

DYSFUNCTIONAL VOIDING

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Dysfunctional elimination syndrome (DES) refers to an abnormal pattern of elimination of unknown etiology characterized by bowel and bladder incontinence and withholding. School-aged children with DES had a higher prevalence of previous urinary tract infections and congenital vesicoureteral reflux. Urinary incontinence in children may be caused by a congenital anatomical or neurological abnormality. Many children, however, do not have such an obvious cause for their incontinence and they are referred to as having functional incontinence. Functional urinary incontinence in children may be due to disturbances of the filling phase, the voiding phase or a combination of both. When incontinence is the result of urethral overactivity during voiding the term dysfunctional voiding is used

Descriptors: DYSFUNCTIONAL ELIMINATION SYNDROM, VOIDING DYSFUNCTION, DYSFUNCTIONAL VOIDING, VESICoureTERAL REFLUX, URINARY TRACT INFECTION

Abbreviations:

DES - dysfunctional elimination syndrome; UTI - urinary tract infection; VUR - vesicoureteral reflux; UD - urodynamics; VUD - videouro-dynamics

Introduction

The lower urinary tract is a dynamic entity with a complicated structure and leads to sometimes controversial ideas on the biomechanics of bladder and sphincter function. Abnormalities of the micturition may occur as a result of neurologic injury or disease, inflammatory or infectious disease, bladder outlet obstruction, structural changes in the bladder and urethra or loss of their supporting structures because of surgical or nonsurgical trauma or strictly psychogenic factors. Several investigations

have focused on the causal factors in the pathogenesis of wetting, recurrent urinary tract infections and vesico-ureteral reflux in neurologically normal children with impaired vesico-urethral coordination. The association of urinary tract infection and dysfunction is well established. There is a close association between reflux and vesico-urethral dysfunction. Unstable bladder is the most frequently occurring and the most important type of vesico-urethral dyscoordination in childhood (1-5).

Dysfunctional elimination syndrome (DES) refers to an abnormal pattern of elimination of unknown etiology characterized by bowel and bladder incontinence and withholding. Symptoms of DES also referred to as voiding dysfunction, usually present in toilet-trained children without underlying anatomic or neurologic abnormalities (6). School-aged children with DES had a higher prevalence of previous urinary tract infections (UTIs) suggesting that UTIs early in life may predispose to DES (7, 8). Similarly, it has been suggested that congenital vesicoureteral reflux (VUR) and DES are associated (9, 10).

Urinary incontinence in children may be caused by a congenital anatomical or neurological abnormality, such as ectopic ureter, bladder extrophy or myelomeningocele. Many children, however, do not have such an obvious cause for their incontinence and they are referred to as having functional incontinence. Functional urinary incontinence in children may be due to disturbances of the filling phase, the voiding phase or a combination of both. Detrusor overactivity may cause frequency and urgency, with or without urge incontinence. Girls present with symptoms of detrusor overactivity more often than boys, but sometimes other symptoms, such as urinary tract infections or constipation, dominate. Incomplete or no relaxation of the sphincteric mechanism during voiding, results in intermittent voiding. When incontinence is the result of urethral overactivity during voiding the term dysfunctional voiding is used (11).

Evaluation

The increasing cost and complexity of modern medicine requires the physician to balance carefully the need for diagnostic examinations and their direct influence on the final treatment against the

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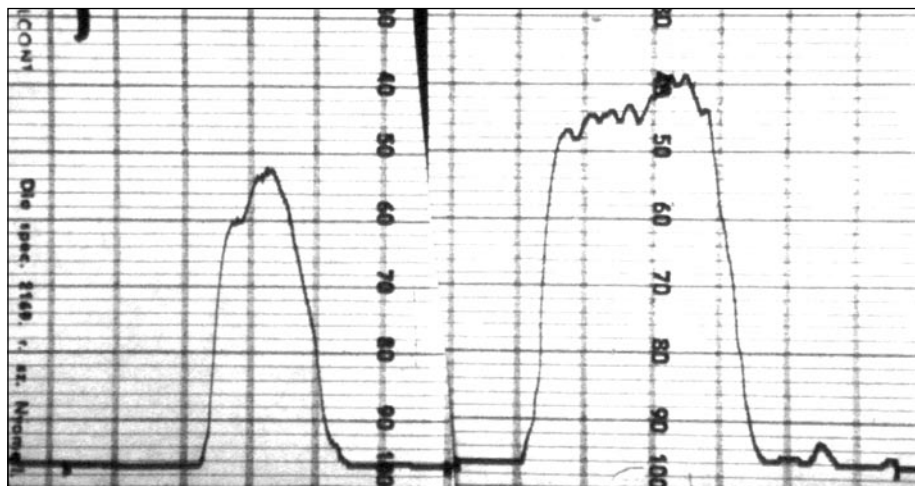


Figure 1
Uroflow curves. Voided volume 80 mls and 160 mls

Slika 1.
Krivulje mlaza mokraće. Izmokreni volumen 80 mls i 160 mls

risk, time, and cost to the patient. A complete *history* and physical examination are essential to determine the nature of dysfunctional voiding, guide treatment, and exclude neurologic or anatomic anomalies. Instructions for the parents to monitor and complete a 3-day voiding and stooling record for the child may be sent home in advance of the first office visit. The child should also be questioned directly about voiding and stooling, as

parents are often unaware of their child's frequency or if the child strains.

Physical examination. A focused physical examination includes assessing the abdomen for palpable bladder and stool in the colon, suggestive of constipation. A rectal examination can provide further confirmation of constipation. The back is examined for sacral malformation, hairy tuft, or asymmetry of the gluteal crease. Any of these clinical find-

ings might suggest a neurogenic cause for wetting related to spinal dysraphism. The genitals are examined assessing for external irritation and to rule out meatal stenosis in boys or labial adhesions in girls. A slow drip of urine from the vagina and a history of constant dampness would suggest an ectopic ureter. Urine dripping from the vagina after a girl has voided is suggestive of vaginal reflux (3, 4, 11).

Measurement of bladder volume at first sensation of bladder fullness is a simple examination (12). The volumes at first sensation of bladder fullness were greater in not operated hypospadias patients. It was significant in patients with diminished flow rates. They had bladder outflow obstruction and had decreased sensation of bladder fullness. The sensory threshold of the bladder mucosa and in the urethra is abnormally high. In diabetics with autonomic neuropathy is found diminished sensation of bladder fullness (13). It is well known that loss of sensation is in adult with benign prostatic hypertrophy (14). The obstructed micturition leads to bladder distension and decreases the autonomic neurons. Changes in detrusor innervation as a result of outflow tract obstruction have been documented both in animals and in men (15, 16). In the diagnosis of diseases of the lower urinary tract the examination of voiding is important. In childhood the evaluation may be complicated, as the child as well as its parents is often incapable of furnishing detailed information.

Uroflow rate is the simplest and often most useful investigation in the assessment of voiding dysfunction is the measurement of urinary flow rate. Uroflowmetry provides critical information in the evaluation of dysfunctional voiders in a noninvasive manner. The most meaningful results are obtained when the child has a full bladder and feels the urge to urinate. The voiding profile and velocity of flow indicate how well a child sustains relaxation of the pelvic floor muscles during voiding. Pelvic floor relaxation can be more accurately assessed when electromyography is coupled with uroflowmetry. A post void bladder scan reveals how well a child empties the bladder. The uroflow and a post void bladder

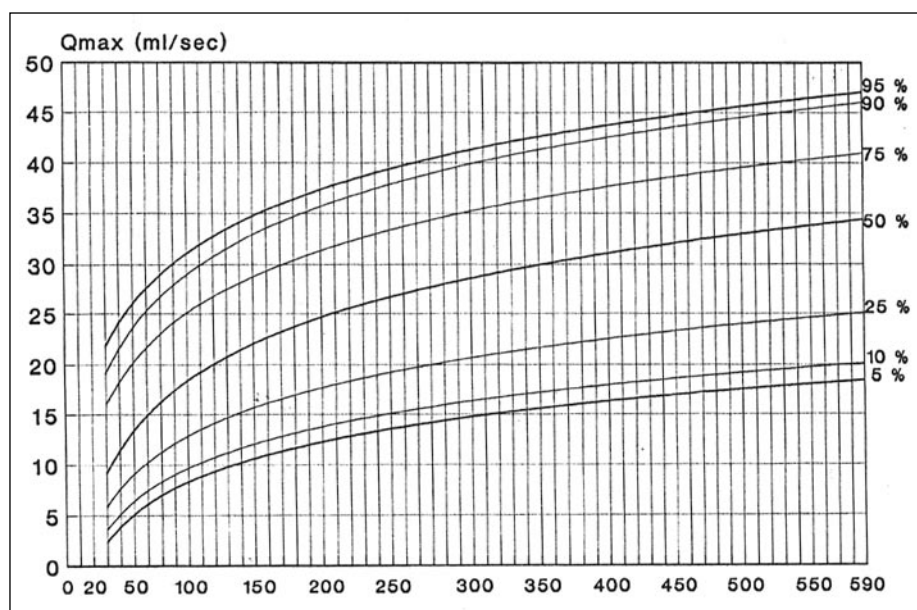


Figure 2
Normal maximal urine flow rates (Q_{max}) at different voided volume (19)

Slika 2.
Normalni maksimalni mlaz urina (Q_{max}) pri različitim izmokrenim volumenima (19)

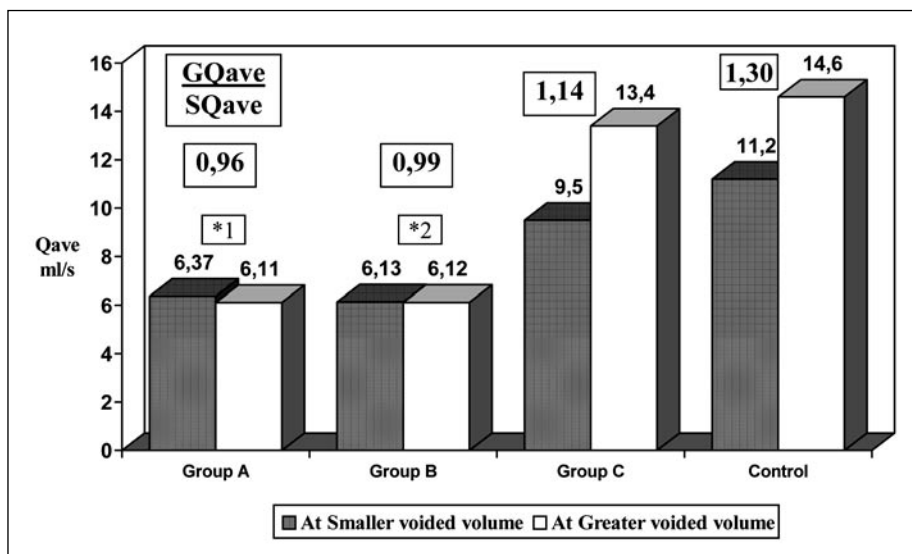


Figure 3

New uroflow parameter. The quotient of Q_{ave} at greater and at smaller voided volume.

*1 $P < 0.01$; *2 $P < 0.001$ Group A and B Patients with Hypospadias and outflow obstruction,

Group C Patients with Hypospadias without outflow obstruction, Group D Controls

Slika 3.

Novi parametar mokraćnog mlaza. Kvocijent Q_{ave} pri većem i manjem izmokrenom volumenu.

*1 $P < 0.01$; *2 $P < 0.001$ Skupina A i B bolesnici s hipospadijom i obstrukcijom mokrenja, skupina C bolesnici s hipospadijom bez obstrukcije mokrenja, skupina D kontrolna

scan measurement provide concrete information to both the child and clinician during treatment (4, 11, 17-22). Peak or maximum urinary flow rate represents one important component of a voiding urodynamic evaluation (1-3). The di-

agnosis of obstructive meatal stenosis should be limited to children with abnormal urinary streams and children with apparently pinpoint urethral openings on inspection void without any difficulty. In some cases a low urinary flow is seen by

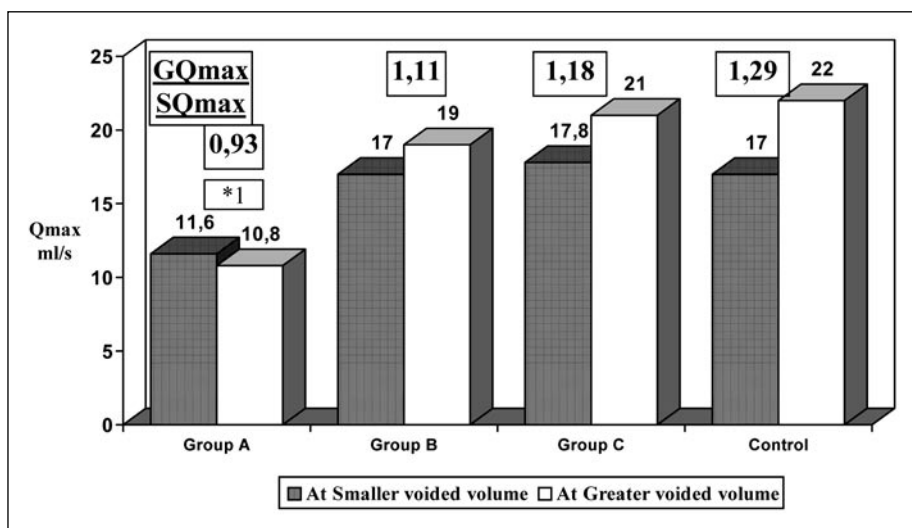


Figure 4

New uroflow parameter. The quotient of Q_{max} at greater and at smaller voided volume.

*1 $P < 0.01$. Group A and B Patients with Hypospadias and outflow obstruction, Group C Patients with Hypospadias without outflow obstruction, Group D Controls

Slika 4.

Novi parametar mokraćnog mlaza. Kvocijent Q_{max} pri većem i manjem izmokrenom volumenu.

*1 $P < 0.01$; *2 $P < 0.001$ Skupina A i B bolesnici s hipospadijom i obstrukcijom mokrenja, skupina C bolesnici s hipospadijom bez obstrukcije mokrenja, skupina D kontrolna

meatus stenosis or urethral stricture. In addition, a normal uroflow does not exclude bladder outlet obstruction (21).

The voided volumes were often small in childhood. Jensen et al found more than 50% of voided volumes 100 ml or less (18). Lower maximal flow rate at small volumes is well known. Normally the flow rate increases with voided volume (Figure 1 & 2) (1, 18, 19, 22). We introduced new uroflow parameters which were the quotient of Q_{max} at greater and at smaller voided volumes, and the same quotient of Q_{ave} (12, 23). We established the normal degree, the standard deviations and standard errors of these parameters. There were significant differences not only in patients with outflow obstruction, but with mild outflow obstruction too (Figure 3 & 4). The results of our study have shown that both the diminished first sensation of bladder fullness and the decreased quotients of maximal and average flow rates at greater and smaller voided volumes are early signs of a bladder outflow obstruction. Our data suggest that these simple examinations may give more chance to realize disturbances earlier (12, 23).

*Urodynamic*s is the study of function of the lower urinary tract. There is a significant application of this technology in a number of diverse clinical pediatric problems, and it can be used in patients of both sexes from infancy to adulthood (1, 3-5, 11, 24). Urodynamics is a neurologic diagnostic tool concerned with the identification and measurement of physiologic and pathogenic factors involved in the storage, transportation, and evacuation of urine. Urodynamic assessment of children with voiding dysfunction characterizes both the storage and emptying phase of urination. Urodynamic facilitates an accurate diagnosis and initiation of appropriate treatment. It is particularly useful when an accurate history cannot be elicited, or when empiric treatment has failed. Testing provides visual information to provider, child, and the family regarding detrusor instability, bladder capacity, bladder compliance, pelvic floor activity during voiding, and the bladder's ability to contract during voiding.

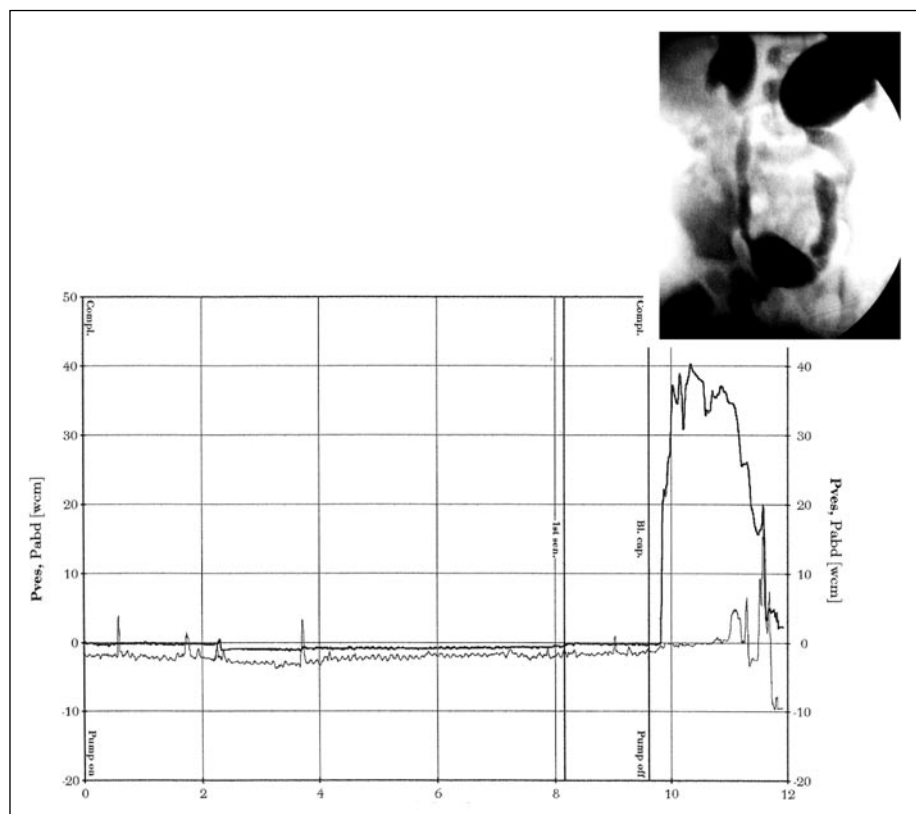


Figure 5
 VUD result of a boy who had difficult micturition with diminished urine flow. The cystography gave a normal bladder function and the cystography revealed the cause of micturition, high grade VUR

Slika 5.
 Rezultati VUD-a u dječaka s teškoćama mokrenja i oslabljenim mlazom mokrenja. Cistografija je pokazala normalnu funkciju mjehura i dijagnosticirala visoki stupanj VUR-a

To reveal function anomalies is very important and the videourodynamics (VUD) including simultaneous Voiding Cystourethrography and Cystometry seems to be a gold standard (24-28). VUD can document the presence of reflux, the characteristics of the bladder wall, the bladder neck and posterior urethra anomalies during filling and voiding, and evaluates the function of the lower urinary tract. Figure 5 shows a VUD result of a boy who had difficult micturition with diminished urine flow. The cystography gave a normal bladder function and the cystography revealed the cause of micturition, high grade VUR. VUD is a useful technique for a complex investigation of the lower urinary tract function and X-Ray morphology. The advantage of these studies is that they combine the objectivity of urodynamics with the visual radiographic image providing a far more logical interpretation of the results and the radiation dose with the less fluoroscopic investigation time might have

decreased. We recommend VUD mostly for children under 6 years of age with recurrent UTI, and each child who has voiding problem (28).

Developing Continence

Micturition during infancy occurs frequently, reflexively, and without voluntary control. From age 6 to 12 months, bladder capacity increases and voiding frequency decreases. Between the ages of 1 to 2 years, the child has conscious sensation and is able to feel fullness in the bladder. Many in this age group are able to postpone micturition for a short time by contracting the sphincter. Volitional micturition typically occurs between the ages of 2 and 3, when the child is able to start micturition by relaxing the pelvic floor and inhibit voiding through the cerebral cortex. By age 4, bladder volume has increased and a child is generally able to remain dry for 2 to 3

hour intervals and void 5 to 8 times per day (29). A fully toilet-trained child has the ability to stop and restart the flow of urine, to start micturition by relaxing the external urethral sphincter, even in the absence of an urge to void, and to cortically inhibit a bladder contraction (30).

A child's bladder capacity can be estimated as the child's age in years, plus two ounces. A normal bladder stores urine at low pressure (<5 cm H₂O) until at least half of expected bladder capacity is reached. Afferent nerves then signal the brain of a need to urinate. Normal emptying occurs as a result of coordination between the bladder muscle contracting and the external urethral sphincter sustaining relaxation long enough for the bladder to empty completely. Bladder contraction is not completely voluntary, as one can exert control over sphincter activity.

Miskolc nomograms(19) (Figure 2)

Several investigators have reported mean values and standard deviations for peak (maximum) flow rates in normal children (3, 17, 31-35). Churchill et al created nomograms for maximum flow rate for boys using regression analysis to fit functions to the data (3). Toguri et al rounded the voided volume to the nearest 25 mL and divided the subjects into two categories of body size, above and below 1.1 m² (33). Di Scipio et al found only low correlations of age, height, weight and body surface area to average and peak flow rates (35).

The capacity of bladder depends on the size of the child and because children of the same age differ in height and weight, the size of a child is best estimated by body surface area, calculated from both height and weight. Nomograms in centile form are very useful for diagnosing urinary flow disturbances over a wide range of voided volumes. We provide reference values of maximal average flow rates of normal boys and girls of three body surface areas, and we hope that by referring to these nomograms when screening children with lower urinary tract symptoms, simple flow measurements alone will prove useful (19).

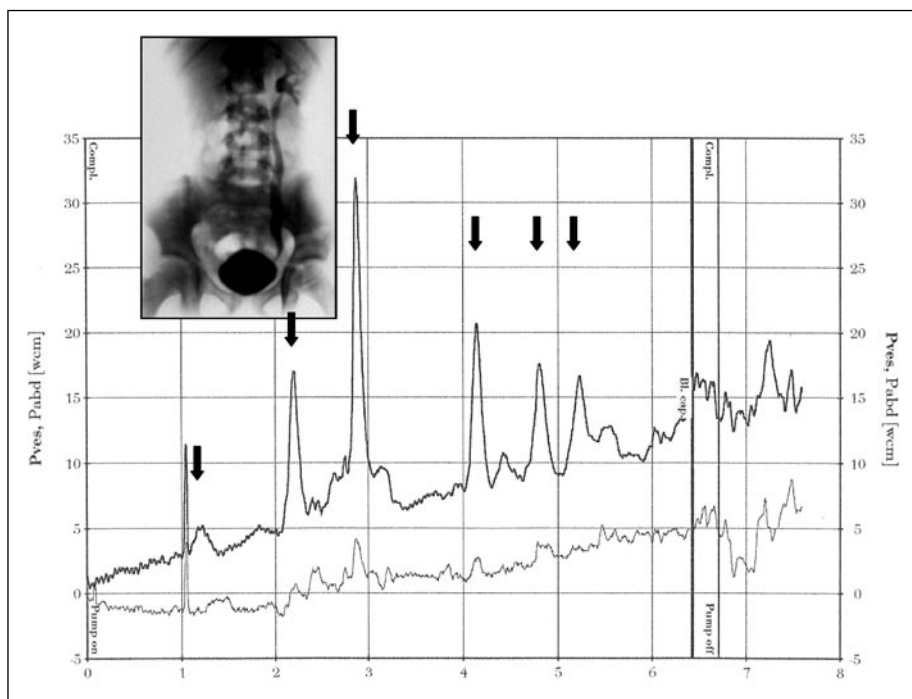


Figure 6
9 years old boy with recurrent UTI, Urge Incontinence. Result: Unstable Bladder Function (arrows), VUR l. s. Grade II. Reflux was appeared during unstable contraction. VCUG inserted on the appropriate time of CM. (Filling rate was 20 ml/min)

Slika 6.

9-ogodišnji dječak s recidivirajućim mokraćnim infekcijama i dugotrajnom inkontinencijom
Rezultat: nestabilna funkcija mjehura (strelice), VUR lijevo II. stupnja. Refleks se pojavio za vrijeme nestabilne kontrakcije. VCUG je napravljen u odgovarajućem vremenu CM (Stopa punjenja je bila 20 ml/min)

Aberle and Krepler reported that the flow rates of girls and boys were similar (36). In our study the curves of 50% of the average and maximum flow rates were the same in both sexes when the voided volume was <100 mL but when >100 mL the curves for the girls were higher. The curves for boys and girls at 5% were similar and the curves at 95% were higher for girls. Gierup also found that the flow rates of girls were higher than those of boys (32). Flow rates were least the lowest body area group, as found by others (17, 32, 33).

The maximal flow rates of boys reported by McMillen et al and Churchill et al were lower than those found in present study (3, 34). Gierup reported that flow rate was constant over a higher range of voided volumes, but Drake found that the maximal flow rate decreased at higher voided volumes because the detrusor was overdistended (32, 37). This difference might have arisen because in the study by Gierup the children did not

suppress micturition for as long as did the adults in the study by Drake and because the detrusor is more elastic in childhood (32, 37). No decrease of flow rates at higher voided volumes were found in the children studied in our report (19). The shapes of the nomograms are similar to those published by Haylen et al (38). The average flow rates of girls with >1.42 m² of body surface area were similar to the flow rates of women, though the maximum flow rates were lower, whereas the flow rates of boys were higher at smaller voided volumes and lower at higher voided volumes than the flow rates of men.

Types of Voiding Disorders

Dysfunctional voiding refers to an abnormality in either the storage or emptying phase of micturition and is associated with urgency, frequency, incontinence, and UTIs. It is important to discern dysfunctional voiding from enuresis. There is normal micturition with complete removal of urine at a socially

less acceptable time or place in enuresis. Enuresis happens more frequently at night (nocturnal), can occur during the day (diurnal). Dysfunctional elimination syndrome refers to children who have problems with both bowel and bladder control. Significant bowel problems take the form of chronic constipation, fecal retention, stool withholding, and encopresis. However, even a low level of constipation can impact urinary symptoms. The association between lower urinary tract dysfunction, infections, and constipation has long been recognized, however, bowel issues are often unrecognized or overlooked (39).

On the basis of urodynamic studies, the functional dysfunctions can be termed unstable bladder, bladder/sphincter dyscoordination, lazy bladder and occult neurogenic bladder. According to the definition of the International Children's Continence Society, incontinence as a result of a filling phase dysfunction, mainly bladder instability, is called urge syndrome and urge incontinence (40). When incontinence is a result of a voiding phase dysfunction it is called dysfunctional voiding, being subdivided into staccato voiding, interrupted voiding and lazy bladder syndrome. The relatively high prevalence (21%) of DES suggests that children frequently have abnormal voiding patterns (7, 8, 42). Only a few children received specific treatment for DES, indicating that this condition is frequently underdiagnosed and undertreated by primary care providers.

Urge incontinence. This is the most common form of functional incontinence in children (42-45). Urge incontinence is characterized by frequent voiding and urgency accompanied by hold maneuvers or posturing such as leg crossing, dancing, squatting, or crouching in a position to press their heel into the perineum (Vincent's curtsy) to prevent urinary leakage. Urodynamic assessment reveals uninhibited detrusor contractions relatively early in bladder filling and increased pelvic floor activity at the point of urgency (Figure 6 shows a VUD result of unstable function) (28). Findings reflect a bladder storage problem and a normal voiding phase. It has been suggested that immaturity of the central inhibition of

the sacral micturition center is responsible for detrusor instability, or the inability to inhibit bladder contractions (46).

Bladder-sphincter dyssnergia. One type of dysfunctional voiding involves discoordination between bladder and sphincter during voiding. Bladder-sphincter dyssnergia is a disturbance in the voiding phase characterized by bursts of pelvic floor and sphincter activity during voiding, coinciding with a rise in bladder pressure and a decrease in urine flow velocity (45). The flow may be staccato in nature and there is often a post voiding residual urine in the bladder. If the amount of residual urine is significant, the child may void frequently, often returning to the bathroom shortly after voiding. It may appear that the child has a reduced bladder capacity; however, bladder capacity and the filling phase are usually normal.

Lazy bladder syndrome. This syndrome can result from longstanding voiding postponement. It is characterized by infrequent and incomplete voiding, very little urge to void, and a larger than normal bladder capacity. The detrusor muscle becomes hypoactive and the use of abdominal muscles and straining may be noted on voiding. Wetting in this group of children is due to overflow (44, 45).

Vaginal reflux. Vaginal reflux is characterized by dribbling a small amount of urine after voiding. It is not associated with urgency, although many girls feel the need to return to the bathroom when their panties feel wet. Vaginal reflux occurs as a result of a few teaspoons of urine flowing back into the vagina during voiding and then dribbling from the vaginal vault when child stands up or becomes active. It is more common in heavy-set girls and those who do not spread their legs while voiding. The condition can usually be remedied by having the child pull her panties down to her ankles and spread her legs while voiding. Sitting backwards or straddling the toilet helps position the pelvis so the urine stream is directed down into the toilet rather than back into the vagina.

Giggle incontinence. In the pediatric population, giggle incontinence usually refers to urine leakage associated with laughter. A detailed history often reveals some degree or history of urgency and dampness at other times as well. In these cases, there is usually some underlying bladder instability and treatment with an anticholinergic may be of benefit (47). An entity rare in children, giggle micturition, or enuresis risoria, refers to the complete loss of urine associated with laughter, rather than just leakage. History is usually negative for urgency or dampness at any other time. Anticholinergics are generally ineffective, but some benefit has been derived from methylphenidate, based on the suggestion that the condition is central in nature and related to cataplexy (48). Giggle incontinence must be differentiated from stress incontinence, which occurs with sudden increase in intraabdominal pressure and is not associated with complete bladder emptying. There isn't known effective treatment for giggle incontinence. Vigorous laughter should be avoided, especially in public places. The condition tends to improve or disappear as adulthood is approached.

Problems Associated with Dysfunctional Voiding

Urinary tract infections. UTIs are among the most common bacterial infections in children, occurring in 3% of girls and 1% of boys by age 11. Hellstrom et al. (49) found that 30% of girls with dysfunctional voiding symptoms (leaking, urgency, frequency, posturing) had a previous UTI. Upadhyay et al. (50) found a higher incidence of children with dysfunctional voiding and UTIs as well. In a study of children with severe dysfunctional voiding, van Gool et al. (45) found 90% to have recurrent UTIs. Dysfunctional voiding patterns lead to UTIs in several ways. Children who void infrequently and those who do not empty the bladder to completion have urine stasis in the bladder. If bacteruria is present, infection can result as the bacteria flourish in the bladder. Urotherapy aimed at improving bladder emptying can prevent further UTIs (9).

Vesicoureteral reflux. The well-known combination of primary vesico-ureteral reflux (VUR) and urinary tract infection (UTI), predisposing to pyelonephritis, renal scarring, hypertension, and chronic renal disease, has been the basis for diagnostic and therapeutic procedures in the past 25 years (51, 52). In the study by Smellie et al, with a longer follow-up (10-41 years), over 90% of a cohort of 226 adults who had primary VUR were clinically well and normotensive, although 38% had renal scarring and 30% had severe reflux at admission (53). In spite of the use of prophylactic antibiotics or of a surgical approach, 57.6% of the children had breakthrough UTIs during follow-up and girls had a greater risk of UTI than boys. As expected, dysfunctional voiding and constipation were also found more frequently in girls (6, 54). Sjostrom et al reported on a cohort of infants with severe reflux and showed that half the children had breakthrough UTIs during follow-up (55). Interestingly, they found a strong correlation between recurrent infections, bladder dysfunction, and no resolution of the reflux.

In our series VUR was the most frequent morphological abnormality (43%), mostly under 6 years of age, followed by unstable bladder dysfunction (31%) by VUD (28). UTI with lower urinary tract anomalies are well known facts. A possible explanation is that during unstable detrusor contractions urine is pushed into the proximal urethra. After the urine returns to the bladder, possibly carrying bacteria from the proximal urethra, the increased bladder pressure may cause VUR and/or wide bladder neck (27, 56). During VUD this effect is easily seen. Hoebeke found a correlation between UTI and detrusor sphincter dysfunction but not with reflux (57). They found that the incidence of developing reflux in association with unstable bladder function and dysfunctional voiding was 15%, while in our series it was 30%. The factors associated with upper tract deterioration are VUR, high intravesical pressures - because of poor bladder wall compliance or detrusor muscle hyperreflexia - particularly if they occur together with UTI (25).

Various studies have shown that 35% to 50% of children with vesicoureteral reflux have voiding dysfunction (50, 56). Children with a dysfunctional voiding pattern use the external urethral sphincter to delay or interrupt urination. This inappropriate response, as well as uninhibited bladder contractions, can lead to increased intravesical pressure and the development or persistence of reflux. A history that includes voiding behavior should be obtained from all children with reflux. In many cases, reflux resolves with treatment of voiding dysfunction (58, 59). Failure to address the voiding dysfunction results in slower resolution of reflux and poorer surgical outcomes. Although boys had a more severe pattern at baseline, girls had a greater risk of recurrent UTI and dysfunctional voiding during follow-up. Consequently, new strategies for the management of VUR will require the development of predictive risk models of adverse outcome, including several variables such as gender, age at diagnosis, severity of reflux, severity of renal damage, laterality, dysfunctional voiding, and associated renal and urological abnormalities.

Diabetic cystopathy. Urinary bladder dysfunction is a frequent complication of diabetes mellitus in adults. Diabetic cystopathy is characterized by an impaired sensation of bladder fullness, increased bladder capacity, reduced bladder contractility and elevated residual urine volume (60). Ueda et al investigated the possible relationship between bladder dysfunction and autonomic neuropathy in unselected diabetic patients (61). Cystometrograms exhibited significant increases in bladder volume at first desire to void and maximal bladder capacity, and a decrease in detrusor contractility in diabetic patients. We found increased bladder capacity in our study (13). Children with diabetes mellitus who were tested with uroflow had a significantly increased voiding volume, increased average urinary flow, and increased delay until the first sensation of the need to void, compared with healthy children. These abnormal urodynamic features are consistent with damage to the afferent sensory pathways. In patients with diabetic cystopathy, most of the parameters in uroflowmetry

were significantly different from those of normal subjects. The acceleration levels of urine flow were significantly decreased in diabetic children in our study (62). We have showed that patients with moderately abnormal glycolmetabolic control already had abnormal uroflow parameters (TQmax and Qmax/TQmax) without any other sign of autonomic neuropathy. Clinicians should be able to determine autonomic neuropathy by using an uroflowmetry that is easy to perform, sensitive, reproducible and need only a small cooperation of the children.

Dysfunctional voiding is the most serious functional voiding abnormality. It is described in the literature under a variety of names including the Hinman syndrome, nonneurogenic neurogenic bladder, occult neuropathic bladder, psychogenic voiding dysfunction, detrusor sphincter dyssynergia, and dysfunctional voiding (63). Dysfunctional voiding is caused by functional obstruction of the bladder outlet during the voiding phase of the micturition cycle. Dysfunctional voiding places the child at risk of developing recurrent UTIs, vesicoureteric reflux, hydronephrosis, and progressive kidney damage. Recommendations for management include voiding retraining, prophylactic antibiotics, treatment of constipation, anticholinergic medication, and, at times, an alpha-1-adrenergic blocking agent. Some clinicians suggest that bladder retraining and psychological counseling, along with family counseling, is successful in the majority of instances. Biofeedback has appeared helpful in some children (64). In some patients with a very refractory problem, clean intermittent catheterization or even urinary diversion has been recommended to prevent chronic renal damage.

Therapy

Behavior modification. A voiding schedule is central to bladder retraining for children with dysfunctional voiding. By voiding at regular intervals, about 2 hours apart, they have an opportunity to regularly empty the bladder prior to the sensation of urgency. The child must understand the importance of voiding every 2 hours in the waking hours. A voiding

chart or diary should be used to remind the child to void and to track progress.

Biofeedback. This training can be beneficial to children with various types of dysfunctional voiding, recurrent UTIs, and vesicoureteral reflux (58, 64). Children who void in a staccato fashion fail to empty the bladder completely, or rely on the use of abdominal muscles to void, receive training to gain conscious control over the pelvic floor musculature. This control of voiding can be initiated and sustained through relaxation of the external urethral sphincter. Biofeedback has also been used to help children learn to inhibit detrusor overactivity (65). By teaching children to contract the pelvic floor muscles and the urethral sphincter, bladder contractions can be inhibited. Biofeedback has also been shown to be an effective method for treating both adults and children with inappropriate sphincter relaxation. The noninvasive use of EMG patch electrodes near the perineum and on the abdomen, combined with verbal instruction and an interactive visual display, help the child to visualize and accomplish pelvic floor relaxation. An uroflow and post void bladder scan provide further input and help gauge progress.

Anticholinergic medication. Since 1972, anticholinergic medications have been used to treat idiopathic detrusor instability (66). For children who void at least every 2 hours and empty their bladder completely but continue to have urgency and wetting, an anticholinergic medication may be indicated. Anticholinergic medications, such as oxybutynin or tolterodine, are often helpful to decrease uninhibited bladder contractions and increase functional bladder capacity. Optimum results are achieved when the child is not constipated and maintains a regular voiding schedule.

Nonpharmacologic vs. Anticholinergic Therapies for Overactive Bladder. Evidence-Based Answer Anticholinergic medications are more effective than bladder training in reducing the number of voids per day. Combining an anticholinergic medication with bladder training is more effective than either therapy alone.

Psychological counseling. When children fail to show improvement with behavior modification and/or medical management, it usually indicates problems with compliance due to comorbid factors such as poor motivation, attention deficit hyperactivity disorder, learning disabilities, sensory processing issues, or problems within the family (43). Family-centered psychological counseling can be very beneficial in such cases. In addition, psychological intervention is necessary at times because dysfunctional voiding can be influenced by emotional disturbances and psychopathology.

Combined therapy. A combination of anticholinergic medications, antibiotic prophylaxis, biofeedback, and psychological Counseling may be the last chance for these patients.

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Sažetak

DISFUNKCIJSKO MOKRENJE

L. Szabo

Sindrom disfunkcionalnog izlučivanja (SDI) je primjer nenormalnog izlučivanja, nepoznatog uzroka s inkontinencijom stolice i mokraće. Školska djeca sa SDI su imala češće mokraćne infekcije te imaju povišenu incidenciju vezikoureteralnog refluksa. Inkontinencija mokraće u djece može biti posljedica anatomskih i neuroloških anomalija. U mnoge djece je prisutna funkcionalna inkontinencija mokraće. Ona može biti posljedica funkcionalnih problema u osjetilnoj fazi, u fazi mokrenja ili kao kombinacija oba čimbenika. Kad je inkontinencija posljedica prekomjernog, učestalog mokrenja zbog hiperaktivnost detrusora upotrebljava se izraz disfunkcijsko mokrenje.

Deskriptori: SINDROM DISFUNKCIONALNOG IZLUČIVANJA, NEKONTROLIRANO MOKRENJE, DISFUNKCIJSKO MOKRENJE, VEZIKOURETERALNI REFLUKS, MOKRAĆNE INFEKCIJE