Case-Based Learning – Elimination and Nocturnal Enuresis

Objectives
1. Understand normal development of behaviour and physiology that leads to readiness for toilet learning
2. Understand the child oriented approach to toilet learning
3. Describe the causes of daytime wetting.
4. Discuss the pathophysiology and causes of nocturnal enuresis.
5. Understand the behavioral treatment of incontinence.
6. Know the medical treatments for nocturnal enuresis.

Case – Part I
Madeline is a 18 month-old female brought to your office for her regular well-child visit. Madeline is the first child for her parents. She is previously healthy, and her mother, Samantha, reports that she is meeting her developmental milestones as expected. Near the end of the visit, Samantha asks you, “When can I start toilet training Maddie? Is now the right time?”

As a group, please discuss the signs of toilet learning readiness you would ask about.

<Pause for discussion>

Samantha reports that Madeline has been walking independently since 13 months of age. She is currently running, and is able to walk up stairs holding on to the rail. She is also able to bend over, squat, and pick up objects on the floor. Madeline follows one-step commands without gestures. She has shown some interest in adults going to the bathroom, but has not been interested in sitting on the ‘potty’. She continues to wear diapers, and can stay dry for approximately 3 hours at a time. She does not consistently tell her parents when she voids.

Based on the above information, is Madeline ready for toilet learning?

<Pause for discussion>

After reviewing signs of readiness with Samantha, please provide anticipatory guidance about how to start toilet training with Madeline when she is ready.

<Pause for discussion>
Case – Part II
Madeline and her mother, Samantha, leave your office, satisfied with your recommendations. Your next patient is Victoria, a 7 year-old female referred for bedwetting. She is accompanied by her mother.

What questions would you ask on history? What red flags on history would make you concerned about an organic cause of enuresis?

<Voice pause for discussion>

Victoria experiences bedwetting twice per week, and her mother reports that she has never been dry for more than 2-3 weeks at a time. She denies any hematuria, dysuria, urinary frequency, or daytime wetting. Her mother reports that her fluid intake seems normal, and she voids 5-6 times per day. She does not consume any drinks with caffeine, including pop.

Victoria achieved toilet learning with voiding at around 2 years of age, and toilet trained with stooling several months later. She has struggled on and off with constipation in the last 6 months. She stools once every 3 days, and often strains when stooling.

Her past medical history is unremarkable, and her review of systems is negative for neurological symptoms, fever, or weight loss. She the product of a term pregnancy, and there were no complications with pregnancy or delivery. Her family history is significant for primary nocturnal enuresis in her father, who experienced bedwetting until he was 8 years old. When Victoria is questioned about her bedwetting, she appears very embarrassed and is reluctant to talk about it.

What would you do on physical exam?
<Voice pause for discussion>

Victoria’s weight is 25 kg (50th percentile) and height is 125 cm (75th percentile). She appears well on exam. Her head and neck, cardiovascular and respiratory exams are unremarkable. An abdominal exam reveals a soft, nondistended, and non-tender abdomen with palpable stool in the lower left quadrant. There is no palpable bladder. A genitourinary exam is normal, with no labial adhesions.

A neurological exam reveals normal muscle bulk and tone in the lower extremities, with deep tendon reflexes in the patella 2+ and ankle 1+ bilaterally. There are no noted spinal deformities or sacral tufts. Her cerebellar and gait exam is normal.
After carefully considering the clinical history and exam, you highly suspect that Victoria has primary nocturnal enuresis. Are there any further investigations you would do to confirm this diagnosis or rule out other conditions?

Victoria and her mother are interested in hearing about management and treatment options. Please outline the non-pharmacological and pharmacological options for primary nocturnal enuresis.

References
Management of primary nocturnal enuresis

M Feldman; Canadian Paediatric Society
Community Paediatrics Committee
Paediatr Child Health 2005;10(10):611-4
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Background
Primary nocturnal enuresis is the involuntary discharge of urine at night by children old enough to be expected to have bladder control. Enuresis is considered primary when bladder control has never been attained and secondary when incontinence reoccurs after at least six months of continence.

Children should not be labelled enuretic unless regular (more than twice per week) wetting persists beyond the age of five years. Primary nocturnal enuresis is more common in boys. Bedwetting is found in 10% to 15% of five-year-old children and 6% to 8% of eight-year-old children, and it declines to 1% to 2% by 15 years of age.

Primary nocturnal enuresis should be regarded as a variation in the development of normal bladder control. It may be associated with deep sleep patterns. Emotional and behavioural problems are not causative factors, although they may influence treatment outcome.\(^2\)

Method of data collection and synthesis
The present statement was last revised in 2002. A PubMed search was conducted for articles published since 1999 to ensure appropriate overlap with the previous review. The search was conducted using the search term ‘Enuresis’, and was limited to ‘Clinical Trials’, ‘Randomized Controlled Trials’ and ‘Meta-Analyses’. In addition, relevant systematic reviews from the Cochrane database were identified, as were relevant references from identified articles. A single reviewer appraised the quality of the articles. Articles about therapy were appraised by using the method of Sackett et al.\(^3\) and systematic reviews were appraised by using the method of Oxman et al.\(^4\)

General measures
A thorough history and physical examination are essential. A family history of enuresis is often present. Recent studies have identified a gene for enuresis on chromosome 13q.\(^5\) For primary nocturnal enuresis, when the history and physical examination are completely reassuring, the low pretest probability of a true-positive result on urinalysis may obviate the need for any routine tests at all, given the potential to generate false-positive results. Judicious, rather than routine, tests for primary nocturnal enuresis are most appropriate. Enuresis that persists beyond the age of eight to 10 years may be associated with a poor self-concept or other psychological problems.\(^6\)\(^7\) Reassurance, support, and avoidance of punishment and humiliation are important to maintain the child’s self-esteem and minimize parental frustrations. Parents may seek medical opinion simply for reassurance. It is important to communicate openly with the child and parents. Enuresis should only be treated with pharmacotherapy and/or alarms in cases where it poses a significant problem for the child (strength of recommendation – B, level of evidence – III [see Appendix for key to strength of recommendations and level of evidence]).

Commonly recommended strategies for parents to help their child achieve continence include the following.\(^8\):

Specific treatment measures

Alarm devices in the management of nocturnal enuresis
In 1907, Pfaundler invented the first alarm device for the management of nocturnal enuresis. Since then, studies have shown the benefit of these devices.\(^9\)\(^10\). The purpose of the enuresis alarm is to teach the child to respond to a full bladder while asleep. The alarm goes off when the child starts to void. It may teach the child to wake up to the alarm and then, by approximation, transfer the waking to the sensation of a full bladder.

The miniature alarm systems are lightweight, portable, worn on the body and run on miniature batteries. Sensitive to a few drops of urine, they give a very prompt alarm response, and young children can operate them without difficulty. There are no ‘buzzer burns’ or shocks, which were associated with the older bell and pad alarms.\(^1\)

The success of the alarm depends on the child being motivated, and on the willingness of both the child and the parents...
to be awakened. Although occasionally effective in children as young as five years, the alarms are most effective in children older than seven or eight years. Initially, the child may continue to sleep deeply through the buzzer, requiring the parents to wake the child and alert him or her to the bedwetting episode.

Therapeutic trials of the alarm system should be continued for three to four months. It may take up to one to two months to see an improvement. Often, the initial improvement is a decrease in urine output rather than a totally dry night. Use of the alarm system is continued until there have been 14 consecutive dry nights. At this point, some authors recommend an ‘overlearning’: the child is encouraged to drink extra fluid (eg, two glasses of water) to ‘overcondition’ the bladder. This overlearning is continued until the patient has achieved seven dry nights in a row [6]. Among the children who relapse, some may be treated successfully with a repeat of the original alarm program [11]. If a relapse occurs, the treatment may be repeated, with a success rate similar to that of the initial course of therapy. There are a number of alarms readily available in the $80$ range. Because they tend to ‘wear out’ after two to three patients, it is more practical for parents to purchase a new alarm for their child. Commercial companies advertise systems at a very high cost. The public should be forewarned before purchasing these systems.

Parents should also be forewarned that alarm therapy also requires a commitment from other siblings because the alarms are sufficiently loud that often all members of the household are wakened when the alarm goes off. Alarms are impractical for ‘sleepovers’ and camp. Other therapies may be more appropriate for such settings.

Two systematic reviews [12][13] have recently been published based on meta-analyses of studies examining the long-term cure rate with alarm devices. Each of these meta-analyses analyzed available data about dropouts in a methodologically appropriate way. In each overview, the length of follow-up and the criteria for reporting success varied among reviewed articles, but the studies were analyzed with uniform criteria.

Both of these systematic reviews concluded that the actual cure rate of primary nocturnal enuresis using alarm devices is just under 50% (significantly lower than previously found) [12][13]. In one of these reviews (from the Cochrane collaboration [12]), it was noted that although less than 50% of the children in the group receiving alarm therapy remained dry, almost none of the children in the groups that did not receive the alarm therapy remained dry at the end of the studies. The Canadian Paediatric Society recommends the use of alarm devices for older, motivated children from motivated families for whom more simple measures are unsuccessful (strength of recommendation – A, level of evidence – I).

Pharmacological therapy

Desmopressin acetate: Desmopressin acetate has been studied for use in enuresis since the 1970s. It is a synthetic analogue of antidiuretic hormone (ADH) [14].

Nørregaard and Rittig’s studies from Denmark [15] showed that in some children, enuresis occurred randomly throughout the sleep cycle. The enuretic children had an altered pattern of ADH secretion compared with control patients. The control patients had an elevation of ADH levels at night, while the enuretic children had a constant level of ADH throughout a 24 h period. Therefore, it appears that in some children with nocturnal enuresis, high volumes of urine are produced at night, with subsequent overflow of the bladder. The rationale that follows from Nørgaard’s study is that desmopressin acetate could be used as a hormonal replacement therapy for children with enuresis.

Moffatt et al [16] reviewed 18 randomized clinical trials with desmopressin acetate. Their review showed that one-quarter of the subjects became completely dry. A systematic overview [17] based on a meta-analysis from the Cochrane collaborative concluded that the use of desmopressin acetate resulted in one to two fewer wet nights per week compared with placebo and twice the likelihood of becoming completely dry during treatment. Cure rates after treatment was discontinued were not substantially greater than with placebo [17]. Potential side effects, usually mild, are headache and abdominal pain, as well as stuffiness and epistaxis for the nasal preparation. Although there have been case reports of water intoxication [17], of the 752 subjects reviewed by Moffatt et al [16], there were no cases of water intoxication.

The expense of this medication needs to be factored into decisions about therapy. In tablet form (100 μg or 200 μg tablets), desmopressin acetate may be prescribed at doses from 200 μg to 600 μg.

Desmopressin acetate should be used with extreme caution in children having problems with osmoregulation or fluid balance, or in children with cystic fibrosis. Special care should be made to avoid consuming fluids for one hour before and eight hours after taking desmopressin.

Desmopressin acetate’s greatest value may be for short-term treatment, in settings such as camp or sleepovers, rather than as an attempt at a cure [17] (strength of recommendation – A, level of evidence – I).

Imipramine hydrochloride: Imipramine hydrochloride is a tricyclic antidepressant whose mode of action in the treatment of enuresis is unclear. The antinueteric response is often immediate. The recommended starting dose is 25 mg for children six to 12 years of age and 50 mg for those older than 12 years. The dose is given 1 h to 2 h before bedtime. The maximal effect is noted within the first week of treatment, but a two-week therapeutic trial should be undertaken before
adjusting the dose. At that time, the dose may be increased gradually to a maximum of 50 mg in children six to 12 years of age and 75 mg for those older than 12 years. An increase beyond this amount does not enhance therapeutic response but may significantly increase the potential for drug toxicity.

The response rate during treatment is similar to that with desmopressin acetate, and the cure rate after treatment is similarly comparable with placebo [18]. Minor side effects are common, and children should be monitored for personality changes, including emotional lability, irritability and anxiety. Other effects include disturbed sleep patterns, headaches and changes in appetite. Rare but serious side effects are convulsions, coma and cardiac arrhythmias from overdose. The possibility of accidental or deliberate overdose cannot be overstated and, therefore, even though imipramine hydrochloride is cheaper than desmopressin acetate, it should be used with extreme caution. Imipramine hydrochloride may be used as therapy for short-term treatment of nocturnal enuresis in distressed, older children if other treatments have been unsuccessful or are contraindicated, and if parents are judged to be reliable and are counselled about safe storage of the medication (strength of recommendation [in these special circumstances] – A, level of evidence – I).

**Behavioural therapy**

Simple behavioural therapy (such as reward systems or waking a child to void in the toilet [*‘lifting!’]*) may be effective for some [19]. Punishment and humiliation are to be avoided [7] [20]. Dry bed training, as described by Azrin and Thienes [21], is a more labour-intensive parent-awakening technique and may be slightly more effective in combination with alarm therapy than alarm therapy alone [22].

Studies examining simple behavioural therapies are too disparate in methodology to be analyzed using meta-analysis [19]. Individual small trials cite fewer wet nights with reward systems (eg, ‘star charts’) and lifting. The potential for negative consequences of such therapy has not been carefully studied.

It may be difficult to convince a child that a wet night is nothing to be ashamed of when dry nights are rewarded. The failure to achieve dry nights leading to stars or stickers may contribute to poor self-esteem. Lifting is labour intensive and may contribute to frustration and conflict. The goal of treatment is largely to reduce problems with frustration, conflict and poor self-esteem and, thus, behavioural therapies for enuresis may do more harm than good.

In a systematic overview from the Cochrane collaborative [19], adverse outcomes of simple behavioural strategies for enuresis (when reported) leading to a high dropout rate were family strife, emotional problems, and failure of the treatment because it was too demanding of the children or their families [19]. Given the limited data from small trials about the effectiveness of behavioural therapy for enuresis, particularly with respect to the potential for adverse effects, there is insufficient evidence to recommend routine use of behavioural therapy for primary nocturnal enuresis (strength of recommendation – I).

### Summary of recommendations

- Clarify the goal of getting up at night and using the toilet.
- Assure the child’s access to the toilet.
- Avoid caffeine-containing foods and excessive fluids before bedtime.
- Have the child empty the bladder at bedtime.
- Take the child out of diapers (training pants may be acceptable).
- Include the child in morning cleanup in a nonpunitive manner.
- Preserve the child’s self-esteem.
- Children for whom primary nocturnal enuresis is not distressing should not receive treatment. Parents should be reassured about their child’s physical and emotional health and should be counselled about eliminating guilt, shame and punishment (strength of recommendation – B, level of evidence – III).
- A conditioning alarm system is the most efficacious therapy, but it will be successful in the long term in less than 50% of children. Alarms may be the most appropriate initial line of therapy for primary nocturnal enuresis for older children in highly motivated families (strength of recommendation – A, level of evidence – I).
- Pharmacological therapy with desmopressin acetate has a place in special situations, such as at camp and sleepovers, or when the alarm system is impractical or not effective (strength of recommendation – A, level of evidence – I). Special care should be made to avoid consuming fluids for one hour before and eight hours after taking desmopressin. In difficult circumstances, imipramine hydrochloride may be used cautiously but requires careful explanation to reliable parents about the danger of overdose. Most children do not require imipramine hydrochloride.
- Treatment of primary nocturnal enuresis should be aimed at minimizing the emotional impact on the child. There is insufficient evidence about the good versus harm that behavioural therapies may exert in this regard. Reward systems and lifting should not be recommended without careful consideration of, and discussion with parents about, potential adverse effects (strength of recommendation – I).
**TABLE 1 Levels of evidence and strength of recommendations**

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Description</th>
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<tbody>
<tr>
<td>II-1</td>
<td>Evidence obtained from well-designed controlled trial without randomization.</td>
</tr>
<tr>
<td>II-2</td>
<td>Evidence obtained from well-designed cohort or case-controlled analytical studies, preferably from more than one centre or research group.</td>
</tr>
<tr>
<td>II-3</td>
<td>Evidence obtained from comparisons between times and places, with or without the intervention. Dramatic results in uncontrolled experiments could also be included in this category.</td>
</tr>
<tr>
<td>III</td>
<td>Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.</td>
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</table>

### Grade Description

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>B</td>
<td>There is fair evidence to recommend the clinical preventive action.</td>
</tr>
<tr>
<td>C</td>
<td>The existing evidence is conflicting and does not allow a recommendation to be made for or against use of the clinical preventive action; however, other factors may influence decision-making.</td>
</tr>
<tr>
<td>D</td>
<td>There is fair evidence to recommend against the clinical preventive action.</td>
</tr>
<tr>
<td>E</td>
<td>There is good evidence to recommend against the clinical preventive action.</td>
</tr>
<tr>
<td>F</td>
<td>There is insufficient evidence to make a recommendation; however, other factors may influence decision-making.</td>
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### Acknowledgements

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### References


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Paediatricians are asked frequently about the timing and method for toilet learning. As with many behavioural issues, there are no concrete answers to such questions. Reaching this developmental milestone can be difficult for both the child and parents. To help facilitate the toilet learning process, physicians should inform parents about the ‘child-oriented’ approach before the process starts, and they should be prepared to offer anticipatory guidance to parents as the child learns toileting skills.

Timing
The age at which parents initiate a child’s toilet learning and the age at which it is considered appropriate for a child to be toilet trained have changed over the years. The relatively ‘laissez-faire’ approach to toilet learning taken at the beginning of the 1900s was replaced by the more rigid ‘parent-centred’ approach of the 1920s and 1930s [1]. These approaches were subsequently rejected in favour of the child-oriented approach advocated by Spock [2] and Brazelton [3], which has become the mainstay of advice provided by physicians [4][12]. This shift in approach has made it acceptable for children to achieve this developmental milestone at a later age.

Important cultural differences exist between the methods used to toilet train a child [13][14]. Most children in western countries achieve bladder and bowel control between 24 and 48 months of age [13][15][24]. Girls tend to achieve this control at a slightly younger age than boys [17][19][25][26]. The average time from the initiation of toilet learning to the attainment of independent toileting varies from three to six months [22]. The attainment of bladder control does not always coincide with the achievement of bowel control, and night time urinary continence may coincide with daytime continence or occur several months or years later [13][16][17][19][20][25][26]. The toileting process encompasses a great deal of heterogeneity, and there is no specific age at which toilet learning should begin.

Assessing a child’s readiness for toilet learning
Toilet learning readiness should not be dictated by a child’s chronological age. Rather, as the child-oriented approach advocates, a child must be physiologically and psychologically ready to begin the process. Parents should be prepared to devote attention and patience to the task on a daily basis for several months.

For the child, physiological readiness precedes psychological readiness. By the time a child reaches 18 months of age, reflex sphincter control has matured and myelination of extrapyramidal tracts has occurred; both processes are necessary for bowel and bladder control. These processes cannot be accelerated [25][26]. Psychological maturation, however, is not necessarily achieved in concordance with physiological maturation.

When assessing a child’s readiness for toilet learning, the physician must consider motor, language and social milestones, as well as the child’s demeanour and relationship with his or her parents [2][17][11][27]. A checklist of a child’s toilet learning readiness is in Table 1.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Signs of a child’s toilet learning readiness</th>
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<tbody>
<tr>
<td>• Able to walk to the potty chair (or adapted toilet seat)</td>
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<tr>
<td>• Stable while sitting on the potty (or adapted toilet seat)</td>
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<tr>
<td>• Able to remain dry for several hours</td>
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<tr>
<td>• Receptive language skills allow the child to follow simple (one- and two-step) commands</td>
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<tr>
<td>• Expressive language skills permit the child to communicate the need to use the potty (or adapted toilet seat) with words or reproducible gestures</td>
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<tr>
<td>• Desire to please based on positive relationship with caregivers</td>
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<tr>
<td>• Desire for independence, and control of bladder and bowel function</td>
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Child-oriented toilet learning techniques
Parental expectations about toilet learning should be assessed by the physician at the child’s first-year visit. This is an opportunity to provide anticipatory guidance because most parents
underestimate the time required to complete the process. The child-oriented approach (explained below) should be discussed at subsequent visits, with the physician emphasizing that the age for toilet learning should be flexible. When the child is about 18 months of age, the toilet learning readiness of the child and parents can be assessed, keeping in mind cultural differences. Parents and all caregivers should be ready to initiate toilet learning by ensuring that time is set aside for the process and that the arrangements are suitable for the entire family. The toilet learning process should not be initiated at a stressful time in the child’s life (e.g., after a move or after the birth of a new sibling), and parents should be prepared emotionally for the inevitable accidents that will occur before the process is completed. Parents should be encouraged to follow their child’s cues to progress from one stage to the next, as outlined in Table 2. Further visits to the doctor can be used to assess progress while providing a forum to discuss issues that may arise.

| TABLE 2 |
| How parents can facilitate a child’s toilet learning |

- Decide on the vocabulary to use.
- Ensure the potty chair and position are easily accessible. Allow the child to watch his or her parents use the toilet.
- If a regular toilet is used, use a toilet seat adapter and a foot stool.
- Encourage the child to tell a parent when he or she needs to void. Give praise upon success, even if the child tells the parent after the fact. Learn the child’s behavioral cues when he or she is about to void.
- Encourage the child with praise. Do not expect immediate results; expect accidents. Avoid punishment and/or negative reinforcement.
- Ensure the cooperation of all caregivers to provide a consistent approach.
- After repeated successes, suggest the use of cotton underwear or training pants. Make this a special moment.

A potty chair is recommended rather than a toilet during the early stages because children feel more secure and stable on the potty. The potty also provides the best biomechanical position for the child.

Initially, the child is encouraged to sit fully dressed on the potty. Next, the toddler is encouraged to sit on the potty after a wet or soiled diaper has been removed. It may be helpful to place the soiled diaper in the potty to demonstrate its function. At a later date, the child can be led to the potty several times a day and encouraged to sit on it for a few minutes without wearing a diaper. Finally, the child is encouraged to develop a routine of sitting on the potty at specific times in the day (e.g., after waking in the morning, after meals or snacks, and before naps and bedtime). Using this method, the child may gain control of bladder and bowel function in a few weeks.

The child needs to be praised whenever he or she expresses an interest in sitting on the potty. Positive reinforcement may be used with this approach, but material rewards should be discouraged. Encouragement and support are more appropriate reinforcement techniques.

Once the child has used the potty successfully for one week or more, he or she may be ready to try training pants or cotton underpants. Accidents are inevitable however, and parents need to be supportive and patient. A child who has experienced a series of accidents soon after trying training pants or cotton underpants should be allowed to return to diapers without shame or punishment.

At times, children may be reluctant to pass stool in a potty or the toilet, particularly if they do not have good support for their feet. At this time, it is imperative that they be allowed to continue having bowel movements in a diaper to prevent the development of constipation and, consequently, painful bowel movements, which will further delay the toilet learning process.

**Toileting refusal**

Organic causes of failure in toilet learning are not common. The most likely explanation for failure is that the child is not ready. If the child is not ready, parents’ attempts to toilet train him or her will be futile. Parents should be advised not to engage in ‘toileting battles’, which damage the parent-child relationship and the child’s self-image, and may hinder progress in acquiring toileting skills.

If a child expresses toileting refusal, a one- to three-month break from training is suggested. This allows trust and cooperation to be re-established between parent and child. After this break, most children are ready to begin training. However, if repeated attempts are unsuccessful or if the child is older than four years, a referral to a general paediatrician or to a developmental paediatrician may be required. The referral may be necessary to explore aspects of the parent-child relationship and to rule out physical and/or neurodevelopmental abnormalities.

Constipation may complicate toilet learning readiness. A child may associate bowel movements with pain and, therefore, try to avoid the experience as much as possible. Dietary changes are the first step in alleviating this problem, and the use of stool softeners or laxatives may also be considered. A more complete review of the treatment of constipation is beyond the scope of this statement.

**Children with special needs**

Identifying the best time for toilet learning for the child with special needs is as important as it is for his or her peers. Al-
though the stages of toilet readiness are identical for all children, the demands of the child with special needs require the paediatrician to ascertain the degree to which the child is hampered in toileting (eg, by social and adaptive delays and/or by medications) and when the parents are prepared to begin the toilet learning process. A comprehensive study of this important topic is recommended for physicians involved in the care of children with special needs.

Conclusions
The process of toilet learning has changed significantly over the years and within different cultures. In western culture, a child-centred approach, where the timing and methodology of toilet learning is individualized as much as possible, is recommended.

References
Enuresis

Katherine M. Graham, MPAS,* Jay B. Levy, MD †

Objectives After completing this article, readers should be able to:

1. Describe the causes of daytime wetting.
2. Discuss the pathophysiology and causes of nocturnal enuresis.
3. Understand the behavioral treatment of incontinence.
4. Characterize the medical treatment of daytime incontinence.
5. Know the treatments for nocturnal enuresis.

Introduction

Both day and night wetting can pose a significant problem for children, parents, and medical practitioners. The prevalence of day wetting in 7-year-old children is between 2% and 3% for boys and 3% and 4% for girls. Most cases represent a functional type of incontinence, with only a few cases due to an anatomic, neurologic, or psychiatric cause. Most children typically are trained prior to starting school, but those who continued wetting rated this happening as a significant embarrassment and life stressor. Wetting often is a significant complaint raised during a visit with the pediatrician. Data suggest that children who have prolonged enuresis have lower self-esteem.

Primary nocturnal enuresis (PNE) is defined as nocturnal wetting in a child who has never been dry on consecutive nights for longer than 6 months. It is estimated that between 5 and 7 million children and adolescents may suffer from this disorder. The incidence of PNE is based on age. Dryness is expected to be achieved by 5 years of age; if not, the child is diagnosed as having PNE. An estimated 10% to 15% of 7-year-old children still struggle with bedwetting. Nocturnal enuresis resolves at a rate of 15% per year, so 99% of children are dry by age 15 years. The social consequences of nocturnal enuresis lead many to seek medical attention.

To clarify day and night wetting, the International Children’s Continence Society recently published new standardization for the terminology of enuresis. (1) They define incontinence as uncontrollable leakage of urine that may be intermittent or continuous and occurs after continence should have been achieved. Continuous incontinence means constant urine leakage, as in a child who has an ectopic ureter or iatrogenic damage to the external sphincter. Intermittent incontinence is urine leaking in discrete amounts either during the day, night, or both. Any wetting that occurs in discrete amounts at night is termed enuresis regardless of whether it is associated with daytime symptoms. Leakage that occurs during the day is daytime incontinence (no longer called diurnal enuresis). Dysfunctional voiding is defined by inappropriate muscle contraction during voiding and usually is associated with constipation and is referred to as dysfunctional elimination syndrome.

Causes of Nocturnal Enuresis

The causes of nocturnal enuresis are not understood completely. Several theories have been proposed, including the role of genetic factors, alterations in vasopressin secretion,
sleep factors, and abnormal bladder dynamics. Other mechanisms may include psychological influences, organic disease, and maturational delay.

Many parents of children who have enuresis report that their children sleep more deeply and are more difficult to arouse than other children. Early studies supported this controversial hypothesis, but numerous recent studies refute it. Controlled studies have shown no difference between children who do and do not have enuresis. No data support the concept that children who have enuresis wet during “deep” sleep, and wetting has been shown to occur throughout different sleep patterns. An association has been shown between obstructive sleep apnea syndrome and enuresis. Affected patients have increased atrial natriuretic factor, which inhibits the renin-angiotensin-aldosterone pathway, leading to increased diuresis. Tonsillectomy, adenoidectomy, or both have been shown to cure enuresis to a significant extent in this select group.

Based on circadian rhythms, nocturnal urine production is approximately 50% less than daytime urine production. As early as the 1950s, children who suffered enuresis were shown to have significantly increased nocturnal urine production compared with unaffected children. Nocturnal polyuria due to alterations in vasopressin release has been shown to be a factor in nocturnal enuresis. This theory is based on studies showing that children who have nocturnal enuresis have abnormal circadian release of antidiuretic hormone (ADH).

Bladder dysfunction, as evidenced by diminished bladder capacity and abnormal urodynamics, may play a role in nocturnal enuresis. Patients who have PNE have been shown to have smaller-than-normal functional bladder capacities at night, and urodynamic studies have demonstrated higher bladder instability at night compared with during the day. As expected, patients who have both daytime incontinence and nocturnal enuresis have a higher degree of functional bladder abnormalities and a higher failure rate with conventional treatment than patients experiencing nocturnal enuresis alone.

Evidence is strong that genetics plays a role in nocturnal enuresis. Studies have shown that when one parent had enuresis as a child, his or her child had a 44% chance of also experiencing the condition. If both parents were affected, this chance increased to 77%. Interestingly, the parental age of resolution often predicts when the child’s enuresis should resolve. Studies of twins support the genetic role, with 68% concordance in monozygotic twins and 36% in dizygotic twins.

Psychological factors contribute to PNE. Some studies have shown a higher prevalence of enuresis in children who have attention-deficit/hyperactivity disorder (ADHD) compared with a control population. Surveys show that children who have ADHD have a 30% greater chance of enuretic events. Recent studies reveal that the reason may not, as previously believed, be inattention but may be a neurochemical effect.

Maturational delay as a hypothesis for enuresis may be the most unifying of the theories. In a large population study, children who had enuresis had more fine and gross motor clumsiness, perceptual dysfunction, and speech defects than did controls. Patients who had nocturnal enuresis differed less from controls compared with those who had both nocturnal enuresis and daytime incontinence. (2)

Secondary enuresis is defined as new-onset nighttime wetting on consecutive nights after a 6-month or greater period of dryness. Although very disturbing, usually this occurrence is not related to an organic cause. In some cases, a stressful event, such as the birth of a sibling, a move, or the death of a parent or grandparent, is the source. Secondary enuresis should be evaluated and treated like PNE; there is no need for additional laboratory work or imaging studies.

Evaluation of Nocturnal Enuresis
Evaluation of nocturnal enuresis starts with a history. It is important to determine whether the enuresis is primary or secondary. The pattern of enuresis also must be determined, delineating the number of nights per week and the number of episodes per night. The pattern of nighttime fluid intake should be documented, as should caffeine intake. The evaluation should include questions regarding polyuria, polydipsia, urgency, frequency, dysuria, abnormal urinary stream, history of urinary tract infection, constant wetness, and bowel complaints (15% of children who have enuresis also have encopresis). A history of sleep disorders such as sleep apnea or insomnia and a neurologic and developmental history should be obtained. Family history is helpful and should be sought.

Most children who have PNE have normal findings on physical examination. Clinicians should focus on the gastrointestinal (GI), urogenital, and neurologic systems. If abnormalities are found, the child most likely does not have an isolated case of nocturnal enuresis. During the abdominal examination, the physician should look for a distended bladder or fecal impaction. The male urologic examination should include evaluation of the phallus and meatus; the female examination should focus on the introitus, looking for labial adhesions or urethral abnormalities. The neurologic examination should assess...
lower extremity muscle tone and coordination, along with deep tendon reflexes and sensation. The skin over the spine should be inspected, looking for a tuft of hair, vascular marking, or a sacral dimple that might signify occult spinal dysraphism.

Laboratory tests, other than a screening urinalysis (UA), are not necessary in evaluating patients who have nocturnal enuresis. Urine specific gravity is measured to evaluate for diabetes insipidus. Glucose spillage may suggest diabetes mellitus, and the presence of bacteria may signify an infection. Urine culture should be obtained if the UA appears to show infection. Patients who have nocturnal enuresis and associated daytime incontinence, with or without encopresis, may warrant additional studies.

Urinary tract infection (UTI) in children who suffer enuresis should lead the clinician to consider imaging studies under certain circumstances, specifically renal and bladder ultrasonography and voiding cystourethrography (VCUG). Both studies should be performed in any boy who has a UTI, in girls who have a febrile UTI, in girls who are not toilet-trained who have a UTI without fever, and in girls who are toilet-trained and have recurrent febrile UTIs (three or more in 6 months). Toilet-trained girls who have febrile UTIs should undergo ultrasonography. If abnormalities are found, VCUG is indicated. Some clinicians extend the indications for imaging further. Blood testing rarely is needed unless there is associated renal disease or suggestive physical findings.

**Treatment of Nocturnal Enuresis**

Treatment of nocturnal enuresis includes both behavioral and medical options. Among the behavioral modifications are limiting nighttime fluid intake 2 hours before bedtime, limiting dairy products 4 hours before bedtime (to decrease urine output from osmotic diuresis), and voiding prior to going to sleep. Medical therapy includes desmopressin acetate, anticholinergic agents, imipramine, or combination therapy. Alarm therapy falls into both categories of treatment. Acupuncture and hypnosis are other treatments, but few data support their use.

**Alarm Therapy**

The bedwetting alarm is by far the most effective strategy for curing nocturnal enuresis, having reported success rates as high as 66% to 70%. Alarm therapy, however, is the most difficult method to employ. Its mechanism is unknown, but it is believed to be a conditioned response. The alarm must be used every night for success and may require 3 to 4 months for results. The family needs to be counseled prior to starting treatment and motivated for success to occur. The patient is instructed to wear underwear rather than paper underpants. Usually the patient awakens to the sound of the alarm (triggered by dampness in the device), but if the child does not wake, the parent must awaken and accompany him or her to the bathroom. Many children awaken more than once a night, which can be stressful on the family.

Advantages of alarm therapy are that it offers a real cure, with no recidivism and no adverse effects. Disadvantages include significant parental involvement because the alarm may not wake the child at first, with disruption of sleep for all family members. Alarm therapy works better in older children who are motivated to be dry. A patient is considered cured if he or she has worn the alarm for 1 month and it is not triggered because he or she remains dry.

**Pharmacologic Treatment**

Medications often are used in the treatment of nocturnal enuresis to help treat, rather than cure, the problem while awaiting natural resolution. The first-line choice is desmopressin acetate. Desmopressin is a synthetic analog of ADH. It works at the level of the kidney, reducing urine output overnight. Such reduction in urine volume overnight may not make the child completely dry, especially if the child has bladder instability and reduced functional bladder capacity at night. The response rate, as defined by a 50% reduction in wet nights, is 60% to 70%. Success rates generally are better in patients who do not have daytime incontinence and who have normal functional bladder capacities.

Desmopressin tablets are well tolerated and have very few reported adverse effects. However, reports of severe hyponatremia associated with seizures and deaths in children who have used the intranasal formulations of desmopressin have caused the United States Food and Drug Administration to advise clinicians not to use desmopressin in that form for treating PNE. (3) Also, desmopressin therapy should be suspended when children experience acute conditions that can cause fluid or electrolyte imbalance, such as fever, recurrent vomiting and diarrhea, or vigorous exercise.

Desmopressin has a dose-dependent reaction. The initial dose is one tablet (0.2 mg) taken 30 minutes prior to bedtime on an empty stomach because the polypeptide is absorbed rapidly in the stomach (if patients cannot swallow the tablet, it can be crushed and put in applesauce). The dose may be titrated to a maximum of 0.6 mg to achieve dryness. Desmopressin is maximally
effective in 1 hour and is cleared within 9 hours after administration. Therefore, the drug only works on the night it is consumed. We recommend that patients use the medication nightly for 6 months and then stop for 2 weeks to see if the patient has outgrown the problem. Practitioners and patients alike find that desmopressin either “works or it doesn’t.” Because the drug controls only one factor, nocturnal urine output, not all patients respond to this treatment alone. Relapse after short-term treatment is common.

Anticholinergic agents long have been used in the treatment of nocturnal enuresis. These drugs are especially effective for patients who have associated daytime wetting and urgency or frequency. They rarely are effective when used alone, but work well in combination with desmopressin. This combination often is a good option when the patient has nocturnal enuresis with reduced functional bladder capacity (with or without daytime incontinence) and has failed desmopressin therapy alone. Approved medications for use in children include oxybutynin chloride (approved in children 5 years or older in the short-acting form and in children 6 years and older in the once-a-day form). Another available anticholinergic that is not yet approved in children is tolterodine tartrate (2 to 4 mg). We have used this medication safely in our clinic, with parental consent, and have had good results.

Imipramine is a tricyclic antidepressant developed in the 1960s that continues to be used in the treatment of enuresis. Its action is unknown, but it appears to have both a weak anticholinergic effect as well as an antispasmodic effect on the detrusor muscle. Recently, imipramine has been found to increase concentrations of ADH release. It has been postulated that imipramine affects the arousal center of the brain by increasing arousal and suppressing rapid eye movement sleep. Wide variation in cure rates have been reported (64% to 80%), but when imipramine therapy is discontinued, especially abruptly, only 25% of patients remain dry long-term. Adverse effects are uncommon but include gastrointestinal disturbance, sleep disturbances, anxiety, and dry mouth. Most serious adverse effects are associated with overdose and include fatal cardiac arrhythmias, seizure, hypotension, and coma. Parents should be notified of these risks, which can be a threat to younger siblings as well as to patients.

**Daytime Wetting**

Daytime wetting, whether dribbling or soaking, can have a significant psychological impact. When asked to rank stressful life events, one group of investigators found that children rated wetting their pants at school third out of 20 stressful events. Another study revealed that parents reported more psychological problems in their children older than 7.5 years of age who had daytime wetting compared with children of the same age who had no daytime wetting. In addition, children who have ADHD are disproportionally affected by day and nighttime wetting. One study showed a 30% incidence of enuresis in children who had ADHD compared with 5% of children who had no ADHD. Also, children experiencing stressful events such as divorce, death of family members, or abuse during the ages of 2 to 5 years have a higher incidence of daytime wetting.
muscle development, brain development, and an anatomically normal urinary tract.

Daytime wetting has many causes. Most cases result from alterations in function, but it is important to seek specific disorders.

**Classification of Daytime Wetting**

Most daytime wetting can be classified either as a storage or an emptying problem. For some patients, however, a combination of the two mechanisms leads to incontinence. The evaluation, management, and treatment of daytime incontinence are straightforward after determining which of the two problems is occurring.

Children who have storage problems can be subdivided into neurologically normal children who cannot fill and store urine at low pressure; neurologically abnormal children who have high pressure (noncompliant) bladders with leakage; children whose bladders are hypersensitive, which results in leakage; and children who have inadequate sphincter tone, with or without an identifiable cause.

In contrast, emptying problems are identified by a failure to empty the bladder completely, on command, at low pressure, and with no significant residual urine. The mechanism may be neurologic, anatomic, muscular, or functional (ie, inability by a neurologically normal child to relax the sphincter during voiding).

**Evaluation of Daytime Wetting**

The history is the most valuable tool in the evaluation of daytime wetting and must include a detailed voiding history. Necessary information includes: age of toilet training, pattern of wetting, volume of wetness (dribbling versus soaking), number of times per day the child is wet, whether the child has ever been dry, what time of day (eg, during play) incontinence occurs, any history of UTIs, number of voids per day, any associated nighttime wetting, and prior evaluation and treatment.

A detailed history of bowel function is important. Among the relevant information is number of stools per week, consistency of stools, presence of frank encopresis or “skid marks” (often misinterpreted as improper wiping), and presence or absence of abdominal pain. A good social history should focus on the presence of abuse, parental attitude toward wetting, and any psychological stressors that may be present.

The physical examination should include close attention to genitourinary abnormalities, back or sacral anomalies, and the rectum. Genitourinary abnormalities that raise suspicion include meatal stenosis, hypospadias, tight phimosis, female epispadias, labial adhesions, and intralabial masses, which could represent a ureterocele or an ectopic ureter. The back and sacrum should be examined for an asymmetric gluteal crease, sacral dimple, vascular malformation, or hairy patch over the sacrum, which might indicate underlying spinal cord malformation. The rectum should be assessed for both tone and the presence of a large amount of fecal material. Abdominal examination should assess for distension, masses, and stool in the sigmoid. The perineal skin should be evaluated for maceration, indicating significant incontinence.

Laboratory evaluation of patients who have daytime wetting begins with a UA and urine culture. Bladder ultrasonography to assess for a postvoid residual (PVR) is imperative. Bladder wall thickness should be measured to evaluate the possibility of bladder trabeculation, signifying overcontraction of the detrusor muscle. Imaging studies should be performed for children who have UTIs, using the guidelines outlined previously. In addition, any child who has both daytime wetting and a UTI should undergo ultrasonography.

A unique procedure that assesses the patient’s urinary stream both quantitatively and qualitatively is the uroflow test. The patient voids into a machine equipped with electric sensors that continuously record the rate of flow. A printout is generated that provides information on flow rate and quantity, and a graphic curve is created that can aid in diagnosis. Typical patterns are seen in such conditions as urge incontinence, emptying problems such as detrusor sphincter dyssynergia (DSD), or a true obstruction such as posterior urethral valves or urethral strictures in males. Uroflow testing is recommended for children who have daytime wetting.

Ectopic ureter should be considered for female patients who have no history of day- or nighttime dryness and characteristic “constant dribbling.” This possibility should be evaluated by magnetic resonance urography, contrast computed tomography scan, or intravenous pyelography. Patients found to have an ectopic ureter should be referred to a pediatric urologist because it is a potential surgical problem.

Urodynamics are performed to evaluate children who do not respond to traditional therapy or patients in whom a tethered spinal cord is suspected. This condition should be suspected especially in patients who have daytime incontinence, nocturnal enuresis, and encopresis. Some patients, however, have tethered cord syndrome that initially presents with no bowel involvement. If tethered cord syndrome is a concern, based either on abnormal urodynamics or a suspicious physical finding, magnetic resonance imaging of the lumbosacral cord is mandatory.
Manifestations of Storage Problems

Clinical manifestations of storage problems are categorized as urge incontinence, overflow incontinence, diurnal enuresis, and urinary frequency (with or without actual wetness).

Urge incontinence, sometimes referred to as urge syndrome, is characterized by frequent attacks of a strong desire to urinate countered by holding maneuvers such as squatting, dancing, and curtseying. This condition is caused by uninhibited bladder contractions and reflexive sphincter contraction to minimize wetting. Often, the amounts of urine lost are small and cause dampness rather than soaking. Children who have urge syndrome may experience suprapubic and low back pain as well as referred pain to the genitalia. Functional bladder capacity generally, but not always, is small for age. Urge incontinence also can be associated with nighttime wetting.

The pattern of daytime wetting that is referred to as overflow incontinence is caused by infrequent and incomplete voiding. This condition develops over time. The bladder becomes large, and the urge to urinate is inhibited easily. Over time, affected children lose their awareness of bladder filling and, therefore, have significantly decreased sensation that they need to void. The amount of wetness varies but usually is large.

Daytime incontinence is described by normal but infrequent or delayed voiding, especially associated with distraction or play. The amount of urine lost varies from small to large. Such characteristics describe children who present with no idea that they are going to wet until leakage occurs. The association of behavior problems in this subgroup is high. Sudden development of daytime incontinence after continence has been achieved should prompt a referral to a pediatric urologist.

Urinary frequency, generally referred to as benign urinary frequency of childhood or pollakiuria, is a very common complaint that is characterized by a sudden need to urinate very frequently, sometimes up to 30 times per day. There is rare nocturia, no dysuria, and no actual urine leakage. Affected patients do not require an extensive radiologic evaluation. Pollakiuria occurs in younger children, usually in those 3 to 8 years of age, and usually is self-limited. Interestingly, affected children often do not respond to anticholinergic therapy. The cause is believed to be related to psychological stressors.

Manifestations of Emptying Problems

Clinical manifestations of emptying problems often, but not always, are more severe in degree than are storage problems. Emptying conditions are categorized, from the least to the most severe, as lazy bladder syndrome, DSD, and nonneurogenic neurogenic bladder (Hinman syndrome).

Lazy bladder syndrome describes a voiding disorder in which children void three or fewer times a day. The bladder becomes enlarged, and the detrusor muscle begins to decompensate. Patients must strain their abdominal muscles to void. They have a poor and often intermittent stream that is ineffective at emptying the bladder completely. They have recurrent UTIs that are afebrile or associated with a low-grade temperature, and they may have concomitant constipation.

DSD is inappropriate contraction of the external urethral sphincter during bladder contraction, causing an intermittent or staccato type of voiding and PVR. DSD often is associated with constipation or encopresis due to failure of the pelvic floor to relax during defecation. DSD is distinguished by recurrent UTI, postvoid leakage, and a classic “spinning-top urethra” (widened posterior urethra and bladder neck narrowing to a voluntarily contracted external sphincter) on VCUG. Affected children are at risk for acquired or secondary vesicoureteral reflux (VUR).

Hinman syndrome is the most severe form of voiding dysfunction. Originally this entity was described by Hinman as a nonneurogenic neurogenic bladder because affected children often had bladder and renal characteristics similar to children who had spina bifida, but with no identifiable neurologic defect. Children who have Hinman syndrome have longstanding DSD that can lead to detrusor decompensation. They develop bladder trabeculation, acquired VUR, hydronephrosis, and reflux nephropathy. Hinman syndrome, if not detected and treated aggressively with mechanisms to empty the bladder, leads to renal insufficiency or chronic renal failure.

Other Types of Daytime Wetting

Two types of daytime wetting do not qualify as either storage or emptying problems: giggle incontinence and vaginal reflux.

Giggle incontinence is a very rare form of daytime wetting described as complete bladder emptying with extreme laughter. This condition occurs almost exclusively in females ages 10 to 20 years. The disorder seems to be worse in the early teens, but does extend into adulthood. True giggle incontinence does not have other associated voiding abnormalities such as urgency or frequency. Urodynamics show a normal filling and emptying pattern. The cause is unknown, but the incontinence is believed to be mediated by a cataplectic phenomenon that exists in patients who have narcolepsy. As
a result, patients usually are treated successfully with methylphenidate.

Vaginal reflux is dribbling associated with urine being trapped in the vaginal introitus after voiding and leaking out when the child walks away. This condition often is seen in overweight girls and in young thin girls who cannot balance themselves on the toilet. Vaginal reflux also may be seen in girls who have vaginal adhesions. The underwear is described as “always damp.” Diagnosis is made by a postvoid vaginal examination with a Valsalva maneuver that elicits urine flow from the introitus. Because this is primarily a problem of positioning, it is treated easily by having the patient sit backward on the toilet or concentrate on keeping the thighs separated during voiding.

**Therapy for Storage and Emptying Problems**

Behavioral therapy ultimately is the best treatment for daytime wetting, regardless of cause. One element consists of encouraging the child to void every 2 hours. Double voiding also is encouraged, especially for patients who have emptying problems. Patients are advised to avoid known bladder irritants such as caffeinated and carbonated beverages, high citrus-content beverages, and artificial red dyes. Also, patients should be encouraged to sit on the toilet 30 minutes after a large meal with

| Table. Medication for Treating Daytime Wetting and Nocturnal Enuresis |
|-------------------------|-----------------|-----------------|-----------------|-----------------|
| **Drug**                | **Available Dosage** | **Advantages** | **Adverse Effects** | **Precautions** |
| Hormonal Agents (nocturnal enuresis) | 0.1-, 0.2-mg tablets (0.1 to 0.6 mg qhs) | Reduces the volume of urine made at night | Water intoxication and hypernatremia | Hypertension and von Willebrand disease |
| Desmopressin acetate, vasopressin, DDAVP | 25-, 50-, and 75-mg tablets (25 to 50 mg qhs <12 years of age and up to 75 mg qhs >12 years of age) | Reduces uninhibited bladder contractions | Arrhythmias, hypotension, and electrocardiographic changes | Narrow-angle glaucoma |
| Tricyclic Antidepressant (nocturnal enuresis) | 5-, 10-, and 15-mg extended-release tablets q day | Reduces uninhibited bladder contractions | Dry mouth, facial flushing, constipation | Narrow-angle glaucoma, obstructive uropathy |
| Imipramine | Elixir 0.15 mg/kg tid Transdermal patch 3.9 mg/day | Extended-release tablets approved for patients >6 years of age |  |  |
| Anticholinergic Agents (daytime and nocturnal enuresis) | 2-, 4 mg q day | Reduces uninhibited bladder contractions |  |  |
| Oxybutynin | | Does not cross blood-brain barrier |  |  |
| Tolterodine tartrate | 0.4 mg q day | Capsules can be sprinkled on food |  |  |
| Alpha Blockers (daytime enuresis) | 1, 2 mg; begin with 0.5 mg and increase over 4 weeks to 1 mg q day | Reduces bladder outlet resistance | Headache, dizziness | Contraindicated in renal impairment |
| Doxazosin | | Lowers postvoid residual |  | May cause hypotension |
| Tamsulosin | 0.4 mg q day | Reduces bladder outlet resistance | Headache, dizziness | Contraindicated in renal impairment |
| | | Lowers postvoid residual |  | May cause hypotension |
| | |  | Not FDA-approved for pediatric use |  |

FDA—United States Food and Drug Administration
their feet supported for 10 minutes to encourage pelvic floor relaxation.

A bowel program is extremely important in treating children who have daytime wetting because most of these patients have some form of constipation. First-line treatment for constipation includes diet changes that incorporate high-fiber foods. If the response to this is poor or marginal, medication may be needed, such as polyethylene glycol powder, with adjustments as needed until a daily medium-size, soft-formed stool is achieved. If a bowel program and behavioral therapy are ineffective, other medication may be necessary to help manage the problem.

If the patient has a storage problem that is associated with urinary frequency (not benign) or suprapubic or penile pain, anticholinergic agents are necessary. Six choices currently are available (Table), although most are not approved for pediatric use. However, we have used some of them successfully, with parental consent, in our dysfunctional voiding clinic. Adverse effects are essentially the same for all anticholinergic drugs and include, in order of occurrence, dry mouth, constipation, and facial flushing. Anticholinergic drugs that we have used successfully include oxybutynin and tolterodine.

Patients who have emptying problems have different needs and, therefore, different treatments. Biofeedback essentially is pelvic floor physical therapy for patients who have emptying problems, particularly DSD. The therapy involves contacts on either side of the anus and on the abdomen that are connected to a computer program that teaches the patient the difference between contraction and relaxation of the pelvic floor. The advantages of this therapy are that it is noninvasive, is very effective, and has no drug adverse effects. Disadvantages include slow resolution and the need for dedicated nursing care, parent and patient motivation, and frequent office visits as well as execution at home.

Medical treatments for emptying-based daytime wetting are alpha-blocking drugs, which originally were prescribed for men who had enlarged prostates. The agents appear to work by causing smooth muscle relaxation at the base of the bladder and reducing outlet resistance at the proximal sphincter complex, thereby lowering PVR. Alpha-blocking drugs lower PVR in up to 88% of patients. The advantages include fewer recurrent UTIs due to better emptying. Disadvantages include adverse effects such as headache and dizziness. We use two types of alpha-blockers in our practice: doxazosin (approved for treatment of hypertension in children) and tamsulosin (not approved for children). Anticholinergic drugs also are used in patients who have emptying problems because of the complexity of the symptomatology. Such medications help to alleviate the symptoms of urgency and frequency and control the severity of the incontinence.

Summary
Day and nighttime wetting is a significant problem in pediatrics. It is extremely common and often underdiagnosed. Parents frequently feel helpless because they think there is no solution and, therefore, may not raise the issue with their pediatricians. It is important for the pediatrician to ask the appropriate questions at health supervision visits to ascertain the presence of such problems. Diagnosis and treatment should be tailored in a stepwise approach to minimize the overuse of laboratory and other tests. Referrals should be considered for patients who are recalcitrant to initial therapy.

References

Suggested Reading

http://pedsinreview.aappublications.org/
PIR Quiz
Quiz also available online at pedsinreview.aappublications.org.

5. At least 10% of 7-year-old children have the most common form of enuresis, which is:
   A. Associated daytime incontinence.
   B. Continuous incontinence.
   C. Dysfunctional elimination syndrome.
   D. Isolated nocturnal incontinence.
   E. Urge incontinence.

6. A 7-year-old boy has isolated primary enuresis (nocturnal wetting only). Of the following, he is most likely to have:
   A. Abnormal non-rapid eye movement sleep.
   B. A positive family history.
   C. Bladder outlet obstruction.
   D. Occult spinal dysraphism.
   E. Urinary tract infection.

7. A 7-year-old boy has isolated primary enuresis. Other than nocturnal wetting, he has no findings of note on history. Results of his physical examination and screening urinalysis are normal. Before discussing therapy, the most appropriate test to perform is:
   A. A urine culture.
   B. Renal and bladder ultrasonography.
   C. Serum electrolyte assessment.
   D. Urinalysis.
   E. Voiding cistourethrography.

8. A 7-year-old boy has newly diagnosed primary nocturnal enuresis. The likelihood of eventual spontaneous remission has been fully explained, but the child and family want to try therapy. The most effective treatment for ending the enuresis for this boy is:
   A. A bedwetting alarm.
   B. An anticholinergic medication.
   C. An oral alpha blocker.
   D. Nasal desmopressin.
   E. Oral imipramine.

9. A 5-year-old girl has never been “dry.” Her underwear is always wet. The most likely cause is:
   A. An ectopic ureter.
   B. Dysfunctional elimination syndrome.
   C. Lazy bladder syndrome.
   D. Maturational enuresis.
   E. Posterior urethral valves.
Enuresis
Katherine M. Graham and Jay B. Levy
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The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pedsinreview.aappublications.org/content/30/5/165