Reversal of Enterostomies in Children

Jayakumar S, Nellihella L and Kufeji D*

Department of Paediatric Surgery, Evelina Children's Hospital, Guys and St Thomas Hospitals NHS Foundation Trust, London, United Kingdom

*Corresponding Author: Kufeji D, Department of Paediatric Surgery, Evelina Children's Hospital, Guys and St Thomas Hospitals NHS Foundation Trust, London, United Kingdom.

Abstract

Objective: To investigate the outcomes of ileostomy reversal (IR) and colostomy reversals (CR) in children and the various factors that influence post-operative outcomes.

Methods: Retrospective review of children with enterostomies reversed between January 2010 and December 2012. Data are expressed in median (range). Statistical analysis was performed with Fischer's exact and non-parametric tests using Graphpad software(© 2013). P value of < 0.05 was considered statistically significant.

Results: Complete data was available for 50 (32 IR, 18 CR) out of 53 patients with median age of 4months (IR) and 11 months (CR). Among IR patients underlying diagnoses included: necrotising enterocolitis (17), Hirschsprung disease (5) meconium ileus (3) and others (7). Among CR patients underlying diagnoses included: anorectal malformations (14), Hirschsprung disease (2), trauma (1) and ischaemic colon perforation (1). Multiple and dense adhesions (p = 0.016), bowel discrepancy (p = 0.05) and post-operative complications (p = 0.034) were observed more commonly in IR than CR patients. Time to full feeds and length of stay were considerably longer for IR (p = 0.008) than CR (p = 0.012) patients. Post-operative complications were noted in 10 (31%) IR patients but in only 1 CR patient (5.5%). Mechanical bowel preparation [IR (p = 0.08) CR (p = 0.61)], delay in stoma reversal [IR (p = 0.59) CR (p = 0.78)], and early introduction of enteral feeds [IR (p = 0.08) CR (p = 0.55)], were not associated with increased post operative complications in both IR and CR patients. Median follow-up was 8 (1 - 26) months IR and 14 (2 - 38) months CR. There was no mortality recorded.

Conclusion: Multiple and dense adhesions, bowel discrepancy and post-operative complications are significantly high among Ileostomy than Colostomy reversal children. Mechanical bowel preparation, delay in stoma reversal, and early introduction of feeds are not associated with increased post operative complications following ileostomy and colostomy reversal in children.

Keywords: Stoma; Stoma Reversal; Children; Ileostomy; Colostomy

Abbreviations

IR: Ileostomy Reversal; CR: Colostomy Reversal; IC: Ileocaecal, MBP: Mechanical Bowel Preparation; OPCS: Operating Procedure Codes Supplement (NHS.GOV.UK); IV: Intravenous; NEC: Necrotizing Enterocolitis; PEG: Polyethylene Glycol

Introduction

The idea of performing an enterostomy in a child was first propounded by Littré in 1710 [1]. Ever since then, stomas have been routinely formed in children for many intestinal conditions and play an important role in bowel management. Stomas in children are usually temporary, but pose a significant challenge to both parents and children and also health care providers [2]. Complications related to stomas are well documented [3-6]. Despite many advances, a very high rate of complications are still reported, especially in neonates (upto 42%) [7]. Reversing the stoma is therefore crucial, but can be associated with its own complications, such as anastomotic leak, wound infection, and incisional hernias. We aimed to investigate the outcomes of ileostomy reversals (IR) and colostomy reversals (CR) and its association with several factors such as age at reversal, interval between stoma creation and reversal, siting of stoma, absence of intact ileocaecal [IC] valve, pre-operative mechanical bowel preparation [MBP] along with post-operative outcomes including complications, time to full feeds and length of stay were also analyzed in our cohort of pediatric patients.

Materials and Methods

We studied contemporaneously recorded clinical data by retrospective case note review of all children who had reversal of enterostomy over a period of 3 years between January 2010 and December 2012 at our centre. Hospital database was accessed to identify patients using OPCS codes. Patients with multiple stomas simultaneously created at same time were excluded from the study [n = 1]. Data was collected on patient demographics, details of stoma formed previously, underlying diagnosis, co-morbidity, pre-operative investigations, use of mechanical bowel preparation and peri-operative antibiotics, intra-operative findings, post-operative outcomes including complications, time to full feeds, length of stay and return of bowel activity. Data are expressed in median (range). Statistical analysis was performed with Fischer's exact test and non-parametric tests using Graphpad software (version 2013) and a p value of < 0.05 was considered statistically significant.

Results

A total of 53 patients were identified during the study period. Data was available for 50 [(32 ileostomy reversal (20 male, 12 female) and 18 colostomy reversal (11 male, 7 female)] patients. Among the 32 ileostomy reversal (IR) patients the underlying diagnoses (Figure 1) included: Necrotizing enterocolitis (17), Hirschsprung disease (4) Meconium ileus (3) and others (7). Among the 18 colostomy reversal (CR) patients the diagnoses included: anorectal malformations (14), Hirschsprung disease (2), trauma (1) and ischemic colon perforation (1) (Figure 1). The median age of patients at the time of reversal was 4 months (2 months - 15 years) among IR and 11 months (6 months - 12 years) among CR patients. Details of site and type of stoma for all patients are shown in figure 2. The duration between stoma creation stoma reversal from for IR and CR patients was 105 (43 - 899) days and 310 (86 - 990) days respectively.

Pre-operative contrast study was performed in 27 (84%) of IR and in 7 (39%) of CR patients. Distal bowel strictures were found only in lR patients [n = in 4 (15%)] and not among CR patients (Figure 3a and 3b). Pre-operative mechanical bowel preparation [MBP] was used in 6 (19%) of IR patients and in 7 (39%) of CR patients. Normal saline washout of 10 ml/kg was the MBP used in these patients. The washouts were given pre-operatively within 24 hrs prior to surgery. No oral antibiotics were used as bowel preparation. Analyzing the association between use of MBP and complications, we found no statistical significance in both IR (p = 0.08) and CR (p = 0.61) patients.

All but 1 patient [data not available for 1 IR patient] received IV antibiotics (n = 49) intra-operatively. Among the IR patients (n = 31) Co-amoxiclav (Amoxicillin and Clavulanic acid) and Gentamicin was the most common IV antibiotic used (n = 22, 71%) at induction, followed by IV Co-amoxiclav only in 5 patients (16%) and other antibiotics in 4 patients (13%). Among the CR patients (n = 18) Co-amoxiclav with Gentamicin was the most common IV antibiotic used (n = 16, 89%) at induction, and other antibiotics used in 2 patients (11%). Post operative antibiotics were continued for similar duration in both IR and CR groups (72 hrs). Patients with underlying diagnosis of anorectal malformations alone (n = 10) were advised to continue oral prophylactic Trimethoprim once the course of prescribed post-operative antibiotics were completed.
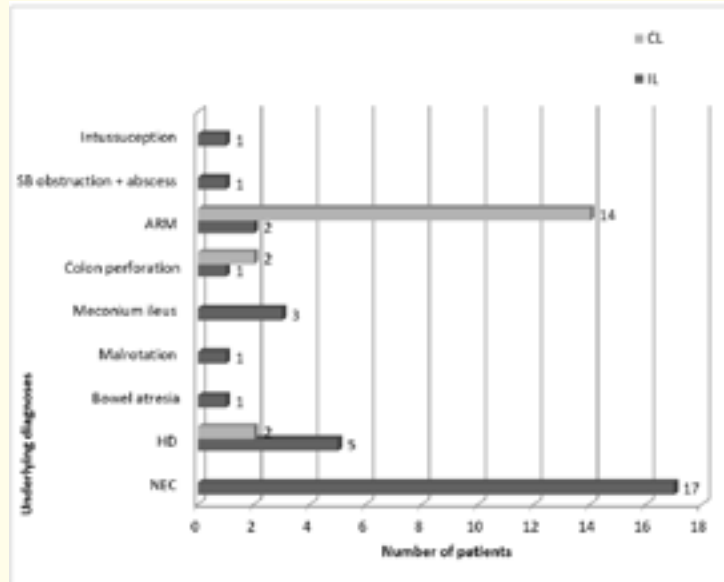
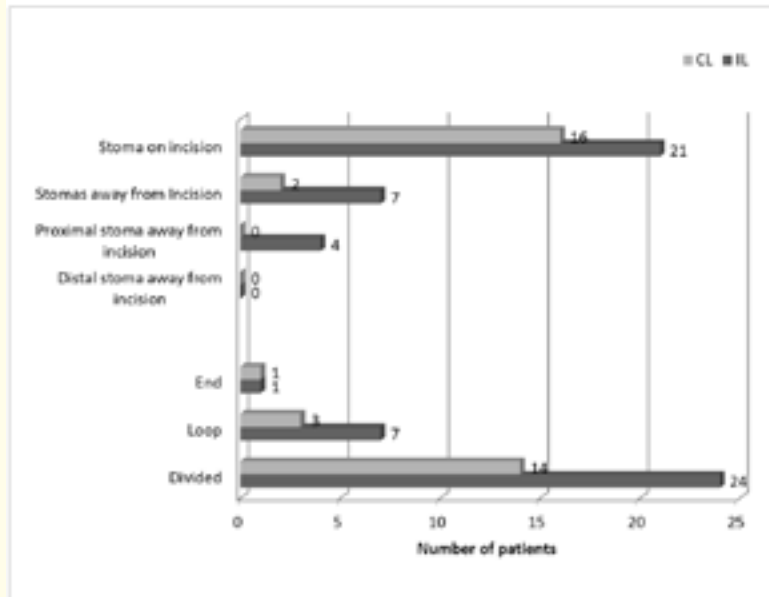**Figure 1:** *Underlying diagnoses of patients with stoma in our series.*

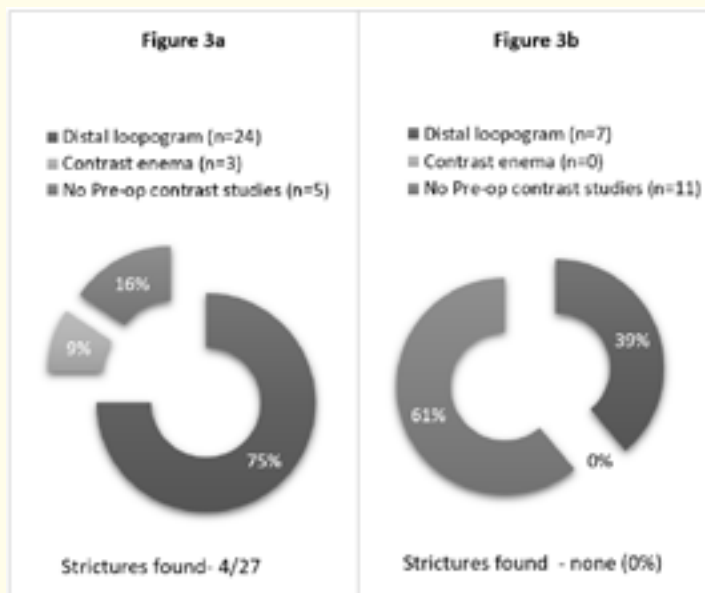**Figure 2:** *Types of stoma and relevance to laparotomy incision.*

Figure 3: 3a: Pre-op contrast study in IR patients; 3b: Pre-op contrast study in CR patients.

Surgical anastomosis was performed with PDS [polydioxanone © Ethicon Endo-Surgery, Inc. 2010 - 2014] sutures in all patients. At the time of stoma reversal, intra-abdominal adhesions were recorded in 26 (81%) IR and in 11 (66%) CR patients. Multiple and dense adhesions were noted in 14 (44%) IR patients but only in 2 (11%) CR patients and this was statistically significant (p = 0.016). Minimal adhesions were noted in 12 (37%) IR and in 9 (50%) CR patients (p = 0.286). Bowel discrepancy was noted in 16 (50%) IR and in 4 (22%) CR patients and this was statistically significant (p = 0.05). Documented bowel discrepancy between distal and proximal stoma prior to anastomosis was 1:3 (1:1.5 - 1:5) in IR patients and was 1:2 (1:2 - 1:4) in CR patients. Comparison of IR and CR patients' intra-operative findings are shown in table 1.

Table 1a	IR	CR	
Intra-operative findings at reversal	**n (%)**	**n (%)**	**P value**
Minimal adhesions	11 (37%)	9 (50%)	0.216
Multiple and dense adhesions	15 (44%)	2 (11%)	0.009
No adhesions	6 (19%)	7 (39%)	0.11
Bowel discrepancy	16 (50%)	4 (22%)	0.05
Table 1b			
Post-operative outcomes following reversal	**IR**	**CR**	**P value**
Bowels opened post-op [median days (range)]	3 (2 - 6)	3 (2 - 5)	0.429
Time to full feeds [median days (range)]	10 (3 - 62)	4 (3 - 6)	0.008
Length of stay [median days (range)]	17 (3 - 153)	6 (5 - 9)	0.012
Complications [n = (%)]	10 (31%)	1 (5.6%)	0.034

Table 1: a: Comparison of intra-operative findings between IL and CL patients; b: Comparison of post-operative outcomes between IL and CL patients.

Post-operatively, stools were passed in 3 days both in IR [3 (2 - 6) days] and in CR [3 (2 - 5) days] patients. Enteral feeds were commenced on day 4 (2 - 9) and on day 3 (2 - 4) post-operatively among IR and CR patients. Full enteral feeds were established in 10 (3 - 62) days among IR and in 4 (3 - 6) days among CR patients and this difference was statistically significant (p = 0.008). The median length of stay among IR patients was 17 (3 - 153) days and was 6 (5 - 9) days among CR patients and this was significant (p = 0.012) (Table 1). The median follow-up of IR patients was 8 (1 - 26) months and that of the CR patients was 14 (2 - 38) months. No mortality was noted within the follow-up period in our study.

Post-operative complications were more common among IR than CR patients (p = 0.034). Post-operative complications were noted in 10 (31%) IR patients; wound infection in 5, complete wound dehiscence in 1, prolonged ileus in 2, anastomotic leak in 1 and intra-abdominal abscess in 1 patient. Only one patient with colostomy had a complication (5.5%). The patient was a post renal transplant immunosuppressed 11 year old boy, who required a laparotomy on post-operative day 1 for hematoma evacuation and control of bleeding along with repair of bowel perforation. At the time of reversal of stoma very dense adhesions were noted in this patient. Comparison of IR and CR patients' post-operative complications are shown in table 1.

Analyses of other variables are shown in table 2. Variables including: patient's age at stoma reversal (≤ 4 months), interval between stoma creation and stoma reversal (> 10 weeks), siting of stoma away from the laparotomy site incision, use of pre-operative mechanical bowel preparation, absence of intact Ileocaecal valve, presence of multiple/ dense adhesions, bowel discrepancy noted intra-operatively, duration of IV antibiotics < 5 days, bowels opened ≥ 3 days post reversal and early introduction of oral feeds (≤ 3 days) were analyzed for risk of increased complications among both IR and CR patients in our series. However, none of the above variables analyzed were associated with increased risk of complications (Table 2) in both IR and CR patients.

Variables	Ileostomy Reversal Complicated vs un-complicated (p value)	Colostomy Reversal Complicated vs uncomplicated (p value)
Age ≤4 months	0.18	0.56
Interval between stoma and reversal > 10 weeks [IR] and >10 months [CR]	0.59	0.78
Stoma away from previous laparotomy incision	0.69	0.11
Pre-op MBP used	0.08	0.61
IC valve intact	0.31	1.00
Multiple and Dense adhesions intra-op	0.54	0.89
Bowel discrepancy intra-op	0.55	0.78
Post-op IV Antibiotics < 5 days (median)	0.49	0.78
BO > 3 days (median)	0.56	0.78
Enteral fluids commenced ≤ 3 days	0.08	0.55

***Table 2:** Association of various variables with complications among IR and CR patients [Fischer's exact test].*

Discussion

In children, especially in neonates, stomas are formed usually to divert bowel as a temporary measure. Pre-operative contrast study to check for bowel strictures and leak prior to reversal of enterostomy is commonly practiced. However, is it absolutely necessary? A study

on 70 adult patients with colorectal anastomosis and defunctioning ileostomy suggested that a radiological study using water soluble contrast enema before closure of the stoma is essential, as they found subclinical radiological leak of contrast in 15.5% of patients who were well post-operatively [11]. However, no such data is available on children. In our series we found no leaks but strictures were noted on pre-reversal contrast studies in 14.8% of children undergoing IR, but none among the CR patients. Interestingly, no complications occurred in these patients with strictures following stoma reversal.

The current practice on pre-operative bowel preparation and antibiotics in children has been largely adopted from adult data. The largest meta-analysis that included 18 randomised controlled trials on 5805 adults, showed that mechanical bowel preparations as an adjunct to intravenous antibiotics conferred no benefit to intravenous antibiotics alone [12]. However, so far only one randomized controlled pilot study in children reported on the use of mechanical bowel preparation in the form of polyethylene glycol (PEG) in colorectal surgery and they did not show any significant difference in the infectious complications with or without use of mechanical bowel preparation [13]. A survey among 42 different hospitals including 5473 children in America showed that the current practice on the use of mechanical bowel preparation and antibiotics in children, varied widely [14]. Leys., *et al*. reported that pre-operative mechanical bowel preparation and per-operative antibiotics for stoma reversal in children (n = 143), have no association with complications [p = 0.58] [15]. However, Serrurier., *et al*. reported that mechanical bowel preparation with glycol, increased the risk of wound infection [p = 0.04] in colostomy closure in children [16]. Our study reiterates previous findings and that pre-operative bowel preparation in the form of normal saline washout along with intravenous antibiotics did not confer any additional benefit in reducing complications in children in comparison with children receiving intravenous antibiotics alone among CR patients (p = 0.61), however it reduced the complications among IR patients but it was not statistically significant (p = 0.08).

Prematurity and low birth infants carry a higher risk for developing stoma-related complications [17]. However, does the age at the time of reversal of stoma influence post-operative complications? Analyzing the age at the time of stoma reversal showed no significant difference among IR (p = 0.18) and CR (p = 0.56) complications in our series. Interestingly, Al-Huddaif., *et al*. have however shown that the delay in stoma reversal significantly impacts the post-operative course in NEC patients. In their series, an early closure of stoma within 10 weeks of formation was associated with significant longer length of stay (p = 0.037) and longer time to achieve full feeds (p = 0.027) [18]. However, in our series among patients with NEC (n = 17) who had stoma reversed within 10 weeks or after 10 weeks, we did not find any significant difference in the length of stay (p = 0.83), time to reach full feeds (p = 0.56) or post-operative complications (p = 0.56).

Both, creating the stoma either away from or within the laparotomy incision are practiced among children. However, there is no consensus as to which offers more benefit in reducing post-operative complications. There is paucity of such data in literature among children as we found only one study on children that reported stomas sited adjacent within the laparotomy wound were not related to increased complications over stomas sited away from the laparotomy wound [9]. Similarly, in our series, we did not find any association between laparotomy site stoma and increased risk of post-operative complications among IR (p = 0.69) or CR (p = 0.11) patients.

Early feeding after closure of colostomy in children is encouraged to stimulate early bowel movement and reduce hospital stay with no increased adverse effects [19]. Early enteral feeds introduced at 28.5 ± 4.4 hrs vs. 158.8 ± 28.6 hrs (among 62 children - mean age 38 months) were also reported to reduce post-operative fever (p = 0.01) and wound infections (p = 0.02) after elective ileostomy/colostomy stoma closure [20]. In our series, feeds introduced at ≤ 3 days vs after 3 days, did not influence the post-operative complications among both IR (p = 0.08) and CR (p = 0.55) patients. The length of stay was also not influenced by early feeding (≤ 3 days) in both IR (p = 0.09) and CR (p = 0.38) patients.

Enterostomy closure has been shown to be associated with post-operative complications in 4 - 20% of children [8-10] with wound related complications predominating. The overall incidence of post-operative complications was 22% in our series with wound related

complications occurring in 12% of the patients. Although we found significant difference in post-operative outcomes and intra-operative findings between IR and CR patients, the underlying disease process and the median age of IR (4 months) and CR (11 months) patients were quite different and we accept this as a limitation in our study.

Conclusion

Distal loopogram prior to reversal of stoma is essential in ileostomy patients to identify strictures (15% in our series). Multiple and dense adhesions (p = 0.016), bowel discrepancy (p = 0.05) and post-operative complications (p = 0.034) are more common after ileostomy than colostomy reversal in children. Time to full feeds (p = 0.008) and length of stay (p = 0.012) were significantly longer for ileostomy than colostomy patients. Age at reversal, interval between stoma creation and reversal, siting of stoma away from laparotomy incision site, absence of intact Ileocaecal [IC] valve, mechanical bowel preparation [MBP] with normal saline, use of intravenous antibiotics duration (< 5 days) and introduction of enteral fluids in 3 days or less post-reversal did not influence post operative complications in both IR and CR patients. Our study is limited by retrospective data and a small study group and further larger multi-institutional prospective studies are recommended to evaluate the outcomes of stoma reversal in children.

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