

Outcome of Divided and Loop Sigmoid Colostomy for the Management of Anorectal Malformation (ARM): A Comparative Study

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Abstract: Background: Anorectal Malformation (ARM) is one of the common congenital anomalies in the world. There are various surgical options for management of ARM. Colostomy is usually performed as a first stage in a new born with high and intermediate variety of anorectal malformations. The aim of the study was to compare the clinical outcomes between divided and loop sigmoid colostomy for the management of anorectal malformations. **Material and Methods:** This prospective comparative study was conducted on 130 pediatric patients at the Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute, who were admitted with anorectal malformations (ARM) up to 7 days of age, from March 2018 to February 2021. Informed consent was obtained after proper counselling with the guardian. They were randomly assigned to the divided sigmoid colostomy group (group 1=65 neonates) and loop sigmoid colostomy group (group 2=65 neonates). The comparative parameters between two groups were the operation time, post-operative complications such as wound infection, skin excoriation, prolapse of colostomy, retraction of colostomy and parastomal hernia. All patients were followed up for 2 months post-operatively. **Results:** The mean age of the patients was 2.43 ± 1.39 days in group 1 and in group 2, the mean age was 2.61 ± 1.73 days where majority of the patients were male. The statistical difference between the two groups regarding operation time was highly significant (0.0001). After operation, 26.15% patients developed skin excoriation in group 1 where in group 2, 29.23% patients developed skin excoriation. In group 1, 6.15% patients developed wound infection but none of them developed prolapse, retraction of colostomy and parastomal hernia. On the other hand, in group 2, 1.54% patient developed wound infection, 15.38% patients developed prolapse and 6.15% patients developed retraction of colostomy and no patient experienced parastomal hernia. The statistical difference between the two groups regarding prolapse of colostomy was significant ($p=0.042$). **Conclusion:** In our study, the frequency of different stoma-related problems was greater in

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the loop colostomy group, although being statistically insignificant. In the divided group, there was significantly less stoma prolapse. In light of these results, divided stoma should be suggested for newborns with ARM.

Keywords: Anorectal malformation, Colostomy, Divided sigmoid colostomy, Loop sigmoid colostomy.

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INTRODUCTION

Anorectal malformations (ARMs) represent a spectrum of congenital abnormalities involving the distal anus and rectum as well as the urinary and genital tracts [1-3]. This is one of the common congenital anomalies in the world [4]. The prevalence of this disease is 1 in 3000 to 5000 live births globally [5]. The cause has not been fully elucidated but it is likely to be multifactorial and include genetic and environmental factors [6, 7]. Males are more affected than females and may occur as a single abnormality or a combination of abnormalities [8-10]. ARMs have been reported to be associated with other congenital anomalies in up to 70% of cases [8, 9, 11]. The final prognosis and quality of life for children with ARMs depend, to a large extent, on the presence and severity of these associated anomalies [11]. Early diagnosis, management of associated anomalies, and efficient meticulous surgical repair provide patients the best chance for a good functional outcome [12]. Various types of colostomy formation have been in use at various pediatric surgery centers. The common types of colostomies used for staged correction of high variety ARM, especially in male neonates, are divided colostomy and loop colostomy. Both have their benefits and drawbacks and optimal technique is still debatable [13, 14]. To treat congenital anomalies, the majority of pediatric surgeons now employ the posterior sagittal technique with or without laparotomy or laparoscopy [15]. Trans-fistula anorectoplasty also done for anorectovestibular fistula in female neonate [16, 17]. The high morbidity of neonatal colostomies has been proven by clinical research, and transverse colostomies are more likely to have difficulties than sigmoid colostomies [18]. Pena advises a divided and separated proximal sigmoid colostomy [13]. To remove the obstruction, a straightforward loop colostomy at the intersection of the descending and sigmoid colons with a sufficient spur is extremely effective [19]. Many surgeons utilize loop colostomies, probably because they may be opened and closed fast. Urinary tract infections, distal fecal impaction, retraction, and prolapse are all caused by loop colostomies. Prolapse is a condition that could be dangerous [13]. In order to reduce prolapse, a number of specialized surgical procedures have been reported, including skin bridges, subcutaneous tunnels for bowel escape, purse-string sutures at the

fascial level, and an anchoring U stitch. Infection of the wound, stomal bleeding, and skin excoriation are essentially same in both groups [20]. Given this background, a randomized controlled trial was done to assess the outcome of divided and loop sigmoid colostomy in the management of anorectal malformation (ARM).

MATERIALS & METHODS

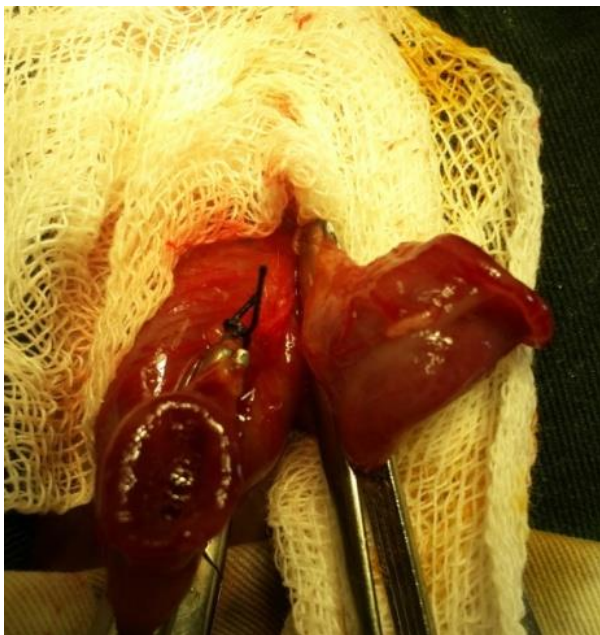
This prospective observational study was conducted on 130 pediatric patients at the Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute, who were admitted with anorectal malformations (ARM) up to 7 days of age, from March 2018 to February 2021. Informed consent was obtained after proper counselling with the guardian. Variety of ARM was diagnosed by an X-ray prone cross table lateral view with elevated buttock after 24 hours of birth for those patients where no fistulous tract was identified. Patients with ARM who required colostomy up to the age of 7 days were included in this study. Pouch colon syndrome, VACTERL association, intestinal perforation, septicemia and DIC, other gross congenital anomalies, parents/guardian refusal in participation were excluded. Complete blood count, bleeding time, clotting time, blood group and Rh typing, serum creatinine, serum electrolytes, random blood sugar was done in all the selected patients. USG of KUB region was done to see any renal anomaly, Plain X-ray of abdomen in erect posture and Echo cardiogram also done when required. After careful evaluation of the study cases with physical findings and imaging techniques the variety of ARM was assessed and a treatment plan was set up accordingly. They were randomly assigned to the divided colostomy group (group 1=65 neonates) and loop colostomy group (group 2=65 neonates). All the patients got Inj. Cefazidime, Inj. Metronidazole and Inj. Amikacin

Operative Technique

Divided Sigmoid Colostomy:

Patient was placed in supine position on the operative table. After General anaesthesia, proper painting with povidone iodine and draping was done. One preoperative dose of antibiotic was given. An oblique incision was made halfway between the anterior superior iliac spine and the umbilicus on the left side of the abdomen. The anterior rectus sheath and the external oblique aponeurosis

together with the internal oblique muscle were incised along the line of skin incision. The peritoneum was opened and a part of the proximal sigmoid colon was delivered through the skin and the colon divided. The proximal stoma was created using the first mobile portion of the colon immediately distal to the descending colon. The distal segment was copiously irrigated to remove all the meconium. The proximal stoma was exteriorized through the upper and lateral part of the wound and the mucous fistula was placed in the medial or lower part of the wound. The stoma sutured in three layers by 4/0 vicryl. The mucous fistula was made very small to prevent prolapse. The stomas were separated enough to allow the use of a stoma appliance. The intervening portion was then repaired in layers. The operative time was recorded starting from the incision to the last stitch.



Photograph 1: Divided sigmoid colostomy

Loop Sigmoid Colostomy:

Patient was placed in supine position on the operative table. After General anaesthesia, proper painting with povidone iodine and draping was done. One preoperative dose of antibiotic was given. An oblique incision was made halfway between the anterior superior iliac spine and the umbilicus on the left side of the abdomen. The anterior rectus sheath and the external oblique aponeurosis together with the internal oblique muscle were incised along the line of skin incision. The peritoneum was opened and a part of the proximal sigmoid colon was delivered through the skin and kept it in place using a rubber catheter to prevent fall back. Then the peritoneum in the first layer and the muscle as a second layer were sutured to the colonic seromuscular layer with a few interrupted

4/0 vicryl. A U-shaped stich was taken in the two limbs of the colostomy with the peritoneum and the muscle layer to prevent prolapse and retraction of the colostomy. The colon was then opened longitudinally with cutting diathermy. Then the full-thickness of the opened colon was stitched with surrounding skin with absorbable 4/0 vicryl suture. The operative time was recorded starting from the incision to the last stitch.



Photograph 2: Loop sigmoid colostomy

For the first post-operative day (POD), all patients received only intravenous fluid replacement (fourth to half strength normal saline with 10% dextrose as needed) and paracetamol suppository. Assessed factors were appearance, body temperature, abdominal distension, urination, stoma condition, and wound state. Breast milk and IV fluid were injected starting from the second and third POD in accordance with the needs. They were also instructed to wear stoma equipment and frequently apply zinc oxide paste (40%) around the stoma. Only breast milk was advised between the third and fifth POD. On the sixth POD, all patients were discharged with instructions regarding stoma care, stoma function, stoma condition, wound care, and parastomal skin condition. For the second, fourth, and eighth weeks following surgery, all patients were instructed to visit the operating room. A clinical evaluation of the patient's feeding history, stoma color, wound infection, skin excoriation, colostomy prolapse or retraction, and parastomal hernia was performed at each follow-up visit.

To preserve uniformity, the data were manually reviewed, revised, and validated after data collection was complete before being tabulated. SPSS (statistical package for social science) version

20 statistical software was used to do the statistical analysis. The study's findings were displayed in tables by frequency and percentage. The characteristics of the entire sample were described using means and standard deviations for continuous variables and frequency distributions for categorical variables. A student t-test was used to evaluate

associations between continuous data. Using the Chi-square test and Fisher exact test, associations between categorical data were evaluated. A p value of <0.05 was regarded as significant for both tests.

RESULTS

Table1: Comparison of age and sex distribution of the participants between two groups

Age (in days)	Group 1(n=65)	Group 2(n=65)	P value
Mean ±SD	2.43±1.39	2.61±1.73	0.498
Male	37(56.9)	36(55.4)	0.763
Female	28(43.1)	29(44.6)	

Above table shows the age and sex distribution of two groups. In group 1, the mean age of participants was 2.43±1.39days and in group 2, the mean age of participants was 2.61±1.73days. The range was from 1 day to 7 days in both the groups. P value was 0.498 (t-test).37(56.9) participants in

group-1 and 36(55.4) participants in group-2 were male. In both groups majority of the participants were male. There was no significant difference between the groups (p-value=0.763) (Pearson’s Chi-square test).

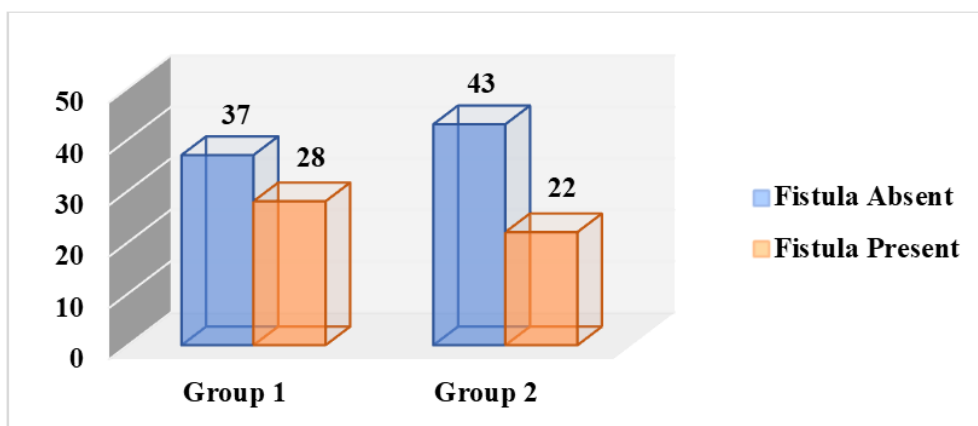


Figure1: Distribution of fistula in two groups

Above figure reveals that fistula was absent 37(56.92%) cases in Group-1 whereas in Group-2, 43 (66.15%) participants had no fistula.

Table 2: Clinical characteristics of the participants between two groups

Variable	Group (n=65)	Group 2 (n=65)	P-value
Birth weight (Mean± SD)	2.64±0.26	2.71±0.28	0.374
Gestational age, n (%)			
Term	57(87.69%)	58(89.23)	0.982
Preterm	8(12.31%)	7(10.77)	
Associated anomalies, n (%)			
Absent	53(81.54)	54(83.08)	0.813
Present	12(18.46)	11(16.92)	

Above table shows the clinical characteristics of the study patients in two groups. In group 1, the mean birth weight of participants was 2.64±0.26kg. In group 2, the mean birth weight of participants was 2.71±0.28kg. p value was 0.374(t-test). In group 1, 57(87.69%) of the participants were term babies whereas in group 2

58(89.23) of the participants were term babies. P value was 0.982 (Fisher exact test). Associated anomaly was absent in 53(81.54) cases in group 1 whereas in group 2, 54(83.08) participants had no associated anomaly. P value was 0.813 (Pearson’s Chi-square test).

Table 3: Comparison of operation time between two groups

Operation time(In minutes)	Group 1(n=65)	Group 2(n=65)	P value
Mean±SD	42.31±3.02	30.78±2.99	0.0001

Table 3 shows that, the mean operation time of group 1 and group 2 was 42.31±3.02 and 30.78±2.99 respectively. P value was 0.0001 (t-test).

Table 4: Stoma related complications of the participants between two groups

Type of complications	Group 1 (n=65)		Group 2 (n=65)		Total		P value
	n	%	n	%	N	%	
Skin excoriation	17	26.15%	19	29.23%	36	27.69%	0.732
Wound infection	4	6.15%	1	1.54%	5	3.85%	0.493
Prolapse	0	0	10	15.38%	10	6.15%	0.042
Retraction	0	0	4	6.15%	4	3.08%	0.388
Parastomal hernia	0	0	0	0	0	0	---

Above table presents the Stoma related complications of the participants between two groups. In group 1, 17 (26.15%) participants developed skin excoriation and in group 2, 19 (29.23%) participants developed skin excoriation. P value was 0.732 (Pearson’s Chi-square test). In group 1, only 4 (6.15%) patients developed wound infection where as in group 2, one patient developed wound infection. P value was 0.493 (Fisher exact

test). In group-1, no patient developed prolapse of colostomy where as in group-2, 10(15.38%) patients developed prolapse of colostomy. P value was 0.042 (Fisher exact test). In group 1, no patient developed retraction of colostomy where as in group 2, only 4 (6.15%) patients developed retraction of colostomy. P value was 0.388 (Fisher exact test). After operation no patient developed parastomal hernia in any group.



A. Healthy

B. Skin excoriation

C. Wound infection

Fig. 2: Dividing Colostomy



A. Healthy

B. Colostomy Retraction

C. Colostomy Prolapse

Fig. 3: Loop Colostomy

DISCUSSION

One of the most prevalent surgical procedures worldwide is the creation of a colostomy for ARM. Divided colostomy and loop colostomy at the level of the descending or sigmoid colon are two common techniques for colostomy development in cases of anorectal abnormalities [6, 13, 14, 21, 22]. Each method has advantages and disadvantages of its own. Mucosal prolapse, colostomy stenosis, mucosal haemorrhage, anaemia, parastomal herniation or evisceration, stoma retraction, urinary tract infection, and distal faecal impaction are common sequelae of colostomy creation in cases of anorectal abnormalities [6, 13, 14, 21-24]. In this study, in group 1, the mean age of participants was 2.43 ± 1.39 days where the range was from 1 day to 7 days. In group 2, the mean age of participants was 2.61 ± 1.73 days where the range was from 1 day to 7 days. There was no significant difference between ages of two groups as the p value was 0.498 (obtained by t-test). In both groups majority of the participants were male. This result was consistent with other studies where they also found a slight male preponderance [20, 25, 26]. In the current study, fistula was absent in 37 (56.92%) cases in group-1 where as in group- 2, 43 (66.15%) participants had no fistula. Where fistula found, female neonates had rectovestibular fistula and male neonates had rectourinary fistula. This result was consistent with other studies where the most common defect in females was rectovestibular fistula, whereas the most common defect in males was rectourethral fistula [19, 25, 26]. In this study, it was found that the mean operation time in group-1 was 42.31 ± 3.02 minutes and in group-2 it was 30.78 ± 2.99 minutes. The statistical difference between these two groups was highly significant as the p value was 0.0001. The operation time was more in group-1 because the incision was large; the colon was separated completely and was fixed separately in the two ends of the incision. In between the colostomy loops the repair was done in three layers. It is noted here that there was no operation time mentioned in any literature while comparing the two types of operation. Skin excoriation is a common problem after colostomy. It is caused by the stool contact with the surrounding skin. In patients with ARM, Odaet *et al*, [18] examined the complications of loop vs divided stomas and discovered significantly greater complications in the group with the loop colostomy [31.5% in the loop group and 15.5% in the divided group ($p=0.031$)]. On multivariate analysis, only stoma prolapse was revealed to be substantially different from the other several stoma-related problems. Similar to the previous study, loop colostomies had statistically greater stoma prolapse complications than other

stoma-related complications. Transverse loop colostomy and sigmoid loop colostomy have the highest rates of stoma prolapse, respectively. Reverse peristalsis produced in the distal unused colon is thought to be transmitted mostly by the continuation of the mesenteric side of the colon, resulting in prolapse. Forming a divided stoma is typically used to treat recurrent stoma prolapse that is unresponsive to other interventions. It follows that primary divide stomas should have a lower likelihood of developing stoma prolapse. Patients with ARM are advised to have divided stomas. Pena suggested that before securing the distal stoma to the abdominal wall, it should have its lumen narrowed. Moreover, this lessens the chance of stoma prolapse in these kids [6, 13]. A catheter can be inserted into the distal stoma's constricted lumen to perform a distal colostogram later on during care. Another potential advantage of a divided stoma is a decreased risk of urethral infections (UTI). As is common knowledge, a rectus fistula with the urinary system exists in the majority of patients with high variation ARM, particularly in newborn males. In 26 trials with 3864 newborns who had ARM, 2241 individuals underwent loop colostomies and 1994 underwent divided colostomies, according to a meta-analysis. UTI incidence was not significantly different according to meta-analysis (OR: 2.55 [0.76, 8.58], $p=0.12$), however prolapse rates were significantly greater for loop colostomies [27]. A study conducted in India found 30.2% skin excoriation in the study [13]. In the present study, skin excoriation was absent in majority of cases. In group-1, 17 (26.15%) participants developed skin excoriation and in group- 2, 19 (29.23%) participants developed skin excoriation. There was no statistical association between two groups regarding skin excoriation as the p value was 0.732 (>0.05). In this study only sigmoid colostomy was fashioned. Formed stool came through sigmoid colostomy which was less irritant and did not pass frequently like those of transverse colostomy. Skin excoriation was also consistent with Sheikh *et al*, 25.0% [28] and Lister *et al*, 21.6% [29]. After operation no patient developed parastomal hernia in any group in the present study. This result was also consistent with other study where parastomal hernia occurred in 3% cases of loop colostomy and in divided colostomy no patient developed parastomal hernia [18]. So, stoma prolapse is the only complication with loop colostomies that is much more common and sometimes requires a second operation for revision, which increase the morbidity and treatment costs. Similarly, in our study, stoma prolapse was considerably higher in the loop stoma group whereas all other stoma-

related problems were equivalent between the two procedures.

CONCLUSION & RECOMMENDATION

In our study, the frequency of different stoma-related problems was greater in the loop colostomy group, although these were statistically insignificant. There was significantly less stoma prolapse in the divided group than in the loop colostomy group. Although divided colostomies took significantly longer operative time, but experienced insignificantly less skin excoriation, wound infection, and retraction of the colostomy. In light of these results, this study recommends that divided sigmoid colostomy should be suggested for newborns with ARM.

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