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Investigating colostomy-related morbidity in children following stoma formation and closure in a tertiary hospital, Abha, Saudi Arabia: a retrospective cohort study 2024

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Abstract

Background Overall, stoma-related morbidity affects a reported 20–38% of pediatric patients. However, determining the true incidence of major stoma-related morbidity is challenging due to limited cohort sizes in existing studies. Thus, the aim of this study was to investigate colostomy related morbidity among children both after stoma formation and stoma closure.

Methodology This is a retrospective cohort hospital-based study, conducted in an Abha maternity and children hospital, between August 1, 2018, and August 1, 2023, among 126 pediatric patients (aged 0–12 years) who underwent colostomy formation and subsequent closure during the study period. Data were collected from medical records. Data was analyzed using Statistical Package for Social Sciences (SPSS) v.26.

Results This study included a total of 126 children who underwent colostomy. ($N=37$, 29.4%) of cases included in this study were emergency cases, while ($N=89$, 70.6%) were elective. A variety of antibiotics were used for surgical prophylaxis, metronidazole (77%) and cefuroxime (62.7%) were the most prevalent. Oral feeding was started after 5–6 days in more than one third of cases (39.7%). Wound infection ($N=15$, 11.9%) was the most reported post-operative complication, followed with bowel obstruction ($N=6$, 4.8%). Emergency cases had a longer duration of hospital stay than elective cases; this difference was statistically significant ($P=.04$).

Conclusions Majority of patients reported no stoma related complications, while among those who reported complications, wound infection was the most reported complication, followed by bowel obstruction.

Keywords Colostomy, Stoma closure, Children, Abha, Saudi Arabia

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Introduction

The formation of a stoma may become essential and life-preserving in infants and toddlers confronted with bowel perforation, necrosis, or obstruction [1, 2]. In such critically unwell pediatric cases, opting for a stoma creation over a primary anastomosis is often preferred to mitigate the potential hazard of anastomotic leakage.

Colostomies are indicated for a variety of reasons, which can either be congenital or acquired anomalies, although congenital conditions appear to be more prevalent [3]. Colostomies may be placed in either the transverse or sigmoid colon and can be fashioned as either loop or defunctioning (divided) colostomies.

The congenital indications predominantly include anorectal malformation (ARM) and Hirschsprung's disease (HD). However, the proportion of each condition as an indication varies across different publications, with some reporting HD as more common [4, 5], while others indicate ARM as more prevalent [6, 7]. The incidence of colostomy for HD is declining in certain countries due to early diagnosis and the increasing use of single-stage transanal pull-through procedures [8–10]. Nevertheless, the initial placement of colostomies remains high in environments like ours and other Low- and Middle-Income Countries where delayed presentations are still common [11–13].

Historically, there were numerous transverse and loop colostomies performed, but current practice appears to favor the creation of defunctioning and sigmoid colostomies [14, 15].

Stoma creation can lead to significant morbidity associated with the stoma itself, such as necrosis, stenosis, prolapse, and the development of incisional or parastomal hernias [16]. Moreover, in cases of ileostomies, excessive fluid loss can result in dehydration and failure to thrive [17, 18]. Overall, stoma-related morbidity affects a reported 20–38% of pediatric patients, encompassing both the initial stoma formation and subsequent closure [16]. However, determining the true incidence of major stoma-related morbidity is challenging due to limited cohort sizes in existing studies [2].

Table 1 Baseline characteristics of patients, ($N = 126$)

Variable	Frequency	percentage
Age:		
< 2 years	100	79.4
2–5 years	20	15.9
6–12 years	5	4.0
13–18 years	1	0.8
Gender:		
Male	65	51.6
Female	61	48.4

*Descriptive statistics in terms of mean

The identification of risk factors associated with significant stoma-related morbidity could facilitate the development of preventive strategies or potentially prompt modifications in surgical approaches. Previous research has highlighted a lower weight at stoma closure as a potential risk factor for postoperative morbidity in individuals treated for necrotizing enterocolitis [16]. However, conflicting findings exist, as some studies have failed to corroborate low weight as a significant risk factor for morbidity following stoma closure [18–20]. Furthermore, prematurity and underlying inflammatory conditions have been linked to stoma morbidity in certain studies [22, 23]. To establish more definitive and reliable risk factors, more cohort studies are warranted. Thus, the aim of this study was to investigate colostomy related morbidity among children both after stoma formation and stoma closure.

Methods and materials

Study design

A retrospective cohort hospital-based study.

Study settings and period

The study was carried out at a single location, the Abha Maternity and Children Hospital, from August 1, 2018, to August 1, 2023. This hospital, with a capacity of 240 beds, offers a wide range of specialties, including obstetrics and gynecology, pediatric surgery, neonatal ICU, pediatric ICU, and emergency services for women and children. The pediatric surgery department, one of the largest in the region, performs surgeries on children and newborns, as well as pediatric endoscopies. Last year, this department conducted over 1,350 surgeries, including 145 for newborns, addressing conditions such as diaphragmatic hernia, severed esophagus repair, open abdominal hernia, and intestinal obstruction.

Study population

The study was conducted among pediatric patients (aged 0–12 years) who underwent colostomy formation and subsequent closure during the study period.

Sampling technique and sample size

- Simple random sampling was implemented in this study, where each member in the selected population was assigned a number and using a random number generator the numbers that were selected were enrolled in the study. Sample size was calculated using the formula:
- The sample size was calculated by the equation of known population:

$$n = N / 1 + N(d^2).$$

Table 2 Indication of surgery, preoperative management, and intraoperative events, (*N* = 126)

Variable	Subgroups	Frequency	Percentage
Indication of surgery	Emergency	37	29.4
	Elective	89	70.6
Nutritional support TPN (1 / 2)	Yes	82	65.1
	No	44	34.9
Bowel preparation by mechanical protocol (Pico-Salax/Purg-Odan with 150mL (5oz) cold water) 1/ 2	Yes	89	70.6
	No	37	29.4
Type of surgery	Closure	74	58.7
	Creation	52	41.3
Intraoperative Complications	No	126	100.0
Operative length in minutes	< 30 min	4	3.2
	30–60 min	22	17.5
	61–90 min	32	25.4
	91–120 min	22	17.5
	> 120 min	45	35.7
	Unknown	1	0.8

*Descriptive statistics in terms of mean

n = sample size.
N = population (400).
d = level of precision (0.05).
n = 196.

- Sample size is 196.

Data Collection Tools

The following information were collected from medical records: Demographic information (age, sex), diagnosis and indication for colostomy (Emergency or elective), preoperative management (nutritional support, bowel preparation), details of colostomy formation and closure surgeries (surgical type, intraoperative complications, operative length), postoperative management (antibiotic use, time to oral feeding), complications related to colostomy formation and closure (acute, chronic, stoma-related complications, bowel obstruction, anastomotic leakage, wound infection, etc.), length of hospital stay, readmissions and reoperations.

Data analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were employed, with categorical data presented as frequencies (n) and percentages (%). The chi-square test was utilized to examine correlations between variables.

Results

Baseline characteristics of patients

This study included a total of 126 children who underwent colostomy, majority of patients were under 2 years (79.4%), males were slightly more than females (51.6% and 48.4%) respectively (Table 1).

Indications and preoperative management

(*N* = 37, 29.4%) of cases included in this study were emergency cases, while (*N* = 89, 70.6%) were elective. In regard to preoperative management; (65.1%) received nutritional support TPN (1 / 2), (70.6%) underwent bowel preparation by mechanical protocol (Pico-Salax/Purg-Odan with 150mL (5oz) cold water) 1/ 2 (Table 2).

Details of colostomy formation and closure surgery

More than half (58.7%) of surgeries were closure, while (41.3%) were creation colostomies.

Intraoperative complications and operative length

No intraoperative complications reported among patients, almost one third of operations (35.7%) lasted for more than 120 min, (25.4%) lasted for 61–90 min, and (3.2%) lasted for less than 30 min (Table 3).

Post-operative management

A variety of antibiotics used postoperatively, metronidazole (77%) and cefuroxime (62.7%) were the most prevalent. Oral feeding started after an average of 4.2 days postoperatively (±2.3 SD).

Complications related to colostomy formation and closure

Wound infection (*N* = 15, 11.9%) was the most reported complication, followed with bowel obstruction (*N* = 6, 4.8%), while no complications reported in (*N* = 100, 79.4%) of patients. More than half of cases (57.9%) stayed at hospital for 8–14 days.

Readmission and reoperation

(*N* = 13, 10.3%) readmitted to hospital after discharge, intestinal obstruction (33.3%), and wound infection (25%) were the most common causes for readmission. (*N* = 10, 7.9%) re-operated, exploratory laparotomy (40%) was the most reported cause for reoperation, overall (61.5%) of those which were readmitted were re-operated.

Factors associated with post-operative complications, readmission and reoperation

None of basic characteristics of patients, preoperative or post-operative management was associated with development of post-operative complications ($P > .05$) (Table 4). Regarding readmission of patients; administration of nutritional support TPN was associated with a higher percent of complications ($P = .03$), no factors were

Table 3 Length of hospital stay, post-operative management, readmission and reoperation, ($N=126$)

Statement	Answer	Frequency	Percentage
Length of hospital stay	1–3 days	8	6.3
	4–7 days	23	18.3
	8–14 days	73	57.9
	> 14 days	22	17.5
Post-operative antibiotics	Ceftriaxone	16	12.7%
	Vancomycin	13	10.3%
	Cefuroxime	79	62.7%
	Metronidazole	97	77.0%
	Cefazolin	8	6.3%
	Ampicillin	9	7.1%
	Others	10	7.9%
Were there any complications?	No	100	79.4
	Wound infection	15	11.9
	Bowel obstruction	6	4.8
	Leakage	2	1.6
	Stoma prolapse	2	1.6
	Short bowel syndrome	1	0.8
Readmission($n=13$)	Yes	13	10.3
	No	113	89.7
Causes of readmission	Wound infection	3	25.0
	Intestinal obstruction	4	33.3
	Stoma prolapse\ protrusion	2	16.7
	Other causes (vomiting\rupture)	3	25.0
Reoperation($n=10$)	Yes	10	7.9
	No	116	92.1
Causes of reoperation	Intestinal obstruction	4	40.0
	Stoma prolapse	1	10.0
	Wound dehiscence	1	10.0
	Rupture of anastomosis and peritonitis	1	10.0
	Anastomotic leak	1	10.0
	Other causes (central line insertion)	2	20.0

*Descriptive statistics in terms of mean

found to be significantly associated with reoperations of patients ($P>.05$) (Table 5).

Factors associated with length of hospital stay

Emergency cases had a longer duration of hospital stay than elective cases; (29.7% stayed more than 14 days in compare to 12.4%) this difference was statistically significant ($P=.04$), patients who received nutritional support, and patients who didn't undergo bowel preparation by mechanical protocol had a significantly longer duration of stay (Table 6).

Table 4 Factors associated with post-operative complications, ($N=126$)

Factors	Subgroups	Complications	No complications	*P* value
Age	< 2 years	19	81	0.6
	2–5 years	6	14	
	6–12 years	1	4	
	13–18 years	0	1	
Gender	Male	14	51	0.8
	Female	12	49	
Indications	Emergency	6	31	0.4
	Elective	20	69	
Nutritional support TPN (1 / 2)	Yes	17	65	0.9
	No	9	35	
Bowel preparation by mechanical protocol	Yes	19	70	0.8
	No	7	30	
Surgical type	Closure	18	56	0.2
	Creation	8	44	
Ceftriaxone	No	21	89	0.3
	Yes	5	11	
Cefuroxime	No	9	38	0.8
	Yes	17	62	
Metronidazole	No	6	23	0.9
	Yes	20	77	
Cefazolin	No	23	95	0.2
	Yes	3	5	
Ampicillin	No	25	92	0.5
	Yes	1	8	
Vancomycin	No	23	90	0.9
	Yes	3	10	

*Chi-square test for correlation

Discussion

This study aimed to investigate colostomy related morbidity among children both after stoma formation and stoma closure. A total of 126 children who underwent colostomy were enrolled in this study, out of which, the majority were under 2 years (79.4%), and males were slightly more than females (51.6% and 48.4%) respectively. The study found that the majority of patients reported no stoma related complications, while among those who reported complications, wound infection was the most reported complication, followed by bowel obstruction.

Analysis revealed that more than half (65.1%) received nutritional support TPN, (70.6%) underwent bowel preparation by mechanical protocol. TPN is critical for patients with stomas, as it provides essential nutrients and fluids that may be lost due to the stoma. The mechanical bowel preparation is also important to ensure

Table 5 Factors associated with readmission and reoperation, (*N* = 126)

Factors	Subgroups	Readmission		*P* value	Reoperation		*P* value
		Yes	No		Yes	No	
Age	< 2 years	9	91	0.4	7	93	0.5
	2–5 years	4	16		3	17	
	6–12 years	0	5		0	5	
	13–18 years	0	1		0	1	
Gender	Male	6	59	0.7	4	61	0.4
	Female	7	54		6	55	
Indications	Emergency	1	36	0.07	1	36	0.2
	Elective	12	77		9	80	
Nutritional support TPN (1 / 2)	Yes	12	70	0.03	9	73	0.09
	No	1	43		1	43	
Bowel preparation by mechanical protocol	Yes	11	78	0.2	8	81	0.5
	No	2	35		2	35	
Surgical type	Closure	9	65	0.4	7	67	0.5
	Creation	4	48		3	49	
Ceftriaxone	No	13	97	0.1	10	100	0.2
	Yes	0	16		0	16	
Cefuroxime	No	3	44	0.3	1	46	0.06
	Yes	10	69		9	70	
Metronidazole	No	2	27	0.5	1	28	0.3
	Yes	11	86		9	88	
Cefazolin	No	12	106	0.8	10	108	0.4
	Yes	1	7		0	8	
Ampicillin	No	13	104	0.3	10	107	0.4
	Yes	0	9		0	9	
Vancomycin	No	11	102	0.5	9	104	0.9
	Yes	2	11		1	12	

*Chi-square test for correlation

Table 6 Factors associated with length of hospital stay, (*N* = 126)

Factors	Subgroups	1–3 days	4–7 days	8–14 days	> 14 days	*P* value
Age	< 2 years	7	18	56	19	0.8
	2–5 years	1	5	11	3	
	6–12 years	0	0	5	0	
	13–18 years	0	0	1	0	
Indications	Emergency	0	5	21	11	0.04
	Elective	8	18	52	11	
Nutritional support TPN (1 / 2)	Yes	8	13	43	18	0.03
	No	0	10	30	4	
Bowel preparation by mechanical protocol	Yes	8	18	53	10	0.01
	No	0	5	20	12	
Surgical type	Closure	8	12	44	10	0.05
	Creation	0	11	29	12	

*Chi-square test for correlation

a clean surgical field and reduce the risk of infection. Malnutrition resulting from the loss of nutrients and fluids through a stoma can have detrimental effects on both growth and cognitive development [24, 25]. Reports indicate that as many as 90% of young children with stomas experience a decline in their growth chart, prompting some experts to recommend early closure of the stoma [26, 27]. This recommendation is bolstered by evidence demonstrating that the majority of young children show improved growth following stoma closure, regardless of any associated morbidity, weight concerns, or underlying conditions [26].

Results showed that a variety of antibiotics were used postoperatively, with metronidazole (77%) and cefuroxime (62.7%) being the most prevalent, and oral feeding was initiated after 5–6 days in more than one third

of cases (39.7%). A previous prospective, randomized clinical trial was conducted to compare the outcomes of administering prophylactic antibiotics for one day versus seven days to 30 consecutive patients undergoing colostomy closure. The antibiotics utilized were cotrimoxazole (8 mg/kg per day trimethoprim) and ornidazole (20 mg/kg per day). The use of prophylactic antibiotics is standard practice to prevent postoperative infections, especially in patients undergoing procedures involving the bowel. The choice of antibiotics reflects common protocols aimed at covering a broad spectrum of potential pathogens. Mechanical bowel cleansing and operative procedures were standardized for all patients. Wound infections limited to the subcutaneous tissue were observed in two patients, one in each group (6.6%). No instances of intraperitoneal infection, anastomotic leakage/dehiscence, or wound dehiscence were encountered [28].

Majority of patients reported no complications (79.4%), while on those who reported complications, wound infection (11.9%) was the most reported complication, followed by bowel obstruction (4.8%). A similar study reported that following stoma formation/closure, 27% of the young children experienced complications, mainly consisting of high output stoma, prolapse, stoma stenosis or adhesive obstructions [29]. Another case-control study found that complications following colostomy closure occurred in 17 children and include wound infection (11 cases), stitch granuloma (5 cases), and 2 cases each of small bowel obstruction and incisional hernia. These were not related to the duration of the colostomy [30]. This high rate of no complications is encouraging and suggests effective surgical techniques and postoperative care. However, the reported complications, particularly wound infections, highlight the need for ongoing monitoring and management.

(10.3%) were readmitted to hospital after discharge, and (7.9%) were re-operated. Intestinal obstruction (33.3%), and wound infection (25%) were the most common causes for readmission, while exploratory laparotomy (20%) and intestinal obstruction (20%) were the most reported causes for reoperation. Readmission rates are an important quality metric in postoperative care. The identified causes of readmission highlight areas where preventive measures could be implemented, such as better management of wound care and monitoring for signs of obstruction. Regarding readmission of patients; administration of nutritional support TPN was associated with a higher percent of complications ($P=.03$). This finding is intriguing, as it suggests that while TPN is necessary for managing malnutrition, it may also be linked to increased complications. This could be due to factors such as the underlying conditions necessitating TPN, or potential complications arising from the TPN itself, such as infections related to central venous catheters.

Limited number of Saudi studies were published in this scope; hence this study is considered a valuable base for evidence. Another strength of this study is that it included participants from variable demographical background and socio-economic status, which would aid the authorities in dealing with the issue from all aspects. Furthermore, this study is to pave the way as the base for further studies in this aspect. The study was not without limitations. The fact that it was done within a specific setting may have determined a highly selected group of cases. It may therefore be difficult to generalize the findings to the total community of children who underwent colostomy in the kingdom, larger numbers of respondents would have improved the statistical significance of the results. In addition, the retrospective design might have led to underreporting of morbidity.

Conclusion

Majority of patients reported no stoma related complications, while among those who reported complications, wound infection was the most reported complication, followed by bowel obstruction. Regarding readmission of patients; administration of nutritional support TPN was associated with a higher percent of complications ($P=.03$). Serial and frequent studies on the issue should be conducted and funded to generate more evidence and data regarding this topic. Webinars, medical workshops and conferences should be held to discuss these morbidities and arrange measures to decrease their incidence.

Abbreviations

ARM	Anorectal malformation
HD	Hirschsprung's disease
SPSS	Statistical Package for Social Sciences
TPN	Total parenteral nutrition

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-024-05089-z.

Supplementary Material 1

Author contributions

Idea conception and study design: HAA, MSMA. Questionnaire design: HAA, MSMA, AASA, YAMA. Data collection and entry: HMMA, AMMA, KTSA, RAA, AMA, SJSQ. Analysis planning, data analysis and interpretation: GEMA. Manuscript writing and drafting: HAA, MSMA, GEMA.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to issues of privacy.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Institutional Review Board (IRB) – Ministry of Health, Saudi Arabia. The participants were assured of the confidentiality and anonymity of the information they provide. No financial benefit was offered to participants.

Consent for publication
No personal data were collected from the participants.

Competing interests
The authors declare no competing interests.

Consent to participate
An informed consent was obtained from legal guardians of each individual participant in this study.

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