APGHN
Archives of Pediatric Gastroenterology, Hepatology, and Nutrition

Literature Review

Bowel Preparation in Pediatric Colorectal Surgery, Can We Move On? Historical and Literature Review

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Published:
25th November 2022

DOI:
https://doi.org/10.58427/apghn.1.3.2022.29-35

Citation:
Rinaldhy K, Wisnu G, Widyani NMS, Yani A. Bowel Preparation in Pediatric Colorectal Surgery, Can We Move On? Historical and Literature Review. Arch Pediatr Gastr Hepatol Nutr. 2022;1(3):29-35.

Abstract:

Background: Surgical procedure in colorectal cases have a high morbidity rate; in pediatric population, surgical site infection occurs in more than 13% of patients undergoing elective colorectal surgery. Bowel preparation is believed to decrease infection rate by removing feces from colorectal. This procedure has been routinely performed despite the lack of clear evidence and the invasive nature of the procedure. In pediatric population, the evidence is scarce with varying qualities, thus this study aims to evaluate the effect of bowel preparation on pediatric population.

Methods: We conducted a comprehensive literature review from PubMed and cross-referencing articles. Six full-text studies presenting bowel preparation in pediatric colorectal surgeries were included in the analysis.

Results: Majority of studies we analyzed showed no association between bowel preparation and surgical site infections. They also showed the lack of correlation between the procedure and post-operative complication.

Discussion: Bowel preparation was quickly adapted by surgeons due to its theoretical effect, but current evidence showed no clear benefit in doing so. In pediatric cases, the evidence is scarce and variable, and with the risk associated, surgeons should consider carefully before conducting bowel preparation in pediatric patients.

Conclusion: Bowel preparation does not significantly decrease post-operative morbidities, such as anastomosis leakage, intrabdominal infection, and surgical wound infection.

Keywords: bowel preparation, colorectal surgeries, pediatric, antibiotic

Introduction

Surgical procedure in colorectal cases has a high morbidity rate with associated complications such as leakage of bowel anastomosis, intraabdominal infection, and surgical wound infection. Those complications are believed to be caused by high bacterial counts in colorectal and consequently leading to contamination and higher risk of infection.[1] In pediatric population, surgical site infection occurs in 13-25% of patients who undergoes elective colorectal surgery.[2]

Bowel preparation is defined as a series of various procedures which are conducted pre-operatively to remove feces from colorectal.[3] Bowel preparation consists of four main procedures, including diet control, bowel cleansing with large amount of fluid, rectum irrigation, and laxative agent.[4-6] First patients are put on a restricted diet which only includes low-fiber diet or clear-liquid diet. Then, bowel cleansing is performed by oral administration of 7-12 liter of fluid via nasogastric tube (NGT) or directly. Rectum irrigation is done by giving warm water per rectum to remove solid feces accumulation. Lastly, mechanical bowel preparation agents such as stimulants, osmotic agents, or combination of both are administered.[4,5]

Bowel preparation is theoretically believed to decrease the rate of infection when conducted on adult or pediatric patients. This procedure has been routinely performed even before the 20th century despite its lack of evidence.[7] The most common practice was as the following: 1) Giving prophylactic systemic antibiotic before, during, and after surgical procedure; 2) Decreasing solid fecal burden in bowel lumen; 3) Giving nonabsorbable oral antibiotic to decontaminate bowel lumen. These procedures are invasive and associated with risks ranging from nausea to shock. Even when administered by oral route, bowel preparation still causes discomfort to the patients. Some older studies believe that bowel preparation is crucial to decrease post-operative morbidity, but recent studies showed no such benefit. There's a need to review the disparity and robustness of those evidences based on current knowledge.

In adults, a Cochrane study concluded that the use of bowel preparation in elective colorectal in adult was proven to have no significant benefit.[8] However, such study on pediatric population is still rare. Until 2020, there is only one systematic review and meta-analysis on this topic. Thus, this study aims to evaluate the effect of bowel preparation on pediatric population based on the evidence available.

Methods

We reviewed available evidences and summarized all available data sources regarding the effect of bowel preparation to reduce the risk of complications after colorectal surgeries. A comprehensive literature review was conducted which included studies published in 2018 to 2020. The following key words were used: "bowel preparation" AND "Pediatric" AND "Colorectal surgery" AND "Complication". Other variation of keywords includes "colon preparation", "Leakage anastomosis", "Surgical site infection", and "Wound infection". We limited the studies in pediatric population and restricted the language to include only those written in English and Bahasa Indonesia. Additional articles were identified from the references in the retrieved literature.

Results

We retrieved 169 studies from PubMed based on keywords search, 138 were excluded through title and abstract screening, another 25 was excluded because they did not meet our inclusion criteria. A total of 6 papers consisting of 2 systematic reviews, 2 randomized control trials and 2 retrospective cohort studies were included in the analysis.

A systematic review and meta-analysis by Lok et al analyzed the possible effect of mechanical bowel preparation in pediatric patients who underwent colorectal surgeries.[9] This study included 6 low-quality studies with high randomization bias and confounding factors such as antibiotic administrations and varying amount of colorectal procedures. It was concluded that mechanical bowel preparation did not reduce the rate of anastomosis leakage and surgical site infection. A similar systematic review and meta-analysis by Zwart et al, which analyzed the 6 previous studies with the addition of two randomized controlled trial (RCT) and four retrospective cohorts, also concluded that colon preparation did not significantly reduce surgical complications in pediatric patients who underwent colorectal surgeries.[10] Similiar to previous review, the studies included in this review also had many confounders and high bias.

A randomized pilot study by Aldrink et al analyzed post-operative complication in patients who was treated with mechanical bowel preparation in comparison to patients who was not.[11] This study found that there was no significant difference between two groups in the outcomes which included intraabdominal infection, anastomosis leakage, and wound infection. Additionally, there was no significant difference in length of stay, first passage, nasogastric tube's length of administration and other infection. This result was also supported by a randomized prospective study by Shah et al, which also demonstrated that bowel preparation had no significant beneficial effect in the prevention of sepsis, intestinal obstruction, anastomosis leakage, wound infection and other extra abdominal complications.[12] However both studies suggested the need of large scale multicenter randomized control study to confirm this finding.
A retrospective cohort by Ares et al investigated the relationship between colon preparation and post-operative complication along with analyzing the use of colon preparation among colorectal pediatric patients in United States.[2] This study also evaluated whether mechanical colon preparation in adult population can be applied for pediatric population. At the end, this study concluded that there was no clear benefit in colon preparation in the relation to post-operative complications. Furthermore, this study also recommend a three-armed (no bowel preparation, bowel preparation and combination of bowel preparation and oral antibiotics) randomized controlled study for pediatric patients to further support the study. Another retrospective cohort by Serruier et al , which discussed the effect of colon preparation

in relation to post-operative complication in patients undergoing colostomy closure, surprisingly showed that mechanical colon preparation even increased the risk of surgical site infection.[13] However, the other five out of six studies that we analyzed reported no association between mechanical bowel preparation and higher risk of surgical wound infection.

Discussion

Bowel preparation is aimed to reduce the risk of post-operative complications, such as anastomosis leakage, sepsis, intraabdominal infection, ileus obstruction, and wound infection that may be caused by bacterial colonization in the colon.[11,14-16] Theoretically, bowel preparation will also increase efficacy of antibiotics by reducing fecal mass.

The idea of colon preparation started in late 1800s, when Halstead hypothesized that feces in the colon could induce wound dehiscence. Then in 1890s, Maunsel followed up by introducing rectal cleaning as a method for bowel preparation prior to surgery.[2,13] The practice of bowel preparation quickly progressed in early 20th century. By 1970s, mechanical colon preparation had been adopted as routine procedure amongst the majority of surgeons.[17] In 1973, Nichols-Condon's bowel preparation using neomycin, erythromycin, and mechanical preparation was conducted as standard treatment. It was proven to improve intraluminal and mucosal antibiotic concentration.[15,18] Bowel preparation was also able to prevent peritoneum contamination by eliminating contact between feces and anastomosis site.[19] Moreover, hard and solid feces can be prevented by this preparation as well.[9,10,12] Therefore, most surgeons still consider bowel preparation to assure safety colorectal surgical procedures.[19]

Bowel preparation can be administered by several routes (orally and rectally) without any prior international standardization.[13] No data among pediatric population was found regarding the best route for this procedure as well. Moreover, high rate of post-operative abdominal infection drove surgeon to employ special diet in combination with or without laxative agent prior to abdominal surgery in order to further reduce fecal mass. Antibiotics were proven to reduce post-operative infection only if given with bowel preparation.[15,20] Nevertheless, these claims were then started to be challenged by some recent studies. Hughes et al. reported that bowel preparation did not reduce the risk of sepsis and post-operative anastomosis complication.[21] Irving et al. also supported this statement in their case series publication in which they demonstrated no anastomosis complication in patients who did not recieve bowel preparation.[22] Furthermore, Cannon et al. stated in his publication, there was no significant effect of bowel preparation in reducing the rates of post-surgical complication. Instead, oral antibiotics were more likely to become the possible agents

that eventually reduced the rates.[18] Those publications further encouraged surgeons to evaluate the practice of adult bowel preparation.

In pediatric population, mechanical bowel preparation is a controversial procedure to be done. Pediatric surgeons started the practice of bowel preparations only in the last 30 years. Protocols of bowel preparation was quite similar with those in adults. However, since adult bowel preparation began to be questioned regarding its benefit, Pena et al. was also questioning the same thing with the pediatric population. He found that bowel preparations may still have benefit among pediatrics.[1] In one survey conducted by Breckley et al, which inquired 493 pediatric surgeons regarding bowel preparation in pediatrics, there were huge variations among the surgeons' opinions.[15] Most surgeons in that survey used some form of mechanical bowel preparation despite the lack of beneficial evidence in pediatric population.[15] However, there was a wide variety of protocol on how those surgeons performed the bowel preparation as no international consensus was available.

Based on the latest studies, we concluded that there was no significant difference regarding the post-operative morbidity between patients who received bowel preparation with those did not. Thus, despite the accepted theory that bowel preparation will increase antibiotic efficacy by reducing fecal mass and reducing bacterial colonization which is expected to lower infection risk, and minimalizing mechanical wound, studies conducted in pediatric population show ambiguous benefit and weak correlation in post-operative complications.[17,20,21] One study reported that bowel preparation even increased the risk of infection in stoma closing procedure.[23] Bowel preparation might pose harmful effects on pediatric population, even though one study found that bowel preparation was associated with inflammation process that might correlate with better healing.[24,25] Moreover, a study stated that inadequate bowel preparation in 30% patients may lead to spilling risk intraoperatively.[8] Differences among these results and theories might be caused by biases and other confounding factors during the study.[16] Zwart et al. and Lok et al. concluded that most studies about bowel preparation in pediatric population have low qualities due to various biases and compounding factors, such as the type of procedures and different oral or IV antibiotics administration.[9,10] Therefore a randomized controlled study with large number of subjects is urgently needed to address these discrepancies between previous studies.

Conclusion

After reviewing several studies, it can be concluded that bowel preparation does not decrease post-operative morbidities, such as anastomosis leakage, intrabdominal infection, and operative wound infection.

Conflict of Interest

None declared.

Funding Statement

There is no specific grant from any funding agency involved in this study.

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