Research Article

Urethral Mobility Ultrasound: A Comparable Diagnostic Method for Urethral Hypermobility in Indonesian Women with Stress Urinary Incontinence

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Abstract

Urethral hypermobility is the primary mechanism of stress urinary incontinence. In Indonesia, the prevalence of SUI (stress urinary incontinence) is approximately 13% (the other 16% had mixed urinary incontinence). To diagnose urethral hypermobility, the Q-tip test is performed, but it can provoke discomfort. Urethral mobility ultrasonography (UMU) has emerged as a non-invasive, more comfortable alternative, with high accuracy. This study reports the concordance of the evaluations in Indonesian women with SUI, to evaluate the accuracy of UMU compared with the Q-tip test in diagnosing urethral hypermobility among Indonesian women with SUI. A cross-sectional study was conducted at the outpatient clinic of RSUPN Dr Cipto Mangunkusumo and at the Jakarta Urogynecology (JUN) Centre-YPK Mandiri Hospital during the January – December 2024 period. Thirty-six SUI women without symptomatic pelvic organ prolapse (POP) completed the study. Each subject underwent a Q-tip test and ultrasonographic evaluation of urethral mobility. Ultrasonographic assessment of urethral mobility demonstrated high sensitivity (92.6%) but low specificity (33.3%) compared to the Q-tip test. The positive predictive value (PPV) of UMU was 80.6%, while the negative predictive value (NPV) was 60%. The concordance value was 77.8%. 16.67% of patients reported discomfort and pain during the Q-tip test and required medication to manage their symptoms. In those women, the Qtip test was negative but may reflect bias/false negatives, which can affect ultrasound specificity. With 80.6% PPV, 60% NPV, and 77.8% concordance, UMU may serve as a practical alternative to the Q-tip test in daily clinical practice.
Keywords: *urethral hypermobility, ultrasound, urinary incontinence.*

Ultrasonografi Pergerakan Uretra: Metode Diagnostik Setara untuk Hipermobilitas Uretra pada Perempuan Indonesia Inkontinensia Urin Tekanan

Abstrak

Hipermobilitas uretra merupakan mekanisme utama inkontinnesia urin tekanan (IUT). Di Indonesia prevalensi IUT 13% (16% lainnya memiliki inkontinensia urin campuran). Untuk mendiagnosis hipermobilitas uretra dilakukan tes Q-tip, namun pemeriksaannya menimbulkan ketidaknyamanan. Ultrasonografi pergerakan uretra (UPU) merpakan alternatif pemeriksaan non invasif, lebih nyaman, dengan akurasi baik. Studi ini melaporkan akurasi dan konkordansi pemeriksaan tersebut pada perempuan Indonesia dengan IUT. Studi dilakukan secara potong lintang pada pasien rawat jalan RSUPN Dr. Cipto Mangunkusumo, dan Jakarta Urogynecology (JUN) Center-*RS YPK Mandiri, January – Desember 2024. Tiga puluh enam perempuan tanpa keluhan prolaps organ panggul menyelesaikan studi (dilakukan pemeriksaan Q-tip dan UPU). Pemeriksaan UPU menunjukkan sensitivitas tinggi 92,6% namun spesifisitas rendah 33,3% dibandingkan Q-tip. Nilai prediksi positif (NPP) 80.6%, sedangkan nilai prediksi negatif (NPN) 60%. Nilai Konkordansi 77,8%. Terdapat 16,67% subjek mengeluhkan ketidaknyamanan dan nyeri pada pemeriksaan Q-tip, membutuhkan medikasi. Mereka memiliki hasil Q-tip negatif, namun menyiratkan potensi adanya bias negatif, yang dapat menurunkan spesifisitas UPU. Disimpulkan bahwa dengan NPP 80,6%, NPN 60% NPV, dan konkordansi 77,8%; UPU memberikan diagnosis hipermobilitas uretra yang lebih nyaman dengan akurasi yang dapat diterima pada perempuan IUT.*
Kata kunci*: hipermobilitas uretra, ultrasonografi, inkontinensia urin.*

Introduction

Stress urinary incontinence (SUI) is the involuntary leakage of urine during physical activity, such as sneezing or coughing. This condition significantly impacts quality of life (QoL), affecting daily activities and social interactions. Studies report a prevalence of urinary incontinence at 53%, with SUI being the most common subtype affecting 26% of women (with 16% others having mixed urinary incontinence) in the U.S.[1] In Indonesia, the prevalence of SUI is around 13%.[2] Urethral hypermobility, as evaluated by urethral mobility ultrasonography (UMU), contributes to SUI.[3] Ultrasound imaging has also been established as the first-line modality for assessing urinary incontinence.[4] The primary pathophysiology of SUI is urethral hypermobility, commonly assessed using the Q-tip test.[5] This test involves inserting a cotton swab into the urethra to measure urethral angle displacement during straining. A displacement of more than 30° indicates significant hypermobility.[6] However, the Q-tip test may cause discomfort and pain, and potentially lead to suboptimal examination. Urodynamic studies provide an alternative, but are costly and not widely available.

UMU has emerged as a non-invasive and reliable method for evaluating urethral hypermobility. Studies have shown that bladder neck descent measurements via UMU can effectively predict urethral hypermobility. Moegni-Meria[8] reported that bladder neck descent >20.8 mm was correlated with SUI in Indonesian women. In Turkish women, bladder neck descent (BND) >11 mm (90% sensitivity, 98% specificity) and Rα (resting urethral angle) >16° (80% sensitivity, 98% specificity) compared to the Qtip test.[7] Santoso-Rinaldi[9] reported that urethral rotational angle >41.56° correlated with SUI with sensitivity 76,8% and specificity 67,9% in Indonesian women with pelvic organ prolapse (POP). Another report with an Arabic population reported that angle 19.43° (p <0.001) correlated with SUI,[10], while another reported 45° with 67.2% sensitivity and 78.8% specificity.[11] Santoso-Rinaldi[9] reported that a retrovesical angle of 130.57° correlated with SUI in Indonesian women with POP (sensitivity 64.3% and specificity 55.4%). Others reported that >141.5° correlated with SUI, with sensitivity 73.3% and specificity 80% (in women without POP).[10]

These variations underscore the importance of region-specific cutoffs in diagnoses. However, morphological differences among ethnic groups may influence bladder neck mobility, necessitating population-specific studies. To date, no studies have assessed the accuracy of UMU compared to the Q-tip test in Indonesian women with SUI.

Methods

This study is a diagnostic test study with a cross-sectional design conducted in the outpatient clinic of RSUPN Dr Cipto Mangunkusumo and the Jakarta Urogynecology (JUN) Centre-YPK Mandiri Hospital from January to December 2024. Inclusion criteria were women aged 20–80 years old with SUI (one-hour pad weight test ≥3 g). Individuals who had symptomatic pelvic organ prolapse, were currently (within the last 3 months) undergoing treatment for SUI, or had undergone previous continence correction surgery, were excluded. After providing informed consent, each underwent evaluation for urethral hypermobility using urethral mobility ultrasound (UMU) and the Q-tip test. Different examiners performed the evaluations. Participants will be considered dropouts if they are unwilling or unable to complete the examination process.

Urethral mobility ultrasonography was performed in the dorsal lithotomy position after spontaneous voiding. Initial resting-state scanning was compared with valsava scanning. We use smart pelvic® software from Mindray on the Resona 7 machine or the Nuewa i9 machine, with a volumetric probe covered by a condom and ultrasound gel. The software helps us calculate the bladder neck descent (BND), retrovesical angle (RVA) in the Valsalva state, and urethral rotational angle (URA). For UMU, any one of three parameters exceeding the cutoff value (BND >20.8mm, RVA >141°, or URA >19.43°) is categorized as urethral hypermobility.

The Q-tip test (cotton swab test) was performed in dorsal lithotomy position, with lidocaine gel inserted through the urethra before a

sterile baby's cotton bud was inserted into the bladder, then withdrawn to the urethrovesical junction. Then arc is placed behind the cotton bud and subject performed valsava. Cotton bud deviation >30° was considered positive for urethral hypermobility.[6]

The collected data were processed and analyzed using SPSS version 20. The study received ethical approval from the Ethical Commission of the Faculty of Medicine, University of Indonesia (KET.1727/UN2.FI/ETIK/PPM.00.02/2023) and research funding from Dr Cipto Mangunkusumo Hospital 2024 (NoIR.03.01/D.IX.2.3/485/2023).

Results

In this study, 36 subjects completed the examination and were analyzed. The characteristics of these subjects are shown in Table 1.

Women dominated our population in 41-80 year old (mean was 45.61 years old), obese (mean BMI was 28.69 kg/m^2), multiparous (66.6 % had ≥2 deliveries), pre menopause (63.9 %), and generally healthy (72.2% had no significant history of illness). There were 86.11% SUI women with urethral hypermobility according to UMU, compared to 75.00% according to the Q-tip test. Table 2 compares the findings. We measured the statistical suitability of UMU for the Q-tip test in Table 3.

Table 2 demonstrated an intrinsic accuracy (Sensitivity: 92.6%, Specificity: 33.3%) that resulted in observed clinical relevance within the study population (Positive Predictive Value: 80.6%, and Negative Predictive Value: 60.0%).

Six women complained of discomfort during the Q-tip test. They took 10 minute rest, given an additional dose of lidocaine gel, then the Q-tip test was resumed. However, the insertion of the cotton bud was not optimal, as they still complain of mild discomfort. After the procedure, they still had slight complaints (mild pain, mild soreness, holding back urination, burning urination or incomplete urination). They were given mefenamic acid tablet. All of them had negative urethral hypermobility on the Q-tip test.

Discussion

Based on the distribution of subject characteristics, the majority of patients in this study were in the peri-menopausal phase (ages 41–80 years), accounting for 83.3%, compared to those in the reproductive phase (16.7%). Age is associated with SUI, influenced by hormonal changes, particularly the decline in estrogen levels, which commonly begins between ages 40 and 50.[12] This decrease in estrogen affects the integrity of connective tissues and the physiological function of the pelvic floor. This structural deterioration allows the bladder neck and proximal urethra to rotate more during rises in intra-abdominal pressure. A study by Allafi et al[12] reported that the prevalence of SUI among menopausal women ranges from 13.6% to 84.4%; the prevalence increases according to age and menopausal status. In this study, although most subjects were in the peri-menopausal phase, 63.9% had not yet reached menopause, while 36.1% were postmenopausal. Given that menopause typically occurs between ages 48 and 50[12], a decline in estrogen levels may have already begun in many of these participants.

Obesity, along with being overweight, is a risk independent of female urinary incontinence.[14] Obesity contributes to SUI by increasing intra-abdominal pressure, leading to increased bladder pressure and urethral mobility. Additionally, excessive intra-abdominal pressure can damage nerves, muscles, and connective tissue in the pelvic floor, leading to bladder neck descent and urethral rotation. These changes lead to urethral hypermobility, a primary pathophysiology of SUI. In this study, 77.7% of subjects had a BMI ≥25 kg/m², and 38.8% had a BMI ≥30 kg/m². Huang He et al[16] also identified several significant risk factors for SUI, including a body mass index (BMI) ≥24 kg/m² (OR 2.02, CI 95%), diabetes mellitus (OR 4.65, CI 95%), and vaginal delivery (OR 2.47, CI 95%).

Table 1. Subject Characteristics

Subject Characteristics	Frequency	Percentage	Mean (±SD)/Median (Min-Max)
Age			45.61(±8.32)
Age 20 – 40	6	16.7	
Age 41 – 80	30	83.3	
Body Mass Index (BMI)			28.69 (±4.26)
Education			
Below university	28	77.8	
University	8	22.2	
Family Income			
<3,9 million	22	61.1	
3,9 – 10 million	11	30.6	
>10 million	3	8.3	
Menopause			
No	23	63.9	
Yes	13	36.1	
Nutritional Status			
19 – 22,9	3	8.3	
23 – 24,9	5	13.9	
25 – 29,9	14	38.9	
>30	14	38.9	
History of Illness			
No	26	72.2	
Asthma	1	2.8	
Diabetes Mellitus and hypertension	2	5.6	
Hypertension	5	13.9	
Hypertension post-catheterization	1	2.8	
Benign Ovarian cyst	1	2.8	
History of Hysterectomy			
No	36	100	
Yes	0	0	
History of Spontaneous Labour			
No	7	19.4	
1x	5	13.9	
2x	12	33.3	
>2x	12	33.3	
History of Vacuum Delivery			
No	34	94.4	
Yes	2	5.6	
History of Forceps Delivery			
No	35	97.2	
Yes	1	2.8	
History of Caesarean Delivery			
No	32	88.9	
1x	1	2.8	
2x	2	5.6	
>2x	1	2.8	
Cystocele			
Not Cystocele	1	2.8	
Grade 1	2	5.6	
Grade 2	31	86.1	
Grade 3 (Asymptomatic)	2	5.6	
Pad Test			
2 – 10g	31	86.1	
11 – 50g	4	11.1	
>50g	1	2.8	
Bladder Neck Descent (BND)[8]			2.94 (0.39-35.90)
<20.8mm	23	63.9	
>20.8mm	13	36.1	
Retrovesical Angle (RVA)[10]			134.03 (36.35)
<141°	22	61.1	
>141°	24	38.9	
Uretrhal Rotational Angle (URA)[10]			45.94 (±30.33)
<19°	7	19.4	
>19°	29	80.6	
Funneling			
No	33	91.7	
Yes	3	8.3	

Table 2. Urethral Hypermobility Findings

Urethral Hypermobility	Freq	Percentage
Urethral Mobility Ultrasound		
Urethral hypermobility	31	86.11
No urethral hypermobility	5	13.89
Q-tip Test		
Urethral hypermobility	27	75.00
No urethral hypermobility	9	25.00

Table 3. Correlation of UMU and Q-tip test

Hypermobility on UMU	Hypermobility on Q-tip		Kappa	p	Concordant	
	Yes	No			%	Ratio
Urethral hypermobility	25	6	0.304	0.051	77.8	3.5 x
No urethral hypermobility	2	3				

Vaginal delivery is a mechanical factor contributing to urethral hypermobility and SUI. During childbirth, especially when delivering the baby's head—the most significant part of the body—the pelvic floor muscles undergo extreme stretching, potentially causing levator ani (LA) muscle injury and damage to anatomical support structures. Such trauma results in urethral hypermobility, a key factor in SUI development. Additionally, prolonged stretching of the LA muscle during labour can lead to pudendal nerve injury, resulting in long-term impairments in continence mechanisms. In this study, 80.5% of subjects had experienced vaginal delivery, and 66.6% had given birth at least twice. Instrumental deliveries also occurred, with 2.8% of subjects undergoing forceps-assisted delivery and 5.6% undergoing vacuum-assisted delivery. A prospective 4-D transvaginal ultrasound study of 488 first-time mothers showed a generalised rise in bladder-neck and proximal-urethral excursion four months postpartum, with the most significant shifts observed after instrumental deliveries compared with caesarean section.[15] A first vaginal delivery—especially when vacuum/ forceps-assisted—measurably increases bladder-neck excursion on four-dimensional ultrasound.[15] High body-mass index adds chronic intra-abdominal pressure that further stretches peri-urethral fascia, and advanced anterior vaginal-wall prolapse correlates almost perfectly with large Q-tip angles. Vaginal delivery brings significant changes in proximal urethral mobility.[15] And the majority of our population were multiparous, consistent with previous findings.

Among the study participants, 72.2% had no comorbid conditions. Metabolic-endocrine disorders such as diabetes mellitus (DM) can exacerbate urinary symptoms. Intrinsic sphincter deficiency (ISD), which impairs urethral mucosal coaptation, is seen more in diabetic patients with urinary incontinence. DM also contributes to connective tissue stiffening, which could indirectly affect mechanical stability. Metabolic syndrome and obesity are known to involve chronically elevated abdominal pressure, which could also contribute to urethral hypermobility. In this study, diabetic subjects had controlled blood glucose levels with oral antidiabetic medications.

Regarding the diagnostic accuracy of UMU for bladder neck mobility, the study found that UMU had high sensitivity (92.6%) but low specificity (33.3%). This suggests that while UMU is highly effective in detecting urethral movement, it is less specific in confirming its absence. The PPV was high (80.6%), and the NPV was moderate (60%), indicating that UMU is reliable in predicting urethral hypermobility. These findings contrast with a study by Long et al[17], which reported a sensitivity of 76.5%, specificity of 93.3%, PPV of 95.1%, and NPV of 52%. Differences in population characteristics may explain the variation, as the current study had a higher average BMI (>26.2 vs 25.5 in Long's study) and a younger mean age (42.2 vs. 54.5 years). Additionally, Long et al[17] used a 13.3 mm

cutoff for urethral hypermobility, whereas this study used a 20.8 mm cutoff, which could have influenced the results. However, Long's study had a larger sample size (132 subjects), making it potentially more representative. However, in our population, 16.67% had discomfort and pain during the Q-tip test, which may have contributed to the low specificity rate in our data. Despite these differences, the correlation coefficient (Kappa = 0.304) and the concordance value of 77.8% in this study were comparable to Long's Pearson coefficient (0.91), indicating acceptable agreement.

Turkoglu et al[7] defined a BND threshold of >11 mm for diagnosing urethral hypermobility, with a sensitivity of 90% and specificity of 98%. Their study also emphasised changes in α and β angles (retrovesical angle) during the Valsalva manoeuvre, finding a strong correlation between urethral rotation and the Q-tip test (r = 0.890, p = 0.000). Differences in cutoff values may explain discrepancies in findings. Turkoglu et al[18] also noted that UMU was significantly less painful than the Q-tip test, aligning with this study's findings that 16.67% of subjects experienced post-procedural pain requiring medication. A meta-analysis by Chen reported that UMU parameters in SUI patients were significantly different to those of women with continence, which illustrated the potential value of transperineal ultrasound in diagnosing SUI.[18]

Additionally, 16.67% of subjects had suboptimal Q-tip test results, as six subjects with a positive pad test (≥3 g) had negative Q-tip test findings. This raises concerns about potential false negatives due to technical limitations, such as improper insertion depth of the cotton swab, which may have reached only the distal urethra instead of the bladder neck. This technical challenge in the Q-tip test could explain the higher proportion of subjects classified as hypermobile by UMU (86.11%) compared to the Q-tip test (75%). This is directly proportional to the previous study, which showed that roughly 85% of women with stress urinary incontinence leak primarily because of urethral hypermobility. In contrast, only about 15% have pure intrinsic sphincter deficiency.[5] It is supported by another study, indicating that 72% of cases involved pure urethral hypermobility, while 28% involved a combination of hypermobility and ISD.[19] This suggests that in clinical practice, the Q-tip test's technical challenges may make UMU a reliable diagnostic alternative to the Q-Tip test for the assessment of urethral hypermobility and is preferred by women.

Another factor influencing study results is the high probability of urethral hypermobility in the study population. With a high prevalence of hypermobility in SUI cases, identifying subjects without hypermobility was difficult, leading to an imbalance in the 2×2 contingency Table. This imbalance likely affected specificity and predictive value as well. From an operational standpoint, the goal of this study was to improve healthcare quality by providing a more accurate and more comfortable assessment of urethral hypermobility. Despite its higher cost, UMU appears to be a viable alternative to the Q-tip test, given its superior predictive value and patient comfort. Moreover, ultrasound evaluation is covered by the national health service for the public.

Study limitations include the small sample size and potential inconsistencies in Q-tip test administration. The evaluation was conducted across two centres, which may limit generalizability. The UMU evaluation was performed by a single urogynecologist using the same smart-measurement software, which helps us maintain consistency among evaluations. As the Indonesian UMU cutoff values have not yet been validated, future research should address these issues and establish population-specific UMU cutoff values for Indonesian women.

Conclusion

This study concludes that urethral mobility ultrasound has a sensitivity of 92.6% and a specificity of 33.3% compared to the Q-tip test, with a positive predictive value (PPV) of 80.6% and a negative predictive value (NPV) of 60%. The kappa value for urethral mobility ultrasound was 0.304, and the concordance value was 77.8%. Additionally, 16.67% of subjects reported discomfort and pain during the Q-tip test, leading to suboptimal examinations and requiring medication for symptom relief.

Given these findings, urethral mobility ultrasound, with its high sensitivity, is valuable in diagnosing urethral hypermobility. However, its relatively low specificity and NPV should be addressed by integrating other clinical findings. Further research is recommended to establish appropriate cutoff values for UMU parameters in Indonesian women.

Ethics Statement

The study received ethical approval from the Ethical Commission of the Faculty of Medicine, University of Indonesia (KET.1727/UN2.FI/ ETIK/PPM.00.02/2023) and research funding from Dr Cipto Mangunkusumo Hospital 2024 (NoIR.03.01/D.IX.2.3/485/2023).

Consent for Publication

No personal data/ image attached.

Conflict of Interest

The authors have no conflict of interest to declare.

Authors' Contributions

Gita Nurul Hidayah contributed to study design, data collection, data analysis, manuscript writing, and approval. Ferry Hidayat contributed to manuscript writing and approval. Jesica Angelina contributed to manuscript writing and approval. Fernandi Moegni contributed to the study design and approval.

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Availability of Data and Materials

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. Lee UJ, Feinstein L, Ward JB, Kirkali Z, Martinez-Miller EE, Matlaga BR, et al. Prevalence of urinary incontinence among a nationally representative sample of women, 2005–2016: findings from the Urologic Diseases in America Project. J Urol. 2021;205:1718-24. doi: 10.1097/JU.0000000000001634
2. Sumardi R, Mochtar CA, Junizaf J, Santoso BI, Setiati S, Nuhonni SA, et al. Prevalence of urinary incontinence, risk factors and its impact: multivariate analysis from Indonesian nationwide survey. Acta Med Indones. 2014;46:175-82.
3. Pająk PM, Wlaźlak E, Surkont G, Kalinka J. An assessment of the relationship between urethral hypermobility as measured by ultrasound and the symptoms of stress urinary incontinence in primiparous women 9-18 months postpartum. J Ultrason. 2024;24:20240010. doi: 10.15557/jou.2024.0010
4. Yang JM, Huang WC. Ultrasound in female urinary incontinence. J Med Ultrasound. 2024;32:14-20. doi: 10.4103/jmu.jmu_25_23
5. Rackley RR, Appell RA. Evaluation and medical management of female urinary incontinence. Cleve Clin J Med. 1997;64:83-92. doi: 10.3949/ccjm.64.2.83
6. Pal M, Halder A, Bandyopadhyay S. Approach to a woman with urinary incontinence. Urol Ann. 2020;12:4-8. doi: 10.4103/ua.Ua_50_19
7. Turkoglu A, Coskun ADE, Arinkan SA, Vural F. The role of transperineal ultrasound in the evaluation of stress urinary incontinence cases. Int Braz J Urol. 2022;48:70-7. doi: 10.1590/S1677-5538.IBJU.2020.1100
8. Meria R, Junizaf, Moegni F. Perbandingan mobilitas leher kandung kemih penderita inkontinensia urin jenis stres dan kontinensia melalui pencitraan ultrasonografi [Tesis]. Jakarta: Program Studi Obstetri dan Ginekologi, Fakultas Kedokteran Universitas Indonesia; 2015.
9. Rinaldi A, Santoso BI, Prihartono J, Djusad S, Priyatini T, Moegni F. Hubungan antara profil pergerakan leher kandung kemih (bladder neck descent, retro vesical angle, rotational urethra, funneling), prolaps kompartemen anterior (pop-q titik aa & ba) dengan inkontinensia urin jenis tekanan pada pasien prolaps organ panggul di Rumah Sakit Cipto Mangunkusumo [Tesis]. Jakarta: Program Studi Obstetri dan Ginekologi, Fakultas Kedokteran Universitas Indonesia; 2019
10. Al-Saadi WI. Transperineal ultrasonography in stress urinary incontinence: The significance of urethral rotation angles. Arab J Urol. 2016;14:66-71. doi: 10.1016/j.aju.2015.11.003

11. Xiao T, Xiao T, Chen Y, Gan Y, Xu J, Huang W, et al. Can stress urinary incontinence be predicted by ultrasound? AJR Am J Roentgenol. 2019;213:1163-9. doi: 10.2214/AJR.18.20893
12. Allafi AH, Al-Johani AS, Babukur RM, Fikri J, Alanazi RR, Ali SDMH, et al. The link between menopause and urinary incontinence: a systematic review. Cureus. 2024;16:e71260. doi: 10.7759/cureus.71260
13. Zbucka-Kretowska M, Marcus-Braun N, Eboue C, Abeguile G, Wolczynski S, Kottler ML, et al. Expression of estrogen receptors in the pelvic floor of pre-and post-menopausal women presenting pelvic organ prolapse. Folia Histochemic Cytobiol. 2011;49:521-7. doi: 10.5603/fhc.2011.0073
14. Shang X, Fu Y, Jin X, Wang C, Wang P, Guo P, et al. Association of overweight, obesity and risk of urinary incontinence in middle-aged and older women: a meta epidemiology study. Front Endocrinol. 2023;14:1220551. doi: 10.3389/fendo.2023.1220551
15. Shek KL, Dietz HP, Kirby A. The effect of childbirth on urethral mobility: a prospective observational study. J Urol. 2010;184:629-34. doi:10.1016/j.juro.2010.03.135
16. Huang H, Ding G, Li M, Deng Y, Cheng Y, Jin H. Menopause and stress urinary incontinence: the risk factors of stress urinary incontinence in perimenopausal and postmenopausal women. J Obstet Gynaecol Res. 2023;49:2509-18. doi: 10.1111/jog.15742
17. Long CY, Loo ZX, Wu CH, Lin KL, Yeh CL, Feng CW, et al. Relationship between Q-Tip test and urethral hypermobility on perineal ultrasound. J Clin Med. 2023;12:4863. https://doi.org/10.3390/jcm12144863
18. Chen Y, Peng L, Liu M, Shen H, Luo D. Diagnostic value of transperineal ultrasound in patients with stress urinary incontinence (SUI): a systematic review and meta-analysis. World J Urol. 2023;41:687-93. doi: 10.1007/s00345-022-04264-0
19. Kayigil Ö, Ahmed SI, Metin A. The coexistence of intrinsic sphincter deficiency with type ii stress incontinence. J Urol. 1999;162:1365-6.