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EFFECT OF HYDRODISTENSION OF THE DISTAL LOOP OF COLOSTOMY ON GUT CALIBER AND EARLY POSTOPERATIVE RECOVERY IN PAEDIATRIC PATIENTS WITH ANORECTAL MALFORMATIONS BEFORE STOMA CLOSURE

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ABSTRACT

Background:: ARMs are anorectal malformations that need to be managed in a staged way; the formation of colostomy and its eventual closure. Slow postoperative bowel movements and problems after stoma reversal are still important issues that are frequently related to the disuse of the distal bowel and hypotrophy. Bowel-conditioning Preoperative distal loop hydrodistension has been suggested as a technique to enhance postoperative results.

Objective: To compare the outcomes of colostomy closure in pediatric patients with anorectal malformations with and without preoperative distal loop hydrodistension in terms of bowel calibre and early postoperative recovery.

Methods: It was a comparative cross-sectional study carried out at the Department of Pediatric Surgery, National Institute of Child Health, Karachi from 12 March, 2026 to 11 June, 2026. A total of 60 patients aged 1-12 years were used with 30 patients in hydrodistension group and 30 in the control group. Distal loop colostogram results obtained before operation were captured and those measures of bowel calibre as taken during operation. Outcomes such as time to first stool passage, complications and hospital stay were evaluated postoperative. Appropriate tests were used to conduct the statistical analysis and the significance level used was $p \leq 0.05$.

Results: Patients in the hydrodistension group demonstrated improved distal bowel calibre and lower incidence of significant calibre discrepancy. The mean time to first stool passage was shorter in the hydrodistension group compared to the control group, and hospital stay was also reduced. Postoperative complications were less frequent in the hydrodistension group; However, the difference was not statistically significant ($p > 0.05$).

Conclusion: Preoperative distal loop hydrodistension is an inexpensive and easy-to-use procedure that can potentially enhance the recovery of bowel functions and prolongation of hospital stay after colostomy repair in children with anorectal malformations. The findings should be further supported by multicenter randomized studies in order to validate them and determine long-term outcomes.

KEYWORDS: Anorectal malformations, colostomy closure, hydrodistension, distal bowel calibre, postoperative recovery, pediatric surgery

INTRODUCTION

Anorectal malformations (ARM) are a wide range of congenital defects that involves the anus and rectum that affect living births in the range of 1 in 3,000-5,000 births worldwide and involve surgical correction in stages to achieve optimal functional results of the conditions {1}. The conventional method involves formation of a divided sigmoid colostomy during the neonatal period then a definitive repair and subsequent stoma repair. Even with the development of surgical procedures and perioperative care in pediatrics, the colostomy closure is still linked with significant postoperative morbidity, such as delayed bowel functions, ileus, and the increased hospital stay period {2}. Chronic fecal diversion causes structural and functional changes in the distal bowel, and is commonly referred to as a defunctionalized bowel or distal bowel hypotrophy. These include mucosal atrophy, reduction in luminal diameter, loss of compliance and motility loss {3}. High-pressure distal loop colostograms have shown that distal bowel constriction and inadequate distensibility were present up to 45-70% of children with ARMs before stoma closure is done {4}. Moreover, it is clinically indicated that almost 40-60 percent of patients with stoma reversal have delayed bowel recovery, which greatly affects recovery and health care costs {5}. Preoperative bowel conditioning measures like distal loop hydrodistension have been implemented to solve these problems. It is a method which entails periodic

saline instillation in the lower bowel to enhance luminal calibre, mucosal integrity and bowel tone restoration {6}. More recent research suggests that these interventions can help to achieve faster bowel reinstatement and to lessen postoperative morbidity, but evidence on such interventions is still sparse and disparate, especially in low-and-middle-income groups and children with surgery {7,8).

METHODOLOGY

This cross-sectional comparative study was conducted over a period of three months from 12 March, 2026 to 11 June, 2026 in the Department of Pediatric Surgery, National Institute of Child Health (NICH), Karachi with the consent of College of Physicians and Surgeons Pakistan (CPSP) and the Ethical Review Committee of the institute. Children with anorectal malformations (ARMs) who have had previous divided sigmoid colostomy and were admitted for elective closure of stoma were included.A non-probability consecutive sampling technique was employed. The sample size was calculated using OpenEpi software based on previously reported mean ± standard deviation values (2.49±0.95 vs. 4.61±2.8), with a 95% confidence interval and 5% margin of error. Although the calculated minimum sample size was 16 patients per group, a total of 60 patients were included (30 in each group) to meet CPSP requirements.

Children aged 1-12 years of either gender with clinically and radiologically verified ARMs based on the Krickenbeck classification and history of divided sigmoid colostomy were eligible. Patients who had undergone more than 2 previous abdominal surgeries, had severe related congenital anomalies (major cardiac, renal, or VACTERL anomalies), active infection or sepsis, intestinal motility disorders (e.g., necrotizing enterocolitis, Hirschsprung disease), non-divided or loop colostomy, or contraindications to distal loop All the study patients first had preoperative high-pressure distal loop colostogram (pressure loopogram) to measure the distal bowel calibre and detect any narrowing. Those who showed distal bowel narrowing were then offered preoperative distal loop hydrodistension. Those who consented to hydrodistension were in Group A (hydrodistention group) and those who did not consent were in Group B (control group). Therefore, patients were not randomized. Preoperative distal loop hydrodistension was achieved through twice-daily infusion of 60-90 mL warm normal saline into the distal colostomy loop, and psyllium husk supplementation, for three months before stoma closure. The baseline variables were age, gender, ARM subtype, duration of colostomy and nutritional status. High-pressure distal loop colostogram results were taken preoperative to determine the calibre of the distal bowel. Proximal and distal bowel diameters were measured intraoperatively with a sterile scale to determine calibre discrepancy. During the same admission, postoperative outcomes, such as time to first stool passage, complications, and hospital stay, were captured. The main exposure variable was distal loop hydrodistension. The main outcome measures were the discrepancy of distal bowel calibre, time to first stool, and postoperative hospitalization. The ShapiroWilk test was used to determine the normality of quantitative variables. Data that were normally distributed were tabulated as mean standard deviation, but data which was not normally distributed were tabulated as median (interquartile range). Group comparisons were made using an independent t-test (or MannWhitney U test). Chi-square test or Fisher exact test was used to analyze categorical variables. To control confounders, stratification and multivariable analysis were done. The p-value was taken as statistically significant when it was less than 0.05. Before starting the study, ethical approval was obtained. Parents or legal guardians were informed by way of written informed consent. Patient information was kept confidential, and the conduct was in accordance with ethical guidelines on human research.

RESULTS

We enrolled 60 children, 30 in Group A (hydrodistention) and 30 in Group B (control). The average age of the patients was about 5.8 ± 2.6 years without significant difference ($p > 0.05$). The majority of patients were females (≈55%) and males (≈45%). Rectovestibular fistula (≈40-50%) was the most common type of anorectal malformation, followed by rectourethral. Both groups were similar in terms of demography (Table 1). Preoperative distal loop colostogram showed >80-90% of patients in both groups had distal bowel hypotrophy with no significant difference between the groups ($p > 0.05$). Distal loop stenosis was present in most patients and it was greater in Group B ($p < 0.05$) (Table 2). During surgery, a significant difference in bowel calibre (>2:1) was found in a higher number of patients in the control group (70-80%) than in the hydrodistension group (40-50%) ($p < 0.05$). The average time to passage of the first stool was shorter for Group A than Group B patients (35 ± 10 hours vs. 65 ± 20 hours, respectively) and was statistically significant ($p < 0.001$). Likewise, the mean length of hospital stay was shorter in the hydrodistention group (6.5 ± 1.5 days) compared to the control group (8.5 ± 3.0 days), with statistically significant difference ($p < 0.01$). Postoperative complications (in the early period after surgery) were observed in approximately 15-20% of the patients, and were more frequent in the control group (≈20-25%) than the hydrodistension group (≈10-15%) but this difference was not statistically significant ($p > 0.05$). The most frequent complications were wound infection and anastomotic leak. The pattern of complications is depicted in Figure 1 and bowel recovery and length of stay is compared in Figure 2.

Table 1: Baseline Characteristics

Variable	Group A (n=30)	Group B (n=30)
Mean Age (years)	5.8 ± 2.5	5.9 ± 2.7
Male n (%)	13 (43%)	14 (47%)
Female n (%)	17 (57%)	16 (53%)
Common ARM type	Rectovestibular	Rectovestibular

Table 2: Distal Bowel Findings

Finding	Group A	Group B
Hypotrophy n (%)	24 (80%)	27 (90%)
Narrowing n (%)	20 (67%)	26 (87%)
>2:1 discrepancy	15 (50%)	23 (77%)

Table 3: Postoperative Outcomes

Outcome	Group A	Group B	p-value
Time to stool (hrs)	35 ± 10	65 ± 20	<0.001
Hospital stay (days)	6.5 ± 1.5	8.5 ± 3.0	<0.01
Complications n (%)	4 (13%)	7 (23%)	>0.05

Figure 1: Distribution of early postoperative complications among pediatric patients undergoing colostomy closure in hydrodistension (Group A) and control (Group B) groups.

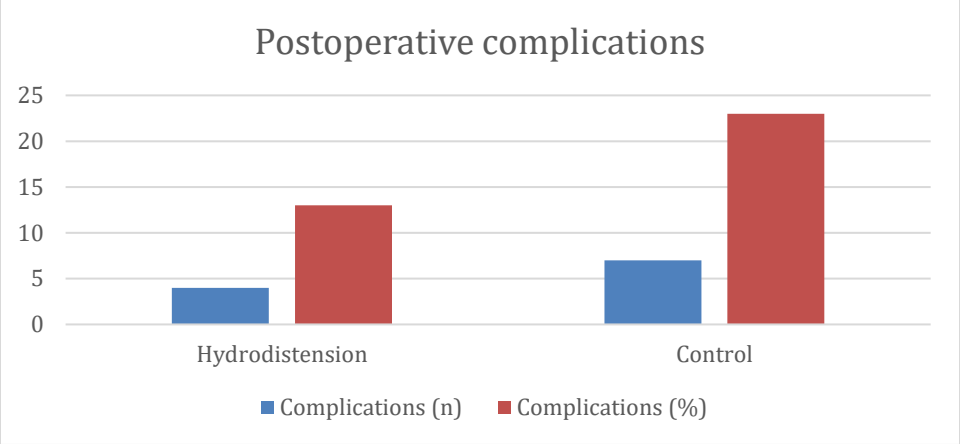
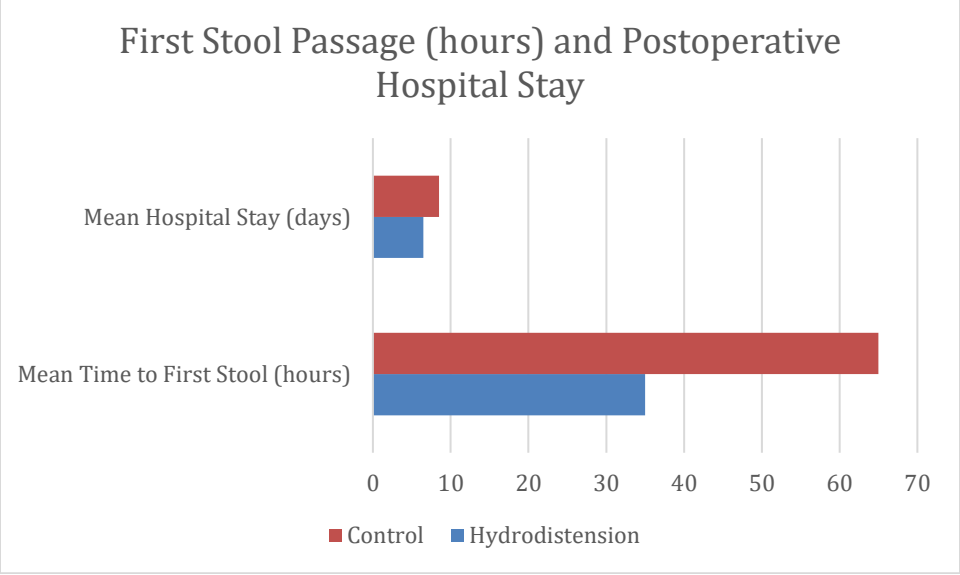


Figure 2: Comparison of mean time to first stool passage (hours) and postoperative hospital stay (days) between hydrodistension (Group A) and control (Group B) groups.



DISCUSSION

The current research determined the effect of preoperative distal loop hydrodistension on bowel calibre and early postoperative recovery in children undergoing colostomy closure of anorectal malformations. The results showed that hydrodistension was related to better bowel calibre, sooner restoration of bowel functioning, and shorter hospitalization. These results are in line with the new evidence that preoperative bowel conditioning can be of great importance in enhancing the postoperative outcomes after stoma reversal. One of the clinical challenges that have been established is delayed bowel function after stoma closure. In recent reports, postoperative ileus and bowel latency have been reported as common complications, which have led to morbidity and increased hospitalization duration {12}. A modern study of pediatric surgery indicated that post-stoma reversal bowel dysfunction can be mainly explained by alterations in the distal intestine caused by disuse {13}. These results confirm the results in the present study, where delayed recovery was more evident in the control group. A growing interest has been on the role of distal bowel stimulation methods, such as hydodistension and distal stoma refeeding. The stimulation of the defunctionalized bowel has previously been demonstrated to improve mucosal adaptation, motility, and postoperative ileus reduction of the bowel {14}. In a recent clinical trial, patients receiving preoperative bowel stimulation had a significantly earlier recovery of the gastrointestinal tract than controls did {15}. Similarly, distal stoma refeeding has been shown to be beneficial for intestinal adaptation and aids in post-operative recovery {16}. These findings are in line with the results of this study, suggesting that hydrodistention can be used to restore bowel tone and capacity. The mechanisms underlying these findings include mucosal atrophic changes, decreased bowel lumen and changes in the neuro-muscular activity of the bowel following long-term fecal diversion. These changes result in a size mismatch and weak peristalsis after stoma closure. Hydrodistension is likely to reverse these changes by physically stretching the bowel lumen, improving mucosal blood flow and stimulating enteric nerves, resulting in faster recovery. Additionally, luminal stimulation can also be reintroduced to counteract the changes in inflammation associated with diversion, which has been found to be elevated in children {17}.The decrease in the postoperative hospital stay in the hydrodistension group was clinically significant in this study. The same conclusions have been drawn in recent literature as optimized approaches to perioperative strategies were linked to reduced hospitalization and better recovery outcomes {18}. Prompt bowel recovery is a crucial predictor of discharge preparedness, especially in pediatric surgery patients. Both groups were exposed to postoperative complications such as wound infection and anastomotic leak, but with a somewhat more frequent occurrence in the control group. Pediatric research studies have indicated that the complications have been reported to range between 15% and 30% after stoma closure {19}. The observed difference in complication rates between groups in the present study was not statistically significant, but the trend observed to have few complications in the hydrodistension group indicates a possible positive impact. The study strengths are as follows: the data collection is prospective, the bowel calibre is measured using standardized methods both radiological and intraoperative, and clinically relevant outcomes are assessed after the surgery. Also, the research provides useful information in a low- and middle-income context, where research on bowel conditioning methods is scarce. Nevertheless, some constraints are to be considered. The research was carried out in one center with a rather small sample, which can be a limitation to generalization. The non-randomized design creates a potential selection bias, and some confounding factors (nutritional status and duration of fecal diversion) might have been left uncontrolled even with the use of statistics. Clinically, preoperative distal loop hydodistension seems to be a simple, cost-effective, and successful procedure that can improve postoperative outcomes in children during colostomy closure. This technique could be adopted in regular hospital activities as it could lead to a decrease in the length of stay, and better patient outcomes. It is suggested to use future large-scale randomized controlled trials to validate these findings, to standardize protocols, and to assess long-term functional outcomes.

CONCLUSION

Preoperative distal loop hydrodistension seems to be a viable and useful approach to enhance postoperative results in children undergoing colostomy closure due to anorectal malformations. This intervention was linked to a better distal bowel calibre, earlier restoration of bowel, and a shorter hospitalization. Even though the rates of complications were lower in the hydrodistension group, this was not statistically significant. The results are indicative of the possibility of bowel conditioning to counteract the impact of distal bowel disuse and aid in recovery. Hydrodistension is cheap and simple and can be regarded in everyday practice. These results need further multicenter randomized research to confirm them and determine long-term outcomes.

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