THE PHYSICIAN'S GUIDE TO M.O.P.

Treating Enuresis and Encopresis with the Modified O'Regan Protocol

"M.O.P. works radically better than anything else."

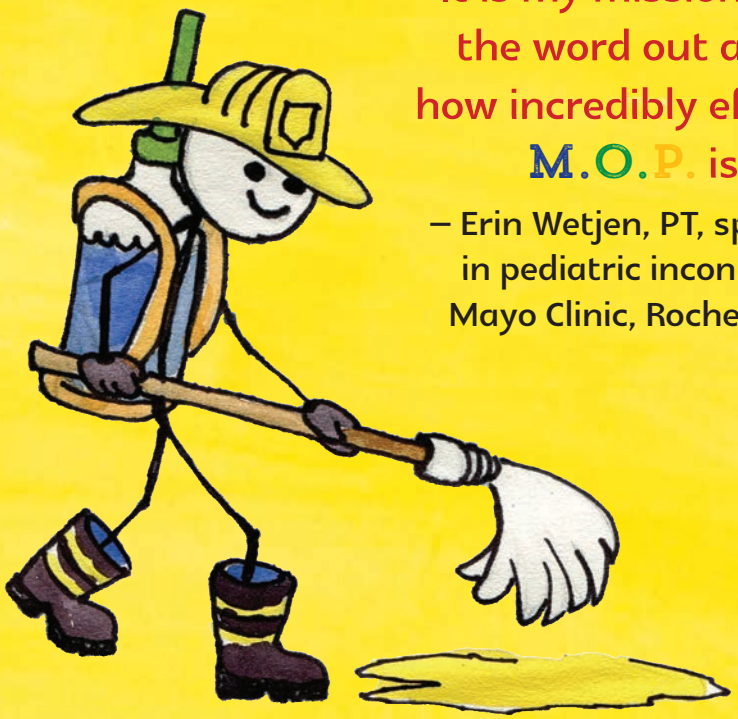
– James Sander, M.D., Pediatric Urologist, UT Health, Rio Grande Valley, TX

"Families and kids are a lot more receptive to M.O.P. than I would have thought."

– Irina Stanasel, M.D., Pediatric Urologist, UT Southwestern Medical Center, Dallas, TX

"It is my mission to get the word out about how incredibly effective M.O.P. is."

– Erin Wetjen, PT, specialist in pediatric incontinence, Mayo Clinic, Rochester, MN



By Steve Hodges, M.D.
Professor of Pediatric Urology
Wake Forest University School of Medicine

"No enuresis treatment works as well as M.O.P. — not even close."

– Victoriano Romero, M.D., Urologist, Redding Urologic Associates, Redding, CA

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Dear Colleague,

I am writing to share a treatment protocol for enuresis and encopresis that works far better for my patients than Miralax, Ex-Lax, medication, alarms, or other treatments I learned in my medical training or used early in my career. It is an enema-based regimen called the Modified O'Regan Protocol. M.O.P. is based on the published research of pediatric nephrologist Sean O'Regan, M.D., who practiced at the University of Montreal Hôpital Sainte-Justine in the 1980s and is now retired.

Dr. O'Regan's original and highly successful protocol lasted 90 days:

- 30 consecutive days of enemas
- 30 days of enemas every other day
- 30 days of enemas twice a week

I have "modified" Dr. O'Regan's protocol based on my own research and clinical experience and discussions with Dr. O'Regan himself. Most significantly, I recommend:

- Extending the daily enema phase until all accidents cease. I do not recommend tapering until the child has completed at least 30 consecutive days of enemas and has been accident-free for 7 days and nights.
- Adding a daily osmotic laxative to the enema regimen. One exception: encopresis patients should avoid osmotic laxatives for at least two weeks.
- Adding a daily stimulant laxative for children who do not "spontaneously" poop (in addition to pooping after the enema). Senna/Ex-Lax can replace the osmotic.

Physicians unfamiliar with M.O.P. may consider it overly aggressive, perhaps "traumatic" for children. Some worry daily enemas will cause dependence or electrolyte imbalance. These concerns are unwarranted. I've used M.O.P. with thousands of patients, without incident and with excellent success. Electrolyte imbalance is a non-issue; patients can use liquid glycerin, docusate sodium, or other enema solutions. Enemas quickly become routine. As one mom told me, "You know what's traumatic? Wearing diapers to school every day in 5th grade. To my daughter, enemas are no big deal." I hear this all the time.

Enuresis patients are often told, "Don't worry, you'll outgrow it." But many don't. I treat countless teens whose accidents were dismissed or attributed to "deep sleep" or "stress" — kids prescribed PEG 3350 or useless meds for years on end. These kids, highly distressed and left out of sleepovers and camps, are grateful for a treatment that works.

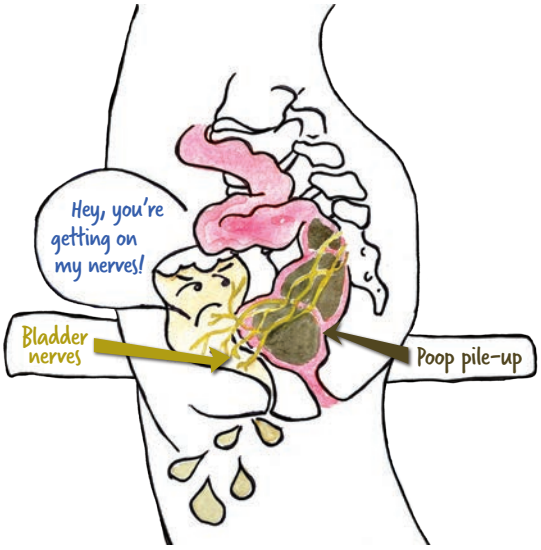
I have made enuresis and encopresis the focus of my research and clinical practice and am eager to share with colleagues the regimen that has worked so well with my patients. This packet briefly explains the rationale and scientific support for M.O.P. The different M.O.P. variations are described in *The M.O.P. Anthology 5th Edition*, a comprehensive guide for parents. I urge physicians to become familiar with the variations, as M.O.P. is not one-size-fits-all. I am happy to email you a .pdf of the book, and I enjoy discussing enema effectiveness and safety with colleagues. Email me and we'll set up a time to talk!

Warmly,

Steve Hodges, M.D.
Professor of Pediatric Urology
Wake Forest University School of Medicine

The Premise Behind M.O.P.

Standard remedies for enuresis and encopresis miss the boat in one of two ways: 1.) They don't address the root cause of accidents, chronic constipation, or 2.) They are inadequate to the task of resolving constipation.



The first category includes bedwetting alarms, bladder medication, sleep strategies, fluid restriction, and behavioral or psychological therapy. These approaches fail because they are beside the point. As I discuss in the *M.O.P. Anthology 5th Edition*, accidents are not caused by deep sleep, urine overproduction, a hormonal imbalance, an underdeveloped bladder, stress, anxiety, "attention seeking," or "acting out." Rather, the culprit is a clogged, dilated rectum. You can see it plain as day on an x-ray.

With enuresis, the enlarged rectum aggravates the bladder nerves, triggering random and forceful contractions. With encopresis, the dilated rectum loses sufficient tone and sensation, and stool falls out, without the child noticing. It doesn't matter what form enuresis takes — daytime or nighttime, primary or secondary. **It doesn't matter whether a child has autism, ADHD, or a family history of enuresis. In a child with an intact spinal cord, wetting accidents do not happen in the absence of constipation.** Stool accidents, too, cannot occur unless a child's rectum is stuffed with poop.

For these reasons, treatment for enuresis and encopresis must focus on resolving constipation. More specifically, the rectum must be completely emptied and must remain empty long enough (about three months) to shrink back to size, stop aggravating the bladder, and regain full tone and sensation. This is a deceptively difficult task in children with enuresis and/or encopresis. Daily osmotic laxatives rarely suffice, and in the case of encopresis, osmotic laxatives often make accidents worse. **Oral "clean-outs" are similarly inadequate. The rectum quickly fills back up, and accidents persist.**

I know this because early in my career, Miralax was my go-to treatment. I did not x-ray my patients and did not grasp how clogged their rectums were. I simply followed what I'd been taught. But my success was limited. Fifteen years later, I know what works: **M.O.P.**

The Modified O'Regan Protocol has numerous variations, but at its core, the treatment begins with a daily enema and, in most cases, a daily oral laxative (osmotic or stimulant, depending on the case). Once accidents reliably cease, the child gradually weans from enemas and then laxatives. The most aggressive and effective variation, **Multi-M.O.P.**, involves two or three docusate sodium mini-enemas per day and no laxatives. (Yes, it's safe!) The Cheat Sheet of **M.O.P.** Variations, included in this packet, summarizes the options. I discuss each variation in depth in the *Anthology 5th Edition*.

Origins of M.O.P.

Sean O'Regan was not the first physician to link enuresis and encopresis with chronic constipation, but he was the first to prove a causal connection and to demonstrate that daily enemas resolve these conditions — safely and highly effectively. It's a fascinating story.

Are enemas safe for daily use in children? Yes. Do they traumatize children? No.

Enuresis and encopresis were not Dr. O'Regan's area of research or interest. But his 5-year-old son was wetting the bed nightly, and Dr. O'Regan, prompted by his wife, wanted to help the boy. At this time, bedwetting children were thought to have psychological and/or anatomical problems, such as an excessively narrow bladder neck. Dr. O'Regan rejected both theories and searched for answers at the renown McGill University Medical Library. There he found several papers, dating back to the 1890s, referencing a connection between constipation and urinary dysfunction.

Intrigued, Dr. O'Regan enlisted a colleague, Dr. Salam Yazbeck, to test his son's rectum using anorectal manometry, the gold standard diagnostic tool. Dr. Yazbeck reported to Dr. O'Regan, "The kid's got no rectal tone." Dr. O'Regan

> *"We knew the root cause of bedwetting was incomplete rectal emptying. And enemas were the only way to solve the problem."*
>
> – Sean O'Regan, M.D.

began giving his son nightly enemas. Within a week, the boy enjoyed his first dry nights. Within two months, his enuresis had resolved.

Based on this success, Dr. O'Regan conducted studies using the protocol he'd tested on his son: daily enemas for a month, tapering to every other day and then twice a week. He spread the word to local pediatricians and attracted most of the French Canadian population of children with urinary dysfunction. I urge you to read the full text of Dr. O'Regan's studies. In one investigation, Dr. O'Regan tracked 47 girls with recurrent UTIs who also had encopresis, enuresis, or both. After three months on the step-down enema regimen, UTIs had resolved in 44 of the 47 girls. Encopresis resolved in 20 of the 21 patients with this condition, and 22 of the 32 girls with enuresis had stopped wetting.[1] Among the girls who didn't improve, most of their parents conceded they hadn't followed the regimen fully.

Dr. O'Regan told me he got no pushback from physicians regarding the use of enemas. None suggested enemas would damage a child's physical or emotional health or that oral laxatives would be preferable. (Though PEG 3350 wasn't available back then, senna and magnesium were.) "We knew the root cause of bedwetting was incomplete rectal emptying," Dr. O'Regan told me. "And enemas were the only way to solve the problem."

I have come to agree. **A decade ago, I considered Miralax ("clean-outs" plus "maintenance") to be a reasonable alternative to enemas. I have long since changed my mind.** Enemas work far better — it's not even close. For example, in one study, my clinic compared a Miralax regimen to Dr. O'Regan's protocol in 60 patients with daytime enuresis, with an average rectal diameter of 6 cm. After three months, daytime wetting had ceased in 30% of the Miralax patients, compared to 85% of the enema patients.[2] The data explained why: Among the Miralax patients, the average rectum remained dilated, to 5 cm on average. The slight improvement was enough to help a few kids but was inadequate for most. By contrast, rectal diameter among the enema patients had retracted to 2.15 cm. Among the three enema patients whose wetting persisted despite enemas, the rectum remained enlarged. These are the kids who require the more aggressive variations of **M.O.P.**

In children with enuresis and encopresis, Miralax is a poor remedy, no matter the dose or the regimen. Most of my patients can't get anywhere near accident-free in the long-term without persistent enema treatment. It's indisputable that enemas work better. But are they safe for daily use in children? Yes. Do they traumatize children? No.

Yes, Daily Enemas Are Safe

I have never had a patient harmed by enemas, and I have treated *thousands* of children with M.O.P. When I asked Dr. O'Regan if any of his patients had ever suffered complications, he responded, "Our only complication was a 7-year-old girl who clogged the toilet at our hospital after an enema. She was legendary." Yes, the damage was to the plumbing, not the patient!

Dr. O'Regan wasn't the only researcher of his day who treated accidents with enemas. A Johns Hopkins team, in a 21-week study on children with severe encopresis, described its enema regimen as "highly effective," "rapid and easy to perform," "involving minimal risk," and "the treatment of choice for encopresis." The Hopkins folks noted the treatment's success "seem to gratify parents and to encourage them to cooperate with the treatment regimen."[3]

> **There is no evidence enemas are harmful or even risky to the physical or mental health of children with enuresis or encopresis, and there's plenty of evidence to the contrary.**

Yet, today, enemas are perceived by many physicians as damaging and coercive. What changed? One mom posited a theory that seems plausible to me: "I wonder if the shift toward viewing enemas as 'abusive' and a last resort is

1 O'Regan, S., Yazbeck, S., & Schick, E. (1985). Constipation, bladder instability, urinary tract infection syndrome. *Clinical Nephrology*, 23(3), 152–154. https://pubmed.ncbi.nlm.nih.gov/3987104

2 Hodges, S. J., and Colaco, M. (2016). Daily Enema Regimen Is Superior to Traditional Therapies for Nonneurogenic Pediatric Overactive Bladder. *Global Pediatric Health*, 3, 2333794X16632941. https://doi.org/10.1177/2333794X16632941

3 Lowery, S., Srour, J., et al., Habit Training as Treatment of Encopresis Secondary to Chronic Constipation, *Journal of Pediatric Gastroenterology and Nutrition*, 4:397-401, 1985. https://pubmed.ncbi.nlm.nih.gov/4020572/

connected to the greater awareness of child sexual abuse and a subconscious connection between that and enemas. Obviously, greater awareness of child sexual abuse is a good thing, but I do wonder if enemas have been tainted by association." That sounds about right.

There is no evidence enemas are harmful or even risky to the physical or mental health of children with enuresis or encopresis and plenty of evidence to the contrary. Below, I counter the concerns I've heard from colleagues. For an extended discussion, see Section 1 of the *Anthology 5th Edition*.

Dependence: Enemas do not cause "lazy bowel." In a chronically constipated child, the bowel is already not working normally. Once the rectum rebounds, the child will no longer need enemas. If a patient is able to poop only after an enema, this is not a sign of dependence on enemas. It is a sign the child's rectum remains dilated.

Electrolyte imbalance: This issue applies only to phosphate (Fleet) enemas, so any physician with the slightest concern about phosphate can simply recommend another type of enema, such as liquid glycerin or docusate sodium. However, even phosphate enemas are plenty safe in children with normal kidney function. Children simply void the extra phosphate. Electrolyte imbalance is practically unheard of. A review of 39 studies conducted over 50 years found just 15 cases of electrolyte imbalance in children ages 3 through 18. *Over half a century.* Most of these cases involved children who had a chronic disease or were given more than one phosphate enema in a day.[4]

Damage to the intestinal mucosa: While some children do feel internal burning from phosphate enemas, switching to a different enema solution solves the problem.

Elimination of helpful gut flora: I believe that for chronically constipated children, the benefits of stimulating full evacuation every day far outweighs any reduction in helpful gut bacteria. Some children take probiotics while on **M.O.P.** to prevent elimination of good bacteria. I don't know if this helps, but there's no downside.

Physical pain: Understandably, many parents and children worry enemas will hurt, and sometimes they do hurt, because the child isn't relaxed or lying in the right position or because the tip needs more lubricant. But families quickly solve the problem, and inserting an enema becomes no big deal. Many of my patients, even as young as 6 or 7, insert their own enemas, as they prefer the control and privacy. Our *Enema Rescue Guide* helps parents troubleshoot.

Nope, Enemas Don't Traumatize Children (Accidents Do)

Many physicians reflexively assume enemas will "traumatize" children, but this is unfounded conjecture. For example, in a Dutch study that compared enemas and PEG 3350 for the treatment of fecal impaction, the researchers noted, "It is often assumed that children strongly dislike enema administration."[5] And yet, in contradiction to their own expectations, their study found the enemas were just as well tolerated as Miralax, not to mention more effective and far less messy.

I urge physicians to keep an open mind about enemas and to avoid speculating to families about how children may feel about this treatment.

But I don't need studies to tell me enemas are well tolerated among children with enuresis and encopresis. I see it every day in my practice. **It is *accidents*, not enemas, that cause emotional trauma.**

Many of my patients are teased at school, terrified of slumber parties, and panicked the accidents will never stop. They shoulder much shame and blame and often feel hopeless. Here is a small sampling of what parents in our support group have posted on the subject of "trauma":

- "When I told our doctor we were getting good results with enemas, she told us to 'stop that right away.' The most upsetting thing was her language around the 'trauma,' which has not been our experience at all. Enemas are just part of our evening routine, like brushing teeth."

4 Mendoza, J., Legido, J., et al., (2007), Systematic review: the adverse effects of sodium phosphate enema. *Alimentary Pharmacology & Therapeutics*, 26: 9-20. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2036.2007.03354.x

5 Bekkali, NLH, et al., Rectal Fecal Impaction Treatment in Childhood Constipation: Enemas Versus High Doses Oral PEG, *Pediatrics* (2009) 124 (6): e1108–e1115. https://doi.org/10.1542/peds.2009-0022

"Clean-outs gave my daughter messy accidents, humiliation, and painful rashes. My daughter loves her enemas."

- "It is way more traumatic to poop in the middle of class and stink up a room full of kids who don't yet have a verbal filter. A quick, painless enema is much easier."
- "My daughter asks for enemas and her confidence has increased five-fold because she's not smelly. She used to be unsure and would ask me in a whisper if she smelled OK. It broke my heart. Now THAT was traumatic, especially when you're in middle school."
- "M.O.P. was literally life saving for my son, who was repeatedly hospitalized for suicidal ideation due to encopresis and enuresis. He was on board to try enemas because nothing else had worked. It still shocks me how much resistance we got from everyone — the GI doctor, the pediatrician, the mental health care providers, his dad. But we did it anyway, and it worked. My son is 16, and I was finally able to buy him underwear."
- "Clean-outs gave my daughter messy accidents, humiliation, and painful rashes. My daughter loves her enemas."

I could provide hundreds more posts like these. I urge physicians to keep an open mind about enemas and to avoid speculating to families about what children may feel about this treatment.

Three Lessons From a Decade Prescribing M.O.P.

Based on my experience with M.O.P., here are three valuable lessons I've learned:

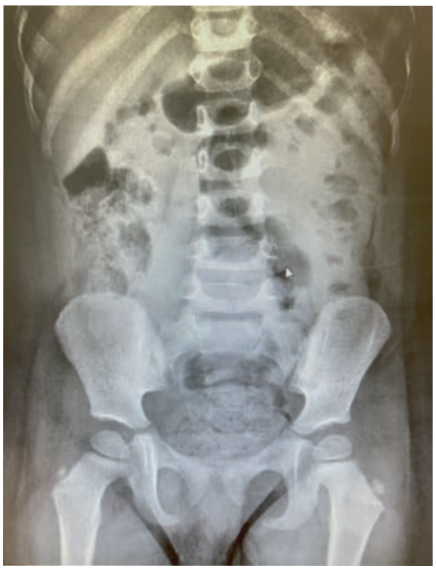
Lesson #1: X-Rays Are Invaluable

I x-ray all my enuresis patients and urge other physicians to do the same. Is this a safe practice? Yes. The radiation dose of a KUB is what you'd get from living on this planet for three to six months. I am absolutely opposed to the overuse of x-rays in children, but the amount of good an x-ray can do for a child with bladder dysfunction far outweighs any risk.

A KUB is an invaluable tool on many fronts. Specifically, I use x-rays to:

- **Rule out alternative causes of wetting.** In rare cases, wetting accidents are caused by conditions that are unrelated to constipation and require surgery, such as tethered cord syndrome or posterior urethral valves. I've seen a few cases of both.
- **Assess the extent of a patient's constipation.** Today's common diagnostic tools — patient history, patient exam, Sitz marker studies, Rome criteria, the Bristol Stool scale — are highly unreliable. Many severely constipated children poop daily, and small, lean children can harbor massive amounts of stool that cannot be palpated. I've had countless patients with grapefruit-sized rectal masses that went undetected by the referring physician because no x-ray was ordered.

  I look for what I call the "O'Regan sign": stool in the rectum and right colon. It is untrue that the rectum "always has some stool." Stool in the rectum signals constipation, A rectal diameter measurement adds value. A measurement greater than 3 cm indicates constipation. In most of my enuresis patients, the rectum measures 6 cm or greater.
- **Establish a baseline to guide treatment.** I don't routinely order second x-rays, but if accidents persist on M.O.P., I may use a follow-up x-ray to adjust treatment. For example, if the rectum remains severely backed up, I will recommend Multi-M.O.P. or M.O.P.x. If the rectum is empty, or nearly so, but remains dilated, I may prescribe bladder medication in addition to M.O.P. to get the child "over the hump" while the rectum heals.



In my clinic, we use the term "O'Regan sign" to refer to this common pattern: rectal poop plus an accumulation of poop in the right (ascending) colon.

I x-ray all my enuresis patients and urge other physicians to do the same.

- **Prove to families that accidents are not the child's fault.** As one mom told me: "The x-ray really decreased our frustration with our 5-year-old son. We thought his accidents were a behavior or anxiety issue. Now we all have better attitudes, as we view the wetting as a medical issue."

> *"When I started x-raying my patients and could see how much their rectums were distended, I realized enemas were the only thing that would make a difference."*
>
> – James Sander, M.D. Pediatric Urologist, UT Health, Rio Grande Valley, TX

Lesson #2: Enuresis and Encopresis Should Be Treated Promptly

Many parents are told nocturnal enuresis is a "normal part of child development" and is not worth treating until age 5, 7, or even age 10. I strongly disagree. I treat nocturnal enuresis with **M.O.P.** at age 4, and I treat daytime accidents — whether enuresis or encopresis — in any toilet-trained child, no matter how young. If a 2- or 3-year-old continues to have accidents after toilet training, the child is almost certainly constipated and at high risk for accidents to persist. Children with both daytime and nighttime symptoms are the least likely to outgrow enuresis. One-third of teen and tweens with nocturnal enuresis also have daytime accidents.[6]

Many parents are told nocturnal enuresis is a "normal part of child development" and is not worth treating until age 5, 7, or even age 10. I strongly disagree.

Accidents may be common, but "common" is not the same thing as "normal." Left untreated, chronic constipation often worsens. While it is true that most children eventually outgrow nocturnal enuresis, hundreds of thousands of children do not, and many suffer distress, shame, and teasing in the meantime.

Though physicians often reassure patients, "Don't worry, you'll outgrow it," you can't actually make that assumption. The longer accidents persist, the less likely the child is to spontaneously outgrow the condition. Without effective treatment, children with enuresis at age 9 are highly likely to be wetting at age 19. Parents should be informed that wetting can persist.

I believe no child is served by spending an extra two, five, or 10 years in diapers, especially when accidents are highly treatable with a regimen such as **M.O.P.**

Lesson #3: No Cases Are "Refractory" to Treatment

In a 2022 study on the (failed) use of fluoxetine for persistent nocturnal enuresis, Egyptian authors argued that many enuresis cases are "refractory to treatment" and therefore we must search for "novel and more efficient therapies," such as antidepressants.[7]

In reality, novel treatments for enuresis aren't needed. Efficient treatment already exists, even for the most difficult cases. When a child is declared "refractory to treatment," this signals to me the child was not properly diagnosed or treated for chronic constipation. Indeed, in the fluoxetine study, constipation was assessed only by patient history, not x-ray or anorectal manometry, so the results are highly unreliable.

When I have an enuresis case that proves resistant to the standard **M.O.P.** regimen, I turn to more aggressive variations and, if x-rays guide me in that direction, bladder medication. In the most persistent enuresis cases, I use bladder Botox, a nearly sure-fire way to halt accidents. On the rare occasions when Botox fails and/or doesn't last three months, it's always for the same reason: the child remains severely constipated. My enuresis patients who fare best with Botox are those who got close to dryness with **M.O.P.** but needed help through the home stretch. As always, aggressive bowel emptying is the key to resolving enuresis. Getting to the root of the problem remains more effective than covering it up.

My experience with bladder Botox provides additional evidence that enuresis is caused by constipation, not deep sleep, an underdeveloped bladder, anxiety, or urine overproduction. If those conditions caused wetting, Botox would not stop accidents. But it does.

6 Yeung, C., Sreedhar, B., Sihoe, J., Sit, F., & Lam, J. (2006, April 6). Differences in characteristics of nocturnal enuresis between children and adolescents: a critical appraisal from a large epidemiological study. *BJU International*, 97(5), 1069-1073. https://doi.org/10.1111/j.1464-410X.2006.06074.x

7 Hussiny, M., Hashem, A., et al., The Safety and Efficacy of Fluoxetine for the Treatment of Refractory Primary Monosymptomatic Nocturnal Enuresis in Children: A Randomized Placebo-Controlled Trial, *The Journal of Urology, 208(5), 1126-1134.* 1 Nov 2022, https://doi.org/10.1097/JU.0000000000002896

Cheat Sheet of M.O.P. Variations

After any 30-day period without progress, adjust the regimen.

Standard M.O.P.

— Small enema + osmotic laxative

Enema options:
- phosphate (Fleet)
- liquid glycerin suppository (store-bought or homemade)
- docusate sodium (Enemeez)
- sodium citrate (Microlax)

Laxative options:
- PEG 3350 (Miralax)
- lactulose
- magnesium hydroxide
- magnesium citrate

M.O.P.X

— Small enema + stimulant laxative

Enema options:
- any store-bought enema
- LGS (homemade or store-bought)

M.O.P.+

— Large-volume enema + osmotic laxative

Enema solution progression:

First, try saline + glycerin. Then... → ...add Castile soap. Then... → ...add phosphate enema contents.

Double M.O.P.

— Overnight oil enema + morning large-volume enema

Oil-retention enemas can be done daily, weekly, or periodically.

Oil options: mineral oil 

olive oil 

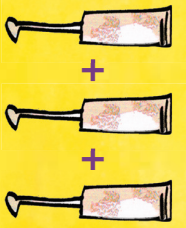
Multi-M.O.P.

— Docusate sodium mini-enema 3x/day (or 2x)

Age 12+: Use 283 mg version.

Under 12: Use 100 mg version.

Add osmotic laxative when tapering to every other day.



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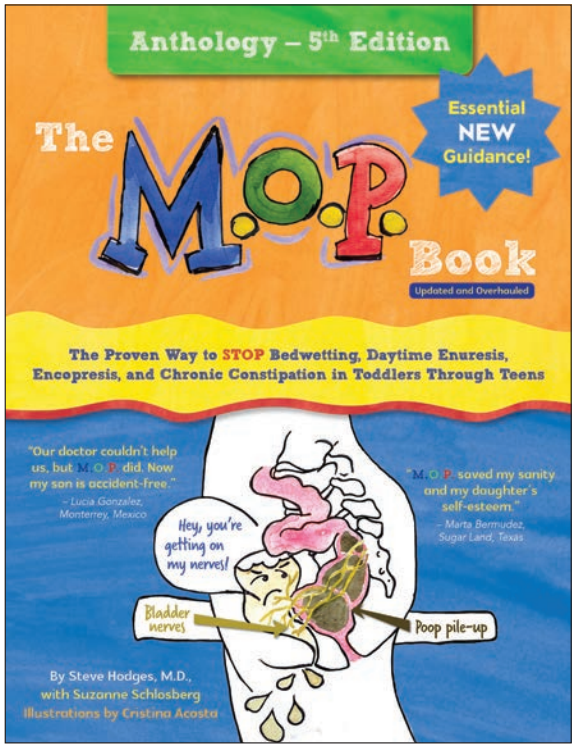
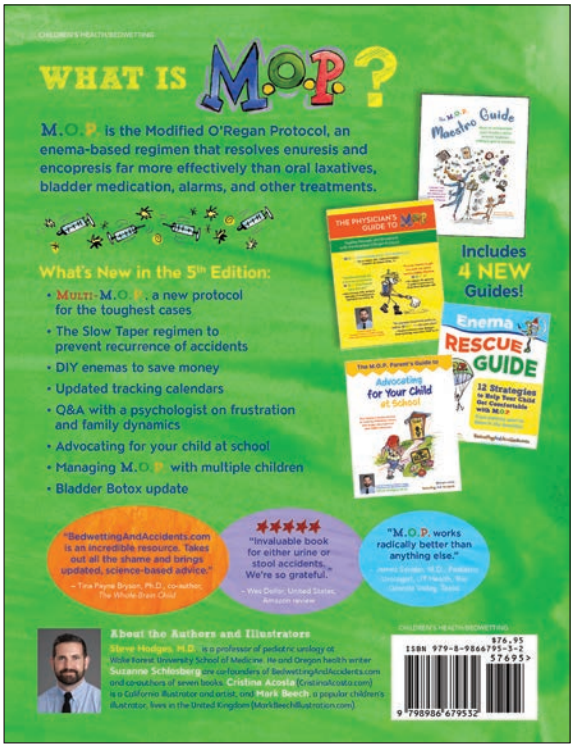
Resources to Share With Families

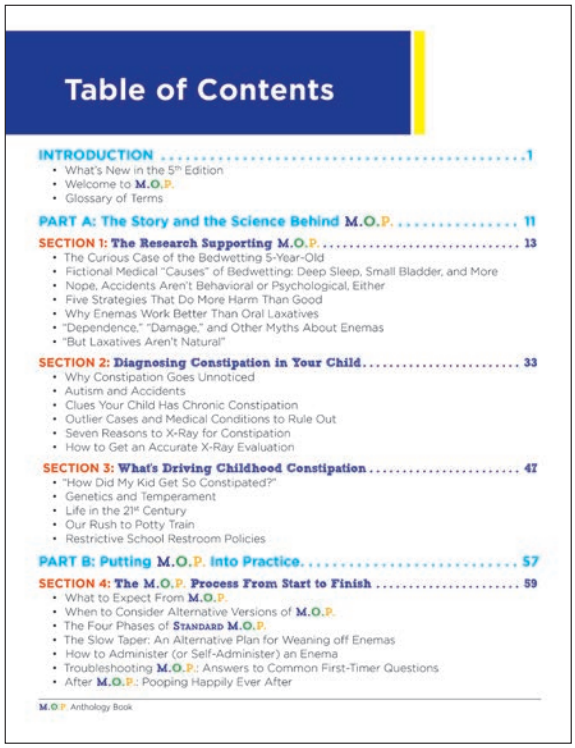
Our website, BedwettingAndAccidents.com, offers numerous books, guides, videos, and infographics you can use to educate patients. We offer health professionals the .pdf versions of our books at no cost. Just email us: suzanne@bedwettingandaccidents.com.

Here's a look at some of our materials.

The M.O.P. Anthology 5th Edition







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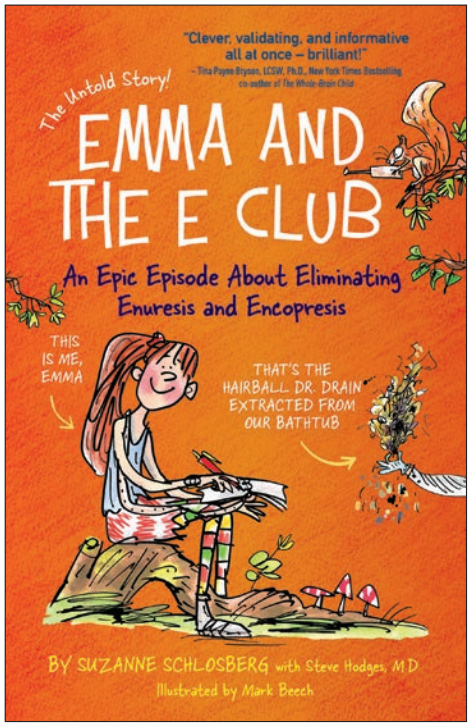

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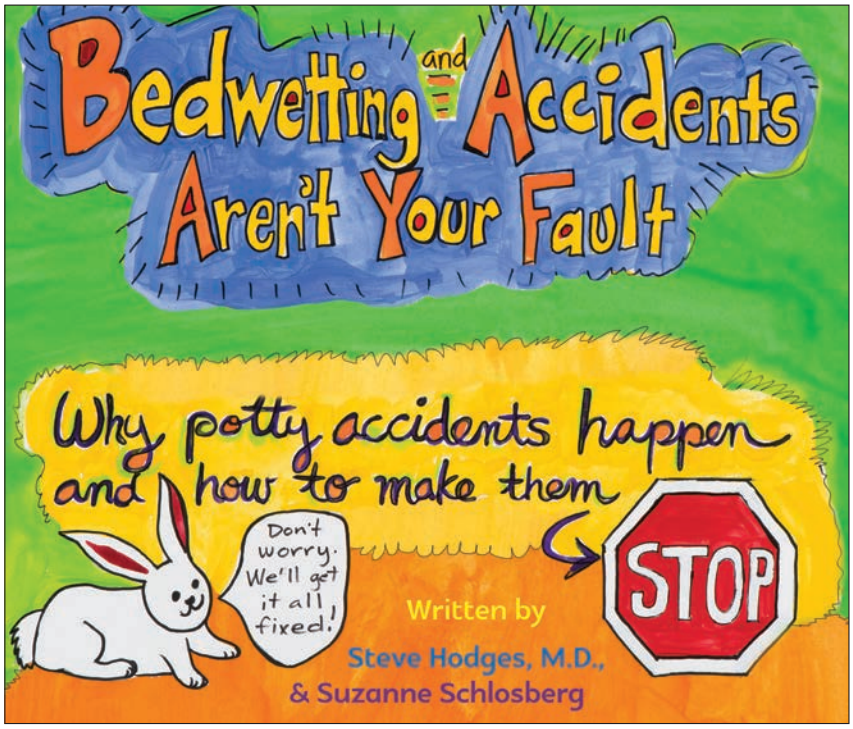

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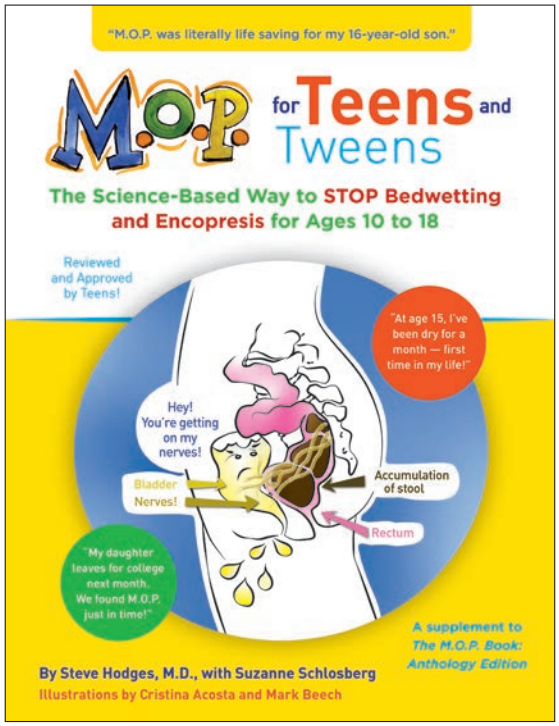

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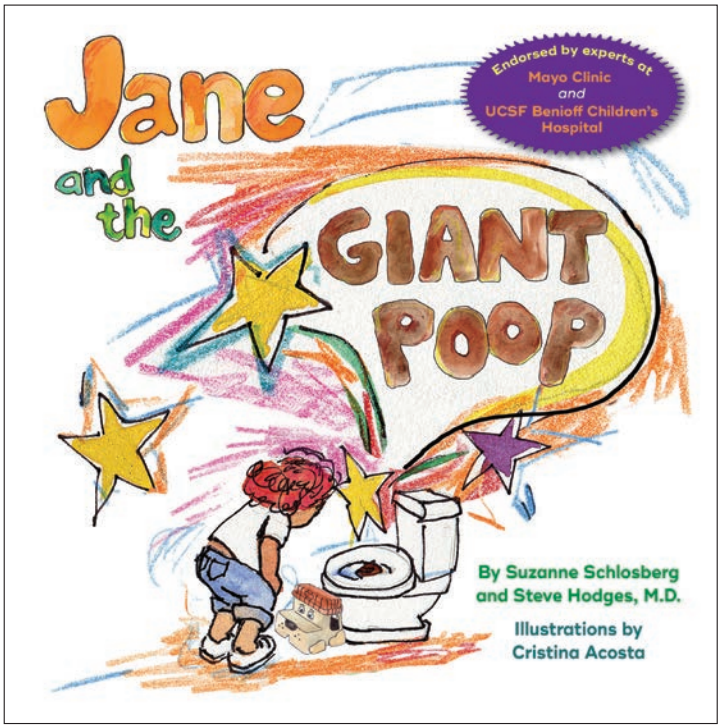

12 Signs Your Child is Constipated

1. **XXL poops.** We're talking "Holy cow!" poops – larger than ¾" x 6."

2. **Firm poops.** Logs or pellets = bad; thin snakes or mushy blobs = good.

3. **Poop accidents.** When the rectum is overstuffed, poop just falls out.

4. **Bedwetting and pee accidents.** A big ol' poop mass squishes the bladder.

5. **Recurrent UTIs.** Bacteria from overflowing poop crawl up to the bladder.

6. **Extremely frequent and/or urgent peeing.** You think, "AGAIN? But you JUST peed!"

7. **Infrequent pooping.** But daily pooping doesn't rule out constipation.

8. **Pooping more than 2x/day.** A stretched-out rectum lacks the tone to evacuate fully.

9. **Belly pain.** Constipation is the #1 source of tummy ache in kids.

10. **Skid marks or itchy anus.** Clogged kids can't fully empty
→ bottom is hard to wipe
→ poop stains.

11. **Super-loose poop.** Some poop can ooze around the large, hard rectal clog.

12. **Continued trouble toilet training.** Your child may fear pooping or hide to poop in diapers.

BedwettingAndAccidents.com

O'Regan Press

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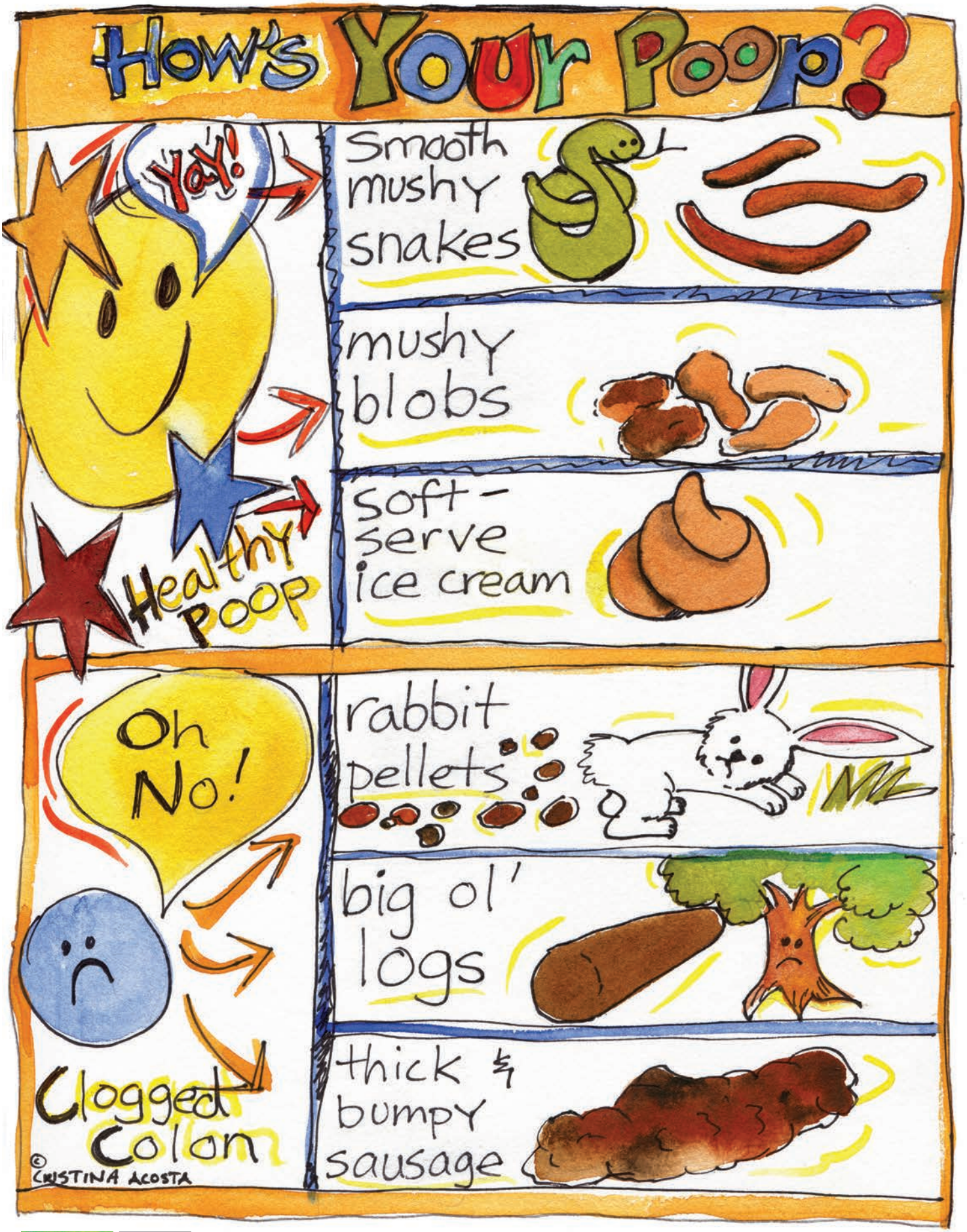

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Key Studies

The O'Regan Studies: Link Between Chronic Constipation and Enuresis, Encopresis, and UTIs

- **Relevance of Constipation to Enuresis, Urinary Tract Infection and Reflux. A Review**
  Yazbeck S, Schick E, O'Regan S., *European Journal of Urology*, 1987
- **Constipation, Bladder Instability, Urinary Tract Infection Syndrome**
  O'Regan S, Yazbeck S, Schick E., *Clinical Nephrology*, 1985
- **Constipation a Commonly Unrecognized Cause of Enuresis**
  O'Regan S, Yazbeck S, et al., *American Journal of Diseases of Children*, 1986
- **Constipation and the Urinary System**
  Sean O'Regan, Salem Yazbeck and Eric Schick, *Pediatric Urology*, Chapter 16, 1997

Effectiveness of Enemas for Treating Enuresis, Chronic Constipation, or Fecal Impaction

- **Daily Enema Regimen Is Superior to Traditional Therapies for Nonneurogenic Pediatric Overactive Bladder**
  Hodges SJ, Colaco M. *Global Pediatric Health*, 2016
- **Rectal Fecal Impaction Treatment in Childhood Constipation: Enemas Versus High Doses Oral PEG**
  Bekkali, NLH, et al., *Pediatrics*, 2009 (Abstract only)
- **A Randomized Trial of Enema Versus Polyethylene Glycol 3350 for Fecal Disimpaction in Children Presenting to an Emergency Department**
  Miller, M. K., et al., *Pediatric Emergency Care*, 2012 (Abstract only)
- **The Usefulness of Olive Oil Enema in Children with Severe Chronic Constipation**
  A. Yokoi and N. Kamata, *Journal of Pediatric Surgery*, 2021 (Abstract only)

Safety of Phosphate Enemas in Children

- **Systematic Review: The Adverse Effects of Sodium Phosphate Enema**
  Mendoza, J., Legido, J., *Alimentary Pharmacology and Therapeutics*, 2007

Bedwetting Does Not Always Spontaneously Resolve

- **Differences in Characteristics of Nocturnal Enuresis Between Children and Adolescents: A Critical Appraisal From a Large Epidemiological Study**
  Yeung, C., Sreedhar, B., et al. *BJU International*, 2006

Eur. Urol. *13:* 318–321 (1987)

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Relevance of Constipation to Enuresis, Urinary Tract Infection and Reflux

A Review

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Key Words. Constipation · Urinary tract infection · Enuresis

Abstract. Little attention has been afforded the relevance of constipation to urinary symptoms. Problems of definition and measurement have contributed to this problem. A review of the literature suggests that rectal dilatation may influence the function of the urinary tract leading to urinary tract infection and enuresis. Our studies indicate that constipation may, by causing uninhibited bladder contractions, cause urinary tract infection, enuresis and vesicoureteral reflux.

The world of medicine has undergone revolutionary changes, with quantum leaps in information on various organ systems being realized in the last 3 decades. As a result, not only has specialization evolved concentrating on single organ systems, but the explosion of knowledge has been such that subspecialization based on elements within organ systems is commonplace. Attention by specialists is usually focused on adjacent organ systems only when infiltrative lesions are involved, distant derangements occur due to hormonal effects or toxin accumulation or when multi system organ dysfunctions occur due to systemic disease. Consequently in the field of nephro-urology relatively scant attention has been afforded to observations relating derangements in bowel function which might influence the function of the urinary tract system.

During the past 5 years we have focused our attention in our nephro-urology clinics to determining the relevance of constipation to pediatric problems associated with enuresis, urinary tract infection and vesicoureteral reflux. We review evidence substantiating a role for constipation in causing urinary symptoms.

Prior to puberty the pediatric abdominal and pelvic cavities are one. As a result the close proximity of the rectum to the posterior wall of the bladder is such that any gross distention of the rectum could therefore result in compression of the bladder, bladder neck obstruction or distension of the urethra leading to abnormalities of urinary tract function [1]. Shofpner [2] in 1968 demonstrated that the presence of constipation has the potential for inducing gross distorsion of the bladder and urethra in children. Though this report concentrated on radiologic evidence of distorsion resulting from constipation, of note was the fact that of the 39 children studied, 8 had reflux, 21 also had enuresis and 2 had recurrent urinary tract infection. The relevance of these abnormalities to the constipation was not discussed. Neumann et al. [3] in 1973 noted the association of constipation and recurrent urinary tract infection in children. On occasion they also noted the presence of reflux in these constipated children and they indicated that the aggressive treatment of constipation resulted with its resolution of associated urinary tract infection. In addition these workers made the point that constipation was not sought commonly as a complaint because: (a) the doctors did not inquire; (b) bowel preparation prior to radiologic studies resulted in evacuation, eliminating radiologic signs of constipation, and (c) mothers did not volunteer the information because of either lack of

[1] Supported by a grant from the Hospital for Sick Children Foundation (Toronto) and NATO.

knowledge of the presence of constipation or because it was not a dominant presenting complaint.

Progress in this field has been hampered by the lack of a standard definition of constipation. Also a method of measurement of rectal abnormality which would correlate with the presence of constipation and which was recordable and therefore free of observer bias was not generally available.

Progress in the past decade has enabled the development of methods and definitions which go someway to achieving these ends. We [4] therefore define functional constipation as being present if any of the following are present: (1) more than a 72-hour interval between bowel movements; (2) the presence of an overflow fecal incontinence (soiling or encopresis); (3) the passage of small hard scibalous stools with intermittent passage of large stools; (4) poor emptying and dilatation of rectal ampulla after defecation as determined by rectal examination, and (5) grossly decreased level of perception and increased tolerance of balloon insufflation in the presence of normal anorectal relaxation during rectal manometry, combined with any element of the above.

We performed rectal manometric studies using an air-filled balloon system. We noted the smallest inflation volume perceived by the patients, the volume at which relaxation of the internal sphincter occurred and the maximum inflation volume that was tolerated by the patients without pain or discomfort [5]. The diagnosis of constipation is a diagnosis to be made by a physician with appropriate questioning (quantity and quality of stools, frequency of defecation, etc.) and physical examination. A convenient way of avoiding being misled is to obtain a written record of stool frequency and quality at follow-up visits.

Similarly apart from radiologic studies, acceptable measurements and recording of bladder and urethral function under normal and abnormal conditions were generally not available. However, the advent of techniques to assess urodynamics has led to the identification of uninhibited bladder contractions as a common finding in children with urinary tract infection. The presence of uninhibited bladder contractions were determined by urodynamic studies using a DISA 1200 system [4]. Bladder instability was considered present if at least one of these elements were identified: (1) the presence of uninhibited contractions of the detrusor during the filling phase of the bladder with an amplitude equal or greater than 15 cm of water and (2) the occurrence of detrusor contraction at the end of or after urinary flow.

Constipation and Urinary Tract Infection

Using these criteria for constipation and uninhibited bladder contractions we studied 47 children with recurrent urinary tract infections [6]. In all these patients follow-up urodynamic studies indicated uninhibited bladder contractions.They were also constipated. Enuresis was present in 32 and encopresis in 21. Aggressive treatment of the constipation resulted in cessation of infection in 44 of the 47 children, enuresis in 22 of 32 patients and encopresis in 20 of 21 patients and an improvement of bladder function as indicated by cessation of uninhibited contractions in 12 who underwent repeat studies. These results were achieved by appropriate dietary advice (increase fiber content) and by aggressive treatment of constipation utilizing a phosphate soda enema daily for 1 month, every other day for a further month and twice weekly or more often if required for a third subsequent month. This was in order to allow for return of normal rectal tone by a dilated hypotonic rectum. Of interest was that many of the patients studied had no prior history, or a history of constipation was denied. Normal bowel habits were perceived by patients and parents even in the presence of proven rectal reservoirs of feces by rectal examination and rectal manometry and on occasion even with encopresis. White and Taylor [7] have also noted the frequent presence of constipation with urinary tract infection as have Smellie et al. [8]. A retrospective analysis of the incidence of urinary tract infection in patients with Hirschprung's disease, a constipating entity, disclosed a much increased frequency of infection prior to and after surgery [9]. An increased incidence of bacteruria occurs in rats with fecal retention [10].

Constipation and Enuresis

Therapy for enuresis presents a major problem for pediatric nephrologists and urologists. Psychologic stress inflicted on the patients by discomfort of bed wetting and by parental reaction is considerable. As a result numerous therapeutic modalities have been used including alarm devices and systemically acting drugs, none of which is completely satisfactory [11]. The exact etiology of enuresis is unknown. However, we did note a very high incidence of enuresis in girls with urinary tract infection and constipation [6]. The enuresis resolved upon treatment of constipation. We therefore studied 22 patients with enuresis [4]. We noted that in over 40% of these cases encopresis or soiling was also present but was considered a

minor symptom. By history, physical examination including rectal examination and rectal manometric studies, constipation was an extremely common though often unrecognized accompaniment of enuresis. These patients had uninhibited bladder contractions similar to that previously observed by Berger et al. [12] who also noted a decreased bladder capacity in relation to age in many of these patients, a phenomenon similarly noted by us. Aggressive treatment of constipation resulted in rapid resolution of enuresis without any form of pharmocologic drug therapy. Our studies strongly implicate unrecognized rectal distension as an etiologic factor in enuresis.

As previously stated, Shopfner [2] in discussing urinary tract pathology associated with constipation also noted that 54% of these patients were enuretic. Similarly Baumann and Hinman [13] described the treatment of incontinent boys with nonobstructive disease of the urinary tract. These children had encopresis and enuresis. Hypnotherapy was emphasized for the therapy of the enuresis. However, they did note that aggressive treatment of constipation including, if necessary, digital evacuation of the rectum was required prior to cessation of enuresis. This fact suggests to us that the constipation was the primary element in causing enuresis. We have also noted uninhibited bladder contractions in children who were constipated but did not have urinary symptoms [4]. Uninhibited bladder contractions in the absence of urinary incontinence can occur in situations in which urethral constriction can overcome the increased intravesical pressures induced by uninhibited contractions [14]. The presence of uninhibited contractions in otherwise asymptomatic but constipated children [4] suggests a cause and effect relationship. Drug therapy directed towards the suppression of uninhibited bladder contractions in enuretic [15] or refluxing patients [16] may be successful. However, aggressive treatment of constipation, a therapy directed against a common etiologic factor causing bladder abnormalities, may be more beneficial.

Constipation with Vesicoureteral Reflux

Though little attention has been paid to the observation, constipation was noted to cause dilatation of the urinary system [16]. Dilatation of the urinary tract, especially the bladder, but also the ureters was noted by numerous authors to occur in association with Hirschsprung's disease [17-19]. In addition successful treatment of Hirschsprung's disease may result in resolution of the vesicoureteral reflux [20]. Kottmeier and Clatworthy [21] noted a similar incidence of vesicoureteral reflux in children with severe functional constipation and those with Hirschsprung's disease. We noted constipation to be present in patients with primary vesicoureteral reflux [22]. Though numbers did not allow for a controlled study, we did note rapid resolution of reflux with aggressive treatment of constipation in the absence of antibiotic therapy, or anticolinergic therapy for treatment of associated inhibited bladder contractions. Similarly White [23] noted that resolution of infection with reflux is more easily attained when accompanying constipation is aggressively treated. These reports suggest that constipation is a nonfortuitous phenomenon occurring in patients with vesicoureteral reflux and may be of major etiologic importance. Consequently this phenomenon may be a major factor of contention in the interpretation of the medical-surgical prospective study of the International Study on Vesicoureteral Reflux since, in the medical protocol, avoidance of constipation is emphasized whereas this factor is not considered in the surgical approach to therapy [24].

Hinman [25] made note of the fact that the constipated child may have an evolution of encopresis leading to enuresis, to urinary tract infection and eventually to vesicoureteral reflux. Though the symptom complex was attributed by him to behavioral characteristics, perhaps constipation may be the initiating factor as resolution of reflux and enuresis followed therapy including treatment of encopresis [26]. The precipitating cause of constipation may be due to short episodes of psychologic stress (e.g., to early aggressive toilet training, to anal fissure, etc.), causes that may be long resolved but which, however, may result in persisting constipation.

Studies by Bailey et al. [27] noted a 55% incidence of abnormal anal sphincter electromyograms in children with enuresis and urinary tract infection. These observations substantiate the possibility that abnormalities of the rectum may cause enuresis, urinary tract infection and reflux in children. The observation that children with functional constipation may have uninhibited contractions of the bladder in the absence of urinary symptoms strongly supports this possibility. Because the rectal sphincter and the urethral sphincter, together with the perineal musculature is considered as a single physiologic unit, with voluntary rectal sphinter contraction, consequent concomittant urethral sphincter contraction occurs. This urethral sphincter contraction, in turn, may be responsible for a dyssynergistic voiding pattern with secondary bladder instability, enuresis, urinary tract infection, and/or vesicoureteral reflux possibly ensuing. Thus a

spectrum of disease may exist of constipation with uninhibited bladder contractions in the absence of urinary symptoms or with enuresis, urinary tract infection and vesicoureteral reflux. Because of the high spontaneous resolution rate of vesicoureteral reflux, a long-term controlled trial of constipation treatment would be required to substantiate the thesis of a cause and effect relationship.

Since the intestinal transit time in children with functional constipation is normal, oral therapy alone directed to maintenance of an empty rectum is inappropriate [28]. Though we have achieved satisfactory success using phosphate soda enema therapy, factors of cost as well as patient discomfort and inadequate volume to achieve consistent and complete rectal evacuation have arisen. A more appropriate and satisfactory approach is the use of saline enemas (5 ml of salt in 1 liter of warm water). Using a bag held 2 feet above the patient an adequate volume will be infused under gravity. The incidence of cramps is less with this method [Murray, R., personal commun.].

The morbidity associated with enuresis, urinary tract infection and reflux is so high and constipation a condition easily amenable to resolution with aggressive therapy that extreme care should be exercised in determining whether constipation is present in children presenting with these complaints, so that therapy for constipation may be instituted and thus aid in the resolution of the urinary symptoms.

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Constipation, bladder instability, urinary tract infection syndrome

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Abstract. Forty-seven children with recurrent urinary tract infection were noted to have large fecal reservoirs by rectal examination and rectal manometry. Constipation was accompanied in the majority by enuresis and/or encopresis. Urodynamic studies indicated uninhibited bladder contractions. Aggressive treatment of the constipation resulted in cessation of infection in 44 patients, enuresis in 22 of 32 patients and encopresis in 20 of 21 patients and an improvement in bladder function with cessation of all other forms of treatment.

Key words: urinary tract infection – constipation – bladder contractions

Introduction

Recent studies have indicated that some children may have urodynamic abnormalities associated with recurrent urinary tract infections in the absence of radiologic abnormalities of the urinary tract [Allen and Bright 1978, Firlit et al. 1978, Smey et al. 1978]. It has been indicated in one study that abnormal bowel habits as determined by parental response to questioning may be observed in some patients with urinary tract infection [Neumann et al. 1973]. Distortion of the urinary tract system associated with constipation, though in the absence of urinary tract infection has also been reported [Shopfner 1968]. Also anal electromyography has been reported as abnormal in 57% of children with urinary tract infection [Bailey et al. 1970]. We describe the association of constipation, commonly unrecognized, with uninhibited bladder contractions as determined by urodynamic studies in children with symptomatic urinary tract infection without radiologic evidence of anatomic abnormality.

Patients and methods

The identification of several children investigated for recurrent urinary tract infection who had uninhibited bladder contractions and functional constipation, all of whom had large fecal reservoirs as determined by rectal examination and rectal manometry, led to the investigation of 47 patients who had no evidence of radiologic abnormality but had a similar pattern of abnormal bladder contractility and recurrent urinary tract infection. All were girls, with a mean age of 8.2 ± 2.53 years (1 SD) and a mean duration of symptoms of 3.7 ± 2.28 years (1 SD). Mean age of onset of first urinary tract infection was 4.6 ± 2.26 years. Close questioning of the parents of several children did disclose elements suggesting the presence of chronic constipation. However, in 21 cases, constipation was denied as a symptom. All patients had been referred for assessment because of culture proven recurrent urinary tract infection with (32 patients) or without (15 patients) enuresis. Twenty one patients had mild encopresis. Radiologic investigation in all had been negative. Three patients had an anterior anus as determined by a decreased distance between the anal orifice and the vestibule. Because of the identification of the typical urodynamic tracings of an unstable bladder, later patients underwent directly rectal manometry in the absence of a history of constipation or encopresis. All patients had normal renal function as determined by normal plasma creatinine levels.

Urodynamic studies were performed using a DISA 2100 Urosystem

The patient was placed in a lithotomy position. After desinfection and draping, a 7-F single microtip transducer catheter was passed into the bladder per urethram and the bladder was filled. A balloon filled with water was placed in the rectum to register intra-abdominal pressure variations. Circular surface electrodes were placed on each side of the anus, and were used for perineal electromyography.

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Reprint requests to Dr. Sean O'Regan.

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The child was seated on a flowmeter chair and data were recorded on a six channel recorder. The recorder noted simultaneously the total bladder pressure, the intra-abdominal (rectal) pressure and the intrinsic bladder pressure, obtained by the substraction of the rectal pressure from the total bladder pressure. The bladder was filled with NaCl 0.9% at room temperature and 2 to 3 complete voiding cycles were registered on each child.

Bladder instability was considered present if at least one of these elements was identified:

1. The presence of uninhibited contractions of the detrusor during the filling phase of the bladder with an amplitude equal or greater than 15 cm H_2O.
2. The occurence of detrusor contraction at the end of or after urinary flow.

Rectal manometry performed as follows

Rectal manometric studies were done using a Beckman 710 recorder with a Shuster air filled balloon system [Menuier et al. 1967]. We noted the smallest inflation volume perceived by the patient, the volume at which relaxation of the internal sphincter occurred and the maximal inflation volume that was tolerated by the patient without pain or discomfort.

Functional constipation was deemed present when the following elements were noted:

1. Decreased perception and increased tolerance in response to large volume stimulation by the rectal balloon.
2. The presence of a normal rectal-anal reflux.

Twelve patients had been treated with oxybutyrin chloride (Ditropan) to inhibit abnormal bladder contractions without satisfactory response. All these patients with functional constipation were treated with a phosphate-soda enema (Fleets) once a day for one month and once every other day for the 2nd month to maintain the dilated rectum empty and prevent re-accumulation while awaiting the return to a normal rectal tone. All other forms of treatment were stopped [oxybutyrin chloride (Ditropan, antibiotics)] when the enema treatment was initiated.

Results

A consistent pattern of uninhibited bladder contractions was observed in all patients studied, consisting of detrusor contraction during the filling phase of the bladder with an amplitude equal or greater than 15 cm H_2O or the presence of detrusor contraction at the end of or after urinary flow [Allen and Bright 1978, Firlit et al. 1978].

Though sensation under normal circumstances can be determined when the balloon of the rectal manometer is inflated with 5 ml to 10 ml of air the majority of these children had poor perception of rectal distension until at least 40 ml had been instilled into the balloon. All patients could tolerate balloon distension of 80 to 110 ml (maximal balloon insufflation volume; 110 ml, 6.7 cm diameter) without experiencing any discomfort. A majority of patients had a decrease in urinary bladder capacity. Three patients were noted to have an anterior anus.

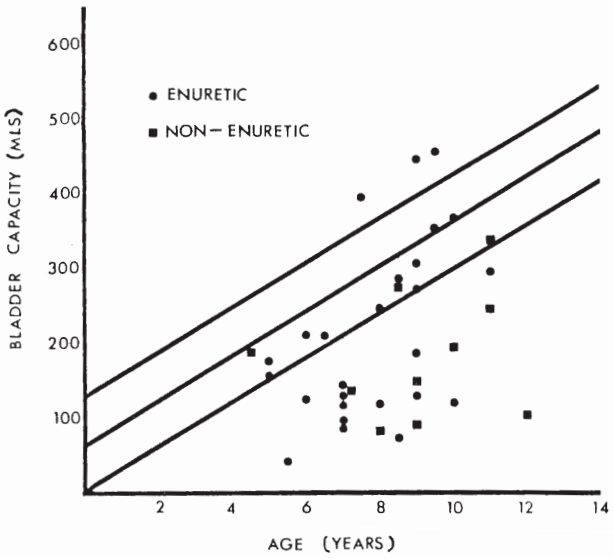

Fig. 1 Bladder capacity in 36 children with urinary tract infection and constipation. Upper and lower lines indicate 95% confidence limits [Berger et al. 1983].

Dramatic improvement was evident in all patients who followed the enema regimen. At follow-up clinic visits during which cultures were done only 3 patients had further episodes of urinary tract infection after initiation of treatment. At follow-up, constipation persisted in 2 patients. Enuresis ceased in 22 patients and improved (1 night/wk to month) in 7. Encopresis resolved in 20 patients. Two of 3 patients who did not respond completely were noted to have refused to follow the enema regimen appropriately. At follow-up of 17 to 9 months (mean 12 ± 2), elimination of constipation resulted in dramatic symptomatic and psychologic improvement in 44 patients. In 12 patients in whom follow-up urodynamic studies were done, normal bladder function as determined by urodynamic studies has been attained. Control rectal manometry was performed in some patients and showed perception to lower volumes of balloon insufflation.

Discussion

Functional constipation has been associated with radiologic distortion of the urinary system in the presence and absence of urinary tract infection

[Neumann et al. 1973, Shopfner 1968]. We describe the association of rectal reservoirs of feces and uninhibited bladder contractions with enuresis, encopresis and recurrent urinary tract infection. In many of the patients studied there was no prior history or a history of constipation was denied. Normal bowel habits were perceived by patients and parents even in the presence of proven rectal reservoirs of feces by rectal examination and rectal manometry and on occassion even with encopresis. Close questioning however, indicated that patients had been toilet-trained very early in childhood and either had large infrequent stools or incomplete evacuation as determined by rectal examination after defecation. Elimination of constipation resulted in dramatic symptomatic improvement with cessation of urinary tract infection and enuresis even in the presence of some continuing abnormal bladder contractility.

Uninhibited bladder contraction is typical of that seen in infancy before full maturation of cortico-spinal control of bladder activity is achieved [Smey et al. 1978]. It is possible that the presence of abnormal contractions is indicative of arrest in the development of normal detrusor peroneal synergism, possibly due to chronic constipation.

Another possibility is that day wetting might induce voluntary peroneal contraction resulting in functional constipation. However, the elimination of enuresis and urinary tract infection after the treatment for constipation, as well as the fact that constipation and secondary encopresis preceeded urinary symptomatology in several patients, militates against this possibility.

It is possible that the compression of the bladder due to pressure from a rectal fecal reservoir might serve to trigger such unhibited bladder contractions. However, such contractions are not observed in pregnancy when the bladder is compressed by the gravid uterus. Since the innervation of the rectum and bladder are both from S2-4, it is possible that the development of constipation might precipitate, due to stimulation of the detrusor and consequent incoordination between detrusor contraction and external bladder sphincter relaxation.

One can surmize that in chronically severe constipated patients the rectum is never empty. In this case, the external sphincter of the anus remains the main if not the only means of rectal continence. It then is contracted continuously by the normal reflex mecanism and by voluntary action. Anal electromyography has been reported to be abnormal in children with urinary tract infection [Bailey et al. 1970]. Since concomittant contraction of the external sphincter of the bladder and the anus normally occurs, the presence of a continuous contraction of the anal sphincter would induce the continuous contraction of the bladder sphincter resulting in urinary symptoms. This may explain the observation of Bailey et al. [1970] who noted a 57% incidence of abnormal anal electromyography in children with recurrent urinary tract infection. Elimination of constipation would result in cessation of voluntary anal and consequent urethral sphincter contraction, thus allowing for attainment of a more normal voiding pattern. This theory best explains the dramatic success of elimination of constipation in our patient series and is subtantiated by the observation of an extremely high incidence of urinary tract infection in children with Hirschsprung's disease [O'Regan and Yazbeck 1984].

Pharmacologic manipulation has been utilized in the management of children with dysfunctional voiding problems with some success [Firlit et al. 1978, Smey et al. 1978]. However, pharmacologic manipulation based on urodynamic studies may result in variable symptomatic improvement without elimination of a possible primary cause i.e., functional constipation. Our experience indicates that the association of constipation and recurrent urinary tract infection is a frequent uncommonly recognized symptom complex. Rectal examination should be performed on all patients with recurrent urinary tract infection.

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CONSTIPATION: A CAUSE OF ENURESIS, URINARY TRACT INFECTION AND VESICO-URETERAL REFLUX IN CHILDREN

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ABSTRACT

The observation that constipation alone may induce uninhibited bladder contractions in children and is associated with recurrent urinary tract infection in childhood suggests an etiologic association (1). Rectal distension due to faecal retention in chronic functional constipation causes bladder distortion (2) and may cause stimulation of detrusor stretch receptors resulting in detrusor peroneal dyssynergism. Distortion of the trigonal area may result in failure of ureteral valve competence and allow for vesico-ureteric reflux.

INTRODUCTION

The causes of recurrent urinary tract infection, enuresis and vesico-ureteric reflux in the absence of anatomic abnormality are unknown. Studies investigating recurrent urinary tract infection in children in the absence of radio-urologic abnormalities have concentrated on the identification of particular characteristics of infecting bacteria resulting in urinary tract infection such as pili formation and host bladder wall receptors (3). The latter postulate infers that urinary tract infection is caused by infecting organism characteristics suggesting that it may be an infectious disease. This is not so. Enuresis has been attributed to abnormalities of neural control of bladder function (4) and has been treated with alarm systems (5) or with systemically acting drugs such as Imipramine and Vasopressin to decrease urinary output (7), none with a satisfactory result. Vesico-ureteric reflux in children has been attributed to abnormalities of ureteric insertion of the ureter into the bladder wall (8). However, the observations that reflux spontaneously resolves suggests that previous congenital anatomic abnormalities spontaneously resolve, an unlikely proposition (9).

Recurrent urinary tract infection in children

Recurrent urinary tract infection in children as shown by epidemiologic studies has an incidence of up to 3% in North American children (10).

Treatment usually consists of antibiotic therapy of infectious episodes or chronic prophylactic therapy. Urinary tract infection usually resolves at the end of the first decade or beginning of the second decade of life. In 1967, Shofpner et al. studying bladder and ureteral distortion due to constipation in 36 children noted that 3 of them had recurrent urinary tract infection (2). Neumann et al. noted the frequency of abnormal bowel habits, specifically constipation, in association with urinary tract infection in children and noted a high incidence of resolution of recurrent urinary tract infection with treatment of the constipation (11).

In a study of 47 children (1) it was noted, utilizing urodynamic and rectal manometric studies, that constipation was a constant associated condition. Constipation was measured not subjectively but objectively by measuring rectal ampulla capacity and rectal sphincter response to air balloon insufflation thus providing a measurement of constipation not subject to observer bias. Fifty percent of the mothers denied constipation as a symptom though questioning the individual children indicated defacation episodes of 2 to 3 times per week in the majority of cases. Aggressive treatment of the constipation resulted in resolution of all the recurrent urinary tract infections and also of associated enuresis in 67% of those who had it. These studies indicated the association of constipation with urinary tract infection.

A retrospective study of the incidence of urinary tract infection in Hirschsprung's disease (12), a constipating congenital abnormality of the large bowel, indicated an incidence greater than that normally observed in infancy. The study suggests that constipation may contribute to the development of recurrent urinary tract infection in children. The fact that the rectum may be abnormal in these children, substantiates the studies of Bailey et al. (13) who demonstrated abnormal anal electromyography in 57% of children with urinary tract infection.

Three possibilities exist as to how constipation may be associated with urinary tract infection:

a) the presence of recurrent urinary tract infection may allow for the development of constipation;
b) the presence of uninhibitable bladder contractions against a closed ureteral sphincter would lead to intermittent urinary wetting. Efforts to maintain continence would lead to ureteral and simultaneous anal sphincter contractions resulting in constipation;
c) the presence of constipation with a faecal reservoir would compress the bladder causing stimulation of stretch receptors resulting in uninhibited bladder contractions. Detrusor contraction would force urine down into the urethra against the closed external sphincter resulting in reflux of urine contaminated with bacteria back up from the urethra resulting in bladder infection;
d) chronic constipation is associated with external anal sphincter contractions (voluntary or reflex). This leads to simultaneous bladder external sphincter contraction leading to failure of normal development of detrusor contraction/peroneal relaxation synergism.

Constipation and enuresis

Urodynamic studies in children with constipation in the absence of other symptomatology demonstrated uninhibited bladder contractions (1). Further studies in children with enuresis also demonstrated uninhibited bladder contractions with decreased bladder capacity as seen in children with recurrent urinary tract infection (1). Aggressive treatment of constipation in boys and girls with enuresis resulted in resolution of their enuresis. A decrease in bladder capacity is noted in enuretics (14) and may be due to bladder compression by the rectum. Shopfner (2) noted that 54% of 36 patients with constipation were enuretic. It was also noted by Bailey et al. (13) that 55% of the children with enuresis had abnormal anal electromyography substantiating the postulate indicating that constipation is an etiologic factor.

Vesico-ureteric reflux and constipation

Several series of children with Hirschsprung's disease have shown megaureter with dilatation of the genito-urinary tract (15,16,17). Kottmeir et al. noted a similar incidence of this phenomenon in children with functional constipation (17). Also constipation has been observed to cause hydronephrosis (18,19). Surgical resolution of Hirschsprung's disease may result in return to normal of the uretero-calycial dilatation (20). Since innervation of the bladder in Hirschsprung's disease is normal (21), a similar neuro-etiology for bladder and ureteric dilatation is not tenable. Children with vesico-ureteric reflux in the absence of anatomic abnormalities have uninhibited bladder contractions with dysfunctional voiding patterns (22). Treatment with cholinergic drugs such as Oxybutyrin may result in a decrease in the degree or resolution of the reflux by depressing uninhibited bladder contractions (22). Our observation that children with vesico-ureteric reflux are commonly constipated suggested to us that a spectrum of abnormalities of recurrent urinary tract infection, enuresis and vesico-ureteric reflux all of which are associated with uninhibited bladder contractions in childhood may be secondary to bladder distortion by chronic functional constipation. Since aggressive treatment of constipation results in resolution of enuresis, and recurrent urinary tract infection, with resolution of non inhibited bladder contractions, we propose that vesico-ureteric reflux on which volumes have been written (20) may be caused by chronic constipation.

The constipation may be undetected because:

a) physician does not inquire;
b) the mother is unaware since she will not document bowel motions in children when it is not a primary complaint;
c) because its presence may be over shadowed by symptomatology from recurrent urinary tract infection or psychologic trauma produced by enuresis;
d) because of bowel preparation prior to radiologic investigation.

The cumulative evidence may be summarized as follows:

1) Uninhibited bladder contractions are common to enuresis, recurrent urinary tract infection and vesico-ureteral reflux.

2) Constipation is associated with recurrent urinary tract infection in children. Treatment of constipation results in resolution of infection.
3) Constipation is associated with obstructive uropathy and reflux in children with Hirschsprung's disease and functional megacolon. Urinary tract infection is increased in Hirschsprung's disease with or without obstructive uropathy. Treatment of the constipation results in resolution of urinary tract dilatation.
4) Enuresis and decreased bladder capacity is associated with constipation.
5) Posterior bladder wall distortion may be caused by constipation.
6) Constipation may be the common etiologic factor causing bladder distortion and unhibited detrusor contraction resulting in enuresis, recurrent urinary tract infection and vesico-ureteral reflux.

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16 Constipation and the Urinary System

SEAN O'REGAN SALEM YASBECK ERIC SCHICK

A major drawback in studying relationships between constipation and abnormalities of the urinary system has been the lack of a standard definition of constipation. In addition, a method of measurement of rectal abnormalities which could be correlated with the presence of constipation and which was recordable has only recently been available. The availability of rectal manometry has allowed for the assessment of rectal function in evaluation of constipation. We consider constipation to be present if one or more of the following criteria are present:

- More than 72 h interval between bowel movements.
- The presence of overflow fecal incontinence (encopresis or soiling).
- The passage of small hard scybalous stools with intermittent large stools.
- Incomplete rectal emptying as determined by rectal examination after defecation.
- Grossly decreased level of perception and increased tolerance to balloon insufflation in the presence of a normal rectoanal relaxation on rectal manometry, combined with any of the above elements.[1-4]

Rectal manometry allows the operator to determine the smallest rectal distention perceived by the patient, the volume at which relaxation of the internal sphincter occurs and the maximal volume that can be tolerated by the patient without discomfort or pain.[1]

This facilitates the diagnosis of constipation, especially as norms for manometry have already been established for children. The diagnosis of constipation is to be made by a physician with appropriate questioning on quantity and quality of stools and frequency of defecation, and physical examination. A simple question to the mother as to whether the child is constipated or not allows for a misdiagnosis to be made on the basis of arbitrary definitions. A convenient way of avoiding being misled is to obtain a written record of stool frequency and quality at follow up visits.

Similarly, the advent of techniques to assess urodynamics has led to the identification of non-inhibited contractions[2] of the bladder in patients with urinary tract infection, and on occasion enuresis and vesicoureteral reflux.

Constipation and Urinary Obstruction

Prior to puberty the child's abdominal and pelvic cavities are one. As a result the close proximity of the rectum to the posterior wall of the bladder is such that any gross distension of the rectum by stools has been reported to result in compression of the bladder, with bladder neck obstruction or distension of the urethra leading to urinary obstruction.[3]

Constipation and Urinary Tract Infection

Leishman, in 1939, suggested that constipation did not play a role in urinary tract infection in adults.[8] In a series of 39 patients, Shopfner demonstrated, in 1968, that the presence of constipation has the potential for distorting the bladder wall and urethra.[9] Of the 39 patients, eight had reflux, 21 had enuresis and two had urinary tract infection. Campbell[10] described the lazy bladder syndrome as consisting of recurrent cystitis, urinary dribbling and constipation. Neumann *et al.*[11] in 1973, noted the presence of constipation in children who presented with anomalies ranging from recurrent urinary tract infection to mild or severe vesicoureteral reflux. Constipation was diagnosed on the basis of a history of infrequent bowel motions and the radiologic evidence of accumulated feces. Aggressive treatment of constipation resulted in resolution soiling, with proven rectal reservoirs of feces as determined by rectal examination and rectal manometry. It is essential therefore that a written record of stool frequency and quality be kept so that parents recognize the presence of constipation. This then facilitates compliance with appropriate therapy.

An increased incidence of bacteriuria occurs in rats in whom fecal retention is surgically induced.[17]

Constipation and Enuresis

The etiology of enuresis is not completely understood. In 17 constipated enuretics who had uninhibited detrusor contractions, treatment of coexisting constipation resulted in the cessation or improvement of enuresis in 15 and two cases respectively.[18]

As previously stated, Shopfner, in discussing urinary tract pathology associated with constipation, also noted that 54% of these patients were enuretic.[9] Baumann and Hinman[19] discussed the treatment of incontinence with non-obtructive disease of the urinary tract. Their 73 male patients had enuresis with encopresis. Though the emphasis was on hypnotheraphy as specific treatment of enuresis, they did note that aggressive treatment of constipation, commonly including digital evacu-

ation of the rectum, was required before cessation of enuresis, suggesting that constipation may have been a relevant element causing enuresis. Urodynamics in patients who were severely constipated but did not have urinary symptoms showed uninhibited bladder contractions.[18] This suggests that constipation may induce uninhibited bladder contractions, with consequent enuresis.

Constipation and Vesicoureteral Reflux

Dilatation of the urinary tract, including the bladder, has been noted by numerous authors to occur in association with Hirschsprung's disease.[20,21] Successful treatment of this disease may result in resolution of the vesicoureteral reflux.[22] Kottmeier and Clatworthy noted a higher incidence of vesicoureteral reflux in children with severe functional constipation than in those with Hirschsprung's disease.[23] Also, constipation may cause ureteral dilatation with hydronephrosis and, when relieved, may allow for resolution of urinary tract dilatation.[24] Ochoa and Gorlin have described a syndrome of distortion of facial expression associated with urinary tract dilatation.[25] In two-thirds of afflicted patients moderate to severe constipation was present. Whether the constipation is a primary motility problem contributing to urinary tract dilatation or is secondary to chronic dehydration due to renal failure associated polyuria was not determined. Abnormal large bowel motility has been noted in patients with vesicoureteral reflux.[26,27]

We have noted the presence of constipation in children with primary vesicoureteral reflux.[28] Although a control study was not done, rapid resolution of reflux occurred with aggressive treatment of constipation in the absence of antibiotic or anticholinergic therapy for treatment of associated uninhibited bladder contractions. White also noted that resolution of infection with reflux was more easily attained when associated constipation was aggressively treated.[29] Hinman[30] observed that the constipated child may have an evolution of encopresis to enuresis to urinary tract infection to vesicoureteral reflux. Studies by Bailey *et al.*[31] noted a 55% incidence of abnormal anal sphincter electromyograms in children with enuresis and urinary tract infection, suggesting the possibility that abnormalities of the rectum may cause enuresis and urinary tract infection and reflux in children. Indeed the observation that children with functional constipation may have uninhibited contractions of the bladder in the absence of urinary symptoms strongly supports this possibility.

Because the external anal sphincter and the urethral spincter together with the perineal musculature may be considered to be a single physiologic unit, with voluntary anal contraction consequent concomitant urethral sphincter contraction occurs. It is possible that the urethral sphincter contraction may be responsible for a dyssynergic voiding pattern with secondary bladder instability, enuresis, urinary tract infection or vesicoureteral reflux.

Since the rectum may be dilated for months to years in association with chronic constipation, one-time emptying of the rectal ampulla will result in a momentarily empty but still dilated rectum, without resolution of constipation. Oral therapy alone directed to the maintenance of an empty rectum is not consistently successful; the maintenance of an empty rectum is only achieved by repeated use of enemas. A satisfactory approach is the use of daily saline enemas (5 ml of salt in 1 liter of warm water). Using an enema bag held approximately 0.5 m above the patient maintained in a proper position, an adequate volume will be infused under gravity with minimal induction of cramps.

Although the frequency of enemas will be decreased progressively, treatment of constipation should be continued until rectal tone returns to normal. This usually takes at least 3 months.

Summary

The morbidity associated with enuresis, urinary tract infection and vesicoureteral reflux is exceedingly high. Constipation is a condition easily amenable to resolution with appropriate therapy. Consequently, in the management of children with any of these conditions, appropriate investigation should be performed to determine the presence of constipation. Should constipation be present, therapy should be instituted so that it may aid in the resolution of the urinary symptoms.

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Daily Enema Regimen Is Superior to Traditional Therapies for Nonneurogenic Pediatric Overactive Bladder

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Abstract

Our objective was to evaluate the efficacy of daily enemas for the treatment of overactive bladder (OAB) in children. This study was a prospective, controlled trial of 60 children with nonneurogenic OAB. The control patients (40) were treated with standard therapies, including timed voiding, constipation treatment with osmotic laxatives, anticholinergics, and biofeedback physical therapy, whereas the treatment patients (20) received only daily enemas and osmotic laxatives. On assessment of improvement of OAB symptoms, only 30% of the traditionally treated patients' parents reported resolution of symptoms at 3 months, whereas 85% of enema patients did. At the onset of the study, the average pediatric voiding dysfunction score of all patients was 14, whereas on follow-up, the average scores for traditionally treated patients and enema-treated patients were 12 and 4, respectively. This study demonstrated that daily enema therapy is superior to traditional methods for the treatment of OAB.

Keywords

voiding dysfunction, dysfunctional elimination, constipation, enema, incontinence

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Introduction

Overactive bladder (OAB) is a common and vexing problem in children, and despite great advancement in therapies, a certain percentage of patients remains resistant to treatment. We believe that children whose symptoms do not resolve with timed voiding, laxatives, anticholinergic medications, and biofeedback physical therapy do so because of an undiagnosed and inadequately treated megarectum and that therapy directed specifically at the dilated rectum will resolve OAB symptoms most efficaciously. In this study, we evaluated the efficacy of daily enemas for the treatment of OAB in children.

Material and Methods

The study was approved by the institutional review board. This was a prospective, controlled trial of 60 children with nonneurogenic OAB. The inclusion criterion was a diagnosis of pediatric nonneurogenic OAB. Exclusion criteria included neurogenic cause of bladder dysfunction, urinary tract infection, prior lower-urinary-tract surgery, and any diagnosed anatomical abnormalities of the urinary tract that could influence voiding function, such as posterior urethral valves. OAB was defined as uncontrolled daytime urge incontinence, and bladder function was measured using the pediatric voiding dysfunction symptom score (DVSS).

The 40 control patients were treated with traditional therapies, including timed voiding, osmotic laxative PEG3350 (regardless of bowel history to maintain daily, soft bowel movements), and in select cases, anticholinergic medications and/or biofeedback therapy. The 20 remaining patients were prescribed only a daily enema (liquid glycerin suppository for ages 2 to 5, pediatric fleet enema for ages 6 to 11) and enough osmotic laxative to maintain soft spontaneous bowel movements, with no other therapy or voiding schedule. If the voiding symptoms resolved while on the daily enemas, patients were instructed to taper off the daily enemas over a 2-month time period (an enema every other day for a month, and then an enema twice weekly for a month). All patients were evaluated on each visit with complete

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Table 1. Pretreatment Measurements.[a]

	Treatment Group	Control Group	Difference (*P*)
DVSS	14	14	0 (.68)
BSS	3.55	3.95	0.4 (.12)
Rome III	0.55	0.85	0.3 (.3)
Rectal diameter (cm)	6.35	6.2	0.15 (.66)

Abbreviations: DVSS, pediatric voiding dysfunction symptom score; BSS, Bristol Stool Scale.
[a]There were no variables that were significantly different between the control and treatment groups prior to enema.

Table 2. Measurements Done After the Treatment Phase.[a]

	Treatment Group	Control Group	Difference (*P*)
DVSS	4	12	
Change from pretreatment	−10	−2	8 (<.01)
BSS	3.85	4.05	
Change from pretreatment	0.3	0.1	0.2 (.08)
Rome III	0.1	0.2	
Change from pretreatment	0.45	0.65	0.2 (.45)
Rectal diameter (cm)	2.15	5	
Change from pretreatment	4.2	1.2	3 (<.01)

Abbreviations: DVSS, pediatric voiding dysfunction symptom score; BSS, Bristol Stool Scale.
[a]Participants who underwent enemas had a significantly greater improvement in DVSSs and maximum rectal diameters.

history and physical, urinalysis, Bristol Stool Scale (BSS), Rome III criteria, KUB X-ray, and Pediatric Voiding Dysfunction Questionnaire. All children were followed up at 3 months.

Data analysis was performed using SPSS Statistics Version 23 (IBM Corp, Armonk, NY). For the nonparametric variables—DVSSs, BSS scores, and Rome III scores—comparisons were made using Mann-Whitney *U* tests. For the continuous variable—maximum rectal diameter on KUB—a student *t* test was used. Comparisons were made both within groups for the pretreatment and posttreatment phases as well as between groups.

Results

A total of 60 children (20 experimental and 40 controls) were included in this study. Table 1 demonstrates the mean DVSS, BSS, Rome III, and rectal diameters prior to treatment. There was no significant difference on any of these measurements between the control and treatment groups. Table 2 demonstrates the mean posttreatment measures and the mean change in each metric after the treatment period. Patients who underwent enema had significantly more improvement in DVSSs and significantly greater change in maximum rectal diameters than control patients (Figures 1 and 2). There was no difference in the amount of change between groups. Of note, both control and treatment groups demonstrated significant improvement in all measured variables after the treatment period.

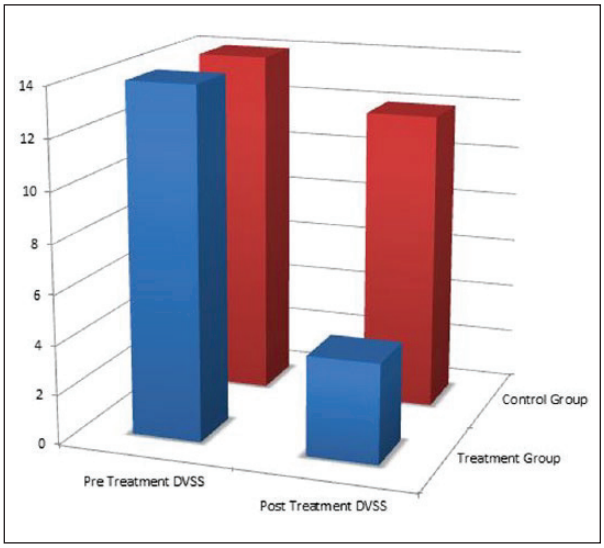

Figure 1. Pretreatment and posttreatment pediatric voiding dysfunction symptom score (DVSSs): the treatment group showed a significantly greater improvement in DVSS when compared with the control group.

Discussion

The historical teaching regarding OAB of childhood was that a congenital obstruction interrupted urine flow and led to the development of detrusor hypertrophy and hyperactivity, and the accepted therapy was serial and repeated dilation of this obstruction.[1] As time progressed, this anatomical obstruction was found to be the result of a willful dyssynergic contraction of the pelvic floor during voiding, and the treatment was changed to biofeedback physical therapy.[2] This nonphsyiological contraction of the urethral sphincter was no medical curiosity but a disease process so severe that it could influence the natural history of many childhood disorders, such as vesicoureteral reflux and nocturnal enuresis, and in extreme cases induce renal failure.[3,4]

There is some debate among scientists as to whether this dyssynergic sphincter contraction is a learned or inborn condition.[5] It is the author's opinion that in children with an intact nervous system, uninhibited voiding dominates the infantile period of voiding prior to toilet training. This is most clearly represented by the progressive bladder growth in pre–toilet-trained

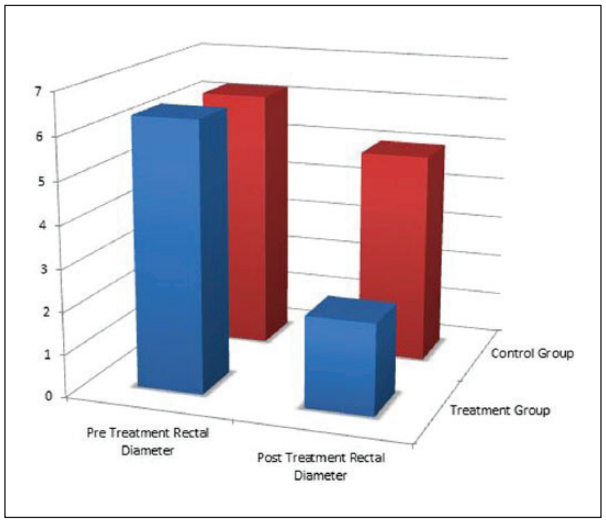

Figure 2. Pretreatment and posttreatment maximum rectal diameters: the treatment group also showed a significantly greater improvement in maximum rectal diameter on KUB when compared with the control group.

children, with increasing compliance.[6] This is mirrored in children with cerebral palsy, who demonstrate progressive bladder growth when they maintain an uninhibited, infantile voiding pattern.[7]

The teaching of bladder overactivity as the natural progression of an obstructed voiding pattern evolved from pathological models of voiding dysfunction such as posterior urethral valves and the neurogenic bladder, which develops in myelodysplastic patients with discoordinated sphincters.[8-10] This led to the development of the modern model of dysfunctional elimination, an acquired condition where children paradoxically fail to relax their pelvic floor during elimination, resulting in bowel and bladder pathology.[11,12] This study sought to investigate an alternative theory regarding the origins of dysfunctional elimination, with a therapy directed toward that cause to examine its benefits.

We have long known of the association between bowel and bladder dysfunction. This was first noticed in the 1960s, largely because of the presence of urinary symptoms in children with Hirschsprung's disease. In his seminal work, Shopfner[13] noted that the distention of the colon, especially the rectum, could have profound effects on bladder function.

O'Regan furthered this work with several groundbreaking studies linking rectal distention to bladder overactivity, with excellent success in treating nocturnal enuresis, urinary tract infections, and vesicoureteral reflux simply by alleviating this rectal distention. What has unfortunately hampered the development of this work has been the lack of a uniform definition of constipation.[14-17]

O'Regan defined constipation not as functional constipation, but mainly as the presence of fecal soiling, incomplete rectal emptying, and/or grossly decreased level of perception to balloon insufflation on anorectal manometry. The interesting discovery that O'Regan made was that often children with OAB symptoms presented with no functional signs of constipation, yet had markedly abnormal anorectal manometry studies. In other words, they often volitionally delayed defecation until the rectum distended to fill the anatomical pelvis and then would reach a new, abnormal homeostasis where stools would evacuate at regular intervals and with surprisingly normal appearance; yet the rectal tone would be so diminished as to have abnormal manometry studies. Put another way, these children were changing the rectum from a sensing organ (which in normal circumstances provides cues on the need to defecate), to a storage organ, with decreased sensation, and often resultant fecal soiling, but more often than not—normal stooling patterns.[16]

O'Regan early on discovered what we have also demonstrated in this study that parental reporting of their children's bowel habits by BSS or Rome III criteria is often inaccurate, and even when accurate, often not helpful in diagnosing rectal distention in children with OABs.[17] Not only that, but in children with completely normal bowel habits, rectal distention can be the main or sole cause of urinary symptoms, leading to compression of the bladder, uninhibited contractions, and often urethral obstruction, all of which has been proved years ago.[13]

The ability of rectal stool to induce uninhibited bladder contractions is well understood and was described as early as the 1980s; this work has been supported by numerous studies, although the exact mechanisms have yet to be defined. The uncanny ability of children to be cured of nocturnal enuresis by simply restoring normal rectal tone is a great testament to this relationship.[16]

What O'Regan proposed was that "in chronically constipated children; the rectum is never empty, necessitating the repetition or maintenance of rectal sphincter complex contraction to maintain fecal continence. Consequent concomitant urethral sphincter contraction occurs"[16]p. 261. In other words, the pelvic floor contractions during voiding are not a willful process that can be unlearned, but a physiological response to stool withholding. And this could be reversed by directing therapy specifically at rectal dilation, in other words daily enemas, with excellent results.

So what if the modern theory of dysfunctional elimination and the resultant OAB is wrong? Our research

points to a different cause altogether. We have proved that simply emptying the rectum repeatedly with the goal of restoring normal rectal tone resolves OAB in children more efficaciously than the standard of care. In fact, if the current model of voiding dysfunction were accurate, it should be impossible for our treatment to have been beneficial at all because we made no effort to influence pelvic floor function. Some would argue that our therapy would make pelvic floor contractions worse. Yet, in almost all children, the bladder symptoms resolved. And in children whose symptoms did not resolve, the enemas were often not successful in restoring rectal tone.

Conclusion

A daily enema regimen specifically targeted at restoring normal rectal tone is more effective than the standard of care for the treatment of OAB in children.

Author Contributions

SJH contributed to the conception and design; contributed to the acquisition, analysis, and interpretation of data; drafted the manuscript; gave final approval; and agrees to be accountable for all aspects of work ensuring integrity and accuracy. MC contributed to the analysis and interpretation of data and drafted the manuscript.

Declaration of Conflicting Interests

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ARTICLES | DECEMBER 01 2009

Rectal Fecal Impaction Treatment in Childhood Constipation: Enemas Versus High Doses Oral PEG

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OBJECTIVE: We hypothesized that enemas and polyethylene glycol (PEG) would be equally effective in treating rectal fecal impaction (RFI) but enemas would be less well tolerated and colonic transit time (CTT) would improve during disimpaction.

METHODS: Children (4–16 years) with functional constipation and RFI participated. One week before disimpaction, a rectal examination was performed, symptoms of constipation were recorded, and the first CTT measurement was started. If RFI was determined, then patients were assigned randomly to receive enemas once daily or PEG (1.5 g/kg per day) for 6 consecutive days. During this period, the second CTT measurement was started and a child's behavior questionnaire was administered. Successful rectal disimpaction, defecation and fecal incontinence frequencies, occurrence of abdominal pain and watery stools, CTTs (before and after disimpaction), and behavior scores were assessed.

RESULTS: Ninety-five patients were eligible, of whom 90 participated (male, $n = 60$; mean age: 7.5 ± 2.8 years). Forty-six patients received enemas and 44 PEG, with 5 dropouts in each group. Successful disimpaction was achieved with enemas (80%) and PEG (68%; $P = .28$). Fecal incontinence and watery stools were reported more frequently with PEG ($P < .01$), but defecation frequency ($P = .64$), abdominal pain ($P = .33$), and behavior scores were comparable between groups. CTT normalized equally ($P = .85$) in the 2 groups.

CONCLUSION: Enemas and PEG were equally effective in treating RFI in children. Compared with enemas, PEG caused more fecal incontinence, with comparable behavior scores. The treatments should be considered equally as first-line therapy for RFI.

Randomized Controlled Trial > Pediatr Emerg Care. 2012 Feb;28(2):115-9.
doi: 10.1097/PEC.0b013e3182442c0a.

A randomized trial of enema versus polyethylene glycol 3350 for fecal disimpaction in children presenting to an emergency department

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Affiliations + expand

PMID: 22270500 DOI: 10.1097/PEC.0b013e3182442c0a

Abstract

Objective: This study aimed to compare efficacy of enema versus polyethylene glycol (PEG) 3350 for pediatric fecal impaction treatment.

Methods: We conducted a prospective, randomized comparison of treatments of fecal impaction in children in a pediatric emergency department (ED). Treatment arms were a single milk and molasses enema in the ED or PEG 3350 for 3 days outpatient. Telephone follow-up was done on days 1, 3, and 5. The primary outcome was main symptom improvement. Additional outcomes were stool frequency, consistency, and ease of stool passage. Treatment failures (home enema, ED return, or hospital admission) were tracked.

Results: Seventy-nine subjects participated (39 PEG; 40 enema). At day 1, PEG subjects were less likely to have improved main symptom (odds ratio [OR], 0.3; 95% confidence interval [CI], 0.1-0.8) but no difference in other outcomes. Half (54%) in enema arm were reported as upset by ED therapy, whereas no children in PEG arm were upset ($P < 0.05$). At day 3, more patients in enema arm reported ideal stool consistency (74% vs 38%; $P < 0.05$). At day 5, no difference between groups was noted. Most treatment failures were in PEG arm (83%; $P = 0.08$).

Conclusions: This pilot study suggests that disimpaction by enema may be superior to PEG for immediate relief of symptoms. Larger trials are needed to assess any advantage.

Review > J Pediatr Surg. 2021 Jul;56(7):1141-1144. doi: 10.1016/j.jpedsurg.2021.03.024. Epub 2021 Mar 26.

The usefulness of olive oil enema in children with severe chronic constipation

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Affiliations + expand

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Abstract

Purpose: Few reports have determined the efficacy of olive oil enemas for severe constipation. Here, we review our experience with olive oil enemas in children with severe chronic constipation.

Methods: In our outpatient pediatric surgery department, the charts of 118 patients prescribed with olive oil enemas between January 2010 and November 2019 were retrospectively reviewed. A 1-2 ml/kg olive oil enema was given either alone or followed several hours later by a glycerin enema. Ratings included "very effective (VE)," "effective (E)," "limited (L)," "ineffective (I)," and "unknown (U)."

Results: One hundred and fifteen (97.5%) patients were able to use olive oil enemas at home. Forty-nine had functional constipation; 43 had anorectal malformation; 40 had Hirschsprung disease; 12 had spina bifida; and 10 had other maladies. Used as an enema, olive oil was effective in treating fecal impaction in 77.6% of patients; as a lubricant, it was effective in treating 76.9% of patients. Efficacy for fecal disimpaction was similar among patients with different underlying disorders.

Conclusion: Olive oil enemas are useful for more than three-quarters of children with severe chronic constipation. Further study is warranted to add olive oil enemas as an adjunctive treatment in the management of severe constipation.

Alimentary Pharmacology & Therapeutics

Systematic review: the adverse effects of sodium phosphate enema

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SUMMARY

Background
Sodium-phosphate enemas are widely used to treat constipation, and are rarely associated with side effects.

Aim
A systematic review of the literature was conducted to identify the most common adverse effects of sodium-phosphate enemas and associated risk factors.

Methods
A systematic search was conducted in Internet (MEDLINE), and the Cochrane Library, from January 1957 to March 2007.

Results
A total of 761 references were identified initially, and 39 relevant papers were finally selected. The most common therapeutic indications included constipation (63%). Sixty-eight per cent of the patients having adverse effects had associated conditions, the most common being gastrointestinal motility disorders, cardiological diseases and renal failure. Virtually, all side effects were due to water and electrolyte disturbances. Most patients were under 18 years of age (66%) or older than 65 years (25%). A total of 12 deaths were found.

Conclusion
The main side effects caused by sodium phosphate enemas are water and electrolyte disturbances. The main risk factors are extreme age and associated comorbidity.

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INTRODUCTION

Monosodium or disodium phosphate enemas are used for the treatment of acute and chronic constipation, and also for colon cleaning as preparation for endoscopic and surgical procedures, in both children and adults.[1–3] Phosphate enemas contain sodium acid phosphate and sodium phosphate, which have an osmotic activity. This activity could increase the water content and the volume of the stool, which will follow to a rectal distension. It is thought that this induces defecation with stimulation of rectal motility. Generally, the effect is limited to 5–10 min, which lowers the effect of phosphate toxicity as it is evacuated with the stool. These products have been widely used for many years, and have been associated with minimal adverse effects in the general population. However, there are reports in the literature of some clinical cases with severe side effects, even leading to death. If defecation does not take place, pooling of the fluid in the bowel can result in large amounts of water in the gut, causing dehydration. On the other hand, if phosphate is retained in the gut lumen can potentially be absorbed, and sudden and severe hypernatraemia and hyperphosphataemia may result.[4]

Manufacturers propose a careful use of the product in young children (<2 years) and in the elderly population, specially if associated comorbidity as renal disease or impaired intestinal motility exists. Nevertheless, there is a lack of information of the real risk of phosphate enemas. We therefore considered it necessary to conduct a systematic review to know what are exactly the most common side effects, their frequency, their severity and the profile of patients with a high risk of experiencing such complications.

METHODS

We performed a literature search in Internet in the MEDLINE database (from January 1957 to March 2007). The clinical trials register (Cochrane Controlled Trials Register) of the Cochrane Library (number 1, 2007) was also reviewed. The following descriptors or key words were used (in all search fields): 'phosphate enema or sodium phosphate enema' or 'phosphate-based enema' or (phosphate AND enema) or (fleet AND enema) or 'sodium phosphate laxatives' or 'sodium phosphate catharsis' or 'sodium phosphate cathartic'. No restriction by language or by type of publication was introduced. Literature references included in the papers meeting the selection criteria were also reviewed.

We selected the articles referring to secondary effects because of the administration of phosphate-based enemas. Data from the articles about anorectal or traumatic injuries were not examined because of the different ethiopathological approach.

To analyse the results, we performed a subanalysis according to the age criteria of the manufacturer's recommendations (children under 2 years, children under 18 years, adults and elderly (above 65 years), to perform a more comprehensive analysis.

In articles evaluating the side effects of sodium phosphate enemas, data were collected on the number of patients, sex, age, comorbidity, indication for use, number of units administered, deaths and their cause when they were due to use of enemas. Data extraction was conducted by two independent reviewers and discrepancies in the interpretation were resolved by consensus.

RESULTS

The search conducted initially identified a total of 773 literature references. After a first selection by reading their abstracts, 707 references were discarded; most of these (553) did not refer to the question in hand. A further large group (146 references) was discarded because they addressed about sodium phosphate cleaning solutions administered by the oral route. Finally, 20 articles on sodium phosphate enemas were not included because their side effects were not reported.[5–23]

The remaining 54 articles were comprehensively analysed. Eleven of these were clinical trials, and seven of such trials compared several cleaning methods for performing endoscopy (sodium phosphate enemas, oral laxative sachets) and secondarily analysed adverse effects.[2, 3, 24–27] The remaining four clinical trials evaluated water and electrolyte disturbances after enema administration.[28–31] Of the remaining 43 references, we found conclusive data in 39 references, all of them case reports and letters to the editor.[32–70] We also found four references to enema-induced anorectal injuries.[71–74] All the cases revealed a damage in the anorectal tissue, mainly because of a harmful application. Because of the differential cause of damage, these cases were not considered as adverse effects

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but as a consequence of a harmful application and they were not considered in the review.

Out of these 39 references,[32–70] the occurrence of side effects after administration of sodium phosphate enemas was reported in 44 patients. Twenty-two of these patients (50%) were women and 22 men (50%). Mean age of patients was 26 years (range, 6 weeks to 96 years).

Therapeutic indications

Therapeutic indications included constipation in 28 patients (64%)[33, 37–39, 41, 42, 44–50, 52, 54–70] and preparation for diagnostic test (barium enema or colonoscopy) or surgery in six patients (14%).[32, 36, 39, 57, 64, 69] No mention was made of the indication in all other cases (10 patients, 23%).[34, 35, 38, 40, 43, 51, 53]

Units administered

Units administered were difficult to assess, as dosage was not given for all patients. Dosage was stated in a total of 40 cases[32, 33, 35–44, 46–56, 58–70] (91%), but many of these data were incomplete or inadequate (not exact dosage, type of enema or frequency of administration). The exact dosage and frequency when it was given are in Tables 1–5. The maximum number of enemas received by a patient was 8,[62] but the time interval over which they were administered was not stated. The maximum frequency found in all analysed studies was six enemas over 6 h.[69]

Comorbidity

Regarding past medical history, 38 patients (86%) had prior diseases,[33, 36–44, 46, 47, 49–70] as summarized below. The most common associated diseases were gastrointestinal conditions, found in a total of 18 patients (41%), the most frequent was Hirschprung disease was reported in six cases.[40, 44, 59] Neurological diseases were reported in eight cases (18%) and cardiological diseases occurred in five patients (11%). Chronic renal failure was reported in six patients (14%).[53, 56, 58, 67, 68] Other conditions found are included in the Tables 1–5.

Side effects

The side effects mainly included metabolic disturbances, particularly hyperphosphataemia, hypocalcaemia, hypernatraemia, hypokalaemia and metabolic acidosis. Tetany resulting from the hypocalcaemia-induced was reported in 17 cases (34%),[37, 39, 40, 43, 47, 48, 52–56, 58, 62, 65, 69] being the most frequent complication (the remaining complications can be consulted in Tables 1–5).

Age

The results in all patients were stratified by age, forming groups of patients under 18 years of age and adults (over 18 years of age). In turn, separate analyses were made in each group of patients <2 years old (in those under 18 years) and patients older than 65 years (in the adult group).

Paediatric age (0–18 years)

A total of 29 case reports, representing 66% of all reported cases, were identified. Patients aged 2 years or less (15 cases, 34% of all cases analysed)[32–44] and patients older than 2 years (14 cases, 32%)[38, 40, 45–56] were separately analysed. Within the latter group, it should be noted that almost all patients had ages ranging from 1 to 5 years, we only found one case of a child older than 5 years.

Children under 2 years of age

Nine boys (60%) and six girls (40%) were found under the age of 2. As regards associated comorbidity, an underlying disease was found in 11 cases (73%). Indications for prescription included constipation in six cases (40%)[33, 37, 40] and colon preparation for surgery in another three patients (20%).[32, 36, 39] All cases seen in infants under 2 years of age showed metabolic disturbances. Finally, a case was identified in a newborn that had bone mineralization disturbances probable because of repeated enema used by his anorexic mother during pregnancy[34] (Table 1).

Children aged 2–18 years

Seven males (50%) and seven females (50%) were found between the ages of 2–18. Twelve of these patients (86%) had associated comorbidity (Table 2). The most common group of conditions were gastrointestinal motility disorders, found in six patients (43%).[38, 40, 47, 49, 50, 54]

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Table 1. Adverse effects reported in patients under 2 year of age

Author/year	Sex	Age	Associated condition	Indication	No. of units administered	Disturbances induced	Death
Everman *et al.* (2003) [32]	Male	1 year	No	Preparation for surgery	1	Water-electrolyte disturbances, acute respiratory failure	No
Ismail *et al.* (2000)[41]	Male	1.5 years	Asthma, epilepsy	Constipation	1	Water-electrolyte disturbances	Yes
Walton *et al.* (2000)[33]	Male	6 weeks	Premature birth	Constipation	1	Water-electrolyte disturbances, acute renal failure	Yes
Craig *et al.* (1994)[42]	Female	2 years	VATER syndrome	Constipation	2	Water-electrolyte disturbances	No
Rimersberger *et al.* (1992)[34]	Female	Newborn	No	–	Multiple, administered to mother during pregnancy	Bone mineralization disturbances	No
McCabe *et al.* (1991)[43]	Female	2 years	Cat cry syndrome, heart failure	–	1 (90 mL)	Water-electrolyte disturbances, tetany	No
Wason *et al.* (1989)[35]	Female	5 months	No	–	1 (adult)	Water-electrolyte disturbances	No
Martin *et al.* (1987)[36]	Male	11 months	Intestinal reconstruction due to imperforate anus	Preparation for surgery	4 (adult)	Water-electrolyte disturbances	Yes
Reedy *et al.* (1983)[37]	Male	1 year	Muscle dystrophy	Constipation	1	Water-electrolyte disturbances, tetany, fever	No
Gómez *et al.* (1981)[44]	Male	1.3 years	Hirschprung	Constipation	2	Water-electrolyte disturbances	No
Davis *et al.* (1977)[38]	Female	4 months	Constipation	Constipation	1	Water-electrolyte disturbances	No
Honig *et al.* (1975)[39]	Male	5 months	Intestinal reconstruction due to imperforate anus	Preparation for surgery	60-mL fleet enema	Water-electrolyte disturbances, tetany, fever	No
Moseley *et al.* (1968)[40]	Male	8 months	Hirschprung	–	2 every 12 h	Water-electrolyte disturbances, tetany	No
Moseley *et al.* (1968)[40]	Male	7 months	Hirschprung	–	½ adult enema	Water-electrolyte disturbances, tetany	No
Moseley *et al.* (1968)[40]	Female	2 years	Hirschprung	–	½ adult enema	Water-electrolyte disturbances, tetany, QT prolongation	No

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Table 2. Adverse effects reported in patients older than 2 years and younger than 18 years

Author/year	Sex	Age (years)	Associated condition	Indication	No. of units administered	Disturbances induced	Death
Butani *et al.* (2005)[56]	Male	11	Neurogenic bladder, end-stage renal failure	Constipation	2 paediatric enemas	Water-electrolyte disturbances, tetany, QT prolongation	No
Marrafa *et al.* (2004)[55]	Female	4	Spinal muscular atrophy	Constipation	2 adults enemas within 4 h	Water-electrolyte disturbances, tetany, QT prolongation	No
Melvin *et al.* (2002)[45]	Male	3	No	Constipation	–	Water-electrolyte disturbances, intravascular haemolysis	No
Ballesteros *et al.* (2001)[46]	Male	3	Lymphoma, liver transplantation	Constipation	1 (80 mL)	Water-electrolyte disturbances	Yes
Helikson *et al.* (1997)[47]	Female	3	Anorectal malformation	Constipation	3 (adult)	Water-electrolyte disturbances, tetany	No
Franch *et al.* (1995)[48]	Female	4	No	Constipation	1 (250 mL)	Water-electrolyte disturbances, tetany	No
Hunter *et al.* (1993)[49]	Female	4	Constipation	Constipation	2.5 enemas 3 times weekly	Water-electrolyte disturbances, abdominal distention	No
Edmonson *et al.* (1990)[50]	Male	4	Constipation	Constipation	3 (adult)	Water-electrolyte disturbances, QT prolongation	No
Forman *et al.* (1979)[51]	Female	3	Gaucher	–	2	Water-electrolyte disturbances	No
Sotos *et al.* (1977)[52]	Female	3	Myelomeningocele	Constipation	2	Water-electrolyte disturbances, tetany	No
Davis *et al.* (1977)[38]	Male	3	Constipation	–	1	Neurological disturbances	No
Oxnard *et al.* (1974)[53]	Male	5	Chronic renal failure, congenital urinary obstruction	–	1 (adult)	Water-electrolyte disturbances, tetany, QT prolongation	No
Swerdlow *et al.* (1974)[54]	Male	3	Pyloric stenosis	Constipation	1 (undiluted Fosfosoda)	Water-electrolyte disturbances, tetany	No
Moseley *et al.* (1968)[40]	Female	3	Hirschprung	–	–	Water-electrolyte disturbances, tetany, QT prolongation	No

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Table 3. Adverse effects reported in patients aged 18–65 years

Author/year	Sex	Age (years)	Associated condition	Indication	No. of units administered	Disturbances induced	Death
Eckstein *et al.* (2006)[60]	Female	64	Kidney transplantation, hyperpathiroidism, gastrectomy	Constipation	3 (in several days)	Extensive calcifications, liver enzymes elevation, multiorgan failure and shock	Yes
Pitcher *et al.* (1997)[57]	Male	64	Rectal neoplasm	Preparation for colonoscopy	–	Water-electrolyte disturbances, shock, multiorgan failure	Yes
Haskell *et al.* (1985)[58]	Male	58	Polycystic renal disease, chronic renal failure	Constipation	2	Water-electrolyte disturbances, tetany	No
Young *et al.* (1968)[59]	Male	21	Hirschprung	Constipation	4 in 48 h	Water-electrolyte disturbances	No

The indication for enema was constipation in 10 cases (71%),[45–50, 52, 54–56] while no data on indication was found in the remaining four patients (35%).[38, 40, 51, 53] All patients experienced the previously reported water and electrolyte disturbances. Other conditions included tetany in seven cases (50%)[40, 47, 52–56] and QT interval prolongation in five cases (36%).[40, 50, 53, 55, 56] One death (7%) was identified in this group, in a male with a significant comorbidity (gastrointestinal lymphoma and liver transplantation).[46]

Adults aged 18–65 years.

In the adult group, a total of 15 cases with adverse effects were found. Four of these occurred in patients under 65 years of age,[57–60] and 11 in patients over 65 years of age.[61–70] The mean age in patients aged 18–65 years who experienced adverse effects was 52 years. They all had comorbidity of a different severity. Water and electrolyte disturbances occurred in all cases. We found two deaths in this group[57, 60] (Table 3).

Adults over 65 years of age

Finally, 11 clinical cases, eight females and three males with a mean age of 81 years (range: 70–96 years), were found among patients older than 65 years. They all had comorbid conditions. The most common associated conditions were heart diseases, reported in six patients (55%).[61–64, 67, 68] Indications included constipation in nine cases (73%)[61–63, 65–68, 70] and preparation for colonoscopy or barium enema in two patients (27%).[64, 69] As regards the dosage given, seven patients (64%) received three or more units,[61–63, 65, 66, 69, 70] and a maximum of eight doses were received by a single patient.[62] All patients experienced water and electrolyte disturbances (Table 4). Six patients over 65 years of age died (55%).[61–63, 67, 70] Five of these patients (45%) had been given three or more doses,[61–63, 70] and the remaining patient had significant associated comorbidity (acute pulmonary oedema, heart failure and chronic renal failure).[67]

Mortality

Among all aforementioned studies, a total of 12 deaths (27%) were found, six in males and six in females.[33, 36, 41, 46, 57, 60–63, 67, 70] Eleven of such deaths

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Table 4. Adverse effects reported in patients over 65 years of age

Author/year	Sex	Age (years)	Associated condition	Indication	No. of units administered	Disturbances induced	Death
Farah *et al.* (2005)[70]	Male	70	Spondyloartropathy	Constipation	4 enemas within 12 h (133 ml each)	Water-electrolyte disturbances, cardiac arrest	Yes
Tan *et al.* (2002)[61]	Female	73	Heart failure	Constipation	3	Water-electrolyte disturbances	Yes
Tan *et al.* (2002)[61]	Female	82	–	Constipation	3	Water-electrolyte disturbances	Yes
Martinez Velasco *et al.* (1998)[62]	Female	86	Atrial fibrillation	Constipation	8	Water-electrolyte disturbances, tetany	Yes
Knobel *et al.* (1996)[63]	Female	87	Ischaemic heart disease, high blood pressure, megacolon	Constipation	4 in 48 h	Water-electrolyte disturbances, coma, and respiratory failure	Yes
Sutters *et al.* (1996)[64]	Male	71	Chronic obstructive pulmonary disease, high blood pressure, supraventricular tachycardia	Preparation for colonoscopy	2	Water-electrolyte disturbances	No
Korzets *et al.* (1992)[65]	Female	77	Urinary incontinence	Constipation	6 in 12 h	Water-electrolyte disturbances, confusion, QT prolongation, and tetany	No
Aradhye *et al.* (1991)[66]	Female	96	Dementia, gastrostomy	Constipation	2	Water-electrolyte disturbances, lethargy	No
Spinrad *et al.* (1989)[67]	Female	91	Heart failure, acute pulmonary oedema, chronic renal failure	Constipation	1	Water-electrolyte disturbances	Yes
Biberstein *et al.* (1985)[68]	Male	81	Chronic renal failure, atrial fibrillation, atherosclerosis	Constipation	1	Water-electrolyte disturbances, QT prolongation	No
Rohack *et al.* (1985)[69]	Female	77	Diverticulitis	Barium enema preparation	6 in 6 h	Water-electrolyte disturbances, coma, tetany, and fever	No

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Table 5. Dead patients

Author/year	Sex	Age	Associated condition	Indication	No of units administered	Cause of death
Eckstein *et al.* (2006)[60]	Female	64 years	Kidney transplantation, hyperpathiroidism, gastrectomy	Constipation	3 (in several days)	Extensive calcifications, liver enzymes elevation, multiorgan failure and shock
Farah *et al.* (2005)[70]	Male	70 years	Spondylortopathy	Constipation	4 enemas within 12 h (133 ml each)	Water-electrolyte disturbances, cardiac arrest
Tan *et al.* (2002)[61]	Female	73 years	Heart failure	Constipation	3	Pneumonia. Water-electrolyte disturbances
Tan *et al.* (2002)[61]	Female	82 years	No	Constipation	3	Water-electrolyte disturbances
Ballesteros García *et al.* (2001)[46]	Male	3 years	Lymphoma, liver transplantation	Constipation	1 (80 mL)	Water-electrolyte disturbances
Ismail *et al.* (2000)[41]	Male	17 months	Asthma, epilepsy	Constipation	1	Water-electrolyte disturbances
Walton *et al.* (2000)[33]	Male	6 weeks	Premature birth	Constipation	1	Water-electrolyte disturbances, acute renal failure
Martinez Velasco *et al.* (1998)[62]	Female	86 years	Atrial fibrillation	Constipation	8	Water-electrolyte disturbances
Pitcher *et al.* (1997)[57]	Male	64 years	Rectal neoplasm	Preparation for colonoscopy	–	Water-electrolyte disturbances
Knobel *et al.* (1996)[63]	Female	87 years	High blood pressure, ischaemic heart disease	Constipation	4	Water-electrolyte disturbances
Spinard *et al.* (1989)[67]	Female	91 years	Heart failure, acute pulmonary oedema, chronic renal failure	Constipation	1	Water-electrolyte disturbances
Martin *et al.* (1987)[36]	Male	11 months	Imperforate anus, colostomy	Preparation for surgery	4	Water-electrolyte disturbances

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(92%) were due to water and electrolyte disturbances secondary to administration of sodium phosphate enemas. Age of dead patients ranged from 11 months[36] to 91 years.[67] Virtually, all dead patients were at the extreme ages of life. Four deaths (30%)[33, 36, 41, 46] occurred among patients under 18 years of age. In the group of patients over 18 years of age, a total of six deaths (55%)[57, 60–63, 67, 70] occurred in patients aged 64–91 years. Among adult patients aged 18–65 years, death was only reported in two clinical cases (Table 5).

The subgroup of adults who died included six women (75%)[60–62, 67] and two men.[57, 70] All patients under 18 years of age who died were males.[33, 36, 41, 46]

All dead patients except 1 (92%)[61] had associated comorbidity in all age groups studied. (Table 5).

DISCUSSION

Sodium phosphate enemas are products widely used in both in-patient and out-patient settings. The most common indication is for symptomatic treatment of constipation, and to a lesser extent in preparation for colonoscopy or surgery. There are no accurate data about worldwide prescription of these products. According to the manufacturer (Casen/Fleet), more than 5 00 000 000 U have been sold up to now, which can give us an approximate idea of the widespread use of these products.

No randomized clinical trials, meta-analysis or systematic reviews exist in the literature to answer the question of safeness or adverse effects of these products. The side effects are minimal, and literature reports only refer to the most severe cases, such as water and electrolyte disturbances that may even be fatal in some cases. There are various randomized clinical trials comparing the tolerability and efficacy for colon cleaning of several preparation methods for endoscopic procedures. Such trials assessed the side effects of phosphate enemas that were considered to be mild and with no clinical impact. In a US study[3] conducted on 157 patients, nausea (6–18%), vomiting (0–7%) and abdominal pain (8–9%) were reported, while abdominal distention occurred in 90% of subjects receiving one enema and in 98% of patients when two enemas were administered. Atkin *et al.*[2] found similar results in an analysis of 721 patients receiving a sodium phosphate enema.

It should not be forgotten that sodium phosphate enemas are widely used, and our review only found a minimum number of patients with side effects. Specifically, the review conducted found 46 reports of side effects of different severity, which would represent a minimal proportion of side effects if we take into account the widespread use of enemas. Nevertheless, these data should be analysed with caution because of the possible publication bias incurred, as only a minority of side effects may be reported, and they are probably the most severe.

As regards age distribution of patients reported as experiencing side effects, it should be noted that most of them were in the extreme age groups (older than 65 years and younger than 5 years, 25% and 64%, respectively). Only five cases were reported in patients aged from 5 to 65 years. It should therefore be inferred that extreme ages are associated with a greater frequency of side effects.

Comorbid conditions were noted in 86% of cases, particularly including neurological, gastrointestinal and renal disorders. Such associated conditions could be related to the increased phosphate absorption shown in some clinical trials. Thus, in the Schumann *et al.* study[28], high serum phosphorus levels were shown in patients with a longer enema retention time. There have been reports of several experimental studies in animals showing phosphorus absorption in the colonic mucosa,[29, 30] that is dependent on luminal phosphorus levels. By contrast, other studies analysing water and electrolyte disturbances in patients who were prepared for colonoscopy using sodium phosphate enemas only showed a mild increase in serum phosphate levels that did not reach pathological ranges.[26, 28] It could be hypothesized that the existence of increased blood phosphate levels in patients with gastrointestinal disorders could be due to an increased contact between enema contents and the intestinal wall, which would promote phosphorus and sodium absorption.

The actual dosage administered to cases reported in the literature is difficult to assess, as neither the dose nor the composition of enemas are adequately reported in most publications. It should also be noted that formulations differ depending on the country.[75] Moreover, some publications report out-patient administration of adult enemas to paediatric patients. Overdosage was reported in eight clinical cases, and up to eight enemas were administered to a 86-year-old patient.[62] In this respect, it should be noted that most dead patients had been administered two or more enemas. An influence of the dose

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received on adverse effects and their severity is therefore likely.

The side effects reported are related to water and electrolyte disturbances resulting from hyperphosphataemia, hypocalcaemia, hypernatraemia, and metabolic acidosis, because of the absorptive effect of enema components and to their inadequate elimination in some cases, such as patients with chronic renal failure. Therefore, an increased caution is required when enemas are administered to patients with this condition.

It should be noted that virtually all deaths reported in the literature occurred in people with extreme ages and a significant comorbidity. Deaths were caused by water and electrolyte disturbances, by an episode of pneumonia and by an extensive calcification with subsequent multiorgan failure in a patient with renal transplantation and hyperparathyroidism. To sum up, age older than 65 years and under 5 years could be suggested as a potential risk factor for mortality, which could be related to an increase in associated conditions.

To summarize, it may be concluded that water and electrolyte disturbances are the reason for the main side effects occurring in patients administered sodium phosphate enemas. The main risk factors include chronic renal failure, diseases altering intestinal motility (neurological, morphological, etc.), and extreme ages of life. Adequate prescription is required in patients with such conditions, as use of sodium phosphate enemas are not risk-free, although the incidence of side effects is nevertheless very low. By contrast, administration of sodium phosphate enemas does not involve a serious risk for health in patients without such risk factors, who represent the majority of cases.

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Differences in characteristics of nocturnal enuresis between children and adolescents: a critical appraisal from a large epidemiological study

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OBJECTIVE

To evaluate any differences in the characteristics of primary nocturnal enuresis (PNE) between younger enuretic children and adolescents.

SUBJECTS AND METHODS

In all, 21 000 questionnaires designed to determine the presence or absence of bed-wetting, diurnal incontinence, frequency of wetting, systemic illness, and family history, were sent to children aged 5–19 years from 67 kindergartens, primary schools and secondary schools randomly selected by a computer from different areas in Hong Kong. In addition, questions were asked to evaluate when and how the parents became aware that bed-wetting is a significant medical problem deserving attention in children after the age of 5 years.

RESULTS

Of the 21 000 questionnaires distributed, 16 512 (78.6%) were completed. Among the respondents, 512 children (302 boys, 210 girls) had PNE; of these, 106 (20.7%) also had daytime incontinence. There was a marked reduction in the overall prevalence of PNE with advancing age. At 5 years old, 16.1% of children had PNE (20.7% boys, 10.8% girls; at age 9 and 19 years, 3.14% and 2.2% of children had PNE, respectively. However, this reduction was significantly more apparent among those with mild enuretic symptoms (wet <3 nights/week) than in those with more frequent bed-wetting. Furthermore, younger enuretic children behaved very differently from adolescents and older patients. As age increased there was a significant tendency towards more severe enuretic symptoms. At age 5 years, 14.3% of enuretic children wet 7 nights/week, compared with 48.3% at age 19 years ($P < 0.001$). In addition, significantly more adolescent boys aged >10 years had daytime urinary incontinence than had enuretic children aged ≤10 years (32% vs 14.6%, respectively, $P < 0.001$). Most (89%) parents only became aware that bed-wetting was a significant medical problem deserving attention through material in the mass media over the past 3–4 years.

CONCLUSIONS

The present finding suggesting that PNE spontaneously resolves with increasing age probably applies only to those with mild enuretic symptoms. There are significant differences in characteristics between younger enuretic children and older subjects. As age increases there is an increasing proportion of enuretic patients with more severe bed-wetting. Enuretic children aged >10 years and adolescents have significantly more daytime urinary symptoms and incontinence. The previously reported low prevalence of PNE in Hong Kong was probably due to parental indifference to the problem.

KEYWORDS

primary nocturnal enuresis, adolescents, daytime symptoms

INTRODUCTION

Primary nocturnal enuresis (PNE), or bed-wetting, is a very common clinical and a significant social problem in childhood and adolescence. From published epidemiological studies it is apparent that although the values vary somewhat among different countries, the overall prevalence of PNE remains relatively constant, irrespective of geographical locations. It was estimated that 20–25% of children by the age of 4 years and 10% of children at 7 years are frequent bed-wetters [1–5]. In general, the prevalence decreases with increasing age. However, the condition often has a profound psychological and social impact on the affected children and their families, and generates significant anxiety and even conflicts among them.

A previous epidemiological survey for PNE in Hong Kong in 1995 indicated that the prevalence of PNE in local Chinese school children was surprisingly lower than all reported series from elsewhere [6]. Since then, public educational programmes both in Hong Kong and in surrounding Asian countries have been introduced. In addition, mass screening for PNE in Hong Kong through the local Student Health Service has been implemented. Concurrently, in a tertiary referral centre for PNE, we have seen a rapid increase in severely enuretic children, many of whom have never been regarded by their parents as having a medical problem until very recently. Similarly, results of the subsequent epidemiological studies in other Asian countries indicate a much higher prevalence of PNE than that reported previously in Hong Kong, and were similar to values reported in other western countries. To re-evaluate the actual prevalence of PNE among local children, a repeat epidemiological study

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involving a much larger sample was therefore conducted.

SUBJECTS AND METHODS

Children aged 5–19 years from 67 kindergartens, primary schools and secondary schools, with a greater emphasis on adolescents and teenage groups, were randomly selected among different areas of Hong Kong. A self-administered questionnaire comprising two sections, identical to that used in our previous study, was designed [6]. The first part of the questionnaire determined the demographic details, e.g. age, sex, and family history of enuresis; the second part included questions about the details of bed-wetting problems, if any. Questions included were the presence of daytime wetting, night-time wetting and frequency of wetting. In addition, questions were set to ask the parents when and how they became aware that bed-wetting was a significant medical problem that deserves attention in children after the age of 5 years.

Based on findings from our previous epidemiological study, and given an expectation that up to 2.5–3% of children and adolescents in Hong Kong are likely to have PNE, 21 000 questionnaires were sent to different schools, to ensure an adequate number of enuretic subjects for further statistical analysis. Sealed envelopes were provided to return the questionnaires and to ensure confidentiality. An information leaflet was attached to the questionnaire informing the parent of the voluntary nature of the study. All unreturned and incomplete responses were considered as nonresponders. Enuresis was defined as having at least one wet night every 3 months, as described previously [6]. To evaluate the factors associated with the severity of enuresis, subjects with enuresis were stratified by age. The frequency of bed-wetting was divided into three severity subgroups as <3, 3–6 or 7 wet nights/week, respectively.

The chi-square exact probability test was used to compare the prevalence in PNE between boys and girls in corresponding age groups, and to compare the severity of PNE and associated day symptoms in children and adolescents. To identify significant differences in the prevalence of PNE in boys and girls between different age groups, the chi-square test for trend was used, with $P < 0.05$ considered to indicate statistical significance.

FIG. 1. Prevalence of PNE in Hong Kong schoolchildren.

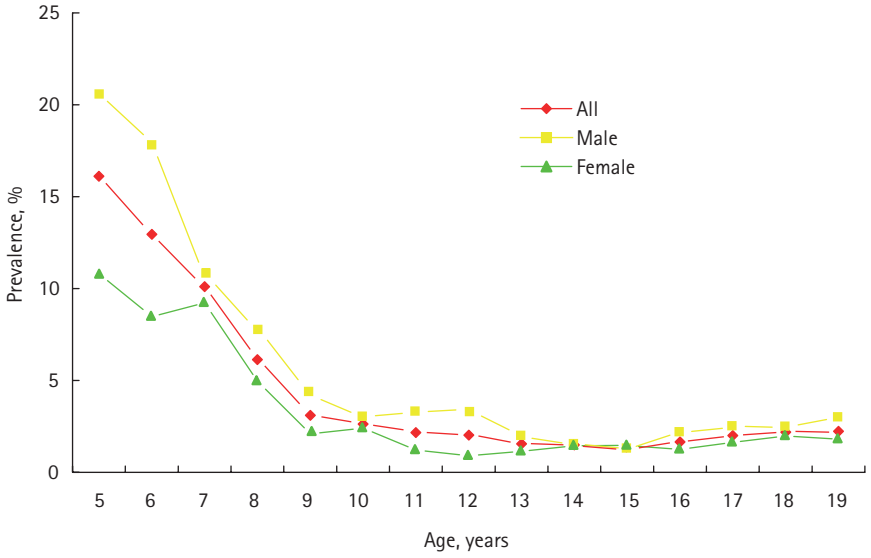

TABLE 1 The prevalence of PNE in Hong Kong school children

Age, years	Male enuretics/normal	Female enuretics/normal	Total enuretics/normal	Mean % (95% CI)
5	48/232	22/203	70/435	16.11 (12.6–19.50)
6	38/212	20/236	58/448	12.95 (9.8–16.10)
7	36/335	23/249	59/584	10.1 (7.7–12.5)
8	19/244	17/342	36/586	6.14 (4.2–8.1)
9	19/445	11/523	30/968	3.14 (2.0–4.2)
10	11/365	15/621	26/986	2.63 (1.6–3.6)
11	16/485	7/573	23/1058	2.17 (1.3–3.1)
12	15/433	5/554	20/987	2.02 (1.1–2.9)
13	10/506	6/520	16/1026	1.55 (0.8–2.3)
14	8/523	7/481	15/1004	1.49 (0.7–2.2)
15	7/621	8/546	15/1167	1.28 (0.6–1.9)
16	22/1014	16/1277	38/2291	1.65 (1.1–2.2)
17	20/803	17/1040	37/1843	2.0 (1.4–2.6)
18	19/768	21/1060	40/1828	2.19 (1.5–2.9)
19	14/469	15/832	29/1301	2.23 (1.4–3.0)
Total	302/7455	210/9057	512/16512	3.10 (2.8–3.4)

RESULTS

Of the 21 000 questionnaires distributed, 16 512 (78.6%) were completed, from 7455 (45.1%) boys and 9057 (54.9%) girls (mean age 13.68 years). Among these, 512 children had PNE, giving an overall prevalence of 3.1% (4.0% boys and 2.31% girls); of these 512, 106 (20.7%) also had daytime urinary incontinence. There was a marked reduction in the overall prevalence of PNE with increasing age (Fig. 1). At age 5 years, 16.1% (20.7% boys, 10.8% girls) children had PNE, at 7 years, 10.1% (10.7% and 9.2%, respectively) and at 9 and 19 years, 3.14% and 2.2% had PNE, respectively (Table 1). Table 1 also shows that there was a significant and decreasing trend in the prevalence of PNE in both genders with age (both $P < 0.001$).

Although there was a marked reduction in the overall prevalence of PNE with increasing age, it was significantly more apparent among those with mild enuretic symptoms (<3 wet nights/week) than in those with more frequent bed-wetting (Fig. 2). Overall, 82% of

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FIG. 2. Severity of PNE in children.

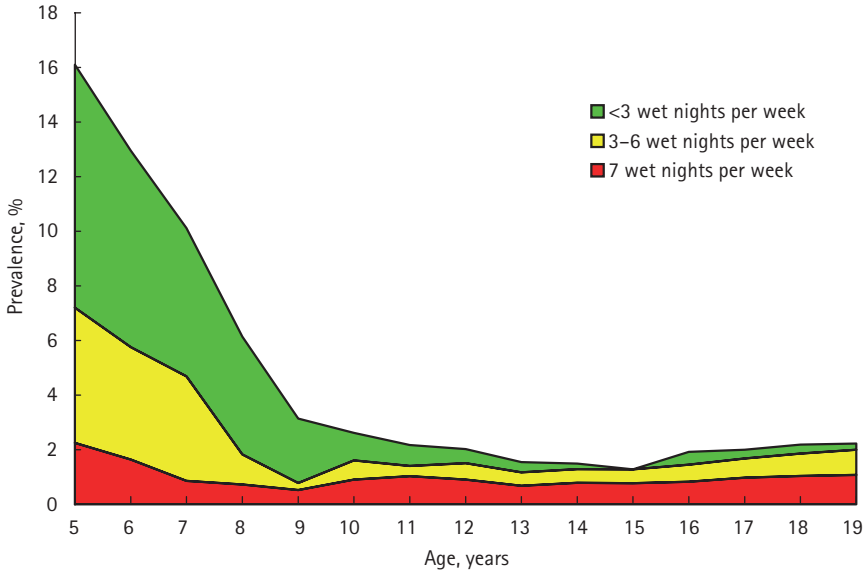

FIG. 3. Severity of PNE vs age.

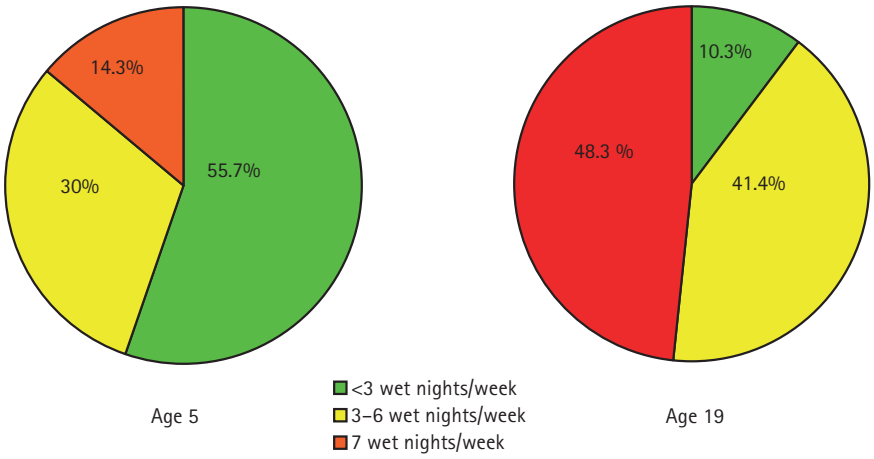

TABLE 2 The severity of NE in younger children and adolescents, and the incidence of daytime urinary incontinence in enuretic younger children and adolescents, as n (%)

Condition	Children (5–10 years)	Adolescents (>10 years)	Total	P
Severity of PNE				
<3 wet nights/week	161/279 (57.7)	42/233 (18.0)	203/512	<0.001
>3 wet nights/week	118/279 (42.3)	191/233 (82.0)	309/512	<0.001
Daytime continence				
Male	25/171 (14.6)	42/131 (32.1)	67/302	<0.001
Female	13/108 (12.0)	26/102 (25.5)	39/210	<0.001
Total	38/279(13.6)	68/233 (29.2)	106/512	<0.001

the adolescent subjects had >3 wet nights/week vs enuretic children aged 5–10 years (42.3%, $P < 0.001$, Table 2). As age increased there was a greater proportion of enuretic subjects with more severe bed-wetting. Daytime urinary incontinence was significantly more prevalent in adolescents than enuretic children (Table 2). Moreover, the prevalence of daytime urinary incontinence was significantly greater in adolescent boys than in boys aged 5–10 years (32% vs 14.6%, respectively, $P < 0.001$). In general, enuretic symptoms in the adolescent subjects were more severe than those in children. At age 5 years, only 14.3% of enuretic children wet 7 nights/week, compared with 48.3% at age 19 years ($P < 0.001$; Fig. 3).

Of the children with PNE, 39% considered that PNE was not a serious problem, while 61% of the children considered it as a serious problem with a significant impact on their daily life. Among these children, 28% became aware of this problem in the last 6 months, 21% had been aware for 1–2 years, 4% for 3–4 years and only 7% for >5 years.

DISCUSSION

Nocturnal enuresis is an old but still prevalent clinical problem in childhood and adolescence. The traditional view is that in most cases bed-wetting is due to a developmental immaturity of voiding control, and most enuretic children will ultimately acquire normal control with age. However, previous studies showed that, although spontaneous resolution can continue throughout childhood and adolescence, enuretic problems may persist in 1.5–3% of the adult population [7–10]. Previous studies also show that the frequency and severity of wetting episodes progressively increases with age; those with severe symptoms are much more likely to have persistent problems into adult life [11,12].

A previous epidemiological study for PNE in Hong Kong revealed a low prevalence in local Chinese schoolchildren; at 5 years old, only 10.4% of boys and 6.6% of girls had PNE. The prevalence decreased rapidly with increasing age and by 7 and 10 years old, only 4.9% and 1.2% of boys and 0.5% and no girls had enuresis, respectively [6]. These values were significantly lower than all previously published series from other countries [1–5,13–18].

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Interestingly, most Chinese traditionally regarded faecal and/or urinary incontinence as normal for young infants and small children until the age of 4–5 years. Until recently, most people, and even medical practitioners, regarded bed-wetting as a normal phenomenon that does not warrant any intervention or treatment. Most parents would be reluctant to take a child with bed-wetting to seek medical advice until a very late age, and even if they do, the advice they receive from the medical practitioner most often would be simple observation, with a reassurance that the condition will disappear with time. This relative indifference or apathy within the Chinese community for PNE probably resulted in the low prevalence values reported in our previous epidemiological survey [6]. However, since the previous epidemiological study in the mid 1990s, an intensive public educational programme on NE has been introduced in Hong Kong, through a series of health talks, seminars, public lectures, featured articles, but most importantly via various mass media channels, including television and radio interviews, newspapers and magazines. In parallel with these there was a rapid increase in public awareness of PNE and the number of enuretic patients encountered in our clinic increased rapidly. Results from the present survey also show that more realistic epidemiological values can be obtained when the target study population has sufficient knowledge and interest in the problem, once misconceptions arising from traditional belief have been corrected.

The most important finding of the present study is that there were significant differences in characteristics between younger enuretic and older children. Although the overall prevalence of PNE decreased with increasing age, the proportion of patients with severe enuretic symptoms (wetting >3 nights/week) progressively increased. A significant proportion of adolescents (82%) had either moderate or severe enuresis, whereas most enuretic children (57.7%) have much milder bed-wetting with less than one enuretic episode/week. At age 5 years, only 14.3% of enuretic children wet 7 nights/week, compared with 48.3% at 19 years old ($P < 0.001$). Notably, the results of a previous epidemiological study of PNE in adolescents and adults up to the age of 40 years indicated that the prevalence of PNE remained rather static, with no further significant decrease after the age of 10 years, and >2% of both men and women remained enuretic. Of these affected adults, over half wet ≥3 nights/week, and a quarter had enuretic symptoms every night [10]. These findings therefore strongly suggest that the enuretic children with more severe symptoms probably have a significantly greater chance of persistent PNE in adult life. It is arguable therefore that for these groups of enuretic children with very severe symptoms, investigations and active treatments should be started at a much earlier age.

PNE is a heterogeneous disorder with various underlying pathophysiological mechanisms, causing in common a mismatch between the nocturnal bladder capacity and the amount of urine produced during sleep at night, in association with a simultaneous failure of conscious arousal, or waking, in response to the sensation of bladder fullness. Recent studies showed the important role of bladder dysfunction, e.g. small functional bladder capacity, instability during sleep, and detrusor hypercontractility caused by BOO, in the pathogenesis of PNE in children, especially those who are refractory to treatment [19–23]. Our previous epidemiological study of PNE in adolescents and adults showed a significantly higher incidence of urinary symptoms (frequency, urgency and incontinence), which were suggestive of underlying bladder dysfunction in adults with PNE, compared to normal controls [10]. Moreover, previous studies on bladder function in adult patients with PNE showed that the great majority (>90%) of adult enuretics had underlying detrusor overactivity, and 70% of the patients had urodynamic evidence of functional BOO [24]. This present study also showed that the incidence of daytime urinary symptoms was significantly higher in adolescents than younger enuretic children aged ≤10 years. The present finding suggesting that PNE will spontaneously resolve with age probably applies only to those with mild enuretic symptoms. Those with severe enuretic symptoms probably represent a more pronounced and refractory form of the condition, often associated with underlying bladder dysfunction, and would be more likely to have persistent enuretic symptoms into adult life [25–29]. This important finding may offer new clues to the poor treatment response in some enuretic patients with very severe symptoms. Further study of this group of adults with PNE, who in general have more pronounced and persistent symptoms than younger enuretic children, may provide further insights into the complex pathophysiology of these various subtypes, and ways to refine the management of this heterogeneous disorder.

In conclusion, PNE is as prevalent in Hong Kong Chinese schoolchildren as in western populations. The present finding suggesting that PNE will spontaneously resolve with age probably applies only to those with mild enuretic symptoms; with increasing age there is a greater proportion of enuretic children with more severe bed-wetting. Enuretic children aged >10 years, and adolescents, have significantly more daytime urinary symptoms and incontinence. The previously reported low prevalence of PNE in Hong Kong was probably due to parental indifference to the problem.

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CONFLICT OF INTEREST

None declared.

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Abbreviations: **PNE**, primary nocturnal enuresis.

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