

Neurogenic Bowel Management Using Transanal Irrigation by Persons with Spinal Cord Injury

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KEYWORDS

• Neurogenic bowel management • Transanal irrigation • Spinal cord injury

KEY POINTS

- The neurogenic bowel has received surprisingly little attention, especially compared with urine incontinence.
- Among individuals with spinal cord injury, bowel function is considered a major physical and psychological problem.
- With transanal irrigation, individuals with neurogenic bowel have received an additional tool that may simplify life once they have got used to it.
- It should be a high priority at spinal cord injury centers to support patients with the right tools for proper bowel management and care.

INTRODUCTION

During early summer of 2018, I was invited to give a talk at Shepherd by Dr Anna Elmers. I was then approached by my colleague and friend Dr John Lin, who is the director in spinal cord injury medicine at the Shepherd Center in Atlanta, Georgia. I felt honored and acknowledged and I did not spend very much time in accepting the offer to be part of this edition. John and I met the first time during The International Spinal Cord Society meeting in Maastricht in the Netherlands, when we were introduced to each other by my even longer old friend Dr Don Leslie.

First, after accepting this task—I thought I was going to sit down and sort out the latest references and try to build up a spectacular 5000-word review article regarding the latest on neurogenic bowel dysfunction and how to embark onto the problem of

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becoming obstipated when being a tetraplegic. After taking out more than 30 volumes of textbooks from the mid-1940s up until today and spending a weekend going through all the articles dealing with obstipation and neurogenic bowel dysfunction, I found myself being so fascinated by what Sir Ludwig Guttmann wrote back in 1946. With this in mind, I decided to make this a different article and take its origin from my own experience after living with a cervical spinal cord injury for more than 35 years and also after treating more than 3000 spinal cord injured patients in that timespan.

Let me start with some history. The last day of May 1984 I dove in shallow water. I dove in once and when I dove in the second time, I hit a concrete pillar and I fractured my C6 cervical vertebrae. I was together with friends, who rescued me from about 3 m of water and brought me up on the jetty. The rescue helicopter from my own hospital Karolinska came and brought me in to the Karolinska University Hospital in Stockholm, where I at that time worked as an anesthesiologist and was involved in intensive care. I was 31 years of age and I was going to get married to my wife Barbro in 2 weeks' time. She worked as a pediatrician and we had lived in sin for more than 5 years; we were going to crown our life with this wedding out in the Swedish archipelago.

That did not happen. Instead, I was in a Stryker bed for 5 days, I was then operated with a bone sponge between my fifth and my seventh vertebrae. I had to wear a thoracocervical collar for 12 weeks, but I embarked into a very active life, despite my disability. The first thing I did, against the will of the University Hospital, was to speak to my "chopper" friends who were running the helicopter service at the hospital. I wanted to go out from the hospital to the outskirts of the Swedish archipelago, where the Hultling family have had a summerhouse for decades. The officer who was in charge of the helicopter service was of course at first questioning whether this was appropriate or not but, taking into consideration the circumstances and the need of intense rehabilitation during the summer of 1984, we were on.

I started to work on September 1, 1984, in the intensive care unit. I could not be in the operating theater and I could not be in the emergency or acute care center. I wanted to be part of the crew and I felt it was important to me with the scrub clothes, white gowns, stethoscope, and pager—all the attributes that constitutes a real doctor on the ward. I focused on speaking to families and patients; I was writing referrals and prescriptions and I was being responsible for the early morning round at 07:30. That was a true challenge with a new tetraplegia to get up at 5 o'clock every morning and be at the hospital and try to do my task. After doing that for half a year, I realized that I was not going to continue with this type of work; I was instead going to work with spinal cord injuries.

WHAT HAPPENED NEXT?

During the first International Spinal Cord Society meeting—in 1985 in Edinburgh—I met with Sir George Bedbrook, who at that time was heading the unit in Perth in Western Australia. He had been asked by the Minister of Health in 1952 to transfer to Western Australia and establish this unit. He had done remarkable work in establishing a large, very comprehensive spinal cord injury unit in Shenton Park in Perth. It had long been doing very well, and they were taking care of more than 120 spinal cord injured patients at any given time. The catchment area was all the way up to Darwin in north and the entire western part of Australia. For his excellent job, he was knighted and became an Officer of the British Empire. When I met him together with my wife Barbro in Scotland, he became interested in finding out whether I could train with him. The first thing he did was to spend 1 hour with my wife to figure out whether she thought that we could handle this sort of situation. After that, he spoke urgently

with me and was very insistent, stating that I should come and train with him. In the summer of 1986, I traveled together with my best friend and colleague professor Richard Levi and we stayed in Perth at his unit for more than 1 year. We were offered housing in the matrons flat over at the hospital; we worked long hours and had to stick with the British aristocracy, as well as a hierarchy with a quite formal way of delegating various task on the ward. Nevertheless, we learned the craftsmanship the hard way and came back to Stockholm in the summer of 1987.

SPINALIS

We were obsessed by the idea of starting a true spinal cord injury unit in Sweden and specifically in Stockholm. We approached the local municipality of health authority, but they were quite reluctant. They were not interested in facilitating this work for us. We approached the private industry and managed to get in contact with one of the most important Swedish entrepreneurs, Kinnevik, part of the Stenbecks' financial sphere. The constitution for Spinalis was signed by Jan Stenbeck, Jan Stenbecks' mother Märtha Stenbeck, and me. Kinnevik chipped in a large sum of money and I chipped in a very minor sum of money, and the foundation was created and up and running in 1989. After that, the foundation has gone through various developing phases and a new era has evolved; as of January 2020, the Rehab Station Stockholm/Spinalis is operating in brand new buildings with 56 inpatients about 3 km away from the main Karolinska Hospital. Situated in a park by the ocean, the Spinalis outpatient unit cares for 1437 spinal cord injured patients living in our catchment area (which constitutes 25% of the Swedish population). Hence, we serve one-quarter of all spinal cord injured patients living in our country.

During these years, I have also been able to work for 6 months with the Miami project in Florida as well as as a visiting professor at Stanford University from 2009 to 2010 in Palo Alto in California, where the clinical work was conducted in the Veterans Affairs unit connected to Stanford University.

LOW ATTENTION TO NEUROGENIC BOWEL

Anyway, this article is supposed to be dealing with the neurogenic bowel and the various types of treatment or approaches that the patient can use to make this huge problem less severe and then specifically regarding the use of transanal irrigation (TAI). But before going there, it has always fascinated me why the neurogenic bladder has been receiving so much more attention over the decades as to why the neurogenic bowel has been extremely neglected. Among individuals with spinal cord injury, bowel function is considered a major physical and psychological problem, likely owing to the severe negative impact bowel problems have on social life and mobility in general.¹ I remember traveling especially in the United States during the mid and late 1980s and how frustrated I was when I tried to establish contact with well-known professional paraplegics and tetraplegics. I could not reach them for a meeting—all because they were “doing their bowel program.” It turned out to be that their entire life was steered and conducted by when they were forced to spend 3, 4, or even 5 hours on the toilet seat waiting for that stool to finally pass the anal sphincter. It does not only hold true for the United States; it holds true for most developed countries in the world. Although these countries were treating spinal cord injured patients after the Second World War and had them embarking into comprehensive rehabilitation, bowel management remains a great challenge for many patients and may severely limit their quality of life.

PATHOPHYSIOLOGY OF THE NEUROGENIC BOWEL

As a result from the spinal cord injury, nerves that allow a person to control bowel movements are often damaged. If the spinal cord injury is above the T12 level (thoracic 12 vertebrae), the ability to feel when the rectum is full may be lost.² The anal sphincter muscle remains tight, however, and bowel movements occur on a reflex basis. This means that when the rectum is full, the defecation reflex occurs, emptying the bowel. This type of bowel problem occurs with upper motor neuron injury. With a spinal cord injury below the T12 level, the defecation reflex may be impacted, and the anal sphincter muscle may be relaxed and nonfunctional. This is known as a lower motor neuron injury.

Commonly after a spinal cord injury, the patient experiences what is called “spinal shock.”³ During that time, the anal sphincter is atonic, and there is no reflexive activity in the sphincter or any part of the bowel. After 3 to 4 weeks, the reflexive activity comes back and for the upper motor neuron lesion patients that implies that they become semi-incontinent (they do not leak or need an anal plug that some lower motor neuron injury patients do). Bowel management is initiated in the acute phase after injury and then throughout life. Patients are informed concerning the importance of diet, fluids, physical activity, and medications to strive to achieve a scheduled bowel care. This training is complemented with other training on facilitating techniques, stimulation techniques, monitoring bowel movements, and other educational activities.

NEUROGENIC BOWEL IN REAL LIFE

How does it feel when you need to go to the bathroom and evacuate your stool or how do you perceive full ampulla, or how does your body react when you really feel an urge for bowel movement?

In the beginning after your spinal cord injury, most people do not sense the fact that they need to pass stool or poop and during these days involuntary accidents are quite common. You are right in the middle of something else and then you become aware of the certain smell, and then you realize that you goofed. It is very embarrassing; it has a huge effect on your psyche and your self-esteem. You feel miserable and you get to the point where you realize that life is unfair. You have to deal with it, and you have to get into a special, rational effective mood to proceed. Cleaning yourself, cleaning your wheelchair, cleaning your cushion, and eventually cleaning your underwear, your jeans, your T-shirt, and your sweater. If the catastrophe is there, there is no reverse gear. You have to deal with the extraordinary situation, and you have to do it without having it affect your emotions to that degree that you will give up. It is not easy, but over time you will learn. After months, and after additional time, your body will get tuned in and you will learn how to detect the small afferent impulses that indicate that something is happening. Not always, but most of the times. You will learn how to distinguish between a full bladder and a full ampulla. Usually, the full bladder signal indicates that you have a very limited time before the involuntary contractions of the detrusor muscle will end up in you passing urine. The idea is then of course to try to find a toilet or a hidden place where you can perform intermittent catheterization and to do that before you pee in your pants.

Back to our neurogenic bowel and the interesting afferent impulses that give rise to this odd feeling of colon and ampulla fullness. It is difficult to describe that very subtle feeling and it is more like a soft shudder that might result in something like a pre-autonomic dysreflexia reaction. You will get a tendency to goosebumps, you will get a tendency to sweat on your forehead, and you feel in your body that something is going on. In the most ideal cases, you can even distinguish between a fart and a full colon ampulla.

The normal procedures among tetraplegics and paraplegics are that they try to get into a formal pattern of emptying their bowel every second day, every third day, or even every fourth day. If you decide to do that the body will start to “learn” that your bowel emptying pattern is semiregular, and for a lot of people that works out fairly well. That means that you get up in the morning on the days that you have your bowel program days, get on your commode chair or the toilet, and introduce some kind of suppository to trigger the rectocolic reflex. The entire idea of stimulating the anus region and the para-anal region is to trigger the rectocolic reflex. The rectocolic reflex is of course the key element in having a proper defecation when you transport the content of your intestines from proximal to distal and eventually have a relaxation of the anal sphincter, which is usually done when the sigmoideum is distended. The routine is then to trigger while using a very mild, “benign” suppository such as a glycerin suppository. What is happening is that, if that does not work, a lot of paraplegics and tetraplegics move on to bisacodyl, which is known as Dulcolax and Magic Bullet. That agent has a much stronger effect on the tissue, and it penetrates the wall of the colon and effects the Meisner and Auerbach’s plexa directly. It states very clearly that this drug should not be used for more than a maximum of 10 to 14 days. Even though those are the regulatory instructions, I have met individuals who have been using it for 15 years and they have developed colon descendant and caecum and an ampulla that is like a downpipe. If you have an overambitious nurse on the ward, she might also move on to bisacodyl, not only as an oral drug, but also as suppositories. The same nurse persuades the patient to take sodium picosulphate as droplets, and then we have used most of the chemicals we can use to evacuate the ampulla. If you look at the problem from another angle, one way is to increase the bulk (the volume) of the stool, which can be done by using polyethylene glycol (known as Miralax). All these attempts or techniques have the same goal: to facilitate the rectocolic reflex and move the contents of the intestines proximal to distal and eventually also out through your anus.

BOWEL MANAGEMENT INTERVENTIONS PYRAMID

If you try to sort out bowel management interventions, you can think of a pyramid (Fig. 1) indicating the degree of invasiveness of the treatment option.

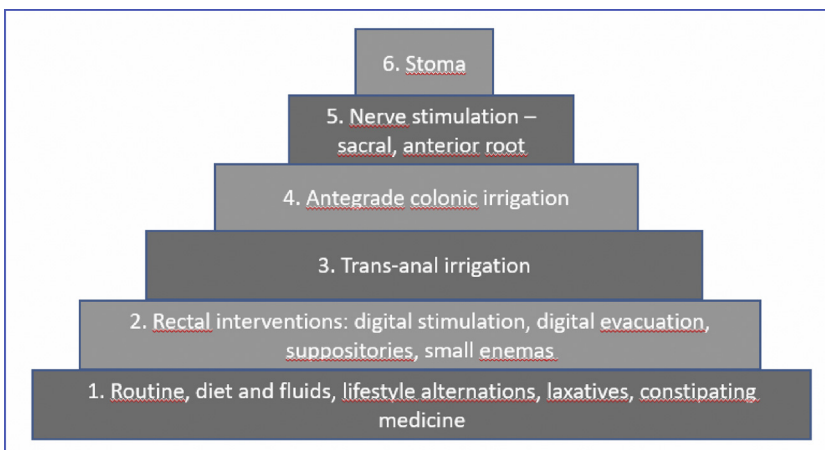


Fig. 1. Bowel management interventions pyramid.

At the bottom, you have the routines for diet, fluids, the lifestyle alterations, the laxatives, and the constipating medicine. That is level 1, at the very bottom. Level 2, the next step up, is rectal intervention, which includes digital stimulation, digital evacuation, suppositories, and small enemas. On level 3, there is TAI. We will definitely get back to TAI elsewhere in this article. On level 4 of this pyramid is the antegrade colonic irrigation through an enema technique that is, antegrade colonic enema. We return to that as well. On level 5 is the sacral anterior root stimulator. As a last option, on level 6 is the stoma, where you can have a colostomy or an ileostomy depending on the injury. Levels 4 to 6 include more invasive treatment options, such as nerve stimulation implants and surgical colonic irrigation.

THE CLAES HULTLING TECHNIQUE

During an early stage of my spinal cord injury, I learned that if you direct a jet of water toward the perianal region, and if the jet is not too strong but gentle and hot enough (not burning), you trigger the rectocolic reflex. It might trigger immediately; it might need a couple of minutes to trigger, and it might also be that you have to introduce small anal probe/catheter through the sphincter to get the acquired or desired effect. A prerequisite for this is that you have access to this small shower water device when you are traveling. That means that, in my case, I always bring a hose about 4 to 5 m long and that tubing helps me in almost any bathroom in the world. I carry with me a large number of connectors so that I can connect my hose to the faucet or the tap. It has worked extraordinary well for 35 years in most cases. However, as a complement to this method, every now and then (maybe once or twice a week), whenever I am “insecure” about whether I actually have emptied my lower part of the colon properly, I use TAI.

WHEN IS IT APPROPRIATE TO START USING TRANSANAL IRRIGATION?

The general idea is to avoid embarking onto a bowel emptying procedure that is more high-tech than the patient needs. If the individual has good, well-functioning reflex emptying of the ampulla and if the time on the toilet does not take more than 30 minutes every other day, it is fine and everyone should be happy and not try to change things that are working well. However, because the bowel procedure usually takes much longer time and frequently is unsatisfying, I think it would be a good idea to try TAI for a period of 3 months—and see if it suits the individual better. If that procedure can improve life quality—which it often does—then go for it.

Interestingly, in a recent survey by the Danish Spinal Cord Injuries Association, it was shown that as many as 37% of the patients with a spinal cord injury interviewed had not heard about the TAI method.⁴

THE TRANSANAL IRRIGATION METHOD

The idea of cleansing the gastrointestinal tract through colon hydrotherapy likely stems from ancient history. As early as 1500 BC, there are ancient Egyptian documents called the “Ebers Papyrus” (Georg Ebers was a German Egyptologist) that describe colon cleansing as beneficial. The Egyptians assumingly used a combination of techniques, such as purgatives, enemas, diuretics, heat, and steam. In the early 1900s, colon hydrotherapy and irrigation was again tried as a remedy, for example, by Dr John H. Kellogg. In 1936, Kellogg filed a petition for his invention of improvements to an “irrigating apparatus particularly adaptable for colonic irrigating, but susceptible of use for other irrigation treatments.”⁵ By the 1920s, enemas were standard practice in many

hospitals.⁶ The modern TAI technique was subsequently introduced at the end of the 1980s, initially to treat children with spina bifida.⁷

There are several TAI devices on the market including Qufora Irrisedo Mini/Cone/Klick/Balloon/Bed systems (MacGregor Healthcare Ltd, Macmerry, UK), Peristeen (Coloplast A/S, Humlebaek, Denmark), and Navina Classic (Wellspect Healthcare/Dentsply IH AB, Mölndal, Sweden). These devices use a manual pump. There is also Navina Smart (Wellspect Healthcare/Dentsply IH AB, Mölndal, Sweden) with an electronic pump and a capacity to store the patient's technical data on the TAI procedure, including an app to allow access to this information. The devices are displayed in [Figs. 2–5](#).

For patients who can use such a device, it does help in preventing constipation and fecal incontinence, and can also give the individual control over the time and place of defecation. It can be used both for patients with upper motor neuron and lower motor neuron injuries. Importantly, the TAI enables a more predictable bowel function and



Fig. 2. The Qufora Irrisedo. (Courtesy of MBH-International A/S, Allerød, Denmark.)

may provide a level of independence for some patients compared with traditional methods. The consideration of using TAI should always be in a dialogue with the spinal cord injury medical team (including the nurse and the doctor), who check if it is suitable for the patient to test and who also ensure that the patient does not have any of the listed contraindications for TAI (Table 1). The spinal cord injury medical team also supports training in the technique.

In short, the TAI method facilitates evacuation of stool from the rectum and lower part of the colon by passing water into the bowel (irrigation) via the anus in a sufficient volume enough to reach beyond the rectum. Regular irrigation of the bowel empties the colon and rectum so effectively that new feces will not reach the rectum before the next scheduled management episode. This pattern not only prevents fecal incontinence, but it also prevents constipation through the insertion of water, which creates a mass movement from the transverse colon.

Once the training period is over and the bowel has adapted, the aim is to use TAI every second day so that the whole TAI process takes 20 to 40 minutes. For some individuals, a longer time is required.

The Navina Smart device is a more updated model compared with the other TAI devices; it has more automatic functions through its electronic pump and control unit, ensuring that each irrigation is the same—the same balloon size and the same water level in the bowel. It can be stopped earlier, but it cannot pass a fixed maximum volume of the balloon or a fixed maximum water volume. The electronic control unit enables the individual to track his or her own irrigation results and the opportunity to optimize the bowel emptying process.

HOW TO USE TRANSANAL IRRIGATION

The patient who is about to start using TAI should read the manual and should spend time with an urotherapist or a neurogenic bowel nurse to get the necessary hands-on



Fig. 3. The Peristeen device. (Courtesy of Colorplast AB, Sweden, Kungsbacka, Sweden.)



Fig. 4. The Navina Classic device. (Courtesy from Wellspect Healthcare/Dentsply IH AB, Mölndal, Sweden.)

information before starting on his or her own. There are also videos that may be useful in dialogue with the patient.^{8,9}

Manual Transanal Irrigation

The simplest equipment for performing TAI is to use the Qufora system. It has a water bag, a tube with a manual pump, a lubricated tip, and a cone. You fill up your water bag with a maximum of 1500 mL and, after that, when seated on the toilet, you introduce the lubricated tip at the end of the tube that is about 5 cm long and ends with a cone into your rectum. Using this system requires good hand function and you need to have 1 hand on the outside of the cone while keeping the catheter into your rectum. The other hand could be used to pump water from the water bag through the tube into ampulla recti. Subsequent versions of TAI equipment available on the market are the Peristeen and Navina Classic. Both systems rely on a water container with tubing and a valve, so that you can increase the air pressure in the container for the water to flow from the container through the pipe into the anal catheter. The Qufora system uses gravity. The Peristeen and the Navina Classic systems use hyperbaric pressure and have an inflatable air balloon in the catheter mounted roughly 25 mm from the tip. The balloon keeps the anal catheter in place. After turning the handle on the device, you can go from a mode where you introduce air to the container to a mode where you introduce air into the balloon, and then water into the pipe and the anal catheter.



Fig. 5. The Navina Smart device. (Courtesy from Wellspect Healthcare/ Dentsply IH AB, Mölndal, Sweden.)

Electronic Transanal Irrigation

With electronic TAI (Navina Smart), the patient fills the container with roughly 1 L of water and adds some soap to make it a little bit softer. The normal procedure holds true, as when introducing every rectal catheter, that it is good to lubricate the area surrounding the anus. The patient should be very careful when pushing the catheter in place. The Navina catheters have a hydrophilic coating that makes additional lubricant unnecessary. When the catheter is in place, the patient starts to fill the balloon with air. With the manual version the patient has to estimate how much air is inflated, but after some training sessions the patient will learn roughly how much air that should be in the balloon. An advantage of the Navina Smart device is that it can be set for the correct amount of air before the catheter is introduced. The patient will after a while realize whether it is enough air to keep the catheter in place.

Absolute Contraindications	Relative Contraindications
Anal or rectal stenosis	Severe diverticulosis Diffuse disease Dense sigmoid disease Previous diverticulitis or diverticular abscess
Active inflammatory bowel disease	Long-term steroid medication
Acute diverticulitis	Radiotherapy to the pelvis
Colorectal cancer	Prior rectal surgery
Within 3 mo of rectal surgery	Fecal impaction
Within 4 mo after endoscopic polypectomy	Painful anal conditions
Ischemic colitis	Current or planned pregnancy Bleeding diathesis or anticoagulant therapy (not including aspirin or clopidogrel) Severe autonomic dysreflexia

Data from Christensen P, Bazzocchi G, Coggrave M, et al. A randomized, controlled trial of transanal irrigation versus conservative bowel management in spinal cord-injured patients. *Gastroenterology*. 2006;131(3):738-47; and Passananti V, Emmanuel A, Nordin M, et al. Short term evaluation of a novel electronic transanal irrigation system in patients with neurogenic bowel dysfunction previously exposed to transanal irrigation systems. *Journal of Pharmacy and Pharmacology*. 2018(6):380-94.

What patients with an injury above the T6 level will recognize is that the catheter with the balloon could trigger autonomic dysreflexia; however, if they have lived with a spinal cord injury for a while, they will have learned to recognize the symptoms and would most likely not overinflate the balloon. It is interesting to note that just the balloon per se might be enough of a stimulus to trigger a gastrocolic reflex. After this procedure, the patient should press the button on the Navina Smart device to set it into the other mode and to start injecting the lukewarm water. He or she can start with a lesser volume, roughly 300 to 400 mL. There is a grading scale on the plastic compartment that indicates how much water has been injected. There is always a risk that if a patient uses this method every day and if he or she has a tendency to increase the volume of water over time, the patient may become caught in a vicious circle where he or she has to inject more and more water every time without a proper result. Therefore, the patient should be a little careful and start with 300 to 400 mL. When the patient uses the Navina Smart device, he or she can also control the speed of the water being infused, which may in itself trigger the rectocolic reflex. If the patient is extremely sensitive for autonomic dysreflexia, he or she might want to have a very slow infusion rate. In general, 300, 400, 500, or 600 mL for 1 minute should be infused.

A personal reflection concerning the electronic TAI device: with this device, I know exactly what volume I shall have on the balloon and how much water I shall introduce into the bowel and I also know with what speed I shall introduce that water to get the optimal effect trying to acquire a rectocolic reflex. It took me about 6 weeks before I could adjust the various variables to suit my needs. It is definitely a technique that can diminish the time the people living with paraplegia and tetraplegia spend on the toilet seat.¹⁰

What Happens Then?

Will the patient just sit on the toilet seat waiting for the rectocolic reflex to start? Yes; that is kind of true. What he or she can do is to keep the catheter with the inflated balloon in place, waiting for the water to do its work for up to 5 minutes. After that, you can give it a little extra push (add an additional 100–200 mL if the reflex is not triggered) after 2 to 3 minutes and thereafter deflate the air balloon leading to the catheter falling out or the catheter is pulled out nice and gently.

How do we know that the full ampulla content is out? Well, we do not (unless a digital rectal examination is performed). There is always a risk that there is something left, but the risk is dramatically decreased by this procedure.

If the patient has a lower motor neuron injury with the complications of flaccid sphincter and less reactive colon around the ampulla, the patient is more likely to leak. This is of course always a problem because the patient must then wear a plug or diapers. I think that the advantages of TAI might be even greater for patients with lower motor neuron injury, because they are the most afraid of leaking and most likely to leak. For a patient with a lower motor neuron injury, there is a risk that even if the patient has evacuated their ampulla thoroughly, there will be some mucus coming through the anus between procedures. This factor needs to be managed through the use of diapers and unfortunately a plug. However, by using TAI, the patient will at least have much fewer bowel accidents than before.

The devices are delivered with many rectal catheters and the patient is supposed to use a new catheter every time he or she embarks on to a TAI procedure. The TAI equipment is quite easy to carry along and the best thing is that, even if the patient does not have access to a shower next to the toilet seat, he or she can still perform a proper defecation maneuver, which would put them into a much better mood when embarking onto a busy day.

ANTEGRADE COLONIC IRRIGATION/ENEMA

The reasons for the antegrade colonic enema surgery include problems such as constipation and fecal incontinence, where other methods (diet, fluid, bowel care techniques, medications) have not been successful.¹¹ The procedure allows the emptying of the bowel by using fluid (similar to an enema) that is inserted into a small opening (nipple) into the colon at the right colon flexure at the lateral side of the abdomen. It has proven to be effective and has been used mostly by children born with a spina bifida; however, it requires surgery.

SACRAL ANTERIOR ROOT STIMULATOR

In the early 1980s, a distinguished English neurophysiologist Giles Brindley started to experiment with electrical stimulation of the sacral roots S2, S3, and S4 to see whether that would be an opportunity to trigger defecation, micturition, ejaculation, and erection.¹² He was quite successful, and a small number of spinal cord injury units tried this device.¹³ Our spinal cord injury unit was among the first to purchase 6 units and tried it on patients during the early 1990s. Unfortunately, in 1998 a big American company took over the operations and bought the rights for the sacral anterior root stimulator. The expectations by the company were not met and after trying to introduce the technique on a more worldwide basis, they decided to pull out and the production of the unit ceased. It reflects the dilemma with trying to introduce new medical device. If venture capital comes in and if the return on investment does not meet the expectations of the investors, they usually do not have enough endurance to continue with

development. The result is that a large number of people, in this case spinal cord injured patients, do not have the opportunity to try a device or therapy, in this case, a bladder emptying technique and bowel emptying technique that could have been much more effective and easier than the other alternatives. The future will tell if there will be a new possibility for this technique.

FUTURE DIRECTIONS

When addressing the problems with neurogenic bowel for paraplegics and tetraplegics, the profession needs to be more focused on this matter, which, in my opinion, has been neglected or given too little attention for decades. The reason for this has been mentioned elsewhere in this issue, being repeated and stressed. Going to the toilet emptying your bowel has been a less attractive subject among scientists, researchers, and clinicians. Other areas have drawn more attention, which highlights that sometimes the medical profession does not pay attention to areas of major concern expressed by patients. Entering into an area where empowerment is a virtue, I strongly believe that this area will be prioritized. TAI is definitely a step forward and, when this technique has been more established and becomes well-known, a large number of paraplegics and tetraplegics will spend less time on the toilet and bowel program days will become a memory from the past and obsolete.

Sacral anterior root stimulation and sacral anterior root modulation have a great potential and there will be opportunities to explore those techniques much further. A handful of scientists have been addressing sacral anterior root stimulation for the last 10 years, but the matter is still pending, for a number of reasons, such as lower priority and less funding. I strongly believe that the future for solving the problem with constipation and evacuating your bowel for spinal cord injury persons lies within the area of next generation electronic devices.

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DISCLOSURE

The author has participated in advisory boards for the companies Wellspect Healthcare/Dentsply IH AB and Coloplast UK.

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