Spinal Cord (2010) 48, 560–565

www.nature.com/sc

ORIGINAL ARTICLE

Transanal irrigation in myelomeningocele children: an alternative, safe and valid approach for neurogenic constipation

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Study design: A total of 60 children with myelomeningocele referred to Spina Bifida Center of Rome (31 boys and 29 girls; aged 8–17 years) were treated with transanal irrigation for three months.
Objective: To investigate whether transanal irrigation is a valid and alternative approach for neurogenic constipation in children with myelomeningocele.
Methods: A questionnaire on bowel disturbances, quality of life and side effects was completed before the beginning and at the termination of the study.
Setting: Italy
Results: About 60% (36/60) of patients reported relief from constipation and 75% (12/16) for fecal incontinence. Wheelchair-bound and walking patients showed same high improvement of bowel habit. Mean (s.d.) scores before and after the study were: neurogenic bowel dysfunction total score: 17.5 (5.2) versus 8.5 (4.3) ($P<0.001$); digital stimulation of anorectum: 4.2 (2.8) versus 1.3 (2.5) ($P<0.01$); frequency of fecal incontinence: 5.5 (1.2) versus 1.3 (1.7) ($P<0.01$) and degree of general satisfaction: 3.0 (2.4) versus 7.7 (1.5) ($P<0.001$).We observed a reduction of urinary tract infections during the course of treatment: 14 total urinary tract infections (9 caused by *Escherichia coli*) before versus 6 (3) during treatment ($P<0.01$)
Conclusion: Transanal irrigation in children with myelomeningocele is an alternative and relatively safe approach for managing neurogenic constipation; in fact, it improves bowel disturbances, quality of life and seems to reduce the risk of urinary tract infections.
Spinal Cord (2010) **48,** 560–565; doi:10.1038/sc.2009.186; published online 19 January 2010

Keywords: transanal irrigation; neurogenic constipation; myelomeningocele; quality of life

Introduction

Patients with myelomeningocele (MMC) present with a spectrum of impairments, such as lower limb paralysis and sensory loss, bladder and bowel dysfunction.[1] The defect in the lumbosacral spine affects the sensory and motor nerves supplying the skin and muscles of the perianal region.[2] The sensations in the region, as well as the motor functions of the striated muscles suffer, compromising the dynamics of continence and the normal process of stooling and leading to incontinence and constipation.[3–4] Neurogenic constipation has been treated by disimpaction of stools from the colon and rectum, administration of stool softeners, oral laxatives, digital evacuation and a healthy diet containing adequate bulk-forming items.[5] Incontinence has usually been managed by behavior modification of self-initiating stooling after meals and positive reinforcement of this process.[6] Transanal irrigation has been known since 1500 BC. Transanal irrigation improves bowel function in adult patients with fecal incontinence or constipation.[7–10] Recent clinical trials in adults with spinal cord injury and neurogenic bowel dysfunction (NBD) clearly showed the benefits of this procedure.[11–12] Compared with best supportive bowel management without irrigation, patients with transanal irrigation had less constipation, less fecal incontinence and improved symptom-related quality of life (QoL).[13] Chronic idiopathic constipation and fecal incontinence (encopresis) are common symptoms during childhood and in general practice and one of the most common symptoms in patients with neurological diseases. There is a lack of literature regarding studies on pediatric population; in fact, recent multicenter clinical trials enrolled adult patients affected with various types of spinal cord lesion. In this study, we studied a large pediatric selected population with MMC. The aim of this study is to evaluate whether transanal irrigation could be a safe and effective alternative approach in pediatric

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Received 18 September 2009; revised 27 October 2009; accepted 28 November 2009; published online 19 January 2010

field for the management of neurogenic constipation in children with MMC and to improve bowel habit and QoL of patients and their family.

Materials and methods

Between April 2007 and December 2008, we enrolled 66 young patients with MMC to undergo transanal irrigation referred to the Spina Bifida Center of the Catholic University of Rome.

Inclusion criteria were: patients with MMC, aged 6–17 years and presenting with chronic constipation or having an unsatisfactory bowel management defined as: spending half an hour or more attempting to defecate each day or every 2 days; fecal incontinence occurring once or more per month, poor response to other treatments or use of digital maneuvers.

Exclusion criteria were: evidence of bowel obstruction or inflammatory bowel disease and previous perineal surgery.

Each patient and parents were exhaustively informed about the study and they gave written permission. We certify that all applicable institutional and governmental regulations regarding the ethical use of human volunteers were followed during the course of this study.

Study design

This was a prospective clinical trial of 6-month period aimed to evaluate whether transanal irrigation improves bowel function in MMC children with neurogenic constipation.

The first phase of 3 months was a roll-in time to determine whether patients respected inclusion criteria, to appreciate their bowel habits and to verify how many urinary tract infections (UTIs) were present during this period. The second phase of 3 months was the operative trial with the use of transanal irrigation (Figure 1).

After recording the medical history, physical and neurological examinations and urodynamic evaluation at first visit, parents of the patients or the patient itself responded to a validated questionnaire on defecatory disturbances and on QoL related to neurogenic constipation.[14]

To ensure sufficient knowledge about transanal irrigation, a specialized doctor taught the patients how to use it. During the trial, they reported on a diary card if there were any changes in bowel habit.

After 3 months of treatment, patients were required to go for a second visit and urodynamic evaluation. Laboratory analyses were obtained at the first and second visits.

Urodynamic parameters

The parameters used for urodynamic evaluation were: bladder volume, compliance, detrusor activity and vesico-sphincteric synergy during micturition. Bladder volume was measured when the child started to urinate or showed discomfort. In patients with abolished repletion sensation, volume was determined when intravesical pressure reached 30 cm H_2O. Compliance was measured by dividing the increment in bladder volume by the concomitant increment in intravesical pressure during the filling phase. Detrusor activity was analyzed during the filling phase to detect inhibited contractions or systoles. Bladder contraction was defined as an increase of more than 2 cm H_2O above the resting bladder pressure, whereas an increase higher than 15 cm H_2O was considered as a systole.

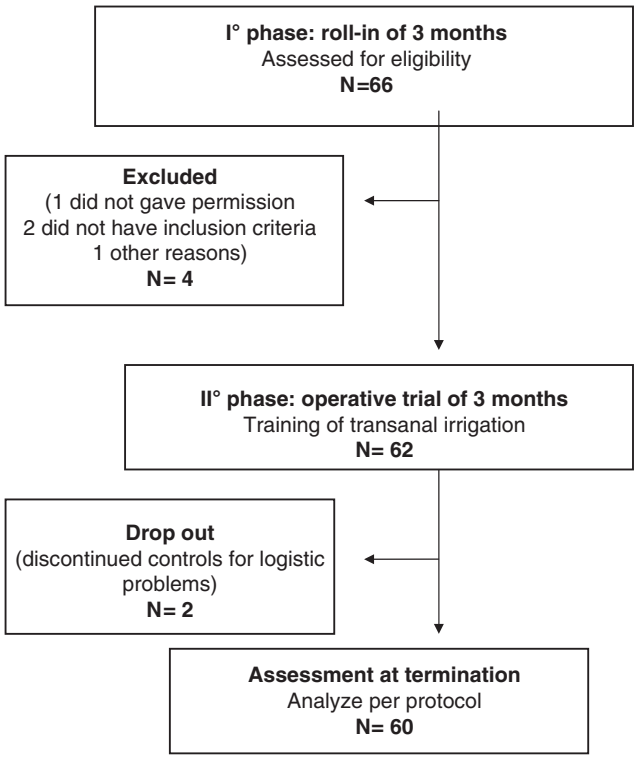

Figure 1 Trial profile.

Treatment

Peristeen anal irrigation system (Coloplast A/S Kokkedal, Denmark), helps people with spinal cord injuries to empty their bowels.[11–13] It consists of a control unit with pump, water bag and a rectal catheter (Figure 2).

Assessment during the trial

To assess the therapeutic effectiveness of transanal irrigation, we considered as primary end point of the study the NBD score[14] (range: 0–47, with 47 representing severe bowel dysfunction). Secondary end point was assessed on numeric box scales: general satisfaction (range: 0–10, with 10 representing complete satisfaction). The remaining secondary end points were time for bowel function, side effects during treatment, variation in use of laxatives and manual extraction, and frequency of urinary infections.

Data analysis

Statistical analysis was performed using the STAT-SOFT (Tulsa, OK, USA) package.

Results are expressed as mean and s.d. value for quantitative variables and as absolute and relative frequencies for qualitative variables.

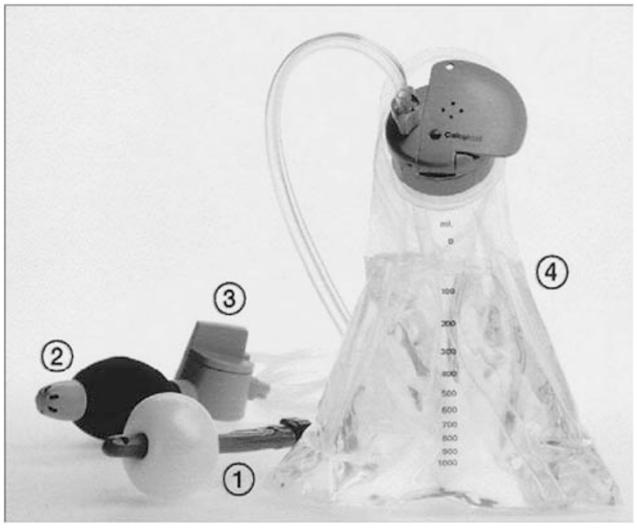

Figure 2 Peristeen anal irrigation system. (1) Coated rectal catheter with balloon for insertion into the rectum. (2) Pump for activating balloon and flushing water. (3) Control unit for regulation of air and water. (4) Bag for water.

Fisher's exact test was used to compare the frequency of symptoms and bowel conditions under basal conditions and at the end of the run in period. Non-parametric tests (Mann–Whitney) and analysis of variance (Koch) were used to assess transanal irrigation and encopresis frequency, and QoL score. Tests with $P \leqslant 0.05$ were considered to be statistically significant.

Results and discussion

We enrolled 66 young patients with MMC, four were excluded from the study because they did not give their consent; thus 62 patients started the trial. During the study, two patients were excluded because of discontinued controls. Thus 60 patients completed the study and were included in the analysis (31 male, 29 female; mean age: 12.5 ± 3.05 years, range 7–17 years; Figure 1). All children underwent, within the first 24 h of birth, neurosurgical intervention for neural tube defect repair. In five patients, the SB lesion was thoracic, in 39 patients the lesion was lumbosacral and in 16 it was sacral.

All children were Italian and white; regarding mobility: 31 children (16 males and 15 females) were unable to walk and required a wheelchair, 10 (5 males and 5 females) walked with tutorial aid and 19 (10 males and 9 females) walked without any aid. Regarding hydrocephalus related to MMC: 46 patients had ventriculoperitoneal shunt, 5 had third ventriculostomy, 9 had no such interventions.

About bladder emptying, 45 patients were submitted to urethral catheterization, 8 used Valsalva maneuver and 7 had normal micturition.

Regarding urinary function, 34 patients had sphynter/detrusor dyssynergia, 8 had acontractile bladder, 11 had neurogenic detrusor overactivity and 7 had no functional problems.

Characteristics at baseline are summarized in Table 1.

Table 1 Patient characteristics at selection visit

	Number of patients
Patients	60
Sex (male/female)	31/29
Age (years), mean ± s.d. (range)	12.5 ± 3.05 (8–17)
Lesion level	
Thoracic	5
Lumbosacral	39
Sacral	16
Hydrocephalus related	
DVP	46
3° Ventriculostomy	5
None	9
Mobility	
Wheelchair-bound	31
Using aid	10
No aid	19
Arnol-Chiari malformation	
Yes	48
No	12
Bladder emptying	
Urethral catheterisation	45
Valsalva maneuver	8
Normal micturition	7
Antibiotic prophylactic	
Yes	42
No	18
Urinary function	
Sphincter/detrusor dyssynergia	34
Acontractile bladder	8
Neurogenic detrusor overactivity	11
No functional problems	7

Urinary tract infections reported in the last 3 months were: 49 patients had none, nine had one infection, two patients had two or more than infections.

Regarding the method used for defecation before transanal irrigation, 25 patients principally used manual extraction, 18 used suppositories or enemas and 17 used laxatives.

Performance in transanal irrigation

Table 2 reports the topics regarding performance of transanal irrigation in 60 young patients with MMC treated for 3 months.

Clinical efficacy and QoL after 3 months of treatment

We observed an improvement in bowel habits and a decreased frequency of fecal incontinence, and patients and their parents reported that these improved their QoL and degree of satisfaction. Comparing questionnaire scores before and at the end of the study, the mean ± s.d. scores were as follows: NBD total score (range: 0–47, 47 = severe bowel dysfunction) was 17.5 (5.2) versus 8.5 (4.3) ($P < 0.001$); frequency of defecation (range: 0–6, 6 = less than once a week) was 4.8 (2.1) versus 2.5 (2.3) ($P < 0.01$); time used for

Table 2 Performance in transanal irrigation

	Mean (s.d.) or patients
Frequency of irrigation per week	2 (1.6)
Difficulties with insertion of the catheter	10/60
Expulsion of the catheter	4/60
Defecation not related to irrigation	23/60
Needed help with irrigation procedure	44/60
Volume of tap water (ml)	510 (330)
Total time spent on bowel irrigation (min)	25 (15)
Time spent sitting at the toilet (min)	20 (10)
Fecal incontinence after irrigation	4/60

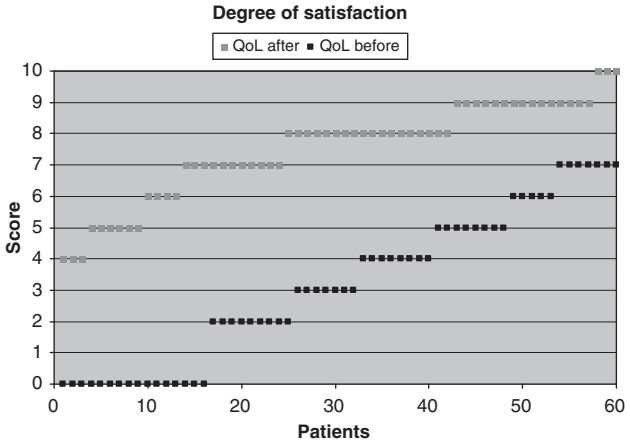

Figure 3 Degree of general satisfaction for bowel habit before and after treatment with transanal irrigation ($P<0.001$).

each defecation (range: 0–7, 7 = more than 1 h) was 3.8 (2.3) versus 2.8 (1.6) ($P = 0.5$); regular use of tablets and/or drops against constipation (range: 0–2, 2 = yes) was 0.85 (1.0) versus 0.3 (0.7) ($P<0.01$); digital stimulation or evacuation of anorectum (range: 0–6, 6 = once or more every week) was 4.2 (2.8) versus 1.3 (2.5) ($P<0.013$); frequency of fecal incontinence (range: 0–13, 13 = daily) was 5.5 (1.2) versus 1.3 (1.7) ($P<0,01$); and degree of general satisfaction (range 0–10, 10 = high degree) was 3.0 (2.4) versus 7.7 (1.5) ($P<0.001$; Figures 3–5). At the end of the trial, 60% (36/60) of patients reported relief from constipation and 75% (12/16) from fecal incontinence ($P<0.001$; Table 3).

About modality for evacuation, we observed a significant reduction in manual extraction (25 patients before versus 4 after the trial; $P<0.01$), in suppositories or enema (18 patients before versus 5 after the trial; $P<0.01$) and in the use of oral laxatives (17 patients before versus 5 after the trial; $P<0.01$; Table 4).

Regarding UTI, data collected evidenced a general decrease during the study, particularly, of *Escherichia coli* infections: 14 UTI in 3 months before treatment (9 *E. coli*) versus 6 (3 *E. coli*) during trial ($P<0.01$).

Correlation between disability and outcome measures

To investigate whether an apparent imbalance of mobility can affect the outcome measures, we report data regarding

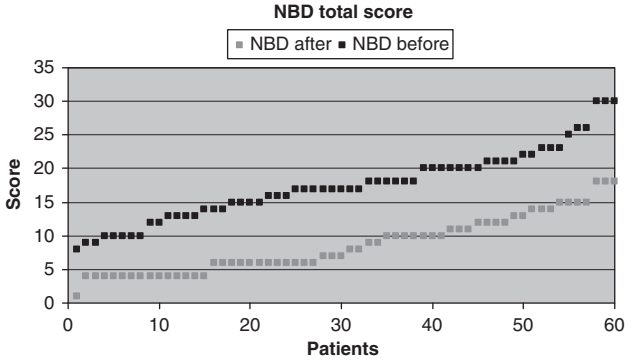

Figure 4 Neurogenic bowel dysfunction (NBD) total score before and after treatment (higher scores = higher bowel dysfunctions; $P<0.001$).

NBD score between patients walking with or without difficulties (29) and wheelchair-bound patients (31) separately (mean NBD: walking pre-trial 15.2 ± 2.8 and post-trial 8.1 ± 3.9 versus wheelchair-bound pre-trial 19.7 ± 7.1 and post-trial 9.1 ± 6.2).

Symptoms and adverse effects during the trial period

No severe adverse effects were recorded during the trial. Symptoms recorded in the diary card are listed in Table 5. We observed that anorectal pain (the most frequent symptom reported) was more frequent in younger patients (<10 years; 6 of 8 patients).

Laboratory data and urodynamic parameters

No treatment-related changes were observed. Particularly, we observed that bladder volume, detrusor activity and compliance were the same before and after urodynamic evaluation.

Discussion

Bowel dysfunction occurs in children with MMC because in them the recto-anal inhibitory reflex is maintained but the defecation urge is not present. When the internal sphincter relaxes, bowel accidents or soiling occurs. Constipation results from an increased colonic transit time and a lack of sphincteric contraction with rectal distention.[15–16] Additional factors leading to bowel dysfunction in children with MMC are: a general decrease in activity, level lesion that causes abdominal muscle dysfunction, resulting in a decreased ability to push out stool.[17] An addition factor for incontinence is that children using wheelchairs or braces require more time to remove their clothing and go to the toilet. For these reasons, most infants and toddlers with MMC develop constipation, typically passing frequent, small and hard stools.[18]

The management of constipation through diet, osmotic agents or stimulant laxatives is an important pediatric responsibility. Literature data report that different doses of polyethylene glycol and lactulose decrease stool consistency, increase stool frequency with the consequence of an higher

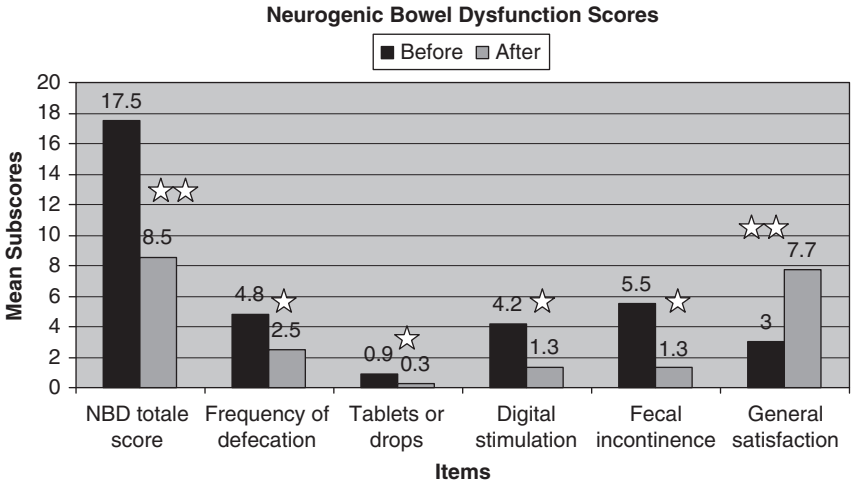

Figure 5 Neurogenic bowel dysfunction (NBD) scores. Scores are expressed as mean scores: **($P<0.001$); *($P<0.01$). NBD total score and degree of general satisfaction ($P<0.001$), frequency of defecation, digital stimulation, use of tablets and drops and frequency of fecal incontinence ($P<0.01$).

Table 3 Results of NBD score before and after treatment

	Before	*After*	P
Frequency of bowel movements (range 0–6; 0 = daily, 6 = less than once a week)	4.8 ± 2.1	2.5 ± 2.3	0.01
Time used for defecation (range 0–7; 0 = 0–30 min, 7 = more than 1 h)	3.8 ± 2.3	2.8 ± 1.6	NS
Use of tablets or drops against constipation (range 0–2; 0 = no, 2 = yes)	0.85 ± 1	0.3 ± 0.7	0.01
Digital stimulation or evacuation (range 0–6; 0 = daily, 6 = less than once a week)	4.2 ± 2.8	1.3 ± 2.5	0.01
Frequency of faecal incontinence (range 0–13; 0 = less than once a week, 13 = daily)	5.5 ± 1.2	1.3 ± 1.7	0.01
Headache or perspiration during defecation (range 0–2; 0 = no, 2 = yes)	0.8 ± 0.3	0.5 ± 0.4	NS
Flatus incontinence (range 0–2; 0 = no, 2 = yes)	1.45 ± 1	1.1 ± 1.1	NS
Perianal skin problems (range 0–3; 0 = no, 3 = yes)	2.2 ± 1.8	1.8 ± 1.7	NS
Total NBD score (range 0–47)	17.5 ± 5.2	8.5 ± 4.3	0.001
Bowel dysfunction (number of patients)			
0–6 very minor	0/60	27/60	
7–9 minor	3	7	
10–13 moderate	11	16	
>14 Severe	46	10	

Abbreviation: NBD, neurogenic bowel dysfunction.
Results are expressed as mean ± s.d.

Table 4 Method for defecation, episodes of incontinence and urinary tract infections before and during trial

Method for defecation	*Before*	*During trial*	P
Manual extraction	25/60	4/60	<0.01
Supporities or enemas	18/60	5/60	<0.01
Laxatives	17/60	5/60	<0.01
Episodes of fecal incontinence	16/60	4/60	<0.01
Urinary tract infections (by *Escherichia coli*)	14 (9)	6(3)	<0.01

Table 5 Symptoms and adverse effects during the trial period

No symptoms	40/60
Abdominal pain	2/60
Anorectal pain	8/60
Nausea	1/60
Sweating	2/60
Headache	1/60
Facial flushing	1/60
Mild general discomfort	5/60

rate of stool.[5] Usually many children and parents prefer manual extraction with or without enemas, supporities or laxatives or, especially in adulthood, surgical procedures as Malone anterograde continence enema or construction of a permanent left-side colostomy, which results in a poor QoL for them and their family.[19] Owing to the myriad of clinical features of MMC, neuropathic bowel arguably has a great impact on social integration. Subjects with neuropathic bowel, benefit from a precise, well-organized treatment plan to clear and prevent fecal retention and promote near regular bowel habits.[20] Transanal irrigation has been known since 1500 BC. Several studies evidenced that transanal irrigation improves bowel function in adult patients with fecal incontinence or constipation due to spinal cord injury.[11–13]

Our clinical trial, to the best of our knowledge, is the first in a selected pediatric population with MMC. Our results suggest that transanal irrigation is a valid treatment for neurogenic constipation; in fact, at the end of the trial 60 % of patients (36/60) reported relief from constipation and 75% (12/16) from fecal incontinence. In recent trials on adult population with spinal cord injuries similar outcomes were reported (fecal incontinence: 40–75% and constipation: 40–65%).[11,12] Patients and their families reported an improvement in QoL, bowel habit and a higher degree of satisfaction. Time for defecation (time spent for bowel irrigation and sitting on the toilet) was not statically different before and after trial. We assume that in a population of MMC children, the presence of a parent is often necessary for bowel management and because of neurological impairment of the patient the time necessary for child's care is always the same. The use of transanal irrigation is very easy but we suggest that an individual training, regarding the use of transanal irrigation, by a specialized doctor who can help parents during the first months is very important to improve bowel habit and to obtain better results from this procedure. During the study, no serious adverse events related to the Peristeen anal irrigation were reported by patients or their parents, in accordance with the safe nature of usage as shown in previous trials.[11–13] We recorded that moderate anorectal or abdominal pain were reported by 15% of patients, particularly, in younger children. As no changes in urodynamic tests were observed, we suggest that in children with MMC, constipation depends on a variable association of neurogenic and functional involvement, such that a longer period of treatment is required to obtain better results. We assume that with the use of a smaller anal catheter these symptoms could be improved. The prolonged treatment with transanal irrigation manifested its favorable effects also regarding abdominal bloating, flatulence and borborygmi, suggesting that a longer period of normal evacuation may improve abdominal symptoms. Results regarding type of mobility indicate that wheelchair users seem to have the same high benefit after the treatment, as walking patients do. Thus, the improvement in bowel management observed after transanal irrigation is not confined to the more physically able patients but is important also for patients with higher disability. Regarding UTIs, we observed a general reduction in frequency and intensity. Interestingly we observed a reduction in, particularly of *E coli*, urinary infections. We propose, as explication, that transanal irrigation by improving bowel habit and washing of the colo-rectal tract reduces the risk of bladder contamination by *E. coli*.

Conclusions

Our results, in accordance with previous studies on adult population, confirmed that transanal irrigation reported a high rate of success both in clinical and in QoL fields in selected pediatric population with MMC. This simple therapeutic method should be considered as a safe and valid choice of treatment for chronic neurogenic constipation, especially before attempting surgical treatment. Nevertheless, we would like to underline that larger population and randomized clinical trials comparing transanal irrigation and conservative bowel management (for example, polyethylene glycol) are necessary to obtain more important information.

Conflict of interest

The authors declare no conflict of interest.

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