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TRANS PERINEAL ULTRASOUND IN FEMALE STRESS URINARY INCONTINENCE: THE SIGNIFICANCE OF URETHRAL ROTATION

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ABSTRACT

Background: Urinary incontinence is a widespread and serious problem in women. Incontinence can disrupt social life, physical exercise, and sexual activity, impacting emotional and psychological well-being. Stress urinary incontinence may only be effectively treated with a thorough understanding of its etiology, pathophysiology, precise diagnosis, and range of therapeutic choices from which a personalized treatment plan can be developed. **Aims:** To study the role of trans perineal ultrasound in the assessment of pelvic floor and urethral rotation in female with urinary stress incontinence. **Methods:** This is an observational, descriptive, hospital-based, case control study was conducted on 30 women having stress urinary incontinence and 30 continent women as a control group. It was conducted at Al-Imamain Al-Khadhimain Medical City, from March 1, 2025, to December 31, 2025. Ladies with neuropsychiatric or cognitive disorders, those with diabetes, previous urogenital surgery, pelvic irradiation, genitourinary tumors, pelvic organ prolapse, urinary tract infection, and patients who took medication that could cause urinary incontinence were excluded from the study. **Results:** The mean age ± standard deviation of the study participants was 58.46 ± 9.51 years, while the patients' range of ages was (29-79) years. Statistically significant difference between patients and controls regarding their α angle at Valsalva (P value <0.001), β angle at Valsalva (P value <0.001), α urethral rotation angle (P value <0.001), β urethral rotation angle (P value <0.001) and mean of bladder neck descends (P value <0.001). While no statistically significant difference between them with regard to α angle at rest (P value = 0.493) and β angle at rest (P value = 0.379). Bladder neck descent (mm) was found as the strongest predictor for stress urinary incontinence (odds ratio = 2.5956, CI = 1.249 – 9.321, P value <0.001), followed by β urethral rotation angle (odds ratio = 1.7097, CI = 1.093-2.673, P value = 0.001) and α urethral rotation angle (odds ratio = 1.2875, CI = 1.096-1.511, P value = 0.002). The sensitivity values varied from 65% for α urethral rotation angle to 95% for bladder neck descent, while specificity varied from 74.07% for α urethral rotation angle to 95.23% for bladder neck descent. Furthermore, the positive predictive value ranged between 65% and 95%, with the lowest values found for urethral rotation parameters and the highest for bladder neck descent and α angle at Valsalva. While, the negative predictive value showed consistently high performance, ranging between 89.5% to 100%. The diagnostic accuracy ranged from 82.5% to 97.5%, with bladder neck descent demonstrating the highest accuracy among all assessed parameters, followed by α urethral angle at Valsalva and β urethral rotation angle. **Conclusions:** Trans-perineal pelvic floor ultrasonography is a useful, non-invasive imaging technique for the assessment and diagnosis of stress urine incontinence. Ultrasonographic parameters examined during the Valsalva maneuver were considerably more informative than those obtained at rest.

KEYWORDS: Angles, Bladder descend, Incontinence, Ladies, Pelvic, Stress, Ultrasound.

1-INTRODUCTION

Urinary incontinence is a widespread and serious problem in women. Incontinence can disrupt social life, physical exercise, and sexual activity, impacting emotional and psychological well-being.[1] Urinary incontinence (UI) is defined by the International Continence Society (ICS) as "any involuntary leakage of urine" or "urine leakage seen during examination" in which the pressure inside the bladder is greater than the urethra's ability to close.[2] It often caused by a loss of urethra function and structural abnormalities.[3] Urinary incontinence is more common in women, especially those who have had many vaginal childbirths, menopause, or pelvic surgery.[4] Approximately 45% percent of adult women encounter UI.[5] According to one study, women's incidence of UI rises from 20.5% at age 15 to 68.8% during menopause.[6] Globally, less than half of incontinent women receive treatment, and around quarter of them ask for medical assistance.[7] Traditional methods of diagnosis have many concerns. As a result, more sensitive and accurate techniques are required for the precise diagnosis of UI.[8] Urinary incontinence comes in two main types: stress (SUI) and urge (UUI).[9]

Stress urinary incontinence is the most common form, especially in younger women.[9] The most prevalent type of incontinence among younger women is stress urinary incontinence, it is described as the involuntary leakage of urine after exercise, sneezing, or coughing in the absence of bladder contraction.[10]

When intraabdominal pressure rises, bladder pressure exceeds urethral closure pressure, causing urine to flow. SUI has two causes: urethral hypermobility and intrinsic sphincter insufficiency.[11] The assessment of SUI includes the assessment of bladder neck movement by using trans-perineal ultrasonography, which is a non-invasive technique that visualizes the anatomy of the urinary bladder and urethra with detection of urine leaks.[12] Previous studies have shown that urethral mobility indexes can vary depending on assessment techniques and conditions, with each technique having its own focus. However, there are only a few studies discussing rotation angles.[13]

Stress urinary incontinence may only be effectively treated with a thorough understanding of its etiology, pathophysiology, precise diagnosis, and range of therapeutic choices from which a personalized treatment plan can be developed.[14] Conservative methods, lifestyle modifications, physical therapy, Kegel exercises, bladder training, biofeedback, electrostimulation, medication, pessaries, urethral bulking agents, slings, and other surgical procedures, such as artificial sphincters, may all be part of such treatment options.[15]

When interpreting ultrasound results, it's important to be cautious when correlating them to symptoms, surgical outcomes, and postoperative adverse events, as some findings may be accidentally discovered.[16]

The aim of this study is to assess the role of trans perineal ultrasound in female urinary stress incontinence with showing the significance of urethral rotation.

2-PATIENTS AND METHODS

An observational, descriptive, hospital-based, case control study was conducted on 30 women having stress urinary incontinence and 30 continent women as a control group. Data collection was performed from the 1st of march 2025 to the end of December 2025.

Adult females who attended the department of radiology at Al- Imamain Al-kadhemain medical city during the study period with their formal request signed by gynecologist or uro-surgeon for doing trans perineal ultrasound due to suspected stress urinary incontinence depending on the clinical presentation, were included in the study. While patients with neuropsychiatric disorders, cognitive disorders, diabetes mellitus, previous urogenital surgery or pelvic irradiation. In addition to patients with genitourinary tumors, those with pelvic organ prolapse, urinary tract infections, pregnant ladies and those who were within 6 weeks postpartum and patients who took medication that could cause urinary incontinence were excluded from the study.

The scans were performed using machine (ACUSON juniper, siemens) medical system, Germany) with 4-dimensional transducer (1.8 to 8.5 MHz) using its 2-dimensional option and measurements, the preparation required is not filling the bladder more than 150 ml which was checked with ultrasonographic volume formula from measurements obtained transabdominally. The examination was performed in the lithotomy position – lying on the back with the hips flexed, slightly abducted and the legs bent at the knees. The probe to be used is placed on the perineum between the labia, after being covered with sterile glove for hygienic reasons, the gel applied in two layers one directly on the probe surface and the other on the gloves surface, the main axis of the transducer is in the mid sagittal plane, showing the inferior margin of the pubis, urethra and bladder neck.

Alpha angle; the angle between the proximal urethra axis and the long axis of the symphysis pubis and Beta angle (β angle); the angle between the proximal urethra and the posterior bladder wall were measured from the marked lines (figure 2.2). These measurements were taken at rest and after strain by asking the patient to fully push, cough and do Valsalva maneuver then the image was obtained with the help of cine-loop function, the mentioned lines were drawn with tracers and angles were measured. The differences of angles at rest and Valsalva (rotation angles) were recorded as R α and R β. For the calculation of bladder neck descent (BND), the distance between the location of the bladder neck and the horizontal axis passing through the distal end of the symphysis was measured on the images taken during rest and Valsalva, the difference was calculated and recorded as BND (figure 2.1 and figure 2.2).

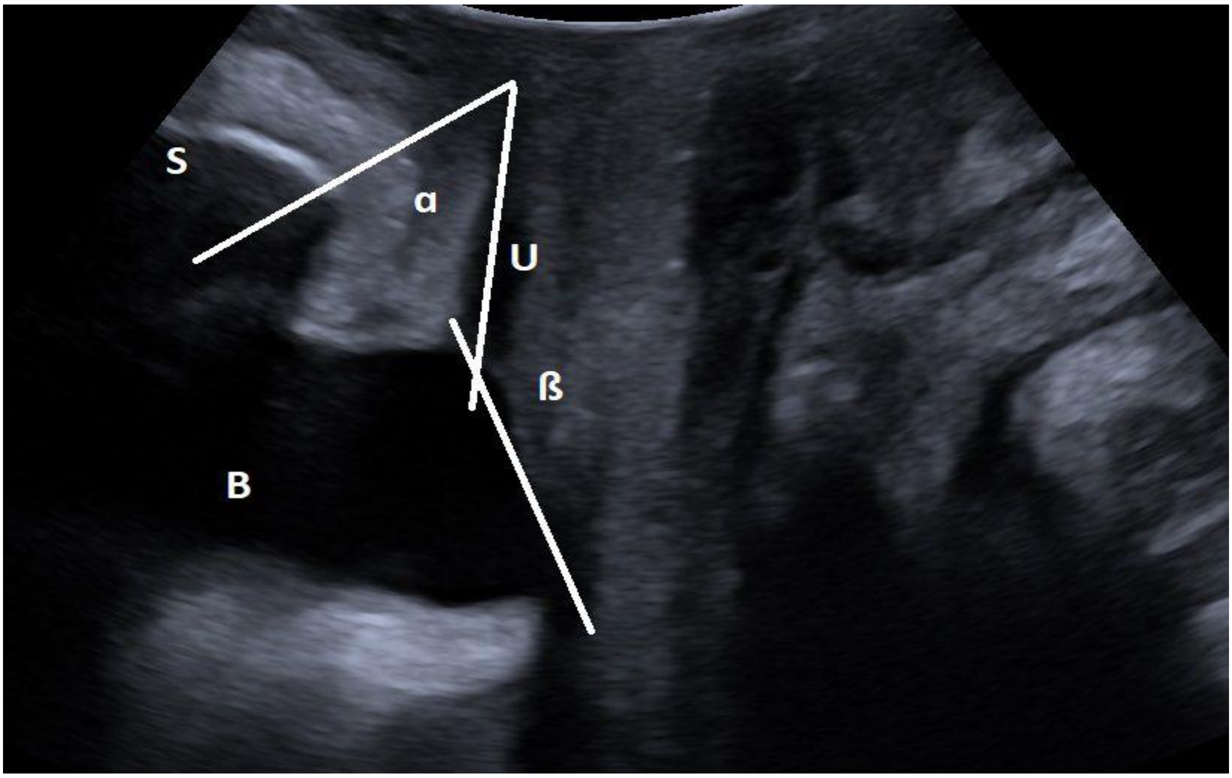

Figure 2.1: Ultrasound imaging showing α angle between the central axis of symphysis pubis and urethral axis while β angle represented by the axis between proximal urethra and posterior bladder wall. (S: symphysis pubis, U: urethra, B: bladder).

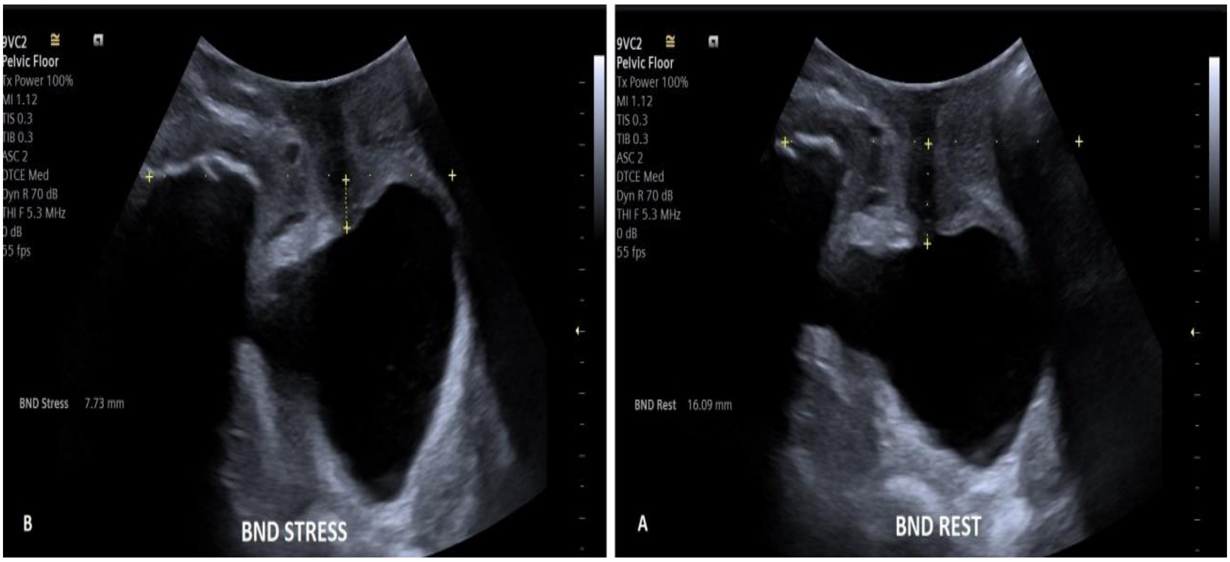

Figure 2.2: Bladder neck descent (BND), the distance between the location of the bladder neck and the horizontal axis passing through the distal end of the symphysis was measured on the images taken during rest (A) and stress (B), the difference was calculated and recorded as BND, which is 8.3 mm in this case.

Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) software, version 31 (IBM Corp., Armonk, NY, USA). Prior to analysis, quantitative variables were checked for normality using the Kolmogorov-Smirnov test. Continuous variables with normal distribution were given as mean ± standard deviation, whereas non-normally distributed data were expressed as median and range. Categorical variables were represented as numbers and percentages. The stress urinary incontinence group and the control group were compared using the independent samples t-test for normally distributed quantitative variables and the Mann-Whitney U test for non-parametric variables. Categorical variables were compared using the Chi-squared test or Fisher's exact test, if applicable. A correlation analysis was used to determine the relationship between stress urine incontinence and sociodemographic, gynecological, obstetrical, and ultrasonographic variables. Pearson's correlation coefficient was utilized for normally distributed variables, and Spearman's rank correlation coefficient for non-normally distributed variables. Binary logistic regression was used to determine independent ultrasonographic predictors of stress urine incontinence. The regression model included variables with statistically significant relationships in univariate analysis. The odds ratios were expressed with 95% confidence intervals. A receiver operating characteristic (ROC) curve analysis was done to assess the diagnostic efficacy of ultrasonographic parameters in predicting stress urine incontinence. The area under the curve, sensitivity, specificity, positive predictive value, negative predictive value, and total accuracy were determined. The Youden index was used to find the optimal cut-off values. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

The study includes 60 patients, distributed into two groups, the first group consisted from 30 patients with stress urinary incontinence (patients), while the second group consisted from comparable 30 normal ladies (controls). The mean age ± standard deviation of the study participants was 58.46 ± 9.51 years, while the patients' range of ages was (29-79) years.

Table 3.1 shows comparison between patients and controls regarding their anthropometric measurements, gynecological and obstetrical history. Statistical difference between the two groups regarding their mean BMI (P value <0.001), median of parity (P value <0.001), mode of delivery (P value <0.001) and menopausal state (P value <0.001).

Table 3.1: Comparison between patients and controls regarding their anthropometric measurements, gynecological and obstetrical history (number = 60).

Characteristics	Patients' group (No.=30)	Controls' group (No.=30)	P value
BMI (Kg/meter^2), mean ± standard deviation	31.15 ± 3.71	25 ± 1.86	**<0.001**
Parity, median (range)	5 (2-9)	3 (2-5)	**<0.001**
Mode of delivery:			**<0.001**
-Normal vaginal delivery	21 (70%)	12 (40%)	
-Assisted delivery	2 (6.67%)	1 (3.33%)	
-Cesarean section	2 (6.67%)	11 (36.67%)	
-Normal vaginal delivery + cesarean section	5 (16.67%)	6 (20%)	
Menopausal state, number (%):			**<0.001**
-Yes	18 (60%)	8 (26.67%)	
-No	12 (40%)	22 (73.33%)	

Table 3.2 shows correlation of urinary incontinence with patients' ages, obesity (Body mass index more than 30 Kg/meter2), gynecological and obstetrical parameters included in the study. Moderate positive correlations and statistically significant differences (P value < 0.05) correlation were found between SUI and obesity, parity, vaginal mode of delivery and menopausal state. While mild positive correlations but no significant differences (P value > 0.05) were found for age of patients.

Table 3.2: Correlation of stress urinary incontinence with sociodemographic, gynecological, obstetrical and medical relevant parameters included in the study.

Variable	Correlation coefficient	P value
Age of the patients	0.1259	0.438
Obesity	0.3014	**0.043**
Parity	0.4598	**0.002**
Vaginal mode of delivery:	0.3462	**0.028**
Menopausal state	0.3101	**0.040**

Table 3.3 shows comparison between patients and controls regarding their ultrasonographic measurements. Statistically significant difference between patients and controls regarding their α angle at Valsalva (P value <0.001), β angle at Valsalva (P value <0.001), α urethral rotation angle (P value <0.001), β urethral rotation angle (P value <0.001) and mean of bladder neck descends (P value <0.001). While no statistically significant difference between them with regard to α angle at rest (P value = 0.493) and β angle at rest (P value = 0.379).

Table 3.3: Comparison between patients and controls regarding their ultrasonographic measurements (number = 60).

Ultrasonographic measurements	Patients' group (No. =30)	Controls' group (No. = 30)	P value
α angle at rest °, mean ± standard deviation	67.25 ± 8.23	62.15 ± 7.89	0.493
α angle at Valsalva °, mean ± standard deviation	89.7 ± 7.66	68.10 ± 3.53	<0.001
β angle at rest °, mean ± standard deviation	111.3 ± 14.36	118.47 ± 12.31	0.379
β angle at Valsalva °, mean ± standard deviation	137.75 ± 12.84	126.68 ± 3.34	<0.001
α urethral rotation angle, mean ± standard deviation	22.45 ± 10.39	7.94 ± 4.47	<0.001
β urethral rotation angle, mean ± standard deviation	26.45 ± 11.60	8.21 ± 7.66	<0.001
Bladder neck descends (mm), mean ± standard deviation	21.2 ± 2.54	7.05 ±1.44	<0.001

Table 3.4 shows correlation of urinary incontinence with ultrasound parameters included in the study. Strong positive correlations and statistically significant differences for each of α urethral angle at Valsalva (P value <0.001) and bladder neck descend (P value <0.001). Moreover, moderate positive correlations and statistically significant differences for each of β urethral angle at Valsalva (P value <0.001), α urethral rotational angle (P value <0.001) and β urethral rotational angle (P value <0.001). Additionally, mild positive correlation and not significant correlation was found for α urethral angle at rest (P value = 0.349) and mild negative correlation was found for β urethral angle at rest (P value = 0.422).

Table 3.4: Correlation of urinary incontinence with ultrasound parameters included in the study.

Variable	Correlation coefficient	P value
α urethral angle at rest	0.0378	0.349
α urethral angle at Valsalva	0.8733	**<0.001**
β urethral angle at rest	-0.022	0.422
β urethral angle at Valsalva	0.5035	**<0.001**
α urethral rotational angle	0.6414	**<0.001**
β urethral rotational angle	0.7237	**<0.001**
Bladder neck descends	0.8637	**<0.001**

Table 3.5 shows Logistic regression analysis was performed to predict stress urinary incontinence and ultrasonographic measurements. Bladder neck descent (mm) was found as the strongest predictor for stress urinary incontinence (odds ratio = 2.5956, CI = 1.249 – 9.321, P value <0.001), followed by β urethral rotation angle (odds ratio = 1.7097, CI = 1.093-2.673, P value = 0.001) and α urethral rotational angle (odds ratio = 1.2875, CI = 1.096 –1.511, P value = 0.002). As shown in table 3.5.

Table 3.5: Association of urinary incontinence with α urethral rotation angle, β urethral rotation angle and bladder neck descends.

Ultrasonographic measurement	Odds ratio	Confidence interval (95%)	P value
α angle at Valsalva	2.1785	0.8391 - 5.656	0.109
β angle at Valsalva	**1.1360**	**1.034 – 1.247**	**0.007**
α urethral rotation angle	**1.2875**	**1.096-1.511**	**0.002**
β urethral rotation angle	**1.7097**	**1.093 – 2.673**	**0.001**
Bladder neck descends	**2.5956**	**1.249 – 9.321**	**<0.001**

Figure 3.1 shows the cut-off point determined for α angle at Valsalva in the diagnosis of stress incontinence is 76 °. At this value the area under curve = 0.9934 (outstanding), 95% CI (0.89 - 1), SE = 0.05, P value < 0.001, with sensitivity = 90.04%, specificity = 94.70%, positive predictive value = 95%, negative predictive value = 89.5% and accuracy of the test = 92.25%.

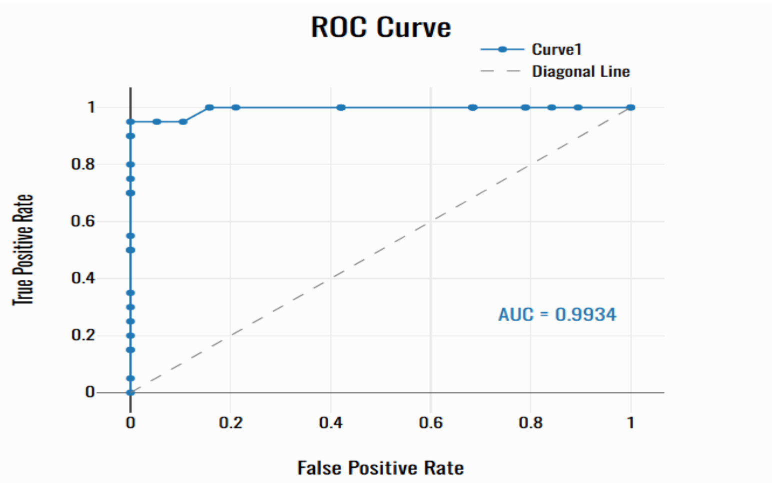

Figure 3.1: Receiver operating characteristic curve of α angle at Valsalva.

Figure 3.2 shows the cut-off point determined for β angle at Valsalva in the diagnosis of stress incontinence is 132 °. At this value the area under curve = 0.7368 (acceptable), 95% CI (0.55 - 0.92), SE = 0.09, P value = 0.012, with sensitivity = 70%, specificity = 76.92%, positive predictive value = 70%, negative predictive value = 100% and accuracy of the test = 85%.

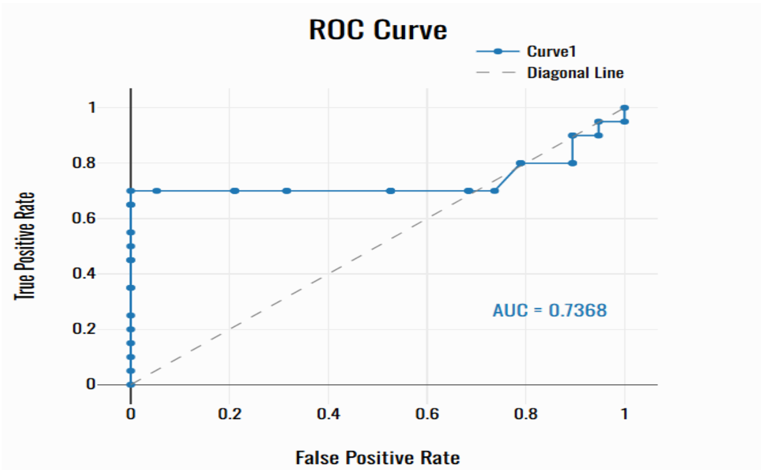

Figure 3.2: Receiver operating characteristic curve of β angle at Valsalva.

Figure 3.3 shows the cut-off point determined for α urethral rotation angle in the diagnosis of stress incontinence is 16 °. At this value the area under curve = 0.8842 (excellent), 95% CI (0.59 - 1), SE = 0.19, P value = 0.015, with sensitivity = 65%, specificity = 74.07%, positive predictive value = 65%, negative predictive value = 100% and accuracy of the test = 82.5%.

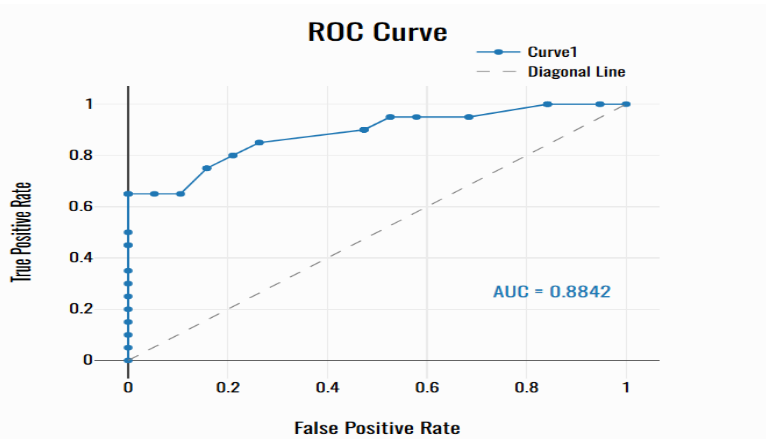

Figure 3.3: Receiver operating characteristic curve of α urethral rotation angle.

Figure 3.4 shows the cut-off point determined for β urethral rotation angle in the diagnosis of stress incontinence is 19 °. At this value the area under curve = 0.9592 (outstanding), 95% CI (0.57 - 1), SE = 0.16, P value = 0.017, with sensitivity = 94.44%, specificity = 86.36%, positive predictive value = 85%, negative predictive value = 100% and accuracy of the test = 90%.

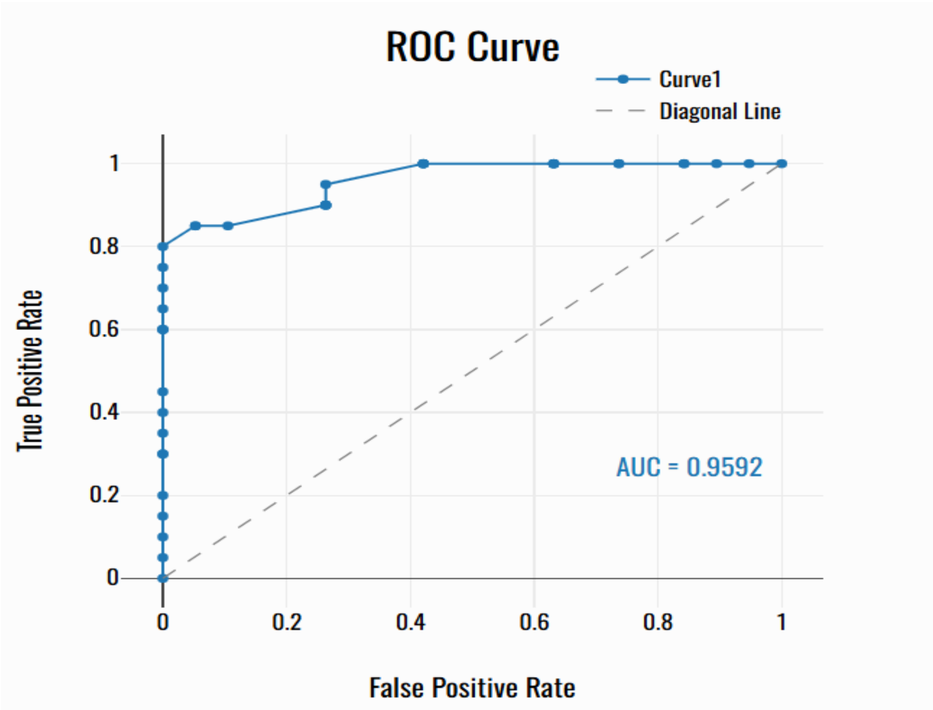

Figure 3.4: Receiver operating characteristic curve of β urethral rotation angle.

Figure 3.5 shows the cut-off point determined for bladder neck descend in the diagnosis of stress incontinence is 15 mm. At this value the area under curve = 0.9789 (outstanding), 95% CI (0.36 - 1), SE = 0.31, < 0.001, with sensitivity = 95%, specificity = 95.23%, positive predictive value = 95%, negative predictive value = 100% and accuracy of the test = 97.5%.

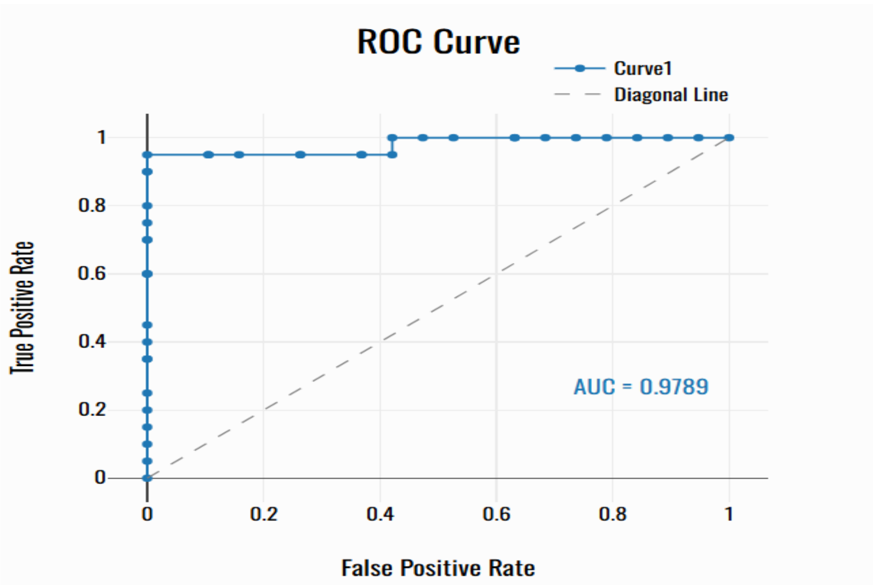

Figure 3.5: Receiver operating characteristic curve of bladder neck descent.

Table 3.6 Summarizes the accuracy measurements according to receiver operating characteristics curve. According to these measurements, bladder neck descend was the most accurate ultrasonographic parameters (97.5%), followed by α angle at Valsalva ° (92.25%) and β urethral rotation angle ° (90%).

Table 3.6: Summary of the accuracy measurements of ultrasonographic parameters.

Ultrasonographic parameters	Cut off point	Sensitivity	Specificity	PPV	NPV	Accuracy of the test
α angle at Valsalva °	76	90.04%	94.70%	95%	89.5%	92.25%
β angle at Valsalva °	132	70%	76.92%	70%	100%	85%
α urethral rotation angle °	16	65%	74.07%	65%	100%	82.5%
β urethral rotation angle °	19	94.44%	86.36%	85%	100%	90%
Bladder neck descends (mm)	15	95%	95.23%	95%	100%	97.5%

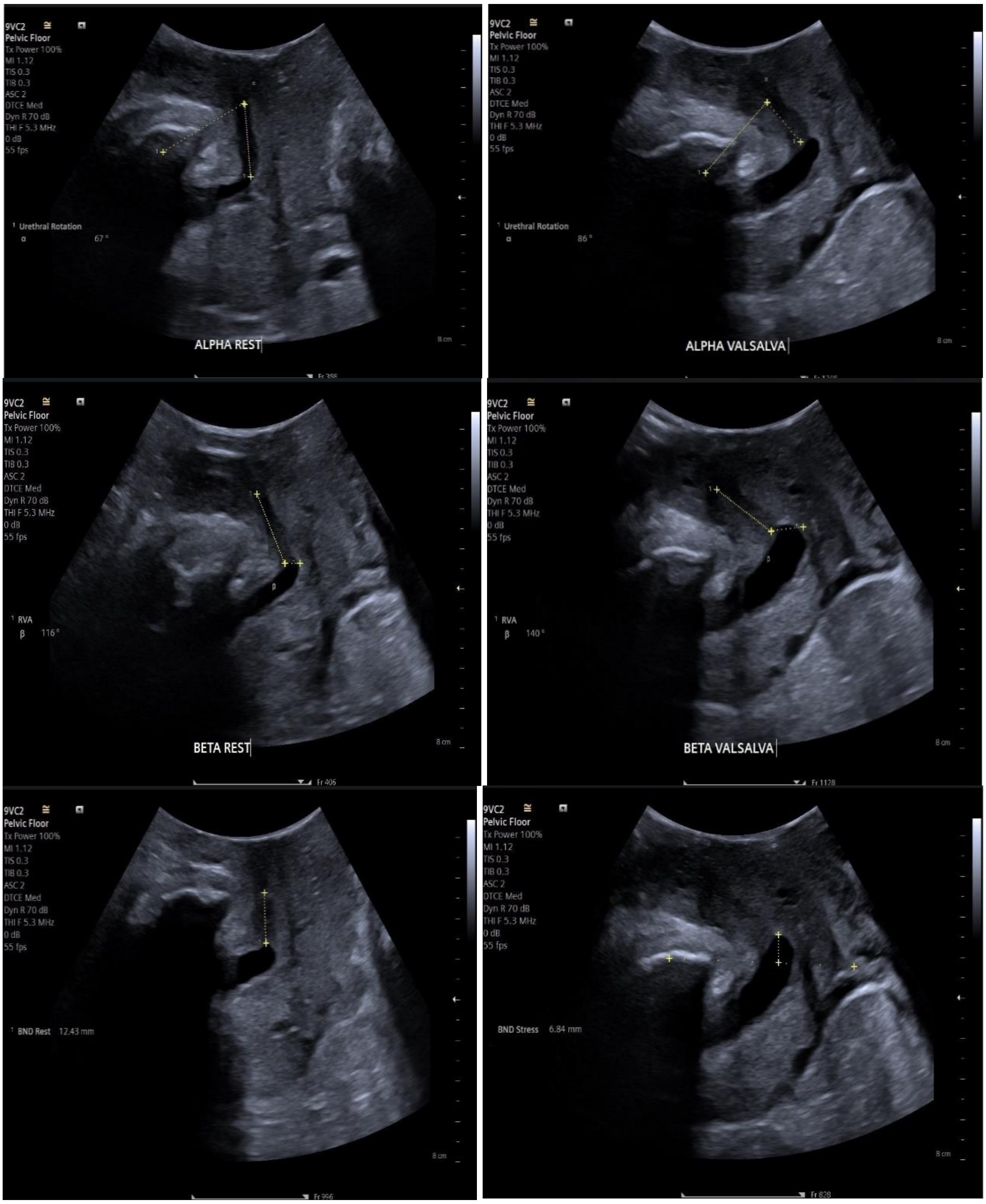

Figure 3.6: 38 years old female patient, obese, multiparous, having three vaginal deliveries and one C/S with negative past medical history presented with frequent urine leakage affecting daily life, trans-perineal ultrasound shows increase in both α angle (67 at rest, 86 at stress and Rα is 19), β angle (116 at rest, 140 at stress and Rβ is 24), with 19.2 mm BND.

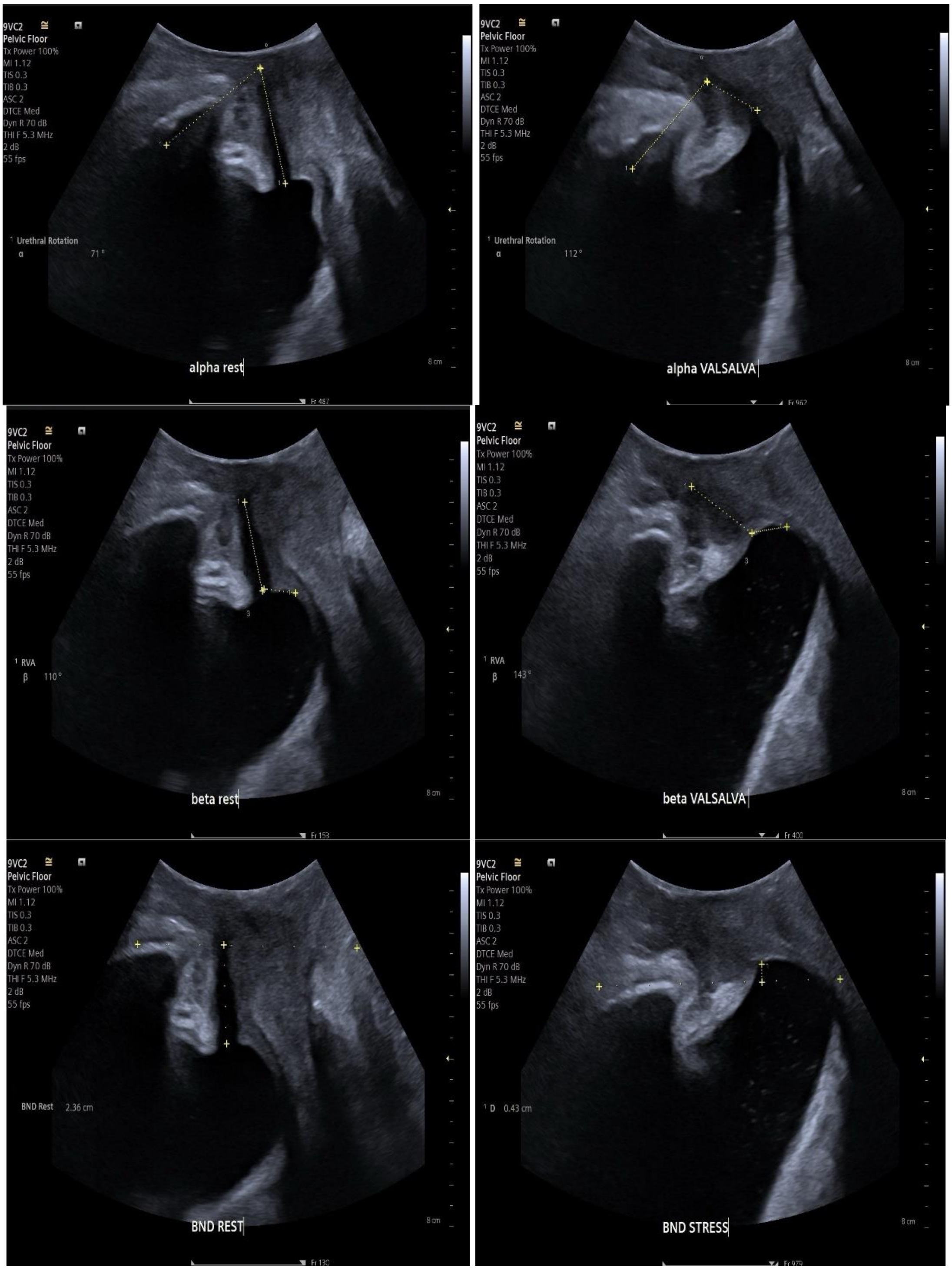

Figure 3.7: 42 years old female patient, multiparous, having four vaginal deliveries with negative past medical history presented with frequent urine leakage during coughing and exercise, transperineal ultrasound shows increase in both alpha angle (71 at rest, 112 at stress and Rα is 41), beta angle (110 at rest, 143 at stress and Rβ is 33) with 27 mm BND.

4. DISCUSSION

According to the matched patients and control ages, the study found the mean age of the participants was a round 58 years. A comparable finding obtained by Nelas et al[17] (58.4 years) and by Chow et al[18] (60 years). Moreover, according to recent 2025 meta-analyses, stress urinary incontinence is most prevalent in women aged 40 and older, with a peak prevalence of in the 50-59 age range.[19] This age is often associated with the hormonal changes of menopause and the long-term effects of risk factors which can weaken pelvic floor muscles and support structures over time. However, the study found no significant correlation between SUI with age, as the study already matched between the ages of patients and controls.

The study found patients with SUI significantly had more BMI than controls, with significant positive moderate correlation between SUI and obesity. This is might occur due to the fact that, overweight or obese puts extra pressure on the bladder and pelvic floor muscles, which can lead to urethral hypermobility and leaking. Frey et al[20] and Yang et al[21] studies showed comparable results.

Additionally, the current study found patients with SUI had given birth several times (greater parity) than in those who had fewer deliveries in a moderate positive correlation. As repeated deliveries could directly damage to the nerves and muscles of the pelvic floor, which are stretched and torn during delivery leading to SUI. This finding goes with the result of Saudi meta-analysis.[22] In the same way, the study illustrate vaginal mode of delivery was significantly higher in patients with SUI compared to cesarean section with significant positive moderate correlation, which aligns with Kokabi and Yazdanpanah[23], Blomquist[24] studies results. Furthermore, the study found menopausal ladies had significantly higher frequency of SUI in comparison to still menstruating ladies with significant moderate correlation. The drop in estrogen after menopause causes urogenital atrophy, decreased urethral closure pressure, and weakening of pelvic tissues, all of which could contribute to incontinence symptoms. Te West et al[25] and Allafi et al[26] showed comparable finding.

The study revealed ultrasonographic significant differences between patients and controls in dynamic parameters during the Valsalva maneuver, such as α angle (urethral angle), β angle (posterior urethrovesical angle), urethral rotation angles (Rα and Rβ), and bladder neck descent. As hypermobile urethra, is a contributing factor to SUI, causes the proximal urethra to rotate more postero-inferiorly and the bladder neck to displaced more inferiorly during Valsalva. However, static measures at rest revealed no significant differences between the two groups. This emphasizes the need of dynamic pelvic floor examination, as urethral hypermobility and bladder neck descent are functional abnormalities that appear during stress rather than at rest. Consistent findings with earlier studies that have highlighted the efficacy of Valsalva-based measures over static parameters in diagnosing SUI.[11-12] Furthermore, correlation analysis further supported these findings, as significant strong positive correlations were found between SUI and α urethral angle at Valsalva as well as bladder neck descent. While moderate positive correlations were also observed for β angle at Valsalva and both α and β urethral rotation angles, on the other hand, α and β angles measured at rest demonstrated weak and non-significant correlations. These findings confirm that excessive urethral mobility and inferior displacement of the bladder neck are key sonographic measurements associated with SUI. Direct correlation coefficients with clinical SUI symptoms were reported by Patel et al[27] who found strong correlation with α angle at Valsalva and BND with SUI severity scales. Moreover, Wang et al[28] found that the correlation between SUI and α angle and β rotational angles were moderate, while the correlation of SUI with bladder neck descent was strong, whereas static measurements at rest were less informative.

Based on logistic regression analysis, the study found bladder neck descent was the most significant predictor of SUI, followed by β urethral rotation angle and α urethral rotation angle. This is mean that bladder neck descent is the most clinically significant independent ultrasonography marker for predicting stress urine incontinence. These results similar to other studies findings.[11,29] These findings indicate, although clinical history, physical examination, and urodynamic investigations are the cornerstone of SUI assessment. However, ultrasound can offer real-time evaluation of the lower urinary tract's anatomical and functional characteristics at a reasonable cost.

Lastly, the study did receiver operating characteristic curve analysis for showing the cut-off point of pelvic floor dynamic parameters. At cut-off point of 76 ° α angle during Valsalva, the study demonstrates outstanding diagnostic performance, with excellent accuracy measurements (sensitivity = 90.04%, specificity = 94.70%, positive predictive value = 95%, negative predictive value = 89.5% and accuracy of the test = 92.25%). While, at cut-off point of 137° β angle during Valsalva, the study showed accepted diagnostic performance, with lesser accuracy measurements than α angle during Valsalva (sensitivity = 70%, specificity = 76.92%, positive predictive value = 70%, negative predictive value = 100% and accuracy of the test = 85%). Comparably, Wasan Ismail Al-Saadi[30] conducted a case control study with 30 patients for each group, she found at cut-off point of 58.5 ° for α angle during Valsalva (sensitivity = 96.7%, specificity = 96.7%) and of 141.5 ° for β angle during Valsalva (sensitivity = 73.3% and specificity = 80). This makes α angle during Valsalva a reliable diagnostic parameter for SUI.

The reverse for rotational angles, the study found β rotational angle at cut-off point of 19 ° had outstanding diagnostic performance for SUI, with excellent accuracy measurements (sensitivity = 94.44%, specificity = 86.36%, positive predictive value = 85%, negative predictive value = 100% and accuracy of the test = 90%). But for α rotational angle at cut-off point of 16 °, the study showed excellent diagnostic performance with lesser accuracy measurements than β rotational angle (sensitivity = 65%, specificity = 74.07%, positive predictive value = 65%, negative predictive value = 100% and accuracy of the test = 82.5%). While Turkoglu et al[11] found the cut-off point of α rotational angle of 16°, up to date no published study clearly defines the cut-off point of β rotational angle, However, Dong et al[2] found that retro-vesical angle (closely related to β rotation) had a cut-off value of 10.7° for differentiating women with SUI from continent controls, with 72%

sensitivity and 54% specificity. This disparity could be happened due to the difference of patient positioning, bladder volume and ultrasound used technique.

Likewise, the study discovered at cut-off point of 15 °, bladder neck descent showed outstanding diagnostic performance with the highest sensitivity, specificity and overall accuracy among all parameters studied (sensitivity = 95%, specificity = 95.23%, positive predictive value = 95%, negative predictive value = 100% and accuracy of the test = 97.5%). Turkoglu et al[11] found in his dynamic pelvic floor ultrasound retrospective study, the cut-off point determined for BND in the diagnosis of SUI was >11mm (90% sensitivity, 98% specificity).

5. CONCLUSION

Based on the study findings, the study concludes that:

1- Trans-perineal pelvic floor ultrasonography is a useful, non-invasive imaging technique for the assessment and diagnosis of stress urine incontinence.

2- Ultrasonographic parameters examined during the Valsalva maneuver were considerably more informative than those obtained at rest. Patients with SUI had significantly higher α and β urethral angles at Valsalva, urethral rotation angles, and bladder neck descent compared to continent women. At rest, α and β angles were not substantially obvious, emphasizing the significance of dynamic assessment.

3- Bladder neck descent is the most significant independent predictor of SUI, followed by β urethral rotation angle and α urethral rotation angle.

4- The diagnostic performance measures of ultrasound parameters demonstrated favorable ranges. The sensitivity and specificity were lowest for the α urethral rotation angle at a cut-off ≥ 76° and highest for bladder neck descent at a cut-off ≥ 15 mm. At the same cut off points, the positive predictive value was generally lower for urethral rotation measurements and higher for bladder neck descent and the α angle at Valsalva. On the other hand, the negative predictive value remained consistently high across all parameters, indicating a strong ability to exclude stress urinary incontinence in negative cases. Overall diagnostic accuracy was highest for bladder neck descent, followed by the α urethral angle at Valsalva and the β urethral rotation angle.

5- Women with SUI had significantly higher body mass index, parity, vaginal method of birth, and postmenopausal status than controls, indicating the multifactorial nature of the condition.

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Conflict of intertest

About this study, the authors disclose no conflicts of interest.

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