



# Impact of cecostomy and antegrade colonic enemas on management of fecal incontinence and constipation Ten years of experience in pediatric population

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## Abstract

**Background:** In childhood and adolescence, fecal soiling represents a psychologically devastating problem. Physical and emotional distress associated with daily rectal enemas is minimized by the introduction of a cecostomy tube for colonic cleansing with antegrade colonic enemas (ACEs).

**Patients and Methods:** Over a period of 10 years (1997-2007), we performed “button” cecostomies in 69 pediatric patients with fecal soiling secondary to a variety of disorders; laparoscopic procedures were performed in 40 and open procedures in 29. Mean postoperative follow-up was 4.03 SD ± 1.76 years. Cleansing protocols differed between patients.

**Results:** We adopted a standardized questionnaire concerning management of incontinence/intractable constipation before and after button cecostomy insertion to assess the long-term impact of ACE on symptom severity and quality of life. Complications included tube dislodgement (n = 9), development of granulation tissue (n = 11), decubitus ulcer (n = 5), and infection (n = 3). Patient/parents satisfaction (appraisal scale 1-3) and improvement of quality of life achieved statistical significance for both ( $P < .001$ ).

**Conclusions:** Since button cecostomy and ACE were introduced in our institution as a management option, the treatment of fecal incontinence and intractable constipation significantly improved in terms of efficacy and patient compliance and also resulted in greater patient and parent satisfaction.

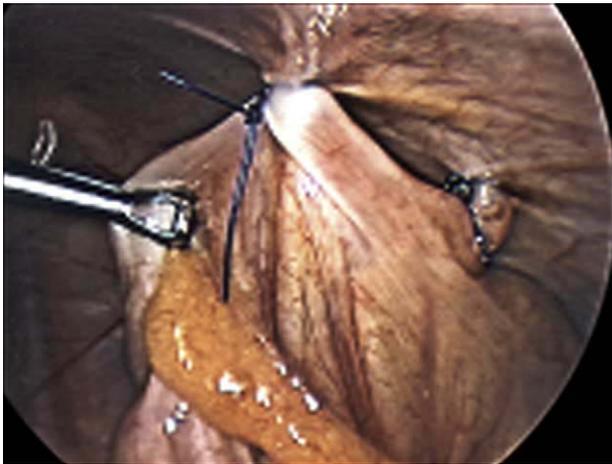
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Patients with a variety of congenital and acquired conditions may be plagued by fecal incontinence and constipation. The medical management of these patients is usually combined with behavioral techniques (toilet training) and cognitive exercises (psychotherapy, family therapy, etc). In patients who cannot achieve the main elements for bowel

continence—anorectal sensation, functioning sphincters, and rectosigmoid motility—these modalities often fail to achieve satisfactory and prolonged results. For these patients, physical and emotional distress associated with a fixed regimen including dietary restrictions and repeated retrograde enemas is largely minimized by the introduction of a cecostomy and antegrade colonic enemas (ACEs).

Many modifications of the ACE procedure have been proposed since Malone et al [1,2] described it in 1990. These include multiple variations on the appendicostomy

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**Fig. 1** Lateral fixation of cecum to anterior abdominal wall.

technique (open and laparoscopic) to achieve a conduit or continent stoma. Different reconstructive procedures using the cecum or ileum can be used to create a catheterizable conduit when the appendix was absent [3-5] or used for another purpose in urinary management and percutaneous cecostomy tube placement, a technique that requires invasive radiologist skills [6,7]. All these procedures are designed to enable antegrade delivery of an enema to clean out at regular intervals the large bowel and reduce soiling episodes. Recently, studies have reported ACE as a therapeutic option in patients with idiopathic, intractable functional constipation when maximal conventional therapies are not successful [8,9].

## 1. Objective

The purpose of this article is to retrospectively review 10 years of experience with a surgically inserted cecostomy tube (both laparoscopic and open) in a children's hospital.

The primary objective is to evaluate the efficacy of a surgically inserted cecostomy tube (laparoscopic/open) for the antegrade administration of colonic irrigations in the management of fecal incontinence and constipation.

A secondary objective was to clarify the long-term impact with determinants of improvement in correlation with the fecal incontinence severity scale before and after cecostomy tube insertion.

## 2. Patient and methods

Failure of conservative treatment was the primary indicator for cecostomy and ACEs. Underlying conditions included spina bifida ( $n = 43$ ), anorectal malformations ( $n = 17$ ), Hirschsprung disease ( $n = 3$ ), trauma ( $n = 1$ ), and intractable functional constipation ( $n = 5$ ).

Clinical descriptors were analyzed retrospectively between the groups, and data were collected from medical charts and by one-to-one interviews during the follow-up in the surgical outpatient clinic. Information regarding efficacy and subsequent complications was obtained from patients, parents, or caregivers. Determinants of improvement were collected using structured questionnaires, and qualitative information was converted into quantitative global scores given to every patient. Statistical results are presented by description of the variables with percentage, mean, and standard deviation; and quantitative variables were determined by a Student's *t* test. A *P* value less than .05 was considered statistically significant.

## 3. Operative technique

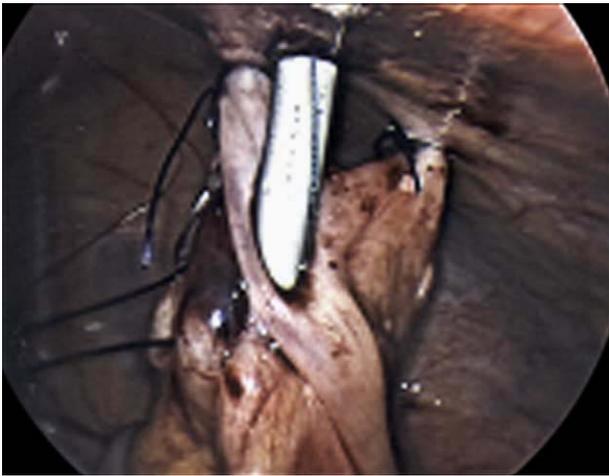
Laparoscopic approaches have previously been described. We briefly outline our approach as follows.

Surgery is undertaken after bowel washouts and parenteral antibiotics.

Our laparoscopic approach involves the use of three 5-mm ports. Port positions may vary slightly but in general are placed suprapubically and in the left lower quadrant. The lateral portion of the cecum is fixed with 2 to 3 intracorporeal sutures (Fig. 1) to the anterolateral abdominal wall. An intracorporeal purse string suture is placed around the anterior cecal tinea. A percutaneously placed Majestic 18-gauge needle is used to puncture the cecum and place, through the purse string, a Seldinger guide wire and preloaded retention suture (Enterostomy Suture Anchor Set; Cook, Bloomington, IN) (Fig. 2). The needle is removed, and the tract is dilated with an 11F Cook dilator (Fig. 3). The appropriate-sized button cecostomy "Chait" tube is loaded on the introducer and inserted through the dilator sheath (Peel-Away Introducer Set; Cook). After



**Fig. 2** Purse string suture on anterior wall of cecum.



**Fig. 3** Cecostomy tube insertion into cecum.

removing the sheath, the purse string suture is tied around the “C”-tube and sutured to the anterior abdominal wall. We complete the cecopexy, fixing the medial portion of the cecum to the anterior abdominal wall with 2 additional intracorporeal sutures (Fig. 4). The intraluminal position and patency of the C-tube are confirmed by contrast injection under fluoroscopy.

In an open procedure, we use a McBurney incision or a midline incision when a concomitant reconstruction of urinary tract (Mitrofanoff) is performed. Cecal mobilization, purse string suture, and fixation are similar as to the laparoscopic approach with the C-tube inserted into the cecum through a separate stab wound. We also fix the cecum to the undersurface of the abdominal wall with 4 anchoring sutures around the shaft of the tube.

#### 4. Results

Over a period of 10 years, we performed 69 “button” cecostomies in pediatric patients, 40 laparoscopic assisted (58.4%) and 29 open (42.6%). The mean patient age at the time of the surgical procedure was 10.8 SD  $\pm$  4.0 years. The decision to proceed with either approach was based mostly on previous or planned concomitant urinary continence procedures. All laparoscopic cecostomies were performed as a single procedure, whereas from 29 patients who underwent the open procedure, 16 had concomitant and 8 already had urinary incontinence surgery (Mitrofanoff). In 5 patients, the procedure was converted from laparoscopic to open because of adhesions from either previous ventriculo-peritoneal shunt insertions (4 patients) or surgery for ruptured appendicitis (1 patient). Clinical parameters are presented in Table 1. The cecostomy tube was flushed with 10 mL of saline, twice daily, starting from the second postoperative day. Oral intake was commenced in most patients by 24 to 36 hours. Most

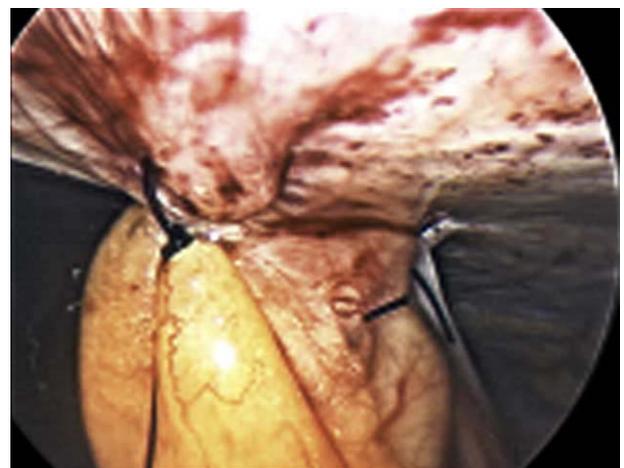
patients had an uneventful postoperative recovery and were discharged by 3 to 4 days. Patients in the open group tended to have a somewhat longer hospital stay (2-5 days longer).

An ACE regimen was started 10 to 14 days after cecostomy insertion with close follow-up in the outpatient clinic. Glycerine and saline enema solutions were most commonly used, with abdominal cramps being reported more often with sodium phosphate enemas (Table 2). On average, enemas were used 3 to 4 times per week once an individualized irrigation routine was established. It generally took an adaptation period of 3 to 7 months to achieve effective total colonic evacuation and cleansing to avoid accidents between enemas. The cecostomy tube can be changed as an outpatient in the radiology suite over a guide wire with fluoroscopic guidance as has been previously described by Shandling et al [7]. This is generally done on a yearly basis.

Table 3 summarizes our cecostomy-related complications.

A scoring system for the assessment of severity of fecal incontinence/soiling is applied to provide an objective comparison of treatment outcomes. A validated scoring system is used to assess the ability to sense defecation; and an additional score, for the use of medications and the need to wear a pad or diaper (Table 4) Score zero represents full continence, and score 24 is complete incontinence.

In our study, we wanted to clarify the determinants of improvement in correlation with the fecal incontinence severity scale before and after cecostomy tube insertion. Our study was completed in 64 of 69 patients; 5 were excluded (1 patient died from cardiac disease, 2 moved and were unreachable, and 2 additional patients were too young to be included in the study). In 48 patients, scoring was established by direct interviews with the parents/caregivers in the outpatient clinic and in 16 patients by telephone interviews. Overall scores showed clear improvement in incontinence symptoms after the introduction of ACEs in



**Fig. 4** Medial fixation of cecum to anterior abdominal wall.

**Table 1** Clinical data

	Laparoscopic	Open
No. of patients	40 (58.4%)	29 (41.6%) *5 Conversions (12.82%) *16 Concomitant, *8 previous Mitrofanoff
Age at operation	10.8 ± 4.0 y	9.6 ± 3.3 y
OR time	75 ± 20 min	*60 ± 10 min (converted) *140 ± 20 min (concomitant)
Antibiotic therapy	3 d IV (Ampicillin + Gentamicin + Metronidazole) *Patients with ventriculo-peritoneal shunt: same and 4 d PO Metronidazole	
Pain management	2.0 ± 1.0 d	2.2 ± 1.2 d (*converted)
Duration of admission	3.2 ± 1.0 d	3.5 ± 1.2 d (*converted)

Laparoscopic—patients who underwent laparoscopic cecostomy. Open—patients who underwent open cecostomy. No. of patients—number of patients in trial. Age at operation—age of patient at time of operation. OR time—time taken in minutes to complete cecostomy procedure. Abx th—type of antibiotics and time of treatment in days. Pain management—number of days pain medication was required. Duration of admission—length of time in hospital in days.

their treatment. Mean score pre- vs postcecostomy insertion was 16 vs 6 ( $P < .0001$ ) (Fig. 5).

In addition, we performed our study in the subgroups based on underlying disease conditions.

In the spina bifida group, we had 41 patients. Almost all of them experienced fecal incontinence. The mean pre- vs postcecostomy score was 18 vs 7, with statistical significance ( $P < .0001$ ) (Fig. 6). Fifteen patients with previous repair of anorectal malformations underwent cecostomy placement. Eleven were incontinent after repair of “high” anomalies, and 4 had severe constipation with soiling after repair of “low” anomalies. Insertion of a cecostomy and introduction of

**Table 2** Antegrade colonic enemas solutions

Antegrade enemas	Adverse effect (cramps)	Time lag before bowel movement
Sodium phosphate and saline (22 pts)	++	5-30 min
Glycerine and saline (42 pts)	+	20-45 min
Warm tap water (5 pts)	+	20-60 min

+ = minimum cramps; ++ = moderate cramps; +++ = severe cramps. Antegrade enemas—type of enemas used. Adverse effect (cramps)—cramps secondary to enema administration. Time lag before bowel movement—length of time in minutes before bowel movement was achieved.

**Table 3** Cecostomy-related complications

	Lap	Open
Dislodgement	4	5
Infection (cecostomy site)	1	2
Decubitus ulcer (short tube/abd wall)	2	3
Granulation	4	7
Total	11	17

Lap—laparoscopic procedure. Open—open procedure. Dislodgment—number of cases where cecostomy tube pulled out. Infection—number of cases with infection at cecostomy site. Decubitus ulcer—number of cases with ulceration secondary to cecostomy tube pressure. Granulation—number of patients who developed granulation tissue at cecostomy site. Total—total number of cecostomy-related complications in group.

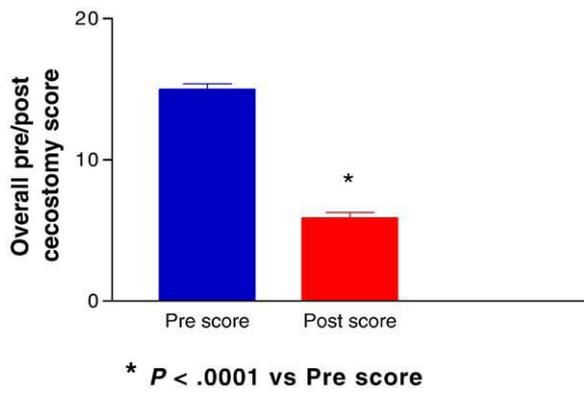
ACEs significantly improved their incontinence scores (mean pre- vs postcecostomy score was 14 vs 5;  $P < .0001$ ) (Fig. 7). Three patients who underwent cecostomy placement had undergone previous surgical therapy for Hirschsprung disease and had issues of constipation and incontinence. Here, too, bowel control improved dramatically after introduction of antegrade enemas; but the numbers were too small to demonstrate statistical significance (Fig. 8).

Patients with recalcitrant functional constipation underwent cecostomy placement. Four of our 5 patients completed the regimen and eliminated fecal soiling (Fig. 9). They subsequently had their cecostomy tubes removed. Although there is marked improvement in constipation and no

**Table 4** Parameters in scoring system

	Never	Rarely	Sometimes	Weekly	Daily
Incontinence for solid stool	0	1	2	3	4
Incontinence for liquid stool	0	1	2	3	4
Incontinence for gas	0	1	2	3	4
Life-style alteration	0	1	2	3	4
Need to wear a pad or plug				No	Yes
Taking constipating medication				0	2
Lack of ability to defer defecation				0	4

\*Adopted from Vaizey et al [10]. Never—no episode in the past 4 weeks. Rarely—1 episode in the past 4 weeks. Sometimes—>1 episode in the past 4 weeks but <1 a week. Weekly—1 or more episode a week but <1 a day. Daily—1 or more episode a day. Score of 0—fully continent. Score of 24—totally incontinent. Life-style alteration—change in behavior or life-style due to complication. Need to wear pad or plug—inserting rectal plug or wearing diaper. Lack of ability to defer defecation—unable to prevent soiling.



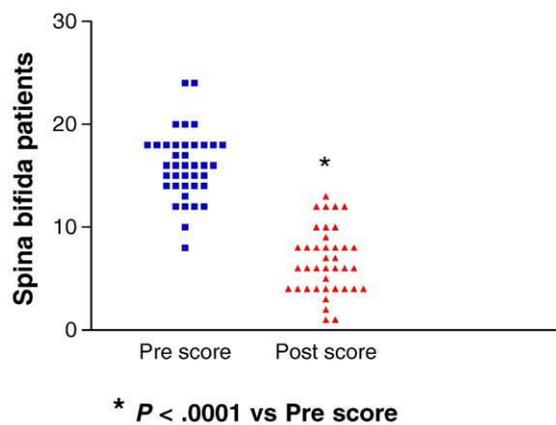
**Fig. 5** Mean patient (n = 69) scores before and after cecostomy insertion.

encopresis in the fifth patient, the caregiver has elected to keep the cecostomy tube in place because the child is mentally challenged.

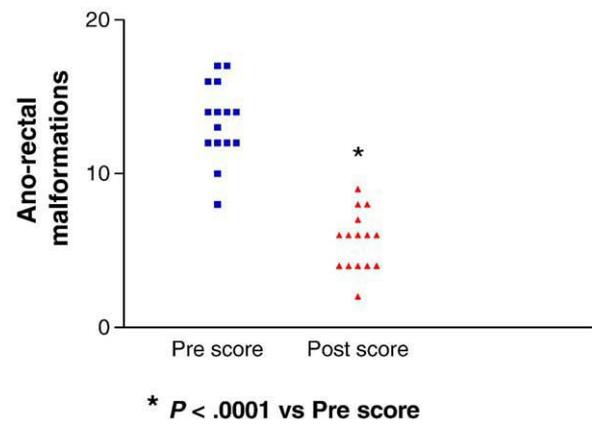
### 5. Discussion

In childhood and adolescents, fecal incontinence/soiling represents one of the most embarrassing and psychologically devastating problems. In particular, it affects patients with spina bifida, patients with history of repair of anorectal anomalies, patients with Hirschsprung disease, and patients with spinal/perineal trauma. In younger children, it is associated with shame and fear of punishment; and in adolescents, with low self-esteem, depression, and anger.

Our goal was to elucidate the relationship between surgically created cecostomy to determinants of improvement in the fecal incontinence severity score. Until recently, there was no interventional radiological service at our institution; and because demand was high, mainly from our spina bifida patients, we started with a laparoscopic-assisted percutaneous insertion of button cecostomy as our surgical compromise for the percutaneous technique initially proposed by Chait et al and Shandling et al [7,8].



**Fig. 6** Spina bifida group patients (n = 41).

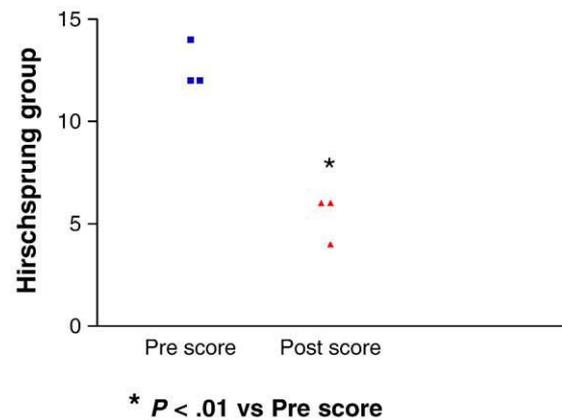


**Fig. 7** Patients (n = 15) with history of repair of anorectal malformations.

Laparoscopic-assisted insertion and fixation of the Chait cecostomy tube safely served this purpose. When compared with the regular appendicostomy, in our technique, the appendix is left intact and can be used for urinary tract reconstruction for patients with spina bifida. The laparoscopic operation was followed by less postoperative pain than the open procedure, and with superior cosmetic results. Stenosis and complications described in appendicostomy procedures do not exist in this technique, and the administration of enemas is very simple. In general, there are fewer complications requiring reoperative intervention than those reported in patients with appendicostomy [8].

Minor complications occurred in both laparoscopic and open groups, but these problems were easily managed in the outpatient clinic.

In our procedure, a purse string suture was placed under direct vision around the cecostomy tube and sutured to the anterior abdominal wall. This method may have some advantages over the radiological placement of the cecostomy tube in that we feel this may decrease intraabdominal contamination. In our study, there was neither radiological leakage nor intraabdominal or shunt infections.



**Fig. 8** Hirschsprung group patients (n = 3).

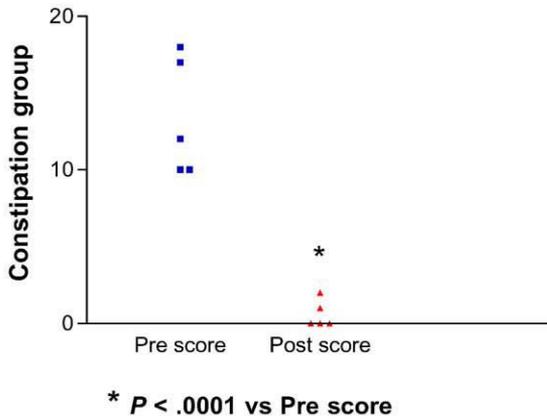


Fig. 9 Functional constipation group patients (n = 5).

Time of up to 6 months is required to adjust the frequency and volume of irrigation to maximize the benefits of the enema. Different irrigation solutions have been used as antegrade enemas, and all patients achieved bowel emptying within 60 minutes after irrigation. Glycerine with isotonic sodium chloride solution was effectively used in most of our patients. Close follow-up and frequent consultation with dedicated stoma nurses are the mainstays of success.

Data about the use and complications of phosphate solutions have been controversial in the literature. Although there are concerns about phosphate toxicity, phosphate solutions have been reported to be safe and effective for colonic washouts in children [11].

During irrigation, abdominal pain (cramps) occurred in 50% of our patients; and the pain during and postirrigation was more common with the phosphate-based enema solution. It is reported that tap water enemas are safe for the use of antegrade enemas in children, without increased risk of water intoxication [12]. One can speculate that warm water might be less painful than irritant solutions such as phosphate.

C-tube customization is very important as our patients grow and the distance from skin level to the cecum changes. An appropriate C-tube size decreases the risk of dislodgment, “uncoiling,” breakage, and leakage around the tube. The most frequent complication is the development of granulation tissue accompanied with an odorless discharge at the cecostomy site. This is treated in the outpatient clinic with the application of silver nitrate.

Creating a fecal incontinence scoring system in the pediatric population that is both reproducible and simple to use is very difficult, as assessments differ qualitatively depending on the child’s age, developmental level, and nature of the condition. A number of scales have been published, but their reproducibility and value have not been compared. We adopted a scoring system that presents a validation study of the 3 most commonly used continence grading scales [10]. In the literature, this is the single scoring system with established validity with respect to reproducibility and sensitivity to changes produced by treatment. We

subdivided our patient population into 4 subgroups: children with spina bifida, children after repair of anorectal anomalies, children after operation for Hirschsprung disease, and children with functional constipation. Symptoms of defecation disorders in children with spina bifida and postrepair of anorectal malformations all improved significantly after a cecostomy was created and ACE was introduced. In the 3 patients with previous operative correction of Hirschsprung disease requiring treatment of either incontinence or constipation with soiling, there was a great improvement in incontinence scores that failed to show significance given the low numbers.

In addition, there was a benefit in terms of the patients’ physical activity and general well-being. Our results are comparable with those reported by other authors [13-22]. There was evidence of benefit in each subgroup of our patients.

Antegrade enemas also provide an alternative and effective way for treating severe cases of functional constipation and encopresis unresponsive to medical management. Cecostomy placement in patients with severe functional constipation has previously been shown to increase defecation frequency, reduce soiling frequency, and improve quality of life [23]. Our data in these patients showed a significant decrease in fecal incontinence score; and 4 patients improved to an incontinence score of zero, regaining full continence.

In summary, our experience of ACEs included in a bowel management program induced significant reduction in incontinence/soiling by establishing regular bowel evacuation. The laparoscopic approach has a distinct advantage over conventional open procedures in view of its less invasive nature and better cosmetic results. Our study was aimed at reviewing improvements in fecal incontinence by the ACE procedure with a sufficiently long follow-up to adequately assess changes associated with the intervention.

To date, there have been reports of a smaller series of children undergoing surgical insertion of button cecostomy for the management of incontinence and severe constipation.

This report describes the largest reported experience using this approach. Patient/parents satisfaction rate (subjective appraisal, scale 1-3) was very positive (2.7); and in most of our patients, the introduction of the ACE has provided a method for more complete colonic cleansing, which has increased the child’s autonomy and decreased the frequency of “accidents” after the procedure. More accurate comparisons are to be made with data reported in consistent fashion and specific to each of the abnormalities (underlying disease) for which cecostomy has been performed.

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