Is Rectal Diameter a Predictor of Daytime Urinary Incontinence in Pediatric Patients?

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Abstract

Aim: With this study, we aimed to evaulate the relationship between daytime urinary incontinence and transverse rectal diameter by using transabdominal ultrasound.

Methods: In this study, pediatric patients were evaluated with symptoms of daytime urinary incontinence referred to the pediatric nephrology clinics of Adıyaman University Faculty of Medicine between November 1, 2022 and January 1, 2023. This observational, cross-sectional study was carried out after obtaining ethics approval. The Dysfunctional Voiding Symptom Score developed by the International Children's Continence Society was used for the diagnosis of lower urinary tract symptoms. Patients with a The Dysfunctional Voiding Symptom Score of ≥9 points were considered as having lower urinary tract symptoms. Transvers rectal diameter measurement was obtained behind the bladder in the axial plane from the outer wall to the outer wall of the rectum. The patients were assessed by the same radiologist. Control group consisted of healthy patients without lower urinary tract symptoms.

Results: A total of 77 children were included in the study. The daytime urinary incontinence group included 39 children (19 boys, 20 girls), while the control group included 38 (16 boys, 22 girls) healthy children. There was no statistically significant difference between the patient group with daytime urinary incontinence and healthy control group when compared in terms of transverse rectal diameter measurements (p=0.387, t=0.870). There was no association between transverse rectal diameter and daytime urinary incontinence (p>0.05).

Conclusion: Our data suggest that increased rectal diameter is not the only predisposing factor for daytime urinary incontinence and neural mechanisms such as cross-organ sensitization are also may be effective in daytime urinary incontinence.

***Keywords**: Children, daytime urinary incontinence, transverse rectal diameter, transabdominal ultrasound.*

1. Introduction

Dysfunctional voiding symptoms are common in childhood and account for a substantial number of referrals to the pediatric nephrology and urology outpatient clinics. They are treatable conditions but can adversely affect quality of life and lead to psychiatric problems when left untreated.[1] Daytime urinary continence is expected to be achieved by 4 years of age, and nighttime urinary continence is attained by 5 to 7 years of age. In children, coordination between the urinary sphincter and bladder improves by increasing age and the frequency of urinary daily incontinence declines.[2]

Corresponding Author: Günes Isık, drgunes07@hotmail.com, *Received: 27.10.2024, Accepted: 26.12.2024, Available Online Date: 31.12.2024 Cite this article as: Işık G, Oktay C, Yavuz S. Is Rectal Diameter a Predictor of Daytime Urinary Incontinence in Pediatric Patients? J Cukurova Anesth Surg. 2024; 7(4): 239-42.*
https://doi.org/10.36516/jocass.1574402

Assessment of voiding disorders is based on the classification of the International Children's Continence Society (ICCS) guidelines, which categorizes voiding disorders into daytime urinary incontinence and nocturnal enuresis.[3] Non-organic (functional) daytime urinary incontinence is defined as intermittent urine leaking during non-sleeping periods. To meet this definition, the patient must be at least 5 years old, with urinary incontinence symptoms occurring more than once a month for at least 3 months and organic reasons need to be excluded. According to the ICCS classification, the common types of functional daytime urinary incontinence include overactive bladder, urge incontinence, underactive bladder with voiding postponement, and dysfunctional voiding associated with detrusor sphincter dyscoordination. Amongst others, the rare forms include stress incontinence, giggle incontinence and vaginal reflux. [3] Evaluation of the patients should include detailed history, family history, physical examination, the types and duration of symptoms experienced, and urine volume, urination frequency, capacity of voiding volume, symptoms of feeling urgency and incontinence frequency

and daily totally fluid intake noted by three days voiding diary. [4]

Abreu et al.[5]s used transabdominal ultrasonography to measure rectal diameter and defined an enlarged rectum for transverse diameter ≥3 cm. Functional constipation (FC) affects the quality of life in children and their parents. It is a common complaint and its incidence varies between 0.7% and 29.6%. [6] Constipation and increased transverse rectal diameter are associated with reduced bladder capacity and urinary urgency due to increased pressure on the bladder, and trigger voiding disorders by disrupting detrusor function. This condition, defined as bladder and bowel dysfunction (BBD), is a known entity. Pelvic floor dysfunction causes recurrent urinary tract infections, voiding disorders and constipation in children, especially in girls. [5,7] We think that measurement of the transverse rectal diameter (TRD) by transabdominal ultrasound in children may provide valuable information on the physiology of urinary incontinence and help predicting its occurrence. The aim of our study was to determine whether the TRD has an effect on the physiology of daytime urinary incontinence or not. Early diagnosis and treatment of daytime urinary incontinence in children is essential because of its negative effects on children's self-esteem and quality of patient and their parent's life .[8]

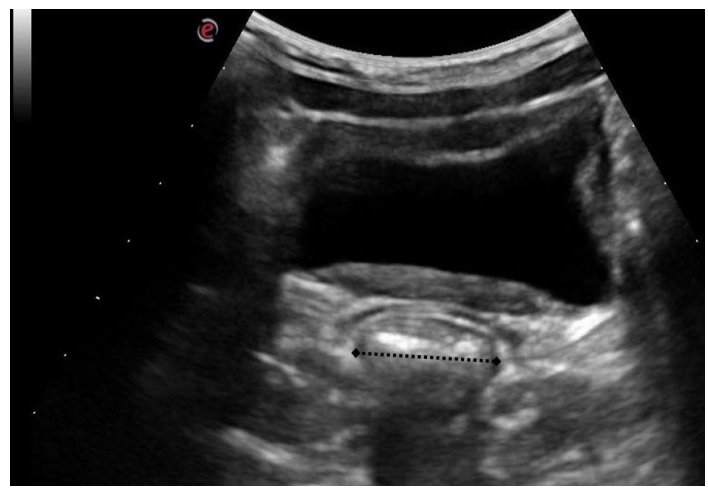
2. Materials and Methods

In our study, pediatric patients who applied to the Department of Pediatric Nephrology, in Adıyaman University Hospital between 1 November 2022 and 1 January 2023 with complaints of daytime urinary incontinence were evaluated prospectively after obtaining ethical approval. All patients were examined for lower urinary tract symptoms and day time urinary incontinence by a pediatric nephrologist. The Dysfunctional Voiding Symptom Score (DVSS) developed by the ICCS and validated by Akbal et al. [3,9] for Turkish children was used for the diagnosis of voiding disorders. Additionally, in all patients, urine volume, urination frequency, capacity of voiding volume, symptoms of feeling urgency and incontinence frequency and daily totally fluid intake noted by three days voiding diary. Complete urinalysis and urine culture were used to rule out active urinary tract infections. The DVSS questionnaire was applied by patients and their parents. Only the patients with daytime urinary incontinence (symptoms of overactive bladder, abnormalities in the filling phase of the bladder, urgency, frequent urination and wetting without nighttime incontinence) were included in the study. Those with an underlying chronic kidney and bladder disease and congenital anomalies of the kidney and urinary tract were not included to the study. Patients having voiding postponement supporting underactive bladder, urine leaking because of decreased urination frequency, giggle incontinence and vaginal voiding were excluded. Conditions that may cause voiding disorders such as attention-deficit hyperactivity disorder, mental retardation and autism spectrum were also excluded. Patients with chronic constipation were not included in the study. Patients with The Dysfunctional Voiding Symptom Score of ≥9 points were considered as having lower urinary tract symptoms. Patients underwent transabdominal ultrasonography for measurement of the transverse rectal diameter. For all patients, TRD was measured by the same radiologist with seven years of professional experience. The healthy control group consisted of completely healthy children without dysfunctional voiding disorders.

Rectal diameter measurement was obtained as described by Klijn et al.[10] Transabdominal ultrasound (US) examination was performed in supine position, using a convex probe (7.5 MHz). The probe was placed over the anterior abdominal wall approximately 2 cm above the symphysis. For the measurement of the transverse rectal diameter, the probe was angled approximately 15° downward from the transverse plane while the vesica was moderately full (30-70% of age-adjusted capacity) (**Figure 1**). Age-adjusted capacity (mL) was estimated using the ICCS formula: [(age in years +1) ×30] .[3] Rectal diameter measurement was obtained behind the bladder in the axial plane from the outer wall to the outer wall of the rectum. The measurements of rectal diameter were repeated three times for all participants and the average value was included in the statistical analysis. Prior to US examination, all children were questioned about the sensation of defecation and those with urge to defecate were excluded from the study. For avoiding bias, the radiologist was blinded to clinical findings of patients throughout the evaluation.

Figure 1

Measurement of the transverse rectal diameter.



2.1. Statistical analyses

Statistical analyses were performed to assess the transverse rectal diameter in children with or without daytime urinary incontinence. The normal distribution of the results for continuous variables was checked using Kolmogorov-Smirnov test. Based on the results of the normality test, Mann-Whitney U test was used to compare two groups in terms of age, and other continuous variables were examined using the independent samples t-test. Intra-rater agreement for the measurements was investigated using Pearson's correlation analysis. Statistical analyses were carried out using SPSS version 23.0, and the accepted level of statistical significance was determined to be $p<0.05$.

3. Results

A total of 77 children were included in the study. The daytime urinary incontinence group included 39 children (19 boys, 20 girls), while the control group included 38 (16 boys, 22 girls) healthy children. The median age was 9 (5-13) in the patient group and 9 (5-14) years in the control group. In our study, 51.3% of the patients were female and 48.7% were male, and 42.1% of the control subjects were female and 57.9% were male. Demographic characteristics and US measurements of the participants are shown in **Table 1**. Frequencies and characteristics of lower urinary tract symptoms in patients are shown in Table 2. The most common complaints in children with voiding dysfunction were urgency 69.2%), enuresis (51.2%), squatting (38.4%) and urinary inkonti-

Table 1

The characteristics and measurements of TRD in groups.

	Patients (n=39)	Controls (n=38)	p
Age*, years	9 (5-13)	9 (5-14)	0.423
Body weight*, kg	24 (15-70)	24 (15-69)	0.397
BMI*, kg/m2	16 (12.8-28.8)	15.8 (12.8 – 23.1)	0.931
Sex, n (%)			
Female (Girls)	20 (51.3%)	16 (42.1%)	0.563
Male (Boys)	19 (48.7%)	22 (57.9%)	
TRD#, degrees, mm	26.88 ± 7.63	28.48 ± 8.51	0.387

#mean ± SD, *median (min-max)
BMI: Body mass index, TRD: Transverse rectal diameter, kg: kilogram.

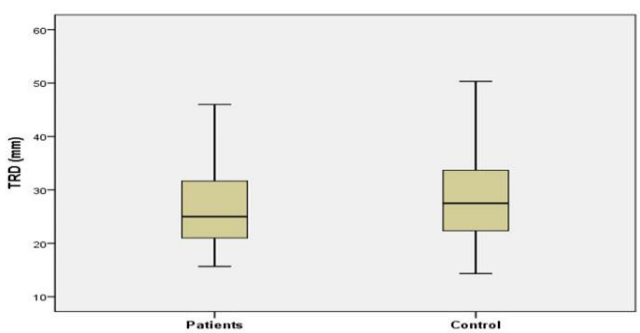
Table 2

Frequencies and characteristics of lower urinary tract symptoms in patients.

	n	%
Voiding Dysfunction	39	
Urgency	27	69.2
Enuresis	20	51.2
Squatting	15	38.4
Urinary incontinance	12	30.7
Staccato urination	11	28.2
>7 Urination in a day	10	25.6
Discontinuous urination	9	23
Painful voiding	8	20.5
Hesitancy	5	12.8

Figure 2

Transverse rectal diameter in patient and control groups



nance (30.7%).

There was no statistically significant difference between the groups in terms of sex, age, body weight and body mass index (BMI). There was no statistically significant difference between the patient group with daytime urinary incontinence and healthy control group in terms of transverse rectal diameter measurements (p=0.387, t=0.870) **(Figure 2)**. Transverse rectal measurements revealed a mean [standart deviation (SD)] TRD of 28.48 ± 7.27 mm in boys and a mean (SD) TRD of 26.75 ± 8.90 mm in girls. An analysis was performed to examine the effect of sex on TRD measurements irrespective of the presence of urinary incontinence, which showed no significant difference between sexes (p=0.351, t=0.938).

The intra-rater agreement for TRD measurements was very strong (p<0.001, r=0.957).

4. Discussion

With this study, we want to determine whether the transverse rectal diameter measured by transabdominal ultrasound has any effect on the physiology of daytime urinary incontinence. We evaluated the TRD of children with day time incontinence with or without FC were compared with healthy controls to evaluate the association between bladder and bowel dysfunction. Dogan et al. suggest to measure rectal diameter by ultrasonograpy to diagnose FC instead of digital examination of rectum. [11] Klijn et al.[10] compared the diameter of the rectum by using ultrasonography in a group having dysfunctional voiding and FC with a control group of without FC. They found the diameter of the rectum was significantly larger than in patient group than the control group. In our study we didn't evaluated FC in groups, but we want to evaluate the effect of transverse rectal diameter on day time urinary incontinence. Patients with voiding disorders and daytime urinary incontinence tend to develop a habit of voiding postponement and contracting the pelvic floor muscles intentionally, which cause a predisposition to urgency, urine leaking and urinary tract infections. Pelvic floor muscle dysfunction is associated with constipation and secondary bladder and bowel dysfunction (BBD). [5,7] While FC and lower urinary symptoms have been studied extensively, the effect of rectal distension on rectal diameter has not been clearly demonstrated.[8] In our study, it was found that transabdominal rectal diameter measurements were not significantly different between the patients with daytime urinary incontinence and healthy controls. In line with our findings, Abreu et al. [7] did not find an association of increased rectal diameter with urgency, daytime urinary frequency, daytime urinary incontinence, nocturia, enuresis and lower urinary tract symptoms, constipation and BBD. This suggests that other factors such as cross-organ interaction between rectum and vesica as well as supraspinal mechanisms may also be involved in voiding dysfunction and daytime urinary incontinence.

In this study, we observed no significant difference when we compared the patients with daytime urinary incontinence with healthy controls in terms of rectal diameter. These findings may indicate that voiding disorders are not affected solely by FC and increased rectal diameter. This may suggests that voiding disorders have a multifactorial etiology which involves central, spinal and sympathetic-parasympathetic neural mechanisms affecting detrusor and sphincter functions, bladder filling and emptying phases and the physiology of urination. Also voiding habits, fluid

intakes and diets have an effect on voiding disorders.
Because of the limited number of studies investigating the association of rectal diameter with urinary incontinence in children, we believe that the data from our study will contribute to the literature.

5. Conclusion

In conclusion, no significant relationship was found between urinary incontinence and rectal diameter in patients with daytime urinary continence in this study. The physiology of urination is complex, involving a multitude of central, spinal and sympathetic-parasympathetic neural mechanisms affecting detrusor and sphincter functions. Therefore, patients should be evaluated in detail for medical history, physical examination and clinical findings. Further evaluation with uroflowmetry and urodynamics should be performed when necessary.

5.1. Limitations

To asses FC for patients and controls with Rome IV criteria and stool diaries are more favorable. Another limitation is small sample size. This is a single centre study. Multicenter, randomized controlled studies in large patient series are necessary to explain the relationship between voiding disorders and rectal diameter as well as FC.

Statement of ethics

This study was approved by the Ethics Committee of the Adıyaman University (Decision no: 2022/7-33, Date: 25.10.2022). The principles of patient privacy and confidentiality were observed, and data were collected in accordance with the Declaration of Helsinki.

Author Contributions

Concept: GI, CO, SY, Design: GI, CO, SY, Literature search: GI, Data Collection and Processing: GI, CO, SY, Analysis or Interpretation: GI, CO, Writing: GI,

Source of Finance

The authors declare that they have received no financial support for this study

Conflict of interest statement

The authors declare that they have no conflict of interest.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

References

1.von Gontard A, Baeyens D, Van Hoecke E, Warzak WJ, Bachmann C. Psychological and psychiatric issues in urinary and fecal incontinence. J Urol. 2011;185(4):1432-6.
https://doi.org/10.1016/j.juro.2010.11.051
2.Jansson UB, Hanson M, Sillén U, Hellström AL. Voiding pattern and acquisition of bladder control from birth to age 6 years a longitudinal study. J Urol. 2005;174(1):289-93.
https://doi.org/10.1097/01.ju.0000161216.45653.e3
3.Austin PF, Bauer SB, Bower W, et al. The standardization of terminology of lower urinary tract function in children and adolescents: Update report from the standardization committee of the International Children's Continence Society. NeurourolUrodyn.2016;35(4):471-81.
https://doi.org/10.1002/nau.22751
4.Chase J, Bower W, Gibb S, Schaeffer A, von Gontard A. Diagnostic scores, questionnaires, quality of life, and outcome measures in pediatric continence: A review of available tools from the International Children's Continence Society. J Pediatr Urol. 2018;14(2):98-107.
https://doi.org/10.1016/j.jpurol.2017.12.003
5.de Abreu GE, de Souza LA, Dourado ER, Schimitz AP, Veiga ML, Barroso U Jr. Role of transverse diameter of the rectum in lower urinary tract symptoms and functional constipation in children and adolescents. J Paediatr Child Health. 2021;57(1):121-5.
https://doi.org/10.1111/jpc.15155
6.Van den Berg MM, Benninga MA, Di Lorenzo C. Epidemiology of childhood constipation: a systematic review. Am J Gastroenterol 2006;101:2401-9.
https://doi.org/10.1111/j.1572-0241.2006.00771.x
7.Halachmi S, Farhat WA. The impact of constipation on the urinary tract system. Int J Adolesc Med Health. 2008;20(1):17-22.
https://doi.org/10.1515/IJAMH.2008.20.1.17
8.Robson WL, Leung AK. An approach to daytime wetting in children. Adv Pediatr. 2006;53:323-365.
https://doi.org/10.1016/j.yapd.2006.04.016
9.Akbal C, Genc Y, Burgu B, Ozden E, Tekgul S. Dysfunctional voiding and incontinence scoring system: quantitative evaluation of incontinence symptoms in pediatric population. J Urol. 2005;17(3):969-73.
https://doi.org/10.1097/01.ju.0000152183.91888.f6
10.Klijn AJ, Asselman M, Vijverberg MA, Dik P, de Jong TP. The diameter of the rectum on ultrasonography as a diagnostic tool for constipation in children with dysfunctional voiding. J Urol. 2004;172(5 Pt 1):1986-8.
https://doi.org/10.1097/01.ju.0000142686.09532.46
11.Doğan G, Keçeli M, Yavuz S, Topçu A, Kasırga E. Measurement of Rectal Diameter and Anterior Wall Thickness by Ultrasonography in Children with Chronic Constipation. Turk J Gastroenterol. 2022; ;33(12):1062-8.
https://doi.org/10.21203/rs.3.rs-719215/v1