

Evaluating the Applicability of a Bowel Preparation Care Bundle Protocol for Pediatric Endoscopic Surgery: Randomized Controlled Trial

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Abstract

Background: Enteroscopy is an important diagnostic and therapeutic procedure. In children, adequate bowel preparation is mandatory for imaging and surgery, but tolerability as well as efficacy must be considered. As a result, good bowel preparation before to such procedures is a critical element in the diagnosis, monitoring, and lowering the risk of probable contamination. **Aim:** The purposes of this study were to assess the efficacy, and safety of care bundles (CBs) in bowel preparation for pediatric enteroscopy, also evaluate the patients' tolerance and safety regarding it, in addition to assess families' anxiety level, and their satisfaction with hospitalization. **Methods:** Between July 2019 and December 2019, Mansoura University Children Hospital enrolled children who underwent electronic enteroscopic surgery in a randomized controlled trial (RCT) under conventional nursing (CN), and between January 2020 and June 2020, children who had the surgery were enrolled under the care bundle trial (CG). This study enrolled a total of 83 children, 44 in the CB group and 39 in the CN group as well as included 80 nurses with 40 nurse in each group e. All children in both previously mentioned groups were lavaged with a polyethylene glycol electrolyte solution to prepare their bowels (PEG-ELS). The CBs included education for nurses, risk assessment for inadequate bowel preparation, education for children and families, and observation and assessment during preparation. We compared the two groups' satisfaction with hospitalization, comfort and safety, family anxiety levels, and quality of bowel preparation. **Results:** The CB group outperformed the CN group in terms of bowel preparation quality [(8.35±6.86) vs. (4.34±02.75) at P<0.001]. Furthermore, the CB group's anxiety score was substantially lower than the CN group's (3.28±0.85 vs. 5.45±1.78 respectively at P>0.001. **Conclusions:** The use of care bundles in the bowel preparation of children undergoing enteroscopy had a highly statistical significance on the quality of preparation and satisfaction with hospitalization, as well as reducing the anxiety of patients and their families. **Recommendation:** Intensive training and educational programs about the evidence bowel preparation protocols should be considered for surgical nurses and all children and their parents undergoing such procedure as a standard of practice.

Keywords: applicability, bowel preparation, care bundle, protocol; pediatric enteroscopy, surgery

Introduction

The incidence of colorectal diseases in children has risen in recent years. With the increasing use of endoscopy in clinical settings, enteroscopy is increasingly recognized for its role in diagnosing and treating intestinal diseases in pediatric patients. The importance of bowel preparation before enteroscopy cannot be overstated, and it must be tailored to the patient's age, size, and clinical condition (Trautwein, Vinitski, and Peck, 2017). For pediatric bowel preparation, however, there is no widely acknowledged gold standard regimen. Several regimens have been tested with varied degrees of success in order to find the safest, most effective, and comfortable combination

(Engum, Carter and Murphy, 2017). Conventional bowel preparation protocols or regimens can be based on lavage (bowel cleaning) or cathartics (substances that hasten defecation), such as a large volume of Polyethylene glycol electrolyte lavage solution, sodium phosphate (an oral low volume hyperosmotic agent), sodium Pico sulphate, bisacodyle, and dietary measures, such as diet packs or clear liquid diet (often in combination with other agents), as well as adequate anticipation of the psychological needs and sedation of the patients (Zmora, Pikarsky and Wexner, 2019).

As a result, integrating these evidence-based and connected interventions can considerably increase patient access to critical

nursing care and make each element of bowel preparation easier to implement. Prior to such treatments, proper bowel preparation is essential to ensure complete vision of the colonic mucosa and to reduce the possibility of contamination during surgery (Trautwein, Vinitski, and Peck, 2017). Children have a considerably more difficult time administering the agents than adults, who have little trouble doing so. The insertion of a nasogastric tube to give the agents has been reported to be an effective means of ensuring bowel wash out in recalcitrant youngsters (Tang, 2019).

Poor intestinal preparation before enteroscopy can hide lesions, pollute the endoscope surface, and make it difficult to insert and see the endoscope; these are the most prevalent causes of missed diagnosis and treatment failures. Furthermore, because enteroscopy is frequently done under general anesthesia, a failed treatment will not only put children at danger and cause them discomfort, but it will also have an impact on their families, wasting resources (Shan, Zhu and Gu, 2015). Oral enema solutions have a unique taste and are frequently used in large quantities, causing vomiting (Tang, 2019). Children rarely accept oral enema solutions, and they are not tolerant of negative reactions (Wang, Wu and Chen, 2012). As a result, bowel preparation in children is particularly difficult, and despite the physiological, pathological, and psychological differences between children and adults, adult approaches and methods are not always suited for children (Hassan, Fuccio and Bruno, 2018).

Aim of the study:

The aims of this research were to assess the efficacy, and safety of care bundles (CBs) in bowel preparation for pediatric enteroscopy, also evaluate the patients' tolerance and safety regarding it, in addition to assess families' anxiety level, and their satisfaction with hospitalization.

Significance of the study:

The role of enteroscopy in the diagnosis and treatment of intestinal diseases in pediatric patients has increasingly been recognized. Bowel preparation is the most important step before enteroscopy. The quality of bowel

preparation plays a key role in ensuring the accuracy of endoscopic diagnosis and the safety of treatment. In our current study, we tried to explore a safe and effective approach for bowel preparation so as to improve the quality of bowel preparation for children and at the same time increasing the satisfaction with hospitalization, as well as reducing the anxiety of patients and their families.

Research hypothesis:

Children under the randomized control trial may have one of the following hypothesis:

1. Children undergoing enteroscopic surgery who receive the care bundle trial, may have more efficient quality of bowel preparation, lower anxiety level, as well as a good satisfaction with hospitalization for them and their families than those who received a conventional nursing care.
2. Children undergoing enteroscopic surgery who receive the care bundle trial, may have the same quality of bowel preparation, the same anxiety level, as well as the same level of hospitalization satisfaction degree than those who received a conventional nursing care.
3. Children undergoing enteroscopic surgery who receive the care bundle trial, may have a lower quality of bowel preparation, higher anxiety level, as well as lower level of hospitalization satisfaction degree than those who received a conventional nursing care.

Materials

Design: A randomized controlled trial was conducted.

Setting: The study was conducted in surgical pediatrics departments affiliated with the Children's Hospital of Mansoura University (MUCH) in Mansoura city

Subjects

- A convenience sample of all bedside/working nurses (80), who were available during the period of data collection in the previously mentioned setting of surgical pediatrics departments and willing to participate in this study, regardless their ages, educational level or years of experience. The surgical nurses were randomly allocated to

two equal groups of intervention which named as care bundle group and conventional nursing group. There are 40 nurses in each group.

- A purposive sample of 83 children who undergone electronic enteroscopic surgery in Mansoura University Children hospital from July 2019 to June 2020 were included as the subjects and met the following criteria: children aged 2-14 years, who did not receive oral bowel preparation prior to admission, their families with no history of psychological disorders (e.g., anxiety) as well as completed and signed informed consent forms. Patients who were not included in the study were: Other reasons for emergency enteroscopy included children with severe underlying disorders (such as heart, brain, and lung diseases, as well as organ malfunction), patients with abnormalities or foreign substances in the digestive tract, and patients with major hemorrhage in the digestive tract.; as well as caregivers who were unable to read and understand the patient education materials; and/or patients without parental consent.

Sample size justification

The sample size was estimated based on the Epi-Info (version 7) program using the following parameters:

1. Target population 368 per 3 months;
2. Expected frequency $p = 50\%$;
3. Acceptable error = 10% ;
4. Confidence coefficient = 95% ;
5. Sample size = 83.

The selected children were assigned to study and control groups using randomization block technique. Randomization block her was done manually according to the following steps:

- ❖ One list contains the numbers from 1 to 83 was prepared by the researchers.
- ❖ Numbers from 1 to 83 again was written in a separate paper for each number.
- ❖ Each paper was rolled up until the number is invisible then all the papers were mixed and collected in a large ball.
- ❖ The 83 pieces of papers were randomly and blindly divided into 4.15 blocks each one contains 20 random numbers.
- ❖ From each block 10 random numbers were picked up blindly to be assigned to the care

bundle group and the remaining 10 to the conventional nursing group.

- Then registration of the cases sequence was done on the previously prepared list (In front of each number the researcher writes the word CN or CB) to be considered during data collection
- Children who underwent enteroscopic surgery and electronic fiberoptic colonoscopy at our hospital between July and December 2019 were enrolled and placed in the conventional nursing (CN) group, while those who underwent these procedures between January and June 2020 were enrolled and placed in the care bundle group (CB). To get all the kids ready, electrolyte lavage solution made of polyethylene glycol was employed (PEG-ELS). The CBs put into place after December 2019 comprised monitoring during preparation, risk assessment of inadequate bowel preparation, education for children and families, and nurse education. The two groups were contrasted in terms of bowel preparation quality, tolerance, safety, anxiety score, and degree of satisfaction.

Bowel preparation modalities: Both the CN and CB groups used the same bowel preparation protocol that the researcher developed after reviewing the evidence-based guidelines of pediatric bowel preparation and it composed of:

- For bowel preparation, all children were given polyethylene glycol electrolyte lavage solution (PEG-ELS). The researchers gave low-residue liquid meals two days before surgery, then 100 mL/kg of PEG-ELS. The solution was given between 6 and 8 hours before operation, with a maximum dose of no more than 4 liters, and the children fasted for four hours before evaluation. If the kid was unable to endure the procedure or the bowel preparation was inadequate, a higher dose, intragastric feeding, or enema was administered depending on physician advice. The CBs incorporated nurse's education, inadequate bowel preparation' risk assessment, children' and families' education, observation and assessment during preparation, which included a comparison of the standard of bowel

preparation, patients' tolerance and safety, families' anxiety score, and satisfaction with hospitalization.

Tools of data collection:

Tool I: Subjects demographic data questionnaire included:

Part I: Children's demographics data after fiberoptic electronic colonoscopy or enteroscopic surgery: The researchers used a review of pertinent literature to create this tool, including, age, sex, residence, age of operation, and type of disease, and previous attending of training program about bowel preparation.

Part II: surgical nurses characteristics that included ages, educational level, years of experience and previous attendance of training courses regarding use of care bundles in the bowel preparation of children undergoing enteroscopy

Tool II. Bowel preparation' quality assessment indicated as the following:

- I. Nurses must monitor defecation at the bedside on the morning of surgery; if the pre-operative bowel preparation was insufficient, an enema was required. As a result, the number of children requiring an enema before enteroscopy is one of the indications used to measure the quality of bowel preparation in these two groups.
- II. Endoscopic nurses utilized the **Aronchick score** (rated from 1 to 5) to evaluate. After the endoscopy was initiated, the quality of the bowel preparation was graded as follows: (1 point) indicated excellent quality (more than 95% of the intestinal mucosa is visible); and (2 points) indicates good quality (more than 60% of the intestinal mucosa was visible) (a large volume of clear liquid covered 25 percent or more of the intestinal mucosa, but more than 90 percent of the intestinal mucosa was visible) (3 points) rated the bowel preparation's quality as fair (some semisolid feces that might be removed with a suction or a wash), but more than 90% of the intestinal mucosa was visible), (4 points) denoted poor bowel preparation (semisolid stool that cannot be washed away or suctioned, but more than 90% of

the intestinal mucosa was visible), and (5 points) implied poor bowel preparation (repeat preparation needed).

- **Intolerance symptoms**, such as distension, stomach discomfort, vomiting, and intragastric feeding, were assessed in both groups to assess bowel preparation safety and tolerance.

Tool III. Families' anxiety scores were

assessed by using anxiety self-rating scale, which designed for the personal use in which, there are no right or wrong answers. This scale included the Symptom Checklist 90 (SCL-90). The SCL-90 contained a total of 90 items, but only ten anxiety-related items were chosen, with scores ranging from 0 to 40, and were classified as follows: 1) minimal anxiety score ranged between 0-8 points, 2) mild anxiety score ranged between 8-16 points, 3) moderate anxiety score ranged between 17-24 points, 4) high anxiety score ranged between 25-32 points, and extreme anxiety ranged between 33-40 points. On the day of release, the families were polled by the researchers. Because they cared for their children for more than 8 hours every day, the chosen families had no prior history of any psychiatric disease or anxiety. The researchers explained the questions to the families in an objective manner so that they could assess themselves prior to scoring.

IV. Questionnaire on the hospitalization

satisfaction, developed by the researchers to estimate satisfaction with hospitalization, was given to families to complete on the day of discharge. Its content matched that of the patient satisfaction survey previously required by the former Ministry of Health and Department of Health and included input from hospital management experts. The questionnaire's content validity score was 0.730, and its Cronbach's alpha coefficient was 0.871. Families must be able to understand the questionnaire's content, and time spent caring for their children throughout the hospital stay must make up more than 70% of the entire amount of time

spent there. Based on the percentage of each questionnaire's score to the overall score, the overall score was divided into three categories: extraordinary (>90 percent), decent (70-89 percent), and bad (70 percent). The survey forms with good or excellent results were the most satisfying.

Method

- An official letter from Mansoura University's Faculty of Nursing was forwarded to the director of the Mansoura University Children Hospital to request permission to conduct the research.
- Endoscopists, experienced endoscopy nurses, surgical unit nurses, and children's families were informed of the study's objective and significance. Study tools were tested for its content validity by 5 experts in enteroscopic surgery and pediatric surgical nursing, Mansoura University, as a jury to test its content validity and the essential modifications were done.
- Pilot study was conducted on 10% of the total subjects' size of both children who underwent enteroscopic surgery and nurses, in which 10% of those children were (8) in which (5 children in (CB group and 3 children in CN group), whereas, 10% of nurses were 8 in which (4 nurses in each group) to examine the clarity of the tools, as well as the time required to apply the tools and any necessary modifications. The subjects of the pilot study were included among the study total sample because there were no significant modifications required in the study tool
- **Reliability of the tools:** The internal consistency of the developed tools was tested by using Cronbach's alpha coefficient test by a statistician to assess reliability of the tools; for whole questionnaire. Tool I was reliable as $r = 0.883$, tool II was reliable as $r = 0.797$, tool III was reliable as $r = 0.865$, tool IV was reliable as $r = 0.987$.
- Children who underwent such surgeries between July and December 2019 were registered and assigned to the conventional nursing group (CN), and those who received them from January 2020 to June 2020 were categorized as the care bundle group (CB).
- Research Ethics Committee of the Faculty of Nursing's Mansoura University approved the research.
- Informed consents were obtained after explaining the purpose of the study for nurses, children, and their parents. The data's confidentiality and anonymity were verified, as well as their right to withdraw from the study at any time was established.
- The CN group adhered to the CN protocol. The nurse who was responsible for the children's admission informed the patients and their families of the current preparations and answered questions. On the day of the operation, the defecation situation was described by the families.
- CBs was followed in the CB group in which, care bundles included a set off our evidence-informed practices performed collectively and reliably to improve the quality of care. The CBs included:
 - 1- **Nursing staff' training**
 - Researchers, endoscopists, and experienced endoscopy nurses trained the whole staff on the ward.
 - The training primarily focused on purposes and requirements of the pediatric enteroscopy; benefits of preoperative bowel preparation prior to enteroscopy, popular medicines used for preoperative bowel preparation, and their side effects, as well as monitoring and assessing the quality of bowel preparation.
 - Ensure all nurses attended the training course that lasted between 15 and 35 minutes for at least three times. During an examination, the effectiveness of the training was evaluated in order to evaluate the trainees' understanding and mastery of the training material.
 - For those who failed the examination, either a second training course was required, or they weren't allowed to be involved in the CN protocol implementation.
 - 2- **Poor Bowel Preparation Risk Assessment**

To determine the likelihood of inadequate bowel preparation, trained nurses evaluated a

variety of factors during the admission, including frequency of faeces, dietary intake two days prior to the admission, medication status, history of enteroscopy, history of bowel preparation before an examination, and Bristol stool scale type (1-7). However, it can be hard to state what is normal and what is abnormal, some health professionals use a scale to classify the type of stool passed. This helps assess how long the stool has spent in the bowel in which, type 1 has spent the longest time in the bowel and type 7 the least time. A normal stool should be a type 3 or 4 and depending on the normal bowel habits of the child, should be passed once everyone to three days, (figure, 1). At-risk children were documented and reported to the medical staff, and protocols were adjusted accordingly.

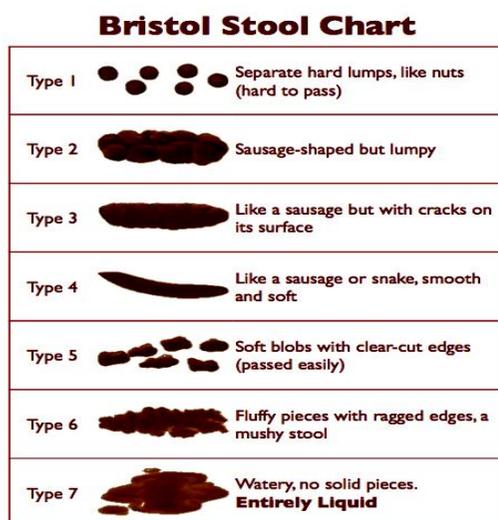


Fig. (1): Bristol stool scale type (1-7)

3- Children and family's education

- Both parents and children aged 7 years or older could access education, but children aged younger than 7 years could only access education through their parents.
- To ensure that each child and his or her family understood what was being taught, the researchers and a trained nurse used a variety of education approaches, including (I) on-site training using drawings and (II) instructive movies.
- Preparations of children for enteroscopy checklist was offered to children and their

families in the education video. The videos covered the contents and timing of the preparation from admission to discharge, Highlighting the significance of properly preparing the intestines before an enteroscopy, potential discomforts during preparation, and how to handle those discomforts., diet during preparation, how to observe the defecation, fasting requirements before surgery, and the benefits of preparing for the procedure.

4- Preparation of bowels: observation and assessment

- Nursing observation and evaluation were recorded as the fourth component of the CB protocol. As part of the observations, nurses recorded (I) the patient's dietary intake during the first two days and (II) the medications used and if there are any adverse drug reactions. Physician was informed in a timely manner about refusal to take a drug or intolerance to a given drug, and the medication plan was adjusted or intragastric feeding was changed accordingly.
- A standardized form was used by nurses to record the children's defecation status the next morning once they had started doing so. As a result, there were four parts on nursing record sheets: an assessment upon admission, an assessment at the bedside, and an assessment of faeces on the day of operation.
- Endoscopists was informed if any children had improper bowel preparation, and they decided whether to postpone enteroscopy or take additional precautions.

Statistic evaluation

SPSS 22.0 was used to analyze the data. To compare numbers that reported as percentages, the chi square test and the Mann-Whitney U test was used. Intergroup differences were analyzed using a t test, and measurement data were reported as means and standard deviations. A P value of less than 0.05 indicated a significant difference.

Results

In this study, 83 children who underwent colonoscopy or enteroscopic surgery were

enrolled and 40 nurses in each group for bowel preparation. **Table (1)** found that 60 percent of the nurses studied in CN group were between the ages of 20 to less 30 years old compared to 67.5 % of them participated in CB group. In relation to sex, high percentages of nurses in both groups were female (65% and 75%) respectively. As regards to years of experience in surgical department, it was clarified that, half of nurses (50%) in both groups had three to less than 6 years of working experience. Furthermore, the majority of the nurses in both groups did not attend any training course regarding use of care bundles in the bowel preparation (75% and 92.5%) respectively with a significant difference between these two groups and previous attendance of training courses at ($P < 0.001$).

Concerning, relationships between Child's General Characteristics and patients' grouping for intervention. **Table (2)** demonstrated that in general statistics, there was a s negative' relationship between two groups (CN, CB), such as gender and age of operation ($P > 0.05$), but there was a significant difference between these two groups and type of disease at ($P < 0.001$).

Table (3); It was illustrated that, more than one third of the CB group had a good quality of

bowel preparation as well as there are no one of them had inadequate bowel preparation compared with 10.25% of the CN group had good quality of bowel preparation as well as there are more than one third of them had an inadequate bowel preparation therefore, they needed for a repeated bowel preparation and examination. Moreover, **table (4)** proved that the CB group had a significantly higher score of bowel preparation quality than the CN group [(8.35±6.86) vs. (4.34±02.75) at $P=0.001$].

These two groups did not differ substantially in intolerance' symptoms, such as distension, stomach discomfort, vomiting, and exhaustion, or during intragastric feeding, as shown in **table (5)**, at $p > 0.005$.

Table (6); Regarding mean scores of anxiety degrees among pediatric CN and CB groups. CB group anxiety levels were significantly lower than CN group anxiety levels (3.2 8±0.85 vs. 5.45±1.78 respectively at $P > 0.001$).

Table (7) shows that the CB group had significantly higher hospitalization satisfaction levels than the CN group (93.18 percent vs. 82.04 percent, respectively; $X^2=8.874$, $P < 0.001$).

Table (1): Number and Percentage Distribution of nurses in both groups according to their general characteristics

Item	(CN) group n= (40)		(CB) group (n=40)		X ²	P
	N	%	N	%		
Nurses' age / yrs.						
20<30 yrs.	24	60	27	67.5	.504	0.312
30<40 yrs.	14	35	10	25		
40<50 yrs.	2	5	3	7.5		
Sex						
Male	14	35	10	25	.262	0.9805
Female	26	65	30	75		
Years of experience in surgical department						
< 3	12	30	15	37.5	14.846	0.001
3< 6	20	50	20	50		
6<9	6	15	4	10		
9 & more	2	5	1	2.5		
Educational level						
Technical institute of nursing	17	42.5	10	25	0.016	0.768
Diploma	8	20	18	45		
Bachelor's degree of nursing	15	37.5	12	30		
previous attendance of training courses regarding use of care bundles in the bowel preparation					7.865	<0.001
No	30	75	37	92.5		

Table (2): Frequency and percentage distribution of children in both groups according to their demographic's characteristics

Item	(CN) group n= (39)		(CB) group (n=44)		X ²	P
	N	%	N	%		
Child's age / yrs.						
2 < 6 yrs.	10	25.6	10	22.72	.236	0.425
6<10 yrs.	20	51.28	5	11.36		
10<14 yrs.	9	23.07	29	65.90		
Gender						
Girls	14	35.89	19	43.18	.372	0.587
Boys	25	64.10	25	56.81		
Child' residence						
Rural	33	84.6	39	88.6	9.774	<0.001
Previous attending of training program about bowel preparation						
No	37	94.9	40	90.9	7.686	0.001
Type of disease						
Suspected inflammatory bowel disease	6	15.38	4	9.09	15.388	0.001
Suspected allergic colitis	4	10.25	8	18.18		
Chronic diarrhea	6	15.38	11	25		
Foreign body removal	6	15.38	2	4.54		
Intussusception	8	20.5	6	13.63		
Lower gastrointestinal hemorrhage	1	2.56	7	15.90		
Endosonography	2	5.12	2	4.54		
Follow up for assessment of efficiency inflammatory bowel disease treatment	2	5.12	3	6.81		
Unexplained iron deficiency anemia	4	10.25	1	2.27		

Table (3): Different categories of Aronchick bowel preparation quality in percentage distribution among pediatric CN group and CB group

Child's groups	Aronchick bowel preparation quality categories									
	Excellent		Good		Fair		Poor		Inadequate	
	No.	%	No.	%	No.	%	No.	%	No.	%
CN group (39)	2	5.12	4	10.25	8	20.51	10	25.64	15	38.46
CB group (44)	12	27.27	20	45.45	10	22.72	2	4.54	0	0%

Table (4): Mean scores of Bowel preparation quality among pediatric CN group and CB groups

Variable	(CN) group Mean ±SD	(CB) group Mean ±SD	Paired t test
Bowel preparation quality scores	4.34±02.75	8.35±6.86	P<0.001*

(*) Statistically significant at P<0.05

Table (5): Frequency and percentage distribution of intolerance symptoms during bowel preparation of CN group and CB group

Symptoms	CB (n=44)	CN (n=39)	X ²	P value
Distension of the abdominal cavity	5	6	0.059	0.072
Pain in the abdomen	4	5	0.015	0.828
Vomiting	7	14	0.014	0.871
Fatigue	28	14	0.018	0.913

NB: CB stands for Care Bundles, and CN stands for Conventional Nursing.

Table (6): Mean scores of anxiety degrees among pediatric CN group and CB groups

Variable	(CN) group Mean \pm SD	(CB) group Mean \pm SD	Paired t test
Anxiety scores	5.45 \pm 1.78	3.28 \pm 0.85	P<0.001*

Table (7): Different categories of hospitalization satisfaction level among pediatric CN group and CB group

hospitalization satisfaction Scoring	(CN) group n= (39)		(CB) group (n=44)		X ²	P
	N	%	N	%		
Excellent	24	61.53	37	84.09	8.874	P<0.001
Good	8	20.51	4	9.09		
Poor	7	17.94	3	6.81		

NB: CB, Care Bundle group ; CN, Conventional Nursing group

Discussion

Endoscopy of the gastrointestinal tract in children has been proven to be a safe and effective method for diagnosing and treating a variety of gastrointestinal problems in children. As a result, it's critical that patients are informed about and involved in the enteroscopy preparation process. The colon should reliably be promptly cleared of all faeces, with no gross or histological alterations to the mucosa, in the ideal scenario for a digestive endoscopy (Sun, Xu, & Jiang, 2016).

The preparation should not cause the patient any discomfort or changes in fluid or electrolyte levels. The preparation should be secure, simple, tolerable, and affordable. An evidence-based treatment protocol is made up of a series of interrelated interventions that are used to treat challenging clinical conditions (Davis, Hancock & Morris, 2017). Furthermore, these straightforward, clear, and operable evidence-based measures may be adopted into clinical practice and have a high level of operability, and their combined application leads to superior patient outcomes than any single strategy. Nursing care is more easily accessible with CB, and each phase of the bowel preparation process may be carried out efficiently (Johnson & Rex, 2018). The CB protocol aspects are favorably related, according to the current study. Nurse education and training are essential for the efficient execution of all elements. The risk assessment and education of a child's family are supplemented by nursing bedside monitoring and observation of the child's health. As a result, when it comes to boosting the quality of bowel

preparation in children, the notion of CB is more advantageous.

In terms of the researched children's characteristics, the current study revealed that more than half of them were boys. This finding is consistent with that of Liang, Xin, Yang, and Li, (2019) who conducted a study on "Applications of care bundles in bowels preparations for colonoscopy in children" and found that boys account for higher percentages than girls who underwent electronic colonoscopy or enteroscopic surgery, while this finding differed from that of Lightdale, Acosta, and Shergill, (2017), who stated that most pediatric patients were girls.

Regarding number and percentage distribution of the studied children according to type of disease, and previous attending of training program about bowel preparation, it was showed that just around a quarter of those who had electronic enteroscopic surgery and enrolled in CB group experienced chronic diarrhea, whereas lowest percent had to have previous attending of training program about bowel preparation. This is contradicted with the findings of Gordon, Karlsen, and Isaji, (2017), who investigated "Bowel preparation for elective procedures in children: a systematic review and meta-analysis" and discovered that the majority of the children analyzed were placed under endosonography.

Furthermore, the vast majority of the children studied did not receive any bowel preparation training. This outcome matched ASGE Standards of Practice Committee, Lightdale and Acosta's (2020) findings, they

conducted a study on "Modifications in endoscopic practice for pediatric patients" and found that more than half of the youngsters tested did not participate in any bowel preparation training programs. This finding could be attributed to a lack of learning resources for nurses to update their knowledge and practice of bowel preparation modalities or regimens before enteroscopy, as well as a lack of time on nurses' hands due to workload and staff shortages, which may have left them with no time to provide any bowel preparation before enteroscopy training program.

Furthermore, the current study found a significant difference between two groups (CN and CB) regarding the type of disease ($P < 0.001$). This finding is contradicted with **Pall, Zacur, and Kramer, (2018)**, who investigated "Bowel preparation for pediatric colonoscopy" and found no significant change in kind of disease between two groups of intervention ($P > 0.05$). This finding, according to the researchers, may be attributed to the fact that enteroscopy or colonoscopy is regularly performed in infants and children for the examination and treatment of disorders like those listed in this result

In terms of different categories of Aronchick bowel preparation quality in percentage distribution among pediatric CN group and CB group, the current study found that more than a third of the CB group had good bowel preparation and none of them had inadequate bowel preparation, compared to the CN group. This finding is similar to that of **Longcroft-Wheaton and Bhandari, (2012)**, who conducted a study titled "Same-day bowel cleansing regimen is superior to a split-dose regimen over 2 days for afternoon colonoscopy: results from a large perspective series" and found that the majority of the children on the bowel cleansing regimen had adequate bowel preparation. Moreover, this finding proved that the CB group had a significantly higher score of bowel preparation quality than the CN group [(8.35 ± 6.86) vs. (4.34 ± 0.75) at $P = 0.001$]. This finding was not in agreement with **Liang, Xin, Yang and Li, (2019)** who carried out research on "Applications of care bundles in bowels preparation for colonoscopy in children", who claimed that the CB group scored much worse than the CN group [(1.24 ± 0.85) vs. (2.35 ± 1.76) ; $t = -3.477$, $P = 0.001$]. This finding could be

linked to the fact that the notion of applying care CB protocols has greater advantages in increasing the quality of bowel preparation in children before enteroscopy, according to the researchers.

One of the current study's findings was that intolerance symptoms such as abdominal pain, vomiting, and fatigue, as well as intragastric feeding, did not differ significantly between these two groups at $p > 0.005$. This result was contradicted by **Johnston, Keswani, and Cyrus, (2015)**, who conducted a study titled "Inpatient Bowel Preparation Adequacy can be Predicted with High Accuracy Using the Nursing Bowel Preparation Assessment Tool (NBPAT)" and found a significant link between the studied pediatric patients and symptoms of bowel preparation intolerance such as distensions, pain of the abdomen, vomiting, and fatigue along with intragastric feeding.

Concerning anxiety mean scores among pediatric CN and CB groups, the current study found that the CB group experienced less anxiety than the CN group, and their anxiety level was much lower (3.28 ± 0.85 vs. 5.45 ± 1.78 respectively at $P > 0.001$). This finding was coordinated with **Di Nardo, Aloï, and Cucchiara, (2017)**, who conducted a study on "Bowel preparations for colonoscopy" and reported that the level of anxiety in children undergoing bowel preparation for colonoscopy was decreased after the implementation of care protocol on them. These findings could be attributed to the use of bowel preparation protocol elements, which can reduce the likelihood of repeat enteroscopy. As a result, children and families who are extremely anxious or concerned about bowel preparation failure may feel relieved and contented by the use of such protocol elements.

Regarding the hospitalization satisfaction level in the pediatric CN and CB groups, It was noted that, the CB group's satisfaction level with their hospital stay was much higher than the CN groups. The current study findings were consistent with those of **Liang, Xin, Yang, and Li, (2019)**, who discovered that the CB group was more satisfied with their hospitalization than the CN group (97.62 percent vs. 85.00 percent, respectively; $X^2 = 6.764$, $P < 0.001$). These findings could be attributed to improved bowel preparation quality and decreased anxiety in the CB group,

resulting in higher hospitalization satisfaction scores.

Conclusion

The use of CB measures in pediatric bowel preparation had highly statistically significant impact on quality of bowel preparation and enhancing the satisfaction with hospitalization experience of children and their families. As well as reducing the anxiety of children and their families.

Recommendations

The study recommended that Intensive training and educational programs about the evidence bowel preparation protocols should be considered for surgical nurses and all children and their parents undergoing such procedure as a standard of practice. Also, CB protocols can be applied in a range of pediatric clinical situations that requires the bowels preparation either for visualization or surgical intervention.

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