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Document heading doi: 10.21276/apjhs.2019.6.1.1 **Research Article**

Demographic Characteristics of the School-age Children With Voiding Dysfunction, and Diagnostic Role of Ultrasound per se

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Abstract

Background: To determine the demographic characteristics of school-age children with voiding dysfunction and to determine the diagnostic role of urinary ultrasonography alone. **Methods:** A questionnaire form was distributed to 5,000 students. Survey questions were prepared in 3 sections. In the first section, general information about the child was questioned. Demographic characteristics of the parents were included in the second section. In the last section, the child's urinary problems, accompanying constipation and familial predisposition were questioned. **Results:** A total of 4850 (97%) questionnaires were obtained. In 497 (10.2%) of the 4850 students' data related to voiding dysfunction were detected. A total of 137 (31.7%) children could hold their urine (delayed their urination). Hundred and eighty (41.5%) children had daytime wetting by drops, while 99 (22.8%) of them could not hold their urine entirely during the daytime. Thirty-five percent (n=152) of the children felt urgent need to urinate. Seventy-one (16.4%) children were holding their urine by crossing their legs. Ninety-one (20.9%) children were having painful urination. Twenty-four (5.5%) children were urinating intermittently. Fifty-two (12.0%) children were involuntarily losing urine when they were coughing and laughing. Sixty-five (15%) children had the feeling that they could not empty their bladders. A total of 371 (85.5%) children were wet at night. **Conclusion:** Nearly half of the children with voiding dysfunction were observed to have similar problems in the family. The urinary system ultrasonography after from detailed history and physical examination will help us to make a diagnosis without the need for further evaluations.

Keywords: Voiding dysfunction; diagnosis; ultrasound.

Introduction

Voiding dysfunction is defined as involuntary leakage of urine in individuals aged ≥ 5 years due to non-organic or functional reasons [1]. The great majority of cases are characterized by functional urinary incontinence, and there is no urological or neurological pathology in these patients. Only a small fraction of those with daytime urinary incontinence has neurological, structural, or other causes [2]. Urinary incontinence is one of the common problems of childhood. Its frequency decreases with age. This disorder is generally perceived as a problem during school age.

In this process especially wetting during the day; may significantly effect the quality of life, school achievement and social communication of the patient due to fear of being embarrassed and ridiculed by their peers [3].Urinary ultrasonography (US) is being used increasingly in the screening of lower urinary tract dysfunctions as a sensitive and noninvasive method [3]. The US provides functional information such as bladder capacity, bladder wall thickness, and amount of

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postvoiding urine as well as anatomic data [4]. Various US findings are associated with urinary dysfunction [4]. Trabecular and/or thick bladder wall detected in the US may be an indirect finding of overactive bladder. Other sonographic findings of overactive bladder include bladder diverticulum, small bladder capacity, post-void residual urine [6]. Bladder wall thickness more than 3-4 mm in the presence of urine amounting greater than 50% of the bladder capacity should raise the suspicion detrusor hyperactivity [7, 8].

A small number of studies on voiding dysfunction in children have been published, and there is no clear and extensive data on its prevalence in our country. Our aim in this study was to determine the demographic characteristics of school-age children with voiding dysfunction and to determine the diagnostic role of US alone.

Material and method

One questionnaire form was used as a data source in the study. These forms were distributed in closed envelopes to approximately 5,000 students. It was requested that the questionnaire forms be filled in by the parents of the children at home. The distributed forms were collected by the school directorate two weeks later. The survey form in the envelope is shown below (**Figure 1**).

In the questionnaire, 34 questions were asked to the parents. Based on the observations of the parents who had children with symptoms suggesting voiding dysfunction were asked to respond, and the number of students participating in the study was determined.

Survey questions were prepared in 3 parts. In the first part, general information about the child was questioned. The number of brothers and/or sisters, and the birth order of the affected child were indicated in this section. Demographic characteristics of the parents were included in the second part. In this section, the questions inquired if the child had biological or step-parents, if the parents were alive or dead, their educational status, occupation, cohabitation, and kinship status. In the last part, the child's urinary problems, accompanying constipation and familial predisposition were questioned.

Figure 1: Questionnaire form

1	**SCHOOL-GRADE:**	
2	**NAME-SURNAME:**	
3	**GENDER:**	
4	**AGE:**	
5	**DATE OF BIRTH:**	
6	**NUMBER OF SIBLINGS? – BIRTH ORDER OF THE PATIENT?**	
7	**MOTHER:**	**FATHER:**
	AGE:	AGE:
	BIOLOGICAL ( ) STEP MOTHER ( )	BIOLOGICAL ( ) STEP FATHER ( )
	ALIVE ( ) DEAD ( )	ALIVE ( ) DEAD ( )
	EDUCATIONAL LEVEL:	EDUCATIONAL LEVEL:

	OCCUPATION:	OCCUPATION:	
	PHONE NO:	PHONE NO:	
8	ARE PARENTS LIVING TOGETHER?	YES ( ) NO ( )	
9	ARE PARENTS RELATIVES?	YES ( ) NO ( )	
10	**PLEASE ANSWER THE FOLLOWING QUESTIONS RELATED TO YOUR CHILDREN BASED ON PARENTAL OBSERVATIONS:**		
		YES	**NO**
11	IS YOUR CHILD HOLDING HIS/HER URINE (POSTPONING)?		
12	IS YOUR CHILD LOSING HIS/HER URINE DURING DAYTIME DROP BY DROP?		
13	DOES YOUR CHILD LOSE HIS/HER URINE COMPLETELY?		
14	DOES YOUR CHILD FEEL AN URGENT NEED TO URINATE?		
15	IS YOUR CHILD DELAYING HIS /HER NEED TO URINATE BY CROSSING HIS/HER LEGS OR SITTING ON THE FLOOR?		
16	DOES YOUR CHILD COMPLAIN OF PAINFUL PEEING?		
17	DOES YOUR CHILD COMPLAIN OF INTERMITTENT PEEING?		
18	DOES YOUR CHILD LOSE URINE WHEN HE/SHE COUGHS OR LAUGHS?		
19	DOES YOUR CHILD SAY THAT HE/SHE FEELS THAT HE/SHE CAN'T EMPTY HIS/HER BLADDER COMPLETELY?		
20	DOES YOUR CHILD LEAK URİNE AT NIGHT?		
21	NUMBER OF BOWEL MOVEMENTS PER DAY?	EVERY DAY ( ) EVERY 2 DAYS ( ) EVERY 3 DAYS ( ) EVERY ≥ 4 DAYS ( )	
22	HOW MANY TIMES DOES YOUR CHILD GO TO TOILET AT SCHOOL?	NONE ( ) ONCE ( ) TWICE ( ) THREE TIMES OR MORE FREQUENT ( )	
23	IS THERE ANY FAMILY MEMBER WITH THE SAME COMPLAINTS?		

After the questionnaire was completed the parents/guardians of the children with symptoms suggesting a voiding disorder were sought, informed about the study, called up in groups to polyclinics. Families who came to the polyclinic were firstly informed about the study and detailed information about the voiding dysfunction was given to them. Then they were asked to sign a consent form which indicated that they participated in the study. Physical examination was done after taking detailed history. Height and body weights of them were measured.

Patients whose physical examination was completed were referred to the urinary system US. All USs were reported by the same radiologist who participated in the study. The urinary US was performed to determine the pathology of the patient. All patients were given voiding training and documents were delivered to the families where information on motivation therapy and voiding training was included.

Statistical Analysis: Data were analyzed using the MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2013). Parametric tests were applied to data of normal distribution, and non-parametric tests were applied to data of questionably normal distribution. Data are expressed as mean±SD or median (interquartile range), as appropriate. Statistical significance was assumed for $p<0.05$.

Results

Approximately 5000 questionnaires were left in the classes of the school to be filled. Feedback from a total of 4850 (97%) questionnaires was obtained. In the questionnaire evaluations, in 497 (10.2%) of the 4850 students' data related to voiding dysfunction were obtained. Of these students, 434 (8.94%) participated in the study including 246 (56.7%) female and 188 (43.3%) male children. The mean age of the children was 8.53±2.39 years. The mean body weight of the children was 31.5±9.53 years. The mean height of the children was 130.98±11.09 cm. The mean number of siblings of the children was 2.62±1.44. (75.11%) A total of 326 children had no kinship. A total of 108 (24.9%) children were relatives.

The mean age of the mothers of the children was 33,98±4,34 years. The mean age of fathers of the children was 36.94±4.67 years. Mothers of all children were their biological mothers, and all of them were alive. Mothers of 34 (7.8%) children were illiterate, and others were primary (n=142; 32.7%), secondary (n=122; 28.1%), lycée (n=124; 28.6%) and university (n=12; 2.8%) graduates. There was a significant difference between the two groups when the children with voiding dysfunction were compared according to their mother's education (chi-square $p<0.01$).

The number of mothers who had secondary or primary school education was higher than those with high school or university education. The fathers of all the children who participated in the study were biological fathers, and 432 (99.5%) of them were alive. Fathers of 16 (3.7%) children were illiterate or primary (n=121; 27.8%), secondary (n=89; 20.5%), lycée (n=160; 36.9%), and university (n=48; 11.1%) graduates. There was no significant difference between the two groups when the children were compared according to their fathers' education (chi-square $p=0.24$). Parents of all the children who participated in the study were living together (not divorced).

A total of 137 (31.7%) children could hold their urine (delayed their urination). Hundred and eighty (41.5%) children had daytime wetting by drops, while 99 (22.8%) of them could not hold their urine entirely during the daytime. Thirty-five percent (n=152) of the children felt urgent need to urinate. Seventy-one (16.4%) children were holding their urine by crossing their legs. Ninety-one (20.9%) children were having painful urination. Twenty-four (5.5%) children were urinating intermittently. Fifty-two (12.0%) children were involuntarily losing urine when they were coughing and laughing. Sixty-five (15%) children had the feeling that they could not empty their bladders. A total of 371 (85.5%) children were wet at night.

As we learned from the history 4 (0,9%) children had not daily defecations. Most (n=389; 89.6%) of the children had defecated only once a day, while 41 (9.4%) children had defecated two times a day. Hundred and six (24.4%) children had not used WC at school. While 254 (58.5%) children used the school WC only once, and 74 (17.1%) of them twice.

Two hundred and fifty-one (56.7%) children had no similar disease in the family, while 183 (42.2%) children had a family history of voiding dysfunction as night wetting, day and night wetting. Two hundred and seventeen (50%) children among the affected children who participated in the study were the first (n=217; 50%), second (n=146; 33.6%), third (n=47; 10.8%), fourth (n=9; 2.1%), fifth (n=7; 1.6%), sixth (n=4; 0.9%), and seventh (0.6%) children of the family. The

children who participated in the study was the 1.78±1.08th children of the family. US results of the children who participated in the study are shown in **Table 1.**

Table 1: Distribution of ultrasonographic findings

	N	%
Normal	273	56.4
Residual urine	46	9.5
Findings consistent with cystitis	43	8.8
Low bladder capacity	43	8.8
Bladder wall thickness	31	6.4
Difference in size	19	3.9
Stone	17	3.5
Ectasia	9	1.9
Double collecting system	1	0.2
Trabeculation	1	0.2
Accessory spleen	1	0.2
Total	484	100.0

During a 6-and-a-half years follow-up of patients with voiding dysfunction, improvements in the disease states of most of the patients with daytime wetting (91%), enuresis (84%) and urinary tract infections (82%) were observed [9].

Discussion

Although voluntary control of urination and toilet training differ among communities as for timing, and methods used, all bedwetting seen in children over five years of age are defined as enuresis [1]. Control of urination was achieved firstly at daytime, and nighttime control develops with time. Population screening revealed that 15-20% of healthy children aged five years wet their mattresses at night, 15% of them gain nightly urine control each year, and 1-2% of them remain as an enuretic when they reach 15 years of age [2].

The incidence of voiding dysfunction is 6.8% in developed countries and 14.2% in developing countries [10,11]. Dirim et al. performed a study in Ankara with 712 children between the ages of 6 and 12, and found the incidence of voiding dysfunction as 7.2% [12]. Özçetin et al. found the prevalence of voiding dysfunction as 39.5% in their study with 271 preschool children [13]. In Brazil, Vaz et al. performed a study with 739 children between the ages of 6 and 12 and detected voiding dysfunction in 21.8% of their pediatric population [14]. In our study, voiding dysfunction was found in 8.9% of the cases.

In our country, the incidence of urinary incontinence was found to be 1.9 - 4.5% in single- center studies [15-17]. Prevalences of daytime urinary incontinence in some studies conducted abroad were as follows: 2.1% in Korea, 4.4% in Belgium, 6.3% in Japan, 10.4% in Germany, 11.2% in Korea, and 16.9% in Australia, and 30% in Brazil [14,18-23]. The prevalence of daytime urinary incontinence was 2.0% in our study.

The prevalence of enuresis nocturna varies among societies. In our country, it is seen in 7-9% of the children between 7-10 years of age, and in 1-2% of the children aged 15 years [24]. However, enuresis nocturna is seen 1.5-2 times more frequently in boys than in girls [24]. Gür et al. performed a study with 1576 children aged 6-16 years in Istanbul and revealed the prevalence of enuresis as 12.7% for girls and 12.2% for boys [25]. Tuncer et al. found the incidence of enuresis as 11.8% among primary school students in Ankara [26]. Gümüş et al. conducted a study with 1703 children aged 7-11 years and found the prevalence of enuresis as 13.7% (girls, 10.6%, and boys, 16.9%) [27]. Dalgıç et al. reported a 29.9% incidence of enuresis in a study conducted in Ankara [11]. In studies performed in different countries, the incidence of enuresis

nocturna was determined to range between 5.6-15.2% [18,20,22,28]. In their study, Serel et al. reported the incidence of enuresis nocturna as 14.3% in males, and 7.6% in females; while enuresis diurna as 0.07% in males and 0.02% in females [29]. In a study of 3527 school children aged 6-11 years in Southeast Anatolia, Özkan et al. found that enuresis was more common in boys and found M/ F ratio as 1.6 [30]. Two hundred and forty-six (56.7%) girls and 188 (43.3%) boys were included in our study. The gender difference was not statistically significant. The prevalence of nocturnal enuresis was 7.6% in our study. It was determined that 371 (85.5%) of the children who participated in our study had bedwetting.

In a study, Chung et al. detected urine holding maneuvers, in 46.4%, delayed voiding in 23.5%, urge incontinence in 16.8% and urgency in 16.6% of their patients [22]. In the study of Vaz et al., urine holding maneuvers were found in 19.1%, painful urination in 4,2%, stranguria in 4.5%, and urge incontinence in 13.7% of their patients [14]. Every child with a urinary tract infection and incontinence problem needs to questioned for voiding dysfunction. Therefore, the symptoms of lower urinary tract symptoms should be questioned in children who presented with urinary tract infection [12]. Dirim et al. detected voiding dysfunction in 18%, and 5.3% of the children with or without a history of urinary tract infections, respectively [12]. In their study of 751 children with daytime urinary incontinence, Bakker et al. reported that bladder sphincter dysfunction was frequent in children with daytime urinary incontinence, which was also associated with recurrent UTI [31]. Sureshkumar et al. reported that UTI was a risk factor for boys, but not for girls [23].

According to US results in our study, findings suggestive of cystitis were detected in 43 (0.88%) children. This number corresponds to 9.9% of the number of studies. Bakker et al. [19] indicated that bladder-sphincter dysfunction is common in children

with daytime urinary incontinence which was associated with recurrent urinary tract infections. In our study, among pathologic US findings, low bladder capacity suggested detrusor-sphincter dyssynergia. Urodynamic studies are needed to establish the diagnosis.

Because the embryonic origins of the gastrointestinal and genitourinary systems are the same, and because they are innervated from the same sacral plexus, one condition which affects one system may also affect the other [28]. It has been shown that constipation can lead to deformity in the bladder and thus overactivation of detrusor muscle may induce incontinence [32]. Studies conducted abroad have also found a high association between voiding dysfunction and constipation [20,28]. In our study, no significant relationship was found between constipation and voiding dysfunction.

The etiology of urinary incontinence in children is multifactorial, among which socio-cultural factors are involved [33]. Çarman et al. conducted a study on enuresis with 2589 children in two regions with two socioeconomic levels in Istanbul and found prevalence rates of enuresis in regions with low, and high socioeconomic levels as 25% 16%, respectively [34]. Toktamış et al. could not find any significant relationship between socioeconomic and sociodemographic characteristics of the patient's family and daytime urinary incontinence [16]. In our study, socioeconomic evaluation can be done according to parents' occupations and educational levels. Generally speaking, these two criteria show a family structure with low education and income levels. This indicates that socioeconomic level is effective in voiding dysfunction. To arrive at more significant results, conduction of comparative studies in regions with different socioeconomic levels is more suitable.

In various studies performed, a link between parental education level and voiding dysfunction has been suggested. Şahin et al. and Ünalan et al. found that there was a significant relationship between maternal education level and enuresis [10,35]. Gür et al. found that enuresis is linked with the educational level of both mother and father [25]. Dirim et al. indicated that low family education is a risk factor for daytime urinary incontinence [12]. Chung et al. found that daytime urinary incontinence was more frequent in children with low parental education levels [22]. Unlike these, Baeyens et al. and Sureshkumar et al. found that there was no significant relationship between education levels of families and enuresis [23,36]. In our study, the education levels of mothers of 298 (68.6%) children among those who participated in the study were secondary or primary school, while mothers of 136 (31.4%) children were high school or university graduate. Accordingly, there is a significant difference between the two groups when children with voiding dysfunction are compared according to the levels of maternal education (chi-square; $p<0.01$). A higher number of mothers were primary, and secondary school graduates, when compared with those with high

school, and university graduates. While the educational level of the fathers of 226 (52.1%) children was secondary and primary school, and 208 (47.9%) fathers were high school, and university graduates. There was no significant difference between the two groups when patients with voiding dysfunction were compared according to their fathers' educational level (chi-square p=0.24). In conclusion, there was an inverse relationship between maternal education and voiding dysfunction in our study, but no significant relationship was found between voiding dysfunction and fathers' educational level.

Studies have shown increases in the incidence of enuresis in problematic and broken families, but any significant correlation between the family structure and voiding dysfunction in studies performed in Turkey could not be found [37]. Özçetin et al. and Şahin et al. found no significant correlation between broken families and urinary incontinence [10, 13]. No such comparisons were made in our study because all of the children who participated in our study had undivorced parents.

As the number of children increases in the family, the interest towards children decreases and in these crowded families there are opinions that the child tries to distract attention by bedwetting [10]. Gür et al. compared the families with ≤ 5 or ≥ 6 individuals and found nighttime incontinence to be more frequent in crowded families [25]. Çarman et al. found no significant relationship between the number of family members and enuresis [34]. Özçetin et al. could not detect a significant correlation between the number of siblings and enuresis [13]. The patients who participated in our study had an average number of 2.62±1.44 siblings. No significant relationship was found between the number of siblings and voiding dysfunction.

Family history positivity in enuretic patients has been revealed in many studies as a significant risk factor. Various rates of family history positivity were reported by Öge et al. (40.7%), Özkan et al. (42%), Gür et al. (64.5%) and Gümüş et al. (76.5 %) as indicated in parentheses [25,27,30,38]. Serel et al. found higher rates of familial predisposition in children of especially consanguineous families [29]. Labrie et al. emphasized that mothers of the children with voiding dysfunction also had similar symptoms during their childhood and that this condition persisted even in the adulthood of some mothers [39]. Azhir et al. detected the presence of enuresis in 51% of the fathers, and 39 % of the mothers of the children with primary enuresis [40]. In a prospective 8-year- study with 1265 children, Ferguson found that the most important factor in achieving urinary control was the presence or absence of a family history of enuresis story, if both parents or more than two siblings had enuresis than urinary continence is gained 1.5 years later than normal children [41]. In the present study, we found that 183 (42.2%) of the children who participated in the study also had a similar disease in their family.

As ultrasonographic findings of overactive bladder; trabecular bladder wall, thickening of the bladder wall, low bladder capacity, bladder diverticulum, and residual urine may be enumerated [42]. In their study with 82 enrolled children, Demirören et al. detected abnormal US findings in 15 (18.3%) children [42]. In their patients they detected pelvicalyceal ectasia (n=7), grade I increase in the renal parenchyma echo (n=4), nephrolithiasis (n=1), double collecting system (n=1), and bladder wall thickening (n=1).

Jequier et al. detected median wall thickness of the bladder as 1.55 mm in healthy children. The upper limit of bladder wall thickness in full bladder was accepted as 3 mm [3]. Tanaka et al. [4] revealed the presence of prominent upper urinary system findings in children with urodynamic risk factors and a bladder wall thickness greater than 3.3 mm [4]. Measurement of bladder wall thickness is an important screening test in demonstrating upper urinary tract involvement in children with neurogenic bladder [43]. In a study of 114 children with lower urinary tract disturbances, Kocaoğlu et al. found detrusor instability in 66 and an increase in bladder wall thickness in 44 of their 66 patients [44]. The presence of residual urine up to 50% of the estimated bladder capacity and thicker bladder wall (> 3-4 mm) should suggest detrusor hyperactivity [44]. Kuzmic et al. found significantly different bladder wall thickness in children with bladder dysfunction [8]. In the present study, US results were normal in 273 children (56.4%); however, in 161 (43.6%) children, clinically significant results were obtained in the US. US also demonstrated findings consistent with residual urine in (9.5%), low bladder capacity in 43 (8.8%), cystitis in 43 (8.8%), increase in bladder wall thickness in 31 (6.4%), discrepancies in the dimensions of both kidneys in 19 (3.9%), stone in 17 (3.5%), ectasia in 9 (1.9%), double collecting system in 1 (0.2%), trabeculation in 1 (0.2%) and accessory spleen in 1 (0.2%) child. According to these results, after a detailed anamnesis and good physical examination as a noninvasive and easily accessible imaging study, the

US will aid us in making a diagnosis without any need for further tests.

Conclusion

In conclusion, the incidence of voiding dysfunction and incontinence detected in the study is consistent with the literature. Nearly half of the children with voiding dysfunction were observed to have similar problems in the family. Also, urinary system US after a detailed history and good physical examination will help us to make a diagnosis without the need for further tests.

Ethical Approval

This study was approved by the local Institutional Review Board.

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