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## Brief Reports

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### Cystometric Evaluation of Voiding Dysfunctions

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Not infrequently, in pediatric practice one is confronted by anxious parents of children with voiding abnormalities. These include children who wet themselves, have frequent micturition, urgency or dribbling. In these subjects investigations like urinalysis, renal ultrasound, intravenous urogram or voiding cystourethrogram (VCUG) are usually conducted. Often, the results of these investigations are normal. More recently, these voiding abnormalities have been approached in a more scientific way and it is possible to detect underlying alterations in lower urinary tract dynamics as the cause of these problems(1). Appropriate pharmacological therapy may provide a satisfactory and lasting solution to this vexed problem. The present preliminary study was, therefore, designed to evaluate the cystometric findings in children with non-neurogenic voiding dysfunctions.

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### Subjects and Methods

This study was performed on children presenting with symptoms of voiding dysfunction in the form of wetting during day and/or night, urinary frequency (pollakiuria), urgency or post-void dribbling. A detailed history and physical examination was done. Investigations included a complete urinalysis, X-ray lumbo-sacral spine, urinary tract ultrasonography and VCUG, when indicated. Those children who had any obvious pathology like spinal dysraphism, posterior urethral valves, urolithiasis or urinary tract infection were not included in the study.

Fifteen children were studied (9 boys and 6 girls). The age range was 6-14 years. Six children presented with nocturnal enuresis alone while 9 others had a combination of symptoms of frequency, urgency, enuresis and dribbling. Following an informed consent, a slow fill water cystometry was done on Dantec Urodyn 5000 system using a trans-urethral bladder catheter. No sedation or anesthesia was given. The bladder was filled at a rate of 5% of expected bladder capacity for age per minute. Expected bladder capacity was calculated using the formula:  $(\text{age in years} + 1) \times 25 \text{ ml}(2)$ . The trans-urethral bladder catheter recorded the intra-vesical pressure (Pves). A rectal catheter was introduced which recorded the intra-abdominal pressure (Pabd). The detrusor pressure (Pdet) was computed as  $P_{\text{det}} = P_{\text{ves}} - P_{\text{abd}}$ . The end point for bladder filling was when bladder was filled to expected bladder capacity or the child experienced distress or water leaked around the catheter. The parameters that were recorded were functional bladder capacity, bladder compliance

and the presence of uninhibited detrusor contractions. Uninhibited detrusor contractions (UDC) were contractions with an amplitude more than 15 cm water.

### Results

In the group of patients with nocturnal enuresis alone (4 girls and 2 boys), both the boys had normal cystometry, while out of 4 girls, 2 had severe urge at low bladder volume that may suggest a low functional bladder capacity (Fig. 1) and one had UDCs (Fig. 2) (Table I). All 3 girls with abnormal cystometry were above 8 years of age. In the other group of 9 children who had a combination of symptoms, there were 7 boys and 2 girls in the age range of 6 to 14 years. Of these 6 had enuresis, 5 had frequency, 6 had dribbling and 3 had urgency. We divided these children into two subgroups, one with urgency and other symptoms (3 children) and the other without urgency but with other symptoms (6 children). All 3 children with urgency had abnormal cystometry with low functional

bladder capacity in 3 (Fig. 3) and UDCs in 2 patients (Fig. 4) (Table I). In the other group with no urinary urgency, all children had normal cystometry.

### Discussion

Voiding disturbances in the absence of any obvious underlying cause like spina bifida or obstructive uropathy are encountered frequently in children. These present as urinary frequency, urgency, daytime incontinence or nocturnal enuresis. These micturition problems are sometimes detected when evaluating children with recurrent urinary tract infection or vesico-ureteric reflux.

There is no consensus yet on the minimum evaluation required to reach a diagnosis in such children. Traditionally, the urological evaluation has used ultrasonography, intravenous urography and voiding cystourethrography, all of which have been largely helpful only in excluding structural malformations. More recently,

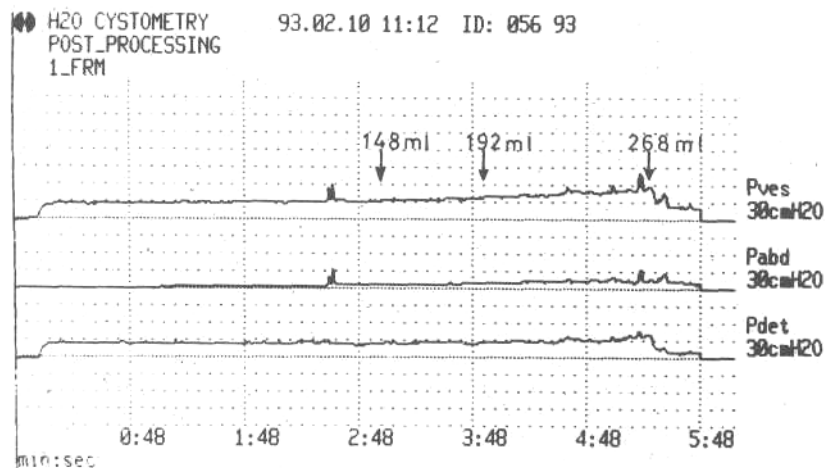


Fig. 1. Cystometry (CMG) in a child with nocturnal enuresis. The expected bladder capacity was 300 ml. The child had the first urge at 148 ml and a strong urge to void at 192 ml. She finally voided at bladder volume of 268 ml.

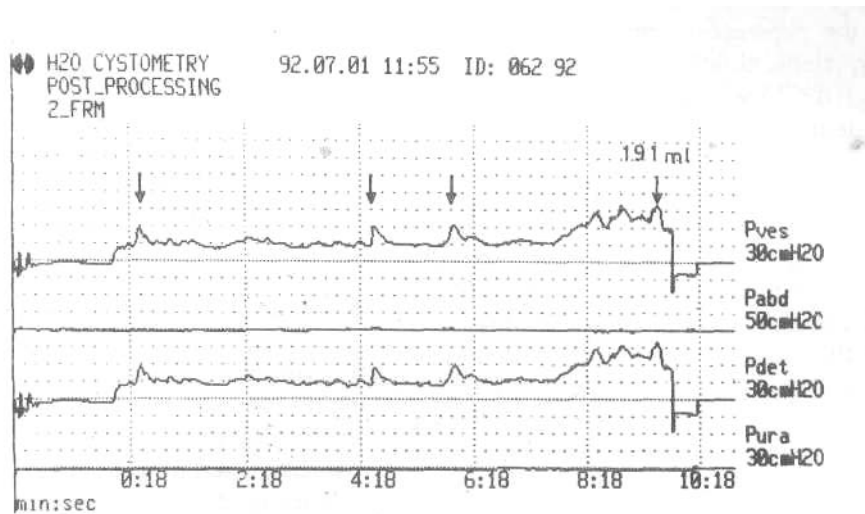


Fig. 2. CMG in another girl with nocturnal enuresis. The expected bladder capacity was 300 ml but she could not hold beyond 191 ml. Note also the multiple UDCs (arrows) occurring from early part of bladder filling.

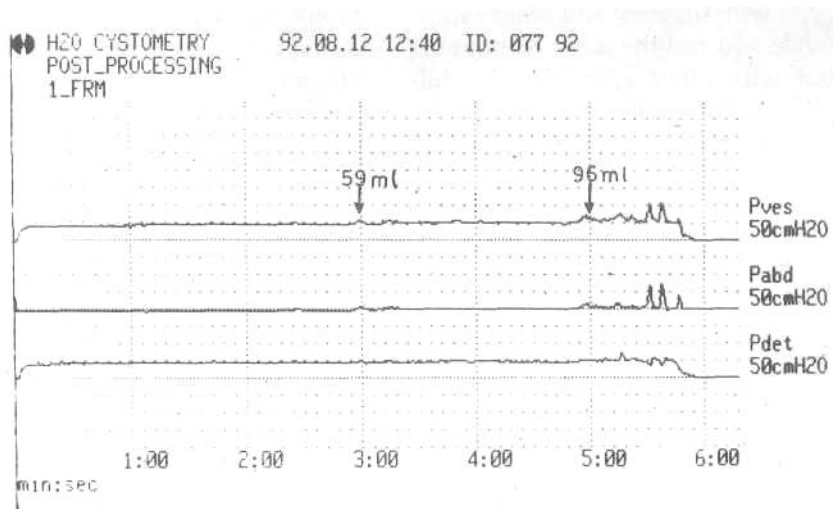


Fig. 3. CMG of a child with urgency and urinary frequency. The expected bladder capacity was 275 ml. The child had a strong urge at 59 ml and could not hold beyond 96 ml bladder volume.

urodynamic studies have been used in the evaluation of these children(1). These studies offer an assessment of function of the lower urinary tract, rather than simple anatomic appearance. This is much more helpful in determining the pharmacological

manipulation required in the treatment of such cases.

Nocturnal enuresis without daytime wetting affects upto 20% of children at the age of 5 years. Thereafter, it ceases spontaneously at the rate of 15% of the involved

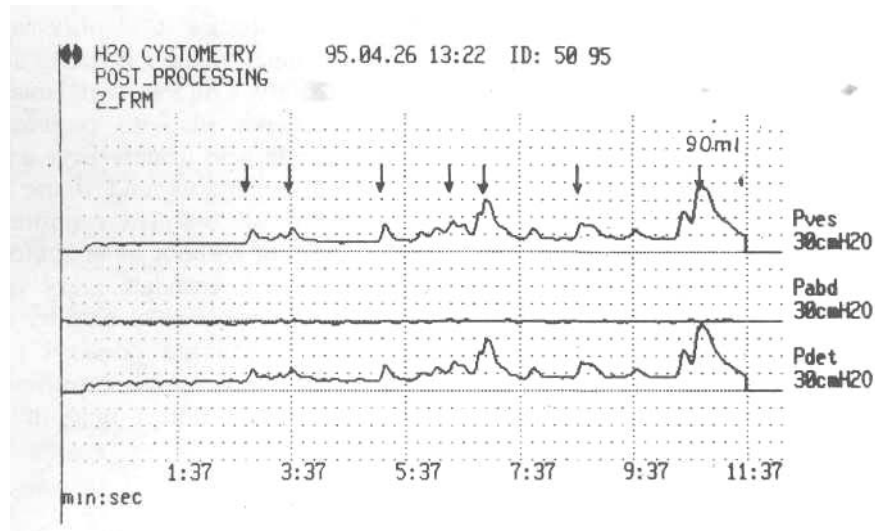


Fig. 4. CMG of a child with urinary frequency-urgency. The functional bladder capacity was 90 ml (expected 200 ml) and there were multiple UDCs (arrows) from the early phase of bladder filling.

TABLE I—Results of Cystometry

Nocturnal enuresis (n=6)	
Normal cystometry	3
Urge at low bladder volume	2
UDC	1
Combination symptoms (n=9)	
Normal cystometry	6
Abnormal cystometry	3
functional bladder capacity low	3
UDC	2

children every year, with the incidence falling to 1% in adults. It is three times more common in males(3). The standard treatment in use is imipramine, desmopresin nasal spray and alarms. By and large, urodynamic studies have been shown to be normal in these patients(4) but detrusor instability has been seen in over 10% of the total cases with nocturnal enuresis(5).

In our study, 3 out of 4 girls who had abnormal cystometry were more than 8 years of age. Two had small functional bladder capacity and one had detrusor in-

stability. Both the males in this group had normal cystometry. Older girls with nocturnal enuresis form a group where urodynamic studies may be indicated. Most males and younger females do not need cystometric studies(3) and can be managed with simple measures for toilet training and reassurance. Cases with detrusor instability and small bladder capacity respond very well to oxybutynin or the cheaper alternative, imipramine.

The daytime urinary frequency or pollakiuria is a clinical condition of previously completely toilet trained children in whom isolated daytime frequency develops without other symptoms or signs(6). The cause of this benign, self limiting condition is unknown and the condition resolves spontaneously in about 10 weeks from the time of diagnosis(5). No urodynamic abnormalities are found in these children and it is generally thought, that this group be excluded from extensive evaluation. Medication is also not helpful and the condition resolves on it's own(6).

In our study, the sub-group of 6 children with combination of frequency, enuresis and dribbling but without urgency, may have belonged to this group. All of them had normal cystometry. We suggest that the cases with symptom of urinary urgency should not be included in the day time frequency disorder as has been done by others(7).

Unstable bladder is characterized by involuntary, uninhibited detrusor muscle contractions and identifies voiding dysfunction in children who have no neurological lesion(4). Children with unstable bladder may present with a combination of symptoms of frequency, urinary urgency, recurrent infection, dribbling and enuresis. It is well established now that urodynamic studies are diagnostic and dictate the most appropriate therapy (4). Cystometrically, bladder instability in children can be classified into 2 groups. The first group includes hyperreflexic bladder in which uninhibited detrusor contractions occur during bladder filling, although the child may void normally on command(8). The small capacity hypertonic bladder constitutes the other group where the bladder capacity is more than two standard deviations smaller than normal for that age(8).

In the present study, 3 children had urgency along with other symptoms. On cystometry, all the 3 had reduced functional bladder capacity with uninhibited detrusor contractions in 2 children. These 3 children responded to imipramine therapy. We would have preferred to put them on oxybutynin therapy (oxybutynin is an anticholinergic agent with independent musculotropic relaxant and local anesthetic activity) but the cost of the medicine was prohibitive.

From our preliminary data, we suggest that older children with nocturnal enuresis alone, particularly girls, should undergo

cystometric studies to identify cases with low functional bladder capacity and bladder instability. Children with isolated daytime frequency or with combination of symptoms but no urinary urgency can be managed largely without doing detailed urodynamic studies. The symptom of urgency with or without other symptoms, in our experience, correlates very well with urodynamic evidence of bladder instability. These children deserve detailed cystometric studies and show remarkable improvement with imipramine or oxybutynin therapy.

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