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Personal Practice

Urinary Incontinence in Children: The Surgeon's Perspective

JDY ***SIHOE***

Abstract Urinary incontinence in children, whether occurring during the day or night, is a very distressing condition not only for the child but also for their parents. Over a decade ago, children in many societies were still just expected to be able to achieve urinary continence as they grew older and by the time they started school. Little emphasis had been placed on the problem of persistent wetting and so many a times these children and their parents just kept the problem to themselves. However, increasing interest and research in this area has highlighted the possible social and psychological impact that the condition may have on the child and thus raising awareness among families and clinicians. Our increasing knowledge and understanding of the topic, including the spectrum of possible underlying voiding dysfunctions, has also led to profound changes in its management strategy, which now often involves a multidisciplinary approach and targeted therapy. This article discusses the local prevalence, problems and management of non-neurogenic urinary incontinence from a surgeon's perspective.

Key words Children; Nocturnal enuresis; Urinary incontinence

Definitions and Standardisation of Terminology

With the increasing number of research and published articles involving lower urinary tract function, several new concepts have been introduced with different interchangeable terms. To try to lessen the amount of confusion thus created, the International Children's Continence Society (ICCS) had set up a Standardisation Committee consisting of professionals from different parts of the World to put together a set of guidelines for the use of different terminology for lower urinary tract (LUT) function in children with the latest update published in 2006.[1]

Urinary Incontinence is defined as the uncontrollable leakage of urine and is applicable after the age at which bladder control is attained or 5 years of age. This can be continuous (usually associated with congenital malformations) or intermittent, and can occur both day and night. Enuresis refers specifically to intermittent incontinence which occurs during sleep.

Enuresis can be sub-divided into secondary (SNE) if the child has had a previous dry period for more than 6 months or primary (PNE) if otherwise. It can also be sub-divided into monosymptomatic if the child has no history of bladder dysfunction and no other LUT symptoms or nonmonosymptomatic if they do.

Classification of daytime incontinence is much more difficult as a whole spectrum of LUT dysfunction exists which can overlap and progress with time. Such conditions are described in Table 1.

All members of the different multidisciplinary teams involved in the clinical management of urinary incontinence

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Table 1 ICCS Classification of daytime LUT conditions

Term	Definition
Urge incontinence	Incontinence in the presence of urgency.
Overactive bladder (OAB)	Urinary urgency with or without urinary frequency and/or urge incontinence. Often associated with detrusor overactivity on cystometric evaluation.
Voiding postponement	Daytime incontinence associated with habitual postponement of micturition often by various holding maneuvers. Child has often learned to restrict fluid intake during the day.
Underactive bladder	Voiding by increased intra-abdominal pressure often associated with low voiding frequency and interrupted flow.
Dysfunctional voiding	Voiding against a contracted urethral sphincter resulting in staccato pattern on uroflowmetry.
LUT obstruction	Characterised by increased detrusor pressure on voiding and a decreased urine flow rate.
Stress incontinence	Leakage of urine (usually small amounts) on exertion or with an increased intra-abdominal pressure.
Vaginal reflux	Urinary incontinence (usually moderate amounts) occurring soon after voiding in toilet-trained pre-pubertal girls due to vaginal entrapment of urine.
Giggle incontinence	Almost complete voiding occurring during or after laughing with otherwise normal bladder function.
Extraordinary daytime urinary frequency	Small (<50% expected bladder capacity) and frequent (>once hourly) voids during the day with normal nocturnal bladder behaviour.

in children should be familiar with these terms and guidelines to ensure better communication. It is also important for researchers to adhere to these in order to allow for better analysis and comparison between articles.

Epidemiology and Prevalence in Hong Kong

An epidemiological survey in 1995 reported the overall prevalence of PNE to be 3.5% amongst local Chinese school children between the ages of 4 to12 years.[2] Only 0.1% of these children had both day and night-time incontinence. When stratified according to age, 10.4% of boys and 6.6% of girls were wet at 5 years, decreasing rapidly with increasing age to a prevalence of only 0.5% amongst boys and 0% amongst girls at age 10. This result was rather surprising as it was significantly lower than what was noted in Western countries at the time.

However, since then, the local Student Health Service had been implemented providing mass screening for different health problems including urinary incontinence. Along with increased public educational programmes at the time, an influx of patients with urinary incontinence seeking medical advice was noted. Therefore, a second large scale epidemiological survey was carried out, this time, on local school children between the ages of 5 to 19 from 67 randomly chosen schools in different areas of Hong Kong.[3] A total of 21,000 questionnaires were sent out with a response rate of 78.6% (mean age 13.7 years). The overall prevalence of PNE this time was 3.1%, of which, 20% had both day and night-time symptoms. When stratified according to age, the prevalence of PNE was 16.1%, 10.1%, 3.14% and 2.2% at 5, 7, 9 and 19 years respectively. This time, the results were consistent with those found in other Western countries. It was noted in this study that 89% of parents only became aware of this condition within 3-4 years prior to the survey. Thus it was postulated that the difference in prevalence between the two studies may have been due to an initial reluctance of the children to come forward with their symptoms or parental indifference to the condition back in 1995 and that subsequent efforts placed in raising public awareness within the community was able to reveal a more realistic picture of the problem.

Furthermore, an epidemiological study carried out on local Chinese adults between 16 to 40 years of age found that the overall prevalence of PNE in adults was 2.3%.[4] Of

these, 18.4% also had daytime urinary incontinence. The study also showed that the prevalence of PNE remained relatively unchanged as age advanced. When stratified according to severity of symptoms, it was also noted that the significant reduction in overall prevalence with increasing age was more evident amongst mild enuretics whereas those with persistent PNE in adulthood tended to have more severe symptoms. Hence, it is postulated that severe enuretics were more likely to have persistent symptoms into adulthood with less likely spontaneous resolution.

Limited local data is available in the literature for the prevalence of daytime urinary incontinence alone in children. However, a telephone survey carried out on local Chinese adults between 16 to 40 years of age in 2006 (unpublished data) noted that 6.8% of respondents had experienced persistent urinary incontinence with onset before 10 years of age based on recollection of symptoms. There was no gender difference at this age. This is compatible with other international series. Kajiwara et al[5] reported a prevalence of daytime urinary incontinence of 6.3% amongst Japanese primary schoolchildren 7 to 12 years of age. Similarly, Bower et al[6] reported a prevalence of 5.5% amongst Australian school children 5 to 12 years of age.

Misconceptions and the Development of Bladder Control

Urodynamic studies on normal infant bladders have shown that bladder function in young children develops progressively from an indiscriminate infantile voiding pattern to a more voluntary type of micturition during the first 2 to 3 years of life through an active learning process whereby the child gradually acquires the ability to voluntarily inhibit or initiate voiding at socially convenient times. This process is dependent on an intact nervous system, a progressive increase in bladder functional storage capacity, maturation of voluntary control over the urethral striated muscle sphincter and development of direct volitional control over the bladder-sphincteric unit so that the child can voluntarily initiate or inhibit the micturition reflex. However, it can also be influenced by an awareness of the accepted social norms in families during toilet training.[7]

Traditionally, urinary incontinence and bedwetting was attributed to a delay in the normal maturation of bladder control and hence the belief that these conditions would get better with age.[8] Moreover, parents often had the misconception that their child was lazy or would even blame themselves for not being able to toilet train their child. Therefore, many a times children with this condition are reluctant to come forward with the problem and parents do not readily take their children to seek medical advice. This is particularly so in Chinese families due to cultural stigmata regarding this as a shameful behaviour. Parents and children often felt embarrassed and are afraid to be labeled as "slow" if they could not achieve dryness before kindergarten.

A report published by The Hong Kong Childhood Enuresis Study Group in 2004 showed that nearly 90% of children (7 to 15 years) with enuresis felt embarrassed and avoided talking about the problem and 18% even denied having wetting episodes. The majority of parents (86%) worried about organic or psychological causes but the majority had not sought proper medical advice before. Fifty-seven percent of them were punishing their children because of bedwetting. This report therefore highlighted the level of parental ignorance over the issue and the possibility that bedwetting could be a cause for poor inter-family relationships.[9]

Social and Psychological Impact

Mothers often complain that their enuretic child is lazy and refuses to wake up at night despite bedwetting. They also tend to complain of poor attentiveness and concentration during the day at home. The relationship between enuresis and psychosocial factors were thus also addressed by the previous epidemiological studies in Hong Kong which found that enuretics did tend to have more difficulty in sleep arousal with frequent nightmares. They also tended to have poor school performance and poor relationship with peers compared with controls.[2] Furthermore, they had a higher incidence of depression and low self-esteem compared with controls.[3]

When Hong Kong adult PNE patients were studied, it was found that significantly less enuretics reached tertiary education (33.4% vs. 17.8%, $p<0.01$) compared to non-enuretic controls. Similar to children, they also had a higher incidence of depression, lower self-esteem and more sleep disturbances. Interestingly, 32-40% of adult bedwetters reported that PNE affected their choice of a job, work performance and social activities whilst 23% felt the condition affected their family life and in making friends of either sex.[4]

Data (unpublished) from Hong Kong adults with LUTS showed that respondents suffering from daytime urinary

incontinence and urinary frequency had higher depression levels compared with controls. However, depression levels for those who reported resolved symptoms in the past were comparable with controls and it is thus postulated that resolution of symptoms could revert the problem of depression. Similar findings were noted between NE and decreased self-esteem. In all cases, the depression and self-esteem scores were independent of the symptom onset or resolution age.

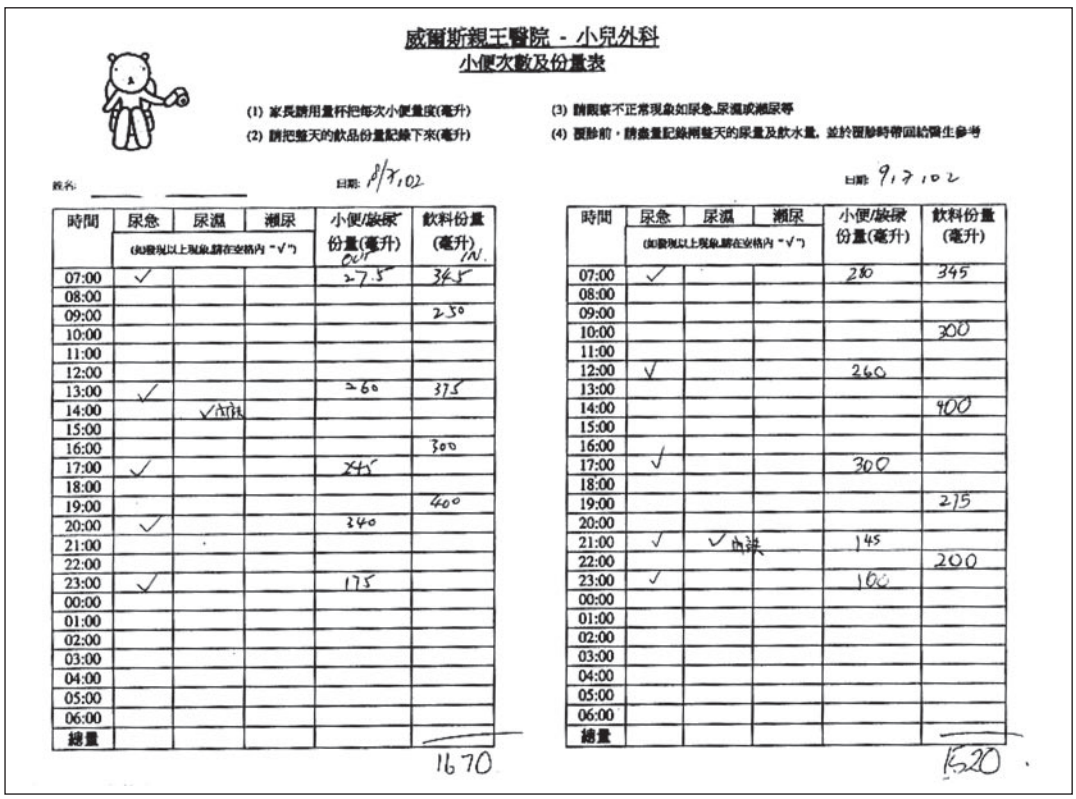
Evaluation

History

A detailed history from the child, parent or the usual career should be obtained. This should include relevant questions to exclude neurological and congenital abnormalities. Bowel dysfunction can coexist in the form of encopresis, constipation and fecal impaction and should be noted during history taking. The urinary history should focus on symptoms related to both the storage and evacuation of urine. For daytime incontinence, it is usually possible to determine whether it occurs before or after voiding and whether there are any precipitating factors. The child's mental status should be noted as children with attention deficit hyperactivity disorder have a greater risk of incontinence and tend to be much more challenging to treat.[10] Family issues should be addressed and when suspected a history of child sexual abuse should be looked into.[11]

Bladder Diary: Frequency-Volume and Bedwetting Charts

A bladder diary is an essential assessment tool in toilet-trained children and includes recordings of daily fluid intake, urine output and bladder related symptoms at home under normal conditions. When properly filled-in, it should include data regarding the number of voidings per day, the distribution of voids during the day, the voided volume as well as records of any episodes of urgency and leakage. It is a useful tool to help identify underlying dysfunction and those who may warrant further studies as well as in follow-up. As opposed to a freqency-volume chart, a bladder diary would also provide further information on nocturia, enuresis and incontinence episodes. Our practice would be to use a separate chart for day and night-time symptoms. The bedwetting chart would allow one to assess the severity of enuresis and to monitor progress (Figures 1 & 2).



威爾斯親王醫院 - 小兒外科

小便次數及份量表

(1) 家長請用量杯把每次小便量度(毫升)
(2) 請把整天的飲品份量記錄下來(毫升)
(3) 請觀察不正常現象如尿急,尿漏或濕尿等
(4) 覆診前,請盡量記錄兩整天的尿量及飲水量,並於覆診時帶回給醫生參考

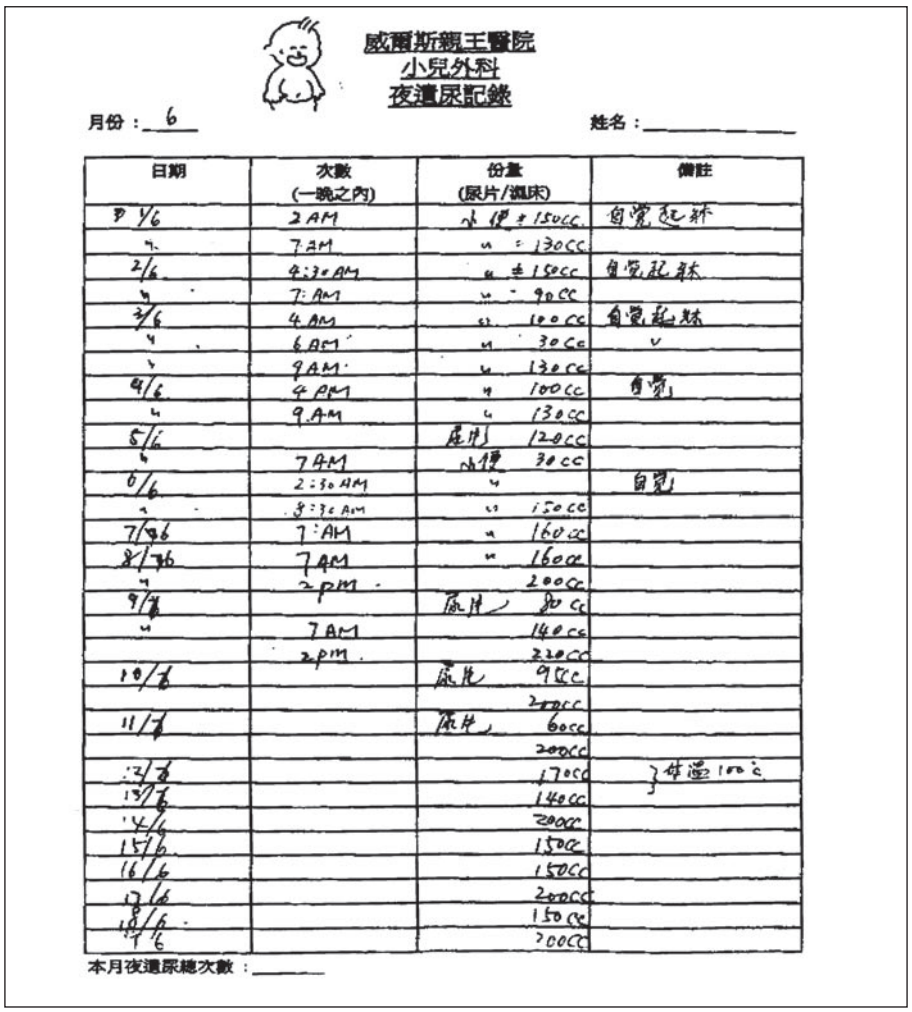
姓名: _____ _____ 日期: 8/7/02

時間	尿急	尿漏	濕尿	小便/缺尿份量(毫升)	飲料份量(毫升)
	(如發現以上現象,請在空格內 "√")			OUT	IN
07:00	√			27.5	345
08:00					
09:00					230
10:00					
11:00					
12:00					
13:00	√			260	375
14:00		√			
15:00					
16:00					300
17:00	√			245	
18:00					
19:00					400
20:00	√			240	
21:00					
22:00					
23:00	√			175	
00:00					
01:00					
02:00					
03:00					
04:00					
05:00					
06:00					
總量				1670	

日期: 9/7/02

時間	尿急	尿漏	濕尿	小便/缺尿份量(毫升)	飲料份量(毫升)
	(如發現以上現象,請在空格內 "√")				
07:00	√			280	345
08:00					
09:00					
10:00					300
11:00					
12:00	√			260	
13:00					
14:00					400
15:00					
16:00					
17:00	√			300	
18:00					
19:00					275
20:00					
21:00	√	√ 血絲		145	
22:00					200
23:00	√			100	
00:00					
01:00					
02:00					
03:00					
04:00					
05:00					
06:00					
總量					1520

Figure 1 Example of a bladder diary.



威爾斯親王醫院
小兒外科
夜遺尿記錄

月份：6　　姓名：_____

日期	次數 (一晚之內)	份量 (尿片/溼床)	備註
1/6	2AM	小便 150cc	自覺起牀
〃	7AM	〃 130cc	
2/6	4:30AM	〃 150cc	自覺起牀
〃	7:AM	〃 90cc	
3/6	4AM	〃 100cc	自覺起牀
〃	6AM	〃 30cc	〃
〃	9AM	〃 130cc	
4/6	4AM	〃 100cc	自覺
〃	9.AM	〃 130cc	
5/6		尿片 120cc	
〃	7AM	小便 30cc	
6/6	2:30AM	〃	自覺
〃	3:30AM	〃 150cc	
7/6	7:AM	〃 160cc	
8/6	7AM	〃 160cc	
〃	2pm	200cc	
9/6		尿片 80cc	
〃	7AM	140cc	
	2pm	220cc	
10/6		尿片 90cc	
		200cc	
11/6		尿片 60cc	
		200cc	
12/6		170cc	共溼100cc
13/6		140cc	
14/6		200cc	
15/6		150cc	
16/6		150cc	
17/6		200cc	
18/6		150cc	
19/6		200cc	

本月夜遺尿總次數：_____

Figure 2 Example of a bedwetting chart.

Physical Examination

Physical examination is usually normal in children with non-neurogenic voiding dysfunction but careful examination is required to exclude those who may require further neurological evaluation. Occasionally, in an otherwise normal child, one may find a palpable bladder on abdominal examination in cases of decompensated bladders. Abnormalities of the lower spine should be sought specifically to exclude the possibility of an occult spinal dysraphism. Lesions such as an asymmetric gluteal fold, hairy patch, dermovascular malformation or lipomatous abnormality of the sacral region should prompt further imaging evaluation. The external genitalia may be examined to exclude any obvious anatomical problems that can explain the urinary symptoms in question, for example labial adhesions in girls may cause post-void dribbling. Rectal examination may reveal fecal impaction or distended rectum in those with chronic constipation. In the absence of any positive findings on examination, further investigations may be warranted.

Laboratory Investigations

Laboratory investigations are generally not routinely required unless the child presents with complications such as urinary tract infections. However, to complement a full work-up, urinalysis may be performed to rule out bacteriuria and glucosuria. Serum and urine osmolality may be looked at in cases of nocturnal enuresis to assess renal concentrating ability.

Ultrasonogram

An ultrasonogram (USG) is often the first-line investigation in children with non-neurogenic voiding dysfunction as it is a simple, readily available and non-invasive tool which is able to provide information both on

anatomical and functional problems when performed by experienced paediatric radiologists.

Over the last 5 years, we have been routinely measuring bladder parameters used to calculate a "bladder volume and wall thickness index" (BVWI). This BVWI can be classified into normal, thick or thin according to the measured parameters. Our studies have shown that this classification corresponded closely to urodynamic findings of underlying bladder dysfunctions and can act as a reliable tool to guide for further invasive investigations.[12]

Other Imaging Studies

Radiological examination of the spine may be necessary to rule out any neurogenic causes of voiding dysfunction.

A micturating cystourethrogram may be performed in patients to rule out vesicoureteral reflux. Information on the bladder emptying efficiency may be obtained and the status of the urethra can be assessed to exclude any outflow obstruction.

Urodynamic Studies

Urodynamic studies (UDs) are employed to describe the physiological parameters involved in the bladder mechanics during filling and voiding. A complete study would involve cystometry combined with uroflowmetry and perineal electromyography (EMG). Bladder filling and storage can then be described according to bladder sensation, detrusor activity, bladder compliance and bladder capacity. According to our protocol, UDs are reserved for those children with moderate to severe PNE (>3 nights per week) and all children with daytime urinary symptoms. It can help further classify the underlying bladder dysfunctions for target therapy (Table 2).

Cystometry requires a bladder catheter introduced transurethrally or suprapubically. Although more invasive, the use of suprapubic catheterization has been suggested as a better alternative to transurethral catheterization as voiding can be more physiological. A catheter in the urethra, particularly in young children, not only causes obstruction to the flow of urine but can also cause significant discomfort. For suprapubic catheterization, a 6 Fr double lumen catheter is placed suprapubically under sedation and left in situ for 24 hours before commencement of the urodynamic study.

The suprapubic catheter is connected to a computer system and used to measure intravesical pressure. Another catheter is placed in the rectum to measure intra-abdominal pressure surrounding the bladder. By subtracting the latter from the intravesical pressure, we can calculate the detrusor pressure. Sphincteric activity is measured with simultaneous perineal EMG recordings and pressure flow studies are carried out during the voiding phase with uroflowmetry. All the measured data are directly fed into a computer for analysis and display of graphical measurements.

Traditionally, the bladder is filled artificially with water/normal saline to speed up the study and the child is asked to indicate his/her desire to void if they are old enough to do so and then void into a specially designed seat with an uroflowmeter attached. More recently, studies have shown that the non-physiological filling of the bladder during conventional fill urodynamics, even at low filling rates, can lead to misrepresentations of true bladder activity during normal situations. Therefore, natural fill urodynamic studies may be performed whereby the child is asked to drink to allow the bladder to fill up on its own rate. It appears that artificial filling may inhibit the detrusor response and attenuate its maximum contractile potential, rendering detrusor overactivity much less pronounced and undetectable in conventional fill UD. Therefore, natural fill cystometry is the preferred technique in children or better still, the combined use of artificial and natural filling

Table 2 Urodynamic classification of bladder dysfunction

Classification	Description
Detrusor overactivity (DO)	Characterised by uninhibited detrusor contractions during the filling phase.
Primary bladder neck dysfunction (pBND)	Characterised by a marked delay in initiation of urinary flow after onset of detrusor contraction and is often associated with high detrusor pressure but minimal pelvic electromyography activity.
Dysfunctional voiding	Characterised by voiding which is preceded with abdominal or pelvic straining and evidence of increased pelvic floor electromyography activity. There is marked staccato or interrupted voiding on uroflowmetry.

urodynamic studies are helpful to accurately delineate the underlying bladder dysfunction.[13]

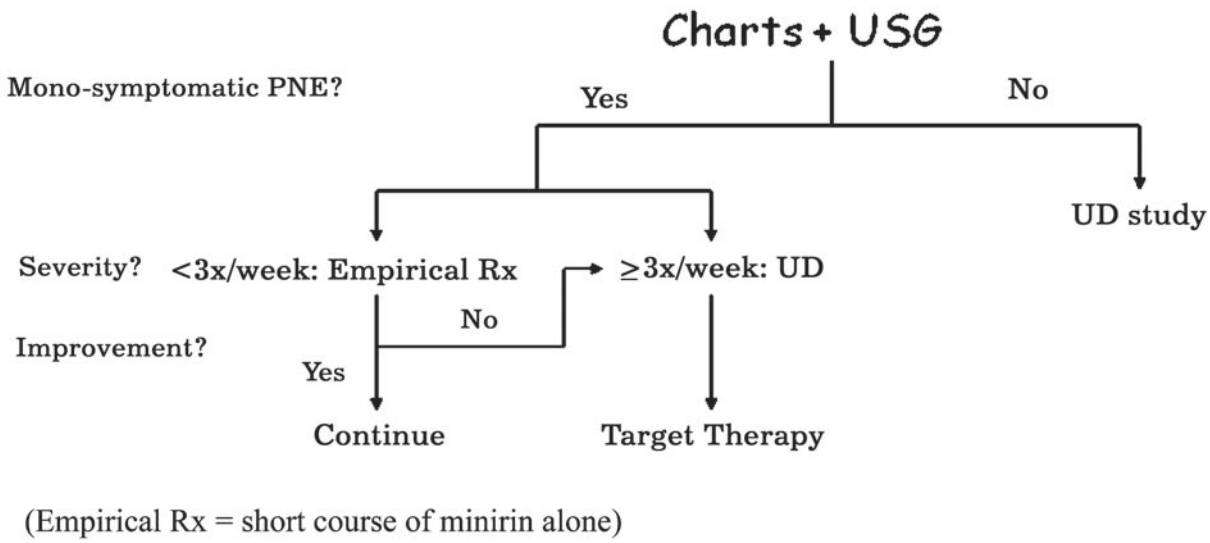
Some centres now perform video-urodynamics which combines fluoroscopy with conventional fill UD with the added benefit of being able to capture images of the bladder, bladder neck and urethra during cystometry to better delineate conditions such as primary bladder neck dysfunction.

When performing uroflowmetry, the child must experience normal desire to void for it to be representative and repeated recordings should be performed. In children, normal flow rates are different from adults and there is usually a poor correlation between maximal flow rate (Qmax) and outflow resistance as the detrusor is able to exert much stronger contractions to counteract any increased resistance. It is therefore important to study the pattern of the flow curve in addition to the flow rates in children. The precise shape of the flow curve is determined by detrusor contractility, the presence of any abdominal straining and by the bladder outlet. An uroflow is usually followed with a measurement of post-void residual urine. Young infants do not always empty their bladder completely. However, in older children, more than 20 ml residual urine found on repeated occasions is suggestive of incomplete emptying.

The unfamiliar hospital and urodynamic laboratory environment as well as the presence of an urodynamics investigator can sometimes cause significant distress to young children. To overcome this, an ambulatory urodynamic study may be performed.[14] This study is performed with ambulatory equipment strapped to the child so that he/she can conduct normal activities, be totally mobile and be accompanied by one or both of the parents undisturbed in a private cubicle during the study. Traditionally, it relies on infra-red telemetry but more recently, the Bluetooth system had been introduced. The investigator sits behind a one-way mirror to observe the study and can make note of any events occurring during the study such as sudden large movements.

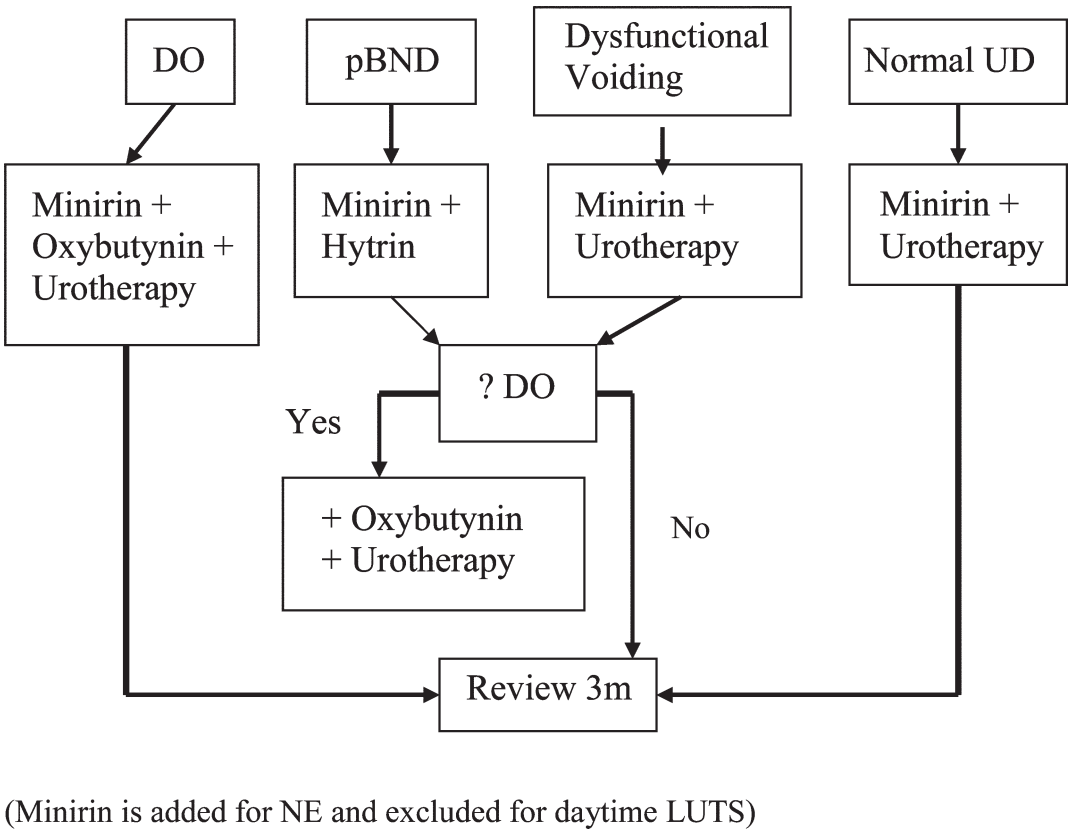
Management

Management takes the form of a multidisciplinary approach involving paediatric nephrologists, child psychologists, paediatric urologists and urotherapists. The role of urotherapy in the management of urinary incontinence and other LUTS has become increasingly significant over recent years and now, urotherapy has become an indispensible part of the treatment protocol. As mentioned early in this article, bladder dysfunction exists as a dynamic spectrum of different conditions. Therefore paediatric urologists and urotherapists work in close collaboration to derive on an individualised targeted treatment plan for each patient dependent on the assessment and evaluation to help achieve dryness in the majority of children (Figures 3 & 4).



USG: ultrasonogram; PNE: primary nocturnal enuresis; UD: urodynamic study

Figure 3 Flow chart for management of urinary incontinence.



DO: detrusor overactivity; pBND: primary bladder neck dysfunction; UD: urodynamic study

Figure 4 Target therapy for voiding dysfunction.

Urotherapy

(i) Behaviour Modification and Standard Urotherapy

Urotherapy is a non-pharmacological and non-surgical combination of cognitive, behavioral and physical therapy with an aim to normalise micturition pattern and prevent further functional disturbances of the lower urinary tract. The children and their parents are educated on proper voiding mechanics and their specific problem is explained to them to provide motivation for improvement. Specific instructions are then given as to how and when to void. Children are assessed and taught correct sitting or standing positions for voiding. They are taught how to relax the pelvic floor and avoid straining. Their drinking and voiding habits are studied and modified accordingly to include proper hydration with timed voiding. A proper assessment of their bowel function is imperative to successful management. To achieve good results, strong patient support with adequate motivation of both the child and the parents are essential.

(ii) Biofeedback and Pelvic Floor Rehabilitation

Biofeedback is based on the concept of building self-perception on detrusor contractions and pelvic floor relaxation in the patient. By combining uroflowmetry with real time monitoring, the child is able to see how well they are voiding. It also helps them understand what can be altered with voluntary control and with relaxation of the pelvic floor. Biofeedback as a treatment modality for children with dysfunctional voiding is based on this concept and has proven to be highly effective either on its own or in combination with standard urotherapy.

(iii) Neuromodulation, Acupuncture and Other Treatment Modalities

Transcutaneous electrical nerve stimulation (TENS) is a simple, cost-effective, non-invasive treatment modality for the management of a wide variety of lower urinary tract disorders with few reported side-effects. The mechanisms of action of the reported techniques remain unclear but

symptomatic improvements are common. Changes in urodynamic parameters during transcutaneous stimulation may occur, suggesting that the TENS therapy was capable of inhibiting detrusor contractions. The beneficial effects of TENS over the sacral dermatomes (S2-S3) in patients with lower urinary tract symptoms associated with detrusor overactivity have been reported. The use of low frequency electrical current to inhibit detrusor activity in adults is common, and appears to modulate excitatory and inhibitory components of bladder control. Such studies provide the rationale for the application of TENS therapy to modulate detrusor function in patients with functional detrusor dysfunction.

Traditional acupuncture has also reported high efficacy in the treatment of nocturnal enuresis with low relapse rate. Reports have used acupoints innervated by sacral segments S2-S4 and stimulation involved both manual and electro-stimulation. However, its use in the paediatric population remains limited by the intrinsic fear of needling in children.[15]

Bowel Management

The principles of bowel management include rectal emptying of impacted stool and the maintenance of regular soft stools. A reliable bowel habit pattern can only be established when the child is able to achieve pain-free defecation of soft stool. An initial clean-out of the bowel can be achieved by oral laxatives and rectal enemas on a regular basis until complete disimpaction of the rectum. Occasionally, high colonic washouts may be necessary to achieve a good result. Only when this has been achieved should the second stage of management commence which involves prevention of further stool accumulation with continuation of regular oral laxatives and/or stool softeners as well as dietary modification. Correct toileting posture and correct recruitment of abdominal muscles in the defecation process aids in the effectiveness of bowel emptying. However, success of a bowel management program can only be achieved with sound support from the family. Parental education is necessary so that they can help reinforce and encourage correct toileting habits at home.

Medications

Pharmacological control of the LUT can either act via the central nervous system (CNS) or peripherally. Several CNS regions have been identified to be involved with micturition control including the cortex, pontine tegmentum, medulla and spinal structures. All these regions are modulated by several different neurotransmitters, which have become targets for drug treatment. However, many of the drugs developed with CNS action are not sufficiently selective to affect only the lower urinary tract and hence these drugs may cause significant adverse drug reactions.

Desmopressin (DDAVP or Minirin) is a vasopressin / anti-diuretic hormone (ADH) analogue which is used to reduce urine production at night for children with bedwetting. Studies have shown that children with NE had an abnormal diurnal rhythm of vasopressin secretion resulting in large night-time urine productions.[16] The response is monitored by the actual reduction in wet nights per week and reports have shown that a good response rate (>50% reduction in wet nights) can be achieved in about 70% of children with PNE following a short course of desmopressin.[17] Side-effects are few but desmopressin can cause water intoxication and patients should be cautioned to avoid excessive water intake.

Antimuscarinics (e.g. oxybutynin/tolterodine) are gold standards in treatment of overactive bladders. Muscarinic receptors are found in the human detrusor muscle and are responsible for initiation of bladder contractions. The main action of antimuscarinics is on the M1 and M3 receptor subtypes thought to be responsible for the pathogenesis of detrusor overactivity. Hence, antimuscarinics act by reducing the frequency and intensity of involuntary contractions resulting in an increase in bladder capacity. However, the non-selective pattern of activity and penetration of the blood brain barrier are known to induce systemic and central side-effects.

Alpha-blockers are used in patients with evidence of bladder neck dysfunction for relaxation of the bladder neck. The density of noradrenergic nerves is highest around the bladder neck particularly in males thus noradrenaline typically relaxes the detrusor and causes contraction of the bladder neck.

Tricyclic Antidepressants, such as imipramine, have been found to be effective for increasing urine storage by both decreasing the detrusor contractility and increasing outlet resistance. However, the precise mechanism of action is not well explained although its effectiveness is related to antimuscarinic activity and action on the central nervous system. Its possible effect on the bladder outlet has been described by inhibition of norepinephrine reuptake producing alpha-adrenergic stimulation. These agents are associated with a high incidence of side effects and their use should be judicious.

Beta-adrenergic agonists, parasympathicomimetics, calcium antagonists, potassium channel openers, prostaglandin inhibitors have all been described for use with

effect on the bladder but these are rarely used in children either due to their unfavorable side-effects or due to a lack of proven efficacy.

Clean Intermittent Catheterization

Clean intermittent catheterization (CIC) may become necessary in children with decompensated or underactive bladders where bladder emptying efficiency is compromised and upper urinary tract dilatation may exist. Regular emptying of the bladder to achieve low pressure emptying improves detrusor contractility and bladder emptying function. Therefore a regular clean intermittent catheterization program can allow for bladder re-training. Some of these children may be able to eventually wean from use of CIC.

Other Specific Treatments

Giggle incontinence – cystometry is usually completely normal or occasionally demonstrates some detrusor overactivity. The cause is unknown and these children have no structural anomalies of the genitourinary tract or infection. The diagnosis is based on history. Treatment is notoriously difficult. Anticholinergic drugs may help to ameliorate the symptoms in children in whom detrusor overactivity is thought to be the culprit but results have not always been promising. There is also report suggesting this to be centrally mediated, similar to cataplexy (muscle hypotonia triggered by emotional events) and the use of methylphenidate was shown to be beneficial. However, symptoms recurred when the medication was discontinued or missed.[18]

Vaginal reflux – this is usually diagnosed based on a history of urinary incontinence occurring soon after voiding in toilet-trained pre-pubertal girls and is due to vaginal entrapment of urine. When in doubt, it can be confirmed by performing a micturating cystourethrogram. The condition is harmless and tends to resolve with age but the child may also be taught to empty her vagina by simply voiding with her thighs apart and leaning forward after voiding before getting up.

Surgical Options

Where conservative management with non-pharmacological and pharmacological treatment fails, we may need to consider surgical approaches. Cystoscopy may need to be considered in any patient with suspicion of bladder outlet obstruction during work-up, such as those with an obstructed/prolonged flow pattern on uroflowmetry and a dilated posterior urethra on MCU. Posterior urethral valves have been observed in 6% of children presenting with PNE and requires transurethral incision. Surgical means have also been employed to reduce urethral/sphincteric pressure as an alternative to alpha-blockers. Recent studies have focused on the use of balloon dilatation of the bladder neck and Botulinum A toxin (Botox) injection into the urethral urinary sphincter in children with non-neurogenic voiding dysfunction. Botox is a potent neurotoxin that blocks neuronal acetylcholine secretion by binding to presynaptic nerve endings. Early studies have shown that 60% of children with non-neurogenic detrusor overactivity presenting with daytime urinary incontinence, small bladder capacities and urinary urgency had complete resolution of symptoms after one injection at 6 months follow-up and another 20% had partial response. However, these methods require general anaesthesia and subsequent repeated injections. Further studies looking at the long-term effect and efficacy has yet to be presented.[19]

Very rarely, bladder augmentation may be considered to help produce a low-pressure system with increased bladder capacity. Augmentation may be performed using intestinal segments such as colon, ileum or stomach. However, the complications that may ensue must be considered including mucus production, electrolyte imbalance and even possible metaplasia/malignancy. Therefore, such major surgery is usually reserved for neurogenic voiding dysfunctions.

Treatment Outcome

Data from our urotherapy clinic had been analyzed (unpublished data) to review our efficacy of treatment with urotherapy. A total of 48 children (mean age 8.7 years; 55% male) with abnormal uroflow curves and post void residual urine (PVR) of greater than 10% of voided volume were recruited. They all underwent urotherapy training and both uroflows and PVRs were repeated at 3 months after training. Results showed that urotherapy training alone could significantly improve bladder emptying from 81% to 91% at 3 months. Similarly, uroflow patterns improved significantly from only 24% to 86% of children achieving a normal bell-shaped curve.

Further to this, another study looked at 83 children (mean age 8 years; 47 boys and 36 girls) with moderate to severe NE (>3 wet nights per week). Of these, 25% had monosymptomatic PNE and 75% also had daytime LUTS. Targeted treatment involving urotherapy and medication was started accordingly and patients were reviewed every

3 months for 1 year. Results at 1 year showed that 77.1% of children achieved complete or greater than 90% dryness, 13.2% achieved 50-90% dryness and only 9.6% showed no response. Improvements in social and inter-family relationships were also reported by the children and parents in follow-up discussion/interview.

Summary

Urinary incontinence is a common condition in children with significant psychosocial impact which should not be ignored. Urinary incontinence may persist into adulthood if left untreated. Educational programs should be implemented to raise public awareness amongst parents and practitioners so as to encourage patients to seek proper medical advice at appropriate times. Targeted therapy can achieve good results in the majority of cases.

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