ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/urology.2025-111420

The Long-Term Impact of Childhood Nocturnal Enuresis on Overactive Bladder in Adulthood: A Cross-Sectional Study

Çocukluk Çağı Gece İdrar Kaçırma Bozukluğunun Erişkinlikte Aşırı Aktif Mesane Üzerine Uzun Dönem Etkisi: Kesitsel Çalışma

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ABSTRACT Objective: Nocturnal enuresis (NE) and overactive bladder (OAB) are common conditions worldwide. NE primarily affects children, while OAB is more prevalent in adulthood; both share pathophysiological mechanisms. This study aimed to assess the impact of childhood NE on adult OAB to enhance diagnosis and treatment. **Material and Methods:** A total of 434 adults aged ≥18 years who visited a urology clinic between January 2023 and June 2024 were included. The OAB-validated 8 (OAB-V8) questionnaire assessed OAB symptoms. Participants were grouped into those with OAB symptoms (n=159) and those without (n=275). The relationship between childhood NE and OAB symptoms was analyzed. **Results:** NE history was reported by 32.5% of participants, and 36.6% exhibited OAB symptoms. Participants with childhood NE had significantly higher OAB-V8 scores (p=0.018), with moderate to severe symptoms being more prevalent (p<0.001). Among those with NE persisting beyond age 10, higher urgency (p=0.008), nocturia (p=0.008), and total OAB-V8 scores (p=0.018) were observed. Multivariate analysis identified NE as an independent risk factor for OAB (odds ratio: 2.087, p=0.003). **Conclusion:** Childhood NE significantly influences adult OAB development, indicating it is not merely a transient childhood issue but may have lasting bladder health impacts. Early recognition and management of NE could help prevent future bladder dysfunction.

Keywords: Bedwetting; overactive bladder; neurogenic bladder; nighttime urinary incontinence; nocturnal enuresis

ÖZET Amaç: Noktürnal enürezis (NE) ve aşırı aktif mesane [overactive bladder (OAB)], dünya genelinde yaygın olarak görülen durumlardır. NE genellikle çocuklukta ortaya çıkarken, OAB daha çok erişkin yaş grubunu etkiler; ancak her iki durum da benzer patofizyolojik mekanizmaları paylaşır. Bu çalışmanın amacı, çocukluk çağı NE'sinin erişkinlikte OAB gelişimi üzerindeki etkisini değerlendirmek ve tanı ile tedavi süreçlerine katkı sağlamaktır. **Gereç ve Yöntemler:** Ocak 2023-Haziran 2024 tarihleri arasında bir üroloji polikliniğine başvuran, yaşları ≥18 olan toplam 434 erişkin çalışmaya dâhil edildi. OAB semptomlarını değerlendirmek amacıyla OAB-doğrulanmış 8 (OAB-V8) anketi kullanıldı. Katılımcılar, OAB semptomu olanlar (n=159) ve olmayanlar (n=275) olarak 2 gruba ayrıldı. Çocukluk çağı NE öyküsü ile erişkinlikte OAB semptomları arasındaki ilişki analiz edildi. **Bulgular:** Katılımcıların %32,5'i çocuklukta NE öyküsüne sahipti ve %36,6'sında OAB semptomları gözlendi. Çocukluk NE öyküsü olan bireylerde OAB-V8 skorları anlamlı olarak daha yüksekti (p=0,018) ve orta-şiddetli semptom görülme oranı daha fazlaydı (p<0,001). NE öyküsü 10 yaşından sonrasına uzanan bireylerde ise aciliyet hissi (p=0,008), noktüri (p=0,008) ve toplam OAB-V8 skorları (p=0,018) anlamlı olarak daha yüksekti. Çok değişkenli analizde, NE erişkinlikte OAB için bağımsız bir risk faktörü olarak belirlendi (odds oranı: 2,087, p=0,003). **Sonuç:** Çocukluk çağı NE'si, erişkinlikte OAB gelişimini anlamlı düzeyde etkilemektedir. Bu durum yalnızca geçici bir çocukluk problemi değil, uzun vadede mesane sağlığı üzerinde kalıcı etkileri olabilecek bir durumdur. NE'nin erken tanı ve tedavisi, ileride gelişebilecek mesane fonksiyon bozukluklarının önlenmesine katkı sağlayabilir.

Anahtar Kelimeler: Altını ıslatma; aşırı aktif mesane; nörojen mesane; gece idrar kaçırma; noktürnal enürezis

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Peer review under responsibility of Journal of Reconstructive Urology.

Received: 21 Apr 2025 ***Accepted:*** 28 May 2025 ***Available online:*** 08 Jul 2025

Nocturnal enuresis (NE) is a prevalent condition affecting both children and adults, characterized by involuntary urination during sleep.[1] The pathophysiology of NE remains incompletely understood, though it is recognized as multifactorial. Three main theories explain its pathogenesis: delayed central nervous system development causing bladder-brain discoordination, nocturnal overactive bladder (OAB) due to low functional bladder capacity, and reduced nocturnal antidiuretic hormone levels.[2]

In addition to these 3 main theories, factors such as increased nighttime urine production and detrusor overactivity have also been linked to NE. For instance, it has been demonstrated that patients with NE produce more urine at night compared to those without this condition.[2] Another contributing factor is detrusor overactivity, characterized by involuntary contractions of the bladder muscle during the filling phase. Detrusor overactivity may lead to increased bladder pressure and decreased bladder capacity, thereby contributing to the development of NE.[3]

OAB syndrome is a common condition affecting millions worldwide.[4] It is a multifactorial disorder marked by urinary urgency, frequency, and nocturia, without infection or other identifiable pathology. Though the pathophysiology remains unclear, it is linked to two primary mechanisms: increased sensory (afferent) activity and abnormal signal processing.[5] Increased afferent activity may result from urothelial receptor or neurotransmitter abnormalities (urothelium-based hypothesis) or myocyte excitability (myogenic hypothesis). Abnormal afferent signal processing is also implicated.[6]

Although NE and OAB are distinct conditions, they share certain common features in their pathophysiology. This study aimed to investigate the effects of childhood NE on the development and progression of OAB in adulthood, contributing to understanding the relationship between the 2 conditions and improving the diagnosis and treatment of affected patients.

MATERIAL AND METHODS

This study adhered to the Declaration of Helsinki and the country's ethical standards, with approval obtained from our Institutional Research Ethics Committee (date: November 15, 2024, no: 35).

Among a total of 434 volunteers who presented to the urology outpatient clinic between January 2023 and June 2024, those aged ≥18 years who consented to participate and exhibited symptoms of OAB (n=159) completed the OAB-validated 8 (OAB-V8) questionnaire and answered questions regarding NE. The control group consisted of an equal number of volunteers (n=275) without complaints of OAB, who also completed the OAB-V8 questionnaire and answered questions about NE.

The OAB-V8 questionnaire is a valid and reliable instrument consisting of 8 questions used to assess symptoms of OAB.[7] These questions evaluate various aspects of OAB symptoms. Frequent daytime urination (OAB-V8 1) assesses how often individuals urinate more frequently than normal during the day. Urgent urination discomfort (OAB-V8 2) measures the level of discomfort caused by a sudden and urgent need to urinate. Sudden, unexpected urge to urinate (OAB-V8 3) examines the frequency of experiencing a strong, uncontrollable need to urinate. Accidental leakage of small amounts of urine (OAB-V8 4) addresses the occurrence of unintentional urine leakage. Nighttime urination (OAB-V8 5) evaluates how often individuals wake up to urinate at night. Waking up due to an urge to urinate at night (OAB-V8 6) focuses on the interruption of sleep caused by urinary urgency. Uncontrollable urge to urinate (OAB-V8 7) assesses the inability to suppress the urge to urinate. Finally, urinary incontinence associated with urgency (OAB-V8 8) evaluates the frequency of urine leakage linked to a strong urge to urinate. It is designed to determine the frequency and severity of symptoms experienced by patients over the past 4 weeks and is commonly preferred in clinical practice.

Data were analyzed using IBM SPSS, with tests including Kolmogorov-Smirnov for normality, Mann-Whitney U for non-normally distributed data, and Pearson's chi-square with Yates' correction for categorical comparisons. Relationships and factors affecting OAB symptoms were assessed using Spearman's rho and logistic regression, with results re-

ported as mean±SD or frequency (percentage), and p<0.05 considered significant.

RESULTS

Table 1 provides general descriptive statistics for demographic and clinical characteristics. The average duration of OAB symptoms was 6.75 years, and complaints of NE persisted until an average age of 9.99 years during childhood. Childhood NE was present in 32.5% of the patients, while 36.6% reported OAB symptoms.

The mean OAB-V8 score of the patients was 17. When examining the OAB-V8 levels among participants, it was observed that a majority (32.3%) experienced moderate symptoms (Table 1).

A statistically significant difference was found in the ages of patients based on OAB complaint status (p=0.028), with patients reporting OAB complaints having a higher median age. There was a statistically significant difference in the distribution of NE status among patients based on OAB complaint status (p=0.011). The rate of patients with NE among those with OAB complaints is higher at 40.3%, while this rate is 28% among patients without OAB complaints.

A statistically significant difference was found in the scores patients received from OAB-V8 questions based on OAB complaint status (p≤0.001). The total OAB-V8 score of patients with OAB complaints was higher than those without OAB complaints. There was a significant correlation between OAB complaint status and OAB-V8 levels of the participants (p<0.001).

Table 2 presents the relationship between NE complaint duration and the individual scores of the 8 OAB-V8 questions. The average age for puberty was 10 years, and subjects with NE complaints up to 10 years of age were compared with subjects with NE complaints who were more than 10 years of age. OAB-V8 2, OAB-V8 3, and OAB-V8 5 values were significantly higher in patients with NE lasting more than 10 years (p=0.042, p=0.008, and p=0.008). The total OAB-V8 score was significantly higher in patients with NE lasting more than 10 years than in patients with NE complaints for up to 10 years (p=0.018). A significant difference was found in OAB-V8 levels according to the duration of NE complaints (p=0.017), and this difference was observed among the proportions of patients with no or very mild, mild, and moderate symptoms. The box plots for each OAB-V8 question based on NE duration (up to 10 years and over 10 years) are presented in Figure 1. Among patients with no symptoms or mild symptoms, the proportion of those with NE complaints lasting more than 10 years was 10.9%, while the proportion of those with complaints lasting less than 10 years was 24.7%. Among patients with mild symptoms, the proportion of those with NE lasting more than 10 years was 7.3%, while those with NE lasting less than 10 years was 20%. Among patients with moderate symptoms, the proportion of those with NE lasting more than 10 years was 50.9%, while those with NE lasting less than 10 years was 32.9% (Table 2).

Box plot of total OAB-validated 8 (OAB-V8) scores based on NE duration up to 10 years and more

TABLE 1: General descriptive statistics for the demographic and clinical characteristics of the patients

	n=434	
Age	36.29±11.02	35 (16-72)
Body mass index	25.67±4.63	25.56 (15.57-52.86)
Gender		
Female	199 (45.9)	
Male	235 (54.1)	
Duration of OAB complaint (Year)	6.75±7.45	3 (1-35)
Until what age did enuresis last? (n=140)	9.99±3.9	10 (3-33)
Duration of enuresis (Years, n=137)	5.15±3.8	5 (0-28)
OAB complaint (n=170)		
No	275 (63.4)	
Yes	159 (36.6)	
Enuresis		
No	293 (67.5)	
Yes	141 (32.5)	
OAB-V8 score		
No or very mild symptoms (0-8)	112 (25.8)	
Mild symptoms (9-16)	74 (17.1)	
Moderate symptoms (17-24)	140 (32.3)	
Severe symptoms (25-32)	81 (18.7)	
Very severe symptoms (33-40)	27 (6.2)	
Total OAB-V8 score	17±10.32	18 (0-40)

Mean±standard deviation; Median (minimum-maximum); n (%);
OAB: Overactive bladder; OAB-V8: Overactive Bladder-validated 8

TABLE 2: Investigation of the relationship between prolonged NE complaint and OAB-validated 8 (OAB-V8) score

	Until what age did enuresis last?			
	≤10 years	>10 years	Test statistic	p value
Frequent daytime urination	1 (0-5)	2 (0-4)	-1.154	0.249[m]
Urgent urination discomfort	2 (0-5)	3 (0-5)	-0.032	**0.042**[m]
Sudden, unexpected urge to urinate	2 (0-5)	3 (0-5)	-2.632	**0.008**[m]
Accidental leakage of small amounts of urine	2 (0-5)	3 (0-5)	-1.952	0.051[m]
Nighttime urination	1 (0-5)	2 (0-5)	-2.658	**0.008**[m]
Waking up due to urge to urinate at night	1 (0-5)	2 (0-5)	-1.790	0.073[m]
Uncontrollable urge to urinate	3 (0-5)	3 (0-5)	-1.620	0.105[m]
Urinary incontinence associated with urgency	2 (0-5)	3 (0-5)	-1.520	0.129[m]
Total OAB-V8 score	18 (0-36)	21 (2-40)	-2.371	**0.018**[m]
OAB-V8 score				
No or very mild symptoms (0-8)	21 (24.7)[a]	6 (10.9)[b]	12.065	**0.017**[y]
Mild symptoms (9-16)	17 (20)[a]	4 (7.3)[b]		
Moderate symptoms (17-24)	28 (32.9)[a]	28 (50.9)[b]		
Severe symptoms (25-32)	12 (14.1)[a]	8 (14.5)[a]		
Very severe symptoms (33-40)	7 (8.2)[a]	9 (16.4)[a]		

[a,b]There is no difference between groups with the same letters (Bonferroni adjusted Z test); [m]Mann-Whitney U test; [y]Yates correction; Median (minimum-maximum); n (%);
OAB: Overactive bladder; OAB-V8: Overactive Bladder-validated 8

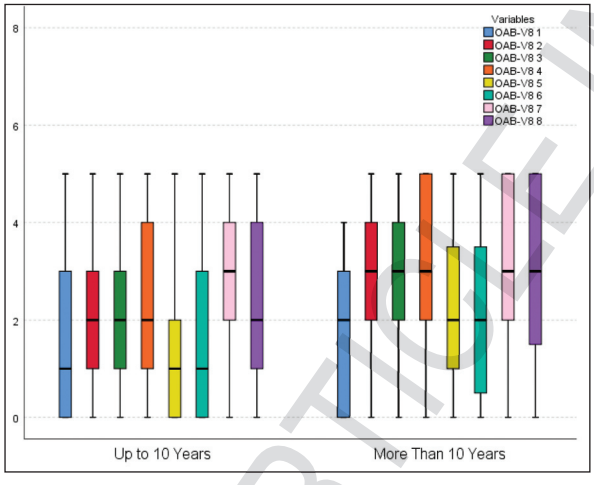

FIGURE 1: Box plot comparison of participant scores for each question in the Overactive Bladder-validated 8 (OAB-V8) questionnaire based on NE duration (≤10 years and >10 years)
OAB: Overactive bladder

than 10 years.

A statistically weak positive correlation was found between the total OAB-V8 score and the duration of NE complaints (years) (r=0.216, p=0.011).

The factors affecting the presence of OAB complaints in patients were examined using univariate and multivariate logistic regression models. The univariate analysis found that age, duration of NE, NE status, and total OAB-V8 score had a statistically significant effect on the presence of OAB. The likelihood of having OAB complaints increased as the patients' age increased (odds ratio [OR]: 1.022, p=0.016). Patients with NE lasting more than 10 years were 2.035 times more likely to have OAB complaints than those with NE lasting less than 10 years (OR: 2.035, p=0.043). The likelihood of having OAB complaints was 1.732 times higher in patients with NE compared to those without (OR: 1.732, p=0.009).

The combined effects of the factors found to be significant in the univariate model were examined in the multivariate model. The duration of NE was not included in the model due to its insignificance. As patients' age increased, the likelihood of having OAB complaints also increased (OR: 1.029, p=0.009). Patients with NE were 2.087 times more likely to have OAB complaints than those without NE (OR: 2.087, p=0.003). Additionally, as the OAB-V8 score increased, the likelihood of having OAB complaints also increased (OR: 1.142, p<0.001).

There was a statistically significant difference in the duration of OAB complaints based on NE status (p=0.001). The median duration of OAB complaints

in patients without NE was 3 years, while it was higher at 6 years in patients with NE. Additionally, there was a statistically significant difference in the duration of NE based on NE status (p=0.040). The median duration of NE in patients without NE was 8 years, whereas it was higher at 10 years in patients with NE.

DISCUSSION

OAB significantly affects patients' quality of life and leads to substantial healthcare expenditures, underscoring its considerable financial burden.[8]

Identifying the causal link between NE and OAB will benefit various medical fields and inform parents about potential adult bladder dysfunctions, enabling early diagnosis, treatment, and cost reduction for OAB.

Goessaert et al. emphasized that in adults with a history of NE during childhood, urinary urgency, daytime frequency, urinary incontinence, and nocturia occurred at rates of 17%, 8%, 25%, and 35%, respectively.[9] In the present study, in parallel with these findings, patients whose NE continued beyond the age of 10 exhibited significantly higher OAB-V8 2, OAB-V8 3 (urgency), OAB-V8 5 (nocturia), and total OAB-V8 values compared to those whose NE resolved before the age of 10 (p=0.042, p=0.008, p=0.008, and p=0.018).

Çakıoğlu et al. examined the relationship between OAB and NE and found that patients with a history of NE in childhood reported OAB complaints at a younger age.[10] Similarly, in the present study, the average age of onset for OAB was found to be 27.73 years in individuals with a history of NE, while it was 33.69 years in those without a history of NE, and this difference was statistically significant (p=0.040).

In the present study, 40.3% of patients diagnosed with OAB had previously suffered from NE, whereas the rate of NE in patients without OAB complaints was found to be 28%, and this finding was statistically significant (p=0.011). Given the average age of 36.29 in our OAB patients, triggering factors may contribute to bladder dysfunction between NE resolution and OAB onset.

These findings reveal a strong relationship between NE and OAB in symptom severity, onset age, and symptom frequency, suggesting NE as a potential predisposing factor or early indicator of OAB in young adulthood.

The study's main limitations are the small sample size and lack of urodynamic studies, though OAB diagnosis followed a standard protocol using clinical, laboratory, and imaging tools.

CONCLUSION

Statistical analysis revealed that a significant proportion of patients diagnosed with OAB had suffered from NE in the past. The persistence of childhood NE into later years was found to be associated with more severe OAB symptoms. The current data suggest a possible pathophysiological causal relationship between the 2 conditions. Given the impact of OAB on patients' quality of life and healthcare economics, the potential causal link between NE and OAB warrants further research.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Buğra Çetin, Mustafa Asım Avcı, Özkan Onuk;* ***Design:*** *Buğra Çetin;* ***Control/Supervision:*** *Cem Tuğrul Gezmiş, Özkan Onuk;* ***Data Collection and/or Processing:*** *Gökhan Yazıcı, Buğra Çetin, Cem Tuğrul Gezmiş;* ***Analysis and/or Interpretation:*** *Mustafa Asım Avcı, Gökhan Yazıcı;* ***Literature Review:*** *Mustafa Asım Avcı, Buğra Çetin;* ***Writing the Article:*** *Buğra Çetin, Mustafa Asım Avcı;* ***Critical Review:*** *Özkan Onuk, Cem Tuğrul Gezmiş;* ***References and Fundings:*** *Buğra Çetin;* ***Materials:*** *Buğra Çetin.*

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