



# The morbidity of a divided stoma compared to a loop colostomy in patients with anorectal malformation<sup>☆</sup>



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## ABSTRACT

**Purpose:** Loop colostomies may contaminate the genitourinary (GU) tract in patients with anorectal malformations (ARM) owing to incomplete diversion of stool. Stoma complications are also thought to be higher with a loop versus divided colostomy. We sought to compare the morbidity, including urinary tract infections (UTI), in these two types of colostomies in children with ARM.

**Methods:** A review was performed at a children's hospital (1989–2014). Children with ARM who had a colostomy performed were identified. Demographic data and outcome variables were collected. Analyses included Student's *t*-test, Fischer's exact and logistic regression as appropriate.

**Results:** 171 patients were identified (loop = 78; divided = 93). Thirty percent of patients with a divided colostomy and 24% with a loop experienced a stoma complication ( $p = 0.5$ ). A subgroup analysis of children with a rectourinary fistula (54 divided, 26 loop) was performed to assess for effect of colostomy type on UTI. After controlling for other UTI risk factors (major GU anomalies, vesicostomy, and prophylactic antibiotics), loop ostomies were not associated with risk of UTI (OR 0.83, 95% CI 0.27–2.63). No patient with a loop colostomy developed megarectum.

**Conclusions:** Children with ARM who undergo a loop colostomy are not at a detectable increased risk of experiencing a UTI compared to a divided stoma. The rate of stoma complication is high regardless of the type of stoma created.

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Children born with an anorectal malformation (ARM) and no fistulous opening on the perineum will generally have a colostomy created initially and the definitive repair performed at a later time. Creation of a loop colostomy versus a divided colostomy and mucous fistula has been debated owing to the theoretical risk of contaminating the urinary tract with a loop stoma [1]. Also, loop colostomy may be more prone to complications such as prolapse [2,3]. Our practice varies in the type of colostomy created in these newborns. We sought to review our experience and examine complications associated with each type of colostomy in this population. Specifically, we sought to test the commonly held view that loop colostomies are associated with an increased risk of urinary tract infection in children with a rectourinary fistula.

## 1. Methods

Following IRB approval, a retrospective review was performed at our tertiary care children's hospital (January 1989 to August 2014) of children born with an ARM who underwent colostomy creation. Patients were

identified using our Pediatric Colorectal Center database. Patient demographics, associated anomalies, incidence of wound infection, urinary tract infection (UTI) and stoma complications were collected by reviewing our electronic medical record. Children with a fistulous connection to the genitourinary (GU) tract underwent subgroup analysis. Children with ARM were excluded from this study if they did not undergo colostomy creation or if the medical record was incomplete.

All patients were managed by a group of seven surgeons at our children's hospital. The decision to create a divided or loop colostomy was at the discretion of the treating surgeon. In the majority of cases, the divided colostomy was performed in a standard fashion by placing the proximal sigmoid colon in the lateral aspect of the left lower quadrant incision and the mucous fistula in the medial aspect of the incision. A small skin bridge was created in between the two stomas. Loop colostomies were created predominantly at the level of the proximal sigmoid colon. Definitive reconstructions were performed at a later date followed by colostomy closure.

Wound infection was defined as cellulitis treated with antibiotics or a superficial surgical site infection requiring opening of the incision or stoma revision. Patients were considered to have a UTI if they experienced a febrile illness with positive urine culture and initiation of antibiotics or a change in the antibiotic regimen if already on prophylactic antibiotics. Patients with renal dysplasia, vesicoureteral reflux or neurogenic bladder were considered to be at an increased risk of UTI at baseline and were

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**Table 1**  
Type of anorectal malformation and colostomy.

Malformation	Loop	Divided	Total
Rectal atresia/stenosis	5	7	12
Rectoperineal	3	8	11
Rectovestibular/vaginal	27	10	37
Cloaca	4	17	21
Rectobulbar/prostatic	14	27	41
Rectobladder neck	8	8	16
Imperforate anus without fistula	6	9	15
Unknown	11	7	18
<b>Total</b>	<b>78</b>	<b>93</b>	<b>171</b>

categorized as having an UTI predisposing GU anomaly. Patients were considered to have developed a megarectum if significant rectal dilation was identified on the preoperative distal colostogram or if tapering of the rectum was required at the time of the anorectoplasty.

The primary outcome was the prevalence of urinary tract infection with additional outcomes including any stoma complication and wound infection. Statistical analysis was performed with SAS 9.2 software (SAS Institute, Cary, NC). Univariate analysis was performed using Student's *t*-test for continuous variables. Categorical variables were compared using Fischer's exact test. Multivariable modeling was performed using logistic regression.

## 2. Results

One hundred seventy-eight patients were identified. Seven patients were excluded owing to incomplete records. The mortality rate was 9% (12/16 with congenital heart disease). Seventy-eight of the 171 patients had a loop colostomy (46%). The types of ARM in our cohort are shown in Table 1. Baseline characteristics including gender, gestational age, birth weight, presence of a genitourinary anomaly associated with UTI, presence of a vesicostomy, and stoma duration were similar between the two groups (Table 2). Patients were more likely to be given a divided colostomy if a rectourinary fistula was present ( $p = 0.0047$ ). The majority of patients had the colostomy performed at the level of the proximal sigmoid colon (94%; loop = 75, divided = 89).

A subgroup analysis of 80 children with a rectourinary fistula (54 divided, 26 loop) was performed to assess for effect of colostomy type on UTI risk. The two groups were not different in terms gestational age, birth weight, GU anomalies, vesicostomy, prophylactic antibiotics, or stoma duration (Table 3). The prevalence of at least one episode of UTI was 44% in the divided colostomy group and 39% in the loop colostomy group. This difference was not significant ( $p = 0.64$ ). Univariate analyses (Fischer's exact test) showed genitourinary anomalies, vesicostomy and prophylactic antibiotics to be associated with significant increased risks of at least one episode of UTI. Patients with renal dysplasia, vesicoureteral reflux, or neurogenic bladder were at 3.1 fold increased risk of developing a UTI ( $p = 0.001$ ). Vesicostomy was associated with a 2.1 fold increased risk ( $p = 0.01$ ) and prophylactic antibiotics risk was 2.0 fold ( $p = 0.014$ ). The results of a logistic regression model including these risk factors and stoma type are shown in Table 4. On logistic regression, when controlling for urinary anomalies

**Table 2**  
Baseline characteristics.

	Loop (78)	Divided (93)	P-value
Gestational age median (min-max)	38.0 weeks (27–41)	38.0 weeks (29–41)	0.7
Birth weight median (min-max)	2719 g (970–3345)	2835 g (785–3945)	0.12
Rectourinary fistula	26 (40%)	54 (64%)	0.005
GU anomaly associated with UTI	15 (60%)	33 (67%)	0.61
Vesicostomy	4 (5%)	13 (14%)	0.07
Stoma duration (median weeks)	47.7	43	0.77

**Table 3**  
Baseline characteristics of subset with rectourinary fistula.

	Loop (26)	Divided (54)	P-value
Gestational age (Median)	39.0 weeks (27–41)	37.5 weeks (30–41)	0.44
Birth weight median (min-max)	2920 g (970–3345)	2853 g (960–3843)	0.32
GU anomaly associated with UTI	15 (60%)	33 (67%)	0.61
Vesicostomy	2 (7.7%)	11 (20%)	0.20
Prophylactic antibiotics	8 (31%)	17 (31%)	1.0
Stoma duration (median weeks)	48	48.3	0.24

that predispose to UTI, stoma type, vesicostomy, or the use of prophylactic antibiotics was not associated with increased or decreased risk of UTI. In this multivariable model GU anomalies continued to be significantly associated with UTI.

Thirty percent of patients with a divided colostomy and 24% with a loop colostomy (Table 5) experienced a stoma complication ( $p = 0.5$ ). Seventeen percent in the divided stoma group and 14% of those with a loop colostomy required stoma revision ( $p = 0.7$ ). Patients with a vesicostomy were at an increased risk of experiencing a stoma complication which required colostomy revision (RR = 3.19,  $p = 0.0071$ ). No patient with a loop colostomy developed megarectum.

## 3. Discussion

Creation of a colostomy is often the initial surgical management of newborns with anorectal malformations. A divided stoma created at the junction of the descending and sigmoid colon has been recommended [4]. The proximal stoma is created using the first mobile part of the colon immediately distal to the descending colon where there is a normal retroperitoneal attachment. The stomas are then placed within the incision and separated enough to allow the stoma bag to cover only the proximal stoma thereby isolating the mucous fistula. Potential advantages of this technique compared to a loop colostomy include a smaller and more manageable stoma, decreased incidence of stoma prolapse, elimination of risk for fecal impaction in the distal loop and preservation of sufficient length of colon distal to stoma for tension free pullthrough [1,5,6]. Furthermore, it is believed that creating a loop colostomy in these children increases the risk of UTI from fecal contamination through the rectourinary fistula [1].

In this study, we were unable to detect a significant difference in stoma complications or the need for stoma revision between the loop colostomy and divided stoma groups. This is similar to the findings of Patwardhan et al. [4] but contrary to others who have reported an overall incidence of any stoma complication as 31%–63% with loop colostomy versus 15%–45% with divided stomas [2,3]. Our incidence of stoma prolapse (loop 8% vs. divided 10%) was slightly lower than other reports of 15%–18% with loop colostomies and similar to the 3%–6% reported for divided stomas [1–4]. This is likely owing to the fact that we created the majority of our stomas at the first mobile part of the sigmoid colon, immediately distal to the descending colon, regardless of whether or not we separated the bowel. The reason for the association between vesicostomy and need for colostomy revision is unclear, but is likely related to the limited space on the abdominal wall in these young children.

It is not surprising that we were more likely to create a divided stoma in malformations with a rectourinary fistula given the often

**Table 4**  
Results of logistic regression for risk of UTI (includes only children with rectourinary fistula).

Risk factor	Odds ratio (95% CI)	P-value
Divided ostomy	1.2 (0.38–3.7)	0.78
Urinary anomaly	5.5 (1.7–17)	0.005
Prophylactic antibiotics	2.7 (0.79–9.4)	0.11
Vesicostomy	2.3 (0.47–11)	0.30

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