MEGA JOURNAL OF CASE REPORTS

Research Article

Compiled Date: December 06, 2022

To Repeat Measurement of Resting Urethral Pressure Profile Is It Necessary?

Jimao Zhao*

Department of Urology, Beijing Friendship Hospital, Capital Medical University, PR China

***Corresponding author**: Jimao Zhao, Department of Urology, Beijing Friendship Hospital, 95 Rong An Lu, Xuan Wu District, Beijing 100050, PR China, Tel: +86 10 6313 9106; Fax: +86 10 6302 3261; E-mail: zhaojimao@foxmail.com

Abstract

Background: measurement of resting Urethral pressure profile (UPP) is used as a supplement modality in assessing female urethral condition.

Objective: To find out if a repeated measurement of UPP is necessary.

Design, Setting, and Participants: Urodynamic data including the UPP with the patients' medical history are retrieved from the MMS software storage file in the Department of Urology, Beijing Friendship Hospital, Capital Medical University. The UPP curves and parameters are summarized in Excel data sheets for further analysis. Adult women with LUTS are randomized into the urodynamic examination.

Intervention: Following the PFS UPP was performed at a half-full bladder with the patient in a semi-lithosupine position.

Outcome Measurements and Statistical Analysis: The difference of the UPP curves and parameters between the two measurements. Paired-sample T test. $P<0.05$ was considered as statistically significant.

Results and Limitation: 37 women, with a mean age of 57.27±15.79 years (range: 18–86 years), are included in the study. 22 (59.46%) are clinically diagnosed as SUI. 11 (29.73%) patients are diagnosed as BOO and 5

(13.51%) had DI by PFS. The mean maxim flow rate is 11.28±7.45 (ml/s) (0- 30 ml/s). Maximum urethral closure pressure (MUCP) is 75.67±38.99 cm H_2O (27-169 cm H_2O). 8 patients refused to take the second UPP due to uncomfortable experience in PFS. 7 were failed to get satisfied curves due to severe damaged urethral competence and urine leakage (3) and DI (4) the remaining 22 patients had got a consistent curve from the second UPP and the parameters were compared. These parameters include the maximum urethral pressure (MUP), maximum urethral closure pressure (MUCP), bladder neck pressure (BNP), functional length of the urethra (FUL), profile length (PL), length to peak (LtoP), total profile area (TPA), proximal area to peak (PAP). No Statistically significant difference is found between the two measurements.

Conclusions: When a satisfied and explainable UPP curve is obtained, it is unnecessary to repeat the measurement in order to avoid the possibility of urethral injury and inflammation.

Introduction

It is important to identify the existence of BOO when the symptoms of the lower urinary tract dysfunction appear. The pressure-flow study is now used widely for the evaluation of BOO and is accepted as an international standard in the diagnosis of BOO for men with BPH **[1,2],** but the criteria to quantify obstruction accurately, especially for women, have yet to be determined **[3-5].** When a patient has a compromised detrusor and could not produce a urinary flow in a pressure-flow study, alternative methods are used as a supplement modality. Obstruction is a physical concept, which is assessed from the measured pressure and the corresponding flow rate during voiding. It indicates that the urethral resistance to flow is abnormally elevated. The Urethral Pressure Profile (UPP) has long been utilized in the evaluation of urethral resistance. According to the ICS, two types of UPP are in common use: resting and stress UPP **[6].** Inherent pitfalls of UPP have been drawbacks in its application, and accordingly its use in the assessment of BOO has been in dispute. Nevertheless, resting UPP is a routine preoperative test in many urodynamic laboratories, including ours. But the test is vulnerable to physiologic and technical artifacts that must be minimized to produce technically accurate and clinically meaningful results. To compensate the inherent deficiency, it is recommended that two measurements of UPP are applied before corresponding parameters are reported correctly. From our experience the parameters from the simultaneously repeated UPP are usually as the same as those from the previous one. In view of the time needed to have a repeated performance to have an averaged reading and the inconvenience as well as the discomfort the patient feels and the potential injury or inflammation to urethra as a result of multiple catheter insertions, the present study is to evaluate the value of a repeated UPP performance.

Patients and Methods

Patients and data collection

Adult women with LUTS are randomized into the urodynamic examination. Detailed history is reviewed and complete physical and limited neuro-urologic examinations (knee jerk, bulbocavernosus reflex and the integrity of anal sphincter tone) are applied to exclude patients with severe neurologic and cardiovascular diseases. Urodynamic data including the UPP with the patients' medical history are retrieved from the MMS software storage file. The UPP curves and parameters are summarized in Excel data sheets for further analysis. Women with high-grade cystocele (grade 3 or more, according to Baden and Walker), associated bladder or urethral pathology, or history of surgery for pelvic cavity were also excluded from the study.

Methods

As a routine an informed written consent was obtained from patients before the examination. Urodynamic investigation was performed according to the suggested good urodynamics practice standards of the International Continence Society **[7].** The technique, definitions and units of the urodynamic measurement conform to the standards proposed jointly by the International Continence Society and the International Urogynecological Association **[6].** In a brief, Following the PFS UPP was performed at a half-full bladder with the patient in a semi-lithosupine position, using the MMS Solar urodynamic equipment with external pressure transducers. Zero the pressure channels to the atmosphere with the water transducer holder at symphysis pubis level. An F8 dual-lumen water-filled catheter was utilized and inserted in the bladder, with a terminal hole used for bladder pressure (Pves) measurement and a side hole, 5 cm from the distal one, used for urethral pressure (Pura) measurement. The urethral and vesical channels openings should be positioned in the bladder before running the puller, which could be confirmed by checking that the Pura and Pves are almost equally elevated when the patient had a cough. Using an MMS automatic catheter puller, the catheter mounted was pulled out at the rate of 1 mm/s. The puller speed is used to calculate the length of the urethra and the related UPP parameters.

The Sterile physiological saline solution at a room temperature was infused through the transurethral catheter at the infusion rate of 1 ml/min. When the first UPF is accomplished, the puller was stopped and the catheter was sterilized and re-inserted into the urethra and bladder, the puller returned to its starting position automatically, and then another UPP was obtained. During the measurement, the side hole for urethral pressure is maintained in the direction of 9 o'clock. Curves automatically obtained were manually revised with a profile start marker

and a profile end marker, so that the beginning and the end of each pressure profile were accurately located.

Statistical method

Statistical analysis of the UPP parameters between the two measurements was conducted with the commercially available statistical software (SPSS 16.0) using paired-sample T test on a two-tailed basis with values considered significant at $P<0.05$.

Results

37 women, with a mean age of 57.27±15.79 years (range: 18–86 years), are included in the study. All patients have LUTS and 22 (59.46%) are clinically diagnosed as SUI. 11 (29.73%) patients are diagnosed as BOO and 5 (13.51%) had DI by PFS. The average maximum capacity is 354.16±146.73 (ml) (60-800 ml). The mean maxim flow rate is 11.28±7.45 (ml/s) (0- 30 ml/s). Maximum Urethral Closure Pressure (MUCP) is 75.67±38.99 cm H_2O (27-169 cm H_2O). 8 patients refused to take the second UPP due to uncomfortable experience in PFS. 7 were failed to get satisfied curves due to severe damaged urethral competence and urine leakage (3) and DI (4) in which an elevated bladder pressure had influenced the UPP curves during UPP measurement. The remaining 22 patients had got a consistent curve from the second following UPP measurements, although there were bladder dysfunction including urgency (one case), hyporefexic bladder and urine retention (>50 ml) (8 cases) and other conditions including transurethral resection of bladder neck two years ago (1) and catheterization for more than 3 days before examination (5). The parameters from the two UPP measurements of 22 patients were compared in **Table 1.** These parameters include The Maximum Urethral Pressure (MUP), Maximum Urethral Closure Pressure (MUCP), Bladder Neck Pressure (BNP), Functional Length of the Urethra (FUL), Profile Length (PL), denoting the anatomic length of the urethra, Length to Peak (LtoP), Total Profile Area (TPA), Proximal Area to Peak (PAP). 12 patients had MUCP>60 cm H_2O with a mean of 107.83±31.94 cm H_2O. No Statistically significant difference is found between the corresponding parameters from the two measurements.

Table 1: The compare of parameters from two urethral pressure profile measurement (x±s).

Parameters	urethral pressure profile (n=22)		P
	First	second	
MUCP	78.36±41.01	79.00±40.20	0.703
BNP	38.62±21.33	38.15±19.10	0.837

MUP	79.23±41.42	79.68±40.39	0.749
FUL	31.55±5.14	32.59±6.37	0.172
PL	31.68±5.19	32.77±6.43	0.156
LtoP	15.64±5.03	16.59±4.71	0.292
TPA	131.73±74.38	136.77±77.45	0.152
PAP	63.19±37.67	69.00±41.54	0.179

Note: paired sample T-test, MUCP: maximum urethral closure pressure, BNP: bladder neck pressure, FUL: functional urethral length, MUP: maximum urethral pressure, FUL: functional length of the urethra, PL: profile length, LtoP: length to peak, TPA: total profile area, PAP: proximal area to peak.

Discussion

The Urethral Pressure Profile (UPP) measurement assesses the intraluminal pressure along the anatomic length of the urethra. This pressure represents the ability of the urethra to prevent leakage in the storage phase of the bladder. Two types of UPP may be measured. One is resting UPP, with the bladder and subject at rest. The other is stress UPP, with a defined applied stress, for example cough and strain **[6].** The simultaneous recording of both bladder pressure and intraurethral pressure is essential during profilometry in order to calculate the MUCP as well as to identify the influence of detrusor contractions at the examination. The idea of UPP could be dated back to 1969, when Brown and Wickham developed a new method of assessing urethral competence. It was aimed to study the effect of electrical stimulation to the pelvic floor on the closure force of the urethra **[8,9].** The method has been applied to the study on urinary incontinence and urethral strictures.

The UPP is not applied alone. Clinically it is usually accomplished following a PFS. The clinical use of UPP is aimed to understand further the results of PFS, whether the BOO is associated with the existence of urethral resistance or other unexpected urethral conditions. However, UPP in nature doesn't explain the behavior of urethra during a voiding phase. For the convenience of urologists and patients, UPP is performed following a PFS and it usually uses the same catheter as the one utilized in the previous PFS. In this way re-insertion of catheter is omitted. And if one UPP measurement was applicable, then another reinsertion of catheter for the second measurement is spared. UPP would be a much less invasive examination. For UPP water transducer catheters, 3-lumen catheter is marketed. A 3-lumen catheter has one channel for measuring the bladder pressure, the second for measuring the urethra pressure. And the third for water perfusion to the urethra channel. The

higher expense of the catheter has prevented its wide application in clinical practice. A 2-lumen catheter, which is less expensive and usually used in cytometry and pressure-flow studies, has one for measuring the bladder pressure, the second for filling the bladder. A three-channel connector is employed when a 2-lumen catheter is used in UPP, in which the one for measuring the bladder pressure is transformed as the urethra pressure and water perfusion needed in UPP, and the second for filling the bladder in PFS as a bladder pressure channel. Although many different techniques have been used to assess Urethral function **[10],** such as Micturition Pressure Profilometry (MUPP) for determining obstruction during voiding and Detrusor Leak Point Pressures (DLPP) for sphincter competence with neurological disease, UPP is adopted by many investigation centers and doctors **[11].** It is used as a method to identify the effect of epidural analgesia drugs on urethral sphincter function **[12],** to compare with other modalities in the diagnosis of intrinsic sphincter deficiency **[13],** to prospectively analyze the efficacy and safety of bulking agents in elderly women with SUI **[14]** and outcome of SUI surgery **[15,16].** There are researches on the association of MUCP with bladder condition and symptoms in women **[17],** and the influence of a mid-urethral tape sling operation on UPP **[18].** It remains unclear exactly which women would most benefit from such preoperative study and if urodynamic evaluation definitively improves treatment outcome **[19,20].**

Urethral function can be assessed using many different techniques. There are three functional tests which are currently available for the clinician to evaluate urethral function in the female: measurements of resting Urethral Pressure Profile (UPP), estimation of urethral hypermobility, and determination of the degree of urethral incompetence through Abdominal Leak Point Pressure (ALPP) test. Schick et al analyzed the relation between two of Maximum Urethral Closure Pressure (MUCP), the degree of urethral hypermobility and the degree of urethral incompetence. It was concluded that MUCP decreases significantly when urethral hypermobility appears and the degree of urethral incompetence increases. Urethral hypermobility is accompanied by increased urethral incompetence, but increased urethral incompetence can be present in the absence of urethral hypermobility **[3,21,22].** So in SUI female, decrease in MUCP may donate the presence of urethral hypermobility and urethral incompetence. MUCP from UPP may confirm the existence of SUI urodynamically. More than half of the patients in the study are with Stress Urinary Incontinence (SUI). Most UPP parameters have been used in the evaluation of patients with SUI. Lower values of fields under the urethral profilometry curve can suggest a greater degree of urethral closing mechanism deficiency and the coexistence of the external sphincter insufficiency. This parameter can be very useful in the group of patients with moderate leakage point [23]. However, the pre-operation values of MUCP and VLPP have no predictive value in determining the

success rate of the Burch colposuspension [24]. Some even think the routine use of resting UPP has no added value in terms of the prediction of success of incontinence surgery [25]. There are many factors that affect the values of UPF parameters. For example, MUCP tended to be higher in a standing than a sitting position, even this did not reach statistical significance. Urethral lengthening appears to occur on standing with a mean FUL increase of 5 mm on standing. For both FUL and MUCP, there was a wide variation in the difference between sitting and standing values. There was poor reproducibility of measurements of MUCP and FUL in the standing position, limiting its clinical applicability. The difference between sitting and standing MUCP and FUL was not affected by age, parity, weight, height, BMI, or oestrogen status [26]. The reason for the recommendation of multiple measurement of UPP is based on one assumption that the contraction of pelvic floor muscle during the examination may influence the urethra pressure, which is partly caused by the strength of muscle tissue around the urethra. From our data and experience, we didn't find this influence. But other artifacts were found in the study. From our experience, the UPP is usually influenced by the compromised condition of the bladder and urethra. As it is named, resting UPP is performed while the patient is at rest in which no contraction of bladder, urethra and even abdomen is permitted. However, the involuntary events are not preventable that is testified by the presented results in the study. The severe damaged urethra caused the decreased capability of the urethra to hold the urine and it was difficult to produce a satisfied UPP. It is the same for an unstable bladder which dramatically influences the UPP results. A patient with OAB and urodynamiclly confirmed DI had an abnormally elevated pressure on the UPP curve, and the following automatically calculated parameters are changed accordingly. In this situation, a satisfied UPP curve might be obtained in the second or even the third measurement.

Conclusions

Our results show that when a satisfied and explainable UPP curve is obtained, it is unnecessary to repeat the following another insertion and withdraw of catheter in order to avoid the possibility of urethral injury and inflammation.

Acknowledgments

My colleagues had supported in the enrollment of patients. Beijing Municipal Science & Technology Commission and Beijing Bureau of Health gave funding support to the research.

References

1. Madersbacher S. Urodynamics prior to prostatectomy: pro. Eur Urol. 2004;45(5):557-60.
2. Rischmann P. Urodynamics prior to prostatectomy: con. Eur Urol. 2004;45(5):561-3.
3. Schick E, Tessier J, Bertrand PE, Dupont C, Jolivet-Tremblay M. Observations on the Function of the Female Urethra: I: Relation Between Maximum Urethral Closure Pressure at Rest and Urethral Hypermobility. Neurourol Urodyn. 2003;22(7):643-7.
4. Akikwala TV, Fleischman N, Nitti VW. Comparison of diagnostic criteria for female bladder outlet obstruction. J Urol. 2006;176(5):2093-7.
5. Blaivas JG, Groutz A. Bladder outlet obstruction nomogram for women with lower urinary tract symptomatology. Neurourol Urodyn. 2000;19(5):553-64.
6. Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association (IUGA) /International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. Int Urogynecol J Pelvic Floor Dysfunct. 2010;21(1):5-26.
7. Schafer W, Abrams P, Liao L, Pesce F, Zinner NR, Sterling AM, et al. Good urodynamic practices: uroflowmetry, filling cystometry, and pressure flow studies. Neurourol Urodyn. 2002;21(3):261-74.
8. Brown M, Wickham JEA. The urethral pressure profile. Br J Urol. 1969;41(2):211-7.
9. Brown MC. The urethral pressure profile. Proc R Soc Med. 1970;63(7):701.
10. Khullar V, Cardozo L. The urethra (UPP, MUPP, instability, LPP). Eur Urol. 1998;34(1):20-2.
11. Lemack GE. Urodynamic assessment of patients with stress incontinence: how effective are urethral pressure profilometry and abdominal leak point pressures at case selection and predicting outcome? Curr Opin Urol. 2004;14(6):307-11.
12. Wuethrich PY, Kessler TM, Burkhard FC. The Effects of Thoracic Epidurally Administered Drugs on Urethral Sphincter Function in Women: A Pooled Analysis. Pain Med. 2013;14(8):1248-53.
13. Thubert T, Deffieux X, Jousse M, Guinet-Lacoste A, Ismael SS, Amarenco G. Posterior vaginal wall pull down maneuver: A clinical test to diagnose intrinsic sphincter deficiency in women suffering from genuine urinary stress incontinence. Int J Urol. 2013;20(11):1124-9.
14. Mohr S, Siegenthaler M, Mueller MD, Kuhn A. Bulking agents: an analysis of 500 cases and review of the literature. Int Urogynecol J. 2013;24(2):241-7.
15. Harris N, Swithinbank L, Hayek SA, Yang Q, Abrams P. Can maximum urethral closure pressure

(MUCP) be used to predict outcome of surgical treatment of stress urinary incontinence? Neurourol Urodyn. 2011;30(8):1609-12.

16. Costantini S, Nadalini C, Esposito F, Alessandri F, Valenzano MM, Mistrangelo E. Transobturator adjustable tape (TOA) in female stress urinary incontinence associated with low maximal urethral closure pressure. Arch Gynecol Obstet. 2010;282(3):277-84.
17. Valentini FA, Robain G, Marti BG. Is a sequence of tests during urethral pressure profilometry correlated with symptoms assessment in women? Int Braz J Urol. 2012;38(6):809-17.
18. Zheng J, Xu K, Sun Y, Sun C, Ding Q, Fang Z. Evaluation of Urodynamic Findings Before and After Mid-Urethral Tape Sling Operation for Female Stress Urinary Incontinence. J Minim Invasive Gynecol 2013;20(4):482-6.
19. Rosier PF. The evidence for urodynamic investigation of patients with symptoms of urinary incontinence. F1000Prime Rep. 2013;5:8.
20. Dahms SE, Lampel DS, Kloeppel S, Hohenfellner M, Melchior SW, Müller SC, Thüroff JW. Low urethral pressure profile--clinical implications. Scand J Urol Nephrol Suppl. 2001;(207):100-5.
21. Schick E, Bertrand PE, Jolivet-Tremblay M, Dupont C, Tessier J. Observations on the Function of the Female Urethra: II: Relation Between Maximum Urethral Closure Pressure at Rest and the Degree of Urethral Incompetence. Neurourol Urodyn. 2004;23(1):16-21.
22. Schick E, Jolivet-Tremblay M, Tessier J, Dupont C, Bertrand PE. Observations on the Function of the Female Urethra: III: An Overview with Special Reference to the Relation Between Urethral Hypermobility and Urethral Incompetence. Neurourol Urodyn. 2004;23(1):22-26.
23. Witek A, Nowara A, Prajsner A, Mikuś K, Wróbel E. Extended analysis of urethral profilometry in women with urinary stress incontinence--preliminary report. Ginekol Pol. 2010;81(8):582-7.
24. Martan A, Masata J, Svabík K, Drahorádová P, Pavlíková M. Changes in values of urethral closure pressure and its position after Burch colposuspension--predictive value of MUCP and VLPP for successful rate of this operation. Ceska Gynekol. 2006;71(3):209-19.
25. Wadie BS, El-Hefnawy AS. Urethral pressure measurement in stress incontinence: does it help? Int Urol Nephrol. 2009;41(3):491-5.
26. Dörflinger A, Gorton E, Stanton S, Dreher E. Urethral pressure profile: is it affected by position? Neurourol Urodyn. 2002;21(6):553-7.

Citation of this Article

Zhao J. To Repeat Measurement of Resting Urethral Pressure Profile Is It Necessary?. Mega J Case Rep. 2022; 5: 2001-2008.