North Clin Istanb 2024;11(5):471–475
doi: 10.14744/nci.2024.89990

Original Article PEDIATRICS

Evaluation of bladder capacity in pediatric patients with nocturnal enuresis using voiding diary and uroflowmetry: A retrospective study

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ABSTRACT

OBJECTIVE: This retrospective study was conducted in a tertiary hospital in Turkiye, it was aimed to evaluate the results of kidney and bladder ultrasonography, uroflowmetric study and volume frequency chart in children diagnosed with bedwetting at night.

METHODS: This study focused on patients aged 5-17 years who were treated for nocturnal enuresis in the single-center pediatric urology clinic of a tertiary hospital between 2017-2021. Patients' comorbidities, surgical history, urinary ultrasonography findings, uroflowmetry examination results, and two-day voiding diary were requested.

RESULTS: The number of pediatric patients diagnosed with enuresis nocturna was 956. Abnormal ultrasonography findings were observed in 13.9% of patients. Almost half of the patients had a positive family history, and 13.4% had a history of previous surgical procedures. While the voiding diary indicated that 54.2% of patients had bladder volumes equivalent to the expected bladder capacity, uroflowmetry examination revealed low bladder capacity in 65% of patients.

CONCLUSION: This study underscores the significance of comprehensive evaluations, including detailed ultrasonography and voiding diary measurements, in pediatric patients with monosymptomatic enuresis nocturna. Our study suggests that bladder volume measured through a two-day weekend voiding diary may provide more effective information for estimating optimal bladder capacity compared to measurements obtained through uroflowmetry.

Keywords: Bladder; enuresis; frequency; ultrasonography; uroflowmetry; volume.

Cite this article as: *Yener S, Ilce Z. Evaluation of bladder capacity in pediatric patients with nocturnal enuresis using voiding diary and uroflowmetry: A retrospective study. North Clin Istanb 2024;11(5):471–475.*

Nocturnal enuresis is a prevalent issue affecting approximately 15% of individuals under the age of six [1]. Monosymptomatic nocturnal enuresis, with or without daytime bedwetting, is associated with bladder dysfunction [2, 3]. The evaluation of monosymptomatic nocturnal enuresis (MNE) relies significantly on clinical history. Diagnosis includes detailed history-taking, physical examination, assessment of urinary and defecation behaviors, urinalysis, and if necessary, ultrasonography. The efficacy of alarm therapy, desmopressin, and anticholinergic drugs has been demonstrated in randomized trials [4, 5]. Evaluating the effectiveness of drug therapy in enuresis studies is challenging due to common misconceptions among families of these children. Additionally, children with enuresis may be monitored by various specialists including family physicians, pediatricians, pediatric urologists, and urologists. The diversity in medical perspectives during the diagnostic phase can lead to misunderstandings. This study aimed to retrospectively evaluate the history and examination, outcomes of patients diagnosed with monosymptomatic nocturnal enuresis who presented to a single pediatric urologist.

Received: June 24, 2024 *Revised:* July 30, 2024 *Accepted:* August 08, 2024 *Online:* October 03, 2024

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MATERIALS AND METHODS

This retrospective study focused on patients aged 5-17 years who were treated for nocturnal enuresis in the single-center pediatric urology clinic of a tertiary hospital between 2017-2021. A total of 956 pediatric patients had a diagnosis of monosymptomatic nocturnal enuresis. Patients with diseases and/or surgeries that could affect neurological and/or urological continence were excluded from the study. Patient age, gender, positive family history, urine, uroflowmetry (UFM), ultrasonography (USG), and voiding volume chart for two weekend days were recorded. Additionally, any surgeries and additional illnesses were documented. Patients were questioned about their history of urotherapy, biofeedback and medication use before uroflowmetry and voiding diary. Patients who had not received any treatment before were included in the study. Umraniye Training and Research Hospital Clinical Research Ethics Committee reviewed and approved the study design (date: 10.02.2022, decision no: B.10.1.TKH.4.34.H.GP.0.01/57). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

In our study, simple statistics were used, and the mean±SD and % values of the groups were obtained from the statistical calculation in the Microsoft Excel Worksheet.

RESULTS

Of the patients included in the study, 38% (n=364) were female and 62% (n=592) were male. The mean age was 9.2 years. Family history revealed that 47.1% of patients (n=451) had a history of enuresis among first and second-degree relatives. Associated diseases were detected in 14.8% of patients (n=142). The most common diseases in order of frequency were Familial Mediterranean Fever (FMF), encopresis, and allergic diseases. Surgical history was present in 13.4% of patients (n=129), with adenoidectomy being the most frequently performed procedure. Urinary system ultrasonography revealed normal findings in 86.1% of patients (n=822) and various abnormalities in the remaining 13.9% (n=134) Table 1. No specific features were detected in the complete urine analysis. Using the ICCS formula to determine bladder capacity (EBC=[30x(age+1)mL]), it was found that 37.9% of patients had a capacity below EBC (n=362), 54.2% had a capacity equivalent to EBC (n=518), and 8% had a capacity above EBC (n=76). The bladder volume measured during the initial uroflowmetry examination without electromyography showed low volume in 65% of patients (n=622), expected bladder capacity in 14.5% (n=139), and high volume in 20.5% (n=195) Table 2.

Highlight key points

- A two-day well-structured voiding diary provides important information in bladder volume assessment.
- Even if there are no other symptoms other than nocturnal enuresis, abnormal findings can be detected in urinary system ultrasonography.
- Uroflowmetry is an important noninvasive test that evaluates voiding function in voiding disorders.

Table 1. USG findings of patients

	Total n	Bilateral n	Right n	Left n
Upper urinary system				
Hydronephrosis	60	17	24	19
Duplex system	8	0	4	4
Renal calculi - crystalloid	6	3	1	2
Kidney cyst	5	0	4	1
Increase in echogenicity	3	3	0	0
Parenchyma Thinning	1	0	0	1
Angiomyolipoma	1	0	1	0
Kidney hypoplasia	1	0	1	0
Renal ectopia	1	0	1	0
Renal agenesis	1	0	1	0
Lower urinary system				
Increase in wall thickness	28			
Bladder trabeculation	12			
Cystitis	4			
Bladder diverticulum	2			
Residual urine	1			

USG: Ultrasonography.

DISCUSSION

Monosymptomatic nocturnal enuresis is a common condition that can significantly affect a person's psychological and social development. Patients and their families who are followed up for bedwetting should be informed about urological, psychological, and sociological conditions associated with enuresis and the need for treatment should be stated.

TABLE 2. Bladder capacity comparison in uroflowmetry and voiding diary

	(%)	Age	Gender	
			Boys (n)	Girls (n)
Ufm volum				
Under	65.0	9.4±2.6	384	237
Same	14.5	10±3.0	94	44
Above	20.5	8.0±2.2	114	83
Diary volum				
Under	37.9	9.1±2.5	209	154
Same	54.2	9.2±2.7	338	179
Above	8.0	9.5±2.9	45	31

UFM: Uroflowmetry.

Studies have shown that enuresis is a more common problem in boys [6, 7]. Consistent with previous research, our retrospective analysis found that nocturnal enuresis was more common in boys (62%). Some studies conducted in our country report a higher prevalence of urinary incontinence in boys compared to girls [8, 9]. The higher prevalence of MNE in boys in this study is consistent with the current literature. The rate of family members of our patients with a history of enuresis was found to be 46.3%. Some studies have reported a higher likelihood of children having enuresis if their parents have a history of enuresis [10]. In one study, the prevalence of family history was 40.7% in enuretics and 9.5% in non-enuretics [8]. In another series, the rate for siblings was found to be 42% and 66% for family members other than siblings [9]. Some parents lacked sufficient knowledge about their own and their relatives' enuresis histories. Responses from families with unclear information were considered negative family histories. For this reason, we believe that the determined proportional values may be higher.

Some parents had insufficient information about their own and their family members' enuresis histories. Therefore, we think that this rate may be higher than reported in the series.

When examining the diseases identified during patient history, it was observed that patients with FMF were the highest patient group among those presenting with nocturnal enuresis symptoms (14.1%, n=17). Although there are no articles on the relationship between colchicine treatment and nocturnal enuresis, a case report of an adult patient noted bowel and bladder incontinence following colchicine treatment [11]. Another study reported detrusor instability after colchicine treatment, which blocks neurotransmitters from neurons [12]. Twenty-nine percent (n=5) of patients diagnosed with Familial Mediterranean Fever had family members with a history of enuresis. We think that this situation may be related to the effect of colchicine on bladder function.

The most common disease observed in our patients after FMF disease was constipation (11.6%). Various studies have shown that there is a close relationship between the regulation of bowel function and the function of the bladder [13, 14]. As a significant finding, in a study, it was determined that improvement in constipation did not sufficiently ameliorate nocturnal enuresis complaints to achieve complete resolution [15]. They emphasized the need to address bowel issues but noted that this approach alone would not ensure the child remains dry at night.

In conducted studies, the frequency of allergic diseases has been found to be statistically significantly higher in patients with monosymptomatic nocturnal enuresis [16]. In our series, allergic diseases rank third among the most common conditions observed in patients. In another series, a significantly higher rate of adenoid hypertrophy has been detected in children with enuresis compared to the control group, with approximately 50% of enuretic children showing this condition [17]. A similar study investigating a comparable patient group revealed an increase in attention deficit and nocturnal enuresis incidence among patients with adenoid hypertrophy [18]. Furthermore, adenoidectomy surgery has been reported to be effective in improving symptoms of this condition. An intriguing finding in our patient group is the frequent reporting of adenoidectomy as the most common surgical procedure, prompting the need for more extensive studies on the effectiveness of adenoidectomy in enuresis.

In the literature, it is stated that treatment for enuresis can be initiated without further investigation in children who only present with nocturnal enuresis complaints, have a normal physical examination, and do not exhibit any other urological symptoms [19]. However, in our study, accompanying diseases were often found despite the absence of urinary tract pathology. Our recommendation involves taking a thorough medical history, conducting a physical examination, performing non-invasive laboratory tests, and having the patients evaluated by specialists in the field to formulate a treatment plan.

Examining bladder function and capacity is crucial for the diagnosis and treatment of lower urinary system dysfunction. In our patient group, evaluation was conducted using ultrasound not only on the bladder but also on the upper urinary system. The most common finding in the upper system was hydronephrosis, while an increase in bladder wall thickness was observed in the lower urinary system. To obtain objective and reliable results in a voiding diary, it is recommended to record for a minimum of two days [20].

We requested a two-day voiding diary from all our patients, with the condition that it should cover a weekend. We specifically requested it to accommodate the fact that all our patients are school-aged children and their parents typically have high occupational engagements. The rationale behind this request was thoroughly explained to the parents or caregivers during the examination. Upon reviewing the results, the highest voided volume measured in the diary was taken into consideration. It was observed that in more than half of our patients, the recorded results were consistent with the expected bladder capacity. Despite opinions suggesting that keeping a voiding diary may not be effective and yield reliable results in cases where sufficient motivation cannot be ensured in children and caregivers, we believe that emphasizing the importance of the voiding diary in a clear and understandable manner to both the child and the caregiver can be highly beneficial.

In our study, bladder capacity was observed to be measured below EBC in 65% of patients during the initial UFM examination. It is believed that there was no physiological bladder filling with a large amount of fluid intake shortly before UFM and that anxiety about urinating in a hospital setting may affect the results in children. A study has acknowledged that uroflowmetry should be repeated to enhance its accuracy, reliability, and correct interpretation [21].

It has been reported that despite variations in bladder volume measurements detected in uroflowmetry, which is commonly used in the treatment process, it does not create an unusual standard deviation. Similarly, it is indicated that uroflowmetry and voiding diary can be used interchangeably and evaluated for correlation in monitoring and treating all types of voiding disorders. [22, 23]. Our opinion is that it may support selected cases where excretion diary cannot be done effectively.

In addition, we also observe that a voiding diary conducted effectively within a framework of understandable and trust-focused communication with the family reflects more reliable values for bladder volume compared to uroflowmetry conducted in a hospital setting, as measured by volume.

There are some limitations to our study. These are that the treatment success was not evaluated, the second was that uroflowmetry was performed without EMG, and the third was that the bladder volume could not be correlated with ultrasonography.

Conclusion

Patients with MNE may not exhibit any symptoms other than nocturnal enuresis during the initial examination, but accompanying urinary anomalies may be detected via ultrasonography. Our study suggests that bladder volume measured through a two-day weekend voiding diary may provide more effective information for estimating optimal bladder capacity compared to measurements obtained through uroflowmetry. This underscores the critical importance of properly conducting voiding diaries in the management of enuresis cases.

Ethics Committee Approval: The Umraniye Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 10.02.2022, number: B.10.1.TKH.4.34.H.GP.0.01/57).

Authorship Contributions: Concept – SY, ZI; Design – SY; Supervision – ZI; Fundings – SY; Materials – SY; Data collection and/or processing – SY; Analysis and/or interpretation – SY, ZI; Literature review – SY; Writing – SY; Critical review – SY, ZI.

Conflict of Interest: No conflict of interest was declared by the authors.

Use of AI for Writing Assistance: Not declared.

Financial Disclosure: The authors declared that this study has received no financial support.

Peer-review: Externally peer-reviewed.

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