Types and Levels of Colostomy in Children with Anorectal Malformation

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ABSTRACT

Objective: Divided colostomy for anorectal management is often recommended due to reports of higher complications associated with loop colostomy. This study was conducted to compare outcomes and complications in colostomies in children with anorectal malformations according to type and level of colostomy.

Materials and Methods: A retrospective study was performed in children with anorectal malformations who underwent a colostomy at Siriraj Hospital between December 2003 and June 2018.

Results: Out of 167 patients, 159 had a loop colostomy while 8 had a divided colostomy. Overall complication rates were 33.3% for loop colostomy and 62.5% for divided colostomy (p = 0.100). Urinary tract infection was the most frequently encountered complication in both loop and divided colostomies, at 23.7% and 50%, respectively (p = 0.094). The prolapse rate in the loop colostomy group was 8.8 % and 0% in the divided colostomy group (p = 0.376). Overall complication rates with respect to location of stoma also did not differ (p = 0.706). Prolapse rates were 15.8 % in transverse colostomy and 7.1 % in sigmoid colostomy (p = 0.231). Overall complications rates of colostomy closure in loop and divided colostomy was 7.5% and 12.5%, respectively (p = 0.672). Non-inferiority was demonstrated by the differences in overall complications of loop and divided colostomy (p = 0.008).

Conclusion: There was no difference in incidence of complications between type or location of colostomy performed in children with anorectal malformations. Loop colostomy was non-inferior to divided colostomy in respect to overall complications.

Keywords: Anorectal malformation; loop colostomy; divided colostomy; colostomy prolapse; urinary tract infection; complication (Siriraj Med J 2022; 74: 693-698)

INTRODUCTION

Among all congenital anomalies, the gastrointestinal anomaly was the second most common system involved (33.67%).[1] Anorectal malformations are a common gastrointestinal anomaly encountered by pediatric surgeons worldwide. There is a wide spectrum of malformations, ranging from simple cutaneous fistula to cloacal malformations. Colostomy, with subsequent definite repair is the standard treatment in those with non-low type anorectal malformation. Loop colostomy was the only preferred option in Division of Pediatric Surgery at Siriraj Hospital for more than five decades, until divided colostomy was firstly introduced by Peña A, who developed posterior sagittal anorectoplasty, the most popular definite operation for anorectal malformation in 1982.[2-5] Divided colostomy is generally preferred over loop colostomy due to the higher rate of complications associated with the latter, which includes prolapse, risk of incomplete diversion of feces that causes subsequent distension of distal rectal pouch, and possible contamination

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of feces into the urinary tract in those with a connecting fistula between the rectum and genitourinary system.[2-6] However, controversy still surrounds the higher risk of complications associated with loop colostomies compared to divided colostomies with previously published studies showing debatable results.[7-9] Thus, this study was conducted to describe and compare outcomes and complications of colostomies in children with anorectal malformations according to type and level of colostomy. Outcomes related to colostomy closure with respect to type of colostomy were also compared.

MATERIALS AND METHODS

Following approval by the Siriraj Institutional Review Board (Si 175/2019) a retrospective study was conducted in children with anorectal malformations who underwent a colostomy at Siriraj Hospital between December 2003 to June 2018. Children with cloacal exstrophy and major chromosomal anomalies incompatible with life and those with incomplete medical information were excluded from the study. Patients' demographics, type of malformation, location and type of colostomy was collected. First, a colostomy was performed and this was followed by definitive repair. Following achieving an adequate neo-anus size as dilated by the parents, colostomy closure was performed. Loop colostomy was the preferred option in our division at Siriraj Hospital. Complications during colostomy were recorded, including prolapse, retraction, parastomal hernia, urinary tract infection, bleeding, and skin excoriation. Upon colostomy closure, operative time and complications were noted. Complications during colostomy closure included wound infection, wound dehiscence, and anastomosis leakage. The collected data was analyzed using SPSS software version 18 (SPSS Inc. Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc.). Continuous data was expressed as median and IQR and categorical data expressed as numbers and percentages. A Chi square test or Fisher's exact test was used to compare outcomes in type and location of colostomy. Non-inferiority test for difference in overall complications between loop and divided colostomy was conducted. Non-inferiority was demonstrated when lower bound of the 95% one-sided CI for difference in overall complications was lower than pre-specified non-inferior margin of 10%. A p-value of <0.05 indicated statistical significance.

RESULTS

Of the 178 patients whose medical records were reviewed, 11 were excluded, which meant 167 patients were included in the study. Out of the 167 patients included, 159 underwent loop colostomies while eight had a divided colostomy for fecal diversion. One hundred and four out of 159 participants were male, of which 98 had a loop colostomy. Sixty-three patients were female, of which 61 underwent a loop colostomy. For colostomy level, there were four locations in total; ascending colon, transverse colon, descending colon, and sigmoid colon. The majority of patients underwent a (134 out of 167) sigmoid loop colostomy. There was a wide distribution of malformation types ranging from imperforate anus without fistula to complex defects without significant differences between the loop and divided colostomy group (Table 1).

The differences in complications found in the loop and divided colostomy groups were not significant (Table 2). Overall complication rates were 33.3% in the loop colostomy group and 62.5% in the divided colostomy group ($p = 0.100$). Urinary tract infections were the most frequently observed complications in both the loop (23.3%) and divided (50%) colostomy group. The prolapse rate was 8.8% in the loop colostomy group and 0% in the divided colostomy group, while skin excoriation was 6.3% in the loop colostomy group and 12.5% in the divided colostomy group. When comparing complications according to colostomy location, there were no difference in overall or individual complications (Table 3). Interestingly, no statistically significant difference was noted in overall complications or prolapse rates between the transverse and sigmoid colostomy.

The median operative time for colostomy closures was 160 minutes for loop colostomy and 195 minutes for divided colostomy. The difference was not statistically significant ($p = 0.128$). The incidence of complications such as wound infection, wound dehiscence, and leakage following closures in loop colostomy and divided colostomy were not statistically significant (Table 4).

When statistics for non-inferiority were performed, with pre-specified non inferior margin of 10% between loop and divided colostomies, non-inferiority was demonstrated as the difference in overall complications ($p = 0.008$).

DISCUSSION

Colostomy with subsequent definite repair is the standard treatment in people with non-low type malformation. Divided colostomies have been proposed over loop colostomies due to reports of an increase in complications associated with loop colostomy.[2-6] In fact, loop colostomy was condemned by Pena A,[2,4,5] a world authority in anorectal malformation management, due to an increased prolapse rate, risk of incomplete diversion of feces causing subsequent distension of distal rectal pouch,

TABLE 1. Comparison of the patient characteristics between the loop colostomy and the divided colostomy.

Variable	Loop Colostomy (n = 159)	Divided Colostomy (n = 8)	Total (n = 167)	*P*-value
Gender, n (%)				0.711
Male	98 (61.6%)	6 (75.0%)	104 (62.3%)	
Female	61 (38.4%)	2 (25.0%)	63 (37.7%)	
Level of Colostomy, n (%)				0.137
Ascending	3 (1.9%)	0 (0%)	3 (1.8%)	
Transverse	18 (11.3%)	1 (12.5%)	19 (11.4%)	
Descending	2 (1.3%)	1 (12.5%)	3 (1.8%)	
Sigmoid	134 (84.3%)	6 (75.0%)	140 (83.8%)	
Type of Malformation, n (%)				0.819
Imperforate Anus Without Fistula	30 (18.9%)	3 (37.5%)	33 (19.8%)	
Perineal Fistula	10 (6.3%)	0 (0%)	10 (6.0%)	
Vestibular Fistula	14 (8.8%)	0 (0%)	14 (8.4%)	
Rectovaginal Fistula	6 (3.8%)	0 (0%)	6 (3.6%)	
Rectobulbar Urethral Fistula	26 (16.4%)	0 (0%)	26 (15.6%)	
Rectoprostatic Urethral Fistula	19 (11.9%)	1 (12.5%)	20 (12.0%)	
Rectobladder Neck Fistula	11 (6.9%)	1 (12.5%)	12 (7.2%)	
Rectovesicle Fistula	9 (5.7%)	0 (0%)	9 (5.4%)	
Persistent Cloaca < 3 Cm	13 (8.6%)	1 (12.5%)	14 (8.4%)	
Persistent Cloaca > 3 Cm	7 (4.4%)	0 (0%)	7 (4.2%)	
Rectal Atresia	3 (1.9%)	0 (0%)	3 (1.8%)	
Complex Defect	3 (1.9%)	0 (0%)	3 (1.8%)	

TABLE 2. Complications from colostomy, comparing between loop colostomy and divided colostomy.

	Loop Colostomy (n = 159)	Divided Colostomy (n = 8)	Total (n = 167)	*P*-value
Overall Complication, n (%)	53 (33.3%)	5 (62.5%)	58 (34.7%)	0.100
Prolapse	14 (8.8%)	0 (0%)	14 (8.4%)	0.376
Retraction	2 (1.3%)	0 (0%)	2 (1.2%)	0.747
Parastomal Hernia	1 (0.6%)	0 (0%)	1 (0.6%)	0.820
Urinary Tract Infection	37 (23.3%)	4 (50.0%)	41 (24.6%)	0.094
Bleeding	5 (3.1%)	0 (0%)	5 (3.0%)	0.607
Skin Excoriation	10 (6.3%)	1 (12.5%)	11 (6.6%)	0.502

TABLE 3. Complications from colostomy, comparing among different sites.

Variables	Ascending colostomy (n = 3)	Transverse colostomy (n = 19)	Descending colostomy (n = 3)	Sigmoid colostomy (n = 140)	*P*-value
Overall Complication, n (%)	2 (66.7%)	6 (31.6%)	1 (33.3%)	50 (35.7%)	0.706
Prolapse	1 (33.3%)	3 (15.8%)	0 (0%)	10 (7.1%)	0.231
Retraction	0 (0%)	0 (0%)	0 (0%)	2 (1.4%)	0.948
Parastomal Hernia	0 (0%)	0 (0%)	0 (0%)	1 (0.7%)	0.981
Urinary Tract Infection	2 (66.7%)	5 (26.3%)	1 (33.3%)	34 (24.3%)	0.409
Bleeding	0 (0%)	0 (0%)	0 (0%)	5 (3.6%)	0.820
Skin Excoriation	1 (33.3%)	0 (0%)	0 (0%)	10 (7.1%)	0.168

TABLE 4. Outcomes at colostomy closure, comparing between loop colostomy and divided colostomy.

Variable	Loop Colostomy (n = 159)	Divided Colostomy (n = 8)	Total (n = 167)	*P*-value
Operative time (min)				0.128
Median (min. max)	160 (35, 457)	195 (120, 215)	160 (35, 157)	
Complications, n (%)	12 (7.5%)	1 (12.5%)	13 (7.7%)	0.672
Wound Infection	8 (5.0%)	1 (12.5%)	9 (5.39%)	0.410
Wound Dehiscence	1 (0.6%)	0 (0%)	1 (0.6%)	0.814
Leakage	1 (0.6%)	0 (0%)	1 (0.6%)	0.814
Gut Obstruction	3 (1.9%)	0 (0%)	3 (1.8%)	0.682
Incisional Hernia	1 (0.6%)	0 (0%)	1 (0.6%)	0.814

TABLE 5. Overall complications in loop and divided colostomy.

	Loop colostomy (n=159)	Divided colostomy (n=8)	Difference (95% one-sided CI)	Non-inferiority test (*P*-value)
Overall complications	53 (33.3%)	5 (62.5%)	-28.5% (-1.7, ∞)*	0.008**

*Non-inferiority was demonstrated (lower bound of the 95% one-sided CI for difference in overall complications between loop and divided colostomy was lower than pre-specified non-inferiority margin of 10%)

**Non-inferiority was demonstrated and *p*-value of non-inferiority test was less than significant level of 0.05

and possible contamination of feces into the urinary tract in patients with a connecting fistula between the rectum and genitourinary system.[2-5] However, in our study, there was no statistically significant difference between the loop and divided colostomy group regarding overall complications. The complication rate associated with loop colostomies in this study was consistent with previously published studies at about 20%-30%.[3,7,9] However, this study elicited a higher rate of complications in divided colostomies compared to other studies (62.5% vs. 8%-30%).[3,7,9]

The prolapse rate of loop colostomies was quite low in our study (8.8%) compared to other published studies which reported rates of up to 18%.[3,9] A low prolapse rate in loop colostomies in our institution might be the result of the stoma creation technique used at our center where loop colostomy was performed at the descending-sigmoid colonic junction and the proximal and distal limb of colostomy site were sutured together prior to exteriorization and fixation at sheath and skin. The suturing of the proximal and distal limb may have decreased the mobility of colon.

Divided colostomies were preferred over loop colostomies due to risk of fecal contamination into the distal rectourinary fistula in the latter.[2,4] Although urinary tract infection was the most common complication, there was no significant difference between the loop and divided colostomy group in this study. This finding was consistent with previously published studies.[3,7] A loop colostomy conducted in the proper way was able to complete fecal diversion and was not different from divided colostomy.

Regarding location of colostomy, no statistically significant difference in complication rates was elicited in this study. However, our study had higher rates of overall complications for both transverse and sigmoid colostomies compared to results published by van den Hondel et al[9] and Demirogullari et al.[10] This might be the result of including urinary tract infection as a complication in our study while other studies did not include it. Previous literatures have revealed that transverse colostomies have a higher prolapse rate than other colostomy locations.[9-11] Regarding transverse colostomies, our study had a lower prolapse rate than others. As mentioned previously, this might be due to our surgical technique of placing sutures between the proximal and distal limb of colon prior to exteriorization of stoma at sheath and skin. Also, we had more experience performing a loop colostomy regardless of location when compared to other studies.

Since there were no significant differences in complications in loop and divided colostomies, we attempted to determine whether loop colostomy was non-inferior compared to divided colostomy in respect to complication rates. The non-inferior margin was pre-determined to be 10%. Interestingly, we found that non-inferiority, which was shown as a *p*-value in the non-inferiority test, to be less than the significant level of 0.05. This had not been shown in previously published studies.

Since there was no difference in complications between loop and divided colostomies during the stoma creation period, outcomes during and after colostomy closure were investigated to demonstrate the advantage of one stoma over the other. The operative time for colostomy closure seemed shorter for loop colostomy at 160 minutes compared to 195 minutes for divided colostomy. However, there was no significant difference to suggest easier closure in loop colostomy. Complications such as wound infection, wound dehiscence and anastomotic leakage were also not significantly different.

The limitation of this study was its retrospective design which means some information might be missing. Moreover, the number of subjects was relatively small at 167 patients. Also, there were a smaller number of divided colostomy patients compared to the loop colostomy group as it is our division's preference to perform the latter. This made comparison between the two groups difficult in the study. However, our results were similar to previously published studies in which loop colostomy had good results compared to divided colostomy. A multicenter study may be performed in the future to increase the number of patients and data of divided colostomy cases.

CONCLUSION

Loop colostomy is non-inferior to divided colostomy in terms of overall complications and is a feasible diversion procedure for anorectal malformation. Proper technique and experience with loop colostomy helps achieve complete diversion of feces with outcomes similar to that of divided colostomy.

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