Original Article

Identification of potential associated factors for stress urinary incontinence in women: a retrospective study

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Background: This study sought to analyze the potential associated factors for female stress urinary incontinence (SUI).

Methods: A total of 5,013 women were screened for pelvic floor function at the West China Second Hospital of Sichuan University from January 2015 to January 2019. Of these, 410 patients were diagnosed with SUI. A single-factor Chi-square test and multi-factor logistic regression analysis were conducted to examine the relationship between pre-pregnancy urinary incontinence, vaginal delivery, menopause, and hormone therapy, chronic cough, and smoking, and postpartum SUI.

Results: The postpartum SUI rate in patients with urinary incontinence during pregnancy was 19.33%, while that of patients without urinary incontinence was only 5.44%. The rates of urinary incontinence in patients experiencing vaginal delivery or cesarean delivery were 13.62% and 4.36%, respectively. The SUI incidences in patients with or without a family genetic history of SUI were 28.46% and 7.48%, respectively. The incidence rates of SUI in smoking and non-smoking patients were 18.92% and 8.39%. The rate of SUI in patients with chronic cough (16.46%) behaved significantly differently from those with non-chronic cough (8.21%). The occurrence of SUI was highly correlated with the following factors, including pre-pregnancy urinary incontinence (OR =5.256; 95% CI: 2.061–13.409; P<0.001), urological incontinence during the pregnancy period (OR =2.965; 95% CI: 2.111–4.163; P<0.001), vaginal delivery (OR =4.028; 95% CI: 2.909–5.577; P<0.001), and genetic history (OR =4.341; 95% CI: 2.8–6.73; P<0.001).

Conclusions: The occurrence of SUI is highly related to a history of urinary incontinence, the delivery mode, chronic cough, smoking, and genetic history. Further, urinary incontinence before and during pregnancy, natural delivery, and genetic history are important independent high-associated factors for SUI. Our findings show the importance of screening for the above associated factors in association with SUI.

Keywords: Stress urinary incontinence (SUI); incontinence; vaginal delivery; genetic history

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Introduction

Stress urinary incontinence (SUI) is a common gynecologic urinary disorder defined as involuntary urine outflow, which is characterized by the normal absence of enuresis and an automatic flow of urine following a sudden increase in abdominal pressure (1). The incidence of urinary dysfunction in adult females is approximately 33%, and 50% of urinary incontinence is SUI (2). At present, there is no ideal treatment for SUI. Surgery is a common treatment, however, it is extremely painful for SUI patients (3). There is therefore a need to explore risk factors for SUI in order to provide early intervention for patients.

The initiation and progression of SUI has been linked to age, being overweight, diabetes, and obstetric trauma (4,5). Further, vaginal delivery, menopausal and hormone therapy are known to affect the functionality of the inferior ureter (6,7). The multifactorial risk of SUI can be categorized into predisposing, triggering and dysfunctional factors that have been shown to have a very complex impact on the development of SUI (8). There are several limitations and shortcomings in the previous studies. In addition, the sampling methods of previous studies may not be representative of all women. Thirdly, the diagnosis of SUI in some studies was based on the patient's chief complaint without clinical examination data such as radiological or urodynamic findings. The current study sought to increase awareness of this common medical problem to improve the treatment effect.

Our present study showed that the occurrence of SUI was highly associated with a history of urinary incontinence, the delivery mode, chronic cough, smoking, and genetic history. Further, urinary incontinence before and during pregnancy, natural delivery, and genetic history were important independent high-associated factors for SUI. Our findings would provide the first screening for SUI-related relevant factors. We present the following article in accordance with the STROBE reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-22-3539/rc).

Methods

This hospital-based retrospective study analyzed the data of 5013 patients who presented with or without urinary incontinence from January 2015 to January 2019 at the West China Second Hospital of Sichuan University. The identification of SUI was dependent on the Guidelines for the diagnosis and treatment of female SUI. According to the classic symptoms of SUI, urine overflow occurs during varying levels of increased abdominal pressure (such as laughing, coughing, sneezing, or walking); the abnormal urine overflow disappeared if the pressure stopped. The divergent exposure factors included a history of urinary incontinence, age, body mass index (BMI), job (i.e., mental worker or manual worker), number of deliveries, the delivery method (i.e., Caesarean section or vaginal delivery), diabetes, hypertension, genetic history, smoking, chronic cough, and constipation. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Medical Ethics Association of West China Second Hospital of Sichuan University [2018.No.(069)]. All patients signed informed consent.

Statistical analysis

The patient characteristics were expressed as the absolute number (percentage) or mean ± standard deviation (SD). For those whose measurement data was normally distributed, the independent sample *t* test was used for those whose variances between groups were homogeneous. Count data and categorical variables were tested by chi-square test. The factors with P≤0.10 in univariate analysis were further included in multivariate logistic regression analysis. The relationship between pre-pregnancy urinary incontinence, vaginal delivery, menopause, and hormone therapy, chronic cough, smoking, and postpartum urinary incontinence was calculated. All statistical tests were 2-sided probability tests. P value <0.05 was considered statistically significant. Statistical analyses were conducted using SPSS26.0 software.

Results

The characteristics of patients in this study and potential associated factors for the occurrence of SUI

First, we conducted a single-factor analysis to identify the relevant factors related to SUI (*Table 1*). Among the patients diagnosed with SUI, the postpartum urinary incontinence rate of patients with urinary incontinence before pregnancy was 45.16%, while that of patients without urinary incontinence before pregnancy was only 6.73% (P<0.001). The postpartum urinary incontinence rate of patients with urinary incontinence during pregnancy was 19.33%, while that of patients without urinary incontinence during

Table 1 Patient features in this study, and potential associated factors for the occurrence of SUI based on a single-factor analysis

Patient features	Non-SUI	SUI	χ^2 value	P value
Urinary incontinence before pregnancy			63.6245	<0.0001
Negative	3,547	256		
Positive	17	14		
Urinary incontinence during pregnancy			116.8176	<0.0001
Negative	3,201	184		
Positive	363	87		
Age			0.0527	0.8184
<55 years	2,763	263		
≥55 years	1,818	169		
BMI			0.5597	0.4544
<25 kg/m^2	3,664	339		
≥25 kg/m^2	917	46		
Job			1.2491	0.2637
Mental worker	3,229	328		
Manual worker	376	46		
Number of deliveries			3.0686	0.0798
1	2,635	234		
2	1,848	196		
Delivery method			123.507	<0.0001
Caesarean section	2,304	105		
Vaginal delivery	1,922	303		
Diabetes			0.0775	0.7807
Negative	4,187	388		
Positive	253	22		
Hypertension			0.2489	0.6178
Negative	4,114	376		
Positive	69	5		
Genetic history			130.921	<0.0001
Negative	4,166	337		
Positive	176	70		
Smoking			3.9786	0.0331
Negative	4,400	403		
Positive	30	7		

Table 1 (*continued*)

Table 1 (*continued*)

Patient features	Non-SUI	SUI	χ^2 value	P value
Cough			6.8981	0.0086
Negative	4,358	390		
Positive	66	13		
Constipation			2.4143	0.1202
Negative	3,409	301		
Positive	1,029	109		

SUI, stress urinary incontinence.

Table 2 The multivariate logistic regression analysis indicated the independent associated factors for SUI

Item	OR	95% CI	P value
Urinary incontinence before pregnancy (positive *vs.* negative)	5.256	2.06–13.409	0.0005
Urinary incontinence during pregnancy (positive *vs.* negative)	2.965	2.111–4.163	<0.0001
Age (≥55 *vs.* <55 years)	0.792	0.558–1.123	0.1903
BMI (≥25 *vs.* <25 kg/m^2)	1.273	0.89–1.819	0.1862
Mental worker *vs.* manual worker	0.954	0.558–1.632	0.8636
Number of deliveries (2 *vs.* 1)	1.454	1.057–2.002	0.0216
Natural delivery *vs.* Caesarean section	4.028	2.909–5.577	<0.0001
Diabetes (positive *vs.* negative)	1.192	0.659–2.157	0.5612
Hypertension (positive *vs.* negative)	0.684	0.149–3.133	0.625
Genetic history	4.341	2.8–6.73	<0.0001
Smoking (positive *vs.* negative)	1.933	0.392–9.522	0.418
Cough (positive *vs.* negative)	1.432	0.514–3.992	0.4923
Constipation (positive *vs.* negative)	1.151	0.83–1.595	0.3992

SUI, stress urinary incontinence.

pregnancy was only 5.44% (P<0.001). The rates of urinary incontinence in patients experiencing vaginal delivery or cesarean delivery were 13.62% and 4.36%, respectively (P<0.001). The prevalence of urological incontinence in patients with or without a family genetic history of SUI were 28.46% and 7.48% (P<0.001). The prevalence of urological incontinence in smoking and non-smoking patients were 18.92% and 8.39%. The rate of SUI in patients with chronic cough (16.46%) behaved significantly differently from those with non-chronic cough (8.21%).

Multivariate logistic regression of the independent associated factors for SUI

Based on the single-factor analysis, to exclude the influence of confounding factors on the occurrence of SUI, we conducted a multi-factor logistic analysis. As *Table 2* shown, the multivariate logistic regression revealed that the occurrence of SUI was highly correlated with the following factors, including urinary incontinence before pregnancy [odds ratio (OR) =5.256, 95% confidence interval (CI):

2.061–13.409, P<0.001], urinary incontinence during pregnancy (OR =2.965, 95% CI: 2.111–4.163, P<0.001), vaginal delivery (OR =4.028, 95% CI: 2.909–5.577, P<0.001), and genetic history (OR =4.341, 95% CI: 2.8–6.73, P<0.001).

Discussion

Normally, the complete support of adjacent tissues of the posterior pubic urethra is necessary to maintain urine control under pressure (8,9). In cases of vaginal wall laxity and pelvic tissue damage, the contractile muscles of the pubococcygeus caudalis cannot act as maintenance and the urethra autonomously fails to close, leading to the development of urinary incontinence (10,11). Somewhat concerningly, the number of patients with SUI has been steadily growing over the past decade (12,13). This study showed that the development of SUI was highly associated with a history of urinary incontinence, mode of delivery, chronic cough, smoking and genetic history. In addition, incontinence before and during pregnancy, spontaneous delivery and genetic history were independent factors associated with SUI.

Age is thought to be associated with decreased sensitivity, detrusor activity, and bladder capacity, all of which can induce SUI (14,15). Previous research has shown an association between age and SUI (16,17), however, we were unable to confirm any relationship between age and SUI in the present study. Further, previously existing urinary incontinence in patients has been recognized as a potential risk factor for SUI (18,19). SUI is more prevalent in individuals who have experienced incontinence. In line with previous studies, we found a high proportion of patients had urinary incontinence after pregnancy. It is thought that decreased estrogen receptor levels are involved in the development of premenopausal SUI, as SUI appears to occur in conjunction with estrogen deficiency (20). However, the present study did not find any difference between menopausal and non-menopausal patients. In the current study, we were not able to confirm a significant correlation between SUI and menopausal and non-menopausal patients.

There is emerging evidence that hypertension or hypertension treatment drugs trigger or exacerbate SUI (21,22). For example, adrenergic-receptor antagonists have been shown to inhibit the closure of the bladder neck and cause SUI (21). Diuretics can inhibit the reabsorption of urine and increase the urine produced by the kidneys, thereby aggravating the original urine (22). However, there was no difference in the incidence of SUI between hypertensive and non-hypertensive patients.

Obesity has been described as a cause of SUI, as increased intraabdominal pressure leads to increased intravesical pressure (23). However, our results showed that patients with different BMIs had similar SUI rates. Similarly, early research has suggested that SUI is more common in diabetic women than non-diabetic women, which indicates that diabetic microvascular complications reduce the normal control function of the bladder (24,25). Additionally, no such difference in the predominance of SUI was observed in the present study.

Some studies have suggested that multiple pregnancies, multiple births, and perineal lacerations are associated factors for SUI (26,27). Currently, most scholars have believed that changes in the anatomical pelvic-floor structure supporting tissue and the pelvic-floor impairment function are the main causes of SUI (28). Multiple pregnancies and childbirths have the cumulative effects on the damage to the pelvic floor sphincter and ligaments (29). Postpartum pelvic floor tissue cannot be restored to its original muscle strength and elasticity, and there is a cumulative effect of pelvic floor functional deficits or injuries. Additionally, perineal lacerations can cause during childbirth lead to the formation of scars after delivery. Perineal tension is significantly reduced, which will result in pelvic floor tissue relaxation and promotes the occurrence of SUI (30,31). In the present investigation, the rate of urinary incontinence in vaginal delivery patients was higher than that of cesarean delivery patients, which indicated that vaginal delivery increased the risk of SUI.

Given the potential for the development of SUI, a genetic history of SUI is an independent risk factor for SUI. This is suggested that a genetic history of SUI will increase patients' susceptibility to SUI. To ensure the appropriate interpretation of the sample data, relevant information needs to be gathered on the composition of SUI from similar cohorts. We found that chronic cough was more closely linked to a risk of developing SUI than no cough. However, the associations between chronic cough and SUI need to be more thoroughly explored in the future.

The present study had a number of strengths, including a sufficient sample size. To date, this study included the largest series of samples examined in association with SUI associated factors. The present study also had rigorous participant characterization and adopted comprehensive analytical approaches. Thus, the results of this large study

have good suggestive and reference significance.

This study had some limitations due to its retrospective design. We observed a number of potential associations, however, due to the retrospective results, we were unable to imply direct causation. In addition, the entire testing process relied heavily on the patient's chief complaint and the patient's medical history might be affected by recall bias. The information of some patients was also missing, which might affect the replicability of our results. Finally, because our data were collected from a center, there might be the sample bias.

Despite the above limitations, our results revealed a correlation between a history of urinary incontinence, the delivery mode, chronic cough, smoking, and genetic history, and the subsequent development of SUI. In addition, urinary incontinence before and during pregnancy, vaginal delivery and genetic history were found to be important independent high correlates of SUI, which may help in counselling patients on the risk of SUI. Our findings have emphasized the importance of screening for the above-mentioned associated factors in association with SUI. Additional in-depth studies evaluating the biological and histological characteristics of women with SUI need to be conducted.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-3539/rc

Data Sharing Statement: Available at https://atm.amegroups.com/article/view/10.21037/atm-22-3539/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-3539/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Medical Ethics Association of West China Second Hospital of Sichuan University [2018.No.(069)]. All patients signed informed consent.

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