Ostomy Closures in Children: Variations in Perioperative Care Do Not Change the Outcome

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Abstract This study aimed to evaluate ostomy closure applications and outcomes and determine the effect of personal differences among surgeons on patient postoperative course. Ninety-eight patients who underwent elective ostomy (ileostomy and colostomy) closure for 8 years at a pediatric surgery training department were investigated. Postoperative complications included superficial surgical site infection (SSI; 9.4 %), organ/cavity infection (1 %), small bowel adhesions (8.2 %), and incisional hernia (1 %). SSI and postoperative complications were not affected by the preoperative antibiotic regimen used. Operation duration, pre- and postoperative antibiotic use durations, postoperative inpatient period, ostomy type, primary diagnosis, performance of abdominal exploration, SSI, and postoperative complications were not significantly different. However, the time of nasogastric (NG) tube withdrawal, time to oral feeding initiation, abdominal closure method used, and preoperative antibiotic regimen were significantly different among different surgeons. We conclude that while surgeons used different preoperative antibiotic regimens and abdominal closure methods and stipulated different times

for NG tube withdrawal and oral feeding initiation, the postoperative course and prognosis were unaffected. Thus, the pre- and postoperative inpatient period and antibiotic use duration can be decreased in children by procedure standardization using practice guidelines; the procedures can also be performed with a more aesthetic, acceptable incision.

Keywords Ostomy · Colorectal surgery · Treatment outcome · Antibiotic prophylaxis · Surgical wound infection · Anastomosis · Surgical

Introduction

Ostomy closure is a frequent elective procedure in pediatric surgery. Despite the benefits for the child, this procedure is associated with serious risks such as surgical site infection (SSI), anastomotic dehiscence, postoperative small bowel adhesions, and even mortality. However, there is no consensus in the literature regarding preoperative mechanical bowel cleansing (MBC), duration of pre- and postoperative antibiotic use, administration of routine nasogastric (NG) decompression, and time of postoperative oral feeding initiation for these patients. The approach to these issues thus depends on the preference of the attending surgeons.

This study aimed to evaluate the application and outcomes of ostomy closures and to determine the effect of personal differences among surgeons on the postoperative course of patients.

Patients and Methods

The study group consisted of patients who underwent elective ostomy (ileostomy and colostomy) closure surgery between

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January 2005 and December 2012 at our clinic, a pediatric surgery training department. Patients in whom ostomy closure was performed as part of another surgery and those who underwent ostomy closure with an emergency indication were excluded from the study.

Our hospital is a high-volume training and research hospital for gynecology/obstetrics and pediatrics. A total of eight pediatric surgeons, five of whom are among the training staff, work at our clinic. The surgeries in the study were performed by residents who were at least in their second year. During surgery, they were monitored by one of the specialists.

The records of patients in the hospital information system were retrospectively evaluated to determine the demographic data, primary disease diagnoses, level and type of ostomy used, surgeon who performed the operation, time between opening and closure, surgical duration, whether only the ostomy ends were released or if exploration and bridectomy were performed, whether pre- and postoperative antibiotic administration and preoperative MBC were performed, forms of abdominal layer closure used, time to the first postoperative gas and stool passage, time of NG tube withdrawal, time of oral feeding initiation, postoperative complications, and inpatient period.

Preoperative MBC was performed three times a day via irrigation with physiological saline (PS) starting from patient admission. No products containing polyethylene glycol were used for MBC. The patients were divided into three groups on the basis of the preoperative antibiotic regimen used, which differed according to the preference of the surgeon: (1) *Oral antibiotic group*: Trimethoprim/sulfamethoxazole and ornidazole administered before surgery, oral feeding terminated at 13:00 on the day of surgery, and intravenous (IV) ampicillin+amikacin+clindamycin/metronidazole (triple antibiotics) were started and continued after surgery; (2) *IV antibiotic group*: IV triple antibiotics were started, oral feeding was terminated the day before surgery, and antibiotics were continued after surgery; and (3) *No preoperative antibiotics group*: Oral feeding was terminated before surgery, IV triple antibiotics were administered at anesthesia induction, and antibiotics were continued after surgery.

Following skin preparation with 10 % povidone-iodine under general anesthesia, the ostomy ends were released with an ostomy circumferential incision. The whole abdomen was explored, and adhesions were separated if the surgeon felt this was necessary. To ensure the continuity of the bowel, intra-peritoneal anastomosis was performed with intermittent polyglycolic acid (PGA) sutures placed manually end-to-end in a double row. The peritoneal cavity was washed with plenty of warm PS and aspirated after anastomosis. All skin incisions were primarily closed and not left for secondary recovery. Each abdominal layer was washed with PS and dried before it was closed. The abdomen was closed using three methods according to the preference of the surgeon: (1) *Mass closure*

group: all abdominal layers were fully closed with intermittent polypropylene sutures; (2) *Peritoneum fascia single layer group*: the peritoneum and fascia were closed with intermittent PGA sutures, and the subcutaneous layers and the skin were closed separately with intermittent PGA sutures; and (3) *Layered closure group*: the peritoneum, fascia, subcutaneous layers, and the skin were closed separately with intermittent PGA sutures avoiding dead space. No drain was used. An NG tube was inserted routinely during surgery. NG drainage was continued, and the patients were not fed orally until findings indicated the return of bowel function such as gas or stool passage. After NG tube removal, oral feeding was initiated but at a time preferred by the surgeon.

SSI was diagnosed according to the guideline for the prevention of surgical site infection [1]. Small bowel adhesions were diagnosed postoperatively in patients who presented with symptoms of postoperative abdominal pain, nausea and vomiting, and abdominal distension; who could not defecate; and who were found to have small bowel obstruction on standing direct abdominal X-ray [2].

Statistical analyses were performed using SPSS for Windows version 16 (SPSS Inc.) software. The distribution of continuous variables was evaluated using the One-Sample Kolmogorov–Smirnov test. Normally distributed data are shown as the mean±standard deviation, and non-normally distributed data are shown as the median and minimum–maximum. Two averages for constant variables were compared using the *t* test for normally distributed data and the Mann–Whitney *U* test for non-normally distributed data. To compare constant variables among groups, one-way ANOVA was used if the assumptions were met and Kruskal–Wallis variance analysis was used if they were not met. If *p* was significant in the ANOVA test, the *t* test was used to determine which of the groups was different; the Mann–Whitney *U* test was used for the Kruskal–Wallis test. Categorical variables were analyzed using the chi-square test. *p*<0.05 was accepted as significant.

Results

A total of 116 ostomy closures were performed during the study. Eighteen patients who did not comply with the study criteria were excluded, and thus, 98 patients were included in the final analysis. The time to the first postoperative gas passage was only noted for 12 patients. Therefore, this criterion was excluded from the evaluation.

In total, 49 females and 49 males were included in the study. The surgical data for these patients are presented in Table 1. The data on durations are presented in Table 2.

Nine (9.4 %) patients had superficial SSI, and one (1 %) patient had an organ/cavity infection. Eight (8.2 %) patients had small bowel adhesions, and one (1 %) patient had an

Table 1 Patient surgical data

		<i>n</i> (%)
Ostomy level	Right transverse colon	42 (43.3 %)
	Sigmoid colon	34 (35.1 %)
	Ileum	11 (11.3 %)
	Others	10 (10.3 %)
Ostomy type	Separated	61 (64.2 %)
	Loop	28 (29.5 %)
	Hartmann's pouch	6 (6.3 %)
Primary diagnosis	Anorectal malformation	42 (42.9 %)
	Hirschsprung's disease	25 (25.5 %)
	Intestinal perforation	21 (21.5 %)
	Rectal trauma	7 (7.1 %)
	Colonic atresia	1 (1 %)
	Meconium ileus	1 (1 %)
	Volvulus	1 (1 %)
Abdominal exploration and bridectomy	Not performed	75 (76.5 %)
	Performed	23 (23.5 %)
Abdominal closure method	Layered closure	71 (72.4 %)
	Mass closure	20 (20.4 %)
	Peritoneum fascia mass	7 (7.1 %)
Preoperative antibiotic regimen	Oral antibiotic group	70 (71.4 %)
	Preoperative no antibiotic group	19 (19.4 %)
	IV antibiotic group	9 (9.2 %)

incisional hernia as a postoperative complication. The patient with an incisional hernia underwent a further surgery at a later date. No anastomotic dehiscence was observed in our patient series.

The median duration of preoperative antibiotic use was 3 (1–10) days in the oral antibiotic group and 2 (1–3) days in the IV antibiotic group ($p=0.002$; Mann–Whitney *U*). The median postoperative duration of antibiotic use was 6 (4–18) days

Table 2 Data of the patients regarding durations [median/mean±standard deviation (minimum–maximum)]

	Median/mean	Min–max
Age	27.5 months	(4–206)
Time between the opening and closure	50 weeks	(6–513)
Surgical duration	162±47 min	(54–300)
Preoperative hospitalization period	3 days	(0–20)
Preoperative antibiotic use duration	3 days	(1–10)
Postoperative antibiotic use duration	7 days	(3–41)
First postoperative stool passage	3 days	(1–21)
NG tube withdrawal time	4 days	(5–25)
Oral feeding initiation time	5 days	(3–30)
Postoperative hospitalization period	7 days	(4–41)

in the no preoperative antibiotics group, 7 (5–15) days in the IV antibiotic group, and 7 (3–41) days in the oral antibiotic group ($p=0.287$; Kruskal–Wallis). The incidence of SSI and postoperative complications did not differ according to the preoperative antibiotic regimen ($p=0.585$ and $p=0.777$, respectively; chi-square).

Furthermore, the surgical duration did not differ significantly according to the ostomy level ($p=0.549$; ANOVA), abdominal closure method used ($p=0.342$, ANOVA), or the incidence of SSI ($p=0.320$, ANOVA) and postoperative complications ($p=0.520$, ANOVA). However, the surgical duration was significantly longer among patients who underwent abdominal exploration than among those who did not (195 ± 45 vs. 152 ± 43 min, respectively; $p<0.001$; *t* test). The surgical duration thus differed significantly according to ostomy type ($p=0.004$; ANOVA).

The surgical duration was also significantly longer among patients who had Hartmann's pouch than among those who underwent separated or loop ostomy (217 ± 56 , 165 ± 41 , and 148 ± 52 min, respectively; $p=0.006$ and $p=0.006$; *t* test). The surgical duration did not differ between those who underwent separated or loop ostomy ($p=0.084$; *t* test).

While the abdomen was closed in a layered manner in 77.3 % (58/75) of the patients who did not undergo abdominal exploration and bridectomy, this rate decreased to 56.5 % (13/23) among those who underwent these procedures. This difference was significant ($p=0.038$; chi-square).

When differences among surgeons were examined, no significant difference was observed in surgical duration, duration of pre- and postoperative antibiotic use, time to the first postoperative stool passage, and postoperative inpatient period. However, a significant difference between surgeons was observed in the time of NG tube withdrawal, and the time of oral feeding initiation (Table 3). There were no significant differences among surgeons in the ostomy type employed, primary diagnosis, performance of abdominal exploration, and incidence of SSI and postoperative complications, but a significant difference was observed in the abdominal closure method used and the preoperative antibiotic regimen prescribed (Table 4).

The median follow-up duration was 11 (0–81) months.

One patient (1 %) died; the patient had colonic atresia and had undergone ileostomy for perforation during the neonatal period. The patient developed small bowel adhesions and underwent two further surgeries but died on the 40th day after ostomy closure.

Discussion

The mean duration of colostomy closure varies from 77 to 133 min in the literature [3, 4]. In our series, the mean duration of ostomy closure was 162 ± 47 min. The relatively long

Table 3 Duration according to the preference of the surgeon [median/mean±standard deviation (minimum–maximum)]

Surgeon	Surgical duration (minutes)	Preoperative antibiotic use duration (days)	Postoperative antibiotic use duration (days)	First postoperative stool passage (days)	Postoperative hospitalization period (days)	NG tube withdrawal time (days)	Time of oral feeding initiation (days)
1 <i>n</i> =17	177±51 (54–250)	3 (1–7)	7 (6–13)	3 (2–4)	7 (6–13)	4 (3–6)	5 (4–6)
2 <i>n</i> =21	160±41 (90–270)	3 (1–7)	6 (3–14)	3 (1–5)	6 (4–40)	3 (2–6)	4 (3–6)
3 <i>n</i> =9	125±34 (80–180)	3 (2–3)	7 (5–41)	4 (2–21)	7 (5–41)	5 (4–25)	6 (5–30)
4 <i>n</i> =7	158±43 (102–231)	3 (2–4)	7 (5–12)	4 (2–4)	7 (5–12)	4 (3–4)	5 (3–5)
5 <i>n</i> =23	166±55 (90–300)	3 (1–10)	6 (4–22)	3 (2–7)	6 (5–22)	4 (3–7)	4 (3–8)
6 <i>n</i> =11	182±34 (120–225)	3 (2–4)	7 (5–15)	4 (2–5)	7 (5–15)	4 (3–5)	5 (4–6)
7 <i>n</i> =3	150±1 (150–151)	2 (2–7)	8 (5–9)	3 (1–5)	8 (6–8)	3 (2–4)	4 (3–4)
8 <i>n</i> =3	173±76 (85–225)	–	7 (6–8)	3 (2–6)	7 (6–8)	3 (2–5)	5 (4–6)
9 <i>n</i> =4	140±46 (93–200)	2 (1–2)	6 (5–11)	3,5 (1–5)	6 (5–11)	3,5 (3–5)	4 (4–5)
<i>P</i>	0.225 ^a	0.277 ^b	0.317 ^b	0.627 ^b	0.828 ^b	0.004 ^b	0.017 ^b

^a One-Way ANOVA^b Kruskal-Wallis

duration may be because the procedures were performed by relatively inexperienced residents. However, the surgical duration did not influence the incidence of complications in our series. Although extended surgical duration has been identified as an independent risk factor for SSI by some studies due to prolonged exposure to microorganisms in the operating environment and diminished efficiency of antimicrobial prophylaxis, other studies have shown that the duration of ostomy closures does not have an effect on the incidence of complications, which is supported by our findings [5, 6]. The duration of ostomy closure was longer when Hartmann's pouch was employed versus separated and loop ostomies, which is similar to previous reports, and therefore, avoidance of the use of Hartmann's pouch if possible will be less traumatic for the patient [7]. Moreover, no specific indication exists for Hartmann's pouch ostomy in pediatric surgery.

MBC was performed routinely in our study in order to reduce the fecal burden; however, the necessity of this procedure is controversial. A review in 2011 reported no supporting evidence for MBC or the use of rectal enemas and stated that bowel cleansing in colonic surgery can be safely eliminated [8]. Many studies have suggested that anastomotic leakage is even more frequent in patients undergoing bowel cleansing [9].

There is no consensus on the optimal duration of antibiotic use after elective colorectal surgery [10]. No difference was found between the duration of postoperative antibiotic use and

the incidence of SSI and postoperative complications according to the preoperative antibiotic regimen used in our study. We therefore believe that changing to antibiotic use at induction may be useful for decreasing the duration of preoperative hospitalization, amount of antibiotic used, and consequently the possible side effects.

Surgeons classically use an NG catheter to speed up the return of bowel function after abdominal surgery, prevent lung complications, reduce the risk of anastomotic leakage, increase patient comfort, and shorten the inpatient period [11]. These theoretical advantages have not been supported by properly planned studies. In fact, some studies have shown a lower incidence of atelectasis and pulmonary complications in patients who did not undergo NG decompression [12]. The routine postoperative use of an NG catheter is reportedly unnecessary in most major abdominal operations in children [11, 12]. An NG catheter was used routinely in our series, and the routine catheter withdrawal time varied depending on the surgeon's preference despite the lack of other influencing factors, such as intestinal adhesions.

SSI is a serious cause of morbidity in patients after surgery. Although there are surgeons who prefer secondary closure to prevent SSI as colostomy closure is a contaminated procedure, primary skin closure can be performed safely [13, 14]. All our incisions were closed primarily, and no subcutaneous drain was placed. Our SSI rate was 9.2 %. Rates of SSI due to ostomy closure vary between 0 and 36 % in the literature [4,

Table 4 Categorical data relating to the preference of the surgeon (chi-square)

Surgeon	Ostomy type			Primary diagnosis				Abdominal exploration	
	Separated	Loop	Hartmann's pouch	ARM	Hirschsprung's disease	Perforation	Rectal trauma	Others	Not performed
1 <i>n</i> =17	7	6	3	7	6	3	–	1	11
2 <i>n</i> =21	16	4	1	13	4	3	1	–	20
3 <i>n</i> =9	2	7	–	1	5	3	–	–	9
4 <i>n</i> =7	6	1	–	4	0	2	1	–	5
5 <i>n</i> =23	14	5	2	10	5	5	2	1	16
6 <i>n</i> =11	9	2	–	4	2	2	2	1	6
7 <i>n</i> =3	2	1	–	1	1	1	–	–	2
8 <i>n</i> =3	2	1	–	1	1	–	1	–	2
9 <i>n</i> =4	3	1	–	1	1	2	–	–	4
<i>P</i>	0.165			0.825					0.099

Surgeon	Postoperative complications			Abdominal closure methods			Preoperative antibiotic regimen			
	None	Superficial	Organ/cavity	None	Small bowel adhesions	Incisional hernia	Layered closure	Mass closure	Peritoneum fascia single layer	Oral antibiotic
1 <i>n</i> =17	16	1	–	17	–	–	17	–	–	14
2 <i>n</i> =21	19	2	–	19	2	–	20	1	–	10
3 <i>n</i> =9	9	–	–	8	1	–	6	–	3	5
4 <i>n</i> =7	7	–	–	7	–	–	6	1	–	4
5 <i>n</i> =23	20	2	1	1	4	1	6	14	3	21
6 <i>n</i> =11	9	2	–	11	–	–	7	4	–	10
7 <i>n</i> =3	2	1	–	3	–	–	3	–	–	3
8 <i>n</i> =3	3	–	–	3	–	–	3	–	–	–
9 <i>n</i> =4	3	1	–	3	1	–	3	–	1	3
<i>P</i>	0.876			0.782			<0.001			<0.001

5, 14, 15]. The mean SSI rate was 14 % (17/118) in a similar study where the incisions were primarily closed after ostomy closure in children, and SSI rates did not differ according to bowel cleansing and preoperative and postoperative antibiotic regimens, which supports our own findings [10].

Prospective studies have revealed that closing abdominal incisions using mass or layered closures with PGA sutures does not change the outcome in children, and non-absorbable sutures are not necessary [16]. The cosmetic and functional outcome of ostomy closure scars is important in children, and it is sometimes the only visible reminder of the underlying disease [17]. Closing the layers one by one also prevents the creation of a dead space. Mass or secondary closure that produces aesthetically worse results and more pain should be avoided [14].

The habit of leaving a patient hungry after abdominal surgery is under discussion. Oral feeding is classically initiated when postoperative distention decreases and gas or stool passage begins. In cases where intestinal anastomosis is performed, the patients are not allowed oral feeding until the surgeon feels that the anastomosis is safe. Randomized studies have shown that early feeding of adults after lower gastrointestinal surgery reduces hospitalization and complications [18]. Experimental peritonitis models have also demonstrated the healing effect of early enteral feeding [3]. Early feeding after ostomy closure in children has similarly been shown to stimulate bowel movements without increasing complications [3]. Children can be given clear liquids on the first day if there is no distension or vomiting [14].

A limitation of our study is that it was retrospective. We plan to continue monitoring the patients after establishing a common consensus between surgeons.

Conclusion

While different surgeons used different preoperative antibiotic regimens, abdominal closure methods, times to NG tube removal, and times for oral feeding initiation, none of these affected the postoperative course and prognosis. In conclusion, ostomy is an important procedure that has both psychological and social impacts on the children and their families. The preoperative inpatient period and duration of antibiotic use in children can be decreased by standardization of the procedures used through the implementation of practice guidelines for each clinic and the procedure can be performed with an aesthetically more acceptable incision.

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