Spinal Cord (2000) 38, 255–261

www.nature.com/sc

Neurogenic colorectal dysfunction – use of new antegrade and retrograde colonic wash-out methods

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Objectives: To evaluate results of the Enema Continence Catheter (ECC) and the Malone Antegrade Continence Enema (MACE) applied in patients with severe neurogenic colorectal dysfunction.
Methods: The ECC was offered to 21 patients (mean age 39.9, range 7–72 years). The MACE was used in eight patients (mean age 32.8 years, range 15–66 years). All patients still using the ECC or the MACE at follow-up were interviewed. Results from patients not available for follow-up were drawn from hospital records.
Results: Overall success with the ECC was found in 12 of 21 patients (57%). In patients with faecal incontinence, the ECC was successful in eight out of eleven patients (73%), while four out of ten patients (40%) with constipation were successfully treated. Overall success with the MACE was found in seven out of eight patients (87%). Successful treatment with the ECC or the MACE was followed by significant improvement in quality of life.
Conclusion: The ECC is a simple therapeutic method in severe neurogenic colorectal dysfunction. If the ECC fails the MACE, as a minor and reversible operation, is a suitable alternative to more extensive procedures.
Spinal Cord (2000) **38,** 255–261

Keywords: colonic wash-out; enema; faecal incontinence; constipation; spinal cord injury; spina bifida

Introduction

Colorectal dysfunction in spinal cord injured patients (SCI patients) has recently been documented in several studies.[1–7] In SCI patients colorectal dysfunction results in constipation, outlet obstruction or faecal incontinence with a great impact on quality of life.[1–3] Colorectal dysfunction is also common after stroke[8–10] in spina bifida[11–13] and in patients with multiple sclerosis.[14–16] Treatment of neurogenic colorectal dysfunction has largely been empirical and individual solutions have been sought. Documentation for the efficiency of different bowel management procedures is lacking.

The Enema Continence Catheter (ECC) is a specially designed catheter with an inflatable balloon.[17] The catheter is inserted into the rectum and the balloon is inflated to hold the catheter in the rectum while an enema is administrated (Figure 1). When the enema has been installed in the bowel, the balloon is deflated, the catheter removed and the bowel will empty the enema and other bowel content. Thereby faecal incontinence is prevented and constipation or outlet obstruction is treated.

The Malone Antegrade Continence Enema (MACE) procedure[18] is a simple operation which brings out the appendix to skin level forming an appendicostomy. If the appendix is no longer available it is possible to construct a neoappendix with a coecal flap technique[19] or more recently from the terminal ileum. Through the small stoma patients can introduce a catheter and administrate an enema (Figure 2). Due to the wash-out effect and perhaps the stimulated colonic peristaltic, the colon and rectum will empty. Thus, faecal incontinence is prevented and constipation or outlet obstruction is treated.

Both the ECC and the MACE were originally designed for treatment of colorectal dysfunction in children with spina bifida or anorectal anomalies. The use of the ECC in adult patients with neurogenic colorectal dysfunction remains to be studied. The use of the MACE in adult patients with neurogenic colorectal dysfunction has only been a subject to a few studies.[20,21] The aim of this study was to evaluate results of the ECC and the MACE applied primary to adult patients with severe neurogenic colorectal dysfunction.

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Methods

The Enema Continence Catheter

From January 1994 to February 1999, 24 patients with severe neurogenic colorectal dysfunction resistant to previous bowel management procedures were offered the ECC. Three patients tried the ECC once only and are excluded from these data. One of these had a minor rectal bleeding after the procedure and did not want to continue. The two other patients had immediate expulsion of the catheter at enema administration making the procedure impossible and they are now both in line for the MACE. Among the remaining 21 patients (11 women and 10 men, mean age 39.9, range 7–72 years) neurogenic colorectal dysfunction was caused by traumatic supraconal spinal cord injuries in three (T2/incomplete, T4/complete and T11/complete), traumatic conal or cauda equina injuries in 12 (all incomplete), spina bifida in five and cerebral palsy in one (Table 1). Spinal cord injuries were classified according to the international standards for classification of spinal cord injuries.[22]

In order to determine the colonic transit time patients took a single capsule with 24 radiopaque markers followed by an abdominal X-ray 5 days later.[23] If more than five markers were seen, the colonic transit time was prolonged. If remaining markers were scattered about the colon, the condition was most likely generalised prolonged colonic transit time. If remaining markers were accumulated in the left colon or the rectosigmoid, the condition was most likely isolated prolonged left colonic transit time or prolonged rectosigmoid transit time. More recently the colonic transit time was determined by taking a capsule with 10 radiopaque markers for 6 days followed by an abdominal X-ray on day 7.[24] By this method it was possible to calculate the total colonic transit time as well as the segmental transit time for

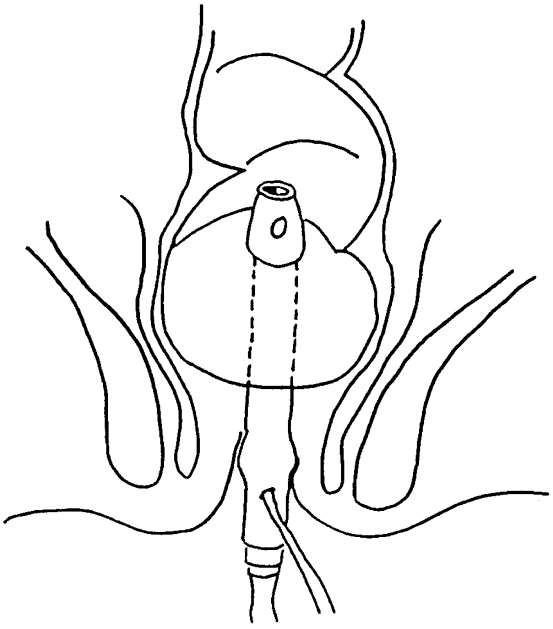

Figure 1 The Enema Continence Catheter. The catheter is inserted into the rectum and the balloon is inflated to hold the catheter in the rectum while an enema is administrated. When the enema has installed, the balloon is deflated, the catheter removed and the bowel will empty the enema and other bowel content

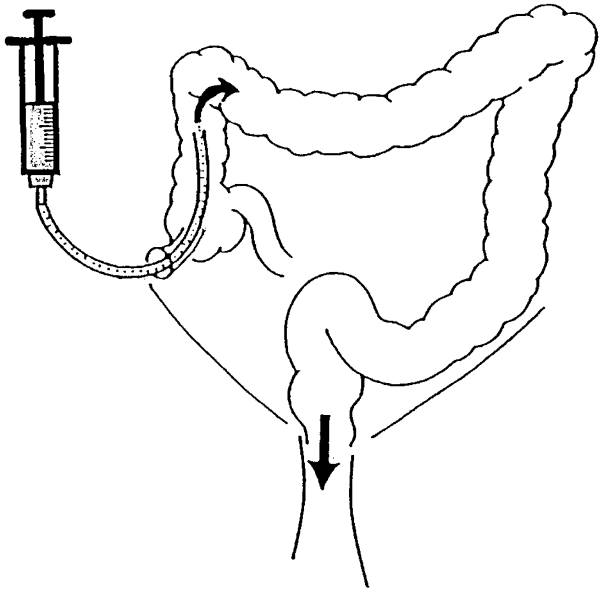

Figure 2 The Malone Antegrade Continence Enema procedure is a simple operation which brings out the appendix to skin level forming an appendicostomy. Through the stoma patients can introduce a catheter and administrate an enema. Due to the wash-out effect and perhaps the stimulated colonic peristaltic, the colon and rectum will empty

Table 1 Patients treated with the Enema Continence Catheter – patients with successful outcome in parentheses

Cause of neurogenic colorectal dysfunction	*Faecal incontinence*	*Slow transit constipation*	*Obstructed defecation*	*Total*
Supraconal spinal cord injury	1 (0)	2 (1)	–	3 (1)
Conal or cauda equina injury	5 (4)	3 (2)	4 (1)	12 (7)
Spina bifida	4 (3)	–	1 (0)	5 (3)
Cerebral palsy	1 (1)	–	–	1 (1)
Total	11 (8)	5 (3)	5 (1)	21 (12)

each colonic segment. Nine patients had normal colonic transit time and 12 patients had prolonged colonic transit time. Among patients with prolonged colonic transit time, 10 had isolated prolonged left colonic transit time, one isolated prolonged right colonic transit time, and one had generalised prolonged colonic transit time.

The patients were divided in two groups: (1) faecal incontinence – patients with faecal incontinence as the predominant symptom regardless of whether the colonic transit time was prolonged or not; and (2) constipation – two or less defecations per week and/or straining or feeling of incomplete evacuation in more than 25% of defecations.[25] Patients with constipation were then subdivided into (a) slow transit constipation – patients with constipation and confirmed prolonged colonic transit time (five patients); and (b) obstructed defecation – patients with constipation and pronounced difficulties with defecation but normal colonic transit time (five patients) (Table 1).

Before the ECC, relevant data on the patients bowel function were obtained. All patients used the same type of silicon catheter (La Fayette Farmaceuticals, IN, USA, length 10 cm, diameter 1 cm). The silicon balloon could retain 300 ml of air, by which it reached a diameter of 8 cm. Training was carried out on an out-patient basis by a specialist nurse. Frequent telephone contacts with the clinic were encouraged especially when the procedure was being initiated. The frequency of enema administration and volume of water used were determined by trial and error during the first months.

The Malone Antegrade Continence Enema

From January 1993 to January 1999, eight patients with severe neurogenic colorectal dysfunction underwent the Malone operation (five women and three men, mean age 32.8 years, range 15–66 years). Patients were divided in two groups: (1) slow transit constipation or outlet obstruction (two patients) and (2) faecal incontinence (six patients). Neurogenic colorectal dysfunction was caused by traumatic supraconal spinal cord injuries (two patients, C5–6 and T2, both incomplete), traumatic cauda equina injuries (two patients), spina bifida (two patients), cerebral palsy (one patient), and cerebral thrombosis (one patient) (Table 2). Prior to the operation colonic transit time had been determined in five patients of whom it was prolonged in two. All patients were resistant to previous bowel management procedures, in three patients also to treatment with the ECC.

The surgical procedure was carried out as described previously,[26] one patient without an appendix had a 'neoappendix' constructed from the caecum.[19] Training in the irrigation procedure was initiated before the discharge from hospital and continued afterwards by frequent outpatient visits and telephone contacts. The frequency of enema administration and volume of water used were determined by trial and error during the first months.

Data collection

All patients still using the ECC or the MACE at follow-up were either interviewed at the planned outpatient visit or by telephone using a questionnaire describing colorectal function, practical procedure, impact on daily living and quality of life, and the patients general satisfaction with the treatment. Results from patients not available for follow-up were drawn from hospital records.

Results

The Enema Continence Catheter

After a mean follow-up period of 16 months (range 1–51) 11 of 21 patients (53%) still used the ECC. One patient with faecal incontinence due to a cauda equina injury secondary to a lumbar disc prolabs became continent after using the ECC for 2 months and had no further need for it. Nine patients tried the ECC for 1–8 (mean 2.6) months before they gave it up. The main reason for failure was leakage beside the catheter (Table 3).

At follow-up five patients used the ECC every second day, four patients two to three times per week and two patients once a week. Time spent at the procedure was 12–60 (mean 34) min. The amount of tap water used was 500–2000 (mean 1118) ml. One patient added sodium phosphate to the enema. The balloon was inflated with 50–150 (mean 98) ml of air. No major complications were observed. Eight patients experienced minor side effects during the procedure: abdominal pain, chills, anorectal pain, nausea, minor rectal bleeding, and dizziness. Four patients occasionally experienced minor leakage beside the catheter and

Table 2 Patients treated with the MACE – patients with successful outcome in parentheses

Cause of neurogenic colorectal dysfunction	*Faecal incontinence*	*Constipation*	*Total*
Supraconal spinal cord injury	1 (1)	1 (1)	2 (2)
Conal or cauda equina injury	1 (0)	1 (1)	2 (1)
Spina bifida	2 (2)	–	2 (2)
Cerebral palsy or cerebral thrombosis	2 (2)	–	2 (2)
Total	6 (5)	2 (2)	8 (7)

Table 3 Side effects and problems using the ECC. *n* refers to the number of patients. Each patient may have more than one complaint

	Side-effects or problems in patients still using the ECC (n = 11)	*Reason for failure in spite of intention to treat* (n = 9)	*Reason for immediate failure* (n = 3)
Abdominal pain	3	–	–
Chills	1	–	–
Anorectal pain	1	–	–
Nausea	1	–	–
Minor rectal bleeding	2	–	1
Dizziness	1	–	–
'Hang overs'	–	1	–
Need assistance	3	–	–
Leakage besides the catheter	4	5	–
Expulsion of the catheter	2	1	2
No effect	–	2	–

five occasionally expulsion of the catheter. Three patients required help to perform the procedure (Table 3).

Among 11 patients with faecal incontinence one became continent after 2 months with the ECC and did not need the ECC anymore, six reported significant reduction in the frequency of incontinence episodes, and one did not experience any reduction in the frequency of incontinence episodes but found overall improvement in bowel function and quality of life. Thus, eight out of 11 (73%) patients with faecal incontinence were successfully treated with the ECC. Three patients with failure of the ECC were later operated with the Malone operation. Among 10 patients with constipation, four (40%) used the ECC at follow-up all finding a reduction in time spent on defecation, need for digital evacuation and use of oral laxatives or rectal klysma. Divided into subgroups, three out of five with slow transit constipation and one out of five with obstructed defecation continued to use the ECC. Thus, overall success was found in 12 of 21 patients (57%) (Table 1).

Before treatment with the ECC seven out of 11 patients available for follow-up felt that colorectal dysfunction imposed a major restriction on their quality of life and social activities, two patients some restrictions, one minor restriction and one failed to answer the question. At follow-up two felt some restriction, six minor restriction, and six no restriction. Overall, satisfaction was very good in three patients and good in eight patients. All patients still using the ECC were asked to compare bowel function before treatment and at follow-up using a scale in which 0 was the worst possible and 100 ideal. Before treatment the mean score was 23 (range 10 – 50) and at follow-up it was 80 (range 70 – 90).

The Malone Antegrade Continence Enema

After a mean follow-up period of 38 months (range 4 – 77) five out of eight patients still used the stoma. One patient with cerebral palsy and faecal incontinence had uncomplicated use of the appendicostomy for 58 months with relief of the bowel complaints. Subsequently the bowel complaint was reduced to an extent where use of the MACE was no longer needed and the appendicostomy was closed. One patient with faecal incontinence due to cerebral thrombosis had uncomplicated use of the appendicostomy for 28 months before it was given up due to disseminated breast cancer. One patient with a lumbar fracture and incomplete affection of conus medularis suffered from faecal incontinence and used the MACE for 16 months before it was given up due to abdominal pain caused by stenosis of the stoma in spite of repeated dilatations. A sigmoideostomy was performed and the patient is now satisfied.

At follow-up three patients used the stoma every day, one every second day, and one occasionally. Time taken to perform the enema was 30 – 90 (mean 46.6) min. All used tap water without any addition. In four patients the volume of water used was 1000 ml. One patient with incomplete tetraplegia used several litres as he just let the water flow through an apparently atonic colon. The same patient needed help for the procedure. The only complication noticed was stenosis of the appendicostomy in one patient as described above. Occasional chills during the wash-out and headache and general discomfort for some hours after the wash-out was experienced by one patient with incomplete spinal cord injury (T2). One patient had occasional bleeding from the appendicostomy when the catheter was inserted and one patient had nausea during the wash-out. Four patients had regular reflux of water, air or faeces through the appendicostomy. In three patients this could be controlled by an ordinary plaster. In one patient with continued reflux of faeces a gastrotomy tube (MIC-KEY, Ballard Medical Products, UT, USA) has been inserted through the stoma with some success (Table 4).

Among six patients with faecal incontinence, two suffering from faecal incontinence several times per week prior to the treatment and also having failed

Table 4 Side effects and problems using the MACE. *n* refers to the number of patients. Each patient may have more than one complaint

	Side-effects and problems in patients still using the MACE (n = 5)	*Reason for failure* (n = 1)
Abdominal pain	–	1
General discomfort	1	–
Occasional bleeding from the appendicostomy	1	–
Nausea	1	–
Regularly reflux through the appendicostomy	3	–
Need for assistance	1	–

treatment with the ECC became fully continent using the MACE. One suffering from faecal incontinence daily prior to the treatment had a significant reduction in the frequency of incontinence episodes. Three patients were not using the MACE at follow-up, but as pointed out, two of them had successfully treated their bowel complaints with the MACE before the stoma was either closed or discontinued. Prior to the operation two patients suffered from constipation or obstructed defecation. Both experienced a reduction in time spent on defecation, the use of oral laxatives and the need for digital evacuation of the rectum. Both felt that their problems from constipation were very much reduced since the operation. Overall, successful outcome was found in seven out of eight patients (87.5%) operated (Table 2).

Before the operation three out of five patients available at follow-up felt that colorectal dysfunction imposed a major restriction on their quality of life and social activities, one felt some restriction and one no restriction. At follow-up two patients reported that colorectal dysfunction caused only some or little restriction, and three patients reported no restriction. Overall satisfaction was very high in one patient and high in four patients. All patients were asked to compare bowel function before the operation and at follow-up using a scale in which 0 was the worst possible and 100 ideal. Before the operation the mean score was 19 (range 0 – 50) while at follow-up it was 74 (50 – 95).

Discussion

The magnitude of colorectal dysfunction in SCI patients has recently been documented in several studies.[1–7] Colorectal dysfunction affects between 62.5% to 95% of the SCI patients. Constipation or obstructive defecation was reported by 43% to 81%, and faecal incontinence by 13.9% to 75%, although only 4% to 13.7% with severe faecal incontinence. Colorectal dysfunction has a great impact on daily life, socialisation and quality of life for SCI patients. Up to 41% spend more than 1 h each day on defecation[3] and up to 61% feel that colorectal dysfunction affects their daily living.[27] Furthermore 27% to 39% feel that colorectal dysfunction affects their quality of life and socialisation.[1,27] In one study[1] 30% considered their bowel problems worse than sexual and bladder dysfunction. In another study bowel problems were regarded as greater than bladder dysfunction and not far from loss of mobility.[2]

In children with spina bifida colorectal dysfunction affects 44% to 57%.[11,12] Parents find that colorectal dysfunction is stressful or very stressful in 75% and more stressful than the physical limits caused by the disease.[11] In adults with spinal bifida there are similar findings.[13] Colorectal dysfunction is also common after stroke. On admission between 31% to 40% of patients with stroke will suffer from faecal incontinence[8–10] and 7% to 9% still suffer from faecal incontinence 6 months after the stroke. In patients with multiple sclerosis the prevalence of colorectal dysfunction is 41% to 68%, the prevalence of constipation is 36% to 53% and depending on the definition used the prevalence of faecal incontinence is 3.4% to 53%.[14–16,28]

Several studies have demonstrated that colonic transit time is prolonged in SCI patients,[4,29–31] in spina bifida[32] and in patients with multiple sclerosis.[33,34] In supraconal SCI patients a segmental transit study showed prolonged colonic transit time involving the entire colon.[30] Another study showed prolonged colonic transit time especially in the left colon.[31] The anal squeeze pressure and anorectal sensibility is reduced or absent in SCI patients. The anal resting pressure is normal in supraconal SCI and near normal or reduced in conal or cauda equina injury.[35] Furthermore, studies of patients with high spinal cord injuries have shown reduced rectal compliance due to hyperreactibility of the rectum to distension.[36,37] Patients with supraconal injury may take advantage of this rectal hyperreactibility as a majority uses some kind of rectal stimulus to initiate defecation.[1] In some patients this may increase the effect of irrigation, but in patients using the ECC it may lead to giant contractions of the rectum and subsequently leakage or expulsion of the ECC (Table 3).

The effect of enema administration is in part due to a simple mechanical wash-out effect, but studies of enema administration through colostomies[38] have shown that irrigation with an enema above 250 ml generates colonic mass movements. Distension of the colon[39] and installation of bisacodyl though a

colostomy[40] generates the same mass movements. It is most likely that a generated mass movement therefore share the effect of enema administration but this needs further study. In the present study we found only minor complications to the ECC and the MACE. However, one has to be aware of the potential risk of bowel perforation when introducing a catheter into the stoma or anorectum, the potential risk of autonomic dysreflexia in patients with lesions above T6,[41] and disturbances in electrolytes.

The ECC improves bowel function in 60% to 100% of children with spina bifida.[42–46] There are only few published results of the use of the transanal enema administration in adults.[47,48] The preliminary results of the use of the ECC from a group of patients with a heterogeneous pathology[49] showed significant improvement in the bowel function among 42% with faecal incontinence, but only 18% had improvement in the subgroup with constipation or obstructed defecation. In the present study the ECC was successful in 57% after a mean follow-up of 16 months. In the subgroup with faecal incontinence as a predominant symptom 73% had successful outcome. In the subgroup with constipation 40% had successful outcome. Among those who continued the ECC there was a significant improvement in quality of life and socialisation and marked satisfaction with the procedure. The main reason for failure of the procedure was leakage besides the catheter or expulsion of the catheter (67% of total failures). The ECC has the advantage of being minor invasive, easy to learn, safe and with only minor side effects.

In the present study the overall success rate with the MACE was seven out of eight (87.5%) patients after a mean follow-up of 38 months. As with the ECC, successful treatment leaves the patient with significant improvement in quality of life and with marked satisfaction with the procedure. The MACE-procedure used in adults has only been the subject of a few studies.[20,26,50] Results from a group of patients a heterogeneous pathology[26] showed marked improvement in 75%. Other authors have similar results in adults,[20] whereas a study with MACE applied only on adult patients with neurogenic colorectal dysfunction was less promising with success in just 38%.[21] The present results are comparable to a recent review among English paediatric surgeons, where 300 children operated with the MACE in UK up till now were reviewed[51] with overall success in 79%. Since the MACE-procedure is a minor and reversible operation we find it suitable as an alternative to more extensive procedures. If patients find the side effects unacceptable they can discontinue using the stoma. It will then obliterate, leaving the patient no worse than before the operation.

During the first month after starting the ECC or the MACE the irrigation procedure was determined by trial and error with individualised frequencies of enema administration and volume of water used. Therefore, it is most important that all patients are well motivated and understand that some time is necessary to learn the procedures. During this initial period, instructions from an experienced nurse with a special interest in this field are very important.

Although still on an experimental level, promising results have come up with the use of the sacral nerve stimulation.[52,53] The burden of the bowel related problems and failure of other treatment modalities could lead to construction of a permanent left side colostomy. Although this attempt seems drastic it often leads to significant improvement in quality of life, a reduction in bowel related complaints, significant reduction in time spent with bowel care, improvement in independence of help and last but not least better socialisation and self esteem.[54–56]

Conclusion

The ECC is a simple therapeutic method of managing neurogenic colorectal dysfunction with successful outcome in 73% of patients with faecal incontinence and 40% of patients with constipation and resulting in significant improvement in quality of life. If the ECC fails the MACE, as a minor and reversible operation, is an alternative with successful outcome in 87% of patients. Studies of the physiological effects of enema administration is needed for better understanding the mechanism behind the ECC and the MACE and to improve future selection of patients to the optimal treatment.

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