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ORIGINAL ARTICLE

Bowel Management Program in Children with True Fecal Incontinence and Its Efficacy on Their Quality of Life: Zagazig University Experience

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ABSTRACT

Background: Fecal incontinence (FI) in children significantly impairs quality of life (QoL), particularly among those with anorectal malformations (ARM), Hirschsprung's disease, and other congenital anomalies. Bowel Management Programs (BMP) offer a non-surgical approach to achieve continence and improve psychosocial outcomes. The aim of this study is to evaluate the effectiveness of a structured BMP on the quality of life in children with true fecal incontinence following surgical treatment for anorectal malformations, Hirschsprung's disease, or sacrococcygeal teratoma.

Methods: A prospective case series was conducted at the Pediatric Surgery Department, Zagazig University Hospitals, involving 26 children diagnosed with true FI. Participants were divided based on colonic motility into two groups: Group A (hypomotile colon) and Group B (hypermotile colon). All patients underwent a three-month BMP tailored to colonic type. Quality of life was assessed using the Pediatric Quality of Life Inventory (PedsQL 4.0) before and after the intervention.

Results: Both groups demonstrated statistically significant improvements in physical, emotional, social, and school functioning after BMP ($p < 0.001$). Although the hypomotile group showed slightly better outcomes, intergroup differences in post-BMP QoL scores were not statistically significant ($p > 0.05$). A positive correlation was noted between age and enema volume requirement. Loperamide was selectively used in hypermotile cases to achieve continence.

Conclusion: A structured, individualized BMP significantly improves the quality of life in children with true fecal incontinence. Implementation of a multidisciplinary, family-centered approach is essential for optimal outcomes.

Keywords: Fecal incontinence; Bowel management program; Anorectal malformations; Quality of life; Pediatric surgery.

INTRODUCTION

Fecal incontinence (FI) remains a challenging complication, affecting nearly 25% of children with anorectal malformations (ARM), and is defined as the unintentional leakage of stool in children over the age of four years [1]. Regardless of its etiology—whether structural or

functional—FI significantly impairs quality of life (QoL) in pediatric patients [2].

According to the World Health Organization, QoL encompasses an individual's self-perception of their position in life within the framework of cultural, societal, and personal goals, expectations, and concerns [3]. Differentiating between true incontinence—resulting from anatomic

or neurologic dysfunction despite adequate surgical repair—and pseudo-incontinence, which is typically due to chronic constipation or overflow, is essential in guiding appropriate therapy [4,5].

Children with complex congenital anomalies, such as spina bifida, cloacal malformations, or recto-vesical fistulas, are more likely to experience poor continence outcomes. Similarly, those with Hirschsprung's disease who undergo pull-through procedures are also at risk, especially if injury to the dentate line occurs during surgery [6].

Bowel Management Programs (BMP) have been developed as structured, non-surgical approaches aimed at achieving 24-hour fecal continence through regular enemas. These programs have demonstrated significant benefits in terms of psychological and social well-being, yet they remain underutilized due to limited awareness among healthcare providers [7].

Effective BMP implementation requires tailoring the type, volume, and components of enemas to the patient's colonic motility profile. A trial-and-error method is often needed to optimize outcomes and ensure that children can engage fully in normal activities such as school, play, and social interaction [2].

Despite being primarily medical interventions, BMPs are often overlooked by pediatricians and gastroenterologists, while surgeons may lack the time to provide ongoing bowel care. This creates a gap in service availability for children with FI. Therefore, institutions that provide a multidisciplinary, dedicated approach to BMP offer a much-needed solution for affected families [4].

This study aimed to evaluate the impact of a structured Bowel Management Program on the quality of life in children with true fecal incontinence following treatment for ARM, Hirschsprung's disease, or sacrococcygeal

teratoma at Zagazig University Hospitals.

METHODS

A prospective case series was conducted in the Pediatric Surgery Department at Zagazig University Hospitals, Sharkia Governorate, Egypt. The study aimed to evaluate outcomes following bowel management in children with true fecal incontinence (FI). Based on an expected increase in total Pediatric Quality of Life Inventory (PedsQL) scores from 24.4 ± 3.4 to 79.3 ± 3.8 , a minimum sample size of 26 participants was calculated to achieve 89% power with a 95% confidence interval.

Inclusion criteria:

patients who had anorectal malformations operated on and had real FI. Following surgery, Hirschsprung's disease developed in patients with real FI. patients with a sacrococcygeal teratoma that is linked to real FI. Patients with a tethered cord who have real fecal incontinence.

Exclusion criteria:

patients under the age of four and those with pseudo-fecal incontinence.

Ethical Consideration:

The study was approved by the institutional Review Board of Zagazig University faculty of Medicine approval number (ZU-IRB 9573/6-5/2023) . Written, informed consent was provided by each participant. This study was conducted in compliance with the World Medical Association's Code of Ethics (Declaration of Helsinki) for human subjects research.

Steps of performance:

1-Parents were informed by the study and have a clear discussion about every step and all possible complications.

2. Parents and their kids were asked to complete the "PedsQL questionnaire" once their consent to participate in the study was obtained.

3. In order to assess bowel control, which is dependent on the following factors: "type of malformation-sacral ratio-abnormalities of

spinal cord-quality of the operation," patients were assessed through history, physical examination, and spinal and sacral radiographs.

4. Patients over the age of four who had a poor prognosis for bowel control were our target population.

5. After a contrast enema was performed to identify the kind of colon, patients were divided into two groups:

Group A: Patients who have a dilated colon (also known as a "hypomotile colon") require a concentrated, large-volume enema.

Group B: Patients with "hyper motile colons," or non-dilated colons, may require loperamide, a small volume enema, and a constipating diet.

6. Youngsters are told to give the enema slowly over five to ten minutes, hold the solution in for five to ten minutes, and then sit on the toilet for thirty to forty-five minutes in order to get rid of the enema. This is known as the "trial and error" week, which starts the first week. Abdominal radiographs were taken every day to compare and assess the enema's effectiveness. Reports from parents and patients were collected daily.

Based on the prior experience, we were able to modify the enema by increasing or decreasing its concentration; perhaps we might slow down the solution's flow or warm it up.

7. When the child has not had any soiling and the abdominal radiograph shows no stools in the left colon or rectum, the treatment approach is deemed successful.

8. Following a successful regimen, the clinic followed in with patients at one, two, and three months to see if their symptoms had changed.

9-An abdominal x-ray and any other necessary tests were requested of the patients in advance of the visit.

10. Three months after the trial began, parents and kids were invited to complete the "PedsQL questionnaire" once more.

Statistical analysis:

After being gathered and assessed using The Statistical Package for the Social Sciences (SPSS) version 20.0 software was used to analyze the data after it was imported from Microsoft Excel. The mean $\pm$ SD is used to express quantitative data, while qualitative data is represented by numbers and percentages. quantifiable independent multiple differences using ANOVA. The significance criterion for each of the aforementioned statistical tests was set at the 5% level (P-value). A P value of less than 0.05 indicates that the results are significant. A P value of less than 0.001 indicates highly significant results. The results are more significant when the P value is less.

RESULTS

The two study groups—children with hypomotile and hypermotile colons—were well matched in terms of baseline characteristics. No significant differences were observed in age ($p = 0.7$) or gender distribution ($p = 0.2$), with a male-to-female ratio of approximately 4:1 in both groups. The mean age was 8.1 ± 1.5 years in Group A and 7.9 ± 1.1 years in Group B. A majority of parents in both groups had low educational attainment (Table 1).

Etiologies of Fecal Incontinence:

Anorectal malformations were the most frequent cause of fecal incontinence in both groups, accounting for 44.4% and 87.5% in Groups A and B, respectively. Operated Hirschsprung's disease and tethered cord were additional contributors in Group A, while only one child in Group B had tethered cord-related incontinence (Tables 2).

Correlation between Age and Enema Volume:

A significant positive correlation was identified between age and the volume of

saline and glycerin required during the enema regimen. Older children consistently required higher volumes, suggesting age-dependent adjustments in bowel management protocols.

Use of loperamide in Hypermotile Group:

In Group B, loperamide was administered to aid in achieving continence. Two children (25.0%) received two tablets daily, while three (37.5%) were on a single dose. Two children (25.0%) did not require medication, and one child received three tablets per day.

Quality of Life Outcomes in Hypomotile Group:

Following three months of BMP, children in Group A showed significant improvements across all domains of the PedsQL 4.0 questionnaire. Physical function scores decreased from a mean of 27.9 ± 0.04 to 10.2 ± 0.09 ($p < 0.001$). Emotional, social, and school-related aspects similarly improved, contributing to an overall enhancement in QoL (Table 3). Parents'

assessments mirrored these findings, with total QoL scores improving from 78.9 ± 2.3 to 22.9 ± 0.09 ($p < 0.001$) (Table 4).

Quality of Life Outcomes in Hypermotile Group:

Children in Group B also reported significant improvements in PedsQL scores post-BMP. The total quality of life score decreased from 82.1 ± 2.3 to 27.3 ± 1.1 ($p < 0.001$), indicating better physical, emotional, and social functioning (Table 5). Parent-reported QoL scores followed a similar pattern (Figure 1).

Comparative QoL Between Groups:

Although both groups experienced substantial improvement after BMP, Group A (hypomotile colon) showed slightly better overall scores in both child- and parent-reported assessments. However, the differences in post-BMP total QoL scores between the groups were not statistically significant ($p > 0.05$) (Table 6).

Table (1): Demographic Characteristics of Children in the Hypomotile and Hypermotile Colon Groups

Characteristics	Group A No=18 (%)	Group B No=8(%)	T-test
Age Mean $\pm$ SD Median (Range)	8.1 ± 1.5 8 (6-12)	7.9 ± 1.1 7 (5-12)	0.3
Age group 5-8 years ≥ 8 years	14 (77.8%) 4 (22.2%)	5 (62.5%) 3 (37.5%)	FET
Sex Male Female	14 (77.8%) 4 (22.2%)	6 (75.0%) 2 (25.0%)	FET
Parent education Poorly educated. Well educated	11 (61.1%) 7 (38.9%)	6 (75.0%) 2 (25.0%)	FET

FET=Fischer exact test.

Table (2): Etiological Classification of Fecal Incontinence in both groups Group

Causes of fecal incontinence	The hypomotile. Hyper motile group	
	No=18	N=8
Operated anorectal malformation	8 (44%)	7(87.5%)
Operated Hirschsprung's disease	7(38.9%)	0 (0%)%
Associated sacrococcygeal teratoma	1(5.5%)	0 (0%)%
Associated tethered cord	2(11.1%)	1 (12.5%)%

Table (3): Pre- and Post-BMP Pediatric Quality of Life Scores in Hypomotile Colon Group (PedsQL 4.0)

Characteristics	Pre-BMP No=18 Mean ± SD (Range)	Post-BMP No=18 Mean ± SD (Range)	Paired T-test	p-value
Physical function	27.9±0.04 (23-31)	10.2±0.09 (8-13)	6.1	0.001**
Emotional aspect	18.1±0.2 (16-20)	4.4±0.04 (2-6)	5.2	0.001**
Social aspect	18.1±0.03 (16-20)	4.1±0.03 (2-6)	6.3	0.001**
School function	15.2±0.05 (13-18)	5.2±0.1 (3-7)	5.8	0.001**
Total QOL	79.3±3.3 (71-86)	24.4±1.2 (19-33)	11.4	0.001**

**Statistically highly significantly different,

Table (4): Parental Quality of Life Assessments Before and After BMP in Hypomotile Group (PedsQL 4.0)

Characteristics	Pre-BMP No=18 Mean ± SD (Range)	Post-BMP No=18 Mean ± SD (Range)	Paired T-test	p-value
Physical function	26.3±0.03 (23-31)	9.1±0.04 (7-11)	18.7	0.001**
Emotional aspect	18.5±0.04 (15-20)	5.2±0.02 (3-8)	15.4	0.001**
Social aspect	18.3±0.02 (16-20)	4.3±0.1 (4-7)	7.9	0.001**
School function	15.8±0.01 (12-19)	4.4±0.04 (4-7)	8.5	0.001**
Total QOL	78.9±2.3 (73-86)	22.9±0.09 (16-28)	13.1	0.001**

**Statistically highly significantly different

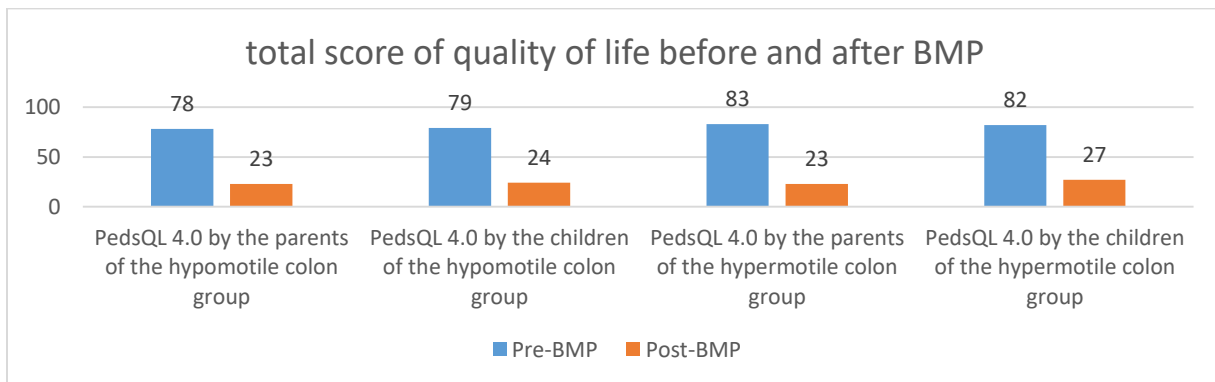
Table (5): Pediatric PedsQL Scores Before and After BMP in Hypermotile Colon Group

Characteristics	Pre-BMP No=8 Mean $\pm$ SD (Range)	Post-BMP No=8 Mean $\pm$ SD (Range)	Paired T-test	p-value
Physical function	29 $\pm$ 0.03 (27-31)	10.5 $\pm$ 0.09 (9-13)	10.2	0.001**
Emotional aspect	18.4 $\pm$ 0.04 (16-20)	6.7 $\pm$ 0.05 (5-8)	4.1	0.001**
Social aspect	18.3 $\pm$ 0.05 (17-20)	4.9 $\pm$ 0.03 (3-7)	5.7	0.001**
School function	16.2 $\pm$ 0.03 (13-19)	5.3 $\pm$ 0.02 (4-7)	6.3	0.001**
Total QOL	82.1 $\pm$ 2.3 (78-87)	27.3 $\pm$ 1.1 (25-32)	5.7	0.001**

**Statistically highly significantly different

Table (6): Comparison of Total Quality of Life Scores Between Hypomotile and Hypermotile Groups Pre- and Post-BMP

QOL	Group A No=18	Group B No=8(%)	T- test	p-value
Total QOL by the parents pre-BMP	78.9 $\pm$ 2.3 (73-86)	84.2 $\pm$ 3.3 (75-94)	1.1	0.2
Total QOL by the parents post-BMP	22.9 $\pm$ 0.09 (16-28)	24.3 $\pm$ 0.06 (22-26)	2.2	0.3
Total QOL by the children pre-BMP	79.3 $\pm$ 3.3 (71-86)	82.1 $\pm$ 2.3 (78-87)	1.3	0.2
Total QOL by the children post-BMP	24.4 $\pm$ 1.2 (19-33)	27.3 $\pm$ 1.1 (25-32)	1.8	0.08


Figure (1): Total Quality of Life Score Improvements in Both Groups Following BMP

DISCUSSION

Fecal incontinence presents significant physical and psychological burdens on children, often leading to social isolation and reduced self-esteem. It is increasingly recognized in children with conditions such as anorectal malformations, Hirschsprung's disease, spinal anomalies, and other congenital or acquired neurologic disorders [6].

Epidemiological studies estimate that FI affects between 1.6% and 4.4% of children, with higher prevalence observed among those post anorectal or spinal surgeries [7]. Effective bowel control in these populations typically requires comprehensive evaluation and tailored management strategies [8].

Conventional therapies—including biofeedback and sacral nerve stimulation—have shown some utility but are often limited by accessibility, high cost, and the need for specialized equipment and trained personnel [9,10]. Moreover, their effectiveness in the pediatric age group remains inconclusive.

In contrast, the Bowel Management Program (BMP), pioneered by Peña and Levitt, offers a structured, low-cost alternative that can be administered at home under clinical guidance. The protocol focuses on achieving 24-hour cleanliness through customized enemas, often leading to discontinuation of diapers and significant lifestyle improvements in over 90% of patients [5,11]. Although the regimen demands consistent effort from both children and caregivers, it remains one of the most effective non-surgical interventions for pediatric FI [1].

Despite potential side effects, such as colitis or electrolyte imbalances, the program is considered a less invasive alternative compared to other therapies, significantly enhancing the quality of life for children with fecal incontinence [1]. In our study,

there were no statistically significant differences between the two groups, regarding age and sex, with p-values of 0.7 and 0.2, respectively. The age range of the study participants was between 5 and 12 years, with mean ages of 8.1 ± 1.5 and 7.9 ± 1.1 years, respectively. The male-to-female ratio was 4:1. This finding is in agreement with Rajindrajith et al. [12], who observed a male-to-female ratio ranging from 3:1 to 6:1 in children with fecal incontinence. Similarly, Shen et al. [13] also reported a higher incidence of FI in boys compared to girls.

Our study found that the most common cause of fecal incontinence in hypomotile and hypermotile colons was anorectal malformation, followed by sacrococcygeal teratoma, tethered cord, and surgically corrected Hirschsprung's disease. Similar findings were reported by Colares et al. [1] and Bischoff et al. [14], who identified that the majority of cases of fecal incontinence resulted from surgically repaired anorectal malformations.

Peña and Levitt [8] described that all patients with anorectal malformations exhibit abnormalities in their fecal continence mechanisms, and many experience functional defecation difficulties. Our findings align with this, as we observed that in group A, 44.4% of patients with operated anorectal malformations had fecal incontinence, while in group B, the incidence was 87.5%. Our results demonstrated a strong statistically significant association between follow-up visits and parental education, with simple follow-up visits provided to all children of highly educated parents. Halleran et al. [15] showed that regular caregiving by caregivers has a significant positive impact on the effectiveness of the bowel management program (BMP). Additionally, Cushing et al. [17] emphasized that, alongside the

appropriate biological regimen, a multidisciplinary approach is essential to ensure adequate education and family support. For optimal treatment outcomes, such a multidisciplinary team should include at least one member experienced in parent-child relations, family dynamics, and adherence to the regimen.

Our findings revealed a highly statistically significant improvement in all quality-of-life score items, as assessed by both parents and children, in both the hypermotile and hypomotile colon groups before and after three months of the Bowel Management Program (BMP) (p-value < 0.001). This is consistent with the results of Colares et al. [1], where the PedsQL4.0 evaluation showed improved quality of life perceptions reported by both parents and children (p-value < 0.01). Additionally, John et al. [18] used a BMP-specific questionnaire to assess children with anorectal malformations and fecal incontinence in India, finding a significant improvement in their quality of life, a finding also supported by Bai et al. [19]. Bongers et al. [20] found that the negative effects of fecal incontinence (FI) are more pronounced in the emotional domain than in the social domain. Our results showed a statistically significant improvement in quality of life across all dimensions—academic, social, physical, and emotional—following the Bowel Management Program (BMP). Prior to treatment, feelings of fear, despair, and worry were reported as "almost always" present in relation to the emotional aspect, but these challenges were "rarely" encountered after therapy. This aligns with the findings of Colares et al. [1], who emphasized the importance of addressing psychological factors, in addition to preventing fecal loss. Both groups showed significant improvement in physical function before and after three months of Bowel Management Program (BMP) treatment (p-

value < 0.001), consistent with the findings of Miner (2004) [21]. One possible explanation is that, with BMP, walking pain and perineal dermatitis decreased from "frequently" to "almost never," allowing children to resume regular activities without pain. The social component showed a significant reduction in emotional distress both before and after the Bowel Management Program (BMP) treatment (p-value < 0.001). After three months of treatment, children were observed to interact more positively with their classmates, were no longer subjected to derogatory remarks, and began participating in activities such as swimming, jumping, and ball play, which were previously unattainable. Following the use of artificial cleaning, patients gained the freedom to enjoy these activities without the concern of becoming soiled.

Both groups showed significant improvement in school function before and after the application of the Bowel Management Program (BMP), with a highly statistically significant improvement observed months after therapy (p-value < 0.001). This aligns with the findings of Bai et al. [19]. Frequent school absences due to illness or hospitalization were initially reported as a "frequent" issue, but absenteeism decreased to "almost never" following improvements in fecal incontinence (FI) and the discontinuation of diapers after BMP. Additionally, emergency room visits related to malaise were often converted into elective appointments.

From the perspectives of both parents and children, the hypomotile colon group performed significantly better than the hypermotile colon group across all quality-of-life score categories before and after the three-month Bowel Management Program (BMP). This finding is consistent with Bischoff et al. [14]. The hypomotile colon group demonstrated a higher success rate compared to the hypermotile colon group.

We agree that individuals with fecal incontinence and a short or hyperactive colon face considerable challenges, as managing bowel movements becomes more difficult. As a result, we recommend that surgeons strive to preserve as much colon as possible in patients with anorectal malformations (ARM), particularly those with abnormalities that have a poor functional prognosis. Preservation of colon tissue enhances water absorption and improves the potential for solid stool formation. Additionally, the slow transit of the large bowel, in contrast to the small bowel, is critical for effective bowel management.

Our study revealed a statistically significant positive relationship between glycerin and saline levels and the children's age. Specifically, older children had higher levels of glycerin and saline.

Our study revealed that the children in the group struggled to obtain the required Bowel Management Program (BMP) from the specially designed enema-constipating meal. To maintain 24-hour cleanliness, loperamide was used. Two cases (25.0%) were given two tablets, two cases (37.5%) did not receive any constipating medications, and one case (12.5%) was given three tablets.

Our study found that the children in the group experienced challenges in obtaining the required Bowel Management Program (BMP) from the specially formulated enema-constipating meal. To maintain a 24-hour clean state, loperamide was used. Two cases (25.0%) were given two pills, two cases (37.5%) received no constipating medications, and one case (12.5%) was administered three pills.

Prior to the implementation of the Bowel Management Program (BMP), a waiting list of children existed. Various enemas, laxatives, and dietary interventions were used to treat these children, but there was no systematic approach, particularly lacking

multidisciplinary involvement.

Unfortunately, the children remained incontinent and dependent on diapers.

The present study contributes to the existing literature by showing that a dedicated and supportive multidisciplinary team can significantly enhance the quality of life (QoL) of Egyptian children and prevent soiling in both dilated and nondilated colon cases. This is achieved by tailoring a specific Bowel Management Program (BMP) to each patient's individual characteristics. I agree that it is essential to understand the challenges faced by children with fecal incontinence and their families, as emphasized by Cushing et al. [17]. Early identification and supportive interventions can improve the quality of life for both the child and their parents.

Our study also revealed a significant positive correlation between age and the amount of glycerin/saline used. In instances where dietary or enema-based management was insufficient, loperamide was used to achieve cleanliness.

Prior to the implementation of the Bowel Management Program (BMP), children were often treated with various methods without a structured approach, leading to continued dependence on diapers. Our findings highlight the importance of a committed multidisciplinary team that tailors the BMP to individual needs, aligning with Cushing et al.'s emphasis on family-centered care [17].

Limitations:

Our study has several limitations. The small sample size, short follow-up period, and single-center design restrict the generalizability of the findings. To enhance the ability to generalize the data, we recommend conducting multicenter studies with larger sample sizes in future research.

CONCLUSION

This study demonstrates that a dedicated and collaborative multidisciplinary team can effectively prevent soiling in both dilated

and nondilated colon cases. By tailoring a bowel management program (BMP) to each patient's unique characteristics, we can significantly enhance the quality of life for affected children. Understanding the potential challenges faced by children with fecal incontinence—and their families—is essential. Early identification and supportive interventions are key to improving outcomes and overall well-being.

Conflict of interest: None.

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Author contribution: Every author contributed equally to the study.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Relevant data may also be obtained from the published article and its supplementary materials, where applicable.

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