

# Long-Term Results of Antegrade Colonic Enema in Adult Patients: Assessment of Functional Results

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**PURPOSE:** This retrospective study reviewed long-term results in a large group of adult patients treated with antegrade colonic enema and antegrade colonic enema combined with a colostomy.

**METHODS:** Retrospective chart review identified 80 patients (64 females, mean age 51) surgically treated between 1993 and 2007 for fecal incontinence or constipation. Surgical treatments included 69 appendicostomies, 13 tapered ileum, 3 cecal tube, and 25 appendicostomy/neoappendicostomy combined with a colostomy. A 44-item questionnaire was mailed considering bowel regimen, complications, bowel function, social function, and quality of life.

**RESULTS:** Sixty-nine patients were available for follow-up (mean follow-up, 75 months). Thirty patients (38 percent) had surgical complications. Forty-three patients (62 percent) were still performing antegrade continence enema and 8 patients (12 percent) no longer needed it. Accordingly, treatment was successful in 51 patients (74 percent). Twenty-seven patients (63 percent) had side effects. Evaluation of bowel function, social function, and quality of life all showed significant improvement. Antegrade continence enema was successful in patients with neurologic disabilities (67 percent), anorectal injury (53 percent), idiopathic fecal incontinence (50 percent), and idiopathic fecal constipation (42 percent). Antegrade continence enema was successful in patients with constipation, incontinence, and mixed symptoms. Results did not differ between appendicostomy, neoappendicostomy, and the combined appendicostomy/neoappendicostomy and colostomy.

**CONCLUSION:** Long-term results were favorable in most patients treated with antegrade continence enema for fecal incontinence or constipation.

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**KEY WORDS:** Antegrade continence enema; Appendicostomy; Fecal incontinence; Constipation.

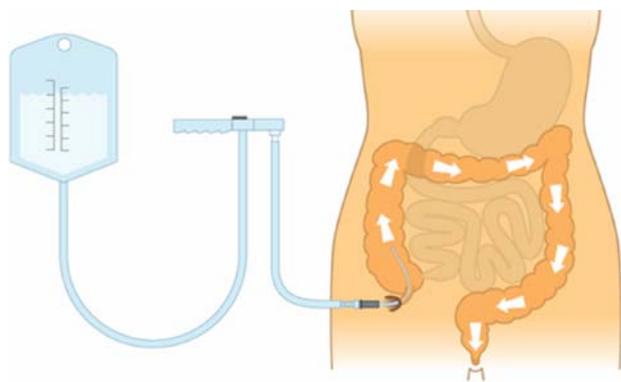
## INTRODUCTION

In 1990, the principle of antegrade colonic washout was combined with the Mitrofanoff nonrefluxing catheterizable channel to produce a colonic stoma for washout (Fig. 1).<sup>1,2</sup> This technique made it possible to avoid a colostomy in some patients suffering from fecal incontinence or constipation resistant to conservative treatment. Initially antegrade colonic enema (ACE) was performed on children with neurogenic bowel dysfunction.<sup>3-5</sup> Later ACE was used in adults with fecal incontinence and constipation.<sup>6-8</sup>

At our institution, the treatment of fecal incontinence and constipation follows an algorithm starting with conservative measures, including dietary advances, oral and rectal laxatives, or constipating agents. If these fail, most patients are offered transanal irrigation,<sup>9,10</sup> and ultimately colostomy or ileostomy. In selected patients ACE is offered as an alternative to colostomy. Furthermore, sacral nerve stimulation is now an option at our unit.

The original work by Malone *et al.* described a method of tunneling the reversed appendix in order to secure continence. Other procedures inspired by Malone's work were *in situ* appendicostomy and ileal or tubularized cecal conduits for patients with unsuitable atrophic appendix or appendectomy.<sup>11-18</sup> In selected cases, the ACE has also been combined with a colostomy<sup>19</sup> which may be preferable in disabled patients to overcome the problem of soiling and persistent colonic inertia in the left colon in spite of antegrade irrigation.

Most studies evaluating long-term results of ACE have been performed in children or have included relatively small numbers of patients.<sup>20-22</sup> This retrospective study reviewed long-term results in a large group of adult patients treated with ACE and ACE combined with a colostomy.



**FIGURE 1.** Administration of antegrade continence enema.

## PATIENTS AND METHODS

Eighty patients (64 female, mean age 51, range 17–84) surgically treated for fecal incontinence or constipation between 1993 and 2007 were identified. The main symptom was constipation in 48 patients, fecal incontinence in 20 patients, and a combination of both in 12 patients. The etiologies for fecal incontinence or constipation are listed in Table 1. All patients had tried other bowel regimens prior to ACE.

An appendicostomy was performed in 39 patients, an ileal neoappendicostomy in 13 patients, a cecal tube neoappendicostomy in 3 patients, and an appendicostomy/neoappendicostomy combined with a colostomy in 25 patients. Five patients had urinary tract surgery performed simultaneously. Two patients had a Mitrofanoff autoaugmentation combining an appendiceal conduit with a bladder auto augmentation, 2 patients received a neobladder a.m. Bricker, and 1 patient had urethral surgery.

## Surgical Procedure

The surgical procedures performed in this study for appendicostomy,<sup>13</sup> and neoappendicostomy were previously described.<sup>6,11,16,23</sup>

## Data Collection and Statistical Analysis

Demographic data and information about disability, indication, primary pathology, colon transit time, date of operation, type of operation, simultaneous urologic procedures, and perioperative complications were obtained from patient charts.

A 44-item questionnaire assessing function was sent to the patients. Patients were asked if they still used the ACE. If they had stopped using ACE, they were asked to give the reasons. Patients still performing ACE procedure were asked questions about functional result and side effects. In the questionnaire, overall satisfaction with bowel function, social function, and quality of life before and after surgery was assessed on an arbitrary scale where 0 was worst and 100 was optimal function. Both the preoperative and the postoperative functional scores were estimated at follow-up.

Successful treatment was defined as 1) patients still using ACE at follow-up, 2) patients whose symptoms had resolved as a result of the treatment and who, therefore, no longer required treatment. Statistical analysis was carried out using nonparametric signed-rank test applied to an ordinal scale.

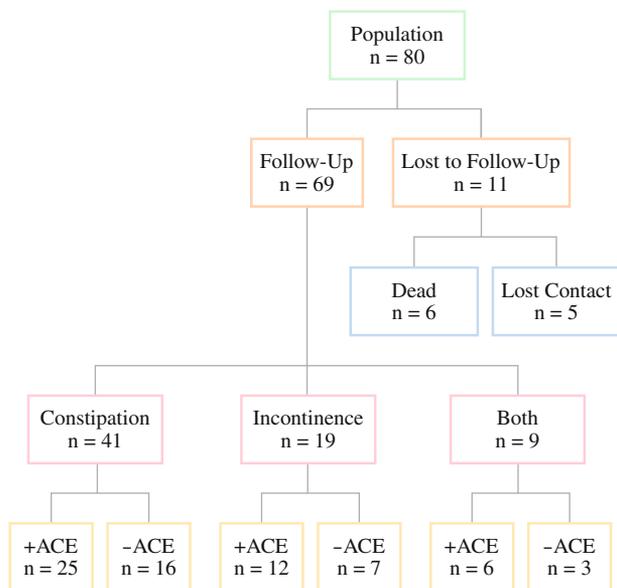
## RESULTS

Among 80 patients, 6 patients died from unrelated causes and 5 patients could not be located. Accordingly, 69 patients were available to follow-up (Fig. 2). Mean follow-up was 75 months (range, 3–183). At follow-up, 43 patients (62

**Table 1.** Etiology, indications, procedures and results for antegrade colonic enema

	Surgery indication			Surgical procedure		
	Constipation (n=48)	Fecal incontinence (n=20)	Both (n=12)	Appendicostomy (n=39)	Neoappendicostomy <sup>c</sup> (n=16)	Appendicostomy/ neoappendicostomy and colostomy (n=25)
Available for follow-up (n)	41	19	12	35	16	18
Functional ACE at follow-up (n)	25	12	6	23	7	13
Etiology						
Chronic idiopathic constipation (n)	19	N/A	N/A	7	7	5
Chronic fecal incontinence	N/A	3	5	5	0	3
Sequelae to anorectal disease or surgery <sup>a</sup>	8	8	1	10	4	3
Neurologic disabilities <sup>b</sup>	20	9	6	16	5	14
Scleroderma	1	0	0	1	0	0

<sup>a</sup> Rectopexia (n=6), fistular surgery (n=4), vulva cancer (n=1), anal cancer (n=1), trauma (n=2), sphincter insufficiency from childbirth (n=3), <sup>b</sup> Hirschsprung's Disease (n=1), spinal cord lesions (n=15), Seq. from lumbar disc prolapse (n=5), cerebral palsy (n=1), spina bifida (n=5), syringomyelia (n=2), pudendal neuropathy (n=1), Multiple sclerosis (n=5) • <sup>c</sup> Tapered ileum (n=13), cecal tube (n=3)



**FIGURE 2.** Antegrade continence enema patient flow-chart. +ACE: used ACE at follow-up. -ACE: did not use ACE at follow-up. (ACE: Antegrade continence enema).

percent) were still performing ACE while 26 patients (38 percent) had stopped. Among the latter, 8 patients did not need ACE anymore as symptoms had resolved, 14 patients did not have satisfactory effect, 3 patients found the procedure time consuming and troublesome, and 1 patient did not accept it for psychologic reasons. Accordingly, treatment was successful in 51 of 69 patients (74 percent) available for follow-up.

**Surgical Complications**

Postoperative complications occurred in 30 patients (38 percent). Early complications after surgery appeared in 19 cases (24 percent) and included pneumonia (n=1), urinary tract infection (n=4), wound infection (n=9), and 5 local problems (infection, via falsa and necrosis of the conduit stoma, n=5).

Late surgical complications were found in 11 patients. Ten patients developed stenosis of the appendicostomy which was treated with daily catheterization (n=5),

dilatation (n=1), or operation (n=4). Six patients reported continuing problems with the catheterization. One patient encountered perforation because of forceful removal of a catheter which was treated with colonoscopic placing of a Mic-key® button (Kimberly-Clark Worldwide Inc, Draper, UT).

**Functional Results of ACE**

Twenty-three *in situ* appendicostomies (66 percent), 7 ileal neoappendicostomies (44 percent) and 13 combined appendicostomy/neoappendicostomy and colostomy (72 percent) were functional at follow-up (Table 2).

Sixteen patients (37 percent) used ACE on a daily basis, 17 (40 percent) used it every other day, and 10 (23 percent) used it 2 to 3 times per week or less. Mean time for ACE was 50 minutes (range, 30–120) and mean volume of water was 1331 mL (range, 10–2000). Five patients added laxatives to the flush water. Nine patients needed assistance to perform the procedure and 15 needed to change position during the procedure.

Side effects from ACE were experienced by 27 patients (63 percent): painful catheterization (n=7), autonomous symptoms including chills, nausea, or tiredness afterward (n=20), anal skin problems or rectal bleeding (n=7) (Table 2). Problems caused by reflux from the stoma and leakage through the anal canal are described in Table 2.

One patient needed no bandage to cover the stoma while others used normal sticking plaster (n=9), an absorbing bandage (n=17), or a Mic-key® button (n=17). Some used more than one cover simultaneously.

Overall 34 of 43 patients still using the ACE were satisfied or very satisfied with the result, 8 patients were neither satisfied nor dissatisfied, and none were dissatisfied or very dissatisfied. One patient did not answer this question. On an arbitrary scale (0–100) mean values for bowel function before and after were 12 and 81 respectively (P<0.01). For social function, the corresponding values were 30 and 81 (P<0.01) and for quality of life they were 28 and 81 (P<0.01).

Among 41 patients treated for constipation, 25 (61 percent) used ACE at follow-up (Fig. 2). They reported

**Table 2.** Practical problems and side effects of long-term antegrade colonic enema (ACE)

	Total (n=69) <sup>a</sup>	Type of operation		
		Appendix (n=35)	Tapered ileum (n=13)	Appendicostomy/neoappendicostomy + colostomy (n=18)
ACE in use	43	23	7	13
Washout side effects n (%)	27 (63)	14 (61)	5 (71)	8 (62)
Stenosis n(%)	10 (23)	4 (17)	2 (29)	4 (31)
Reflux of feces (>1 weekly) n (%)	19 (44)	12 (52)	2 (29)	5 (38)
Reflux of mucus (>1 weekly) n (%)	23 (53)	14 (61)	4 (57)	5 (38)
Reflux of flatus (>1 weekly) n (%)	10 (23)	5 (22)	2 (29)	3 (23)
Leakage pr. rectum n (%)	4 (9)	3 (13)	1 (14)	0
Difficulties with catheterization n (%)	6 (14)	2 (9)	1 (14)	3 (23)

**Table 3. Subjective evaluation of function by surgical procedures for antegrade colonic enema**

	Appendicostomy (n=35)			Ileal neoappendicostomy (n=13)			Appendicostomy/ neoappendicostomy + colostomy (n=18)		
	Before	After	P value	Before	After	P value	Before	After	P value
Bowel function, mean <sup>a</sup>	10	78	<.01	11	89	<.01	19	79	<.01
Social function, mean <sup>a</sup>	31	81	<.01	29	84	<.01	26	81	<.01
Quality of life, mean <sup>a</sup>	28	78	<.01	34	91	<.01	23	79	<.01

<sup>a</sup>Arbitrary scale 0–100 (0 worst, 100 best)

emptying problems after surgery to be much less (n=8) and less (n=17).

Among 19 patients treated for fecal incontinence 12 (63 percent) used ACE at follow-up (Fig. 2). After surgery, incontinence was reported to be much less (n=3), less (n=3), unchanged (n=3), and worse (n=1). Wexner incontinence score at follow-up was less than 9 in 30 patients and greater than 9 in 10 patients.<sup>24</sup>

Among nine patients treated for combined incontinence and constipation, 6 (67 percent) used ACE at follow-up (Fig. 2). These patients reported emptying problems after surgery to be much less (n=2), less (n=2), and unchanged (n=1). Patients reported incontinence after surgery to be much less (n=2), less (n=1), and unchanged (n=2). Functional results for the different procedures are shown in Table 3 demonstrating no difference in chosen parameters.

Results for patients with chronic idiopathic constipation, neurologic disability (spinal cord injury, sequelae from disc prolapse, multiple sclerosis, spina bifida, syringomyelia, and cerebral palsy), idiopathic fecal incontinence, and anorectal sequelae are shown in Table 4. All four groups reported a large improvement in subjective evaluation of the bowel function, social function, and quality of life.

## DISCUSSION

To the best of our knowledge, the present study is the largest study evaluating long-term results for ACE among adult patients. After a mean follow-up period of 75 months, ACE was successful in 74 percent of patients. These results are comparable to previous studies among

adult patients which have reported success rates between 47 percent and 80 percent.<sup>7,24–26</sup>

Perforation is a serious complication and seldom encountered. In this study, 1 patient had a perforation of the appendix. Another study reviewed 187 Malone ACE procedures in children from 1989–2002 and 7 patients had perforation (4 percent).<sup>27</sup> Postoperative complications were all minor and easily treated in our sample.

Stenosis is a well-known long-term complication, possibly explained by individual washout regimes with up to 2 to 3 days in between, and occurred in 23 percent of our patients. Most were treated by dilatation followed by daily catheterization to keep the stoma open. If more severe, stenosis was treated with a permanent catheter (Mic-Key®, Kimberly-Clark Worldwide, Inc, Draper, UT). Reflux problems were evident for all types of stomas (Table 2) and were overcome with different pads or a Mic-key® button. Difficulty with the catheterization, perianal problems, and autonomic symptoms,<sup>28</sup> were present in 63 percent (Table 2). Catheterization and skin problems can be treated with the assistance of a stoma nurse.

The original procedure described by Malone *et al.* constituted a reversed appendix with a submucous tunneled antireflux mechanism.<sup>2</sup> Later, equally good results appeared when an *in situ* appendix was used.<sup>12,13</sup>

In patients whose appendix was absent, a new conduit could be created from terminal ileum. The ileocecal valve can secure continence.<sup>11,23,29</sup> Another method used a tubulized cecal flap. An advantage of this method is the avoidance of an ileocolonic anastomosis.<sup>14,15,30</sup>

No consistent evidence favored any of the methods. Previously we have shown that ileal neoappendicostomy was a good alternative to appendicostomy in patients

**Table 4. Subjective evaluation of function by etiology for antegrade colonic enema (ACE)**

	Chronic idiopathic constipation (n=19)			Neurologic disabilities <sup>b</sup> (n=33)			Idiopathic fecal incontinence (n=8)			Anorectal sequelae <sup>c</sup> (n=17)		
	Before	After	P value	Before	After	P value	Before	After	P value	Before	After	P value
ACE in use n (%)	8 (42)			22 (67)			4 (50)			9 (53)		
Bowel function, mean <sup>a</sup>	6	92	<.01	15	80	<.01	5	80	<.01	11	79	<.01
Social function, mean <sup>a</sup>	33	88	<.01	38	78	<.01	5	85	<.01	22	79	<.01
Quality of life, mean <sup>a</sup>	39	90	<.01	27	76	<.01	5	85	<.01	27	80	<.01

<sup>a</sup>Arbitrary scale 0–100 (0 worst, 100 best) • <sup>b</sup>Hirschsprung's disease (n=1), Spinal cord lesions (n=15), Seq. from lumbar disc prolapse (n=5), cerebral palsy (n=1), Spina bifida (n=5), Syringomyelia (n=2), Pudendal neuropathy (n=1), Multiple sclerosis (n=5) • <sup>c</sup>Rectopexia (n=6), fistular surgery (n=4), vulva cancer (n=1), anal cancer (n=1), trauma (n=2), sphincter insufficiency from childbirth (n=3)

without the appendix.<sup>11</sup> Others have found the frequencies of leakage, stenosis of the stoma, and reflux all favor ileal neoappendicostomy.<sup>26,31</sup> However, a retrospective review including 45 children found no significant difference in postoperative complications or continence when using appendiceal and ileal segment for ACE.<sup>17</sup>

We compared the functional results of the appendicostomy and the ileal neo-appendicostomy. At follow-up, more patients (66 percent) still used the appendicostomy than used the neoappendicostomy (43 percent). No differences occurred in rates of side effects, stenosis, and reflux (Table 2). No differences between procedures for the description of bowel function, social function, and impact on quality of life were observed (Table 3). For the modality with combined appendicostomy/neoappendicostomy and colostomy the results were fully comparable. All cecal tube neoappendicostomies had been abandoned.

Most patients expressed great satisfaction with the procedure independently of etiology or surgical procedure. Significant improvement in bowel function, social function, and quality of life was reported (Tables 3 and 4).

In recent years sacral nerve stimulation (SNS) is finding its place in the treatment of constipation and fecal incontinence. Indications for SNS are widening which creates difficulty in estimating how many patients in this group would have been suitable for this treatment. No patients had a percutaneous nerve evaluation (PNE). Today patients with fecal incontinence or chronic constipation, either idiopathic or because of incomplete spinal cord injury, would be offered a PNE.<sup>32-34</sup> If the PNE is positive, patients progress to SNS and if the PNE is negative, the patients can be treated with retrograde irrigation, ACE, or a stoma. Patients with a complete spinal cord injury would not be suitable for SNS and they would be treated with irrigation or a stoma.

Except for colon transit time determined in 53 patients, objective measures describing the preoperative condition could not be systematically obtained from charts. Prior to surgery, all patients had tried other regimes without sufficient success and everyone was evaluated preoperatively to clarify the exact indication for the procedure. Incontinence Wexner score was not available preoperatively. Wexner score was obtained in 40 incontinent patients and 75 percent had a postoperative Wexner score less than 9 at follow-up which indicated a socially acceptable function.<sup>35</sup>

Our group of patients was very heterogeneous and the currently used scoring systems for constipation and fecal incontinence have not been validated in most of the patient groups included in our study. For that reason we did not use any specific scoring system, but chose to use an arbitrary scale from 0 to 100. The preoperative status was estimated at follow-up and this retrospective design may have caused recall bias.

## CONCLUSIONS

ACE can help patients suffering from fecal incontinence or constipation resistant to conservative treatment. No subgroups presenting a higher rate of success could be identified. Even though a considerable rate of failure and side effects were common, successful treatment was associated with much improved quality of life even at long-term follow-up. A significant improvement in bowel function, social function and quality of life was observed. A trend toward better results from appendicostomies than from neoappendicostomies was emerging. Today, most patients would be offered a PNE test and in case of failure the ACE would be considered. Results from the combined appendicostomy/neoappendicostomy and colostomy were comparable to those from appendicostomy/neoappendicostomy without colostomy.

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