

The significance of UVJ-M and PUVA in diagnosing stress urinary incontinence in women.

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Abstract

Objective: Our objective is to analyze the significance of mobility of the ureterovesical junction (UVJ-M) and poster urethrovesical angle (PUVA) in diagnosing stress urinary incontinence (SUI) in women, providing a reference for clinical diagnosis of SUI.

Methods: A total of 90 female SUI patients admitted in our hospital between January, 2015-January, 2016 were selected as observation group, and 90 healthy women were selected as control group. Urodynamic indexes were detected; UVJ-M and PUVA were determined by ultrasound. The above indexes in two groups were compared to evaluate the specificity and sensitivity of ultrasound in diagnosing SUI in women.

Results: Post-void residual volume (PVR), bladder volume, functional urethral length (FUL) were not statistically different between two groups ($P>0.05$), the maximum flow rate (Qmax) and abdominal leak point pressure (ALPP) in the observation group were higher than the control group, the maximum urethral closure pressure (MUCP) was lower than the control group, the differences were statistically significant ($P<0.05$). UVJ-M and PUVA in the observation group were both higher than the control group, which were statistically different ($P<0.05$). Spearman rank correlation showed that UVJ-M and PUVA were positively correlated to Qmax and ALPP, and negatively correlated to MUCP, which were statistically significant ($P<0.05$). Using UVJ-M >15 mm and PUVA at increased abdominal pressure stage $>140^\circ$ as the criteria to diagnose SUI, the sensitivity was 90.00% and the specificity was 86.67%.

Conclusion: UVJ-M and PUVA evaluated by ultrasound are significant in diagnosing SUI in women, the advantages such as the non-invasion and convenience may establish a basis for the early diagnosis and treatment of SUI.

Keywords: Ureterovesical junction, Poster urethrovesical angle, Female, Stress urinary incontinence, Diagnosis.

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Introduction

Stress urinary incontinence (SUI) is the pelvic floor dysfunction caused by over mobility of ureterovesical junction and dysfunction of urinary sphincter, the major pathological manifestation is the spontaneous urine outflow when the intra-abdominal pressure increases, the morbidity of SUI is around 12%-55% [1-3]. Although SUI is not life-threatening, its effects on social life and life quality can cause the psychological and psychic dysfunction, which brings more burdens to society and health system than fatal diseases [4-7]. However, the recent reports have shown that the outpatient visiting rate is less than 40%, which is related to the difficult diagnosis and treatment according to the simple and non-specific clinical symptoms [8,9]. Urodynamics is an invasive examination, although the result is reliable, it is not suitable for the early stage diagnosis due to the complicated operation and time consumed [10-13]. Thus, looking for a method to diagnose and grade SUI is the key to guarantee the

therapeutical efficacy and life quality of patients. In our study, the diagnostic value of ureterovesical junction (UVJ-M) and poster urethrovesical angle (PUVA) evaluated by ultrasound in diagnosing SUI was analyzed.

General Data

Characteristics of patients

90 SUI patients admitted in our hospital during January, 2015-January, 2016 were selected in the observation group. Meanwhile 90 healthy women were selected in the control group. This study was approved by the Ethics Committee in our hospital, and all the objects were informed about the study and they signed the informed consent. The age, gender, body mass index (BMI), gravidity, parity and stage of menopause

were not statistically different between two groups ($P>0.05$), which was comparable. As shown in Table 1.

Table 1. Comparison of general characteristics between two groups (n/%)

Index	Observation group (n=90)	Control group (n=90)	P value	
Age (year)	58.51 ± 2.44	58.26 ± 2.70	>0.05	
BMI (kg/m ²)	24.03 ± 1.85	23.99 ± 1.77	>0.05	
Gravidity (time)	2.81 ± 1.05	2.87 ± 1.04	>0.05	
Parity (time)	1.90 ± 0.27	1.85 ± 0.25	>0.05	
Stage of menopause	pre-menopausal period	32 (35.56)	34 (37.78)	>0.05
	menopause	58 (64.44)	56 (62.22)	
Cullen grading according to the symptoms	Grade I	39 (43.33)	--	
	Grade II-IV	51 (56.67)	--	

Note: (1) BMI: Body mass index. (2) Cullen grade: Grade I: there is urinary incontinence when cough; Grade II: there is urinary incontinence when cough or hold the breath; Grade III: there is urinary incontinence when stand upright; Grade IV: there is urinary incontinence when stand upright or obliquely.

Inclusion and exclusion criteria

Inclusion criteria for the observation group: According to the diagnosis criteria of SUI [12]: there is clear SUI history; pressure test showed enuresis; 1 h urine pad test ≥ 2 g; Urine routine test and neurologic examination were normal; Urodynamics showed that there was no instability of detrusor muscle; There was no SUI history before inclusion; There was no administration of steroids within 3 months.

Inclusion criteria for the control group: The medical history, physical examination, imaging examination and gynaecological examination showed no abnormality, there was no pelvic organ prolapse or vaginal wall prolapsed, pressure testing showed no uroclipsia; There was no clinical symptom of uroclipsia or pelvic prolapsed; There were criteria of urinary tract infection or nerve system injury; There was no administration of steroids within 3 months; They were voluntarily included in this study, and signed the informed consent for urodynamic examination.

Exclusion criteria: There was pelvic trauma or surgery history; Complicated with massive mass or nerve system disease; complicated with diseases which can cause long-term cough and sneezing; Heavy manual worker or sportswoman.

Experimental Methods

Urodynamic examination

The urodynamic indexes were taken at resting state by Duet Multi-P Urodynamics apparatus (Dantec Dynamics A/S, Copenhagen, Denmark) and the matches apparatus and

materials in urodynamic examination room. The detected indexes included bladder volume, maximum flow rate (Q_{max}), post-void residual volume (PVR), abdominal leak point pressure (ALPP), maximum urethral closure pressure (MUCP) and functional urethral length (FUL), the detection methods are shown in the literature [14,15].

Ultrasound examination

Phillips IU-22 ultrasound diagnostic apparatus (Koninklijke Philips N.V., Amsterdam, Netherland) and the matched transvaginal probe were used to detect the UVJ-M and PUVA in the ultrasound room, the detection methods are as the following [16]: the objects were at lithotomy position, the bladder filling volume was kept at 300 ml, and the mobility difference between the resting state and the increased abdominal pressure state, which was UVJ-M; the position to detect PUVA was the same to UVJ-M, the probe was placed at the urethral orifice, the bladder, bladder neck, and pubic bone were shown as sagittal plane, the included angle formed by proximal urethra and the posterior side of bladder at sagittal plane was considered as PUVA. The angle difference between the resting state and the increased abdominal pressure state was recorded.

Analysis methods

The urodynamic indexes and ultrasound results between two groups were compared, Spearman rank correlation was used to calculate the correlation between ultrasound indexes and urodynamic indexes to evaluate the value in diagnosing SUI in women.

Statistical analysis

All data were analyzed by SPSS18.0. The enumeration data were presented as n/% and analyzed by χ^2 test, and the measurement data were presented as ($\bar{x} \pm s$), the data which met normal distribution and homogeneity variance were analyzed by independent T-test, the data which did not meet the standard of homogeneity variance were analyzed by modified T-test, and the data which did not meet the standard of normal distribution were presented as M (Q1, Q3) and analyzed by Wilcoxon rank sum test. The significance level was set as $\alpha=0.05$, $P<0.05$ was considered as statistically significant and $P<0.01$ significantly different.

Results

Urodynamic indexes

PVR, bladder volume, FUL were not statistically different between two groups ($P>0.05$), Q_{max} and ALPP in the observation group were higher than the control group, MUCP was lower than the control group, the differences were statistically significant ($P<0.05$). As shown in Table 2.

Table 2. Comparison of urodynamic indexes between two groups ($\bar{x} \pm s$)

Indexes	Observation group (n=90)	Control group (n=90)	P value
Qmax (ml/s)	33.59 ± 7.41	21.25 ± 8.84	<0.05
PVR (ml)	17.69 ± 13.72	18.04 ± 11.52	>0.05
Bladder volume (ml)	355.87 ± 92.96	357.59 ± 91.44	>0.05
ALPP (cmH2O)	74.59 ± 19.80	55.36 ± 10.71	<0.05
MUCP (cmH2O)	67.60 ± 10.42	87.89 ± 15.30	<0.05
FUL (cm)	2.54 ± 0.61	2.95 ± 0.58	>0.05

Note: *P<0.05 compared with before surgery.

Ultrasound indexes

UVJ-M and PUVA in the observation group were higher than the control group, which was statistically different (P<0.05). As shown in Table 3.

Table 3. Comparison of ultrasonic indexes between two groups (x ± s)

Index	Observation group (n=90)	Control group (n=90)	P value
UVJ-M (cm)	15.53 ± 3.75	8.75 ± 2.04	<0.05
PUVA at resting state (°)	131.70 ± 17.25	111.68 ± 15.91	<0.05
PUVA at increased abdominal pressure state (°)	159.09 ± 21.40	115.32 ± 18.84	<0.05

Correlation analysis

Spearman rank correlation showed that UVJ-M and PUVA were positively correlated to Qmax and ALPP, negatively correlated to MUCP, which were statistically significant (P<0.05). As shown in Table 4.

Table 4. Correlation of ultrasonic indexed and urodynamic indexes (r)

Index	Qmax (ml/s)	ALPP (cmH2O)	MUCP (cmH2O)
UVJ-M (cm)	0.765	0.658	-0.592
PUVA at resting state (°)	0.693	0.663	-0.617
PUVA at increased abdominal pressure state (°)	0.702	0.629	-0.633

Analysis of diagnostic value

Using UVJ-M >15 mm and PUVA at increased abdominal pressure state >140° as the criteria to diagnose SUI in women, the sensitivity was 90.00% and the specificity was 86.67%. As shown in Table 5.

Table 5. The diagnostic value of ultrasonic indexes in diagnosing SUI in women (n%).

Ultrasound diagnosis	Clinical diagnosis
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	SUI	Non SUI	In total
SUI	81	12	93
Non SUI	9	78	87
In total	90	90	180

Discussion

SUI is a common pelvic dysfunction disease, the morbidity of which increases as the age increases, and it has become the severe health problem that affects the health and life of patients [17-19]. Due to the privacy of patients, the diagnostic rate has always been low. According to the conservative estimation, the morbidity of SUI in reproductive age women is around 17.3%-48.4%. And in elder women, the morbidity can reach to 80%, the condition can also be worse and significantly affect the life quality of patients if the disease is not diagnosed and treated timely [20-24]. Thus, the early stage diagnosis is the key to guide the therapeutic regimen and improve the life quality of patients.

As the most common diagnostic method for SUI, urodynamic examination can directly show the functional indexes of bladder and urethra, which can exclude any other potential lower urinary tract symptom and provide an effective reference for the diagnosis and treatment of SUI [25-27]. However, this method is invasive, the operation is comparatively complicated, and the morphological change of bladder and urethra are not clear. Thus, looking for a non-invasive and simple objective index has always been the hotspot in clinical [6].

Ultrasonic examination clearly shows the urethra, bladder and symphysis pubis, and the dynamic and static change of urethra morphology, which is expected to be significant in diagnosing and treating SUI. In our study, the results showed that UVJ-M and PUVA were positively related to Qmax and ALPP, and negatively related to MUCP, suggesting that ultrasound may have the similar efficacy in diagnosing SUI clinically [21-28].

Bladder neck is the connection site of bladder and urethra, the normal mobility of which is the basis to maintain the urine controlling in women. Researchers have shown that under normal condition, the bladder neck is closed, but in SUI the bladder neck shows funnel shape, indicating that the internal urethral sphincter is dysfunctional [29,30]. The change of UVJ-M can cause the descending of the connection site of bladder and urethra, which is an important factor to cause pressure transfer dysfunction and further cause the development of SUI. PUVA is the included angle of bladder bottom and urethra, which can reflect the function of bladder, urethra and the surrounding support tissue. Usually PUVA is between 90° and 100° [31], however, in our study, the results showed that PUVA in SUI patients was higher than healthy women no matter at resting state or increased abdominal pressure state, indicating that the urethra of patients showed shortening trend which was consistent with the morphological change of urethra at early stage of urination. Thus there was involuntary urination if the abdominal pressure was increased.

Some researchers used UVJ-M>10 mm to diagnose SUI, however the sensitive and specificity were less than 60%; also some researchers used PUVA>110° to diagnose SUI, the sensitivity was 95.5% and the specificity was only 53.4%. Thus there are some researchers showed that UVJ-M and SUI showed limited value in diagnosing SUI [32,33]. Our study was based on the previous studies, and UVJ-M>15 mm and PUVA>140° were used as diagnostic criteria, the sensitivity was 90.00% and specificity was 86.67% compared with the urodynamics combined with clinical symptoms, indicating that ultrasound is highly valuable in diagnosing SUI in women. As a cheap and convenient non-invasive examination, ultrasound is easier to be accepted by patients, and the high sensitivity and specificity can also provide a more accurate reference for clinical diagnosis [34]. Thus, in future for the diagnosis and treatment of SUI, clinical symptoms combined with UVJ-M and PUVA can provide a more objective reference and the diagnostic value is no less compared with invasive urodynamic examination.

In conclusion, the ultrasonic indexes such as UVJ-M and PUVA have high sensitivity and specificity in diagnosing SUI in women. Furthermore, ultrasound is a non-invasive operation, which can effectively avoid the discomfort and complications caused by urodynamic examination or cystourethrography. It is very significant for the diagnosis and treatment of SUI, which is worthy of further application.

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