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The Effect of an Enhanced Recovery Protocol on Pediatric Colorectal Surgical Patient Outcomes at a Single Institution

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Abstract

Introduction: Enhanced recovery protocols (ERP) have been associated with fewer postoperative complications in adult colorectal surgery patients, but there is a paucity of data on pediatric patients. Our aim is to describe the effect of an ERP, compared to conventional care, on pediatric colorectal surgical complications.

Materials and Methods: We performed a single institution, retrospective cohort study (2014-2020) on pediatric (≤18 years old) colorectal surgery patients pre- and post-implementation of an ERP. Bivariate analysis and logistic regression were used to assess the effect of an ERP on return visits to the emergency room, reoperation, and readmission within 30-days.

Results: There were 194 patients included in this study, with 54 in the control cohort and 140 in the ERP cohort. There was no significant difference in the age, BMI, primary diagnosis, or use of laparoscopic technique between the cohorts. The ERP cohort had a significantly shorter foley duration, postoperative stay, and had nerve blocks performed. After controlling for pertinent covariates, the ERP cohort experienced higher odds of reoperation within 30 days (OR 5.83, P = .04). There was no significant difference in the other outcomes analyzed.

Conclusion: In this study, there was no difference in the odds of overall complications, readmission or return to the ER within 30-days of surgery. However, although infrequent, there were higher odds of returns to the OR within 30 days. Future studies are needed to analyze how adherence to individual components may influence patient outcomes to ensure patient safety during ERP implementation.

Keywords
ERAS, Pediatric surgery

Introduction

Enhanced recovery protocols (ERPs) have been implemented since the early 1990s to optimize the delivery of care for surgical patients.[1] Multiple surgical specialties have developed ERPs including colorectal, thoracic, and gynecologic surgery. Enhanced recovery protocols address all phases of clinical care, from preoperative to postoperative, to optimize recovery from surgery. These protocols include preoperative optimization, intra-operative standardization of antibiotic prophylaxis, emphasis on minimally invasive surgical techniques, avoidance of drainage tubes, utilization of multimodal pain medications, and goal-directed fluid therapy

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(GDFT). Postoperative components include early ambulation/mobilization, early enteral nutrition, and continued use of multimodal analgesia to minimize opioid utilization.[1] The goal of ERPs is to reduce the negative effects of surgical stress that patients experience in order to expedite recovery, reduce complications, and enhance patient satisfaction.[2,3]

These protocols have been thoroughly studied in adult patients, and more recently have been adapted for pediatric patients. Enhanced recovery protocols in adult patients have resulted in reduced length of stay (LOS), fewer postoperative complications, lower postoperative morbidity, and reduced overall costs.[4-7] The literature on ERPs in adult colorectal patients is robust, but similar studies conducted in pediatric colorectal patients are currently lacking. The current body of literature in pediatric patients demonstrates that ERPs are associated with a significant reduction in LOS, decreased opioid utilization, and shortened time to full feeding while maintaining postoperative outcomes among adults.[8,9] Three reviews of ERPs in pediatric patients found a reduced LOS, reduced time to oral intake, higher parent satisfaction, improved pain control, and reduced costs compared to conventional care.[10-12] Each of these reviews included less than 10 articles and covered a variety of surgical procedures. These reviews came to similar conclusions that ERPs are safe to use in pediatric patients and can improve patient outcomes and the quality of care delivered.[10-12]

Given the paucity of data on the effect of ERPs on pediatric surgical patients, further research is warranted. The objective of this study was to investigate the effect of an ERP, in comparison with conventional care, on the outcomes of pediatric colorectal surgery patients at a single institution. We hypothesized that the implementation of an ERP would have similar rates of reoperation within 30 days, readmission within 30 days, and return visits to the emergency room within 30 days among pediatric colorectal surgery patients.

Methods

Study Design

We performed a retrospective cohort study from April 2014 to January 2020 on pediatric patients ($2 \leq x \leq 18$ years old) undergoing colorectal surgery before and after implementing an ERP at North Carolina Children's Hospital. This hospital is a 150-bed children's hospital attached to a tertiary general hospital. During this study period, the pediatric surgery service was staffed by eight pediatric surgeons, with a minimum of five patients in both the control and ERP cohorts. Patients were identified through the hospital's electronic medical records for all pediatric patients who underwent common colorectal procedures using Current Procedural Terminology (CPT) codes (Appendix Table 1). The standardized ERP used at this institution, with an emphasis on goal-directed fluid therapy (GDFT), has been previously described.[9] Briefly, the ERP standardized the use of multimodal pain medication during and after surgery, early postoperative oral intake, early mobilization, and standard intraoperative fluid management that emphasized GDFT and zero fluid balance.

All patients operated on before January 1, 2016, were categorized as pre-implementation of the ERP, and the remaining patients were categorized as post-implementation of the ERP. The a priori primary outcomes were visits to the emergency department within 30 days, 30-day readmission, and 30-day reoperation rates. Collected data included demographic and clinical variables (see Table 1 for a complete list).

Statistical Analysis

Descriptive statistics and perioperative factors were compared between the two cohorts using Student's t Test, Kruskal–Wallis, or Pearson's c^2 where appropriate. Continuous, normally distributed data were reported as mean and standard deviation. Continuous, non-normally distributed data were reported as mean with interquartile range (IQR). Univariate analysis was used to assess for data missingness and there was <1% missing data. A *P*-value of <.05 was considered statistically significant.

Logistic regression was used to evaluate the effect of ERP exposure on 30-day readmission, 30-day reoperation, and 30-day visits to the emergency department. A composite complication variable was generated to reflect the patient experiencing ≥1 of any of these outcomes. *A priori* age, sex, American Society of Anesthesiologists (ASA) physical classification, postoperative length of stay (LOS), length of foley placement, and if the procedure was performed laparoscopically were included as covariates in the model. A composite variable* for preoperative ERP medications (acetaminophen, pregabalin, celecoxib, and alvimopan) and postoperative ERP medications (acetaminophen, pregabalin, celecoxib, Alvimopan, and ketorolac) were created to reduce the collinearity among these variables. Patients were considered to have received ERP medications if they received at least one of the medications in this category. Variables identified as significant on bivariate analysis were also included in the model (Table 1 and Table 2). If a variable was determined to not be independent in a particular analysis it was removed. Collinearity testing and an area under the curve threshold for good fit were applied to all models.

All analyses were performed using StataCorp v16.0, College Station, Texas.

Table 1. Patient demographics in the overall cohort, the control group (pre-implementation of the enhanced recovery pathway (ERP)), and patients managed with the ERP.

	Overall n = 194	Controls n = 54 (27.8%)	ERP n = 140 (72.2%)	P-Value
Patient characteristics				
Age: Median (IQR)	15 (12–16)	15 (13–16)	15 (12–16.5)	.94
Female sex: n (%)	105 (54.1%)	36 (66.7%)	69 (49.3%)	**.03***
BMI: μ (SD)	20.97 (13.8)	19.74 (4.9)	21.4 (15.9)	.38
ASA classification: n (%)				**.02***
2	91 (46.9%)	18 (33.3%)	73 (52.1%)	
3	102 (52.6%)	35 (64.8%)	67 (47.9%)	
4	1 (.5%)	1 (1.9%)	0 (.0%)	
Diagnosis: n (%)				.48
Crohn's disease	75 (38.7%)	19 (35.2%)	56 (40.0%)	
Ulcerative colitis	71 (36.6%)	24 (44.4%)	47 (33.6%)	
Hirschsprung disease	9 (4.6%)	1 (1.9%)	8 (5.7%)	
Familial adenomatous polyposis	6 (3.1%)	2 (3.7%)	4 (2.9%)	
Intestinal tumor	7 (3.6%)	2 (3.7%)	5 (3.6%)	
Chronic constipation	14 (7.2%)	2 (3.7%)	12 (8.6%)	
Urologic disorder	3 (1.6%)	0 (.0%)	3 (2.1%)	
Other	9 (4.6%)	4 (7.4%)	5 (3.6%)	
Procedure: n (%)				.30
Small bowel resection	11 (5.7%)	4 (7.4%)	7 (5.0%)	
Completion coloproctectomy without ostomy	20 (10.3%)	4 (7.4%)	16 (11.4%)	
Completion coloproctectomy with diverting ostomy	22 (11.3%)	11 (20.4%)	11 (7.9%)	
Total abdominal colectomy with diverting ostomy	32 (16.5%)	7 (13.0%)	25 (17.9%)	
Total abdominal colectomy with ileorectal anastomosis	3 (1.6%)	1 (1.9%)	2 (1.4%)	
Ileocectomy	41 (21.1%)	7 (13.0%)	34 (24.3%)	
Ileostomy	16 (8.3%)	5 (9.3%)	11 (7.9%)	
Ileostomy takedown	24 (12.4%)	8 (14.8%)	16 (11.3%)	
Partial colectomy with ostomy	2 (1.0%)	0 (.0%)	2 (1.4%)	
Partial colectomy without ostomy	10 (5.2%)	4 (7.4%)	6 (4.3%)	
Colostomy takedown	4 (2.1%)	0 (.0%)	4 (2.9%)	
Diverting colostomy	5 (2.6%)	1 (1.9%)	4 (2.9%)	
Other	4 (2.1%)	2 (3.7%)	2 (1.4%)	

Abbreviations: μ, mean; SD: standard deviation; IQR, interquartile range; BMI, body mass index; ASA, American Society of Anesthesiologists; ERP, enhanced recovery protocol.

Results

Patient Baseline Characteristics

Of the 194 patients that met inclusion criteria, 72.16% (n = 140) were classified as ERP patients and 27.84% (n = 54) served as controls. There was no significant difference between age or body mass index between the two cohorts, with a median age of 15 for both groups. There was a significant difference in the number of female patients in each group (P = .03), with the control group having a larger proportion of female patients (66.7% vs 49.3%). The primary diagnosis in the control group was ulcerative colitis (n = 24, 44.44%) and Crohn's disease (n = 56, 40.00%) in the ERP group. The most common procedure performed in the control group was a completion coloproctectomy with ileal pouch anal anastomosis with diverting ostomy (n = 11, 20.37%) and an ileocectomy (n = 34, 24.29%) for the ERP group. There was no difference in the number of patients that underwent laparoscopic surgery between the groups (P = .16).

Preoperative Characteristics

There was no difference in preoperative steroid use between the two cohorts. Patients in the control group were significantly more likely to receive preoperative opioids, with 16.7% of patients in the control group compared to 6.4% in the ERP group (P = .03). There was no difference in the number of patients receiving ERP medications (P = .52) (Table 2).

Intraoperative Characteristics

There was no difference in the number of patients that received an epidural (37.04% vs 26.43%, P = .15),

Table 2. Operative and postoperative characteristics in the overall cohort, the control group (pre-implementation of the enhanced recovery protocol (ERP)), and patients managed with the ERP.

	Overall n = 194	Controls n = 54 (27.84%)	ERP n = 140 (72.16%)	P-Value
Preoperative characteristics				
Opioid use: n (%)	18 (9.3%)	9 (16.7%)	9 (6.4%)	**.04***
Steroid use: n (%)	38 (19.6%)	7 (13.0%)	31 (22.1%)	.15
ERP medications: n (%)	136 (70.1%)	36 (66.7%)	100 (71.4%)	.52
Intraoperative characteristics				
Epidural	57 (29.4%)	20 (37.0%)	37 (26.4%)	.15
Block	31 (16.0%)	4 (7.4%)	27 (19.3%)	**.04***
Total intraoperative MME: Median (IQR)	.3 (.2-.5)	.5 (.3-.6)	.3 (.2-.4)	**<.01***
Total perioperative MME: Median (IQR)	.4 (.3-.6)	.6 (.4-.9)	.4 (.3-.6)	**<.01***
Total IVF in mL: median (IQR)	1300 (850-2000)	1636 (1000-2900)	1266 (800-1900)	**.01***
Procedure length (min): μ (SD)	194.0 (91.5)	210.1 (97.1)	187.7 (88.9)	.18
Laparoscopic surgery: n (%)	102 (52.6%)	23 (42.6%)	79 (56.4%)	.08
Postoperative characteristics				
PACU pain level: Median (IQR)	5.0 (0-8)	5.5 (.2-8.0)	5.0 (.0-7.0)	.12
ERP medications: n (%)	189 (97.4%)	51 (94.4%)	138 (98.6%)	.10
Total MME on floor: Median (IQR)	.9 (.4-2.0)	2.0 (.7-5.0)	.7 (.4-1.4)	**<.01***
Total postop IVF (mL): Median (IQR)	2010.8 (1094.6-4017.0)	3159.0 (1675-5937.2)	1723.1 (928.1-3410.7)	**.01***
Foley placement (days): Median (IQR)	1.0 (.8-2.9)	1.9 (1.0-4.1)	1.0 (.8-2.1)	**<.01***
Postoperative LOS (days): Median (IQR)	5.0 (3.8-7.8)	5.9 (4.8-9.1)	4.2 (3.2-7.0)	**<.01***
Complications: n (%)				
Return to ER within 30 days	27 (13.9%)	10 (18.5%)	17 (12.1%)	.25
Readmission within 30 days	36 (18.6%)	12 (22.2%)	24 (17.1%)	.42
Reoperation within 30 days	5 (2.6%)	0 (.0%)	5 (3.6%)	.18
Any complication within 30 days	51 (26.3%)	15 (27.8%)	36 (25.7%)	.77

Abbreviations: μ, mean; SD, standard deviation; IQR, interquartile range; ERP, enhanced recovery protocol; MME morphine milligram equivalents, PACU; postanesthesia care unit, IVF; intravenous fluid, LOS; length of stay, PO; per os, IV; intravenous, ER; Emergency Room.

Bupivacaine (7.41% vs 19.29%, P = .69), or the procedure length (210.13 vs 187.7 min, P = .06) between the two groups. Patients in the ERP group were significantly more likely to receive a nerve block than control patients (19.29% vs 7.41%, P = .04). Patients in the control group received more opioids (.50 vs .23 MME, P < .01) and more total IVF (800 vs 1000 mL, P = .01) (Table 2).

Postoperative Characteristics

There was no difference in pain level reported in the postanesthesia care unit (PACU) postoperatively (P = .12). There was no difference in the number of patients that received postoperative ERP medications (P = .10) or in the total amount of opioids given in MME in the PACU (P = .06) between the two groups. There was a significant difference in the total amount of opioids given on the floor and perioperatively (.6 vs .4 MME and 2.0 vs .7, respectively, both P < .01), with the control group receiving larger quantities. Patients in the control group received more fluids postoperatively (3159.0 mL vs 1723.1 mL, P < .01), had a longer foley duration (1.9 vs 1.0 days, P < .01), and had a longer postoperative LOS (5.9 days vs 4.2 days, P < .01) (Table 2).

Outcomes

There was no significant difference in the number of patients that returned to the emergency room within 30-days (18.5% vs 12.1%, P = .25), were readmitted within 30-days (22.2% vs 17.1%, P = .42), had a reoperation within 30-days (.0% vs 3.6%, P = .13), or experienced ≥1 of these outcomes (27.8% vs 25.7%, P = .77).

The effect of the ERP on any complication and associated predictors

In the unadjusted logistic regression model, individuals that were exposed to the ERP experienced .90 times the odds of any complication compared to non-ERP patients (95% CI 0.44,0.182; P = .77). After adjusting for pertinent covariates, individuals that were exposed to the ERP experienced had similar odds of any complication compared to non-ERP patients (OR 1.13, 95% CI 0.43, 2.97; P = .81) (see Table 3).

Table 3. Crude and adjusted effect of ERP implementation, compared to pre-ERP implementation controls, on any complication, return to the ER within 30 days, readmission within 30 days, and reoperation within 30 days.

	Crude		Adjusted	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Any complication within 30 days [a]	.90 (.44, 1.82)	.77	1.13 (.43, 2.97)	.81
Return to ER within 30 days [b]	.61 (.26, 1.43)	.25	.54 (.18, 1.64)	.28
Readmission within 30 days [c]	.72 (.33, 1.58)	.42	.95 (.32, 2.81)	.92
Reoperation within 30 days [d]	3.52 (.79, 15.81)	.10	5.83 (1.08, 31.42)	**.04***

Abbreviations: ER, Emergency Room; OR, odds ratio; CI, confidence interval; ASA, American Society of Anesthesiologists; LOS, length of stay.
[a]Adjusted for age, sex, ASA classification, laparoscopic approach, preoperative opioid use, total intraoperative opioids in MME, total intraoperative IVF, postoperative ERP medications, total opioids given on the floor in MME, total postoperative IVF, and postoperative LOS.
[b]Adjusted for age, ASA classification, laparoscopic approach, total intraoperative opioids in MME, total opioids given on the floor in MME, total intraoperative IVF, and total postoperative IVF.
[c]Adjusted for age, sex, ASA classification, laparoscopic approach, preoperative opioid use, preoperative ERP medications, intraoperative nerve block, total intraoperative opioids in MME, total perioperative opioids in MME, total intraoperative IVF, postoperative ERP medications, total opioids given on the floor in MME, time with foley in days, and postoperative LOS.
[d]Adjusted for age, sex, and laparoscopic approach.

The effect of the ERP on return to ER within 30 days and associated predictors

In the unadjusted model, individuals that were exposed to the ERP experienced .61 times the odds of returning to the Emergency Room within 30 days compared to non-ERP patients (95% CI 0.26,1.43; P = .25). In the final model, individuals that were exposed to the ERP experienced similar odds of returning to the Emergency room within 30 days compared to non-ERP patients (OR .54,95% CI 0.18, 1.64; P = .28) (see Table 3).

The effect of the ERP on readmission within 30 days and associated predictors

In the unadjusted model, individuals that were exposed to the ERP experienced .72 times the odds of being readmitted within 30 days compared to non-ERP patients (95%CI 0.33, 1.58; P = .42). In the final model, individuals that were exposed to the ERP experienced similar odds of being readmitted within 30 days compared to non-ERP patients (OR .94, 95% CI 0.32, 2.81; P = .93) (see Table 3).

The effect of the ERP on reoperation within 30 days and associated predictors

In the unadjusted model, individuals that were exposed to the ERP experienced 3.52 times the odds of reoperation within 30 days compared to non-ERP patients (95% CI 0.79, 15.81; P = .10). Length of stay was removed from this analysis due to its dependent relationship with the reoperation variable. In our final model, individuals that were exposed to the ERP experienced 5.83 times the odds of reoperation within 30 days compared to non-ERP patients (95% CI 1.08, 31.42; P = .04) (see Table 3).

All models were found to have no significant collinearity and had good predictive performance based on the area under the curve analysis.

Discussion

This is the largest study to date on ERP complications for pediatric patients undergoing colorectal surgery. Logistic regression showed that the ERP was associated with significantly higher odds of undergoing a reoperation within 30 days, after adjusting for covariates. There was no significant difference in the odds of overall complication, return visits to the ER or readmission within 30 days between the cohorts.

The findings of this study are consistent with previously published studies on ERPs for pediatric colorectal surgery patients. A similar study evaluated inflammatory bowel disease patient outcomes after the implementation of a standardized perioperative toolkit in pediatric patients.[13] Short et al found a significant decrease in the number of patients with ER visits and readmissions within 30 days of surgery after implementation of this toolkit. This study examined a smaller sample size of patients and a subset of the patient diagnoses included in our study which may have contributed to a difference in the analyses.

This study's non-randomized design provides the potential for confounding bias resulting from institutional changes that occurred during the pre- and post-implementation that influenced the delivery of care. This study's population was drawn from a single institution, limiting its generalizability to other settings. The small overall sample size and smaller control group makes it particularly challenging to study outcomes with historically low incidence in pediatric populations. Many components of ERPs have become standard of care,

making true randomization between ERP and control cohorts challenging. This study also included a heterogeneous mix of surgical procedures and primary diagnoses, making it difficult to discern differences that may be present between procedures and patient groups. Due to its retrospective nature, this study is bounded by what is reported in the electronic medical record, and not all ERP components were able to be assessed. Adherence to ERP protocols may differ between patients which limits the ability to understand how particular components of this pathway may influence patient outcomes. Lastly, the incidence of these outcomes in pediatric patients is low which can bias the results. Even with the previously described limitations, this study contributes to the current paucity of literature on pediatric ERP protocols given its large sample size.

Conclusion

This study demonstrates that an ERP was associated with an increased odds reoperations within 30 days. While some confounding variables were controlled for in this analysis, additional components could have contributed to the imprecision and magnitude of these results. Additional studies are warranted to understand how individual components of ERPs can influence patient outcomes in order to optimize the quality of care delivered to pediatric patients. In particular, meta-analyses and multi-institutional studies are necessary to examine the impact of ERPs given the low incidence of these complications in pediatric patients.

Declaration of Conflicting Interests

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References

1. Lee GC, Hodin RA. Applying Enhanced Recovery Pathways to Unique Patient Populations. *Clin Colon Rectal Surg* 2019; 32(2): 134–137. doi:10.1055/S-0038-1676479
2. Rafeeqi T, Pearson EG. Enhanced recovery after surgery in children *Transl Gastroenterol Hepatol*. 2021; 6: 46. doi:10.21037/TGH-20-188
3. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review *JAMA Surg*. 2017; 152(3): 292–298. doi:10.1001/JAMASURG.2016.4952
4. Short HL, Taylor N, Piper K, Raval MV. Appropriateness of a pediatric-specific enhanced recovery protocol using a modified Delphi process and multidisciplinary expert panel *J Pediatr Surg*. 2018; 53(4): 592–598. doi:10.1016/J.JPEDSURG.2017.09.008
5. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth* 1997; 78(5): 606–617. doi:10.1093/BJA/78.5.606
6. Varadhan KK, Neal KR, Dejong CHC, Fearon KCH, Ljungqvist O, Lobo DN. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: A meta-analysis of randomized controlled trials. *Clinical Nutrition* 2010; 29(4): 434–440. doi:10.1016/J.CLNU.2010.01.004
7. Roulin D, Donadini A, Gander S, et al. Cost-effectiveness of the implementation of an enhanced recovery protocol for colorectal surgery. *Br J Surg* 2013; 100(8): 1108–1114. doi:10.1002/BJS.9184
8. Phillips MR, Adamson WT, McLean SE, et al. Implementation of a pediatric enhanced recovery pathway decreases opioid utilization and shortens time to full feeding. *J Pediatr Surg* 2020; 55(1): 101–105. doi:10.1016/J.JPEDSURG.2019.09.065
9. Purcell LN, Marulanda K, Egberg M, et al. An enhanced recovery after surgery pathway in pediatric colorectal surgery improves patient outcomes. *J Pediatr Surg* 2021; 56(1): 115–120. doi:10.1016/J.JPEDSURG.2020.09.028
10. Arena S, Di Fabrizio D, Impellizzeri P, Gandullia P, Mattioli G, Romeo C. Enhanced Recovery After Gastrointestinal Surgery (ERAS) in Pediatric Patients: a Systematic Review and Meta-analysis. *J Gastrointest Surg* 2021; 25(11): 2976–2988. doi:10.1007/S11605-021-05053-7
11. Pearson KL, Hall NJ. What is the role of enhanced recovery after surgery in children? A scoping review. *Pediatr Surg Int* 2017; 33(1): 43–51. doi:10.1007/S00383-016-3986-Y/TABLES/3
12. Shinnick JK, Short HL, Heiss KF, Santore MT, Blakely ML, Raval MV. Enhancing recovery in pediatric surgery: a review of the literature. *J Surg Res* 2016; 202(1): 165–176. doi:10.1016/J.JSS.2015.12.051
13. Short SS, Rollins MD, Zobell S, Torres H, Guthery S. Decreased ER visits and readmissions after implementation of a standardized perioperative toolkit for children with IBD. *J Pediatr Surg* 2022; 57(4): 604–609. doi:10.1016/J.JPEDSURG.2021.08.016