pediatric gastrointestinal surgery. Without increasing the risk of postoperative complications, they can improve patient comfort, shorten the duration of the postoperative hospital stay, reduce hospital costs, and accelerate postoperative rehabilitation. Therefore, ERAS protocols deserve wider implementation and promotion

METHODS AND MATERIALS

This prospective observational study was carried out from July, 2019 to June, 2021 in the department of pediatric surgery of Dhaka Medical College Hospital, Dhaka, Bangladesh. Total sample size was 60, equally distributed in two groups: 30 patients in Enhanced Recovery After Surgery(ERAS) perioperative care group was considered as Group A and another 30 patients in Conventional Method group was considered as Group B. All patients were admitted for elective closure of colostomy.

Study Procedure

The patients in the ERAS group were allowed to take solid food up to 6 hours and liquid up to 4 hours before surgery and clear carbohydrate drink (glucose powder mixed in a concentration of 2tsf in 1 glass of water, not more than 5ml/kg) was also allowed prior to surgery at early evening and 2 hours before surgery. To these patients no mechanical bowel preparation was given. With regards to the use of drains, tubes and catheter, they were inserted per-operatively only if indicated and not as part of routine use in this group. No opioid analgesia was used in this group. For analgesia Ketorolac and paracetamol were used in this group. Enteral feeding starting from liquid diet was carried out within 72 hours of postoperative period. The patient's 'out of bed' time was recorded. Sit out of bed at day 0 and walk at day 1 were ensured. Postoperative prophylaxis for nausea and vomiting (Ondansetron 0.1 mg/kg/dose qds up to 1st POD) was routinely used. On the contrary, in conventional method group, patients were fasted overnight or more than that before surgery. Mechanical bowel preparation was given. There was routine use of the nasogastric decompression, urinary catheterization and abdominal drainage in 18

the pre-operative period and each of those was kept for more than 24 hours postoperatively. Enteral nutrition was initiated after 4th to 5th postoperative day. Pain was managed by opioid analgesics at immediate postoperative period and medications for nausea and vomiting were given only on patient's complaint. Patients were mobilized on choice. All patients in both groups were followed up for a period of one month after discharge. Outcome was recorded in terms of return of bowel movement and commencement of oral feeding, post-operative complication and duration of post-operative hospital stay. Both groups were compared using computer based statistical software SPSS version 22.0

RESULTS

Table I shows the distribution of the study subjects by demographic profile. It was observed that almost two third (63.3%) subjects were 12-60 months of age in group A and 23(76.7%) in group B. The mean age was 56.43±48.23 months in group A and 42.73±29.16 months in group B. More than two third (70.0%) subjects were male in group A and 17(56.7%) in group B. Between the two groups the difference was not statistically significant (p>0.05).

Table I: Distribution of the study subjects by demographic profile (N=60)

Demographic profile	Group A (n=30)		Group B (n=30)		p value
	n	%	n	%	
Age (in months)					
<12 months	2	6.7	1	3.3	
12-60 months	19	63.3	23	76.7	
>60 months	9	30.0	6	20.0	
Mean ±SD	56.43±48.23		42.73±29.16		[a]0.188[ns]
Range (min, max)	7,168		9,120		
Gender					
Male	21	70.0	17	56.7	[b]0.284[ns]
Female	9	30.0	13	43.3	

Table II indicates the distribution of the study subjects by effects of mechanical bowel preparation. It was observed that electrolyte imbalance was not found in group A and 3(10.0%) in group B. One (3.3%) subject had dehydration in group A and 5(16.7%) in group B. Fever was not found in group A and 2(6.7%) in group B. Here also the statistical differences between group A & group B were insignificant (p>0.05).

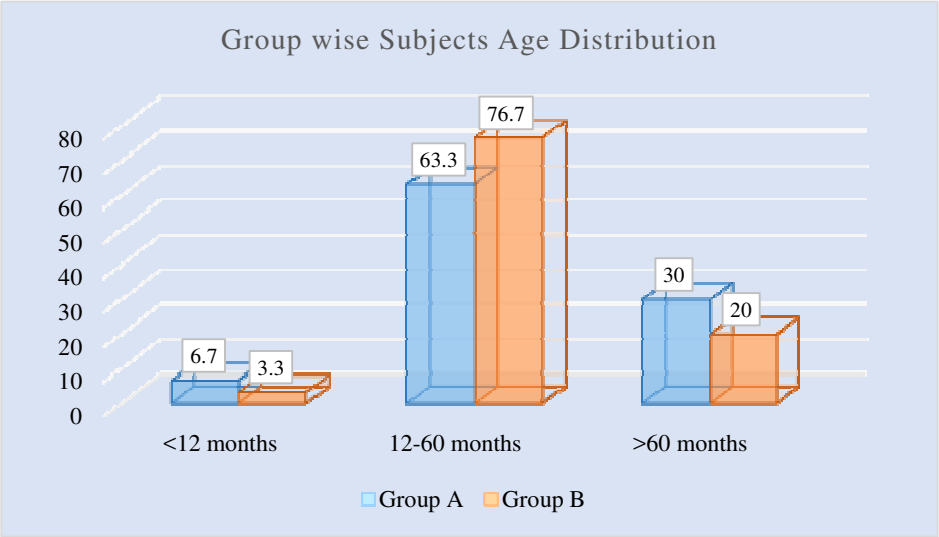

Figure 1: Group-wise Subjects Age Distribution

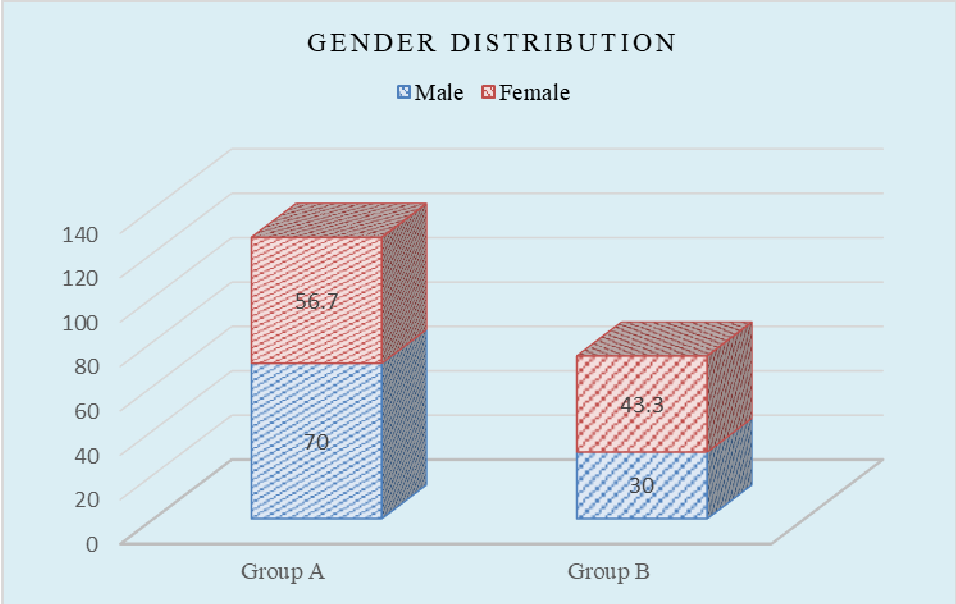

Figure I1: Gender Distribution of the Subject

Table II: Distribution of the study subjects by effects of mechanical bowel preparation (N=60)

Effects of mechanical bowel preparation	Group A (n=30)		Group B (n=30)		p-value
	n	%	n	%	
Electrolyte Imbalance					
Yes	0	0.0	3	10.0	0.076^{ns}
No	30	100.0	27	90.0	
Dehydration					

Yes	1	3.3	5	16.7	0.085^{ns}
No	29	96.7	25	83.3	
Fever					
Yes	0	0.0	2	6.7	0.105^{ns}
No	30	100.0	28	93.3	

Table III describes the data of the study subjects by per-operative adverse effect (Spillage). It was observed that 1(3.3%) subject had per operative adverse effect (Spillage) in group A and 3(10.0%) in group B. It is clear from the statistical data incorporated in the above table that the difference between the concern groups was not significant (p>0.05).

Table III: Distribution of the study subjects by Per operative adverse effect (Spillage) (N=60)

Per operative adverse effect (Spillage)	Group A (n=30)		Group B (n=30)		p value
	n	%	n	%	
Yes	1	3.3	3	10.0	0.300^{ns}
No	29	96.7	27	90.0	

Table IV shows the distribution of the study subjects by postoperative outcome. It was observed that return of bowel movement occurred within 72 hours in 22(73.3%) subjects in group A, whereas, 18(60.0%) study subjects required >96 hours to return bowel function in group B. Almost three fourth (73.3%) subjects had commencement of oral feeding within 72 hours in group A whereas, 18(60.0%) study subjects required >96 hours to start oral feeding in group B. Postoperative outcome (return of bowel movement and commencement of oral feeding) was 4.13 times better in group A than that of group B which was statistically significant.

Table IV: Distribution of the study subjects by post operative outcome (N=60)

Post-operative outcome	Group A (n=30)		Group B (n=30)		OR (95% CI)	p value
	n	%	n	%		
Return of bowel movement						
Within 72 hrs	22	73.3	12	40.0	4.13(1.22-14.35)	0.009^{s}
>96 hrs	8	26.7	18	60.0		
Commencement of oral feeding						
Within 72 hrs	22	73.3	12	40.0	4.13(1.22-14.35)	0.009^{s}
>96 hrs	8	26.7	18	60.0		

Table V confers the distribution of the study subjects by post-operative complications. It was observed that more than one fourth (26.7%) subjects had infection in both groups. One (3.3%) subject had seroma in group A and not found in group B. One (3.3%) subject had haematoma in group A and not found in group B. Anastomotic leakage was not found in group A but 1(3.3%) in group B. The differences were statistically not significant (p>0.05) between two groups.

Table V: Distribution of the study subjects by post-operative complication (N=60)

Post-operative complication	Group A (n=30)		Group B (n=30)		p value
	n	%	n	%	
Wound Complication					
Infection					
Yes	8	26.7	8	26.7	1.000^{ns}
No	22	73.3	22	73.3	
Seroma					
Yes	1	3.3	0	0.0	0.313^{ns}
No	29	96.7	30	100	
Haematoma					
Yes	1	3.3	0	0.0	0.313^{ns}
No	29	96.7	30	100	
Anastomotic leakage					
Yes	0	0.0	1	3.3	0.313^{ns}
No	30	100	29	96.7	

Table VI shows the distribution of the study subjects by post-operative hospital stay. In our study we observed that, 20(66.7%), 6(20%) and 4(13.3%) study subjects required 7 days, >7days and >10days of postoperative hospital stay respectively in group A. More than two third (66.7%) subjects need only 7 days of postoperative hospital stay in group A whereas only 5(16.7%) subjects show 7 days of postoperative hospital stay in group B. The difference was statistically significant ($p<0.05$) between two groups.

Table VI: Distribution of the study subjects by post-operative hospital stay (N=60)

Post-operative hospital stay	Group A (n=30)		Group B (n=30)		p-value
	n	%	n	%	
7 Days					
Yes	20	66.7	5	16.7	0.001^{s}
No	10	33.3	25	83.3	
Above 7 Days					
Yes	6	20.0	17	56.7	0.003^{s}
No	24	80.0	13	43.3	
Above 10 Days					
Yes	4	13.3	8	26.7	0.197^{ns}
No	26	86.7	22	73.3	

Table VII shows the distribution of the study subjects by post-operative discharge F/U data. It was observed that readmission was not found in group A and 1(3.3%) in group B. Re-intervention was not found in any group. The difference was statistically not significant ($p>0.05$) between the two groups as mentioned above.

Table VII: Distribution of the study subjects by post-operative discharge F/U data (N=60)

Post-operative discharge F/U data	Group A (n=30)		Group B (n=30)		p value
	n	%	n	%	
Readmission					
Yes	0	0.0	1	3.3	0.313^{ns}
No	30	100	29	96.7	
Re-intervention					
Yes	0	0.0	0	0.0	-
No	30	100	30	100	

DISCUSSION

There were no significant intergroup differences in demographic or surgical data in our study. However, the bowel function recovery time and duration of postoperative hospital stay were significantly lower in the ERAS group than the conventional method group. In the post-operative complication rate, there was no significant intergroup difference. Gao et al. (2019) study didn't find any significant difference between ERAS and conventional method group in terms of mean age of the study subjects. Fathy et al. (2018) study also observed non-significant findings which is similar with the present study. In regard to gender variation both Fathy et al. (2018) & Rove et al. (2018) observed male predominance. However, Gao et al. (2019) study observed female predominance in their study. [11,12] In traditional perioperative management, the routine use of mechanical bowel preparation (MBP) in colorectal surgery causes metabolic and electrolytes imbalance, dehydration, abdominal pain/bloating, and fatigue (Bucher et al. 2004). In this study there was no statistically significant ($p>0.05$) difference of occurrence of such complications in both the two groups. [13] Preoperative fever is the most frequent complication of MBP in traditional method of GI surgery in pediatric population. [11] In our study there was no statistically significant ($p>0.05$) difference in the number of patients suffering from pre-operative fever among the two groups. But the study done by Fathy et al. (2018), this difference was statistically significant ($p<0.05$). Yadav et al. (2013) study also yielded significant difference. [15] However, in another study Sangkhathat et al. (2003) observed non-significant difference like that of the present study. [14] In the current study per-operative adverse events like Spillage was not statistically significant ($p>0.05$) between two groups. Melnyk et al. (2011) mentioned in their study that the aim of MBP is to rid the large bowel of solid fecal contents and to lower the bacterial load, thereby reducing the incidence of postoperative complications. However, MBP liquefies solid faces, which may increase the risk of intra-operative spillage of contaminant, and it is almost impossible to reduce the bacterial load in the bowel due to the vast number of micro-organisms present in the digestive tract, [16] commencement of oral feeding) was 4.13 times better in ERAS group than that of conventional method group which was statistically significant ($p< 0.05$). Gao et al. (2019) study showed the return of bowel movement and commencement of oral feeding were significantly ($p<0.001$) early in the ERAS group than in the conventional method group. [5] Implementation of ERAS protocol is associated with a decrease incidence of postoperative complications as well as rapid convalescence. [17] The rapid recovery of gastrointestinal function in the ERAS group may have been due to their early enteral nutrition, mobilization, and receipt of

appropriate intravenous fluids and was comparable with the results seen in other studies. [4] Similarly, a study by Mattioli et al. (2009) showed that good bowel movement, rapid mobilization, and early feeding can be achieved by avoiding the use of drains, nasogastric tubes, and urinary catheters and by achieving acceptable pain control and limiting the use of systemic opioid drugs. [8] Therefore, a combination of multimodal perioperative interventions rather than a single intervention might contribute to more rapid postoperative recovery. In this study, there were no significant differences between both groups regarding occurrence of postoperative anastomotic leakage, and wound infection (p>0.05). Fathy et al. (2018) & Gao et al. (2019) [3,11] also showed that there were no significant differences in the incidence of complications between the two groups which support with the present study. Their ERAS protocols in pediatric gastrointestinal surgery were associated with a tendency toward milder postoperative complications. Compared with the conventional method group, the complications in the ERAS group were successfully alleviated following conservative treatment. With the implementation of ERAS and early discharge, none of these complications was associated. Notably, while no postoperative intestinal obstruction occurred in the ERAS group one patient with intestinal obstruction required lysis of adhesions 1 month after surgery in the control group. The authors consider that this lack of intestinal obstruction in the ERAS group is closely related to early oral nutrition and mobilization. [11] Likewise, a recent study Ripolles-Melchor et al. (2019) showed that the increase in ERAS adherence appears to be associated with a decrease in postoperative complications. [18] In our study, we observed that the duration of post-operative hospital stays in ERAS group was significantly (p<0.05) less than that of conventional group. The reduced postoperative length of hospital stay after ERAS may be attributed to rapid GI recovery and reduction in rate and severity of postoperative complications related to this protocol of management. Rafeeqi and Pearson, (2021) and Fathy et al. (2018) study also demonstrates shorter postoperative length of hospital stay in ERAS group. [11,19] In 2021, Behera et al. showed that the length of hospital stay was significantly (p<0.05) less in the ERAS group with compared to conventional method. [20] Gao et al. (2019) study observed that a shorter duration of postoperative hospital stay (p<0.001), where the average length of postoperative hospital stay was 4.809 and 7.737 days in ERAS and no ERAS group respectively. [3] Phillips et al. (2020) reported that, ERAS reduces the duration of hospital stay, hospital re-admission and costs. [21] In 2013 West et al. also showed that the application of ERAS in pediatric surgery could accelerate recovery and reduce the length of post-operative stay. In this present study the difference was statistically not significant (p>0.05) between two groups in regard to re-admission and re-intervention. Yeung et al. (2017) reported that ERAS protocols have lower postoperative complication rates without a concomitant increase in hospital re-admissions. [22] Rove et al. (2018) found that 1 patient had re-admission in ERAS group and 7 patients in conventional method group. [12] The above study findings are comparable with the present study. [21, 23] Although the current evidence supports that the implementation of ERAS protocol is safe and beneficiary in colostomy closure in children, there is still strong resistance to the application of such protocol for some reasons. First, the conventional concept of perioperative management is deeply rooted and has become the largest obstacle to the implementation of ERAS protocol. Second, the ERAS concept has not been adequately promoted and popularized in our country and many medical professionals still need better understanding. Finally, implementation of ERAS protocol requires multidisciplinary collaboration.

Anesthesiologists have also a key role for maintaining different components of ERAS protocol and their co-operation is mandatory for proper application of ERAS protocol. Some previous studies showed that the most important safeguards for successful implementation of ERAS protocols are good organization and coordination by hospital administrators, updating of management philosophy, and innovative management. [24]

CONCLUSION

This study was undertaken to compare the outcome between ERAS and conventional perioperative care protocol in colostomy closure in children. Return of bowel movement and commencement of oral feeding were significantly early in ERAS group. The duration of postoperative hospital stay was also significantly shorter in this group. Therefore, surgeons can be confident in adopting enhanced recovery protocols as a part of standard practice for colostomy closure in pediatric patients.

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