



Clinical evaluation and management of neurogenic bowel after spinal cord injury

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Objectives: To assess the state of the neurological bowel in spinal cord injured (SCI) patients, design and apply a program for the comprehensive management of neurogenic bowel and evaluate outcome.

Setting: Out-patient in a Rehabilitation Service.

Subjects: Thirty-eight SCI patients, 12 (32%) with complete lesions of more than 5 years duration.

Design: Observational, longitudinal and prospective. Pre and post intervention.

Method: Pre and post SCI intestinal function was evaluated clinically prior to beginning program. The presence of GI symptoms were studied. Laboratory work-up included colonic transit time (CTT), anorectal manometry and recto-colonoscopy. An intestinal program was designed, in order to achieve an effective and efficient evacuation in a predictable and socially acceptable time, to avoid short and long term complications and eliminate inadequate intestinal evacuation habits.

Outcome measures: Pre and post SCI difficulty in intestinal evacuation (DIE) was increased (from 2.6% to 26.3%). The most frequent GI symptom was abdominal distention (53%). Colonic inertia was present in 49% of CTT, internal anal sphincter pressure was normal or increased in 77% and rectoanal inhibitory reflex was present in 88%. With the intestinal program, the incidence of DIE was reduced to 8.8%, manual extraction (ME) was reduced from 53% to 37%. Excellent and good results were obtained in 56% of the patients.

Conclusion: The proposed intestinal program is effective in the rehabilitation of SCI patients with neurogenic bowel. It is essential to initiate these physiological and safe procedures as soon as possible after sustaining the injury; this will lead to better results and to the elimination of inadequate intestinal maneuvering in the future.

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Introduction

Neurogenic bowel has a significant impact on the quality of life of spinal cord injured patients, causing morbidity and even death.¹ The altered central or peripheral nervous system⁴⁷ results in delayed gastric emptying, prolongation of intestinal transit time, and poor colonic motility. It is frequently manifested by post-prandial abdominal distention, decreased frequency of defecation and decreased water content in the stools resulting in increased stool hardness.³

Twenty-seven to 41% of patients with neurogenic bowel have chronic gastrointestinal problems that alter lifestyle and may require treatment.^{1,4,5} Nineteen to

23% of SCI patients required at least one hospitalization due to GI tract issues.⁵ The mortality for alimentary tract pathology is currently 10%.⁶

The effects of neurogenic bowel on life quality of SCI patients is significant. Fear of intestinal accidents, such as incontinence, frequently restrict patients from activities outside their home.² Because chronic GI tract symptoms in SCI patients are infrequent within 5 years of the injury, this suggests that they may be preventable.⁵

Constipation in these patients rarely responds to conservative treatment, patients may have to perform invasive, sometimes inadequate procedures in order to avoid fecal impaction and incontinence. This complicates their personal and social lives and increases physical and psychological dependence on others.⁷

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The objective of this study was to assess the state of the neurological bowel in patients with medullary or cauda equina injuries, to design and apply a program for the comprehensive management of neurogenic bowel and to evaluate the results of such a program.

Materials and methods

Forty-one patients with medullary or cauda equina injuries, (residents of Santiago, Metropolitan Region) were studied from May 1996 to July 1997. Three of these underwent colostomy at the beginning of the study, to prevent pressure ulcers, and none needed intestinal transit reconstruction. They, therefore, were excluded from the study. All patients were seen on an out-patient basis in the Rehabilitation Service of the Hospital del Trabajador de Santiago, Asociación Chilena de Seguridad. This is a private mutual company caring for patients who have had workplace accidents for the past 40 years.

The age, gender, level and type of spinal cord lesion, duration of lesion, psychological status, degree of independence in their intestinal management, defecation position, and use of medications likely to produce constipation as well as bowel augmentation cystoplasty were assessed. Pre and post spinal injury intestinal function was evaluated clinically prior to beginning the program (including assessment of intestinal habit, defecatory frequency, time of intestinal evacuation and stool consistency).

Difficult Intestinal Evacuation (DIE)^{2,27} is defined when two or more of the following are present: (a) Defecatory frequency of less than three times a week;⁷ (b) Hard stools. These cause urgency, difficult bowel evacuation, and sensation of incomplete evacuation;^{7,10} (c) Prolonged intestinal management time, more than 45 min.^{5,11-16} The term constipation is avoided because it is inexact.¹⁷ We evaluated the presence of the following gastrointestinal symptoms and complications: flatulence, post-prandial abdominal distention,^{5,18} abdominal pain,⁵ rectal bleeding and incontinence.^{4,13,14} These were marked in importance of their effect socially.

The laboratory work-up included colonic transit time (CTT), anorectal manometry and recto-colonoscopy. CTT was performed according to Karasick²⁰ and Kannisto's³ modification of Arhan's technique.¹⁹ This technique is simple and inexpensive.^{3,7,8,19,21-29}

The patients ingested 50 spherical, 1 mm radio-opaque markers in a gelatin capsule. Throughout the study, the patients consumed their usual diet supplemented with water-soluble fiber. Abdominal X-rays were taken immediately after ingestion of the capsule and every 5 days until fewer than 20% of the markers were seen radiographically. The markers were localized and counted, using the spine as a bony landmark, separating the right colon from left colon and the pelvic inlet that separates left colon from the rectosigmoid.¹⁹

The size of the colon was estimated radiographically immediately post ingestion of the markers by radiologists who were unaware of the patient's background. The test was rated as normal or abnormal according to the amount of markers that could be seen radiologically. If more than 20% were seen, it was considered abnormal. Retention of 10 or more markers in the right colon, left colon or rectosigmoid were defined as colonic inertia, hindgut dysfunction and outlet obstruction respectively.^{8,20,22} The finding of 10 or more markers gathered in more than one sector was considered a mixed pattern. X-rays taken every 5 days categorized the abnormal CTTs as follows: moderate, when more than 10 markers were seen until the tenth day; severe, when more than 10 markers were seen until the fifteenth day; and very severe when 10 or more markers were noted at 20 or more days.

Anorectal manometry was performed after a saline enema. A computerized on-line polygraph was used (Cynetics Medical), with a four channel open-tipped perfusion catheter with a distant balloon. Perfusion was performed with an Andorfer pump. The probe was introduced anally up to the rectal ampulla. The average highest pressure, which corresponds to the internal anal sphincter pressure (PIAS) was measured. Normal PIAS values for our laboratory range from 140 to 240 mmHg.^{2,29-31} The anorectal inhibitory reflex, that is the relaxation of the internal anal sphincter before rectal distention, was measured by insufflating the rectal balloon with 60, 120 and 240 cc of air and noting if relaxation of the sphincter was obtained. Before rectal insufflation the patient was asked whether he had defecatory sensation indicating presence or absence of the rectocortical reflex. Both reflexes are elicited at a rectal distention of up to 120 cc of air.

The colon was prepared with oral polyethylene glycol before rectoscopy and colonoscopy. Inflammation, rectal ischemia, anorectal lesions and melanosis coli were noted if present.^{17,29} Pathological findings were photographed. A total of 35 CTT, 34 anorectal manometries and 36 recto-colonoscopies were performed on 38 patients.

The intestinal program was finally developed with the active participation of the patient;^{2,7,13,16,32} its goal was: (1) to achieve an effective and efficient evacuation in a predictable and socially acceptable period of time with an appropriate stool consistency and defecatory frequency; (2) to avoid fecal incontinence and other short and long term complications; (3) to eliminate inadequate intestinal evacuation habits. The rectoanal care that was used in our program was defined as a scheduled process of facilitated reflex defecation, with the establishment of a routine for stool evacuation, in a predictable and socially acceptable way. Various maneuvers were used gradually and sequentially, such as using a sitting position when defecating, applying pressure and massage to the abdomen, suppository use, and digital stimulation.^{2,33,47}

A review of the literature indicates that evacuation by means of manual extraction, use of purge enemas and forbidden laxatives are considered to be inadequate practices of intestinal evacuation because of their inherent risk and possible complications.^{2,3,9-14,19,20,23,24,29,32,33,35,39,41,46,47}

Thirty-four of the 38 patients assessed were enrolled in our intestinal program. Four were excluded, one patient was in a terminal state for cancer, another died during the study period from non bowel related causes, another patient did not require treatment and one case refused changes in his current routine.

A program for intestinal management was designed according to the literature review.^{1,2,7,11-14,17,32,34-44} Figure 1 shows the program in a schematic form. The patient's intestinal function, symptoms and complications were evaluated monthly. They were educated regarding inadequate practices of evacuation, and medications were changed where necessary. After 6 months on the Program, and having achieved stability in their intestinal management, the patient's intestinal function, symptoms and possible complications as well as compliance were reevaluated. Patient compliance was defined as patient's adherence to the medical regimen and prescribed drugs.

Global results of the program were classified as *Excellent*: patient's defecatory habits were regular, with an acceptable intestinal function (three or more times a week with stools of normal consistency, 'like a snake', smooth and soft, with an evacuation time less than 45 min); *Good*: patients did not achieve a regular defecatory habit, with acceptable intestinal function, defecatory frequency three or more times a week, formed normal stools, evacuation time less than

45 min, and, patients did not carry out inadequate practices of intestinal management; *Fair*: Patients with or without a regular defecatory habit, acceptable intestinal function, defecatory frequency sometimes > three times weekly, evacuation of hard stools and/or evacuation time more than 45 min. Patients occasionally performed inadequate intestinal management procedures, eg manual removal and; *Poor*: with or without regular defecatory habit, acceptable intestinal function or DIE. Patients performed frequent inadequate intestinal management procedures.

Patient compliance was essential in the achievement of our goals. Informed consent was obtained from each patient after he/she was fully informed about the study and procedures, confidentiality of the information, and that there was no risk to their health. Enrolment to the program as well as undergoing the various tests was voluntary. Two patients refused one of the three procedures used in the study and one other patient refused participation in the program.

Statistical analysis

Normal paired bilateral tests corrected for continuity and paired Chi square for pre and post DIE evaluation of the program (z paired); paired Chi square or McNemar with correction of continuity was applied. McNemar (χ^2 paired) or exact binomial probability test (EB) were applied for comparison of paired variable proportions, depending on sample size. For comparison of mean paired variables, such as defecatory frequency pre and post program application, the *t* bilateral paired Student test was applied (*t* paired) with

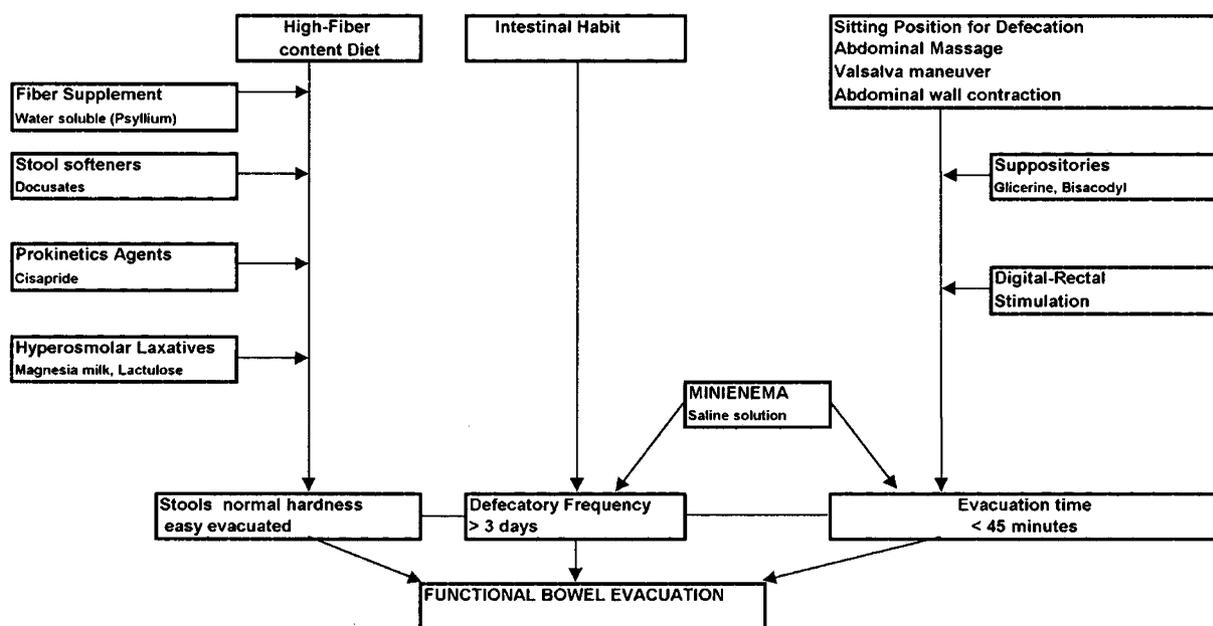


Figure 1 Intestinal program for spinal cord and equina cauda injured patients

or without logarithmic correction, or Wilcoxon's sign range test depending on size and SD of samples. For comparison of mean variables in two samples, such as age and duration of SCI, with and without DIE, the *t* bilateral Student test was applied (*t*), with or without logarithmic correction, or Wilcoxon's range addition test, depending on size and SD of samples.

Results

We studied 38 patients: 34 men, four women; ages 43 (± 12.1) years, ranging from 19 to 71 years of age. Twenty-one patients had complete medullary lesions (CML) (55.3%), 10 had incomplete medullary lesions (IML) (26.3%) and seven had medullary cone syndrome and cauda equina (CC) (18.4%). Two of the CML had cervical (9.5); six had high thoracic (28.6%) and 13 had low thoracic levels of injury (61.9%).

IMLs were composed of five central medullary syndromes (50%); one posterior chord syndrome (10%), three ASIA B lesions (30%) and one ASIA D (10%). Time from injury to beginning of study was 6 (± 3.7) years ranging from 5 months to 16 years. In 22 patients (58%) the SCI had been sustained more than 5 years previous to entering the study. Twelve patients (32%) had complete lesions for more than 5 years previous to entering the study. Moderate to severe psychological involvement was present in seven patients (18.4%) related to concurrent encephalic lesion. Twenty-eight patients (73.6%) were in wheel chairs, 10 (26.3%) ambulated with or without orthosis. Independent intestinal management was present in 28 patients, 10 patients required help from another person (26.3%). Nine patients defecated in bed, 29 managed their bowels by sitting on special WC chairs or in the toilet.

Fifteen patients (39.5%) were on anticholinergic, amytriptiline and/or oxybutinine medication which could produce constipation. Bowel augmentation cystoplasty was performed in nine patients (23.7%) on average 5.8 years before entering the study. When comparing pre and post lesion intestinal function at

the onset of the study, a decreased defecatory frequency was noted which ranged from 8.2(± 3.8) to 5.2(± 3.6) times a week with an increased evacuation time which ranged from 9.7(± 0.9) to 24.1(± 23.9) min respectively, both differences were statistically significant ($P < 0.001$; *t* paired). DIE increased significantly post lesion from 2.6% to 26.3%, $P = 0.031$ (EB).

Regular intestinal schedule (or habit) was present in 21 patients (55.3%), with no differences in the pre and post injury condition before starting with the program.

Issues probably arising from post-medullary lesion DIE are related to poor intestinal habits and the ingestion of potentially constipating medication (Table 1). At the onset of the study, 36 patients (94.7%) had GI tract symptoms, the most frequent being abdominal distention (52.6%) (Table 2). Symptoms were present more than once a week in 14 patients (36.8%), leading to severe social problems in three patients (7.9%), two of who had frequent fecal incontinence. Simple abdominal X-rays revealed colonic dilatation which was moderate in 13 patients (37%) and severe in eight (21%).

The most common CTT pattern was colonic inertia, present in 17 patients (48.6%) with severely decreased marker elimination time in 10 patients (28.6%) (Tables 3 and 4). No significant differences were noted when analyzing distribution patterns according to lesion type. PIAS in anorectal manometry was 91.5 (± 35) mmHg (36 at 206). No different levels of pressure were detected according to type of lesion. PIAS was normal in 22 patients (64.7%), increased in four (11.8%) and decreased in eight.

Table 2 Gastrointestinal symptoms before Intestinal Program

	n	%
Abdominal distention	20	52.6
Abdominal pain	11	28.9
Flatulence	19	50.0
Rectal bleeding	15	39.5
Fecal incontinence	19	50.0

Table 1 Issues related to Difficult Intestinal Evacuation

	With DIE n = 10		Without DIE n = 21		
	n	%	n	%	
Complete injury	5	50	12	27.1	nss
Duration SCI	5	50	16	76.2	nss
Moderate/severe psychological deterioration	3	30	2	9.5	nss
Functional dependence	7	70	9	42.9	nss
Bowel care dependence	3	30	5	23.8	nss
Bowel habit	1	10	13	61.9	ss(z) $P = 0.01$
Defecate in bed	3	30	5	23.8	nss
Previous inadequate practices	8	80	14	66.7	nss
Using potentially constipating medication	8	80	4	19.0	ss (ET) $P = 0.004$
Bowel augmentation cystoplasty	1	10	6	28.6	nss

Table 3 Pattern of distribution of radio-opaque markers in CTT

	n	%
Colonic inertia	17	48.3
Hindgut dysfunction	1	2.9
Outlet obstruction	1	2.9
Mixed	14	40.0
Normal	2	5.7
Total	35	100.0

Table 4 Elimination time of radio-opaque markers in CTT

Time (days)	n	%
5	2	5.7
10	13	37.1
15	5	14.3
20	5	14.3
> 20	10	28.6
Total	35	100.0

Voluntary Control Pressure (PVC) was present in six of the nine IML patients and 6/7 cone and cauda equina lesions (85.7%) reaching values of 43.7(±36.0) mmHg, much lower than normal values. There were no statistical differences between both groups. The inhibitory anorectal reflex was present in 30 patients (88.2%) with no significant differences according to the type of lesion. Recto-cortical reflex was present only in IML and cauda equina lesions in 10/16 patients (62.5%).

Sixteen (44.4%) anorectal lesions were seen in 36 rectoscopies. The most frequent was hemorrhoids, 13 patients (36%) which were symptomatic in eight patients (61.5%) (Table 5). A transverse colon hemangioma was present in one IML patient. The program was applied on 34 patients for 10.4 (±1.5) months, ranging from 6–13 months. More than one type of treatment was used in 30 patients (88.2%).

Water soluble fiber supplementation, psyllium mucilage was given to 30 patients (88.2%); three patients (10%) did not tolerate it because of abdominal distention, flatulence and acidity, and three other patients stopped it spontaneously. On ending the program, 24 patients (70.6%) were on fiber supplement. The average dose was 8.9 g/day ranging from 5.8 to 17.4 g/day.

Glycerin suppositories were used in 25 patients (73.5%). Four patients had difficulty placing them and four did not like the administration route. At the end of the program, 16 patients (47.1%) were using suppositories, 10 used 1–3 per application.

Anal stimulation was used by 17 patients (50%); 12 patients (35.3%) continued with this method until ending the program.

Table 5 Recto-anal lesions seen on rectoscopy

	n	%
Hemorrhoids	13	36.1
Rectal polyps	3	8.3
Chronic papillitis	2	5.6
Anusitis	1	2.8
Proctitis	1	2.8
Chronic anal fissure	1	2.8

Sodium Docusate was used in 15 patients (44.1%), one of whom was intolerant to its use (6.7%). Eight patients (53.3%) stopped medication by themselves due to poor results and in two patients because of poor results its prescription was ended. On ending the program, four patients (26.7%) were on Docusate at average doses of 150 mg/day ranging from 100–200 mg/day.

Cisapride, 30 mg/day was used in 22 patients (64.7%). Four manifested intolerance (17%) two of whom had abdominal distention, one had nausea, another developed headache, flatulence and abdominal distention.

CTT was performed 5 months post cisapride ingestion in 16 patients (72.7%) and no significant changes were seen when compared to initial scans. Cisapride was stopped in the 12 patients (54.5%) that had no pre and post medication changes in their CTT. Mini-enemas were used as part of the program when there was no defecation with usual maneuvers after 3 days. In two medullar injured patients this was used sporadically.

At the end of the study, 32 patients in all (94.1%) had acquired appropriate bowel management habits. Ten of these (29%) previously had no adequate bowel management habits. An important objective of the program was to eliminate inadequate habits of evacuation, such as ME, use of evacuating and saline enemas, stimulants and other forbidden laxatives. Before program application 67.6% of the patients were using inadequate maneuvers, the most common being ME (18 patients (52.9%)), 19 CML patients were using this procedure pre program, eight of these (42.1%) in a daily fashion.

At the end of the study, inadequate habits were reduced to 23.5% of all patients. ME in CML was reduced to seven patients (36.6%), two of which (10.5%) performed it every day. Both reductions were statistically significant, $P=0.007$ and $P=0.03$ (EB) respectively (Table 6). Compliance to the program was good in 11 patients (32.4%), fair in 18 (52.9%) and poor in five (14.7%).

DIE decreased significantly as well as stool consistency and evacuation time (Table 7). The number of defecations per week increased to 6.1(±3.5), $P=0.02$ (t log 10). GI tract symptoms persisted in 20 patients (58.8%), flatulence being the most prevalent (35.3%). The main feature was

Table 6 Inadequate practices before and after program

Practice	Before program		After program		
	n	%	n	%	
Manual evacuation	18	52.9	7	20.6	ss (z) $P=0.001$
Evacuating enema	4	11.8	1	2.9	nss
Forbidden laxatives	8	23.5	0	0.0	ss (EB) $P=0.003$
Total	23	67.6	8	23.5	ss (z) $P=0.0002$

(34 patients completing program)

Table 7 Difficult Intestinal Evacuation before and after program

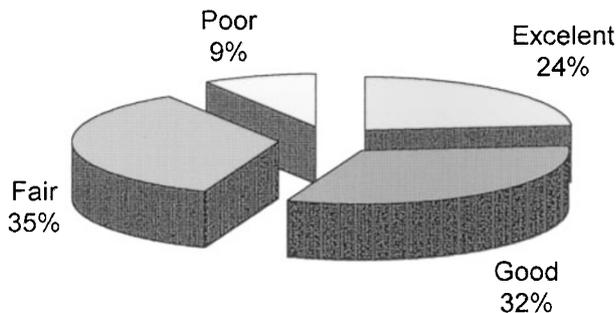
	Before program		After program		
	n	%	n	%	
Defecatory frequency < 3 days	4	11.8	1	2.9	nss
Hard stools	9	26.5	1	2.9	ss (EB) $P=0.004$
Evacuation time > 45 min	9	26.5	4	11.8	ss (EB) $P=0.015$
Total	9	26.5	3	23.5	ss (EB) $P=0.03$

(34 patients completing program)

Table 8 Gastrointestinal symptoms before and after programs

	Before program		After program		
	n	%	n	%	
Abdominal distention	17	50.0	8	23.5	ss (z) $P=0.008$
Abdominal pain	10	29.4	5	14.7	nss
Flatulence	16	27.1	12	35.3	nss
Rectal bleeding	15	44.1	3	8.8	ss (z) $P=0.001$
Fecal incontinence	17	50.0	6	17.6	ss (z) $P=0.001$

(34 patients completing program)


Figure 2 Global results of intestinal program in spinal cord and cauda equina patients

significant decrease in rectal bleeding, abdominal distention and fecal incontinence (Table 8).

Symptoms were persistent more than once a week in five patients (14.7%), $P=0.007$ (BE). Interference with social interaction was eliminated in all patients. Global results were Excellent and Good in 56% (Figure 2). No differences according to type or time of lesion were noted.

Discussion

Our study population comprised mostly complete medullary injured patients (55.3%), with more than

5 years duration previous to entering this study (57.9%). According to the literature, this type of patient is under greater risk of intestinal complications.⁴⁵

After sustaining a medullary lesion, there is a clear decrease in defecatory frequency, increased evacuation time and the stools are harder, increasing DIE from 2.6% to 26.3%. These findings are in agreement with the literature. Glickman¹³ noted increased constipation going from 5% before injury to 30% post lesion. Since there is a loss of conscious defecation, it is important to introduce a predictable stool elimination routine to avoid colonic over-distention.^{2,7,32} Ninety per cent of the patients with DIE in this study did not have a defecatory routine or habit, while 38% did not have DIE. With the use of the program, 10% of the patients acquired intestinal habit. Potentially constipating drugs were used by 39.5% of patients for depression or vesical hyperreflexia, leading to increased DIE. These drugs impair intestinal motility and dry the stools.^{2,34,46} Their use must be avoided in these patients or other treatment modalities must be applied.

The most frequent GI tract symptom was abdominal distention, 52.6% of the patients. This is in agreement with Stone⁵ who reported a 43% prevalence.

Colonic transit time showed mostly an inertia pattern (48.6%) which was very severe in 29% of the

patients. These results are important for treatment concerns.

The internal and sphincter pressure was normal or increased in 87% of the patients, assuring continence. Nonetheless, there was occasional fecal incontinence in 50%, which decreased with the program to 17%. It is probable that in these patients incontinence was due to inadequate intestinal management and to the use of stimulating laxatives.^{5,17}

The inhibitory anorectal reflex was present in 88% of the patients, even in cervical medullary injured patients who used evacuating enema as the only procedure for years. This finding supports the fact that changing to a more physiological procedure is beneficial, even for these patients. The prevalence of hemorrhoids was 36%, lower than the 74% reported by Stone. More than one treatment modality was used in 67.6% of the patients, less than Glickman's reported 95%.¹³

The use of cisapride is currently debatable. Although some series have reported its value in this type of patient, other controlled studies have demonstrated no effect on oroanal transit time, as was seen in our study.^{2,7,12,34,35,37-42,46,47}

Manual extraction is a dangerous and bad habit since it may damage the anorectal mucosa and the anal sphincter in this anesthetized area. Reducing this practice is considered a great success. After ending the treatment period, 37% of CML patients performed ME and only 10% used this method daily, much less than the 26% reported by Glickman and Levi's 64%.^{4,13} The program significantly reduced DIE incidence from 26.5% to 8.8%, as well as the GI tract symptoms and the social impact thereupon.

The global outcome of the program was excellent and good in 56% of the patients, nonetheless, results were bad in three patients (8.8%) who continued ME or did not comply with the program. It is essential to initiate physiological and safe procedures such as those described in our program as soon as possible after sustaining the injury: this will lead to better results and to the elimination of inadequate intestinal management maneuvers in the future.

The colon is a fertile new field of learning for research, for innovation and for an improved quality of life after suffering a medullar lesion.²

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