Pediatric Surgery International (2019) 35:443–448
https://doi.org/10.1007/s00383-019-04440-1

ORIGINAL ARTICLE

Is fecal diversion necessary during ileal pouch creation after initial subtotal colectomy in pediatric ulcerative colitis?

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Accepted: 9 January 2019 / Published online: 19 January 2019

Abstract

Background Pediatric patients with medically refractory ulcerative colitis (UC) often undergo an initial subtotal colectomy end ileostomy (STC-I). The role of fecal diversion in the subsequent completion proctectomy/ileal-pouch anal anastomosis (CP-IPAA) remains controversial.

Methods A multi-institutional retrospective review was performed of pediatric UC patients who underwent an STC-I followed by CP-IPAA from 2008 to 2016. 37 patients were included [diverted ($n=20$), undiverted ($n=17$)].

Results Children who underwent undiverted CP-IPAA had a longer length of stay (days) compared to the diverted group (9, 6.5–13 vs. 6, 5–6, $p=0.002$). The 30-day complication rate was significantly higher in the undiverted group ($p=0.003$) although the difference in anastomotic leak, readmission rate, unplanned computer tomography use, and reoperation was not statistically significant. Three patients with undiverted CP-IPAA required additional surgery in the perioperative period for fecal diversion. The mean long-term follow-up was 25.68 ± 21.56 months. There were no significant differences in functional pouch outcomes.

Conclusions Patients who underwent an undiverted CP-IPAA after initial STC-I had significantly more complications in the immediate postoperative period compared to diverted patients, although this did not translate into long-term differences in functional outcomes. Questions remain regarding careful patient selection and counseling for undiverted pouches in the pediatric UC population.

Keywords Ulcerative colitis · IPAA · Ileostomy · J pouch

Introduction

Novel medical regimens for ulcerative colitis (UC) have transformed the treatment outcomes and quality of life for pediatric patients with ulcerative colitis [1]. Nevertheless, the literature reports that up to 20% of children with chronic UC will still require colectomy within 5 years of initial diagnosis [2–5]. While there is some debate about the proper initial operation in patients with severe refractory disease, it is our practice to offer an initial subtotal colectomy and end ileostomy (STC-I) leaving behind the rectum. Patients can then quickly be weaned off any immunosuppressive and/or immunomodulatory medications prior to undergoing a completion proctectomy with creation of an ileal-pouch anal anastomosis (CP-IPAA). Controversy exists over the need for routine fecal diversion at the time of pouch creation. Proponents of routine diversion suggest that stoma formation can minimize the consequences of a potentially catastrophic anastomotic leak [6]. However, data in the adult literature suggests that CP-IPAA can be safely performed for ulcerative colitis without an ileostomy [7–10]. In the pediatric population, some studies have also suggested that CP-IPAA without ileostomy can be safe [11–13]; however, none have specifically focused on patients who have already undergone STC-I and are weaned off immunosuppression. We sought to compare the immediate postoperative and long-term functional outcomes of pediatric UC patients who underwent a

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CP-IPAA after an initial STC-I with and without a diverting ileostomy.

Methods

After obtaining Institutional Review Board approval, a multi-institutional retrospective review was performed on all children ages 18 and under who underwent an initial STC-I, followed by a subsequent CP-IPAA with and without a diverting ileostomy from 2008 to 2016. Preoperative characteristics, operative details, postoperative and functional outcomes were collected and analyzed. Preoperative patient characteristics included age, body mass index (BMI), gender, preoperative albumin level, use of corticosteroid and/or biologic immunomodulators, duration of disease, and time from subtotal colectomy. Operative details included method of anastomosis, operative approach (laparoscopic versus open), duration of operation, and estimated blood loss. Postoperative outcomes included length of stay, 30-day morbidity, unplanned computerized tomography (CT) use, readmission, reoperation, and duration of ileostomy. Anastomotic leak was defined as evidence of leak on imaging (pelvic fluid collection adjacent to the anastomosis) or at reoperation. Functional outcomes included reports of pouchitis, nocturnal bowel movements, and incontinence, as well as number of anastomotic stricture dilations and daily reported bowel movements. The most recent accounts of functional data were collected. Only patients with the final diagnosis of UC were included in the analysis. Patient and surgeon preference dictated the decision to divert, method of anastomosis, operative approach and time between STC and CP-IPAA. Additional subgroup analysis was performed based on the method of anastomosis.

Univariate statistical analysis was performed using PRISM 7 (GraphPad, La Jolla, CA). Mean and standard deviation are reported. Chi-square and Fisher's exact test was used for categorical parameters and Mann–Whitney *U* test for continuous parameters, as well as D'Agostino and Pearson's test to determine normal distribution. Continuous parameters which were normally distributed are reported as mean and standard deviation; non-normally distributed continuous parameters are reported as mean and interquartile range. Statistical significance was defined as $p < 0.05$.

Results

General (Table 1)

37 patients were identified during the study period; 17 patients underwent an undiverted pouch, 20 patients underwent a diverted pouch. The mean follow up was 25.68 ± 21.56 months.

Preoperative characteristics (Table 1)

There were no significant differences in age, BMI, gender, history of immunosuppression use, preoperative albumin and duration of disease. There was a significantly longer period of time in days (median, interquartile range) between STC-I and CP-IPAA in the undiverted group compared to the diverted group (178, 106.5–266 vs. 100, 87–156.5, $p = 0.042$).

Operative Details (Table 2)

There were no significant differences in method of anastomosis, duration of operation and estimated blood loss between the two groups. Laparoscopy was used in 80% of diverted cases and 47.06% of undiverted cases ($p = 0.047$).

Postoperative outcomes (Table 3)

There was no perioperative or long-term mortality identified. Patients who underwent an undiverted CP-IPAA had significantly longer length of stay in days (median, interquartile range) compared to diverted CP-IPAA (9, 6.5–13

Table 1 Preoperative characteristics

	Undiverted	Diverted	*p* value
n	17	20	
Age (years)	16 (14.5–17)	16 (13.25–17)	0.801
Body mass index	19.8 (17.26–23.5)	20.7 (19–22.9)	0.456
Male (%)	8 (47.06%)	14 (70%)	0.193
Preoperative albumin (g/dL)	3.847 ± 0.436	4.163 ± 0.399	0.05
On steroids prior to STC-I (%)	13 (76.47%)	13 (65%)	0.495
Daily dose (mg of prednisone)	28.64 ± 18.18	21.59 ± 10.86	0.416
On biologics prior to STC-I (%)	8 (47.06%)	14 (70%)	0.193
Duration of disease (years)	2 (1–3)	2 (0.83–3)	0.967
Days between STC-I and CP-IPAA	178 (106.5–266)	100 (87–156.5)	*0.042*

Table 2 Operative details

Operative details	Undiverted	Diverted	*p* value
Handsewn anastomosis (%)	6 (35.29%)	7 (36.84%)	> 0.999
Laparoscopic (%)	8 (47.06%)	16 (80%)	*0.047*
Duration of operation (hours)	3.094 ± 0.6895	3.69 ± 0.855	0.084
Estimated blood loss (ml)	100 (62.5–125)	75 (40–100)	0.256

Significant *p* values are in italics

vs. 6, 5–6) ($p = 0.002$). Undiverted patients also had a significantly increased 30-day complication rate compared to diverted patients (64.71% vs. 15%) ($p = 0.003$). Complications reported included anastomotic leak, pneumonia, wound infection, urinary tract infection, portal vein thrombosis, small bowel obstruction, and anastomotic bleeding requiring blood transfusion. There were no significant differences in the rate of unplanned postoperative CT use, readmission or reoperation rate between the two groups.

The overall anastomotic leak rate in our series was 16.2% and there was no significant difference in the anastomotic leak rate between the two groups. One patient in the diverted group was identified to have an anastomotic leak after presenting with persistent fevers and leukocytosis in the immediate postoperative period. This patient was found to have pelvic fluid collections on CT scan and symptoms resolved with antibiotics and rectal decompression. Five patients were identified to have an anastomotic leak in the undiverted group. One patient presented with anal pain as an outpatient and underwent a perineal exam under anesthesia with revision of an area of dehiscence in the pouch-anal anastomosis. One patient presented with urinary retention and pelvic pressure as an outpatient and on CT scan was found to have air adjacent to the anastomosis. This patient was treated with antibiotics and the symptoms resolved. Finally, three patients presented with clinical signs and symptoms suspicious for pelvic sepsis and anastomotic leak in the immediate postoperative period and underwent additional surgery for fecal diversion. The duration of ileostomy in those three patients was 106 (90–169) days, which was not significantly different from the mean duration of ileostomy in the diverted group (75.5, 47.25–98.75 days).

The 30-day complication rate after ileostomy reversal in the diverted group was 10%. One patient developed urinary retention and pelvic pressure after discharge and returned to the emergency room where symptoms resolved. The other patient developed an intra-abdominal fluid collection distant from the pelvic anastomosis that required operative drainage and antibiotics.

Additional subgroup analysis was performed based on method of anastomosis. Of the 23 patients who had a stapled anastomosis, 12 were undiverted and 11 diverted. Results of the stapled subgroup resembled the overall group at large. The undiverted group had a significantly longer length of stay (10.91 ± 4.99 days) compared to the diverted group (5.67 ± 2.43 days) ($p = 0.005$). The complication rate was also significantly higher in the undiverted group (54.55%) compared to the diverted group (8.33%) ($p = 0.027$). However, the there was no significant difference in anastomotic leak, use of unplanned CT, readmission rate, or reoperation rate between the two groups. Similar findings were identified in the handsewn anastomosis group. A total of 13 patients had a handsewn anastomosis (6 undiverted, 7

Table 3 Post-operative outcomes

Post-operative outcomes	Undiverted	Diverted	*p* value
Length of stay (days)	9 (6.5–13)	6 (5–6)	*0.002*
30-day complication after CP-IPAA (%)	11 (64.71%)	3 (15%)	*0.003*
Anastomotic leak (%)	5 (29.41%)	1(5%)	0.075
Pneumonia (%)	1 (5.88%)	0	0.46
Wound infection (%)	3 (17.65%)	0	0.088
Urinary tract infection (%)	1 (5.88%)	0	0.46
Portal vein thrombosis (%)	1 (5.88%)	0	0.46
Small bowel obstruction	0	1 (5%)	> 0.999
Bleeding requiring transfusion	0	1 (5%)	> 0.999
30-day postoperative CT scan (%)	7 (41.18%)	4 (20%)	0.279
Unplanned readmission (%)	4 (23.53%)	2 (10%)	0.383
Unplanned reoperation (%)	5 (29.41%)	1 (5%)	0.075
Duration of ileostomy (days)	106 (90–169)[a]	75.5 (47.25–98.75)	0.098
30-day complication after ileostomy reversal (%)	0[a]	2 (10%)	> 0.999
Length of follow up (months)	27.82 ± 24.02	23.85 ± 19.68	0.792

[a]Three patients who developed an anastomotic leak after an undiverted pouch required reoperation with subsequent diverting ileostomy

diverted). There was a trend towards increased length of stay in the undiverted group (8.17 ± 2.79 days) compared to the diverted group (6.83 ± 2.14 days), however, the difference was not statistically significant. 83.33% of patients in the undiverted group had a 30-day postoperative complication rate compared to 14.29% in the diverted group ($p = 0.029$). There were no significant differences in anastomotic leak, use of unplanned CT, readmission rate, or reoperation rate between the two groups.

Functional outcomes (Table 4)

There were no significant differences in functional outcomes between the two groups. The overall prevalence of pouchitis in our series was 43.2% also with no significant difference between groups. Both groups reported an average of six bowel movements per day.

Discussion

The purpose of our study was to investigate the role of fecal diversion in CP-IPAA in pediatric UC patients who have already had an initial STC-I. Advocates for routine fecal diversion during pouch creation have cited the mitigation of anastomotic complications with a diverting loop ileostomy [6]. However, closing the loop ileostomy is an additional procedure with its own associated set of complications [14] that is often underestimated. A systematic review of the adult literature by Chow et al. [15] analyzed the outcomes of over 6000 cases of ileostomy closure and reported morbidity as high as 17.3%. Thus, proponents of an undiverted pouch argue that the overall patient morbidity of the combined procedures is not increased by avoiding fecal diversion [8, 10]. Grobler et al. [16] in a small randomized controlled trial in adults in 1992 found low rates of pelvic sepsis and a relatively high incidence of stoma related complications in their population. They thus concluded that the overall increased risk of an adverse event associated with diversion outweighs the potential benefits after restorative proctocolectomy. In a more recent study, Stey et al. [17] compared the cost and resource utilization of diverted versus undiverted pouches at a single institution and found that undiverted restorative proctocolectomy was a higher value procedure with more favorable outcomes at a lower cost. Further observational outcomes studies in the adult literature have strongly supported both sides of this debate and practice patterns continue to vary depending on institutional and surgeon preference [18, 19].

In pediatric patients with UC, the risk profile for developing an anastomotic leak after already undergoing a STC-I and being weaned off immunosuppressive medications should theoretically mimic that of pediatric patients with familial adenomatous polyposis who frequently undergo a single staged pouch procedure [20]. Children and teenagers, in particular, may benefit the most from avoiding an ileostomy with its additional procedural and anesthetic time, and potential resulting body image issues [12, 21]. While other small single institution studies in the literature have investigated the outcomes of pediatric proctocolectomy patients with and without diversion and found similar outcomes between the two groups [11–13], none have focused on this specific subset of patients.

In our series, patients who underwent an undiverted CP-IPAA had a significantly increased length of stay and complication rate compared to diverted pouches. However, there was no significant difference seen in rates of anastomotic leak, readmission, CT use, and reoperation. The overall anastomotic leak rate was 16.2%, which is on par with the leak rate reported in the literature for pediatric UC patients [22–24]. In the adult literature, the rate of pouch related septic complications is about 20% [25] with anastomotic leak rates ranging from 5 to 19% [26–28]. For those five patients with an initially undiverted pouch who developed an anastomotic leak, three patients required an additional operation for fecal diversion. These three patients had a trend towards a longer time between diversion and closure of ileostomy (106, 90–169 days vs. 75.5, 47.25–98.75 days). While not statistically significant, there is clearly a trend towards an increased rate of clinically detectable anastomotic leaks in the undiverted group (29.4%) versus the diverted group (5%). It is possible that the diverted patients had anastomotic leaks that went undetected. However, they also had shorter lengths of stay, decreased need for postoperative CT scans, and decreased readmission rates. If there are hidden subclinical leaks in the diverted group, our data does not indicate that those leaks translated to a post-operative clinical course that is on par to that of patients with clinically

Table 4 Functional outcomes

Functional outcomes	Undiverted	Diverted	*p* value
Reports symptoms of pouchitis (%)	7 (41.18%)	9 (45%)	> 0.999
Number of stricture dilations	0.588 ± 0.795	0.842 ± 0.602	0.207
Daily reported bowel movements	6 ± 1.617	6 ± 1.932	0.829
Nocturnal bowel movements (%)	5 (35.71%)	6 (42.86%)	> 0.999
Symptoms of incontinence (%)	1 (7.14%)	0	> 0.999

apparent leaks. Other studies have also found increased episodes of subsequent bowel obstructions [17] with diverted pouches compared to undiverted, however, we did not recapitulate this finding in the mean follow up of 25 months in our series. While the higher leak rate in our series did not lead to significant differences in the long-term outcomes, a leak rate of 30% compared to 5% must be carefully considered in determining both a surgeon's and patient's tolerance to short-term risk in hopes to avoid a stoma.

Additionally, the increased initial overall perioperative complication rate in the undiverted pouches also did not translate to functional differences when comparing undiverted pouches to diverted pouches. This finding confirms previously published studies in the pediatric UC literature [29]. Koivusalo et al. [30] found that complications after IPAA were not associated with worsened functional outcomes in pediatric UC patients except for those with septic complications or with the final diagnosis of Crohn's disease. The overall rate of pouchitis in our series was 43.2% and was not significantly different between the diverted and undiverted group. Gray et al. [12] showed in their series of pediatric UC patients who underwent IPAA that diverted patients had significantly more anastomotic dilations per patient compared to undiverted patients, however, we did not find a significant difference in our series. While functional status is difficult to assess in a retrospective review, overall the patients in our series had excellent functional outcomes with relatively few patients reporting nocturnal bowel movements and symptoms of incontinence in both groups. However, further studies, notably including quality of life surveys, will be critical in dictating the "success" versus "failure" of the procedure from the patient's point of view.

Our study is limited by its retrospective nature and small sample size and resulting lack of power. We were purposefully rigorous and inclusive in defining anastomotic leak by including any patient with an intra-abdominal fluid collection adjacent to the anastomosis. It is possible that these patients in fact had an intact anastomosis that was unrelated to the fluid collection and thus the leak numbers reported have the potential to be over-inflated. Additionally, patients in the diverted group could have subclinical anastomotic leaks that are not picked up by this data. Given the retrospective nature of the study, there is selection bias between the two study groups with surgeon preference dictating the decision to divert. Additionally, there was no standardization in operative approach or postoperative care given the diverse group of surgeons whose patients are included in the study. The rise in comfort with laparoscopy is reflected in our data which spans 2008 to 2016 with increased use of laparoscopy in more recent cases, as well as increased use of laparoscopy in diverted patients, which is likely the result of the specific surgeons' practices included in the analysis. Time between subtotal colectomy and pouch creation was significantly longer in the undiverted group, which could be a potential confounding point in our results and likely influenced the surgeon's decision to perform and undiverted pouch. A prospective randomized controlled trial would diminish the effects of selection bias, however, the practicality of performing such a study may be limited. Thus, while the results of this small sample of patients from large tertiary care referral centers may not be generalizable to the population at large, the outcomes reported in our study may be useful in improving preoperative patient counseling to help guide decision making in this subset of patients.

Conclusions

In our series, patients who underwent an undiverted CP-IPAA after initial STC-I had significantly more complications in the immediate postoperative period compared to diverted patients, although this did not translate into long-term differences in functional outcomes. Our finding of a higher anastomotic leak rate and overall complication rate in the undiverted group compared to the diverted group clearly speaks to the dramatically altered post-operative course experienced by patients with an undiverted pouch leak compared to patients with a diverted pouch. Both groups likely experienced a similar anastomotic leak rate, as it is difficult to imagine that simple proximal diversion upon completion of the pouch would alter the technical creation of the IPAA, however, patients with diverted pouches with potential subclinical undetected leaks have a post-operative course that is overall less eventful with decreased post-operative CTs, readmissions, and length of stay. The failure to easily detect IPAA leaks in diverted patients without routine cross sectional imaging speaks to the significant protection and benefit proximal diversion offers in this scenario and the impact diversion can have to decrease post-operative morbidity. It is clear that we need a better understanding of perioperative complications and their long-term risks in children with UC who undergo an undiverted CP-IPAA to improve our ability to select and counsel this unique population of patients. Centers with a robust experience in the surgical management of pediatric UC can at best report their series anecdotally acknowledging the complexity of the heuristics that go into the decision to divert. A collaborative effort to create a pediatric surgical inflammatory bowel consortium would provide much needed national data to help guide decision making for future patients and clinicians.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval For this type of study formal consent is not required. This article does not contain any studies with animals performed by the authors.

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