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Genitourinary Disorders: Urinary Incontinence in Children

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Urinary incontinence in children is defined as the repeated daytime or nighttime voiding of urine into the bed or clothes at least twice per week for at least 3 consecutive months in a child who is at least 5 years of age.[1] Most children are successfully toilet trained by around the age of 3, with a very wide range of 0.75–5.25 years. Girls are usually trained earlier than boys.[2]

Enuresis is bedwetting, or wetting during sleep (e.g., nap time), more than twice weekly beyond the age of 5 for girls and 6 for boys. In primary enuresis, bladder control has never been achieved and in secondary enuresis, loss of bladder control occurs after at least 6 months without bedwetting.[3] Primary enuresis, which is more common in boys, occurs in 10–15% of 5-year-olds and 6–8% of 8-year-olds and declines to <2% by age 15. There are 2 subtypes of primary enuresis: volume-dependent enuresis (associated with nocturnal polyuria; a normal nocturnal rise in antidiuretic hormone [ADH] secretion may not occur in these children) and detrusor-dependent enuresis (associated with daytime frequency, urgency or incontinence).[4] Possible causes of enuresis include developmental delay (immaturity of CNS control over bladder contractions and/or responsiveness to bladder filling), genetics (molecular linkage to chromosome 8q, 12q, 13q) and obstructive sleep apnea[5], [6] (very rare). Lack of sufficient ADH release, bladder overactivity and inability to wake can also cause enuresis.[3]

Daytime incontinence occurs in about 10% of children 4–6 years old, declining to 4% in adolescents. Girls are affected twice as often as boys. It is considered a problem in a child 4 years or older who wets daily (primary) or who relapses after 6 consecutive months without daytime wetting (secondary). Possible functional or organic causes of daytime incontinence are listed in Table 1.

There is no evidence that urinary incontinence is associated with any specific behavioural or psychological problems, yet most affected children are clearly distressed by their condition. The parents' supportive role in treatment is crucial; an intolerant attitude on the part of the parents predicts early drop-out from treatment.[7]

Table 1: Possible Causes of Daytime Incontinence

Functional	Constipation (as defined by the Rome III diagnostic criteria for functional gastrointestinal disorders—See www.romecriteria.org/assets/pdf/19_RomeIII_apA_885-898.pdf)[8] Deferral of voiding ("holding it in until the last minute") Fusion of labia minora Urinary tract infection Urge syndrome (unstable bladder; sudden attacks of uncontrollable urge to void; characteristic squatting to avoid detrusor contractions) Stress incontinence Giggle incontinence Emotional stress Daytime frequency syndrome
Organic	Neurogenic bladder Partial urethral obstruction, e.g., posterior urethral valve, congenital strictures Ectopic ureter

Goals of Therapy

- Identify and/or manage serious causes
- Minimize symptoms
- Provide reassurance and guidance

Investigations

- History with attention to:
  - family history (often present in enuresis)

- bowel function; constipation is frequently associated with urinary incontinence that is due to decreased bladder capacity
- pattern of wetting
- history of urinary tract infections (UTI) or urologic surgery
- psychological status of child and family dynamics

- Physical examination with attention to:
  - perineal sensation, perineal reflexes, sphincter tone (to rule out neurogenic bladder)
  - genitalia, particularly the urethral meatus (to rule out anatomical causes such as meatal stenosis in boys or labial fusion in girls)
  - possible occult spinal dysraphism such as tethered cord (congenital spinal cord abnormality that can cause progressive neurologic damage); signs include the presence of a hair tuft, dimple, pigmented lesion or subcutaneous lipoma over the lower spine, or asymmetry of the gluteal cleft (refer to pediatric neurosurgeon)
  - direct observation of voiding, if possible, to rule out abnormalities of urinary stream

- Other investigations as indicated:
  - diary to record voiding pattern and/or bowel movements
  - urinalysis and urine culture; no other investigations are necessary for primary enuresis
  - voiding cystourethrogram (to detect vesicoureteral reflux, partial urethral obstruction or neurogenic bladder) as well as ultrasound of kidneys and bladder are recommended if history of UTI
  - if voiding cystourethrogram is abnormal, a referral to a urologist is likely indicated[3]

Therapeutic Choices

Figure 1 - Management of Urinary Incontinence in Children depicts the management of urinary incontinence in children. Tailor therapy to etiologic factors. Combinations of different interventions may be useful.

Nonpharmacologic Choices

- In cases of daytime incontinence, advise parents to refrain from humiliating or punishing the child, and to support the child's efforts with positive reinforcement, e.g., reassurance, diary of dry days, facilitated access to bathroom at home and school.
- Have the child avoid excessive intake of fluids within 2 hours of bedtime and empty the bladder before going to bed.
- Encourage the child to avoid deferral of micturition.
- *Enuresis alarms* are effective for enuresis when used properly for 3–4 months.[9] Enuresis alarms, which are highly sensitive to moisture, attach to underpants or an absorbent pad and either vibrate or produce sound at the first sign of voiding. Because children with enuresis are usually very deep sleepers, the parent must often be the one to wake the child when the alarm sounds. The child then completes voiding in the toilet and returns to sleep after changing the underwear or bedding. Alarm therapy may be effective in children with a normal urine output and a small or normal bladder capacity.[10] , [11] Enuresis alarms (e.g., Malem, Dri Sleeper, Nytone) are inexpensive (e.g., $80–120) relative to medications and are available at medical supply stores. Alarms may be tried in motivated and committed patients as young as 5 years old with consistent parental involvement and support. In the author's experience, best results are achieved in children 7 years or older. Relapse rates were lower when dry bed training, reward systems or overlearning (child drinks 4–6 oz of water in the hour before going to bed while continuing to use the alarm) were added to alarm treatment.[9]
- Encourage bladder training exercises for daytime incontinence, e.g., scheduled voiding routine, abdominal or pelvic floor muscle exercises.
- There is no evidence of effectiveness for complementary therapies such as hypnosis, acupuncture, chiropractic, faradization (electric shock to the genital area), homeopathy, diet or restricted foods.[12]

Pharmacologic Choices

Table 2 lists medications used in the management of urinary incontinence in children ≥5 years of age.

Antidiuretic Hormone Analogues

Desmopressin, an analogue of human ADH, decreases urine production when given at bedtime and reduces the number of wet nights in 75% of children, with complete cessation in about 50% of those who respond.[13] Desmopressin is used when a rapid response is required. There is limited evidence of long-term success with desmopressin use.[9] If successful, consider a 1-week interruption every 3 months to see if treatment is no longer

needed.[14] Desmopressin may be most effective in children with a normal bladder capacity but with a large urine output.[11] , [14] , [15] Patients with high urine output and *reduced* bladder capacity may require combination treatment with desmopressin and enuresis alarms.[12] If cost is a concern, reserve desmopressin for special occasions such as overnight visits or camp. The risk of overhydration and hyponatremia associated with desmopressin necessitates limiting fluid intake to <500 mL for children >12 years and <250 mL for children <12 years within 1 hour of going to bed.[16]

Desmopressin nasal spray is no longer indicated for the management of primary enuresis. Compared to oral formulations, it is associated with a higher incidence of hyponatremia, which may result in seizures and death.

Smooth Muscle Relaxants

Oxybutynin, an anticholinergic smooth muscle relaxant, is useful for reducing bladder contractions in children with detrusor overactivity (e.g., urge syndrome or neurogenic bladder); efficacy was 67% in a select group of children with detrusor overactivity.[13] A combination of **desmopressin** and **oxybutynin** can be tried in children with both detrusor overactivity and increased urine production. A combination of **desmopressin** and **long-acting tolterodine** (an anticholinergic agent with the same mechanism of action as oxybutynin) at a dose of 4 mg once daily has also been shown to be effective in cases when desmopressin monotherapy has failed.[17]

Reserve desmopressin plus anticholinergic combination therapy for refractory cases.[18] A lower dose of oral desmopressin (200 µg) is required when used in combination.[19]

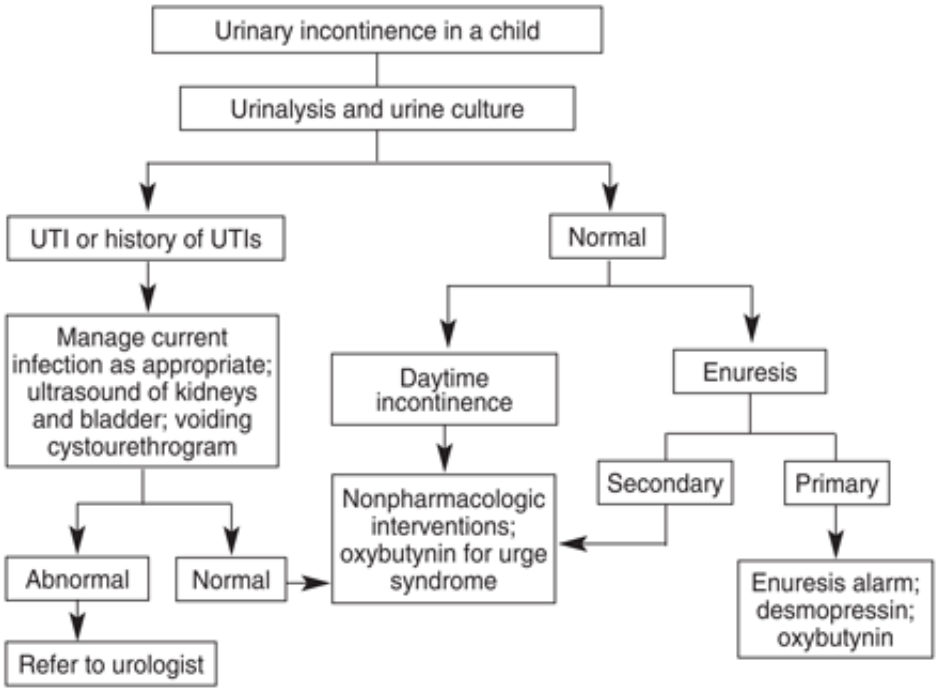
Other Therapies

Imipramine has been used in the past but is not recommended as monotherapy or in combination with other agents because it is not more effective than desmopressin, has a narrow therapeutic window and a high relapse rate. Imipramine may be considered by a healthcare professional with expertise in the management of bedwetting if the child has not responded to all other treatments.[20]

Therapeutic Tips

- Predictors of positive treatment outcome include a motivated child, supportive family and age over 10 years.
- Predictors of treatment failure include developmental delay, low self-esteem, a history of behaviour problems or multiple wetting at night, frequent daytime voiding, parental intolerance or annoyance and unstable family dynamics.[21]
- The cause of most cases of daytime incontinence is uncovered by noninvasive investigations (history, physical exam, urinalysis, urine culture and ultrasound of kidney and bladder).
- **Relative to desmopressin, enuresis alarms are superior in that once the child achieves dryness, there is less chance of relapse.**[9] Useful Info? The effects of desmopressin are immediate, whereas enuresis alarms take longer to reduce frequency of bedwetting.

Figure 1 - Management of Urinary Incontinence in Children



Abbreviations: UTI=urinary tract infection

Table 2: Drug Therapy for Urinary Incontinence in Children ≥5 Years of Age

Class	Drug	Dose	Adverse Effects	Comments	Cost[a]
Antidiuretic Hormone Analogues	*desmopressin* DDAVP Melt, DDAVP Tablets, Minirin generics	Dose is individualized. Tablets: 200–600 µg HS po (start with 200 µg 1 hour before HS. If no response, ↑ by 200 µg increments every 3 days). Fast-melting formulation: 120–240 µg HS sl (start with 120 µg 1 hour before HS. If no response, ↑ by 120 µg increments every 3 days). May continue treatment for 6 mo.	Headache (transient), abdominal pain, water intoxication, hyponatremia-related seizures (rare).	For enuresis. Used in conjunction with nonpharmacologic treatment. Desmopressin should not be used in children with kidney disease, heart failure, diabetes, ileitis or cystic fibrosis. The fast-melting formulation of desmopressin is effective for 7–11 h. 22 Withhold desmopressin in the case of an acute illness leading to decreased fluid intake. Combination therapy of low-dose desmopressin (e.g., 200 µg of tablet formulation) and smooth muscle relaxants can be used in cases refractory to desmopressin monotherapy.	$$-$$$$
Smooth Muscle Relaxants	*oxybutynin* generics	Dose is individualized. >5 y: 5 mg tid po	Dry mouth, constipation, flushing and occasional mood changes.13	Available as syrup. Combination therapy of desmopressin and oxybutynin can be used in cases refractory to desmopressin monotherapy.	$
Smooth Muscle Relaxants	*tolterodine (long-acting)* Detrol LA	Children 6–17 y: 4 mg HS po	Dry mouth, constipation, flushing and	Desmopressin plus long-acting tolterodine combination is used in cases refractory to	$$$$$

			occasional mood changes.13	desmopressin monotherapy.	

a. Cost of 30-day supply; includes drug cost only.

Legend: $ <$15 $$ $15–30 $$-$$$$ $15–60 $$$ $30–45 $$$$ $45–60 $$$$$ $60–75

Suggested Readings

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