

Transanal irrigation (TAI) in the paediatric population: Literature review and consensus of an Italian multicentre working group

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Abstract

Constipation and fecal incontinence in pediatric patients are conditions due to either functional or organic bowel dysfunction and may represent a challenging situation both for parents, pediatricians, and pediatric surgeons. Different treatments have been

proposed throughout the past decades with partial and alternant results and, among all proposed techniques, in the adult population the Transanal Irrigation (TAI) has become popular. However, little is known about its efficacy in children. Therefore, a group of Italian pediatric surgeons from different centers, all experts in bowel management, performed a literature review and discussed the best-practice for the use of TAI in the pediatric population. This article suggests some tips, such as the careful patients' selection, a structured training with expert in pediatric colorectal diseases, and a continuous follow-up, that are considered crucial for the full success of treatment.

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Introduction

Constipation and faecal incontinence are manifestations of bowel dysfunction. Constipation is a very common problem in paediatric age, with a prevalence of 0.7-29.6,¹ and can be related to congenital malformations such as spina bifida (about 60%), anorectal malformations (about 25%), Hirschsprung's disease (about 15%) and sacral agenesis or functional pathologies² such as faecal incontinence.³ Pseudo-incontinence is a serious condition which affects millions of children and adults worldwide and is commonly caused by stool accumulation.⁴⁻⁶

In 1987, Shandling and Gilmour⁷ introduced the practice of Transanal Irrigation (TAI) to treat constipation and incontinence in children suffering from neurogenic bowel dysfunction. Following its high success rate, TAI became a widespread treatment in adults and children for whom other methods had failed,^{8,9} and has now become common practice in those suffering from bowel dysfunction.¹⁰⁻¹²

TAI has been described¹³ as part of a treatment process involving conservative medical treatments, such as dietary measures, use of laxatives, lactulose, polyethylene glycol, suppositories and enemas.¹⁴ In the paediatric field, TAI shows good success rates¹⁵ and should be introduced in all bowel rehabilitation programmes prior to undertaking any form of surgical treatment.

The aim of the study was to evaluate the effectiveness of TAI to treat constipation and incontinence and to provide a consensus on its use in paediatric patients. The results are based on the existing liter-

ature and on the experience of a multicentre group of Italian specialists from various disciplines (*i.e.* paediatrics, gastroenterology, paediatric surgery, paediatric urology, nephrology and neuro-urology) with proven experience in the field of bowel management and TAI.

Transanal irrigation

The use of enemas as a bowel management method was developed empirically through the progressive adjustment based on patients' response.

TAI manages to expel faeces by the mechanical action of water or other solutions instilled through the anus into the rectosigmoid and descending colon. The method has been known since 1500 BC, and was initially used as a detoxifying procedure of the intestine. In 1979, Chapman proposed children with spina bifida be treated by instilling a saline or soapy solution with a syringe through a rubber catheter, reporting its effectiveness, simplicity, and low cost.¹⁶ In 1997, it was proposed the intermittent water irrigation, provided by an electric unit functioning as a pump, in order to generate pulsating waves that stimulate the peristalsis and break down the stool.¹⁷

The enema continence catheter, originally designed by Shandling & Gilmour (1987)⁷ for patients with spina bifida, is a catheter with an inflatable balloon on one end. The catheter is inserted into the rectum and the balloon is inflated to keep it in place and avoid fluid loss during infusion. The washing liquid works by gravity alone. At the end of the procedure, the balloon is deflated and the catheter removed to allow the faeces to be expelled. The method is effective but requires the presence of a caregiver. The reference device of the current review¹⁸ consists of

a control unit, a manual pump connected to a balloon catheter, and a bag to be filled with warm tap water.

Literature Review

Materials and Methods

A group of experts (paediatricians and paediatric surgeons) from 10 Italian centres with experience in the treatment of constipation and neurogenic bowel reviewed the current literature.

English papers published between January 1981 and November 2017 on the use of TAI in children and adolescents with intestinal dysfunctions (*i.e.* incontinence or constipation related to anorectal malformation, Hirschsprung's disease, neurogenic intestine) were selected using PubMed (Table 1). The following keywords were used: "transanal irrigation" OR "rectal irrigation" OR "anorectal irrigation" OR "neurogenic bowel dysfunction" AND "children" OR "child" OR "paediatric" OR "pediatric". The articles were selected by two of the authors to avoid sampling bias.

Inclusion criteria

i) Patient age < 18 years; ii) Long-term use of TAI as a procedure for expelling stool; iii) TAI performed with methods that include hydrostatic pressure, use of syringe, manual pump.

Exclusion criteria

i) Patient age > 18 years; ii) Series with a prevalence of adult patients; iii) Use of TAI for acute disimpaction; iv) Patients who perform antegrade irrigation; v) Letters to the editors.

Table 1. Literature review.

Authors	Number of patients	Number of patients who improved with TAI (%)
Ausili <i>et al.</i> ¹⁹	60	56 (93)
Blair <i>et al.</i> ²⁰	23	20 (87)
Choi <i>et al.</i> ²¹	47	43 (91)
Corbett <i>et al.</i> ¹⁵	21	20 (95)
Eire <i>et al.</i> ²²	33	32 (97)
King <i>et al.</i> ²³	20	8 (40)
Liptak and Revell ²⁴	16	15 (94)
Lopez Pereira <i>et al.</i> ⁴	25	25 (100)
Märzheuser <i>et al.</i> ²⁵	38	32 (84)
Matsuno <i>et al.</i> ²⁶	13	10 (77)
Mattsson and Gladh ²⁷	40	35 (88)
Midrio <i>et al.</i> ¹²	78	78 (100)
Nasher <i>et al.</i> ²⁸	10 (7 CIC, 1 MAR, 2 HD)	10 (100)
Ng <i>et al.</i> ²⁹	31	26 (84)
Peña <i>et al.</i> ³⁰	172 (44 constipation, 128 incontinent)	41/44 (93) 113/128 (88)
Shandling and Gilmour ³¹	112	112 (100)
Scholler-Gyere <i>et al.</i> ³²	41	27 (66)
Vande Velde <i>et al.</i> ³³	24	21 (88)
Walker and Webster ³⁴	12	8 (67)
Willis ³⁵	100 (11 constipation, 43 MMC, 46 ARM)	Constipation: 11 improved (100) MMC: 32 improved, 10 spontaneous defaecation, 1 soiling (98) ARM: 35 improved, 8 spontaneous defaecation (93)
Total	916	817 (89)

CIC: intermittent bladder catheterization; ARM: anorectal malformation; HD: Hirschsprung's disease; MMC: myelomeningocele.

Results

Twenty articles that met the inclusion criteria (shown in Table 1) were selected, for a total of 916 patients. About half of the articles analysed patients and families' quality of life (QoL) but data were not comparable as tests and parameters were different among the papers. In particular, 12 articles noted an improvement in QoL, 7 did not deal with the issue, and 1 reported no improvement. In some papers, the time required to perform TAI is considered a disincentive to continue the procedure; in others, the increase of autonomy and independence of the patient is cited as an encouraging factor.

In the review, 89% of patients showed clinical improvement (*i.e.* increased degree of continence and reduction of episodes of encopresis) after introducing TAI, thus underlining its effectiveness.

Indications and contraindications

TAI is recommended in children with neurogenic bowel as a consequence of acquired or congenital spinal defects, surgical outcomes of Hirschsprung's disease, anorectal malformations, and idiopathic constipation resistant to medical therapy.³⁶ The urge to initiate TAI is often due to the failure of other bowel emptying methods or the need to improve the bowel management in terms of time, autonomy, and effectiveness.^{12,37} Absolute and relative contraindications to TAI are listed in Table 2.

The patient's responsiveness to TAI is determined not only by a correct indication, but also by factors such as the parental compliance, the psychological implications, and the patient's motivations. The approach to TAI of a patient who can already artificially empty his bowel and is looking for an improvement will differ from that of a patient for whom conservative methods have proven unsuccessful. The introduction of TAI should be personalized for each patient based on clinical history, previous surgery, type of stool, symptoms, ongoing therapy, diet, age, ability to walk and manipulate objects.

Clinical examination and preparation

TAI treatment is proposed to patients during a patient-tailored multidisciplinary team meeting, involving the patient and his/her family, dedicated nurse specialists, a specialized doctor and a psychologist familiar with the paediatric/adolescent population. A further meeting one week apart is often organized, if requested, to shed light on possible patient's doubts, to answer questions and to encourage perseverance in the early stages of the program in order to maximize adherence to the treatment and possibility of success. There are no significant differences in caring for in different patients age groups. Support and assistance in the early stages are mainly tailored according to patient's mental and emotional maturity.

A rectal examination is essential to exclude any anal disorders,

ascertain there is no faecaloma in the ampulla, and assess the sphincter tone. Faecalomas must be eliminated before undertaking any TAI programme;⁹ conversely, in the absence of faecal impaction, TAI may start immediately. However, patients suffering from chronic constipation or spinal cord injuries most often require colon cleansing before starting TAI, due to the poor efficacy of conservative treatments (*i.e.* faecal softeners, laxatives, enemas, suppositories, digital evacuation). We recommend performing the preliminary emptying with 2-3 rectoclysis per day (one with saline solution, one with saline solution and phosphate, and another with saline solution and petroleum jelly) until the colon is completely cleansed. The results should be checked radiologically.

How to perform TAI

TAI is a system that allows faeces to be expelled by introducing water (or other solutions) into the descending colon through the anus in order to clean the rectosigmoid tract. Caregivers are trained how to perform the procedure and how to train patients to become more independent over time.³⁸

The irrigation is performed by using either a lubricated Foley catheter or a rectal catheter. The Foley is preferable as it is softer, atraumatic, and the balloon, inflated with 10 cc of water in the rectum, prevents any leakage of the solution, optimizing the result. The solution should be introduced slowly, so as to take about 5 minutes, in order to avoid rapid intestinal distension, and it should be at a temperature of 37-38 °C to avoid abdominal cramps. The water should be preferably inserted by connecting the catheter to an enema bag positioned about one metre above the level of the patient.

The solution is diversified for each patient, both in terms of composition and quantity, and this information is obtained through several attempts. It can be start with just tap water (10 mL/kg), and increase the volume (up to 20 mL/kg) or add sodium chloride (one teaspoon in 500 cc of water to obtain an osmolarity similar to that of body fluids) should the tap water alone achieve no results.²⁵ Other components may be added, such as petroleum jelly, Castile soap, glycerine, and phosphate. The required volume depends on the type of colon: in case of a distended and hypomobile colon, high quantity solutions are required (20 mL/kg of water or salt water in the doses described above), and in case of a non-distended and hypermobile colon, a low volume solution (10 mL/kg) combined with a constipating diet may be recommended.³⁰ The concentration of solutes varies according to the results, especially to reduce possible side effects, such as nausea or abdominal pain.

TAI may be administered with the patient in different positions: on the left side (with the left leg extended and the right one bent at the chest), in fetal position, or supine. Patients are instructed to hold in the fluid for at least 10 minutes and then expel the stool. The entire procedure should not exceed 40 minutes and should be performed in a suitable environment, *i.e.* the bathroom. It is recommended not to reward children after the procedure, so that they may accept the mechanical emptying of their bowel as a "natural" practice.

Table 2. Contraindications for TAI.

Absolute contraindications	Relative contraindications
Inflammatory bowel diseases	Long term steroid therapy
Colonic stenosis	Pelvic radiotherapy
Abdominal, perineal or spinal surgery within the past 3 months	

Complications

There are documented risks associated with TAI, including systemic reactions to the irrigation and rectal perforation,^{39,40} although they are very rare (estimated risk of 1/50000, 0.02%).¹¹ Latex allergy must be excluded before proceeding. Perforation can occur by direct action of the rectal catheter, excessive inflation of the balloon, or excessive hydrostatic pressure during the irrigation. In order to address these complications, the use of a Foley catheter is recommended instead of a more rigid rectal catheter, to check the volume of the balloon outside the rectum and not to exceed the pressure during irrigation. Phosphate based enemas can lead to potentially fatal side effects: electrolyte disturbances (hyperphosphataemia, hypernatremia, hypocalcemia) and severe dehydration. Retention of the phosphate solution with prolonged reabsorption or reduced renal excretion of phosphate may result in hyperphosphataemia and subsequent hypocalcaemia and lethal acidosis.⁴¹

In order to reduce the risk of complications, caregivers must be adequately trained by competent personnel, and signs and symptoms (such as abdominal pain, sweating, chills, general discomfort, dizziness, nausea) leading to complications should be elucidated in order to recognize and manage them (Figure 1). Thanks to detailed explanations and training on how to perform the TAI procedure safely, patients are usually available to adopt the practice. In case of anxious, embarrassed or feared patients, a further multidisciplinary meeting is organized in order to encourage patients in facing their fears and becoming more and more familiar with TAI treatment. So far, no drop-out among paediatric and adolescent population have been recorded.

Conclusions

bowel dysfunctions can be secondary to a variety of clinical conditions, including: Hirschsprung's disease, anorectal malformations, spina bifida and intractable constipation. Constipation and faecal incontinence represent a spectrum of severity that can differ from case to case. Simple dietary measures may be sufficient in milder forms, but hospitalization may be required for the severe forms. Intractable constipation is a disabling condition for a child, with consequences on his quality of life and socialization. The discomfort this condition may induce can lead to absenteeism from school and other social activities. Furthermore, the need for therapies and treatments influences family life and the life of their caregivers, resulting in a significant financial commitment.

There is currently no unanimous consensus on how to deal with bowel dysfunctions in paediatric patients. We believe this study shows that there are the prerequisites to encourage a structured and personalized approach to treat patients who suffer from organic or functional constipation. As previously mentioned, in order to define an adequate treatment plan, the personal and clinical history of each patient must be taken into consideration together with their condition to date and their radiological data. Each child must receive a personalised bowel management programme, adjusting his diet, motor activity, use of laxatives and/or TAI, that improves the bowel function, reduces the related infections and the time spent for bowel emptying.

The data collected in our review were mainly retrospective and with a follow-up of variable length. Prospective studies on TAI in children should be conducted for further investigation.

The social impact and quality of life of the families of patients

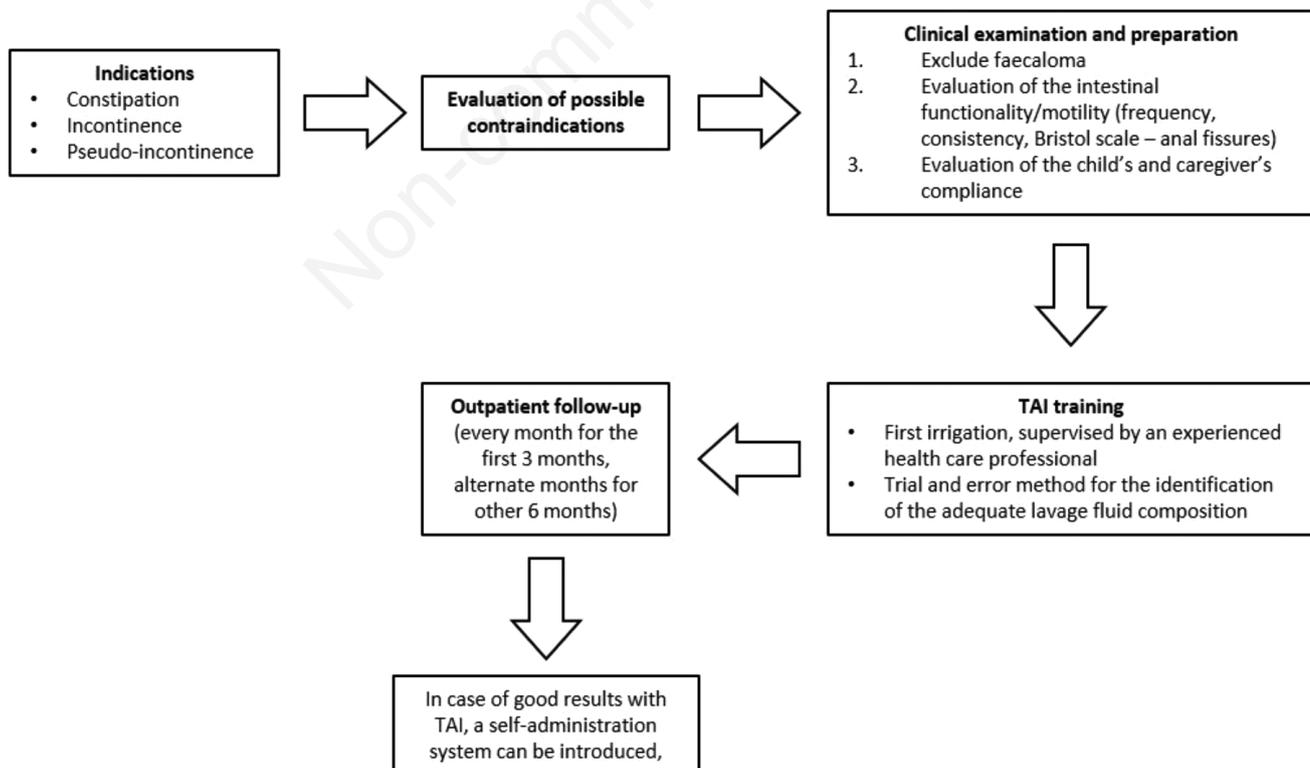


Figure 1. Flow chart representing the steps to follow when TAI is prescribed.

who need assistance for bowel management have not been fully assessed. The effectiveness of TAI for these patients suggests it can be used both in patients for whom other treatment programmes failed as well as a first-line treatment. TAI is usually well tolerated and has a low incidence of major side effects. Individual training assisted by qualified personnel guarantees the best results. It is important to constantly support these patients in order to limit the possible drop-out in the long-term.

The need for a multidisciplinary management of patients suffering from bowel disorders due to surgical, malformative or acquired conditions call for the creation of paediatric colorectal centres.

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