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ARTICLE

Comparison of lumbopelvic stability, low back pain and well-being of women who have overactive bladder syndrome to asymptomatic controls: cut-off points

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ABSTRACT

Aims: Overactive bladder (OAB) syndrome has been associated with core muscles weakness, which is important in aetiology of low back pain (LBP) and affects general well-being. This study aimed to compare the lumbopelvic stability, LBP and well-being of women with OAB to asymptomatic controls and to determine the cut-off points.

Methods: Women with (OAB group, $n = 36$) and without OAB syndrome (control group, $n = 36$) were included. The lumbopelvic stability with the Sahrmann and McGill trunk muscle endurance tests, LBP intensity with the Visual Analogue Scale were assessed. As for general well-being, sleep quality with the Pittsburgh Sleep Quality Index (PSQI), fatigue severity with the Fatigue Severity Index (FSI), anxiety and depression levels with the Hospital Anxiety Depression Scale (HADS-A, HADS-D) were evaluated.

Results: In the OAB group compared to the control group, the lumbopelvic stability scores were lower ($p < 0.001$) while LBP prevalence ($p < 0.001$), pain intensity ($p = 0.020$), and PSQI, FSI, HADS-A, and HADS-D scores ($p < 0.001$) were higher. The cut-off points for trunk extension, flexion, right and left lateral flexion endurance tests and Sahrmann test were $\leq$9.42 sec, $\leq$8.62 sec, $\leq$19.26 sec, $\leq$5.16 sec, and $\leq$2 level, respectively. The cut-off points for PSQI, FSI, HADS-D, HADS-A were $>$5, $>$5.22, $>$6 and $>$6 scores, respectively.

Conclusions: Women with OAB syndrome had lower lumbopelvic stability, higher LBP prevalence and intensity, lower sleep quality, and more fatigue, anxiety, and depression levels compared to asymptomatic women. The cut-off values were detected between the occurrence of OAB and lumbopelvic stability and general well-being parameters.

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KEYWORDS
Low back pain; muscle weakness; overactive bladder

Introduction

Overactive bladder (OAB) syndrome is defined as a sudden feeling of urgency with sometimes increased day and night urination and or urgency incontinence (Abrams et al. 2003). OAB can be sub-classified as dry OAB or wet OAB, based on the presence or absence of urgency incontinence, with an approximate ratio of 2 to 1 (Tubaro 2004; Anger et al. 2012; Chen et al. 2012). Patients with wet OAB have smaller bladder capacity and experience more frequent urgency frequencies (Hsiao et al. 2019). It is a pathological condition seen in approximately 17% of the population (Eapen and Radomski 2016). This is more common in women than in men (Eapen and Radomski 2016). Although OAB does not directly threaten women's life, it should be considered and evaluated because it is a problem that affects their family and social life in a significant way both physically and psychologically, and it affects the quality of life negatively (Lai et al. 2015).

In the development of OAB, excessive contraction of the detrusor, damages in the central and peripheral nervous system, which is important in urinary control, weakening of the pelvic floor muscles, and a sudden decrease in urethral pressure are important (Chancellor and Yoshimura 2004). Low back pain (LBP) has been common in patients with OAB in the clinics. Recently, it has been explained that the weakness of the lumbopelvic muscles especially the transverse abdominus, multifidus, and pelvic floor muscles and their failure to activate them at the appropriate time are important in terms of the aetiology of LBP (Panjabi 1992; Huang et al. 2013). The pelvic floor muscles within the lumbopelvic stability muscles are also responsible for maintaining urine control (Ghaderi et al. 2016). According to Eliasson et al., this dual function of the pelvic floor muscles suggested a relationship between LBP and urinary incontinence (UI) (Eliasson et al. 2008). The pelvic floor muscles were found to be weakened in patients with LBP, similar to OAB patients (Eliasson et al. 2008). As a result, poor lumbopelvic stability can cause LBP and various pelvic floor dysfunctions, such as UI, OAB, and pelvic organ prolapse (POP) (Ghaderi et al. 2016). Moreover, the bladder and pelvic floor are innervated by the lumbosacral nerves. And also, the neurological causes such as radiculopathy related to LBP may affect OAB (Kaptan et al. 2016). Therefore, problems in the lumbopelvic area may be associated with OAB symptoms. However, to our knowledge, no

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study investigating LBP and lumbopelvic stability in OAB exists in literature.

Moreover, many secondary problems such as insomnia, fatigue, and some psychological problems have accompanied this syndrome including (Lai et al. 2016). Several studies have found that sleep disturbance, moderate or severe depression and anxiety are common in women with OAB (Fukunaga et al. 2019 ; Chen and Kuo 2019), and levels of anxiety and depression are mainly associated with urgency incontinence and nocturia (Melotti et al. 2018). In these patients, due to the OAB symptoms may result in reduced fluid consumption, embarrassment, insomnia, limitation of physical activity, and social isolation. These conditions could adversely affect the family, and social and business life of the patients (Lai et al. 2015). However, general well-being in OAB has been briefly addressed in the literature (Lai et al. 2016; Tzeng et al. 2019).

Therefore, this study aimed to compare the lumbopelvic stability, LBP and well-being of women with OAB syndrome to asymptomatic controls and to determine the cut-off points. The following hypotheses were investigated: 1. LBP, lumbopelvic stability, and general well-being would be different in women with OAB compared to those without OAB. 2. There are cut-off values between the occurrence of OAB and lumbopelvic stability and general well-being parameters.

Methods

Study design

A case–control study design was used. It was conducted in accordance with the rules of the Declaration of Helsinki. The study was approved by the Ethics Committee of Ankara Yildirim Beyazit University, Ankara, Turkey (Approval number/date: 2018-15/10.10.2018).

Participants

Those women aged 18–65 years who were admitted to the Department of Urology and diagnosed with OAB syndrome by a specialist physician were included in the OAB group. The physician diagnosed OAB according to anamnesis (Overactive Bladder-Version8 form (OAB-V8) and bladder diary), physical/neurologic examination, post-void residual urine measurement, and urine analysis. In addition, patients with a cut-off value of 11 and above for the total score according to the OAB-V8 scale were diagnosed with OAB (Tarcan et al. 2012). Asymptomatic women who were included in the control group were selected from the asymptomatic healthy women, not being diagnosed with OAB, UI, or pelvic organ prolapse, aged 18–65 years. Exclusion criteria in the OAB and control groups were being pregnant, having a neurological or rheumatological disorder, being diagnosed with acute LBP, having an history of operation in the past year (abdominal, pelvic, spinal operation), having a spinal deformity, being diagnosed with stress and mix UI, having a POP (>grade2), and performing regular exercising or sports for the past 8 weeks. Written informed consent was obtained from all participants.

Outcome measures

The participants' age (years), height (m), body weight (kg), body mass index (BMI), pregnancy, parity, type of birth, menopausal and smoking status, comorbidities and drug use were recorded. Moreover, in women with OAB, OAB symptoms were evaluated with a bladder diary, the OAB-V8, and the Patient Perception of Intensity of Urgency Scale (PPIUS). In addition, lumbopelvic stability, LBP and the general well-being, including sleep quality, fatigue severity, anxiety and depression levels, were evaluated for all the participants.

The Turkish version OAB-V8, whose validity and reliability were established by Tarcan et al. was used to assess the OAB symptom severity (Tarcan et al. 2012). The OAB-V8 including the primary findings of the OAB syndrome, such as frequency of urination during the day and night, sensation of urgency, and incontinence consists of eight items. The total score ranges from '0' to '40', and when the total score increases, the overactive bladder symptoms also increase.

The PPIUS was used to evaluate the urgency severity (Cartwright et al 2011). The scale uses a 5-point Likert-scale design as 0: no urgency, retaining urination for a very long time without fear of voiding, 1: moderate urgency, able to hold urine as long as necessary without fear of voiding, 2: moderate urgency, able to hold urination for a short while without fear of voiding, 3: serious urgency, unable to hold urine, 4: urgency UI, urine leakage occurs before reaching the toilet.

The 3 day bladder diaries were used to evaluate the bladder symptoms of the women with OAB (Schick et al. 2003). The women were asked to systematically record the number of urinations, the amount of urination, the number of UI, the amount of fluid consumed and the type of fluid for 3 days. The mean of the data in these diaries was recorded. Dry or wet OAB was determined according to the urgency incontinence of the women.

Lumbopelvic stability was evaluated dynamically and statically. Static lumbopelvic stability was evaluated with trunk muscle endurance tests developed by McGill (McGill et al. 1999) and the dynamic lumbopelvic stability Sahrmann test (Stanton et al. 2004): These tests include trunk flexion, extension, and right and left lateral flexion endurance tests. In all tests, the time that the tester remained without breaking the test position specified in the instructions was recorded in seconds (s). *Sahrmann Test:* In this test, the inflatable pad of a pressure biofeedback unit (Chattanooga, TN, USA) was placed in the natural lordotic curve of the back and was inflated to 40 mmHg whilst the subject is lying supine. The subject activated the stabilising musculature via the abdominal hollowing technique and then the participants were asked to bring their leg to different positions. If performed correctly, this will result in either no change in pressure or a slight decrease in pressure from the initial 40 mmHg. The test consists of five levels with each level increasing in difficulty.

The presence of LBP was inquired in all the participants. The women with LBP were asked to mark painful body parts with their body diagram. The regions marked for LBP in the body diagram were categorised as low back, posterior pelvic unilateral, posterior pelvic bilateral, and lumbopelvic region, and recorded. The Visual Analog Scale (VAS) (Clark et al. 2003) was used to determine the intensity of LBP. The VAS is a subjective assessment method and consists of a 10 cm horizontal line. The beginning of the line means 'no pain' and the end of the line means 'unbearable pain'. Participants were asked to mark the degree of their LBP on the 10 cm VAS line. The pain intensity was recorded in cm by measuring with the ruler between the beginning of the line and the marked place. In order to detect nerve findings, sacroiliac and mechanic problems in LBP evaluation, some clinic tests were performed, and the test results were recorded as 'positive' or 'negative'. The nerve findings such as radiculopathy or myelopathy originating from lumbosacral region pathologies with straight leg raise test, Lasegue test, femoral nerve stretching test and slump test, and sacroiliac articular problems with Faber Patrick test and posterior pelvic pain provocation test were evaluated. In addition to these tests, McKenzie's clinical active movement tests were applied to women with LBP in the evaluation of mechanically induced LBP.

The Turkish version Pittsburgh Sleep Quality Index (PSQI), whose validity and reliability were established by Agargün et al. (1996) was used regarding the measurement of sleep quality. This scale provides information about the type and severity of sleep disorder and consists of 24 items. Total score is between '0' and '21'. As the scale score increases, sleep quality decreases.

The Fatigue Severity Index (FSI), whose validity and reliability in Turkish were established previously, determines the severity of fatigue with 9 items (Gencay Can and Can 2012). Total score is between '9' and '63'. The higher the total score, the greater the severity of fatigue.

Hospital Anxiety and Depression Scale (HADS) is a Turkish valid and reliable scale designed to measure anxiety and depression levels (Aydemir et al. 1997). This scale has subscales of anxiety (HADS-A) and depression (HADS-D). It contains a total of 14 items. Total score is between "0" and "21". The increase in the total score indicates an increase in the level of anxiety and depression.

Sample size and statistical analysis

Seven women from each group were evaluated for the pilot study. G*Power (Version 3.1.9.2) package program was used for sample size calculation. As a result of the LBP analysis, it was found that, with $d = 0.75$ effect size, $\alpha = 0.05$ type I error, $\beta = 0.05$ type-II error, and for 95% power, at least 64 cases (32 cases for each group) should be included. To avoid data losses, it was decided to increase this number by 20%. As a result, it was calculated that the study should be carried out with a total of 72 volunteers, 36 in each group.

Statistical analysis was performed using IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0, Armonk, NY: IBM Corp.). Statistical significance level was accepted as $p < 0.05$. The suitability of numerical variables for normal distribution was examined graphically and by the Shapiro–Wilk test. According to the variable distribution of the median (interquartile range) and mean ± standard deviation values with the appropriate; while the minimum and maximum values were given, number (*n*) and percentage values were given in categorical variables. In the comparison of numerical variables in the control and OAB groups, two independent samples t-test and Mann–Whitney U-test; in the comparison of categorical variables, an appropriate test from the Pearson, Fisher exact, and Yates corrected Chi-square tests were used.

The lumbopelvic stability and general well-being parameters in predicting the presence of OAB were analysed using the receiver operating characteristic (ROC) analysis, ROC graphics, the determined area under the curve (AUC), and 95% confidence intervals of the area. When a significant cut-off value commonly used for the prevention and diagnosis of various health problems in clinical settings was observed, the sensitivity, specificity, and general accuracy rate were calculated. While evaluating the AUC, a 5% type-I error level was used to accept a statistically significant predictive value of the measurements.

Results

A total of 85 women were evaluated in this study. The study was completed with a total of 72 women in the control and OAB groups. The flow chart of the participants according to inclusion and exclusion criteria was presented in Figure 1. The demographic and clinic characteristics were similar in both groups ($p > 0.05$) (Table 1). Women with OAB did not use medication for their OAB symptoms. Asymptomatic women did not have comorbidities such as diabetes mellitus, hypertension, and metabolic syndrome. Seven women with OAB syndrome had comorbidity (19.4%). Of the womenwith

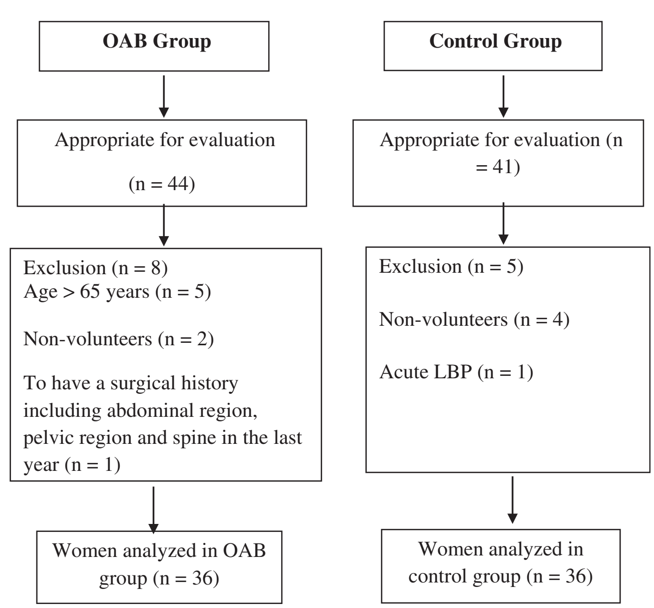

Figure 1. Flow chart of participants.

OAB, four had hypertension (11.1%), two had diabetes mellitus (5.6%), and one had metabolic syndrome (2.8%).

Descriptive information about clinical findings in patients with OAB syndrome is given in Table 2. The mean OAB-V8 of the patients with OAB syndrome was 26.60 ± 7.40 (min: 12; max: 40). The median PPIUS was 3 (IQR: 1; min: 1; max: 4). Thirty-two of the 36 patients with OAB syndrome underwent a bladder diary evaluation. In 32 patients, the rate of dry OAB was 34.3% (*n*: 11), while the wet OAB rate was 65.7% (*n*: 21).

Table 1. Comparison of demographic and clinic characteristics of the groups.

Characteristics	OAB Group (*n* = 36)	Control Group (*n* = 36)	*p* Value
Age (years, X ± SD)	44.7 ± 13.4	39.0 ± 12.4	0.066[a]
BMI (kg/m^2, X ± SD)	28.2 ± 5.5	26.2 ± 4.5	0.091[a]
Parity (*n*, %)			
No	6, 21.4	5, 22.7	0.999[b]
Yes	22, 78.6	17, 77.3	
Type of birth (*n*, %)			
Vaginal	17, 77.3	11, 64.7	0.403[c]
Caesarean	4, 8.2	3, 17.6	
Both of them	1, 4.5	3, 17.6	
Pregnancy Status (median (IQR))			
Number of pregnancies	3 (2)	2 (2)	0.236[d]
Number of births	2 (2)	2 (2)	0.663[d]
Menopausal Status (n, %)			
No	19, 52.8	23, 63.9	0.156[c]
Yes	17, 47.2	13, 36.1	
Menopause Time (years, X ± SD)	10.6 ± 7.4	8.4 ± 4.5	0.470[b]
Smoking (n, %)			
No	27, 75.0	33, 94.3	0.055[c]
Yes	9, 25.0	2, 5.7	

X: mean; SD: standard deviation; IQR: inter quarter range; OAB: Overactive Bladder; BMI: body mass index; [a]Independent two sample t-test; [b]Fisher's exact test; [c]Pearson's chi-square , [d]Chi-square test.

Table 2. Results of OAB symptoms in women in OAB group.

Parameters	*n*	OAB Group
OAB-V8 (X ± SD)	36	26.6 ± 7.4
PPIUS (Median (IQR))	36	3.0 (1.0)
3 days average urination number (X ± SD)	32	10.2 ± 3.6
3 days average night urination number (Median (IQR))	32	1.0 (1.0)
Maximum urine volume at one time (Median (IQR))	32	500.0 (272.5)
Average urine volume (Median (IQR))	32	186.5 (100.9)
Average 3-day incontinence (Median (IQR))	32	1.0 (2.6)
3-day average pad change (Median (IQR))	32	0.7 (2.0)

OAB: Overactive Bladder; X: mean; SD: standard deviation; Min: minimum; Max: maximum; PPIUS: Patient Perception of Intensity of Urgency Scale; IQR: inter quartile range.

Lumbopelvic stability results were examined, the McGill trunk flexion, extension, and right and left lateral flexion endurance test scores (sec) and the Sahrmann test score were lower in the OAB group than in the control group ($p < 0.001$) (Table 3). There were two women (5.60%) with LBP in the control group and 30 women (83.30%) in the OAB group. The prevalence of LBP was higher in the OAB group than in the control group ($p < 0.001$). The LBP score of the control group was 2.85 (0.00) cm, while the LBP score of the OAB group was 5.40 (3.70) cm. The severity of LBP was higher in the OAB group than in the control group (*p*: 0.020). In the clinical tests performed in the women with LBP, it was found that the tests related to nerve findings and sacroiliac joint problems were negative while the results of McKenzie clinical active movement tests were positive in both groups. Two of the women in the control group had LBP. One had LBP (50%) and the other had posterior pelvic pain (50%). Thirty of the women in the OAB group had LBP. Twenty-three had low back (76.70%), two had posterior pelvic unilateral (6.70%), four had posterior pelvic bilateral (13.30%), and one had lumbopelvic pain (3.30%).

Comparison results of sleep complaints, and fatigue, anxiety, and depression scores related to general well-being in the control and OAB groups are presented in Table 3. PSQI, FSI, and HADS-D and HADS-A scores were higher in the OAB group than in the control group ($p < 0.001$), (Table 3).

According to Tables 4 and 5, the AUC values in the study ranged from 0.743 to 0.933. All calculated AUC values were statistically significant. While the Sahrmann test had the highest AUC value, the lowest AUC value belonged to the trunk left lateral flexion endurance test. After the Sahrmann test, the second highest AUC value (0.860) belonged to the TEE test, but the sensitivity value of this test was low (61.1%).

Figure 2 has ROC curve plots of lumbopelvic stability variables. The Sahrmann test cut-off point was ≤2, sensitivity was 91.7%, and specificity was 83.3%. After the Sahrmann test, the second highest AUC value (0.860) belonged to the trunk extension endurance test, but the sensitivity value of this test was low (61.1%). Trunk extension cut-off value was ≤9.42. The sensitivity value of the trunk flexion endurance test with a cut-off point of ≤8.62 was 66.7% and the specificity value was 86.1%. Cut-off point for trunk right lateral

Table 3. Comparison of lumbopelvic stability and general well-being scores of groups.0; 69.2

Parameters	Control Group (*n* = 36) Median (IQR)	Control Group (*n* = 36) Min; max	OAB Group (*n* = 36) Median (IQR)	OAB Group (*n* = 36) Min; max	*p* Value
Lumbopelvic stability test					
Trunk flexion endurance test (s)	22.1 (28.7)	0.0; 180	0.0 (14.6)	0.0; 62.2	<0.001[e]*
Trunk extension endurance test (s)	45.3 (40.2)	0.0; 92.2	0.0 (20.8)	0.0; 50.0	<0.001[e]*
Trunk right lateral flexion endurance test (s)	22.0 (19.9)	0; 69.2	11.1 (15.1)	0.0; 58.0	<0.001[e]*
Trunk left lateral flexion endurance test (s)	17.8 (21.4)	3.7; 83.7	9.4 (16.0)	0.0; 37.1	<0.001[e]*
Sahrmann test	3.0 (1.0)	1.0; 5.0	1.0 (1.0)	1.0; 3.0	<0.001[e]*
General well-being					
PSQI	5.0 (3.0)	1.0; 12.0	9.5 (4.0)	2.0; 16.0	<0.001[e]*
FSI	3.3 (2.4)	1.0; 6.3	5.8 (1.4)	2.2; 6.9	<0.001[e]*
HADS-D	4.0 (4.50)	1.0; 13.0	10.0 (5.0)	1.0; 21.0	<0.001[e]*
HADS-A	6.0 (4.0)	1.0; 16.0	10.0 (7.5)	3.0; 18.0	<0.001[e]*

*$p < 0.05$, OAB: Overactive Bladder; Min;max: minimum;maximum; IQR: Inter Quartile Range; PSQI: Pittsburgh Sleep Quality Index; FSI: Fatigue Severity Index; HADS-D: Hospital Anxiety Depression Scale-Depression; HADS-A: Hospital Anxiety Depression Scale-Anxiety; e: Mann–Whitney U-test .

Table 4. Results of ROC curve analyses for lumbopelvic stability scores.

Parameters	AUC	*p* Value	Cut-off point	Sens	Spec	PPV	NPV
Sahrmann test	0.933	<0.001	≤2	91.7	83.3	84.6	90.9
Trunk extension endurance test	0.860	<0.001	≤9.42	61.1	94.4	91.7	70.8
Trunk flexion endurance test	0.786	<0.001	≤8.62	66.7	86.1	82.8	72.1
Trunk right lateral flexion endurance test	0.749	<0.001	≤19.26	86.1	61.1	68.9	81.5
Trunk left lateral flexion endurance test	0.743	<0.001	≤5.16	38.8	97.2	93.3	61.4

AUC: Area under the curve; Sens: Sensitivity; Spec: Specificity; PPV: Positive predictive value; NPV: Negative predictive value.

Table 5. Results of ROC curve analyses for general well-being scores.

Parameters	AUC	*p* Value	Cut-off point	Sens	Spec	PPV	NPV
PSQI	0.824	<0.001	>5	88.8	61.1	69.6	84.6
FSI	0.831	<0.001	>5.22	75.0	83.3	81.8	76.9
HADS-D	0.832	<0.001	>6	83.3	75.0	76.9	81.8
HADS-A	0.777	<0.001	>6	86.1	58.3	67.4	80.8

AUC: Area under the curve; Sens: Sensitivity; Spec: Specificity; PPV: Positive predictive value; NPV: Negative predictive value; PSQI: Pittsburgh Sleep Quality Index; FSI: Fatigue Severity Index; HADS-D: Hospital Anxiety Depression Scale-Depression; HADS-A: Hospital Anxiety Depression Scale-Anxiety.

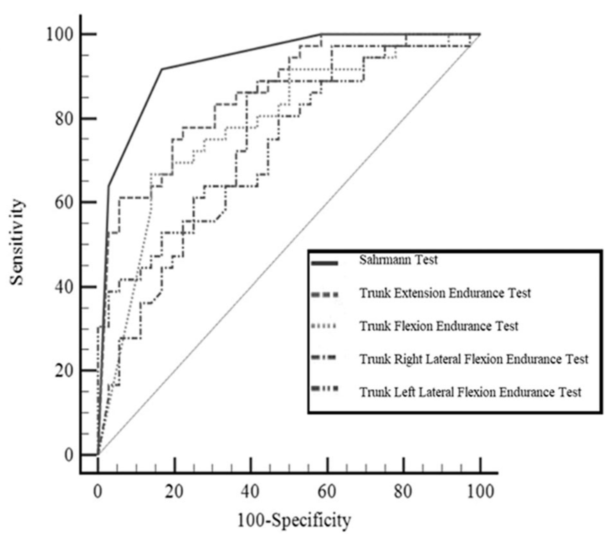

Figure 2. ROC curve graphs of lumbopelvic stability variables.

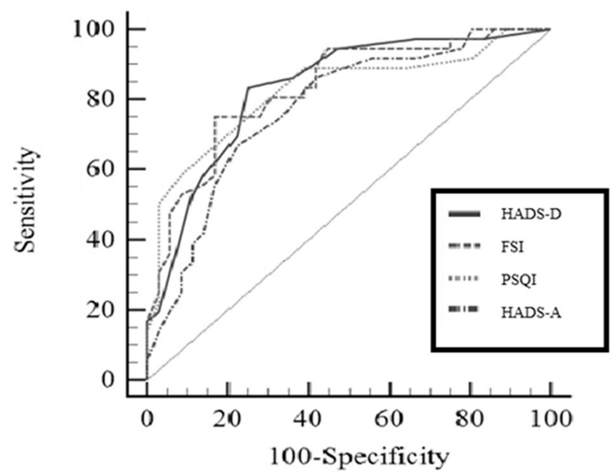

Figure 3. ROC curve graphs of general well-being variables.

flexion endurance test was ≤19.26. The cut off point for the trunk left lateral flexion endurance test was ≤5.16. Sensitivity values were 86.1% for the trunk right lateral flexion endurance test, and 38.8% for the trunk left lateral flexion endurance test. The specificity values were 66.1% for the trunk right lateral flexion endurance test and 97.2% for trunk left lateral flexion endurance test. In addition, ROC curve plots of general well-being variables are presented in Figure 3. According to Figure 3, it is seen that the HADS-D, the FSI, and the PSQI curves overlap. AUC values were 0.832 for the HADS-D, 0.831 for the FSI, 0.824 for the PSQI, and 0.777 for the HADS-A. The HADS-D variable had 83.3% sensitivity and 75.0% specificity at >6 cut-off. The FSI variable had 75.0% sensitivity and 83.3% specificity at >5.22 cut-off. The PSQI variable had 88.8% sensitivity and 61.1% specificity at >5 cut-off. And, the HADS-A had a > 6 cut-off with 86.1% sensitivity and 58.3% specificity.

Discussion

The present study put forward that the prevalence and severity of LBP were higher and lumbopelvic stability and general well-being were lower in women with OAB syndrome than asymptomatic women. The cut-off values were found between the occurrence of OAB and lumbopelvic stability and general well-being parameters.

The prevalence of OAB syndrome increases with ageing (Irwin et al. 2006; Coyne et al. 2008). In a study conducted in Europe, the prevalence of OAB syndrome over the age of 40 was found to be 17% (Irwin et al. 2006). It was observed that this rate increased in women over 64 years of age (Irwin et al. 2006). In our study, the mean age of women with OAB was consistent with the literature. And, since OAB is more common in women, this study was conducted in women with OAB syndrome. In the literature, it has been determined that OAB symptoms may be associated with some comorbidities such as metabolic syndrome, hypertension, and diabetes (Palleschi et al. 2014; Torimoto et al. 2018; Baytaroglu and Sevgili 2021). In this study, it was found that while asymptomatic women did not have comorbidities, some of the women with OAB syndrome had comorbidities.

Pelvic floor muscles, forming the base of lumbopelvic stability, may be affected in OAB syndrome. Gunnarsson et al. found that the strength of the pelvic floor muscles at maximum contraction in women with OAB syndrome was less than that in healthy controls (Gunnarsson and Mattiasson

1994). Artibani's study detected that individuals with pelvic floor muscle weakness had low intra-urethral pressure, which triggered detrusor muscle contractions, which, they explained may have caused an increase in OAB symptoms (Artibani 1997). Furthermore, not all patients with OAB syndrome have detrusor overactivity (Al-Ghazo et al. 2011). However, the perineo-detrusor reflex and pelvic floor muscle function have been very important to reduce detrusor overactivity and OAB symptoms. Impairment of the pelvic floor muscles in OAB may adversely affect lumbopelvic stability. In our study, it was found that the lumbopelvic stability was lower in women with OAB compared to asymptomatic women. These results indicate that the evaluation of lumbopelvic stability may be important in OAB.

The LBP, a common musculoskeletal problem (Senkoylu 2011) has been also seen in patients with lower urinary tract problems (Eliasson et al. 2008; Toprak Celenay and Kaya Ozer 2017). However, there are no studies related to LBP in patients with OAB syndrome, which is one of the common conditions among the lower urinary tract problems. Eliasson et al. (Eliasson et al. 2008) found that 78% of women with LBP had UI and those with LBP had a higher prevalence of UI than those without LBP. Toprak Celenay et al. found that 71.9% of women with stress or mixed incontinence and 12.2% of asymptomatic women had with the LBP (Toprak Celenay and Kaya Ozer 2017). Algudairi et al. put forward that 43% of women with chronic LBP had various pelvic floor problems related to UI and POP (Algudairi et al. 2019). Kaptan et al. found that there was a strong relationship between urge incontinence and lumbar radiculopathy (Kaptan et al. 2016). In the present study, the presence of LBP was 5.6% in asymptomatic women and 83.3% in women with OAB and pain intensity was higher in women with OAB compared to asymptomatic women. Moreover, in our study it was seen that LBP was caused by mechanical reasons according to the results of the clinic tests, and there were no nerve findings (radiculopathy); although, the wet OAB rate (65.7%) accompanied by urge UI was very high. Some studies have asserted that the relationship between LBP and lower urinary tract problems may be due to mechanical, especially pelvic floor muscles weakness, and neurologic problem (Kaptan et al. 2016; Gunnarsson and Mattiasson 1994). In this regard, the synergistic work of the pelvic floor muscles with the abdominal muscles, in which the regulation of intra-abdominal pressure is provided, emphasises the importance of lumbopelvic stability other than providing continence (Eliasson et al. 2008). Therefore, weakness in the pelvic floor muscles may adversely affect both lower urinary tract function and continence mechanism and result in lumbopelvic instability and LBP (Eliasson et al. 2008). It should be considered that both the radiculopathy and mechanical causes are associated with the relationship between OAB and LBP. Moreover, Welk et al. determined that urinary symptoms were associated with pain, especially in the lumbar region (Welk and Baverstock 2020). In the study of Dufour et al., participants with combined low back pain and pelvic girdle pain were found to complain of higher levels of disability and pelvic floor dysfunction (Dufour et al. 2018). In our study, in accordance with the literature, it was determined that the localization of LBP in women with OAB was in the low back region. In clinics, the severity, localization, and type of LBP should be taken into account in treatment approaches of OAB syndrome.

Since humans are a biopsychosocial being, it is important to consider the psychological and social factors besides biological elements in both evaluation and treatment stages. Therefore, it is important to evaluate secondary problems such as sleep, fatigue, anxiety, and depression in addition to bladder symptoms in patients with OAB. Patients with OAB may experience sleep problems, especially due to the need to urinate at night. Ge et al. found that patients with OAB had more sleep disturbance than those without OAB (Ge et al. 2017). In addition, when patients with OAB were evaluated, it was found that as OAB symptoms increased, so did sleep disturbance. In a study, it was found that many women with OAB had sleep disorders but waking up all night could not be attributed to bladder symptoms, and sleep quality was found to be low in women without nocturia (Savoie et al. 2020). In a retrospective study by Tzeng et al. (Tzeng et al. 2019) in which the risk of sleep, anxiety, and depression in women with OAB syndrome was investigated, it was found that patients with OAB had higher risk of sleep disorder, anxiety, depression, and dementia than those without OAB. Lai et al. found that the severity of OAB symptoms increased with increasing fatigue levels in patients with OAB (Lai et al. 2016). In this study, in parallel with the results in the literature, it was found that women with OAB had decreased sleep quality and fatigue severity compared to women without OAB. The need to urinate at night can disrupt patients' sleep cycles; therefore, sleep quality and fatigue should be evaluated in patients with OAB.

As a result of the complaints of OAB, feeling of urgency, frequent need for voiding, and UI complaints may cause embarrassment, inability to reduce physical activity, spend more time at home, social isolation and psychosocial status (Sand and Appell 2006). Felde et al. found a positive relationship between UI and increased symptoms of depression and anxiety (Felde et al. 2017). Siddiqui et al. found that in women with UI, anxiety and depression levels increased (Siddiqui et al. 2018). In the literature, there are studies investigating the levels of anxiety and depression in UI; however, the number of such studies involving OAB is limited. Moreover, UI may not always accompany patients with OAB. Lai et al. and Tzeng et al. found that patients with OAB had higher risk of anxiety and depression than patients without OAB (Lai et al. 2016; Tzeng et al. 2019). Another study of women with OAB found that 121 out of 240 women with OAB had mild depression. In one study, a significant proportion of patients treated for depression had symptoms of OAB (Przydacz et al. 2021). In our study, the anxiety and depression levels were higher in women with OAB syndrome than asymptomatic women. However, in this study, the anxiety and depression levels were not examined according to the types of OAB (dry-wet). In future studies, this issue may be investigated in detail.

The LBP and sleep, fatigue and anxiety, depression problems may occur secondary to OAB (Felde et al. 2017; Ge et al. 2017; Tzeng et al. 2019). In this study, cut-off values were found between the occurrence of OAB and lumbopelvic stability and general well-being parameters. The cut-off points for the trunk extension endurance test, trunk flexion endurance test, trunk right lateral flexion endurance test, trunk left lateral flexion endurance test, and the Sahrmann test were $\leq$9.42 sec, $\leq$8.62 sec, $\leq$19.26 sec, $\leq$5.16 sec, and $\leq$2 level, respectively. The cut-off points for PSQI, FSI, HADS-D, and HADS-A were $>$5, $>$5.22, $>$6, and $>$6, respectively. It may be important to determine the cut-off points related to lumbopelvic stability and general well-being parameters for the prevention and diagnosis of OAB.

This study has some limitations. First, the limitation of this study was that no distinction was made according to the types of OAB. In future studies, it may be examined LBP, lumbopelvic stability, and general well-being in dry and wet OAB. Second, the physical activity level related to the fatigue severity and lumbopelvic or core stability and the sexual functions related to the general well-being were not evaluated in this study. In future studies, these issues in OAB syndrome may be considered.

Conclusions

In conclusion, it was found that women with OAB had lower lumbopelvic stability, higher LBP prevalence and pain intensity, and sleep quality, increased fatigue, anxiety and depression levels compared to asymptomatic women. Cut-off values were determined between the occurrence of OAB and lumbopelvic stability and general well-being parameters. It may be important to consider these results in detailed assessment and holistic treatment approaches in OAB.

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