

The Prevalence of Urinary Incontinence and Associated Risk Factors in Taiwanese Women with Lower Urinary Tract Symptoms

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Background: To analyze the urodynamic-defined prevalence of urinary incontinence and the associated risk factors in Taiwanese women with lower urinary tract symptoms (LUTS).

Methods: We reviewed the medical records of 4,470 women who were referred to our urodynamic center between January 1999 and May 2003. Their records including a comprehensive medical history, physical examination, bladder diary and results of multi-channel urodynamic testing were analyzed.

Results: 3,161 of 4,470 women recruited were eligible for the analyses. The distribution of urodynamic prevalence in 3,161 women revealed that urodynamic stress incontinence (USI) was 1,755/3,161 (55.5%), detrusor overactivity (DO) 231/3,161 (7.3%), mixed incontinence (MI) 142/3,161 (4.5%), voiding dysfunction (VD) 793/3,161 (25.1%) and normal result (N) 240/3,161 (7.6%). The highest prevalence of USI was observed in women aged 40-49 (40.3%) and the prevalence of DO and MI seemed to be lower as compared with the literature reports. Linear regression analysis showed parity ($p < 0.001$) and three urodynamic study (UDS) variables [maximum free flow rate ($p = 0.003$), maximum urethral closure pressure ($p = 0.003$) and functional profile length ($p = 0.014$)] were significantly related to the urinary incontinence in women with LUTS. Menopause ($p = 0.865$) had no impact on the urinary incontinence.

Conclusion: Risk factors contributing to Taiwanese women with LUTS to develop urinary incontinence included multiparity and three specific parameters observed during UDS. Of interest, our data also indicated 25% of patients were diagnosed as voiding dysfunction deserved future study.

(*Chang Gung Med J 2006;29:596-602*)

Key words: lower urinary tract symptoms, urodynamic study, urodynamic stress incontinence, detrusor overactivity, voiding dysfunction.

Urodynamic study (UDS) is used to determine the underlying causes of the complaints in patient

with lower urinary tract symptoms (LUTS). General conclusions show that urodynamic studies define the

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Received: Mar. 2, 2006; Accepted: May 1, 2006

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underlying pathophysiology, which facilitates better treatment of symptoms.⁽¹⁻⁴⁾ It is indispensable to recognize the nature of the patient's complaints and to use urodynamic evaluation as a provocative test to reproduce the symptoms. Lower urinary tract symptoms have a high prevalence in the community and pose a detrimental impact on the quality of life. Therefore, these problems deserve further investigation.

Graham's study of 315 women found risk factors for and conditions of urinary incontinence differed significantly between African-American and Caucasian women.⁽⁵⁾ Problems in Taiwanese women with LUTS had never been evaluated, and previous UDS in Taiwanese women only provided basic information.^(6,7) The purpose of our study was to disclose the prevalence of urinary incontinence and associated risk factors in Taiwanese women with LUTS.

METHODS

Patients

Between January, 1999 and May, 2003, a total of 4,470 women with lower urinary tract symptoms (nocturia, urgency, frequency, stress or urge urinary incontinence, incomplete emptying, and voiding difficulty) were referred to our urodynamic center. The mean age was 50 years (ranging 20-79 years), and mean parity was 3 (range 0-10). The patients were evaluated by history and physical examination, catheterized urinalysis and culture, one-hour pad test and post-void residual. All patients with evidence of urinary tract infection were treated before urodynamic study.

Exclusion criteria

Patients with conditions which included a prior continence procedure, with pelvic prolapse greater than stage II of the International Continence Society (ICS) grading system,⁽⁸⁾ hysterectomy, neurological deficit, and incomplete study were excluded. Thus, 3,161 of 4,470 women were eligible for this study.

Urodynamics

With a 6-channel recorder (Dantec, Skovlunde, Denmark), multichannel UDS was performed with patients in the sitting position. Tests included uroflowmetry, filling (provocative) and voiding cystometry, and a 1-hour pad test. All procedures were

done in accordance with the ICS.⁽⁹⁾ The bladder was filled to the maximum cystometric capacity with room temperature distilled water at a rate of 60 mL/minute through a 10F double-lumen perfusion catheter attached to an external pressure transducer, and an 18F rectal catheter (Dantec) to measure abdominal pressure. Perineal surface electrodes were used to monitor the electrical activity of the periurethral striated muscle.

Data collection

The following five groups of women were identified: Those with urodynamic stress incontinence (USI), detrusor overactivity (DO), mixed incontinence (MI), voiding dysfunction (VD) and normal (N).

Urinary incontinence group

Patients in the USI, DO and MI groups were grouped into the urinary incontinence group for the purposes of data analysis and statistics processing. The data from the one-hour pad test was used as a dependent variable to assess the severity of urinary incontinence.

Voiding dysfunction

Voiding dysfunction was defined as a maximal flow rate on noninvasive uroflowmetry of less than 15 ml per second with a volume of 150 ml, without concomitant incontinence and a sustained detrusor contraction of at least 20 cm H₂O with a flow rate of less than 12 ml per second.⁽¹⁰⁾

UDS data included uroflowmetry (maximum free flow rate [MFR], voided volume, and post-void residual [PVR]), provocative filling cystometry (first desire to void, maximum cystometric capacity) and voiding cystometry (maximum flow rate [Q_{max}], detrusor pressure at maximum uroflow [P_{det}Q_{max}]), and urethral pressure profilometry (maximum urethral closure pressure [MUCP], functional profile length on stress, and pressure transmission ratio). All procedures were performed by an experienced technician or physician, and the data were interpreted by other physicians not involved in the examination. The medical terminology was in accordance with the ICS.⁽⁹⁾

Statistical consideration

Values were given as mean \pm (SD). Linear

regression analysis and Spearman's correlation were performed on the variables that evaluated differences between groups as appropriate. All tests were performed using SPSS-PC software (SPSS, Inc., Chicago, IL). A P value < 0.05 was regarded as significant.

RESULTS

Of the 3,161 women who had UDS USI was found in 1,755 (55.5%), DO in 231 (7.3%), MI in 142 (4.5%), VD in 793 (25.1%) and N in 240 (7.6%). The Table summarizes the patient characteristics and urodynamic results. The mean age was 50 years, and mean parity was 3. We found that 2,128 (67.3%) patients with LUTS had urinary incontinence. Linear regression analysis showed parity ($p < 0.001$) and three UDS variables [MFR ($p = 0.003$), MUCP ($p = 0.003$) and functional profile length ($p = 0.014$)] were significantly related to urinary incontinence. Menopause ($p = 0.865$) had no effect on urinary incontinence in our study.

Fig. 1 illustrates the age distribution in the various urodynamic diagnosis groups. The highest prevalence of USI was observed in women from 40-49 years old (40.3%) (Fig. 1a.) Fig. 1b and 1c show the age distribution in the DO and MI groups. Fig. 1d presents the percentages of urinary incontinence in various age groups. The prevalence of DO and MI

seemed to be lower than in prior reports.^(6,11)

Fig. 2 depicts the relationship between MUCP and parity. There was a significant relationship between parity and the intensity of the MUCP ($p < 0.001$). A higher parity was associated with a lower urethral closure pressure.

DISCUSSION

To date, UDS has been unable to reflect the complete nature of disease in women with LUTS, but it seems to be the best way to evaluate the pathophysiology and to guide treatment. In our study we excluded women with conditions which required prior continence procedures, pelvic prolapse greater than stage II of the ICS grading system, hysterectomy or neurological deficit, which may have influenced our results.

Our understanding of the impact of incontinence in women has been greatly enhanced by the recent emergence of validated instruments. The use of patient-completed questionnaires serves the dual purpose of screening for and assessing the severity of disease. However, they do not offer quantitative measurement. The objective assessment of the severity of urinary incontinence in women is an essential measure in clinical research and the pad test is the most commonly employed method for assessing the amount of urine leakage.^(12,13) This is the reason we

Table. Patient Characteristics and Urodynamic Diagnosis.

	USI	DO	MI	VD	N
n (%)	1755 (55.5)	231 (7.3)	142 (4.5)	793 (25.1)	240 (7.6)
Age (y)	50.7 (10.6)	54.8 (14.6)	55.6 (13.9)	50.4 (13.1)	49.3 (12.1)
Parity (n)	3.5 (1.2)	3.6 (1.3)	4.1 (1.3)	3.2 (1.4)	3.1 (1.3)
Pad test (gm)	15.2 (12.3)	8.9 (5.7)	23.9 (16.5)	6.4 (1.7)	1.5 (1.2)
MFR (mL/sec)	24.2 (11.1)	18.2 (9.7)	21.1 (10.3)	18.1 (9.2)	23.1 (10.3)
Voided volume (mL)	340.5 (169.9)	245.3 (125.6)	250.3 (157.2)	250.1 (139.1)	348.6 (156.3)
PVR (mL)	38.3 (23.1)	55.1 (36.5)	44.7 (24.5)	56.2 (28.1)	34.9 (20.8)
FD (mL)	175.7 (125.4)	141.7 (116.9)	123.6 (80.7)	140.8 (95.2)	176.2 (90.2)
CC (mL)	427.5 (210.5)	306.6 (165.8)	286.7 (128.7)	333.8 (149.7)	440.2 (182.3)
MUCP (cm H2O)	81.5 (36.1)	82.5 (43.6)	68.6 (33.9)	92.8 (39.6)	97.7 (34.5)
FL (mm)	27.4 (13.4)	30.6 (14.4)	26.1 (9.7)	27.9 (11.3)	27.9 (9.7)
PTR (%)	46.1 (20.8)	57.1 (28.3)	38.8 (18.4)	48.2 (27.7)	49.6 (25.8)
Qmax (mL/sec)	14.8 (5.8)	11.1 (5.2)	13.1 (6.7)	11.6 (4.9)	14.6 (4.9)
PdetQmax (cm H2O)	21 (16.5)	24.1 (15.1)	22.3 (14.9)	24.5 (17.6)	22.1 (15.7)

Abbreviations: MFR: maximum free flow rate; PVR: post-void residual; FD: first desire to void; CC: maximum cystometric capacity; MUCP: maximum urethral closure pressure; FL: functional profile length on stress; PTR: pressure transmission ratio; Qmax: maximum flow rate on pressure-flow study; PdetQmax: detrusor pressure at maximum flow on a pressure-flow study Values are expressed in mean. (SD)

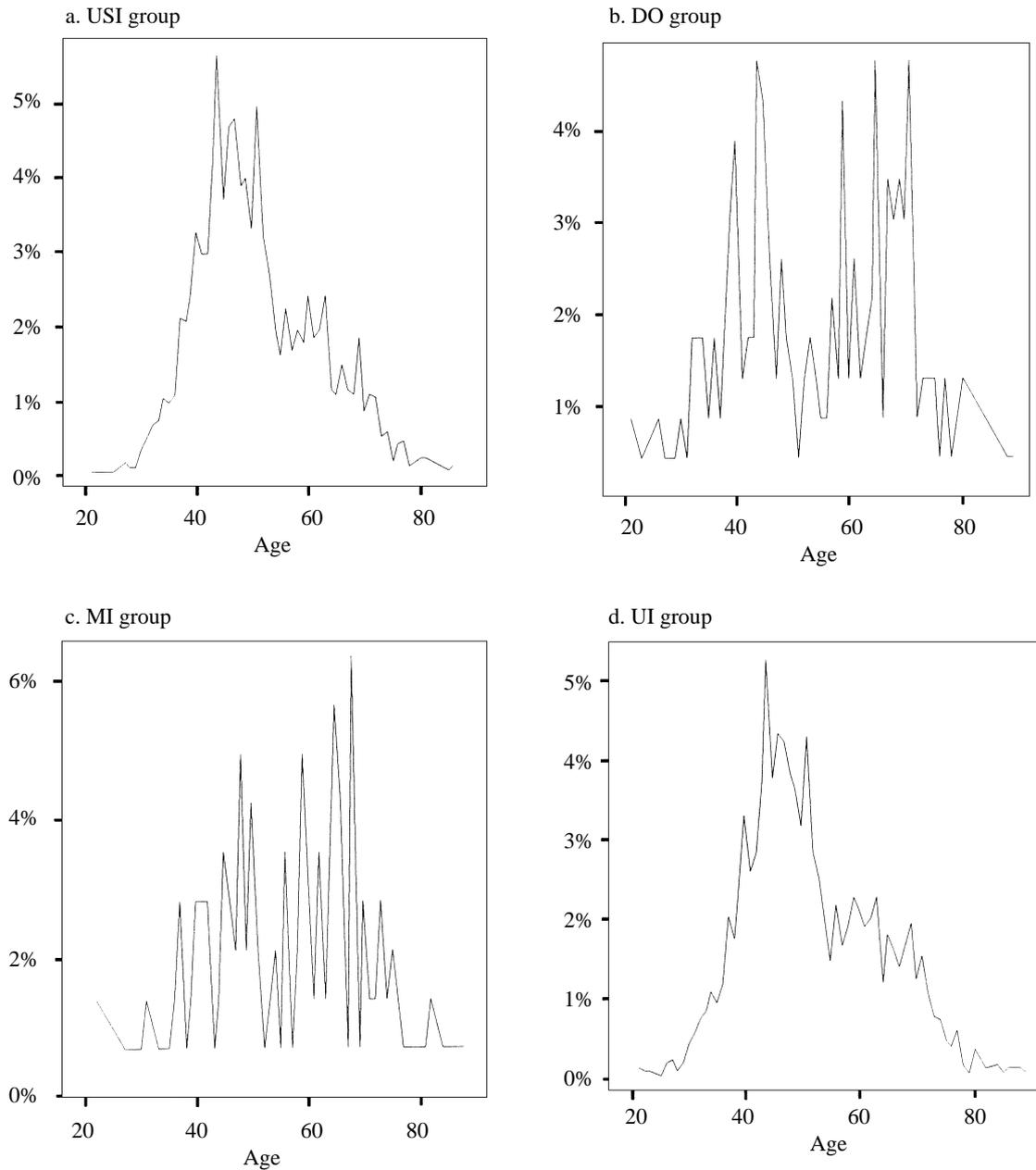


Fig. 1 The age distribution in the urodynamic diagnosis groups.

used the 1-hour pad test for interpretation of the symptom severity of urinary incontinence in our study.

The pad test did not meet scientific standards for test-retest reliability but offered a quantitative measure of urine leakage. In order to measure the real amount of urine leakage, we asked the patient

whether the results of the pad test corresponded with their usual symptoms and signs; if not, we repeated the test. Matharu's study of 341 women indicated that there was a positive relationship between the pad test and symptom severity.⁽¹⁴⁾ The results of the pad test in our study (USI: 15.2 ± 12.3 gm, DO: 8.9 ± 5.7 gm and MI: 23.9 ± 16.5 gm) were compatible with

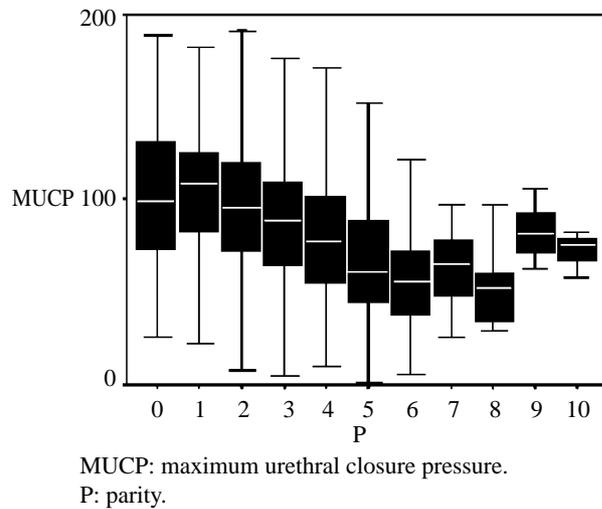


Fig. 2 Relationship between MUCP and parity

clinical findings which disclosed a proper selection for patient underwent UDS.

The distributions of UDS-defined prevalence in our study were inconsistent with previous reports.^(6,15) In Lin's study of 1,171 women, 56% had USI, 5.8% had DO, 16% had MI, 20.9% had VD, and 1.3% had normal urodynamic findings.⁽⁶⁾ That study also indicated female urinary incontinence had a biogenic peak prevalence in the 41-50 and 51-60 year age groups. The relative distributions of urodynamic prevalence in our study differed from Lin's report. We found peak prevalences for USI, DO and MI in the 40-49, 50-59 and 60-69-year age groups, respectively. We did not find a so-called biogenic peak. Klingele's study of 289 women found the distribution of urinary incontinence was evenly divided among USI, DO and MI, but he did not exclude women with pelvic floor prolapse.⁽¹¹⁾ In our study 240 women (7.6%) had normal UDS results. Most of these patients had recurrent urinary tract infections with some evidence that the symptoms were caused by *E. coli*.

In our study, 25% of patients were diagnosed with voiding dysfunction. The possible explanation may be one of the following: (1) Women in our study group voided by detrusor contraction, abdominal straining or some combination of the two while urethral pressure remained high (2) The use of a large catheter resulted in both a significant decrease in Qmax.p and increase in PdetQmax compared with a

small one⁽¹⁶⁾ (3) These women had a non-relaxing sphincter, which will be addressed in an ongoing study.

We found parity, and three UDS parameters (maximum free flow rate, MUCP and functional profile length) were significantly related to urinary incontinence, which is consistent with prior reports.^(15,17) Based on our study, parity had the greatest impact on all types of urinary incontinence. Damage to the pudendal nerve, which may occur during childbirth, can cause weakness and atrophy of the medial portions of the levator ani muscles as well as the voluntary muscles of the perineum. The damage may predispose a patient to vaginal support defects and decrease fast-twitch reflex pelvic muscle contraction, a factor that is believed to contribute to incontinence during stress. Substantial bladder neck hypermobility was present together with diminished functional urethral length and urethral closing pressure. Teleman et al. found that women with urinary incontinence had a significantly more efficient opening/emptying mechanism than healthy controls of the same age and parity, which is compatible with our finding on the correlation between UI and maximum flow rate.⁽¹⁸⁾

Our findings suggest the effect of menopause on urinary incontinence remains uncertain. Atrophic changes in the urethral epithelium and submucosa caused by menopause may increase susceptibility to LUTS. However, reports suggest the impact of menopause is controversial.^(7,19) Age was not a risk factor for urinary incontinence in our study, which is consistent with a prior report.⁽²⁰⁾ Older women are prone to LUTS due to concomitant diseases, such as hypertension, obesity, and diabetes mellitus.

Gynecologists tend to use MUCP to assess the stress incontinence severity during urodynamic study and prior reports confirm the correlation.^(21,22) It is generally agreed that stress urinary incontinence results from pelvic-floor trauma during vaginal delivery. Currently, there is no report evaluating the relationship between MUCP and parity. We found a significant association between parity and the intensity of MUCP ($p < 0.001$); a higher parity was associated with a lower urethral closure pressure, which is consistent with a previous report.⁽²³⁾ Childbirth induces substantial bladder neck hypermobility which diminishes urethral closing pressure and increases the incidence of urinary incontinence. A

study of 255 women without known neurological pathology, or pelvic or anti-incontinence surgery indicated that urethral closure pressure falls significantly when urethral hypermobility is present.⁽²³⁾ There is an inverse relationship between the degree of urethral hypermobility and the MUCP; higher hypermobility is associated with a lower urethral closure pressure.

In conclusion, the prevalence of urodynamic-defined urinary incontinence in Taiwanese women with LUTS differs from prior reports. The highest prevalence of USI was observed in women 40-49 years old (40.3%) and the prevalence of DO and MI seemed to be lower than in other reports. Risk factors contributing to the development of urinary incontinence in Taiwanese women with LUTS include multiparity and three parameters observed during UDS, maximum free flow rate, MUCP and functional profile length. Those associated risk factors highlighted in our study may offer clinical guidance and treatment strategies for both physicians and patients.

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婦女尿失禁之尿動力學評估及危險因子分析

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背景：至少有 40% 的女性有尿失禁的困擾，而且隨著年齡變化，比例也會持續上昇，尿動力學是診斷評估尿失禁最客觀及科學的方法，長久以來，台灣始終沒有對這方面的問題作深入的探討與研究，我們希望由回顧病歷的方式，能夠針對婦女尿失禁的分類及危險因子提供本土的資料。

方法：自 1999 年 1 月至 2003 年 5 月，由 4700 位婦女尿動力學檢查資料中，我們做了詳細的病歷回顧，並且排除病史中含前次尿失禁手術、重度骨盆脫垂、子宮切除及有神經性疾病者，一共有 3161 婦女被納入研究。

結果：我們的結果和之前的文獻記載不太一致，壓力性尿失禁佔了婦女尿失禁的 55%，其餘逼尿肌不穩定佔 7.3%，混合型尿失禁佔 4.5%，解尿障礙佔 25.1%。壓力性尿失禁在 40-49 歲族群中佔最多數，統計分析顯示，生產次數，三項尿動力學參數可以視為尿失禁之危險因子。

結論：台灣婦女尿失禁的分類和以往的文獻不太一致，尿動力學檢查結果中的特殊參數具有重要的參考價值。四分之一研究婦女有解尿障礙，值得進一步探討。本篇研究的結果可以是臨床醫師評估婦女尿失禁重要的依據。

(長庚醫誌 2006;29:596-602)

關鍵字：尿失禁，壓力性尿失禁，尿動力學檢查，生產。

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受文日期：民國95年3月2日；接受刊載：民國95年5月1日

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