Original Article

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To what extent are bladder dysfunctions responsible of recurrent urinary tract infections?

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Summary

Aim: Lower urinary tract function disorders are frequently seen urological problem in children, admitted us for the presence of incontinance, urgency, wetting and increased urination need. Whereas they can only be presented by recurrent urinary tract infection. The aim of this study is to evaluate the frequency of lower urinary tract function disorders in patients coming with recurrent urinary tract infection without any complaint on history taking and to emphasize the necessity of urodynamic evaluation for etiology of recurrent urinary tract infections even if there were no any history.

Material and Method: The study was conducted out by 564 patients underwent urodynamic evaluation in our clinic, 300 cases with bladder dysfunction history, underwent urodynamic evaluation were classified in group1. In group 2 there were cases without any bladder dysfunction history but with undefined etiology of recurrent urinary tract (R.UTI) infection.

Results: At the end of study, the number of cases with pathological urodynamic evaluation, were similar to each other in both groups, 86.3% and 84%, respectively. In secondly taken history of group 2, it was seen that actually in 63% of this group had complaints at beginning, only 37% (n=98) of them had a compatible history with former. Among the 98 cases getting sure that without any complain, 63 of them had urodynamical pathology (63/98;64%). It was seen that in 29 of 113 bladder instability case (29/113; 25.6%) in group 2, had really no bladder dysfunction complaint, the only data was recurrent urinary tract infection. Also, in 85 cases diagnosed with dysfunctional bladder, the rate of being only finding of R.UTI was found as 17/85; 20% and 17/24; 71% in lazy bladder.

Conclusions: It is important to take a careful history from children with R.UTI's before performing advanced exams, in the evaluation of bladder dysfunctions. As it was seen in our study, a specific and more friendly environment in which patient and parents be relax, must be supplied for a careful history taking. Also, it must be in mind that, there is urodynamical pathology without any bladder dysfunction history, in significiantly high rate of cases. *(Turk Arch Ped 2013; 48: 110-116)*

Key words: Children, urinary tract infection, urodynamic

Introduction

Urinary tract infections is the most important health problem in Turkey. It is known that the most common cause of recurrent urinary tract infection (R.UTI) is lower urinary system dysfunction from the age of five. Lower urinary tract dysfunctions are common urological problems in children and they may present with findings including urinary incontinence, urgency, crossing legs, intermittent urination and increased frequency of urination. They may also present with R.UTI without any complaint. If there is no complaint in the history suggesting "bladder dysfunction" in R.UTI, the first test to be performed is not urodynamic evaluation. Lower urinary system dysfunctions affect the upper urinary system and may lead to infections, vesicoureteral reflux (VUR), kidney damage and renal failure (1,2). Currently, urodynamic evaluation is used in the diagnosis of lower urinary system dysfunctions as well as in evaluation of treatment response. In this study, our aim was to determine the frequency of lower urinary tract dysfunction in patients in whom urodynamic evaluation was performed to elucidate the etiology of recurrent urinary

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tract infection though there was no complaint in the history which suggested "bladder dysfunction" and to emphasize the necessity of urodynamic evaluation directed to the etiology of R.UTI.

Material and Method

In our study, 564 patients in whom urodynamic evaluation was performed in Ege University, Division of Pediatric Nephrology between 2010 and 2012 were evaluated retrospectively. Urodynamic evaluation was performed in all patients who described "bladder dysfunction" findings at presentation to the outpatient clinic (with or without R.UTI) and in patients with R.UTI who had no history of "bladder dysfunction" at presentation and who were found to have no anatomical or neurological pathology in relation with R.UTI. Presence of one or more of the following findings is evaluated as "bladder dysfunction": increased frequency of urination in daytime (frequent urination with small amounts), feeling of inability to empty the bladder completely after urination, urinary incontinence in the daytime when awake, sudden urgency and application of maneuvers to keep the urine until going to the bathroom, dribbling of urine after urination, dampening of the underclothes after urination, inability to urinate uninterruptedly, wetness on the hips and calves after urination in girls, stool incontinence. The diagnosis of urinary tract infection was made with significant growth of bacteria in urinary culture. Girls who experienced culture-confirmed UTI three times a year or more and boys who experienced more than one UTI a year were defined as R.UTI.

Subjects who had poor mental development, who were autistic and who were not cooperative during urodynamic evaluation were not included in the study.

Prenatal and postnatal personal history and familial history of the patients, demographic data, reason for urodynamic evaluation, urination charts (daily fluid intake, the amount of urine and urination frequency), presence of "bladder dysfunction" findings in the history, number of UTIs, physical examination findings (including detailed neurological examination: deep tendon reflexes-anal sphincter tonus and perianal examination) and imaging results of the patients were recorded. The kidney dimensions, residual urine after urination, bladder structure and bladder wall thickness on ultrasonographic examination were recorded.

The patients were divided into two groups as the ones with and without complaints suggesting "bladder dysfunction" in the history according to the reasons for ordering urodynamic evaluation. 300 subjects with a complaint of bladder dysfunction in the history who underwent urodynamic evaluation regardless of presence of R.UTI were classified as group 1. Group 2 was composed of 264 patients who had no history of bladder dysfunction, but in whom urodynamic evaluation was performed, since the etiology of recurrent urinary tract infection could not be defined.

Urodynamic tests were performed in the pediatric nephrology urodynamics laboratory using Aymed Dynoürodinami device (Aymed Dynoürodinami, Turkey). Urodynamic evaluation was composed of systometric assessment and uroflow techniques. All tests were performed by a single nurse under supervision of a pediatric nephrologist and the results were evaluated by the same pediatric nephrologist.

Urine cultures were ordered from all patients one week before urodynamic evaluation. In the presence of infection, treatment was started and the procedure was postponed. The treatment of the patients who used oxybutynin was interrupted at least five days before the appointment date. Informed consent was obtained after informing the families and patients before the procedure.

The parents were allowed to stay in the laboratory during the procedure to prevent or minimize agitation in the children. Before the procedure the intestines were cleaned by performing enema. Initially, the perineum was cleaned with an antiseptic agent and dryed. Superficial electrodes appropriate for the ages of the children were placed on the sides of the outer anal sphincter at the 3 and 9 o'clock positions. A 6F double-lumen catheter was used to fill the bladder and a 4,5 F balloon rectal catheter was used to measure the abdominal pressure. The bladder was filled with sterile 0,9% physiological serum at 25-36°C such as 10% of the expected bladder capacity is filled per minute. The bladder capacity, abdominal pressure, bladder pressure, detrusor pressure, electromyographic activity (EMG) of the pelvic base muscles, compliance, type of the urinary flow, speed of the urinary flow (Qmax) and residual urine volume were recorded. The detrusor pressure was calculated by substracting the abdominal pressure from the vesical pressure. The expected bladder capacity was calculated using the Koff formula [30x (age+2)]. Residual urine more than 10% of the bladder capacity was considered significant. Three different fillings were performed and the interpretations were obtained by evaluating each filling individually (3). All methods and definitions were done according to the recommendations of the International Children's Continence Society (ICCS) (4).

If the bladder capacity reached the expected capacity for age and there was no increase in the detrusor pressures during filling, if a complete sphincter relaxation occured during urinations and urination occured without residue the evaluation was interpreted to be normal. The terminology published by the ICSS was used both in normal evaluation and pathological definitions (5).

Urination disorder: Inability of the bladder to empty fully because of an active pelvic base during urination

(absence of relaxation in EMG activity during emptying) in non-neurogenic cases, inability to provide uninterrupted urination pattern

Overactive Detrusor (Instable bladder): Presence of unpreventable detrusor contractions during the filling phase which exceeds 12 cmH_2O (may be induced if the bladder is filled rapidly and posture change occurs) and relaxed pelvic base during urination phase

Decreased Detrusor Activity (Lazy Bladder): Absence of contraction of detrusor. Approximately 2-fold increase in the bladder capacity because absence of contraction at the end of the filling phase. Absence of sufficient increase in the detrusor pressure in the urination phase.

Statistically, the t test was used to compare the frequencies of the findings between the groups and a p value of <0.05 was considered significant.

Results

A total of 564 patients in whom urodynamic evaluation was performed in our clinic in a period of two years were included in our study. The patients were divided into two groups. In the first group, 300 patients in whom urodynamic evaluation was performed because of "bladder dysfunction" complaints were included. R.UTI was present in 176 of these patients (176/300) and the remaining 124 patients were female patients who had never had UTI or who had UTI only one or two times after the age of two. Anatomical pathology (VUR, posterior urethral valve (PUV), diverticle, UPD) was found in 93 of 176 patients who had R.UTI. When the distribution of urodynamic diagnoses in group 1 was examined, it was observed that overactive bladder was reported in 95 patients, urination disorder was reported in 47 patients, lazy bladder was reported in 39 patients, neurogenic bladder was reported in 78 patients and normal examination was reported in 41 patients. Presence of a neuropathological finding was reported in 66 of 78 patients who were found to have neurogenic bladder (sacral dimple, sacral hair, loss of sense in the lower extremity, decrease in the tonus of the anal sphicter).

In the second group, 264 patients who had R.UTI at presentation and in the follow-up, who had no history of "bladder dysfunction" findings, but underwent urodynamic evaluation, since no anatomical or neurological cause which would explain R.UTI could be defined were included. As a result of urodynamic evaluation, overactive bladder was found in 113 (42.8%) patients, urination dysfunction was found in 85 patients (32.2%) and lazy bladder was found in 24 patients (9%), whereas all tests were found to be normal in 42 patients (16%). Urodynamic pathology was found in 222 of 264 (84%) patients in this group.

When the patients in group 1 and 2 were compared, no difference was found in the numerical distribution (patient numbers 300 and 264, respectivley; p>0.05) and the rates of pathology (the rates of urodynamical pathology 86.3% and 84% in group 1 and group 2, respectively) between the two groups (Table 1).

Although no information about "bladder dysfunction" was obtained in the outpatient clinic evaluation from the patients in group 2, the patients and parents were questioned once again during urodynamical evaluation (throughout the examination as a conversation). The distribution of the complaints found in the second history of the patients in group 2 by diagnoses is shown in Table 2. 98 patients (98/264; %37), reported no complaint in the repeated questioning as they did initially. In other words, the second history was compatible with the first one in only 37% of the patients. In 166 patients (166/264; %63), findings which were not reported initially were obtained in the second history. No pathology was found in urodynamical evaluation in 63 of 98 patients (63/98; %64) in whom it was assured that actually no complaint was present with the second history. These pathologies included overactive bladder (29 patients), urination disorder (17 patients) and lazy bladder (17 patients). When we examined the total distribution of diagnoses in group 2, it was found that actually no "bladder dysfunction" finding was present in 29 of 113 patients (29/113; %25,6) with overactive bladder and the only finding in these patients was R.UTI. In 85 patients with a diagnosis of urination disorder, the rate of occurence of R.UTI as the only finding was found to be 17/85 (20%). In patients with a diagnosis of lazy bladder, the rate of absence of any "bladder dysfunction" finding was found to be 17/85 (20%) which was a high rate.

It was found that intermittent urination which is a "bladder dysfunction" finding by itself was present in 121 patients (46%) and urgency/crossing legs was present in 38 (14.3%) patients. If intermittent urination which was present in 46% of the patients and presence of urgency/crossing legs were learned at the first presentation, urodynamic evaluation would be in the first order for differential diagnosis. When the data of the second history were evaluated, it was observed that the complaints of encopresis and urinary incontinenc e during daytime occured with the lowest rate and the presence of these complaints had been reported at the first presentation or constituted the reason for presentation. Frequent urination and constipation were also found with a substantially high rate. It was explained that these complaints were ignored by the family or caregiver or were not reported because they were not considered abnormal.

Nocturnal urinary incontinence which was found in the repeated history in group 2 were found with the diagnoses of overactive bladder and urination disorder with rates of 18.5% and 22.3%, respectively. While the complaint of crossing legs was obtained with the highest rate from the patients with a diagnosis of overactive bladder, it was not observed at all in patients with lazy bladder and normal

bladder. The most notable findings in the group with overactive bladder included frequent urination, intermittent urination and constipation. While constipation was found with a rate of 48% in the instable bladder group, it was found with a notable rate of 25% in the urination disorder and lazy bladder group. While intermittent urination was the most common finding in the patients with a diagnosis of urination disorder, it was found with a very low rate in the patients with lazy bladder and was not observed at all in the normal group. When it was questioned why all these complaints were not reported in the first assessment, it was explained that nucturnal enuresis was considered hereditary, urinary incontinence and encopresis were not reported because of emberrasement or were not considered as complaints and urgency/crossing legs was not paid attention to.

Discussion

Lower urinary system dysfunction is a substantially common clinical problem in the childhood. In the etiology, delayed neurological development which is idiopathic or behavioral disorders during toilet training are involved in addition to anatomical and neurological causes (6,7).

"Bladder dysfunction" leads to UTI by disrupting the laminary flow in the urethra and directing the urinary flow back from the urethra to the bladder (8,9,10). In addition, increased intravesical pressure (40 cmH_2O and above) in patients with overactive bladder may lead to infections, vesicoureteral reflux, development of kidney scars and renal failure at the end by disrupting the upper urinary system flow (1,2). Another reason of urinary tract infection is residual urine in patients with a diagnosis of urination disorder. In patients who are not treated successfully, increased bladder pressure is the most common cause of recurrent urinary tract infection (11,12,13,14,15).

In this study, we aimed to determine the urodynamical pathologies which lead to R.UTI without "bladder dysfunction" findings in the history. In this context, the patients included in the second group were addressed in detail. In 84% of the patients, the etiology of R.UTI was explained by urodynamical pathologies.

In addition, "bladder dysfunction" complaints were found in the repeated history during urodynamic evaluation in 63% of the patients in group 2. In only 37% of the patients (n=98), it was found that the first history was accurate (there was actually no finding suggesting "bladder dysfunction"). It was thought that this was related with the fact that a closer contact could be established with the patients and parents during urodynamic evaluation and questions were asked in a conversation environment. Urodynamic evaluation was found to be pathologic in 63 of the patients (63/98; %64) who had actually no "bladder dysfunction" complaints and this showed that the underlying cause of R.UTI was "bladder dysfunction" in 2/3 of the patients, though no complaint was present.

Although the relation between the bladder and bowel habits is known currently, the exact mechanism of action is not clear (16). Increased tonus of the pelvic base inhibits emptying of the intestines fully and leads to constipation or encopresis (17).

In the study performed by Paepe et al. (18) in which pelvis base therapy was performed in 42 girls with R.UTI, constipation was found in 10 (24%) patients and UTI and constipation were eliminated with pelvic base exercises in 8 of these 10 patients. Similarly, constipation was found in the history in of the patients who were found to have urination disorder in the second group in our study.

Constipation occurs as a common problem together with encopresis. Defecation problems are present in 10-

Table 1. Urodynamical diagnostic distribution of the patients in Group 1 and 2

	Group 1 (n=300)	Group 2 (n=264)	p
Mean age	9.1 yıl	8.3 yıl	p>0.05
Female/Male	1.63	1.93	p<0.05
Diagnosis			
Overactive bladder (n/%)	95/31.6	113/42.8	p<0.05
Urination disorder (n/%)	47/15.6	85/32.2	p<0.05
Lazy bladder (n/%)	39/13	24/9	p>0.05
Neurogenic bladder (n/%)	78/26	-	p<0.05
Total pathology (n/%)	259/86.3	222/84	p>0.05
Normal (n/%)	41/13.6	42/16	p>0.05

Table 2. Complaints obtained with a repeated history and diagnostic distribution in the patients in Group 2

	Overactive bladder	Urination disorder	Lazy bladder	Normal	Total
Number (%)	113 (43)	85 (32)	24 (9)	42 (16)	264
F/M	73/37:1.9	69/23:3	14/10:1.4	18/20:0.9	174/90:1.9
UTI frequency episode/ year	4.3	5.1	3.2	2.9	
Findings:					
Urinary incontinence in daytime	7 (6.2%)	5 (5.8%)		-	12 (4.5%)
Nocturnal enuresis	21 (18.5%)	19 (22.3%)	2 (8.3%)	3 (7.1%)	45 (17%)
Urgency/crossing legs	27 (23.9%)	11 (13%)	-		38 (14.3%)
Frequent urination	39 (34.5%)	24 (28.2%)	-	5 (12%)	68 (26%)
Intermittent urination	58 (51.3%)	61 (71.7%)	2 (8.3%)	-	121 (46%)
Encopresis	1 (0.9%)	-	1 (4%)	-	2 (0.7%)
Constipation	54 (48%)	21 (24.7%)	6 (25%)	3 (7.1%)	84 (32%)
No complaint	29 (25.6%)	17 (20%)	17 (71%)	35(83.3%)	98 (37%)

Table 3. Variables which should be questioned in the history in detail

- Frequency of going to the bathroom in daytime
- The amount of urine for each urination
- Frequency of urinary incontinence
- The time between the wet and dry periods
- Urgency/if present, the response given to this
- Urination pattern (continuous/intermittent)
- Do the underwears get wet after urination?
- Is there wetness in the hips and calves after urination?
- Does encopresis accompany?

25% of the children referred to Pediatric Gastroenterology clinic and the complaint of constipation was found in 32% of the second group in our study (19,20). This shows that presence of constipation should be absolutely interrogated when taking history of R.UTI.

In patients with R.UTI, asphyxia/trauma during delivery should be questioned and presence of prenatal hydronephrosis or oligohydramniosis should be recorded. Information about toilet habits and urine control during daytime and night should be obtained. Questions about urinary incontinence recommended to be asked are shown in Table 3. Systemic physical examination, detailed genitourinary examination and neurological evaluation should be performed (21-23). The points which should be kept in mind in detailed physical examination are shown in Table 4.

Although it has been reported in the literature that a relation is present between “bladder dysfunction” and R.UTI, no exact results have been given (24). This relation was mostly explained by the fact that UTI occured more commonly in girls and girls were more predisposed to “bladder dysfunction” (1,18,25,26). In our study, normal findings were found in only 42 (16%) of 264 urodynamic evaluations performed to determine the etiology of R.UTI. Webster et al. (10) performed urodynamic evaluation in 60 patient who had complaints related with “bladder dysfunction” and found normal urodynamic findings in 18% of the patients. Borzyskowski and Mundy (27) performed urodynamic evaluation in 215 children and found normal results only in 8% of the patients. The rate of our normal subjects was compatible with the study performed by Webster et al. (28,29,30) and higher compared to the results of Borzyskowski.

When we examined the distribution of urodynamic pathologies found in 84% of the patients, we observed that overactive bladder was found in 43% of the patients, lazy bladder was found in 9% of the patients and urination disorder was found in 32% of the patients. Most of these patients were female (F/M:1,9). This ratio was higher compared to most studies in the literature (21). Similarly, Hoebeke et al. (30,31,32) conducted a study with 1000 patients and found overactive bladder with a rate of 58%, urination disorder with a rate of 31% and lazy bladder with

Table 4. Variables which should be evaluated in the systemic examination in the diagnosis of bladder dysfunction

- Globe vesicalis
- Palpable abdominal mass
- Perianal and perineal sense/reflex
- Anal sphincter tonus/reflex
- Disrupted bone structure in the sacral vertebrae which can determined by palpation
- Ability to bend the waist anteriorly
- Sacral dimple
- Lipoma in the sacral region
- Increased pigmentation in the sacral skin
- A handful hairing in the sacral region
- Muscle atrophy/asymmetry in the lower extremities
- Foot deformities/dropped foot
- Gait disorder
- Location of the urethral meatus
- Hymen/ penis examination

a rate of 4%. In only three studies, the rate of overactive bladder was found to be at the level of 90%. Since most studies have not evaluated the emptying phase of urination, it is difficult to compare the frequency of urination disorder. Again, lazy bladder has not been defined in many studies. In the study performed by Hoebeke et al. (33), lazy bladder was found with a higher rate in girls. In our study, lazy bladder was also found with a higher rate in girls (14/24 = 58%) and the frequency of lazy bladder was found with a higher rate (9%).

In the study performed by Hoebeke et al. (33), the highest rate of UTI was found in the patients with a diagnosis of urination disorder. In parallel to these data, the higest rate of UTI was found in the patients with urination disorder and secondly in the patients with overactive bladder in our study. In this study, it was found that the rate of urodynamical pathology which was found in 84% of the patients who had R.UTI, but in whom no underlying anatomical or neurological cause could be found and who had no finding related with urination disorder in the history was higher compared to the rates found in the literature (21).

Conclusion

This study shows the frequency of "bladder dysfunction" which is the cause of a significant part of R.UTIs in the childhood. Although our study reminds that "bladder dysfuncion" findings should be questioned in the history, it emphasizes the necessity of providing a safe and sincere environment for the relatives of the patients to obtain accurate answers, since reliable data can not always be obtained in the history. On the other hand, it shows that "bladder dysfunctions" can ocur only with recurrent UTI without leading to any finding or complaint.

Conflict of interest: None declared.

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