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Which urinary incontinence inquiry form should be used in women with urinary incontinence?

İdrar kaçırma sorunu olan kadınlarda hangi idrar kaçırma sorgu formu kullanılmalıdır?

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Abstract

Objective: To determine urinary incontinence (UI) inquiry forms to be used in the follow-up of incontinence according to UI type.

Materials and Methods: This prospective cohort study was conducted at the University of Health Science Hospital between 2020 and 2022. A total of 449 patients referred for urodynamic evaluation for UI were included herein, and clinical results regarding UI types were collected and reviewed. The validated urogenital distress inventory 6 (UDI-6), incontinence impact questionnaire (IIQ-7), and incontinence quality of life (I-QOL) questionnaires were completed by all patients. The demographic data of the patients, total questionnaire scores, and urodynamic results were compared between the groups according to UI type.

Results: Forty-nine percent of the participants were in the menopausal period, and 41% required regular ped use. A total of 52.1% of patients experienced 5 years of UI. Stress incontinence was reported in 4.2% of patients, urge incontinence in 10%, stress-predominant mixed UI in 59.2%, and urge-predominant mixed UI in 24.7%. The mean ± standard deviation values were 59.62±20.62 for the UDI-6, 54.72±24.84 for the IIQ-7, 62.41±23.52 for the total I-QOL, 21.85±8.55 for the I-QOL limitation of behaviors subscale, 27.99±10.86 for the I-QOL psychological influence subscale, and 12.64±5.72 for the I-QOL social isolation subscale. A statistically significant difference was assessed between the urodynamics results and the UDI-6, IIQ-7, total I-QOL, I-QOL limitation of behaviors subscale, I-QOL psychological influence subscale, and I-QOL social isolation subscale scores ($p<0.001$ for all variables).

Conclusion: In patients diagnosed with UI, when each of the 3 questionnaires for UI diagnosis was compared, the best inquiry questionnaire for the prediction of mixed-type UI was the UDI-6.

Keywords: Urinary incontinence, urogenital distress inventory 6, incontinence impact questionnaire, incontinence quality of life, urodynamic results

Öz

Amaç: Bu çalışmanın amacı idrar kaçırma tiplerine göre inkontinans takibinde kullanılacak idrar kaçırma sorgulama formlarını belirlemektir.

Gereç ve Yöntemler: Bu, 2020-2022 yılları arasında Sağlık bilimleri Üniversite Hastanesi'nde yürütülen prospektif bir kohort çalışmasıdır. Üriner inkontinans (Üİ) için ürodinamik değerlendirme için sevk edilen toplam 449 hasta çalışmaya dahil edildi ve Üİ tiplerine ilişkin klinik sonuçlar toplandı ve incelendi. Tüm hastalar tarafından geçerliliği kanıtlanmış ürogenital sıkıntı envanteri 6 (UDI-6), inkontinans etki anketi (IIQ-7) ve inkontinans yaşam kalitesi (I-QOL) anketleri dolduruldu. Hastaların demografik verileri, anketlerin toplam puanları ve ürodinamik sonuçları, idrar kaçırma tiplerine göre gruplar arasında karşılaştırıldı.

PRECIS: We compared the Urogenital Distress Inventory 6, Incontinence Impact Questionnaire, and Incontinence Quality of Life questionnaires in women with urinary incontinence.

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Bulgular: Katılımcıların %49,7'si menopoz dönemindeydi ve %41'i düzenli ped kullanımına ihtiyaç duyuyordu. Toplamda %52,1'i 5 yıl idrar kaçırma sorunu yaşamıştır. Hastaların %4,2'sinde stres inkontinansı, %10'unda sıkışma inkontinansı, %59,2'sinde stres ağırlıklı karma idrar kaçırma ve %24,7'sinde sıkışma ağırlıklı karma idrar kaçırma bildirilmiştir. Ortalama ± standart sapma değerleri UDI-6 için 59,62±20,62, IIQ-7 için 54,72±24,84, toplam I-QOL için 62,41±23,52, I-QOL davranış sınırlamaları alt ölçeği için 21,85±8,55, I-QOL psikolojik etki alt ölçeği için 27,99±10,86 ve I-QOL sosyal izolasyon alt ölçeği için 12,64±5,72'dir. Ürodinamik sonuçlar ile UDI-6, IIQ-7, toplam I-QOL, I-QOL davranışların sınırlandırılması alt ölçeği, I-QOL psikolojik etki alt ölçeği ve I-QOL sosyal izolasyon alt ölçeği puanları arasında istatistiksel olarak anlamlı bir fark değerlendirildi (tüm değişkenler için p<0,001).

Sonuç: Üİ tanısı konulan hastalarda, Üİ tanısı için 3 anketin her biri karşılaştırıldığında, karma tip Üİ'yi tahmin etmek için en iyi sorgulama anketi UDI-6 idi.

Anahtar Kelimeler: İdrar kaçırma, ürogenital sıkıntı envanteri 6, inkontinans etki anketi, inkontinans yaşam kalitesi, ürodinamik sonuçlar

Introduction

Urinary incontinence (UI) is defined by the International Continence Society (ICS) as the involuntary leakage of urine that leads to social and hygienic problems, significantly affecting the patient's quality of life (QOL)[1]. In the ICS's 2002 standardization report described UI as any involuntary leakage of urine[2]. The prevalence of UI ranges from 10% to 40% worldwide[3], with studies in Turkey reporting prevalence rates between 16.4% and 68.8%[4].

UI contributes to increased social dysfunction in women[5]. Those experiencing more severe symptoms of UI often report a greater impact on their physical activities, social, travel, and emotional well-being[6]. The lower urinary tract (LUT) consists of the urinary bladder and urethra, which allow for conscious, controlled, and coordinated urine expulsion while storing urine at low pressure.

Urodynamics involves measuring the physiological parameters of the LUT to evaluate its function and dysfunction. Clinicians may perform urodynamics non-invasively or invasively. The standard urodynamic test combines both assessment methods, including non-invasive evaluations of urinary bladder emptying and invasive assessments of storage and emptying functions[7]. Typically, standard urodynamic tests begin with non-invasive uroflowmetry, followed by invasive cystometry and pressure-flow studies. Additional tests, such as simultaneous electromyography (EMG) of pelvic floor muscles and urethral pressure profiles, may provide further clinical insights[8].

The current guidelines do not recommend routine urodynamic investigations in patients with incontinence. However, such investigations are indicated for patients with: 1) discordance between complaints and symptoms; 2) plans for surgery; 3) therapy-resistant overactive bladder; 4) a history of unsuccessful incontinence surgery; 5) obstructive voiding symptoms; 6) a history of neurological disease; and 7) increased post-void residual volume (PVR)[9-11].

The purpose of UI inquiry forms is to select appropriate treatment methods and evaluate therapy results rather than to obtain a direct diagnosis[2]. Given that selecting the appropriate inquiry forms according to the UI type yields more accurate results post-treatment, this study aimed to compare UI tests before treatment, such as the urogenital distress inventory 6 (UDI-6), incontinence impact questionnaire (IIQ-7), and the incontinence quality of life (I-QOL) inquiry forms, evaluating their efficiencies and observing changes.

Materials and Methods

Study Population and Data Collection

This cross-sectional study enrolled patients who underwent urodynamic and clinical evaluation at the Urogynecology Outpatient Clinic of a University of Health Sciences Training and Research Hospital between July 2020 and July 2022. Ethical approval was obtained from the University of Health Science Turkey, Zeynep Kamil Women and Children Diseases Training and Research Hospital Clinical Research Ethics Committee (decision no: 138, date: 08.07.2020). Participants were evaluated by a urogynecologist to ensure that they met the following inclusion criteria: 1) Female patients aged over 18 years; 2) patients with sufficient literacy to complete the questionnaires; and 3) patients who provided informed consent. Exclusion criteria: 1) pelvic organ prolapse stage 3; 2) pregnancy; 3) urinary tract infections; 4) current drug therapy for UI; 5) neurological diseases; and 6) neoplastic diagnosis or risk. The study's methodology and objectives were explained to all eligible patients before they signed the informed consent form. After obtaining written consent, participants completed a questionnaire that recorded sociodemographic (age, educational level, marital status, profession, smoking) and physical characteristics (body mass index, height, weight, menstrual and status parity).

Questionnaires

Turkish versions of the I-QOL scale, UDI-6, and IIQ-7 were administered. Urogynecological examinations and urodynamic tests were performed to assess the UI type.

Incontinence Quality of Life Scale Scores

Developed by Wagner et al.[12] in 1996 to assess the QOL of patients with UI in the USA, the I-QOL was revised by Patrick et al.[13] in the same year, reducing the number of questions to 22 by removing six, based on psychometric evaluations for European versions. In Turkey, Öztaç Özerdoğan and Kızılkaya[14] conducted validity and reliability studies on the Turkish adaptation of the I-QOL. The Turkish I-QOL demonstrated strong internal consistency (Cronbach's α=0.96) and very strong test-retest reliability (Spearman's rho=0.97).

All I-QOL items were evaluated using a five-point Likert-type response scale (1: very much, 2: pretty much, 3: moderate, 4: a little, 5: not at all). The total final score was converted into a scale value from 0 to 100 for clarity, with higher

scores indicating a better QOL. The I-QOL consists of three subdimensions: limitation of behaviors (items 1, 2, 3, 4, 10, 11, 13, 20), psychosocial influence (items 5, 6, 7, 9, 15, 16, 17, 21, 22), and social isolation (items 8, 12, 14, 18, 19). Higher scores indicate better QOL than lower scores[12-14].

Urogenital Distress Inventory-6

The UDI-6 is a scale used to determine symptoms related to stress-related UI, bladder outlet obstruction, and detrusor overactivity. The UDI-6 short form consists of six questions that are scored on a scale from 0 to 3. Higher scores indicate a greater impact on QOL. The Turkish adaptation's validity and reliability were established by Cam et al.[15], with strong internal consistency (Cronbach's α=0.74) and very strong test-retest reliability (Spearman's rho=0.99).

Incontinence Influence Questionnaire Form

The IIQ-7 comprises seven questions that are assessed using a four-point Likert-type scale. Scores from the IIQ-7 and UDI-6 are evaluated from 0 to 100, where "0" indicates no bother at all, and "100" indicates significant bother. Higher scores imply poorer QOL[15]. The Turkish IIQ-7 also demonstrated strong internal consistency (Cronbach's α=0.87) and very strong test-retest reliability (Spearman's rho=0.99).

After completing each of the three questionnaires, all participants underwent a urodynamic investigation performed by the principal researcher (CC), who was blind to each patient's questionnaire score. Urodynamic assessment primarily included filling cystometry and uroflowmetric studies.

Cystometric Method

Each participant with a negative urine culture was placed on the delivery table after emptying her bladder. After cleaning the external urethral meatus, urine from the PVR portion of the catheter was measured. To measure intra-abdominal pressure, an intra-abdominal pressure catheter was inserted into the rectum, and the distal part of the catheter was fixed to the thigh with tape. Room temperature saline was used as the filling fluid, and pressures were recorded using external pressure transducers. Intra-abdominal, intravesical, and calculated detrusor pressures were simultaneously displayed on a computer screen. The filling volume and EMG data were also recorded. Bladder filling typically began in the sitting position at a rate of 50-80 mL/min. The volumes at the first sensation of bladder filling and at the first, normal, and strong desire to void were recorded. At a bladder volume of 200 mL, each patient was instructed to perform the Valsalva maneuver. The Valsalva leak point pressure was recorded as the lowest intravesical pressure that resulted in incontinence during effort. The presence of provoked (e.g., cough, change in posture) or spontaneous involuntary contractions of the detrusor muscle indicated detrusor overactivity. The filling phase was completed when the participant could no longer hold the fluid or postpone voiding, and bladder compliance was recorded. The definitions set forth by the ICS were used to define lower urinary system dysfunction and related symptoms, findings, and urodynamic observations[16]. Urodynamic examination, clinical records, and urodynamic tests were performed to classify the UI type, with patients categorized into five groups: normal, stress incontinence, urge incontinence, stress-predominant mixed UI, and urge-predominant mixed UI.

Statistical Analysis

Continuous variables are expressed as mean ± standard deviation (SD) and/or median (minimum-maximum), whereas categorical data are presented as numbers and percentages. Normality analyses of continuous variables were conducted using the Kolmogorov-Smirnov test. One-Way ANOVA (post-hoc: Bonferroni) was applied to analyze variables that followed a normal distribution, while the Kruskal-Wallis test (post-hoc: Mann-Whitney U test with Bonferroni correction) was used for non-normally distributed variables. The linear relationship between scales was tested using Spearman's correlation analysis. Based on the results of urodynamics, the UDI-6, IIQ-7, and total I-QOL scores were utilized to predict incontinence levels (stress, urge, stress-predominant mixed UI, and urge-predominant mixed UI). The area under the curve (AUC) was calculated for subscale scores, and receiver operating characteristic (ROC) curve analysis was performed to determine cut-off values. Sensitivity, specificity, and positive and negative predictive values were calculated for significant breakpoints. A type I error of less than 5% was considered statistically significant. Statistical analyses were performed using IBM SPSS version 26.0 (IBM Corporation, Armonk, NY, USA).

Results

The mean ± SD values for age, average parity, and average urinary bladder capacity among the 449 patients were 48.9±9.3 years, 2.78±1.32, and 489.96±153.9 mL, respectively. Seventy-three percent of the participants had undergone normal vaginal delivery, and 49.7% were in the menopausal period. The sociodemographic health information of the participants is presented in Table 1. In the uroflow assessment, 83.3% of participants exhibited normal results, whereas 5.8% had inadequate volume, 3.3% showed obstruction, 7.1% had mild obstruction, and 0.4% had severe obstruction. Based on the clinical and urodynamic assessment results, 1.2% of patients were classified as normal, 4.2% as having stress UI, 10% as having urge UI, 59.2% as having stress-predominant mixed UI, and 24.7% as having urge-predominant mixed UI, as shown in Table 1.

The mean ± SD values of the UDI-6, IIQ-7, total I-QOL, I-QOL limitation of behaviors, I-QOL psychological influence, and I-QOL social isolation scales are presented in Table 2.

Table 1. Sociodemographic and clinical characteristics of the participants (n=449)

		Mean ± SD	Median (min-max)
Age (year)		48.88±9.33	48 (22-73)
Gravity		2.89±1.4	3 (0-9)
Parity		2.78±1.32	3 (0-9)
BMI (kg/m^2)		29.71±5.25	29 (16-48)
Bladder capacity (mL)		489.96±153.9	459 (188-1104)
		n	**%**
Delivery methods	Nulliparous	14	3.1
	Normal delivery	331	73.7
	Cesarean section	44	9.8
	Normal delivery + cesarean section	60	13.4
Menopausal status	Negative	226	50.3
	Positive	221	49.2
Educational status	Illiterate	40	8.9
	Primary school	235	52.3
	Secondary school	119	26.5
	High school	16	3.6
	University	38	8.5
Marital status	Married	382	85.1
	Single	15	3.3
	Divorced	52	11.6
Occupation	Employee	70	15.6
	Officer	13	2.9
	Retired	37	8.2
	Housewife	328	73.1
Perceived financial status	Low	54	12.0
	Medium	395	88.0
Smoking	Non-smoking	339	75.5
	Smoking	110	24.5
Incontinence frequency	No incontinence	4	0.9
	A few times a day	140	31.2
	A few times a week	84	18.7
	A few times a month	37	8.2
	Sufficient for regular ped use	184	41.0
Period of urinary incontinence	Absent	3	0.7
	1 month	12	2.7
	5 months	37	8.2
	1 year	163	36.3
	5 years	234	52.1

Table 1. Sociodemographic and clinical characteristics of the participants (n=449)

		Mean ± SD	Median (min-max)
Previous urogynecological surgery	Negative	422	94.0
	Operated	1	0.2
	Cystocele	1	0.2
	TVT or TOT	23	5.1
	Present unknown	2	0.4
Uroflow	Normal	374	83.3
	Insufficient volume	26	5.8
	Obstruction	15	3.3
	Mild obstruction	32	7.1
	Severe obstruction	2	0.4
Examination + clinical + result of the urodynamic assessment	Normal	8	1.2
	Stress incontinence	19	4.2
	Urge incontinence	45	10.0
	Stress-predominant mixed incontinence	266	59.2
	Urge-predominant mixed incontinence	111	24.7
Total		449	100.0

SD: Standard deviation, BMI: Body mass index, TVT: Tension-free vaginal tap, TOT: Transobturatory tape, Min: Minimum, Max: Maximum

Table 2. Scores for the UDI-6, IIQ-7, total I-QOL and subscales (n=449)

	Mean ± SD	Median (min-max)
% the UDI-6	59.62±20.62	61.1 (11.1-100.0)
% the IIQ-7	54.72±24.84	52.3 (0.0-100)
Total I-QOL	62.41±23.52	60 (22-110)
I-QOL limitations of behaviors	21.85±8.55	22 (8-40)
I-QOL psychological influences	27.99±10.86	28 (9-45)
I-QOL social isolation	12.64±5.72	12 (5-30)

UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life, SD: Standard deviation, Min: Minimum, Max: Maximum

According to the clinical and urodynamic evaluation results, the UDI-6, IIQ-7 scale, total I-QOL scale, I-QOL behavioral limitation scale, I-QOL psychological impact scale, and I-QOL psychological impact scale scores were found to be statistically significant ($p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$, $p<0.001$; respectively).

The UDI-6 scale scores were as follows: urge-predominant mixed UI [61.6 (22.2-100.0)] >stress-predominant mixed UI [61.1 (16.6-100.0)] >stress incontinence [44.4 (16.6-72.2)]=urge incontinence [44.4 (11.1-88.9)] >normal individuals [30.5 (16.6-77.7)] ($p<0.001$ for all variables).

The IIQ-7 scale scores were as follows: Urge-predominant mixed UI (62.46±22.50) >stress-predominant mixed UI (54.63±24.56) >urge incontinence (47.93±24.71) >stress incontinence (35.58±22.63) >normal individuals (33.92±28.39) ($p<0.001$ for all variables).

The total I-QOL scale scores were as follows: normal individuals (87.88±25.44) >stress incontinence (79.11±21.09) >urge incontinence (73.31±22.94) >stress-predominant mixed UI (60.98±23.13) urge-predominant mixed UI (56.75±21.39) ($p<0.001$ for all variables).

According to clinical and urodynamic assessment results, 1.2% of patients were normal, 4.2% had stress UI, 10% had urge UI, 59.2% had stress-predominant mixed UI, and 24.7% had urge-predominant mixed UI shown in Table 3.

The analysis between the scales reported a fairly strong positive and statistically significant correlation between the UDI-6 subscale score and the IIQ-7 subscale score (r=0.622, p<0.001; respectively).

It was determined that there was a negative, strong, and statistically significant correlation between the UDI-6 scale score and the I-QOL total scale score (r=-0.614, p<0.001; respectively).

The ROC curve analysis used to predict stress and urge UI did not confirm the clinical diagnosis prediction (p>0.05). We determined that the three scales we used to predict stress-predominant mixed UI predicted the clinical diagnosis to be statistically significant (p<0.05). The best cut-off values determined in the ROC analysis among the three scales and the calculated sensitivity, specificity, positive-predictive value, negative-predictive value, and AUC values are shown in Table 4 and Figure 1.

Table 3. Comparison of the UDI-6, IIQ-7, and total I-QOL scales and subscale scores

	Urodynamics evaluation					
	Normal (n=8)	Stress incontinence (n=19)	Urge incontinence (n=45)	Stress-predominant mixed incontinence (n=266)	Urge-predominant mixed incontinence (n=111)	p
%UDI-6 median (min-max)	[30.5 (16.6-77.7)][a]	[44.4 (16.6-72.2)][a]	[44.4 (11.1-88.9)][a]	[61.1 (16.6-100.0)][a]	[61.6 (22.2-100.0)][a]	<0.001**
%IIQ-7 mean ± SD	(33.92±28.39)	(35.58±22.63)[b]	(47.93±24.71)[b]	(54.63±24.56)[b]	(62.46±22.50)[b]	<0.001*
I-QOL mean ± SD	(87.88±25.44)[b]	(79.11±21.09)[b]	(73.31±22.94)[b]	(60.98±23.13)[b]	(56.75±21.39)[b]	<0.001*
I-QOL limitations of behaviors median (min-max)	[32 (12-39)][a]	[28 (11-40)][a]	[26 (9-39)][a]	[22 (8-40)]	[17 (8-40)][a]	<0.001**
I-QOL psychological influences median (min-max)	[43 (13-45)][a]	[37 (10-45)][a]	[34 (9-45)]	[27,5 (9-45)]	[26 (9-45)][a]	<0.001**
I-QOL social isolation median (min-max)	[20.5 (5-25)]	[17 (8-25)]	[17 (5-25)][a]	[11 (5-30)][a]	[11 (5-25)][a]	<0.001**

*: One-Way analysis of variance ([b]: Post-hoc: Bonferroni), **: Kruskal-Wallis Test ([a]: Post-hoc: ***Bonferroni-corrected*** Mann-Whitney U test), UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life, SD: Standard deviation, Min: Minimum, Max: Maximum, SD: Standard deviation

Table 4. Cut-off values and ROC curve analysis results for the UDI-6, IIQ-7, and total I-QOL scales and subscale scores in the prediction of stress-predominant ***mixed*** urinary ***incontinence***

	Diagnostic test					ROC curve		p
	Cut-off	Sensitivity	Specificity	PPV	NPV	AUC	95% CI	
UDI-6	≥36.11	90.2	75.0	99.2	18.8	0.836	0.659-1.000	0.001**
IIQ-7	≥30.95	83.1	62.5	98.7	10.0	0.727	0.514-0.940	0.029**
Total I-QOL	≤79.5	74.8	87.5	99.5	9.5	0.804	0.609-0.998	0.003**
I-QOL limitations of behaviors	≤29.5	78.2	75.0	99.0	9.4	0.783	0.601-0.965	0.006**
I-QOL psychological influences	≤34.5	68.8	87.5	99.5	7.8	0.794	0.604-0.984	0.005**
I-QOL social isolation	≤15.5	72.9	87.5	99.5	8.9	0.793	0.588-0.997	0.005**

*: PPV, **: ROC curve analysis, NPV: Negative-predictive value, AUC: Area under the curve, CI: Confidence interval, UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life, PPV: Positive-predictive value, ROC: Receiver operating characteristic

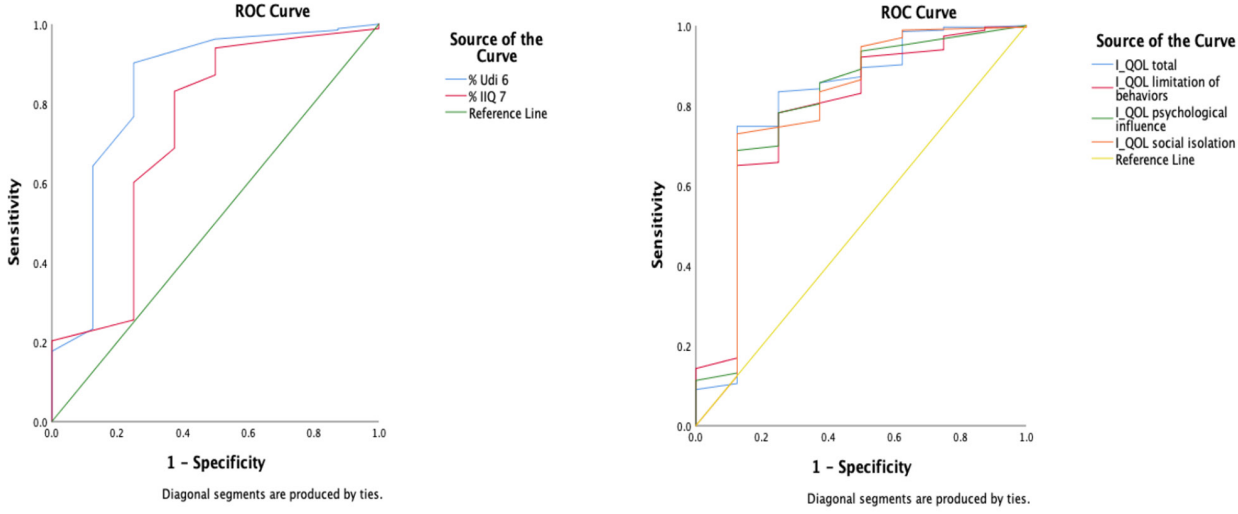

Figure 1. ROC curves of the UDI-6 and IIQ-7 scale scores for predicting stress-predominant mixed urinary incontinence (right) and the total I-QOL scale and subscale scores for predicting stress-predominant mixed urinary incontinence (left)

ROC: Receiver operating characteristic, UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life

Discussion

The results of this study may help clinicians determine the type of symptomatic UI and guide further diagnosis and treatment. Each of the three scales used to predict the clinical diagnosis of stress-predominant mixed UI and urge-predominant mixed UI was effective. However, we found that the UDI-6 was the best scale for each clinical condition, and the other scales used to predict stress and urge incontinence could not reliably predict the clinical diagnosis ($p>0.05$). Our results comprise data from a large population, including a patient population that received a final diagnosis from more than one gynecologist.

By reviewing the literature on this topic, Wuytack et al.[17] defined the UI-specific and generic QOL outcome measurement tools used in women with UI and identified the most psychometrically robust tools to facilitate the selection of appropriate outcome criteria reported by patients to measure QOL in this population. Nineteen instruments used in studies performed in English-speaking populations were UI-specific, whereas four were generic. When reviewing instruments in other languages, nine urinary continence-specific instruments and three generic instruments were used across 19 different languages. Based on the evidence presented, we conclude that the I-QOL questionnaire is the most psychometrically robust specific tool for use in women with UI. The I-QOL is also the most widely-translated tool for other languages[17].

In the study by Skorupska et al.[18], the optimal cut-off score for distinguishing symptomatic from asymptomatic UI in women was a UDI-6 score of 33.33, with scores greater than 33.33 indicating higher distress caused by UI symptoms. Furthermore, a higher impact of UI on health-related QOL (HRQOL) was observed in women who scored 9 or more on the IIQ-7 questionnaire, indicating a perceived impairment in QOL. A UDI-6 score of 33.33 demonstrated 83.33% specificity and 97% sensitivity for determining higher distress caused by UI symptoms[18]. Our study population is not suitable for the cut-off value.

Bushnell et al.[19] employed standardized procedures, the I-QOL measure, and country-specific psychometric testing for validity, reliability, and responsiveness. Confirmatory factor analyses were conducted to evaluate the subscales of the I-QOL. The Incontinence-specific QOL measurement model consisted of three subscales. The summary and subscale scores were internally consistent across 15 versions (α values=0.91-0.96) and reproducible (intraclass correlation coefficients=0.72-0.97)[19].

Although the study by Ross et al.[20] frequently used multiple measures, better evidence is needed before deciding which single questionnaire should be considered the gold standard. Until such evidence is obtained, we recommend that researchers consider using the IIQ or I-QOL, with or without the UDI, as the first-choice method in their trials on incontinence treatments. This recommendation is based on an evaluation of the frequency of use, reliability, validity, sensitivity, and utility of these measurements. Consistent use of the IIQ or I-QOL, with or without the use of the UDI, will also encourage comparability between trials[20]. In our study, when all 3 questionnaires were compared, we found that the best questionnaire for predicting mixed-type UI was UDI-6.

In the study conducted by Öztaç Özerdoğan and Kızılkaya[14], women with stress UI had higher I-QOL scores than those with urge UI and mixed UI. This difference largely results from the

unpredictable nature of stress UI symptoms and related urine leakage. Similar results were found in our study.

Hannestad et al.[3] found that the prevalence of UI increased with age, with half of UI cases being stress-UI type, 11% being urge-UI type, and 36% being mixed-UI type[3].

In our study, clinical and urodynamic assessment results showed that 1.2% of patients were normal, 4.2% had stress-UI, 10% had urge UI, 59.2% had stress-predominant mixed UI, and 24.7% had urge-predominant mixed UI. The differing rates of UI types in our study can be attributed to the cross-sectional design, as the group underwent urodynamics for further assessment of UI. In the prediction of urge-predominant mixed UI, we determined that the three scales we used to predict urge-predominant mixed UI predicted the clinical diagnosis to be statistically significant ($p<0.05$). The best cut-off values determined in the ROC analysis among the three scales and the calculated sensitivity, specificity, positive-predictive value, negative-predictive value and area under the curve values are shown in Table 5 and Figure 2.

Table 5. Cut-off values and ROC curve analysis results for the UDI-6 and IIQ-7 scale scores for predicting urge-predominant *mixed* urinary *incontinence*

	Diagnostic test					ROC curve		p
	Cut-off	Sensitivity	Specificity	PPV	NPV	AUC	95% CI	
UDI-6	≥36.11	92.8	75.0	98.1	42.9	0.851	0.694-1.000	**0.001****
IIQ-7	≥30.95	90.1	62.5	97.1	31.3	0.785	0.580-0.991	**0.007****
Total I-QOL	≤79.5	82.9	87.5	98.9	26.9	0.833	0.633-1.000	**0.002****
I-QOL limitations of behaviors	≤29	89.2	75.0	98.0	33.3	0.832	0.658-1.000	**0.002****
I-QOL psychological influences	≤34.5	77.5	87.5	98.9	21.9	0.833	0.631-1.000	**0.002****
I-QOL social isolation	≤15.5	75.7	87.5	98.8	20.6	0.810	0.603-1.000	**0.004****

**: ROC curve analysis, NPV: Negative-predictive value, AUC: Area under the curve, CI: Confidence interval, UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life, PPV: Positive-predictive value, ROC: Receiver operating characteristic

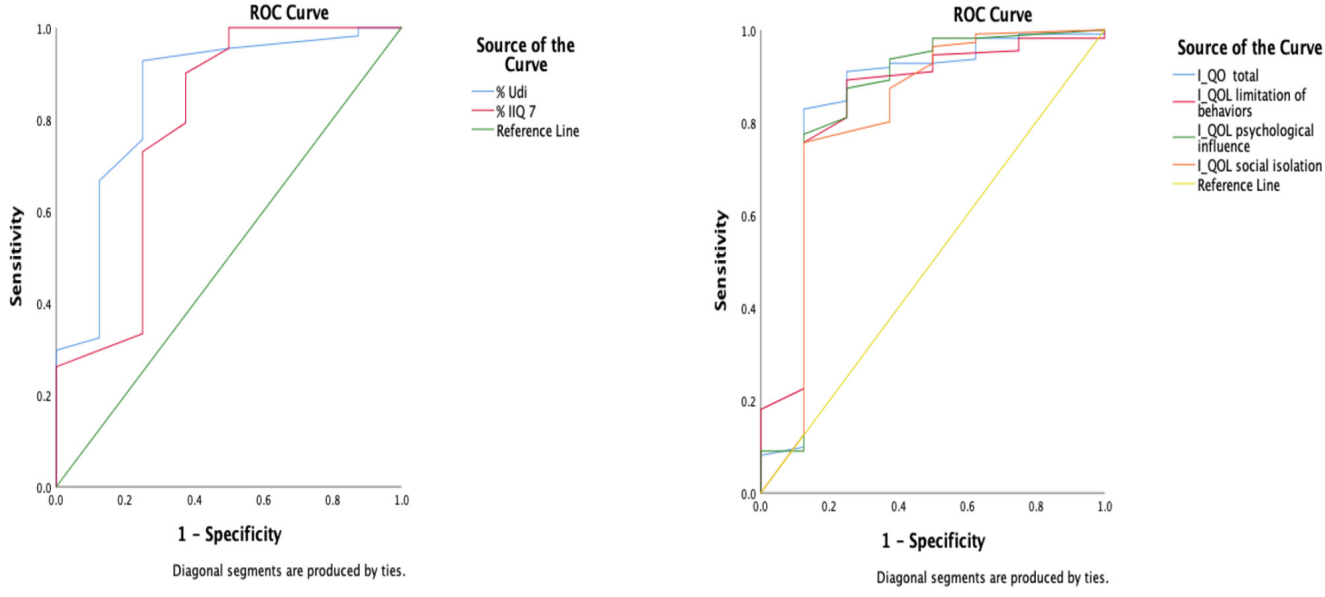

Figure 2. ROC curves of the UDI-6 and IIQ-7 scale scores for predicting urge-predominant mixed urinary incontinence (right), ROC curves of the total I-QOL scale, and subscale scores for predicting urge-predominant mixed urinary incontinence (left)

ROC: Receiver operating characteristic, UDI-6: Urogenital distress inventory 6, IIQ-7: Incontinence impact questionnaire, I-QOL: Incontinence quality of life

Study Limitations

The study limitations include the single-center design, exclusion of men, the referral nature of the study population, and the fact that 98.8% of cases were diagnosed with UI without a control group. Another potential concern is the absence of a true "gold standard" diagnostic test for UI. Since no such test exists for UI types, the validity of any diagnostic test for these types is contentious. Although urodynamic testing is not recommended for the basic clinical evaluation of UI in the current guidelines, it is frequently used in clinical practice to diagnose UI[21,22]. Given the absence of a control group for comparison and a "gold standard" diagnostic test in our study, further research is needed to verify these results in diverse populations.

Conclusion

Among the patients with the chief complaint of UI, we included those who underwent urodynamic evaluation for further diagnosis. All patients were classified according to the type of UI through urodynamic evaluation, with definitive diagnoses made by a urogynecologist. A total of 83.9% of patients presented with mixed UI.

Our study revealed that the UDI-6, IIQ-7, and I-QOL questionnaires showed high performance in predicting mixed urinary UI because they are easy to administer, inexpensive, and quick to complete. Although the UDI-6 questionnaire demonstrated the highest performance in predicting stress-predominant mixed UI and urge-predominant mixed UI, the IIQ-7 and I-QOL questionnaires also performed well in predicting mixed UI overall. For isolated stress UI and urge UI, none of the three questionnaires were predictive.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the University of Health Science Turkey, Zeynep Kamil Women and Children Diseases Traning and Research Hospital Clinical Research Ethics Committee (decision no: 138, date: 08.07.2020).

Informed Consent: Informed consent was obtained from the patients.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Ö.T., Ç.K., A.A., Concept: Ö.T., Design: Ö.T., Z.T., Data Collection or Processing: Ö.T., Ç.K., S.S.K., R.G.İ., Z.T, A.A., Ç.Y.V., A.T., Analysis or Interpretation: Ö.T., S.S.K., R.G.İ., Z.T, A.A., Literature Search: Ö.T., P.K., A.T., Writing: Ö.T., P.K., A.T.

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