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ORIGINAL PAPER

Differences in bladder neck angles between female patients with overactive bladders and healthy peers

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Summary *Aim: The aim of this study was to compare the differences between angles of bladder neck in girls with overactive bladder and those in healthy ones using transabdominal ultrasonography.*
Materials and Methods: This study consists of 28 girls complicated with overactive bladder (Group I) and 40 healthy girls (Group II). The anteroposterior vesical wall angle (APVA), urethroposterior vesical wall angle (UPVA), urethroanterior vesical wall angle (UAVA), thickness of bladder mucosa, distance of urethral orifices, and distance between ureter and urethra orifice were measured in supine position using transabdominal ultrasonography. The results were compared between the two groups.
Results: UAVA in Group I was higher than Group II (135.2 ± 12.2 mm vs. 117.4 ± 14.0 mm; p = 0.009). UPVA was smaller in Group I than Group II (114.6 ± 19.5 mm vs. 135.3 ± 16.5 mm; p = 0.014). The distance between the ureteral orifices was 31.8 ± 8.5 mm in Group I and 17.0 ± 4.1 mm in Group II (p < 0.001). There was no statistically significant difference between groups in terms of APVA, bladder mucosa thickness, and distance between ureter and urethra orifice (p > 0.05).
Conclusion: Bladder neck dynamics may play an important role in overactive bladder pathophysiology due to differences in UPVA, UAV, and location of ureteral orifices in this patient population.

KEY WORDS: *Overactive bladder; Ultrasonography; Bladder.*

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INTRODUCTION

Overactive bladder (OAB) is a dysmotility disorder characterized by various symptoms, including a sudden urge to urinate, urinary incontinence, and frequent urinary tract infections. It is associated with the overstimulation of the detrusor muscle during the bladder's filling phase. In some cases, individuals, especially women, may contract pelvic floor muscles voluntarily by squatting and applying pressure to the urethra with their heels to prevent urinary incontinence (1). While factors such as age, chronic neurological diseases, diabetes, and spinal injuries can contribute to OAB in adults, the etiology of this disorder in women is not fully understood. Diagnosing OAB in women involves a comprehensive approach, including lower urinary tract *ultrasonography* (US), urodynamic examination, and a detailed patient history (2).
Transabdominal *ultrasound* (US) as a preferred non-invasive radiological imaging method for evaluating the urinary system. Transabdominal ultrasound (US) as a preferred non-invasive radiological imaging method for evaluating the urinary system. Limitations of transabdominal US in providing detailed information about bladder dynamics are acknowledged, especially concerning the morphology of bladder neck, which can vary based on factors such as body position and urine volume. Recent studies on ultrasonographic examination of bladder neck dynamics in women highlight the importance of understanding these dynamics (3, 4). The specific aspects evaluated in these studies, such as mucosal thickness, morphology of trigonum and bladder floor, and anteroposterior angle of the bladder wall, demonstrate the complexity of assessing bladder function (3-6). This suggests a focus on understanding how the bladder neck behaves in patients with OAB compared to those without this condition

METHODS

Before study initiation, approval was obtained from the ethics committee of *Tepecik Education and Research Hospital* (Approval number: 2023/08-31), and consent forms from the patients who agreed to participate in the study were obtained. The study was conducted in accordance with the principles of the Declaration of Helsinki.
Patients with kidney disease, stone disease, a history of urinary system interventions, active urinary tract infections, a history of multiple drug use, and anomalies detected in urinary system by ultrasound were excluded from the study.
This prospective study was conducted between October 2023 and December 2023. Among the patients who visited our clinic due to urinary symptoms between the mentioned dates, 29 female patients diagnosed with *Overactive Bladder* (OAB) were planned to be included in the study group (Group I). Additionally, 30 female patients who did not exhibit urinary symptoms were planned to be included in the control group (Group II).

Ultrasonographic examination

The patients were assessed in the supine position, as it provides the most stable bladder conditions during the examination. Following a period for allowing patients to achieve bladder fullness, the examination was conducted by scanning the suprapubic abdominal wall in both sagittal and transverse planes. Initially, the three-dimensional measurement of urine in the bladder was performed, followed by the calculation of bladder volume

Firstly, we assessed bladder volume, bladder wall thickness, the presence of trabeculation, and any additional pathology. Subsequently, we examined the localization of both kidneys, their contours, and the structure of the pelvicalyceal system. Following that, we measured kidney sizes and parenchymal thicknesses. The mucosal thickness of the bladder wall was measured within a distance of up to 2 cm from the bladder neck, while the distance between the bladder smooth muscle layer and the mucosal surface was measured to include the mucosal-submucosal low-echo area. The diameters of both ureteral orifices were then measured at the axial plane. Additionally, we determined whether the ureteral orifices opened to the bladder in the normal position.

The bladder neck was easily visualized as a 'V' depression in the sagittal plane, and the urethrovesical junction was identified. A line parallel to the urethra was drawn throughout the urethra from the level of the urethrovesical junction. The *anteroposterior vesical wall angle* (APVA), *urethroposterior vesical wall angle* (UPVA), and *urethroanterior vesical wall angle* (UAVA) were measured. The APVA of the bladder neck was calculated by measuring the angle between the anterior wall (anterior base plate) and the posterior wall in the sagittal plane. The UPVA between the urethra and the posterior vesical wall and the UAVA between the urethra and anterior wall were then measured. Subsequently, the distance between the ureteral orifices and between the ureteral and urethral orifices was measured on the axial plane. Measurement is shown in Figure 1.

Statistical analysis

All data were analyzed using PASW version 18.0 (*SPSS Inc., Chicago, IL, USA*). Descriptive data were expressed as mean ± SD. Differences between the two groups were assessed using the Mann-Whitney U test for categorized variables and Student's t-test for continuous variables. A p-value of < 0.05 was considered statistically significant.

Results

The age range of the patients was 25 to 49 years, with no difference in age and weight observed between the two groups (Table 1). UAVA was higher in Group I than in Group II (138.4° ± 11.2° vs. 115.2° ± 13.4°, respectively; p = 0.008), whereas UPVA was lower in Group I than in Group II (118.1° ± 18.5° *vs.* 138.2° ± 17.7°, respectively; p = 0.012). The mean distance between the ureteral orifices was 41.7 ± 7.5 mm in Group I and 25.0 ± 3.2 mm in Group II (p = 0.000). No significant difference in the results of other measurements for the lower urinary system was observed between the two groups (p > 0.05; Table 1).

Figure 1.
Measurement of anteroposterior vesical wall angle (APVA), urethroposterior vesical wall angle (UPVA), and urethroanterior vesical wall angle (UAVA).

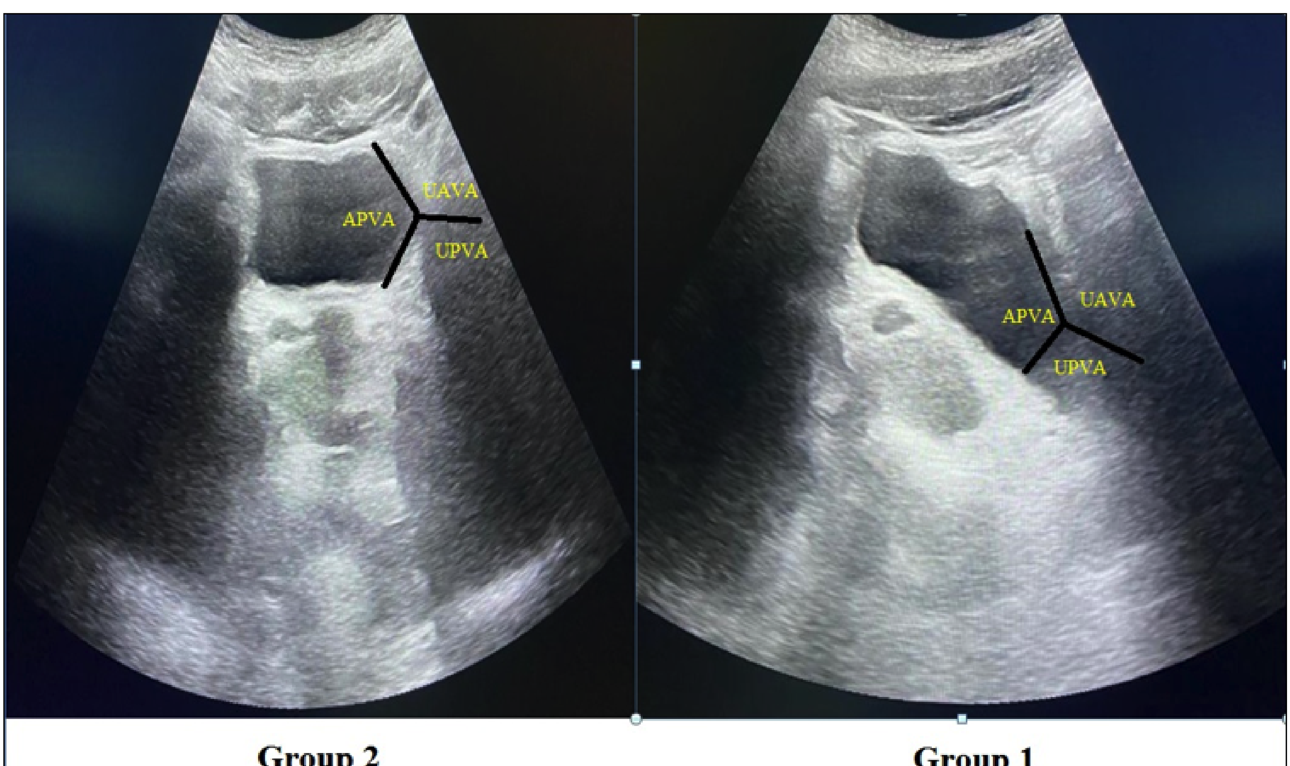

Table 1.
Comparison of demographic and study results between both groups.

Parameter	Study group 1 (n = 29)	Control group 2 (n = 30)	P
Age (year)	37.4 ± 2.5	38.1 ± 1.9	0.401
Weight (kg)	66.0 ± 9.2	68.2 ± 10.1	0.509
Anterior-posterior vesical angle	126.5 ± 15.7	113.4 ± 15.4	0.079
Urethro-anterior vesical angle	138.4 ± 11.2	115.2 ± 13.4	0.008
Urethro-posterior vesical angle	118.1 ± 18.5	138.2 ± 17.7	0.012
Bladder volume (mm^3)	59.2 ± 24.1	61.5 ± 41.3	0.845
Mucosa thickness in bladder neck (mm)	1.9 ± 0.7	1.6 ± 0.6	0.327
Length of urethra (mm)	43.9 ± 8.7	39.1 ± 8.7	0.656
Ureteral–urethral orifice distance (mm)	29.2 ± 8.7	28.9 ± 7.9	0.994
Distance between the ureteral orifices (mm)	41.7 ± 7.5	25.0 ± 3.2	0.000

Data were expressed in mean ± SD (standard deviation).

Discussion

The current study revealed that patients with *Overactive Bladder* (OAB) exhibited decreased UPVA values, increased UAVA values, and an increased distance between orifices. A prior study, albeit with a limited number of adult patients, identified bladder neck changes associated with post-hormonal alterations in bladder neck fibroblast activity (5).

Considering that our participants were female patients in the hormonally active period, we support the validity of this hypothesis for the OAB patient group in our study. We propose that the variances in UPVA and UAVA of the bladder neck among OAB patients may be linked to changes in the bladder wall attributed to excessive detrusor activity. *Sugaya et al.*, who determined *Anteroposterior Vesical Wall Angle* (APVA) values in healthy individuals aged 0-29 years (6), found that children under 10 years old had lower APVA values. Those over 10 years old, however, exhibited values similar to adults that were associated with hormonal changes. However, at present, no study has comprehensively investigated bladder neck angles during adulthood.

Lower urinary tract disorders are prevalent in childhood, with anatomical issues, neurological impairments, and behavioral disorders in toilet training identified as etiological factors (7). Additionally, *Goessaert et al.* demonstrated that children experiencing daytime urinary incontinence had a twofold increased risk of sudden feelings of urination and urinary incontinence in adulthood. Furthermore, *Song et al.* (8) found that individuals with complaints of constipation and urinary incontinence in adulthood had similar issues during childhood. These studies suggest a potential pathological link between childhood and adult disorders. If symptoms persist from childhood to adulthood, as suggested by the aforementioned studies, it becomes crucial to understand the pathophysiology of the disease during childhood and implement appropriate treatment, prioritizing the lifelong well-being of the patient

The strength of our study lies in being the first to explore bladder neck angles in women, confirming that women diagnosed with OAB exhibit alterations in bladder neck angles. However, a notable limitation of the current study is the relatively small number of cases and our exclusive focus on women.

Conclusions

Despite the link between OAB in childhood and similar urinary symptoms in adulthood, the pathophysiology of this relationship has not been fully elucidated. We posit that a more detailed investigation of the bladder neck and its dynamics could yield significant insights not only for the diagnosis and treatment of the disorder during childhood but also for addressing similar symptoms in adulthood. Our findings, indicating changes in bladder neck angles among women diagnosed with OAB, suggest a potential role of these changes in the pathophysiology of OAB in girls. Additionally, the measurement of bladder neck angles could serve as a diagnostic tool for OAB. Therefore, further large-scale studies are needed to uncover different approaches for the treatment of this disease.

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