

Assessment of Non-Neurogenic Incontinence and Lower Urinary Tract Symptoms in Adolescents and Young Adults

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Aims: The aim of this article is to provide insight to clinicians who principally treat adults, about non-neurogenic lower urinary tract symptoms (LUTS) either pre-dating or presenting in adolescence. Assessment fundamentals, diagnostic classification, and rationale behind the process of care are discussed. **Methods:** Standardized terms are used to describe the current classification of symptoms of LUT dysfunction in young adults. The etiology and symptomatology of continuous and organic incontinence, along with the intermittent presentations of incontinence, nocturnal enuresis, and bowel dysfunction are presented. Minimally acceptable assessment processes are defined. Indications for the inclusion of urodynamic investigations are presented. Throughout the review specific needs of adolescents, as they apply to clinical management of LUTS, are highlighted. **Results:** Puberty and growth are likely to challenge compensatory mechanisms for a safe urinary system in young adults with organic/structural/developmental LUT disorders. The priority of care is to screen for and detect precursor signs of renal deterioration. In adolescents with non-neurogenic bladder dysfunction a clear diagnosis and identification of both incomplete bladder emptying and high detrusor pressure will minimize permanent changes to both the upper and lower urinary tracts. **Conclusions:** The assessment of adolescents with LUTS requires time, thoughtful enquiry, and communication. Dysfunction pre-dating young adulthood commonly inhibits autonomy, recreational and social activities thus impacting on the adolescent's self-esteem and adherence to treatment regimes. *Neurourol. Urodynam.* 29:702–707, 2010. © 2010 Wiley-Liss, Inc.

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INTRODUCTION

Adolescence is the period of life between 10 and 19 years of age, an interval from the onset of puberty to assuming adult proportions. Approximately 13% of the general population falls into this age category. During adolescence individuals develop self-direction, significant relationships and sexual function, and achieve an endpoint of living as independent self-supporting adults.¹ Incontinence that presents or persists into adolescence negatively impacts self-esteem and mental health and interferes with the process of achieving independence.²

Management of young adults with lower urinary tract symptoms (LUTS) is superimposed on the background of rapid physical, psychological, and developmental changes.¹ Children who carry LUTS from childhood to adolescence can be considered similar to children with a chronic illness in whom development, body image, and socialization are likely to have been disrupted.³

Childhood health behaviors and compliance with treatment are influenced by parental instruction. In adolescence self-exploration of alternatives¹ may not align with therapeutic advice. Young adults frequently do not prioritize management

of their LUTS, even when the outcome can be catastrophic. Thus the context of adolescence, regardless of the specific LUTS, places unique demands on the adult clinician.

Presentation of childhood functional problems, congenital anomalies and bowel dysfunction to adult services is becoming more common as a result of improved management by pediatric services. Compromised infants now arrive into adulthood, and disorders previously considered self-limiting are evident beyond childhood. Nocturnal enuresis (NE), for example, was reported to resolve spontaneously by early adolescence and thus given little attention in young adults;

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however, it is now known that severe symptoms rarely remit beyond 9 years and this group is thus the most compromised of all enuresis sufferers.⁴ Similarly, dysfunctional voiding, a childhood condition of functional obstruction to voiding, has been reported to be carried into adulthood.^{5,6}

The aim of this article is to provide insight to clinicians who principally treat adults about the etiology of non-neurogenic LUTS pre-dating and presenting in adolescence. Assessment fundamentals and diagnostic classification of non-neurogenic LUTS will be discussed along with the rationale behind the process of care. Subsequent reviews in this series will address the transition of neurogenic dysfunction from childhood to adult services and outline the treatment fundamentals in young adults with and without neurogenic disease.

SYMPTOM CLASSIFICATION

In line with recent standardization of terms⁷ urinary dysfunction is described according to the presenting symptoms and is either congenital or acquired. It is initially categorized as either continuous or intermittent in nature, with the former implying some structural or developmental anomaly. During infancy and childhood the bladder is particularly vulnerable to changes in emptying practices and habits and its ability to develop normally is confounded by urinary tract infections (UTI), vesicoureteric reflux (VUR), and bowel disorders. A primary difference is that disorders of childhood voiding potentiate bladder filling problems, whereas in adult patients filling problems are often considered idiopathic or independent of voiding disorders.

Continuous Incontinence and Organic Causes of Adolescent Bladder Dysfunction

Woodhouse speculated that the “passage to adolescence is kind to the bladder that has no overt disease, but in children with identifiable bladder disease the general tendency is to worsen with age”.⁸ Whilst the primary disorder may have been addressed in childhood, vigilance is needed during the adolescent era when growth challenges compensatory mechanisms.

Recent onset incontinence is rarely related to new anatomical abnormalities in adolescents; however, spinal cord compromise may be manifest as the child grows taller. Symptoms include worsening incontinence, poor response to therapy, and an inability to void.⁹ Symptoms of structural incontinence from childhood may re-present in adolescence. Epispadias in girls may be detected in late adolescence or adulthood as mild urine leakage associated with a short patulous urethra and large incompetent bladder neck.¹⁰ On urodynamic evaluation the detrusor is generally minimally dysfunctional, having high-compliance but a low capacity.¹¹

Posterior urethral valves (PUV) and obstructive membranes, although diagnosed and managed early, have dire consequences in adolescence and should be followed closely. The bladder is commonly overactive, perhaps as a result of early denervation and acetylcholine supersensitivity, but might progress to become poorly compliant, inducing high-storage pressures that are not felt by the patients. By 15 years of age 50% of affected children will have renal failure, in part due to unnoticed continuing high pressure in the bladder, especially during the night.⁸ Co-existing diabetes insipidus accelerates upper urinary tract damage.

Hypocontractile changes occur even in the absence of bladder symptoms, resulting in incomplete bladder emptying

in 66% of 20-year-old boys with a history of valves. The clinician should obtain regular voiding diaries and monitor for signs of both detrusor trabeculation and progressive hydroureteronephrosis. The presence of bladder overactivity carries the most favorable renal prognosis while poor bladder compliance and detrusor hypocontractility are associated with the worst outcome.¹² In late-presenting PUV, bladder dysfunction commonly persists after valve ablation, increasing the risk of renal deterioration.¹³

Vesicoureteric reflux is either primary or acquired. Primary VUR in adolescents has often been present since childhood, and while some patients show radiologic evidence of nephropathy¹⁴ in most cases VUR is eradicated before onset of puberty. Since renal damage usually occurs before 5 years of age, older children with low-grade VUR, no evidence of renal injury, and no bladder/bowel dysfunction can be routinely observed or offered injection therapy. VUR does not cause incontinence per se, however, the acquired form is commonly associated with underlying bladder dysfunction that in turn precipitates incontinence. Girls treated successfully for previous dysfunctional voiding may re-develop infection when they become sexually active.

Boys with mild VUR that escaped antenatal detection may present in adolescence with voiding dysfunction, NE, urinary frequency, or a history of UTI. Symptoms may be accompanied by Schober et al.¹⁵ mild hypertension, hydronephrosis, significant post-void residual urine, detrusor trabeculation, and diverticula.¹³

Intermittent Incontinence: Daytime

The symptom of urinary incontinence during the day has been reported in 1–1.8% of the population between 15 and 17 years.^{4,15} The four main sub-groups of daytime incontinence listed in Figure 1 carry distinct presentations. Symptoms of urgency and frequency generally define the presence of an overactive bladder (OAB), however, adolescents may mask or manage these problems with voluntary dehydration. As few as 5% of patients may report incontinence as an isolated symptom, however, with closer scrutiny up to 1/3 can be expected to have co-existing day and night bladder dysfunction.

The adolescent presenting with OAB is likely to have a history of recurrent UTI, bowel dysfunction, and or fecal retention. Fortunately the development of renal injury after a single infection is uncommon beyond childhood.¹⁶ Since there

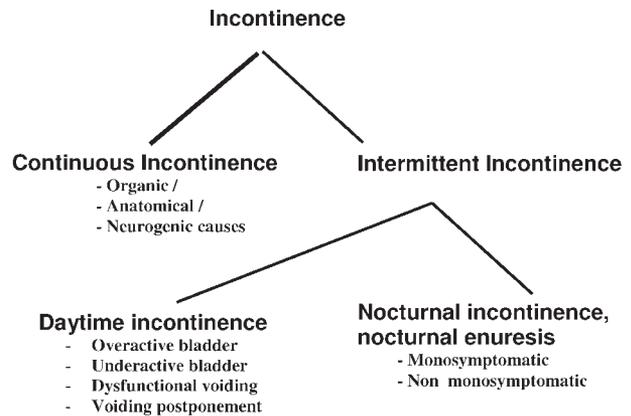


Fig. 1. Classification of childhood urinary incontinence. Modified from Nevéus et al.⁷

is no evidence that the OAB is normal in children, clinicians should not consider symptoms likely to resolve spontaneously during adolescence.

Urgency to urinate during adolescence and more than three bladder infections during childhood have been shown to be significantly more common and predictive in individuals who subsequently develop interstitial cystitis/painful bladder syndrome than in control adults.¹⁷ Although the definition of interstitial cystitis precludes patients under 18 years of age the disease has been described in children and displays symptom creep into adulthood. Common symptoms in children with interstitial cystitis are pain and urinary frequency.

Dysfunctional voiding denotes an inability to fully relax the bladder neck, urinary sphincter, or pelvic floor during voiding. It is primarily a disorder of emptying but with greater outlet resistance the detrusor increases voiding pressure and filling symptoms are evidenced. Over time reduced contractile activity and prolonged bladder emptying may be augmented by abdominal straining, known as an underactive bladder.⁷ Symptoms of dysfunctional voiding include infrequent and incomplete emptying of urine, recurrence of UTI, urgency, incontinence, and stool dysfunction. The cause of dysfunctional voiding is unknown, but usually it starts in earlier childhood. A diminished feeling of the filling state of both the bladder and the rectum is typical in this condition. In cases of late presentation in adolescents or adults, assessment should include questions about both sexual history and negative sexual encounters.^{18,19}

Giggle incontinence is frequently encountered in adolescents of both genders and commonly reported to be familial. Since incontinence occurs during laughter it is often confused with stress incontinence or OAB. Giggle incontinence may continue into adulthood and significantly impair the patient's social life. The definitive etiology is unknown and there is no acceptable evidence that any form of treatment is superior to no treatment.²⁰

Stress incontinence is seen in some young adolescent girls, with symptoms beginning just after menarche. Although the exact cause often remains unknown unusual presentations of epispadias, dysfunctional voiding, or (occult) neurogenic disorder should be excluded. Possibly bladder neck insufficiency or hormonal factors play a role.

Intermittent Incontinence: Nocturnal Enuresis

The prevalence of NE in adolescents varies from 0.5% to 2.6%.^{4,15,21} Adolescents with NE report severe symptoms, with 37% of affected 19-year-old sufferers wet every night.⁴ Co-existing day and night incontinence in adolescents is more common in girls than boys^{15,21} affecting up to 4.7% of girls and <1% of boys.^{21,22} NE in adolescence has much more impact on quality of life and self-esteem than in the younger child.²

The major discriminative feature of NE is whether or not the symptom of wetting whilst asleep occurs in isolation or co-exists with other symptoms of bladder dysfunction. It is no longer clinically important to identify whether the bladder emptied to completion on each episode. Underlying signs of NE include reduced voided volumes, excessive nocturnal urine volume that can vary from night to night and an inability to completely rouse from sleep to void. Patients are sub-grouped according to the presence or absence of these changes.

Patients seeking treatment as adolescents are most likely to have underlying bladder dysfunction that has escaped earlier detection. An OAB has been reported in 66% of children and 63% of adults with refractory NE^{23,4} whilst underlying voiding

dysfunction was identified in 73% of investigations.⁴ Onset of detrusor overactivity during sleep in nocturnal enuretic individuals who were free of daytime symptoms was also reported.²⁴ It has been further postulated that such bladder overactivity at night stimulates repeated transition to light sleep but that complete cortical arousal is paradoxically suppressed by long-term overstimulation from the detrusor.²⁵ Severely enuretic children have been observed to spend significantly more time in light sleep and to have higher arousal indexes than control children. This discrepancy disappears after successful treatment of NE.²⁶

The inference therefore is that NE in the adolescent population is generally non-monosymptomatic. Other disorders may be associated with NE. For example, NE may resolve after obstructive sleep-disordered breathing has been treated with adenotonsillectomy or nasal corticosteroids.²⁷

Bowel Dysfunction

Adolescents with bladder dysfunction often admit to bowel symptoms such as stool impaction, constipation, fecal incontinence, and dyssynergic defecation. Recent studies of 5-year follow-up data in adolescents cited 30–36% of patients who previously experienced bowel problems reported on-going bowel dysfunction.^{28,29} Even later in life, adult enuretic patients describe significantly more constipation and fecal soiling in childhood than do normative subjects.⁵ Two conclusions emerge: Firstly that in the absence of anatomical/neurological anomaly dysfunction of emptying in both urinary and bowel systems are likely to be inter-related.²⁰ Secondly, bowel dysfunction does not necessarily remit either with treatment or spontaneously. Given the high degree of stress and embarrassment experienced by families and sufferers expert attention to bowel function is mandatory.

Constipation can be broadly considered to be due to an abnormal contraction pattern of colonic motor function or to an inability to relax the pelvic floor and anal sphincter during defecation.³⁰ One recent study reported these underlying causes to co-exist in 13% of adolescent subjects.³¹ Up to 70% of constipated children have blunted or absent rectal sensitivity,^{32,33} related to increased rectal compliance, a lack of daily routine, unacceptable toilets, or inadequate privacy. Whilst stool consistency in constipation is generally assumed to be hard and dry, it may also be soft and unformed, and thus difficult to perceive and fully evacuate. Poor perception of rectal filling can trigger increased rectal capacity, impaired stool quality, an increased recto-anal inhibitory reflex threshold, and incomplete emptying at eventual defecation. Symptoms are exacerbated over time.

Fecal incontinence has a prevalence of between 2% and 3% in patients 6–18 years³⁴ and may be mistaken for diarrhea by some parents. It is often the point at which rectal accumulation induces pelvic floor muscle fatigue resulting in reduced competence of the anal sphincter.³⁵ Regardless of origin it causes significant distress for patients and their families.³⁵

ASSESSMENT

The adolescent consultation differs from the adult meeting in that issues around confidentiality and consent are fundamental yet the role of the parents must be considered. Adolescents prefer communication to be directed at themselves rather than their parents³⁶ yet the strength of their family relationships is crucial to successful management.¹ Practically speaking this may involve longer consultations, with afternoon or evening clinics to allow time for discussion

as a family then alone with the young patient.¹ Less than half of adolescents have ever spoken privately with their doctor.³⁷

Consent for any examination should include asking whether or not the young person wishes their parents to be present. Personal privacy can still be maintained by having the parent in the room but aside from the examination table. More girls than boys prefer a same-sex doctor, however, if this cannot be offered then the presence of a same-sex chaperone during examination is recommended.^{37,1}

Minimum Evaluation

Unless there is a history of organic, neurological or urological disease, assessment of lower urinary tract dysfunction in adolescents may only require a thorough history, bladder chart, clinical examination, urinalysis, and ultrasound. It is particularly important to note former surgery, recurrent UTI, the presence of neurological signs, changes to the external genitalia, and evidence of constipation. Since UTI share risk factors and frequently mirror symptoms associated with sexually transmitted infections (STI), any irritative urinary symptoms in sexually active adolescents should prompt STI screening.¹⁸ Clearly, clinical practice in this age group should involve taking a sexual history. Recently a link has emerged between ketamine abuse, bladder pain, and urinary frequency;³⁸ a history of these symptoms in an adolescent should elicit enquiry about drug taking behaviors.

Adolescents with structural LUT anomalies and chronic illnesses can be expected to demonstrate some level of psychosexual dysfunction and anxiety but to generally respond positively to demands of living.^{39–41} Whilst it is known that non-neurogenic LUTS and NE in young adults is associated with impaired self-esteem² and anxiety/withdrawal problems⁴² there is little information available about the psychological impact of de novo LUTS during adolescence. At this stage no recommendation can be made about the use of a screening tool to identify psychological dysfunction in adolescents with LUTS.

Ultrasound evaluation of the urinary tract, kidneys and bladder identifies structural anomalies, upper tract dilatation, ureteral obstruction, and alterations in bladder wall thickness. Bladder wall changes have been shown to correlate with diagnosis of both the hypertrophied OAB and the thin-walled underactive bladder.⁴³ Perineal ultrasound allows visualization of contractions of the pelvic floor, thus aiding discrimination between neurogenic and non-neurogenic voiding disorder by De Jong et al.⁴⁴ Ultrasound of the filling state of the rectum can identify co-existing constipation.⁴⁵

In order to sub-classify NE patients as having nocturnal polyuria, reduced bladder storage or disordered sleep an evaluation of nocturnal urine production is best practice. A bladder diary over four nights plus recordings of the change in weight of wet containment appliances over 2 weeks will allow diagnosis of nocturnal polyuria. Reduced voided volume will be evident on both bladder diary and urodynamic investigation. Sleep disorder is considered to either be a consequence of nocturnal OAB⁴⁶ or to be a primary arousal abnormality, but does not require separate evaluation. When an adolescent with severe enuresis does not respond to a cascade of treatment modalities and combinations it may be relevant to screen for otorhinolaryngological anomalies.

Uroflowmetry, with or without pelvic EMG recording, followed by post-void ultrasound scanning is a useful screening tool in adolescents with continuing or recent onset of LUTS. Significant findings will include abnormal flow patterns,

decreased maximum flow rate, and the presence of a significant residual.

Urodynamic Evaluation

There are two main indications for performing cystometry: to investigate incontinence and to determine bladder compliance. The most common cause of incontinence in young people, without associated neurological or urological abnormality, is leakage secondary to detrusor overactivity. Urodynamic stress incontinence,⁴⁷ although rarely seen in adolescents, can only be differentiated from detrusor overactivity incontinence by means of cystometry. Standard cystometry, with or without pelvic EMG recording, usually provides adequate information concerning bladder function in neurologically intact adolescents.^{48,49} It is, however, an invasive test and requires consideration and negotiation in individuals who have intact urethral sensation.

Loss of detrusor compliance is a recognized sequel of many conditions that affect the nerve supply to the bladder and urethra and of structural disorders. Poor compliance and high-pressure bladders are associated with a trabeculated bladder, vesicoureteric reflux, and renal failure.⁵⁰ If loss of compliance is found during a urodynamic investigation of an apparently neurologically normal adolescent, then further investigation, for example, MRI, is indicated to exclude a covert neurological condition. In adolescents with complex urological problems urodynamic investigation is indicated for routine monitoring,⁸ if there is a change in symptoms or deterioration of renal function. Videocystometry provides additional structural information than can be obtained using fluoroscopy⁵¹ but involves exposure to radiation.⁵² Although voiding cystometry may reveal bladder wall abnormalities or reflux, it is not a reliable modality to detect anatomical infravesical obstruction in boys.^{53,54}

Where there is new onset or worsening LUTS without overt neurological disease or anatomical obstruction, an MRI will exclude tethering of the spinal cord and occult spinal dysraphism. Normal lower limb reflexes and a sensate perineal area do not imply spinal cord integrity. Thus adolescents in whom symptoms cannot be explained should undergo MRI. This is especially advised in patients with known upper tract deterioration.

Evaluating Bowel Function

Fecal incontinence is easily described and may be associated with a call to stool (urgency or withholding) or follow a bowel action. Information about irritable bowel symptoms, dietary extremes, recent travel, and high-impact sports involvement, such as road running, should be included in the assessment.

A diagnosis of constipation can only be made from bowel diary recordings over 2–4 weeks. If two or more of the findings listed in Table I are present functional constipation can be assumed. It is noteworthy that painful defecation in adolescence has been reported to be a predictor of adult interstitial cystitis/painful bladder syndrome.¹⁷ An abdominal examination should be conducted identify a fecal mass and the spine, perineum, and perianal area inspected to exclude spinal dysraphism.³⁵ The controversial recommendation has been made that digital rectal examination be performed at least once⁵⁵ although in young adults a rectal ultrasound or abdominal X-ray may provide sufficient information to guide treatment.³⁵ It should be noted that most school toilet facilities deter young people from answering a call to stool

TABLE I. Diagnosis of Functional Constipation Requires Two or More of the Following Characteristics At Least Once Per Week Over the Preceding 8 Weeks³⁵

Frequency of stool ≤ 2 per week
At least one episode of fecal incontinence per week
Retentive posturing or excessive stool retention
History of painful or hard bowel movements
Presence of large fecal mass in the rectum
History of large diameter stools may obstruct the toilet

during school hours. In addition adolescents often travel long distances to secondary school and develop expertise in withholding a bowel action that they would pass if at home. Thus a discussion of the patient's environment and routine should be included in any assessment of bowel function.

SUMMARY

In summary, the assessment of adolescents with LUTS requires time, thoughtful enquiry and communication. The priority of care is to screen for and detect precursor signs of renal deterioration. In neurologically normal adolescents dysfunctional voiding, may be masked. Failure to detect detrusor dysfunction in young adults, in particular poor compliance, is likely to result in permanent changes to both the upper and lower urinary tracts. Failure to recognize bladder symptoms that are associated with STI rather than detrusor pathology can potentiate pelvic inflammatory disease or infertility. The presentation of NE in an adolescent or adult should be thoroughly assessed as it most certainly suggests the co-existence of significant lower urinary tract dysfunction.

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