

MICTURITION DISORDERS IN CHILDREN: METHODS OF EVALUATION AND RESULTS OF TREATMENT*

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Micturition disorders in children constitute a large group of diseases. Symptomatology usually gives us some indication of how to handle these problems. We also have a battery of diagnostic tests at our disposal. The external genitalia are readily available for examination. The urine is easily obtainable. The lower urinary tract can be studied by means of radiography and endoscopy. And finally, with the introduction of urodynamic techniques, micturition problems in children are being diagnosed and treated successfully.

Here we present our methodology and the results of studies in the evaluation of children with micturition disturbances.

Materials and Methods

Thirty children (22 girls and 8 boys) aged from 2 to 14 years were the subject of a study carried out by the Gülhane Military Academy of Medicine, Ankara, during a 14-month period. The majority of these patients presented with complaints of urinary incontinence and/or urinary tract infection. Ten patients had overt neurologic lesions and 20 presented with diagnostic problems (Table I).

Urologic evaluation included a detailed history of voiding habits, symptoms and the sensation of bladder fullness. A thorough physical examination was then performed. Urinalysis, culture and intravenous pyelography (IVP) also were performed in all children. Voiding cystourethrography (VCU) with fluoroscopy was done to determine the presence of structural abnormality, the child's ability to empty and/or dysfunction of the internal and external urethral sphincter regions. Cystourethroscopy was done only on those patients who were subjected to cystocath insertion for urodynamic study or in whom an anatomical abnormality was strongly suspected. Urodynamic evaluation consisted of the simultaneous recording of the intravesical pressure and the electromyographic activity of the urethral sphincter/pelvic floor

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TABLE I
Clinical Material

Patient category	No. of patients
1. Incontinent or difficulty in starting voiding with overt neurologic lesions:	10
• Myelomeningocele (5) • Supraspinal neurological lesion (birth injury) (2) • Transverse myelitis (1) • Sacral tumor (1) • Spinal dysrhapia (1)	
2. Diagnostic problem without gross neurological deficit:	20
• Daytime damp pants and nocturnal enuresis with recurrent urinary infection (9) • Daytime damp pants and nocturnal enuresis without infection (7) • Urinary tract infection (4)	
Total	30

muscle. Most of the patients also had urinary flow studies. Cystometric studies were performed using carbon dioxide gas cystometry (DISA, 21E01). In most situations electromyography (EMG) was recorded through perineal skin electrodes. Perineal needle electrode was deliberately used in children with gross neurologic lesion to obtain more reliable recording of the urethral sphincter electromyography during Credé or Valsalva maneuver¹. The intravesical voiding pressure was measured either by a small catheter (a 4F infant feeding tube) inserted via the urethra or by a percutaneous cystostomy tube. To obtain a pressure value curve urethral catheterization was performed in older and more cooperative children.

Reliable studies required friendly understanding and verbal cooperation between the patient and the urodynamic team. A continuous record of each child's movements or straining was carefully made and correlated with the level of bladder filling, intravesical pressure and EMG of urethral sphincter/pelvic floor. EMG activity of the urethral sphincter/pelvic floor was also monitored audiographically during the study. All studies were performed while the child was awake and without sedation or interfering pharmacologic drugs. Urethral pressure profiles were determined in certain patients. Bethanechol chloride (Urecholine[®]) sensitivity testing was used to evaluate the innervation of the bladder in selected situations.

Results

Urodynamic evaluation in conjunction with routine urologic assessment allowed us to categorize the functional status of the detrusor reflex and its relationship to the

TABLE II
Analysis of Detrusor/Sphincter Interaction

	<u>No. of patients</u>
1. Normal detrusor function, coordinated sphincter (6) hyperactive sphincter (3)	9
2. Detrusor hyperreflexia, coordinated sphincter (7) hyperactive sphincter (10)	17
3. Detrusor areflexia, hypoactive sphincter (2) hyperactive sphincter (2)	4
Total	30

voluntary sphincter mechanism (Table II). Detrusor behavior was normal in 9 cases, hyperreflexic (uninhibited) in 17 and areflexic (flaccid) in 4. Of the 30 patients, 15 had a hyperactive external sphincter, associated with a normal detrusor function in 3 cases, hyperreflexic detrusor in 10 and areflexic detrusor in 2. Two of four patients with areflexic detrusor demonstrated poor striated urethral sphincter EMG activity during attempts to void by Credé's method or straining. The remaining two, along with 6 other patients with gross neurological findings, demonstrated increased external sphincter electrical activity during Valsalva voiding (Figure 1) or reflex

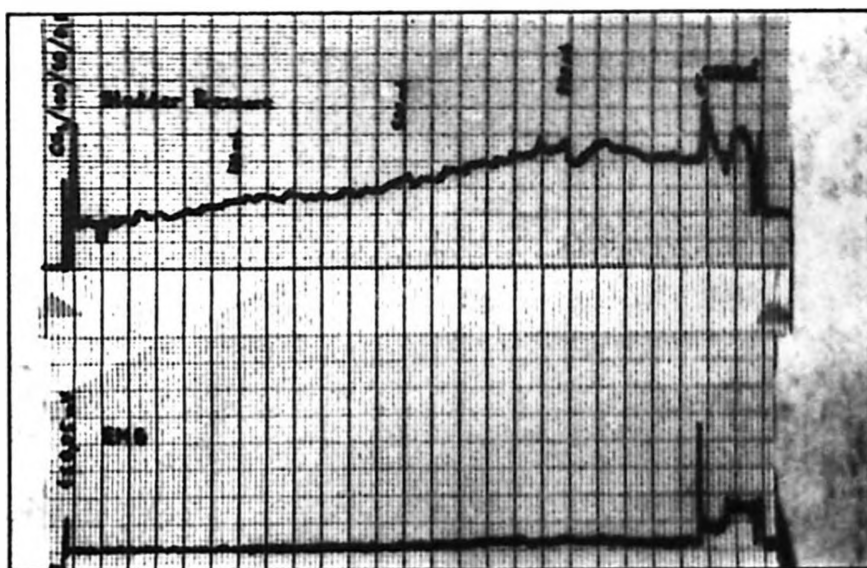


Figure 1.

Simultaneous CMG/EMG study of patient with myelomeningocele. Note increased external sphincter EMG activity (bottom line) during Credé maneuver.

detrusor contractions. This increased activity was very similar to detrusor sphincter dyssynergia. Voiding was inefficient in all these children. Of twenty children with no overt neurologic deficit 13 were able to control their external urethral sphincter voluntarily, 7 demonstrated discoordinate bladder/sphincter function, termed dyssynergia.

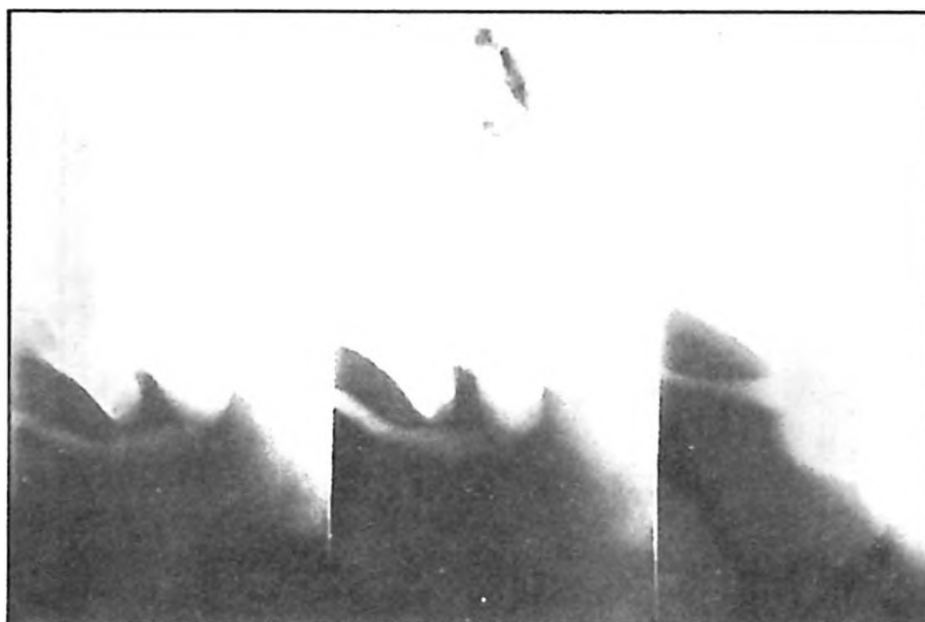
IVP revealed upper urinary tract dilatation in 4 of the 30 patients studied. VCU revealed bilateral reflux in 3 of these patients. Two patients exhibited pyelonephritic scarring, with unilateral reflux in one in VCU. Voiding cystourethrograms were frequently abnormal. Bladder wall irregularity and abnormally configured proximal urethra (incompetent bladder neck, cervical obstruction, narrowing at external sphincter region) were common findings. Of the 15 children with a hyperactive external sphincter and of the 17 patients with detrusor hyperreflexia, 9 and 12 had an abnormal VCU, respectively. DSD was suspected in 5 patients on VCU, which was confirmed in 4 at the time of urodynamic study. Sphincter dyssynergia was also observed in 4 of 9 patients in whom cervical obstruction was demonstrated on VCU. Urinary tract infection was documented in 20 patients, 8 of whom had gross neurological deficit. Urethral pressure profiles determined in 5 children with DSD demonstrated increased urethral resistance across the external sphincter area. Maximal flow rate and resistance were not significantly different in patients with DSD since most patients demonstrated mild external sphincter activity.

Treatment regimens were tailored for each individual depending on the symptom complex, interpretation of the urodynamic studies and findings on VCU. Treatment regimens are listed in Table III. The patients with hyperreflexic bladder were treated with propantheline in order to control urgency incontinence. A hyperactive external sphincter was the cause of daytime wetness in 8 children, 6 of whom were treated primarily with 2 to 4 mg diazepam orally 2 to 3 times daily to relax the hyperactive sphincter (Figure 1 - 2). Seven of the children complained of enuresis in addition to daytime wetting. Consequently, 30 to 75 mg imipramine daily or 15 to 30 mg

TABLE III
Treatment Regimens

	<u>No. of patients</u>
1. Propantheline only	7
2. Propantheline plus diazepam	4
3. Imipramine plus diazepam	2
4. Diazepam alone	7
5. Phenoxybenzamine / CIC	3
6. Timed Credé voiding	1
7. Antibiotics only	6

a)



b)

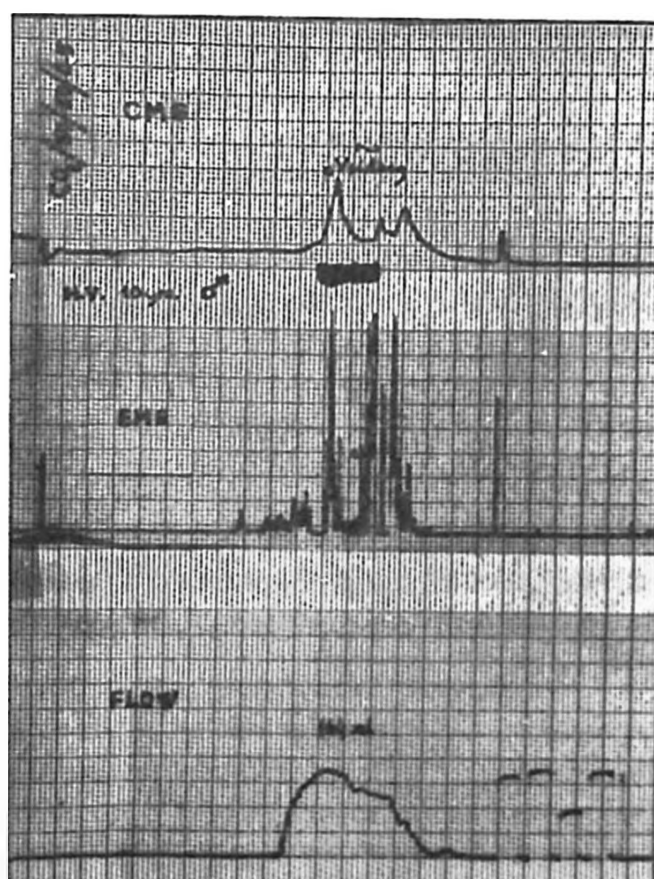


Figure 2.

H.V. 10-year-old boy, presented with daytime wetness and nocturnal enuresis. Clinical examination was unremarkable. a) Voiding cystourethrogram demonstrates narrowing at external sphincter suggesting dyssynergia. b) Urodynamic evaluation reveals increased pelvic floor electromyographic activity compatible with hyperactive external sphincter.

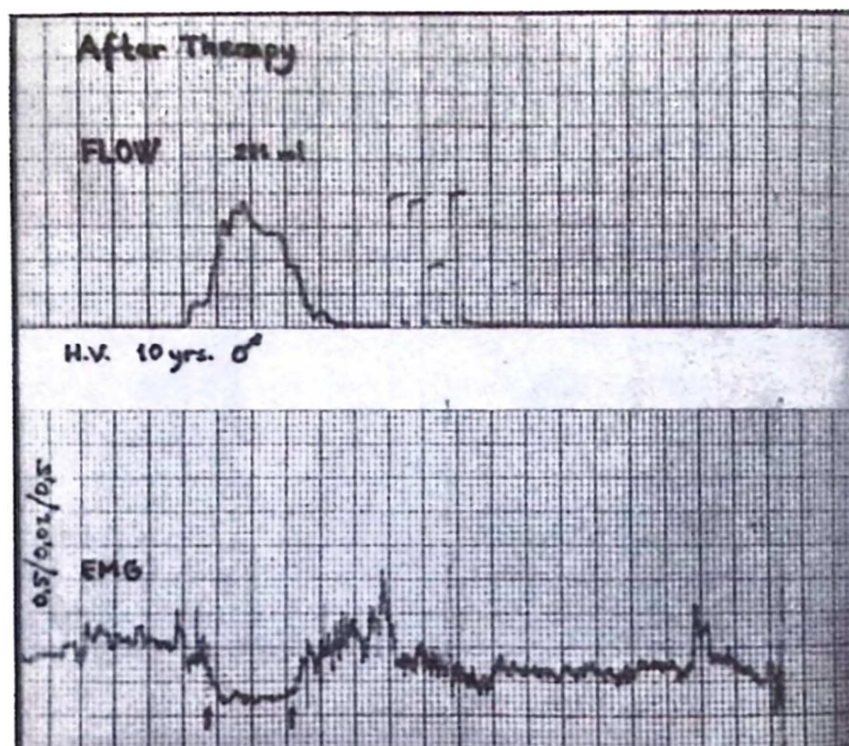


Figure 3.

Voiding study of same patient as in Figure 1, after pharmacologic treatment. Note coordinate pelvic floor electromyogram relaxation with voiding and improved urine flow.

propantheline 3 times a day was administered to help correct the enuresis. Three patients, two born with myelomeningocele and one with sacral tumor, were treated primarily with 10 mg phenoxybenzamine orally, once or twice daily with some success. The patients who failed to respond were managed by intermittent catheterization. One patient in whom no medication was administered was placed on time voiding through Credé. The results of these treatments are listed in Table IV.

Evaluation of the results of treatment reveals that of the 26 patients in whom follow-up was obtained, 80.7% (21 of 26 patients) showed a good result (marked improvement or no persistent symptoms). A poor result (little or no change in symptoms) was obtained in the other 19.3% (5 of 26).

TABLE IV
Results of Treatment

	Success rate
1. Good (marked improvement or no persistent symptoms)	80.7% (21 of 26)
2. Poor (little or no change in symptoms)	19.3% (5 of 26)
3. Four patients were lost to follow-up	

Discussion

The simultaneous multiparameter approach to the incontinent child has been extremely valuable in the identification of patients with discoordinate detrusor/sphincter function. This condition may occur involuntarily in patients with neurogenic bladder disease² or voluntarily in children with hyperreflexic (uninhibited) bladder³. Also, dyssynergia has been seen in children with spastic sphincter⁴ and in those with learned abnormal voiding patterns⁵. The majority of children without obvious gross neurologic deficit had either hyperreflexic (uninhibited) or normal bladders which were associated in varying degrees with sphincter dyssynergia. All had negative urinalysis and cultures at the time of their evaluation. A trabeculated bladder and abnormally configured proximal urethra during cystourethrography are suggestive of this condition. Confirmation is achieved while recording simultaneously the intravesical pressure and external sphincter EMG. Occasionally dyssynergia may masquerade as bladder neck constriction. Diagnosis of this type of obstruction requires very precise radiological imaging and on VCU the bladder neck does not open during the attempts to void. This condition might be associated with urethral obstruction since sphincter dyssynergia was observed in 4 of 9 patients with cervical obstruction. Anxiety, together with bladder and urethral irritability because of instrumentation can influence test results. Thus, it was important to obtain several tracings from each patient in order to obtain reproducible results. Furthermore each patient requires individual preparation and instruction so as to decrease fear and anxiety and to allow for accurate urodynamic studies.

The use of a trocar cystostomy placed on the day prior to the proposed study was of great help in obtaining pressure tracings without given the patient any painful stimuli. We used urethral catheterization in several situations. The presence of a small feeding tube (4 Fr) serving as a urethral catheter caused no significant intermittency or obstruction to urine flow in most of the children tested. In this manner we have been able to combine CMG and EMG studies without subjecting the patients to any percutaneous catheter or general anesthesia. Perianal surface electrodes were used instead of wire electrodes as an alternate method of recording the sphincter electromyogram in several instances. The results were satisfactory.

The medications employed in the treatment of these patients were selected on the basis of the urodynamic findings as well as the routine urologic findings. To promote bladder emptying in children with areflexic bladders, phenoxylbenzamine were used with some success. Those who failed to respond were managed with intermittent catheterization. In our series, probantheline bromide was the drug of choice for hyperreflexic and small capacity bladders. Hyperactivity of the sphincter was controlled by diazepam. Diazepam was chosen because of its skeletal muscle relaxing properties⁶. One patient who demonstrated cervical obstruction on VCU showed marked improvement after therapy with phenoxylbenzamine. This was further confirmed radiologically and by flow study.

We believe that urodynamic testing combined with radiological study has contributed to a more accurate diagnosis and a more rational selection of therapy.

Summary

Thirty children with micturition disorders were evaluated by clinical, radiological and urodynamic investigations. The main urological symptoms were day and night urinary incontinence, incomplete bladder emptying, day time damp pants and nocturnal enuresis, frequent and recurrent urinary tract infections. Only 10 patients had neuropathic bladder dysfunction secondary to overt neurological disease. Micturition disorders were due to detrusor hyperreflexia in 17 (56.6%) children. Bladder activity was normal in 9 cases (30%) and areflexic in four (13.3%). Hyperactive external sphincters were associated with detrusor hyperreflexia in 10 children, intact detrusor reflex in three and areflexic detrusor in two.

Urodynamic testing combined with radiological study has contributed to a more accurate diagnosis and improved quality of treatment for pediatric patients with micturition problems.

REFERENCES

1. Hanna MK, Di Scipio W, Suh KK, et al. Urodynamics in children. Part I. Methodology. *J Urol* 125: 530, 1981.
2. Diokno AC, Koff SA, Bender, LF. Periurethral striated muscle activity in neurogenic bladder dysfunction. *J Urol* 112:743, 1974.
3. Koff SA, Lapidus J, Piazza DH. Association of urinary tract infection and reflux with uninhibited bladder contractions and voluntary sphincteric obstruction. *J Urol* 122:373, 1979.
4. Tanagho EA, Miller ER, Lyon RP, et al. Spastic striated external sphincter and urinary tract infection in girls. *Br J Urol* 43:69, 1971.
5. Allen TD, Bright TC 3d. Urodynamic patterns in children with dysfunctional voiding problems. *J Urol* 119:247, 1978.
6. Smey P, Firlit CP, King LR. Voiding pattern abnormalities in normal children: results of pharmacologic manipulation. *J Urol* 120:574, 1978.