

A Review of Bowel and Bladder Control Development in Children: How Gastrointestinal and Urologic Conditions Relate to Problems in Toilet Training

Robert M. Issenman, MD, FRCP*; Robert Bruce Filmer, MB, BS‡; and Peter A. Gorski, MD, MPA§

ABBREVIATIONS. UTI, urinary tract infection; CNSD, chronic nonspecific diarrhea.

Urologic and gastrointestinal problems in children are of great concern to parents. In most cases, such problems represent no organic disease or serious behavior disorder but nevertheless can cause more serious complications in toilet training than parents recognize. Although bowel and bladder symptoms in otherwise healthy children typically are transient, untreated issues can spiral into physical, behavioral, and developmental problems that disrupt toilet training and maintenance of bowel and/or bladder continence. Chronic wetting and soiling may persist well into the school years and often are refractory to empirical medical treatment.

Clinical experience, however, suggests that in most children these problems can be managed successfully within the realm of general pediatric practice. Two important tools for evaluation are available to the pediatrician: good normative data on bowel and bladder function in children, and management algorithms for toilet training that emphasize pathophysiologic patterns within the context of normal development. Interventions emphasize early anticipation, breaking predictable behavioral and dietary cycles that can turn acute problems into chronic problems. This is especially important during the toilet training years.

BOWEL AND BLADDER INCONTINENCE IN CHILDREN

Almost all children have wetting and/or soiling accidents at one time or another. As with other models of developmental milestones, transient regressions or delays in toilet training logically can be expected. Bowel maturation typically precedes bladder maturation, which is not surprising, given the respective complexities of the developmental pro-

cesses.¹ An estimated 15% to 20% of children will become partially toilet trained but continue to have wetting accidents after age 5.^{2,3} Additionally, at least 20% of developmentally normal children 18 to 30 months of age may refuse stool toilet training at some point.⁴

Encopresis

Children with encopresis (chronic fecal soiling at age 4 and older) typically soil during the day and are unaware of and unable to control their soiling accidents.⁵ Soiling may be attributable to leakage of liquid feces and mucus surrounding a large fecal mass or to incomplete defecation, when anal sphincter constriction propels some of a partially extruded fecal mass into the clothing and some of it back into the rectosigmoid.⁶ The most severe problems occur when habitual stool withholding leads to paradoxical anal spasm and so-called "functional" megacolon, characterized by a flaccid, overdilated sigmoid colon and rectal insensitivity.⁶ In these cases, children cannot feel when bowel movements occur and hence are at high risk for overflow incontinence.⁷ It is now generally accepted that most children with primary or secondary encopresis (ie, occurring before or after toilet training) do not have serious psychological or behavioral disorders and therefore may be managed in the general pediatric setting.⁸

"Toilet refusal" has additional behavioral nuances in that typically it occurs in children at approximately 3 years of age who have regular bowel movements in their clothing or diapers but refuse to defecate in the toilet.⁹ Toilet refusal and encopresis are generally interchangeable from a clinical standpoint because they share a constellation of symptoms: constipation, low-fiber intake, painful bowel movements, bowel-movement withholding, and/or toilet avoidance. However, knowledge still is uncertain regarding what predisposes children to toilet refusal, whether there is an increased risk for megacolon or overflow incontinence in these children, and indeed even where they fit on the continuum of normal to abnormal bowel function.¹⁰

Enuresis

Enuresis, repeated (at least twice monthly) involuntary voiding during the day or night in otherwise normal children 5 to 6 years of age (or once monthly for older children), is by far the most common type of voiding problem presenting to the office-based pedi-

From the *Childrens Hospital at Hamilton Health Sciences, Hamilton, Ontario, Canada; †Division of Urology, Alfred I. duPont Hospital for Children, Wilmington, Delaware; and §Massachusetts Caring for Children Foundation, Boston, Massachusetts.

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Address correspondence to Peter A. Gorski, MD, MPA, Executive Director, Massachusetts Caring for Children Foundation, 100 Summer St, 14th Floor, Boston, MA 02110.

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atrician.² Most voiding problems arise between toilet training age and puberty (average age, 4.5 years).³ Boys are twice as likely as girls to have nocturnal enuresis.¹¹ It is estimated that at least 20% of children with normal bladders have day and night wetting, and in the vast majority, these problems are self-limiting.^{2,12} Nonetheless, if wetting problems remain unresolved or untreated beyond toilet training age, social incontinence can become debilitating from a psychosocial standpoint—an estimated 5% of 10-year-olds and 2% of 12- to 14-year-olds are estimated to have nocturnal enuresis.^{11,13}

Children with “uncomplicated” enuresis do not have an increased incidence of urologic disease and show normal physical, psychiatric, and neurologic findings, as well as normal urinalysis and urine culture.^{2,3,13} It has been widely, although not universally, accepted that in these children, the normal nocturnal bladder volume simply exceeds the daytime bladder capacity caused by some normal delay in development, such as a delay in the growth of functional bladder capacity.² Other explanations may be that the child simply cannot awaken in time to urinate, possibly because of sleep-arousal disorders and/or nighttime antidiuretic hormone deficiency.² Some of these children also may have a family history of enuresis, slightly delayed developmental milestones, or certain sex-specific behavior problems.^{2,11} In cases of isolated bed-wetting, there generally appears to be a strong learned element, with discernible reinforcements or environmental stressors that disrupt toilet training.¹⁴ Like encopresis, wetting during toilet training can evolve into failure to attain social continence, and early voiding problems can lead to difficulties with peers, as well as parental disapproval, irrational rewards and/or punishments, and possibly physical abuse.^{13,15}

The current descriptive standard for functional bladder abnormalities in the absence of demonstrable neuropathy is the “unstable” bladder, sometimes also called persistence of the “infant” bladder, “uninhibited” bladder, or unstable detrusor muscle of the bladder. These terms all basically connote uninhibited bladder contractions in a child who should have achieved voluntary bladder control. Because all infants have spontaneous bladder contractions and because bladder maturation is a gradual process differing from child to child, an unstable bladder is not by definition abnormal.¹⁶

In the most severe situations, an absence of functional synergy arises between the detrusor and sphincter in the child with uninhibited bladder contractions who habitually constricts the sphincter to stay dry. Children with this syndrome, the “Hinman bladder,” cannot relax the sphincter in the face of detrusor contractions (unlike children with simple unstable bladders, who have normal reflex relaxation of the external sphincter once their bladder starts emptying). The result is a potential buildup of very high intravesicular pressures that can cause structural damage to the bladder and dilatation of the upper urinary tract that, in very severe cases, can cause renal damage.¹⁶ These anatomic changes tend

to persist long after bladder instability and incontinence resolve.²

Children with “complicated” enuresis make up a small but important clinical cohort who require evaluation for functional, anatomic, and/or neurologic abnormalities.² Generally, complicated voiding symptoms are distinguishable by their sudden onset and/or progressive course. In these children, enuresis can be associated with daytime frequency; dribbling; urgency and urge incontinence; polyuria; infrequent voiding; blood in the urine; a weak or intermittent urinary stream; straining to void; or a history of chronic constipation, encopresis, and/or urinary tract infection (UTI).^{2,3,11,16}

EVALUATING ENURESIS AND ENCOPIRESIS SYMPTOMATOLOGY: PATTERNS AND COMMON PREDISPOSING FACTORS

Encopresis and enuresis represent complex arrays of signs and symptoms that have multiple gastrointestinal and genitourinary components, as well as behavioral/environmental elements, including toilet training issues.¹⁷ In treating these conditions, pediatricians need to work closely with parents and patients to identify and address common patterns and predisposing factors that transform transient bowel and bladder symptoms into chronic problems.⁵

Constipation and Withholding Behavior Cycles

Idiopathic diarrhea and constipation are quite common among healthy children. As children approach toilet training age, their stools tend to become more susceptible to abnormal dryness and hardness, or alternatively, to having a longer transit time.^{18–20} Chronic constipation accounts for 3% to 5% of pediatric primary care outpatient visits.²¹ Fortunately, in most cases these problems are transient and self-limiting. In a population sample of healthy children, for example, the proportion of parents registering chronic digestive complaints and constipation in their children decreased from 27% and 16%, respectively, when the children were 22 months old to 5% and 3%, respectively, by the time their children were 40 months old.¹⁸

Despite its usually benign course, however, in the minority of children who are susceptible, constipation poses a real risk of becoming a chronic gastrointestinal disturbance that can have a long-range effect on toilet behavior. Studies have firmly established that young children with severe chronic constipation habitually withhold stools in an attempt to keep hard fecal matter out of contact with sensitive portions of the bowel wall and/or to reduce pain from anal fissures.⁶ During withholding, contraction of the external anal sphincter and nearby muscles ejects the feces back into the rectosigmoid, where the fecal mass dries, hardens, and enlarges.⁶ The resulting fecal impaction predisposes to additional withholding. Hence, withholding sets up a vicious cycle of fecal impaction, pain, and more withholding; in some children, this cycle can have a prolonged impact on toilet use. If untreated, transient changes in bowel function associated with constipation can lead to bowel-control problems.⁵ Fecal soiling and impac-

tion account for approximately one fourth of visits to pediatric gastroenterologists.⁶ Unfortunately, constipation often is occult and can be overshadowed by the primary gastrointestinal or urologic complaint (eg, toilet refusal, daytime wetting, recurrent UTI). Moreover, the symptoms of constipation and its precipitating factors (eg, stool withholding, low-fiber diet) often are not obvious. The central role of constipation in toilet training problems, therefore, cannot be overemphasized to the primary care physician or to parents.

For a variety of reasons, the toilet training process itself can be a primary cause of stool-withholding behavior and constipation. Children using regular toilets rather than a potty chair simply may not have sufficient leverage (because they cannot push against the floor) to eliminate stools.¹⁷ Additionally, the toddler in training may begin to withhold stools as a response to excessive parental pressure to maintain bowel control. Children who initially resist stool toilet training are most likely to become chronic soilers if they habitually withhold stools (thereby promoting fecal impaction and primary encopresis), complete toilet training late (past 42 months of age) and/or have siblings in diapers, or if their parents do not impose limits on soiling behavior.⁴ The importance of initial bowel continence is highlighted by the fact that children with secondary encopresis, particularly those who are managed early (within 12 months), appear to have much less trouble gaining permanent control over their bowel function compared with their peers who were never toilet trained successfully.²² Within the early elementary grades, approximately 1.5% of children are still encopretic, with boys outnumbering girls by five to one.^{11,23}

It is highly significant that a majority of youngsters who do not attain social bowel continence have a history of constipation beginning at toilet training age—indeed, descriptions of early withholding as remembered by parents of older encopretics match the descriptions given by parents of encopretic toddlers.⁶ Typically, an early period of painful defecation sets off a pattern of progressively infrequent defecation that stretches over years, until by school age the child has very infrequent, very large bowel movements and regular (sometimes daily) soiling.⁶ By this age, failure to maintain social bowel continence is associated with intense parental disapproval, feelings of embarrassment or shame, and difficulty in social situations.⁵

Predisposing Dietary Factors

Persistence of an “immature” diet appears to be a cause of transient constipation in susceptible toddlers.¹⁸ Specifically, fiber deficiency has been implicated, because fiber clearly lags behind the increase in other food categories during the preschool years.¹⁸ It has been reported, for example, that between 2 and 4 years of age, calorie and macronutrient intakes rise steeply in proportion to growth requirements, but a child’s total daily fiber intake stagnates at approximately 9.5 grams.¹⁸ It is presumed that most children somehow adjust to a low-fiber diet over time, but a “sensitive” minority may develop clinically signifi-

cant constipation in response to chronic fiber deficiency.¹⁸

Another important dietary symptom frequently presenting to the general pediatrician is an idiopathic gastrointestinal complaint called chronic nonspecific diarrhea (CNSD), which has been labeled the “irritable bowel or colon syndrome of childhood.” This is by far the most commonly seen cause of prolonged diarrhea in otherwise healthy children.^{18,24} CNSD is characterized by recurrent episodes of diarrhea each lasting longer than 3 weeks and typically occurs in children 6 months to 3 years of age.¹⁹ Physical examination and laboratory findings are always normal, and nearly all cases remit spontaneously by the time a child reaches age 4 or is toilet trained. Because CNSD does not include failure to thrive or malabsorption, pediatricians have traditionally managed these children with dietary approaches such as decreasing fluid and carbohydrates (fruit juices) and increasing fat.^{19,25}

Functional Associations Between Constipation, Encopresis, UTI, and Enuresis

Constipation and encopresis were once thought to be independent symptoms in children with urinary incontinence but are now known to interfere directly with bladder function.²⁶ Today, complicated enuresis is often characterized as being part of a classic symptom complex including UTI, encopresis, and constipation.² The implications of this relationship for the general practice setting are tremendous; simple strategies for managing constipation and UTI aggressively may preclude extensive urologic evaluation and treatment in the overwhelming majority of children.²⁶ As noted, however, physicians often miss constipation in children with bladder complaints, even after extensive urologic evaluation. Furthermore, parents may notice constipation but disregard it as an incidental symptom and never bring it to clinical attention.²⁷

The triangular relationship between unstable bladder, vesicoureteral reflux, and recurrent UTI also cannot be overemphasized. Approximately 60% of children with recurrent UTI have an unstable bladder, and approximately 30% also have vesicoureteral reflux. Conversely, possibly half of children with vesicoureteral reflux and an unstable bladder have no history of UTI.^{2,12,16} In all these instances, bladder instability is the common factor for three concurrent urologic disturbances in otherwise healthy children.^{12,28} A proposed mechanism for this connection is that increased intravesicular pressure leads to recurrent UTI (possibly attributable to reduced arterial blood flow within the bladder or to increased contact of the bladder with infected urine), with attendant structural derangements in the genitourinary tract. These derangements in turn predispose to vesicoureteral reflux. This theory is supported by evidence that UTI is common in children with diurnal enuresis or secondary nocturnal enuresis, symptoms that are associated highly with bladder instability, and also that eradication of UTI confers long-term protection against enuresis in some cases.^{2,16}

Fecal retention, leading to hardening of the feces

and constipation, can be a predisposing factor for UTI, although the reason for this is unclear. In patients with voiding dysfunction, incomplete evacuation of the bladder, in association with the constipation, could be a contributing cause of the urinary infection.²⁹ Some patients with voiding dysfunction have detrusor/sphincter dyssynergia, which results in high-pressure voiding. In time, such pressure in the bladder can cause secondary vesicoureteral reflux,¹² which in combination with urinary infection, has the potential to damage the kidneys.²⁷ An extreme form of this condition is called the Hinman syndrome.

THE PEDIATRIC-ORIENTED DIAGNOSTIC ALGORITHM

The pediatric-oriented approach to diagnosing encopresis and enuresis emphasizes integrating medical and behavioral data and evaluating the impact of toilet training and treatments on both bowel and bladder symptoms.^{11,13} This approach alerts the physician to predictable patterns of symptoms and to worrisome signs and symptoms that warrant additional assessment. The first element of this approach is the medical evaluation, including physical examination, urine culture and urinalysis, rectal examination, and urodynamic testing if warranted. The second element is the comprehensive clinical interview, including the individual/family medical history, developmental and dietary history, emotional/psychological factors, toilet training, and parental attitudes/responses to accidents. The final element is baseline behavioral recordings (eg, via a voiding diary).

Medical Evaluation for Voiding Dysfunction

Isolated nocturnal enuresis requires a full history; physical examination; urinalysis (specific gravity, glycosuria, proteinuria); and urine culture and sensitivity. Daytime/nighttime wetting, stress/giggle incontinence, urgency incontinence, dysuria, weak urine stream, constantly damp underwear, or urinary infrequency warrant assessment for bladder neuropathy and/or an unstable bladder. In practice, moreover, the pediatrician may commonly see children with occult unstable bladder who present for evaluation of recurrent UTI or vesicoureteral reflux but not for wetting problems.¹⁶ Indeed, most children with vesicoureteral reflux do not have obvious voiding dysfunction, although approximately half of children with such problems show signs of reflux suggestive of some degree of intravesicular disturbance.^{2,28}

That bladder instability can go undetected is not surprising, because clinical manifestations can be very subtle or absent, possibly as a result of individual variations in external urinary sphincter tone.^{3,16} The two thirds of children who present with urgency, frequency, and urge incontinence ostensibly have very powerful bladder contractions and normal sphincter activity. Apparently, the remainder have overactive sphincters and thus manage to maintain continence at the expense of extremely high intravesicular pressures that cannot be relieved until detrusor contractions stop or emptying occurs. The unsta-

ble bladder in turn requires routine evaluation for related problems, including signs of constipation and encopresis; physical examination of these children may reveal an enlarged bladder, normal anal sphincter tone, and perhaps fecal impaction.³

Probably the most important routine requirement of the medical evaluation, therefore, is to rule out bladder instability in children who present with recurrent UTI. In the typical scenario of the child with daytime/nighttime wetting, a physical and neurologic examination, urinalysis, urine culture, screening, and renal and bladder ultrasound scan would be performed. Ultrasound generally is not a specific diagnostic tool in these cases, but it is helpful for reassuring parents that there is no organic cause of bladder obstruction. Sonography entails obtaining multiple views of both the kidneys and the bladder (before and after voiding) to rule out bladder wall thickening and trabeculation, increased postvoid residual urine volume, and lower ureteral dilatation.² Urethral dilation and cystoscopy are rarely, if ever, indicated, but cystography might be useful if the physical and neurologic evaluation indicates bladder/sphincter incoordination to exclude the possibility of vesicoureteral reflux.

The differential diagnosis for suspected complicated enuresis also includes diabetes mellitus, cystitis (which can be associated with vesicoureteral reflux), abnormal renal function, Hinman bladder or neurogenic bladder, and congenital malformations of the lower urinary tract such as an ectopic bladder (in females) or a posterior urethral valve (in males). Additional laboratory tests and investigations for these patients include postvoid residual urine, renal and bladder ultrasound, uroflometry, cystometry/radiography/electromyography of the external urinary sphincter, and voiding cystourethrography.

Physical examination should involve the abdomen, to assess for renal and/or bladder masses; the external genitalia, where skin rashes or urine leakage may be apparent; and the lumbosacral spine, where midline lesions may be seen. Bone formation, perineal sensation, anal sphincter tone, and lower limb function/gait also should be included in the work-up. It is important to note that the absence of somatic stigmata does not rule out neuropathy automatically; other warning signs include sudden onset of voiding dysfunction, large residual urine volume, large-capacity bladder problems ("lazy bladder") and/or straining to urinate, and a positive history for orthopedic and/or neurologic disease.¹⁶

Comprehensive Clinical Interview

The clinical interview provides essential clues for constructing the diagnosis of enuresis and encopresis. The pediatrician's key objectives during the interview are to identify pathophysiologic patterns within the presentation of symptoms and to gain an understanding of the primary contexts (eg, toilet training) within which the problems started. When interviewing parents and patients, the pediatrician can develop a line of questioning designed to determine the precise parameters of bowel and bladder function. Questions also should include the age at

which toilet training was completed and ease of toilet training. Parents should be asked about stressful or emotional events (eg, new home, new baby), as well as about possible pressures related directly to toilet training, that may have contributed to atypical elimination patterns after several months or more of continence. Some children have behavioral problems sufficient to cause enuresis or encopresis. In these cases, it is important to ascertain any persistent sadness or irritability or a change in eating or sleeping habits.³⁰ Although unusual, the possibility of significant emotional problems must be considered, along with referral to a pediatric psychologist or other specialist.

Although emotional factors may not require a specialist, they can interfere significantly with bowel and bladder continence. Persistent bed-wetting or stool-withholding may represent a delayed response to excessive parental pressure on the child to complete toilet training before the child is ready or to situations that evoke new fears and/or insecurities, as mentioned previously.³⁰ For example, daytime frequency/urgency commonly occurs in continent children as a transient response to a temporary stressful situation, in which the child constantly voids small volumes through the waking hours only.²

The pediatrician's line of inquiry also must address whether the child previously had "normal" bladder continence and whether symptoms are intermittent, or began suddenly and/or are progressive. The physician and parents should remember that intermittent wetting or soiling can be caused simply by a delay in getting clothing off or inadequate wiping after using the toilet. The age at which the problem started also is important in the diagnostic algorithm, because, for example, older children are more likely to have occult bladder instability or significant damage from intravesicular pressure, as well as significant behavioral problems. History of recurrent urinary infection or constipation naturally also are valuable clues.

The physician also should watch the male child during the act of elimination, if possible. Such physical observations can be particularly helpful when lines of questioning miss key information about abnormal elimination parameters.^{2,11} For example, infrequent voiders (lazy bladder syndrome) are typically school girls who present with recurrent UTI, often with intermittent enuresis, with parents explaining that the child "waits until the last minute" to void. The true (ie, neuropathic) nature of the voiding problem is often missed, unless the physician asks specific questions about it and learns that the child has abnormally few voids—that is, the child may wait at least an hour after waking to void and may void only two to three times daily, often not at all during school.² However, straining during urination is often obvious in these children, because the pathophysiology often includes abnormally few detrusor contractions and a large-capacity bladder. Additionally, although bladder instability is generally identifiable by a pattern of nocturnal/diurnal wetting, an extremely specific sign of bladder instability is "Vincent's curtsy"—a squatting posture in girls in

which the heel compresses the perineum and thereby obstructs the urethra to prevent urinary leakage.³

Baseline Elimination Behavioral Recordings

An elimination diary kept by the parents is an important way to supplement the history with detailed information about the child's bowel and bladder function parameters and about behavioral factors that may prove integral to resolving the problem. Close collaboration with parents is required to instruct them on how to detail the child's daily urine and bowel frequency and all the circumstances of each elimination (eg, location, child's behavior, quantity, and quality). The information provided by baseline recordings also is invaluable for weighing the costs and benefits of a treatment program as well as for tracking subtle but important nuances in treatment progress, such as reductions in the number and/or size of daily accidents as opposed to the number of accident-free days.¹¹

ATTAINING CONTINENCE: CONSISTENCY IN TOILET TRAINING GOALS

Goals for Parents and Pediatricians

The ultimate treatment goals for children with enuresis and encopresis are toilet training success and social continence. Clinical experience demonstrates the importance of providing early support to parents so that interventions are both timely and successful over the long term. Current urologic therapies (eg, moisture alarms, antidepressants, desmopressin acetate) and dietary therapies are entirely empirical and of limited effectiveness, and as with elimination diets, may even prolong the original symptoms. For example, the antidepressant imipramine, the most popular drug for treating bed-wetting in children, has a 70% relapse rate.³¹ Specialists may be consulted to obtain reassurance that there is no organic disease when the problem has lingered beyond toilet training or has eluded initial treatments. Unfortunately, extensive gastrointestinal and urologic work-ups often are more traumatic and injurious to the child than the symptoms themselves.³ Such procedures are best reserved for children with demonstrated kidney, bladder, or upper urinary tract deterioration or severe anal fissures or signs of megacolon, or those who have failed to improve on therapy.

The vast majority of children do not have functional, anatomic, or neurologic/psychiatric disorders and do not require extensive work-ups or treatments. Thus, the pediatrician's goals should be to listen to complaints conservatively, recognize and disregard transient symptoms, maintain watchful waiting over intermittent symptoms, and undertake to rule out organic causes.³ Equally important, physicians must increase parents' and their own awareness of symptoms and their significance. The role of constipation should be particularly emphasized to parents, focusing on specific symptoms (eg, hard bowel movements, passage of blood in the stool). Parents also need to be made aware that enuresis and encopresis generally resolve on their own, children do not have control over accidents, and arbitrary rewards or pun-

ishments cannot ensure that the child will not wet or soil and may only worsen the situation. Finally, it is important for the physician and parents to recognize that psychosocial issues associated with encopresis and enuresis during toilet training differ qualitatively from issues in older children who are unable to attain social continence.

Integrated Behavioral/Medical Strategies

Optimal behavioral-oriented approaches to treating enuresis and encopresis in the primary care setting include correcting constipation (with specific dietary adjustments and aggressive medications, if needed), anticipating and breaking cycles that can transform symptoms into chronic wetting and soiling problems, and medically managing the unstable bladder. Addressing behaviors relating to toilet training is central to these efforts. For example, parents need behavioral strategies to cope with young children in whom prolonged gastrointestinal problems have become conditioned aversive stimuli leading to toilet refusal (ie, the child associates pain and discomfort with defecation). Some of these children will sit on, but not urinate or defecate into, the potty chair or toilet, claiming that they do not know when they are about to urinate or have a bowel movement, whereas others may start out enthusiastic about toilet training but become extremely toilet-phobic and refuse even to approach the toilet.^{5,7} The practitioner therefore must be prepared to work with parents on ways to use positive reinforcement techniques to reestablish the child's desire to eliminate into the potty chair or toilet. An important way for parents to break the cycle is to encourage children to defecate as soon as they feel the urge and to take as much time on the potty chair or toilet as they want. A relaxed, pressure-free attitude is crucial to helping the child avoid future soiling accidents.¹⁵ Pediatricians also may need to provide psychological support to parents and patients with regard to reducing the gastrointestinal symptoms themselves; for example, as with adult irritable bowel syndrome, chronic diarrheal symptoms in children are exacerbated by physical or emotional stress.^{24,25}

Long-term success has been reported with integrated medical/behavioral strategies that mentally and physically help the child to reestablish discriminatory bowel control. Many studies support the aggressive, short-term, physician-directed use of laxatives to relieve pain-associated withholding.^{21,26} High parental satisfaction and long-term benefits have been reported recently with a regimen integrating lubricants, high-fiber foods, and positive reinforcement of appropriate toilet behavior. Others advocate a regimen integrating suppositories and negative reinforcement of inappropriate toilet behavior.¹⁰ However, parents' fears about using enemas, suppositories, and laxatives in general, as well as real practical limitations imposed by time and ability to carry out such treatments, may pose significant barriers to their acceptance by parents and other caregivers.¹⁰ Less invasive alternatives, including dietary fiber supplementation (fruits, vegetables, whole grains, and bran), may prove helpful.¹⁸

Dietary Strategies

Because most preschool children never become symptomatic on high-carbohydrate diets, blanket recommendations for making dietary changes in toddlers with chronic gastrointestinal complaints probably are not necessary. However, it has been suggested that small dietary alterations to correct the carbohydrate overload could be worthwhile for susceptible children, who theoretically might be predisposed to carbohydrate malabsorption or other problems.¹⁸ Some success in relieving chronic diarrhea has been reported with dietary modifications ranging from temporarily eliminating apple juice or reducing all liquids to increasing the proportion of fat calories.^{19,20,32} Aside from the possibility of reduced carbohydrate malabsorption, the mechanism behind the observed benefits is unclear; it simply may be that carbohydrates and fats have reciprocal effects on gastrointestinal motility and therefore may, respectively, speed up and slow down gastrointestinal transit time.¹⁹

Dietary interventions to treat chronic constipation and/or diarrhea must be appropriate to the child's developmental stage, both in terms of nutritional requirements and a toddler's (typically exasperating) eating patterns. Part of this means teaching parents that healthy children automatically take in the appropriate amount of calories and that toddlers normally are finicky eaters and may have strong preferences for high-carbohydrate foods. Therefore, an important way in which practitioners can help parents to implement dietary interventions successfully is to emphasize that it is best to try to maintain a relaxed attitude at the table.

Medical Management of the Unstable Bladder

Although it should be expected that spontaneous bladder contractions eventually will resolve in a neurologically normal child, anticholinergic agents can be a highly successful interim measure for reducing detrusor hyperactivity and increasing the threshold volume at which contractions occur, thus enlarging the functional capacity of the bladder.² It has been shown that a conservative course of treatment combining prophylactic antibiotics to treat UTI with anticholinergic agents can help to control spontaneous bladder contractions, reduce the rate of reinfection, and speed the resolution of reflux, possibly precluding surgery for vesicoureteral reflux in some patients.^{2,12} Reduction in fluid intake is considered to be an important adjunctive measure to such regimens, but physicians and parents often are reluctant to do this because treatments for acute UTI emphasize excessive fluid intake.¹² Moreover, if constipation and fecal impaction also are problems, anticholinergic drugs and fluid reduction must be used cautiously, because exacerbation of fecal impaction naturally will only contribute to the problem.¹² In these instances, aggressive treatment of constipation with dietary modifications and short-term enema use has been shown to resolve UTI, encopresis, and voiding problems.²⁶

CONCLUSIONS

The office-based pediatrician must recognize that chronic gastrointestinal and urologic complaints typically represent no serious organic disease or behavioral problems but nonetheless can cause significant complications in toilet training. Enuresis and encopresis often are behavioral manifestations of benign gastrointestinal and urologic symptoms that, if untreated, can create vicious cycles of incontinence and increased predisposition to more serious physical and behavioral problems. The generalist treating children with chronic gastrointestinal and urologic complaints needs to use various data-gathering skills and work closely with parents to anticipate toilet problems, identify symptom patterns and predisposing factors, and single out the few children who may have true underlying organic disease and/or psychiatric problems. Minimally invasive approaches, such as dietary adjustments and anticholinergic agents, when accompanied by behavioral techniques, often are the best way to break these cycles early and to ensure long-term success in toilet training and continence.

REFERENCES

1. Brazelton TB. A child-oriented approach to toilet training. *Pediatrics*. 1962;29:121-128
2. Rushton HG. Wetting and functional voiding disorders. *Urol Clin North Am*. 1995;22:75-93
3. Koff SA. Evaluation and management of voiding disorders in children. *Urol Clin North Am*. 1988;15:769-775
4. Taubman B. Toilet training and toileting refusal for stool only: a prospective study. *Pediatrics*. 1997;99:54-58
5. Stadtler AC. Preventing encopresis. *Pediatr Nursing*. 1989;15:282-284
6. Partin JC, Hamill SK, Fischel JE, Partin JS. Painful defecation and fecal soiling in children. *Pediatrics*. 1992;89:1007-1009
7. Ashkenazi Z. The treatment of encopresis using a discriminative stimulus and positive reinforcement. *J Behav Ther Exp Psychiatry*. 1975;6:155-157
8. Friman PC, Mathews JR, Finney JW, Christophersen ER, Leibowitz JM. Do encopretic children have clinically significant behavior problems? *Pediatrics*. 1988;82:407-409
9. Christophersen ER, Rapoff MA. Toileting problems in children. In: Walker CE, Roberts MC, eds. *Handbook of Clinical Child Psychology*. 2nd ed. New York, NY: Wiley; 1992:399-411
10. Luxem MC, Christophersen ER, Purvis PC, Baer DM. Behavioral-medical treatment of pediatric toileting refusal. *Dev Behav Pediatr*. 1997;18:34-41
11. Howe AC, Walker CE. Behavioral management of toilet training, enuresis, and encopresis. *Pediatr Clin North Am*. 1992;39:413-432
12. Koff SA, Murtagh DS. The uninhibited bladder in children: effect of treatment on recurrence of urinary infection and on vesicoureteral reflux resolution. *J Urol*. 1983;130:1138-1141
13. Doleys DM, Dolce JJ. Toilet training and enuresis. *Pediatr Clin North Am*. 1982;29:297-313
14. Young GC. The aetiology of enuresis in terms of learning theory. *Med Officer*. 1965;19-23
15. Schmitt BD. Seven deadly sins of childhood: advising parents about difficult developmental phases. *Child Abuse Negl*. 1987;11:421-432
16. Fernandes E, Vernier R, Gonzalez R. The unstable bladder in children. *J Pediatr*. 1991;118:831-837
17. Christophersen ER. Toileting problems in children. *Pediatr Ann*. 1991;20:240-244
18. Issenman RM, Hewson S, Pirhonen D, Taylor W, Tirosh A. Are chronic digestive complaints the result of abnormal dietary patterns? Diet and digestive complaints in children at 22 and 40 months of age. *Am J Dis Child*. 1987;141:679-682
19. Cohen SA, Hendricks KM, Mathis RK, Laramie S, Walker WA. Chronic nonspecific diarrhea: dietary relationships. *Pediatrics*. 1979;64:402-407
20. Greene HL, Ghishan FK. Excessive fluid intake as a cause of chronic diarrhea in young children. *J Pediatr*. 1983;102:836-840
21. McClung HJ, Boyne LJ, Linsheid T, et al. Is combination therapy for encopresis nutritionally safe? *Pediatrics*. 1993;91:591-594
22. Taubman B, Buzby M. Overflow encopresis and stool toileting refusal during toilet training: a prospective study on the effect of therapeutic efficacy. *J Pediatr*. 1997;131:768-771
23. Levine MD. Encopresis: its potentiation, evaluation, and alleviation. *Pediatr Clin North Am*. 1982;29:315-330
24. Davidson M, Wasserman R. The irritable colon of childhood (chronic nonspecific diarrhea syndrome). *J Pediatr*. 1996;69:1027-1038
25. Lloyd-Still JD. Chronic diarrhea of childhood and the misuse of elimination diets. *J Pediatr*. 1979;95:10-13
26. Yazbeck S, Schick E, O'Regan S. Relevance of constipation to enuresis, urinary tract infection and reflux. *Eur Urol*. 1987;13:318-321
27. O'Regan S, Yazbeck S. Constipation: a cause of enuresis, urinary tract infection and vesico-ureteral reflux in children. *Med Hypotheses*. 1985;17:409-413
28. Koff SA, Lapides J, Piazza DH. Association of urinary tract infection and reflux with uninhibited bladder contractions and voluntary sphincteric obstruction. *J Urol*. 1979;122:373-376
29. Cox C, Hinman F Jr. Experiments with induced bacteriuria, vesical emptying and bacterial growth on the mechanism of bladder defense to infection. *J Urol*. 1961;86:739-748
30. American Academy of Child and Adolescent Psychiatry. American Academy of Child and Adolescent Psychiatry Web site. Available at: <http://www.aacap.org/facts/fam/bedwet.htm>. Accessed Sept 2, 1998
31. National Enuresis Society. National Enuresis Society Web site. Available at: <http://www.peds.umn.edu/Centers/NES>. Accessed Sept 2, 1998
32. Hyams JS, Leichtner AM. Apple juice: an unappreciated cause of chronic diarrhea. *Am J Dis Child*. 1985;139:503-505

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