



Role of mechanical and oral antibiotic bowel preparation in children with Hirschsprung's disease undergoing colostomy closure and pull-through

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Background: Mechanical and oral antibiotic bowel preparation (MOABP) has been performed routinely before colorectal surgery in children, but the necessity was questioned recently. We evaluated the utility of MOABP in children with Hirschsprung's disease (HSCR) undergoing colostomy closure and pull-through.

Methods: The medical records of pediatric patients with HSCR who underwent colostomy closure and pull-through in a single center from January 2010 to January 2020 were reviewed. The use of MOABP was noted. The incidence of postoperative complications, duration of postoperative antibiotic therapy, total hospital cost and length-of-stay were compared between patients receiving MOABP and no bowel preparation (NBP).

Results: A total of 64 patients were included in the study: 33 received MOABP and 31 had NBP. The respective postoperative complications in the MOABP and NBP groups were: intra-abdominal infection (18.2% vs. 29.0%), wound infection (9.1% vs. 16.1%), anastomotic leak (0 vs. 0), intestinal obstruction (6.1% vs. 0) and enterocolitis (3.03% vs. 12.90%). The duration of antibiotic therapy was 4.91±4.21 and 5.23±3.77 days (P=0.75) and hospitalization was 18.21±7.26 and 16.26±6.63 days (P=0.27) respectively. The total hospital cost in the MOABP group (4,720.14±1,858.89 USD) was higher than in the NBP group (3,749.06±2,009.97 USD) (P=0.049).

Conclusions: We did not find any clear benefit of MOABP in children with HSCR before colostomy closure and pull-through. However, a multicenter randomized controlled trial is needed to more definitely determine the best preoperative approach for children with HSCR.

Keywords: Colostomy closure; complications; Hirschsprung's disease; mechanical bowel preparation

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Introduction

Mechanical and oral antibiotic bowel preparation (MOABP) prior to colorectal surgery was thought necessary to remove feces from the large intestine, reduce the bacterial load in the lumen, and decrease surgical site infection (SSI) (1) or other postoperative complications (2,3). However, doubts about the benefit of mechanical bowel preparation (MBP) in adults have been raised (4-11), and the randomized clinical trials, systematic reviews and meta-analyses of preoperative MBP in adults have concluded that it can be safely omitted (12-14). The benefit of MBP in children is still unclear because of the paucity of clinical evidence-based studies in general (15,16). Several small studies done in pediatric elective colorectal surgical patients have found no differences in SSI incidence or other postoperative complications in pediatric patients who underwent MBP or not (2,15,17-19). But the current trend in pediatric hospitals continues to favor use of MBP (17,20). Breckler *et al.* (21) performed a survey in 2007 that revealed 96% of practicing pediatric surgeons used MBP in their practice. Especially for Hirschsprung's disease (HSCR), preoperative MBP is a widely accepted dogma, but MBP is a most unpleasant experience for both children and parents. It can cause dehydration, hypocalcemia, abdominal pain, distension, and fatigue (4,5,22-27).

Hosseinpour *et al.* reported that they had found no clear benefit of MBP for young children with HSCR who were scheduled for Duhamel operation. However, more clinical trials are needed to validate the necessity of MBP in the pediatric population (28). So we conducted this retrospective study to explore whether omission of MOABP would increase the incidence of postoperative complications in infants and children with HSCR undergoing colostomy closure and pull-through. We present the following article in accordance with the STROBE reporting checklist (available at <http://dx.doi.org/10.21037/tp-20-306>).

Methods

Study population

After obtaining IRB approval (#2020224), we performed a retrospective review of all available medical records of pediatric patients diagnosed with HSCR and who underwent colostomy closure and pull-through at West China Hospital, Sichuan University between January 2010 and January 2020. An attending pediatric surgeon and experienced research nurses reviewed each patient's

medical record using the Health Information System database to maintain consistency of interpretation, accuracy and completeness of data. The inclusion criteria were: (I) aged 3 months to 14 years; and (II) diagnosed with HSCR and underwent colostomy closure and pull-through. The exclusion criteria were: (I) presence of severe underlying disease (e.g., heart, brain, and/or lung disease, and organ dysfunction), digestive tract malformation, and intellectual development disorder; (II) incomplete data; and (III) long-segment HSCR. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived.

Patients were divided into two groups based on whether preoperative MOABP was performed or not. All operations were performed by two surgeons and the use of MOABP was at the discretion of the individual surgeon. Information was collected and compared for demographics, symptoms and pre-admission status (based on clinical assessment), and postoperative course, including any postoperative complications, duration of intravenous antibiotic therapy, combination of antibiotics, readmission for intravenous antibiotics, hospitalization, and total hospital cost. Complications included anastomotic leaks, intra-abdominal infection, wound infection, intestinal obstruction, enterocolitis and respiratory tract infection. The assignment of values of each variable was made by two of the authors (LY and XW).

Statistical analysis

Data were processed using SPSS 22.0 software. Count data are expressed as cases, and a two-sample chi-square test or Fisher's exact test was used to compare the preoperative complications, the clinical manifestations, combined antibiotics and the postoperative complications of the two groups. Parametric data are expressed as mean \pm standard deviation, and a two-sample *t*-test was used to compare the ages, weights, duration of temporary colostomy, associated malformations, duration of antibiotic therapy, length and cost of hospital stay of the two groups. A *P* value <0.05 was considered significantly different.

Results

Based on the inclusion and exclusion criteria, a total of 64 patients comprised the study group (48 males, 16 females). The indication for colostomy included enterocolitis, severe

Table 1 Patient demographics, symptoms and pre-admission status in the MOABP and NBP groups

Patient demographics, symptoms and pre-admission status	MOABP (n=33)	NBP (n=31)	P value	OR (95% CI)
Patient demographics				
Sex (male/female)	24/9	24/7	0.67	NA
Age (months)	7.96±3.98	8.16±5.22	0.88	NA
Weight (kg)	7.78±1.63	8.36±2.36	0.25	NA
Duration of temporary colostomy (months)	4.62±2.81	5.82±5.14	0.25	NA
Symptoms and pre-admission status				
Preoperative constipation	0 (0)	0 (0)	NA	NA
Preoperative abdominal distension	3 (9.1%)	0 (0)	0.24	0.49 (0.38–0.64)
Preoperative vomiting	1 (3.0%)	1 (3.0%)	1.00	0.94 (0.06–15.67)
Preoperative enterocolitis	2 (6.1%)	2 (6.1%)	1.00	0.94 (0.12–7.08)
Preoperative water and electrolyte disorder	0 (0)	1 (3.0%)	0.48	0.48 (0.37–0.62)
Preoperative colostomy complications	7 (21.2%)	3 (9.1%)	0.31	2.51 (0.59–10.76)

CI, confidence interval; MOABP, mechanical and oral antibiotic bowel preparation; NBP, no bowel preparation; OR, odds ratio; NA, Not applicable (retrospective study).

abdominal distension, intestinal perforation in a newborn and overdilated proximal colon. The diagnosis of HSCR was confirmed by rectal biopsy in all patients. In this study 33 patients underwent MOABP, and 31 patients underwent no bowel preparation (NBP). All patients received perioperative intravenous antibiotics, including cefoxitin, ampicillin, cefmetazole, clindamycin, monocyclic-lactamase or imipenem cilastatin. Seven patients in each group were given a combination of antibiotics. In the MOABP group, gentamicin and metronidazole were routinely taken orally for 3 days before the operation, and intestinal irrigation with normal saline was performed once daily, including on the day before the operation. The patients in each group were similar in sex, age, weight, duration of temporary colostomy, associated malformations, occurrence of preoperative constipation, abdominal distension, vomiting, enterocolitis, water and electrolyte disorder, and colostomy complications. Demographic data, symptoms and pre-admission status are presented in *Table 1*.

There were no statistically significant differences in duration of antibiotic therapy, combined antibiotics, or length of hospital stay between the two groups. But the cost of hospital stay in the MOABP group (4,720.14±1,858.89 USD) was higher than in the NBP group (3,749.06±2,009.97 USD) (P=0.04). Postoperative complications were uncommon in both groups of patients

(*Table 2*). In the MOABP group there were two cases of intestinal obstruction, which were managed with bowel rest, antibiotics, and total parenteral nutrition. Other complications were managed with antibiotics.

Discussion

Because MOABP before colorectal surgery was believed to help in relieving bloating and reducing the incidence of complications such as anastomotic dehiscence, wound infection and sepsis, it was considered the standard of care by colorectal surgeons for almost half a century. But in the past decades the value of MOABP has been questioned. In our study, omitting MOABP did not increase the occurrence of postoperative intra-abdominal infections, wound infections, anastomotic leak, intestinal obstruction or enterocolitis. That result was in accordance with a recent randomized control trial in adults, which compared MOABP with NBP in patients who were scheduled for colon resection and suggested that MOABP did not reduce the occurrence of SSIs or overall morbidity after colonic surgery (29). A meta-analysis including a total of 5,805 participants also did not show any statistically significant evidence that patients benefit from either MBP or the use of rectal enemas. Accordingly, it is suggested that bowel cleansing can be safely omitted in colonic surgery without

Table 2 Postoperative treatment and complications in the MOABP and NBP groups

	MOABP (n=33)	NBP (n=31)	P value	OR (95% CI)
Postoperative complications				
Anastomotic leak	0 (0)	0 (0)	NA	NA
Intra-abdominal infection	6 (18.2%)	9 (29.0%)	0.38	0.54 (0.17–1.76)
Wound infection	3 (9.1%)	5 (16.1%)	0.47	0.52 (0.11–2.39)
Intestinal obstruction	2 (6.1%)	0 (0)	0.49	0.50 (0.39–0.64)
Enterocolitis	1 (3.0%)	4 (12.9%)	0.19	0.21 (0.02–2.00)
Respiratory tract infection	4 (12.1%)	0 (0)	0.11	0.48 (0.37–0.63)
Duration of antibiotic therapy (days)	4.91±4.21	5.23±3.77	0.75	NA
Combination of antibiotics	7 (21.2%)	7 (21.2%)	0.79	NA
Length of hospital stay (days)	18.21±7.26	16.26±6.63	0.27	NA
Total hospital cost (USD)	4,720.14±1,858.89	3,749.06±2,009.97	0.04	NA

CI, confidence interval; MOABP, mechanical and oral antibiotic bowel preparation; NBP, no bowel preparation; OR, odds ratio.

inducing a higher complication rate.

However, results from other studies suggest that the use of MOABP is associated with more favorable outcomes (30–34). The largest study involves three large retrospective cohort studies of the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP), targeting colectomy data (32,35,36). A total of 45,724 elective colectomies with anastomosis were performed from 2012 to 2015. The combination of MBP and oral antibiotics was associated with lower rates of SSIs, anastomotic leaks and 30-day mortality. However, all evidence to date is based on studies in adults. Pediatric patients are so different from adults in the diagnosis, surgical methods, underlying diseases, immunity status and gut flora, so the results from adults cannot simply be extrapolated to pediatric patients. Furthermore, the MBP process has potential adverse effects and is associated with patient dissatisfaction rates (37). It is also a lot of work for nurses. The same conclusion has been reached in other studies of pediatric surgery (18,38,39), and some studies even suggest that MBP could liquefy solid stools, increasing the chances of intraoperative spillage and contamination (40,41). A growing body of literature data suggests that the microbiota has colon resistant effects (42–44), and theoretically rectal washout and MBP can change the composition of the colonic microbiota and affect bowel function. In the current study, the two patients (6.06%) with postoperative intestinal obstructions were in the MOABP group, and no cases of intestinal obstruction occurred in the

NBP group; although this was not statistically significant, which may be related to the small sample size. A survey by the American Pediatric Surgical Association on bowel preparation practices by pediatric surgeons revealed that 31% used MBP alone, 27% used diet modification only, 20% used MOABP, and 12% did not use any preoperative prep (20). This identified a trend towards no preoperative bowel regimen as the strategy of choice.

In this study, hospitalization of MOABP group had a higher cost than the NBP group, although there was no significant difference between the two groups in the length of hospital stay because the MOABP patients were not admitted early to hospital for the bowel preparation, part of which was completed before admission.

Study limitations

First, this was a retrospective study and patients were not randomly assigned to the MOABP or NBP groups. The decision for MOABP was based on surgeon preference and resulted in selected bias. Second, our results must be interpreted with caution, given the relatively small number of study participants. Finally, the recording may be incomplete that created potential for a significant confounding factor in this study. To overcome confounding factors and other factors in retrospective studies such as comparison of individual surgeon's practices, a large, prospective randomized clinical trial is needed to validate our findings.

Our study indicated that the quality of evidence for the use of MOABP before HSCR colostomy closure and pull-through is low. On the basis of existing evidence, MBP seems not to ‘decrease the incidence of anastomotic leakage, intra-abdominal infection, or wound infection’ compared with NBP and may therefore be safely omitted prior to HSCR colostomy closure surgery in children.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/tp-20-306>

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was approved by the Ethics Committee of The West China Hospital, Sichuan University (#2020224). All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived.

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