Original Article

Uroflowmetry in Pregnant Women without Lower Urinary Tract Symptoms (LUTS)

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Objective: To measure the maximum urine flow rate and the average urine flow rate of uroflowmetry in pregnant women without lower urinary tract symptoms (LUTS) and study the differences of uroflowmetric parameters in each trimester.

Materials and Methods: One hundred forty-eight asymptomatic pregnant women were recruited and categorized into three trimesters, first, second, and third trimesters, respectively. All participants completed a validated Thai version of the urogenital distress inventory (UDI) and incontinence impact questionnaires to confirm that they have no LUTS. Uroflowmetry was performed on an outpatient basis.

Results: The mean age women was 29.28±5.29 years. The mean±SD of maximum urine flow rate in the first, second, and third trimesters were 18.85±6.10, 23.49±7.87, and 25.60±9.85 ml per second, respectively. The average urine flow rate in the first, second, and third trimesters were 10.06±2.81, 12.48±4.60, and 11.82±4.15 ml per second, respectively. The tenth percentile of the maximum flow rate were 12.38, 13.40, and 13.08 ml per second, respectively. There were statistical differences of the maximum urine flow rate and average urine flow rate among the first, second, and third trimesters.

Conclusion: The present study shows the uroflowmetric parameters in Thai pregnant women without LUTS. The maximum urine flow rate and the tenth percentile value can be used as the guide for further investigation.

Keywords: Uroflowmetry, Pregnancy, Lower urinary tract symptoms

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Anatomical, physiological, and biochemical adaptation occur during pregnancy including the urinary systems. Bladder and urethral mucosa become hyperemic and congested due to the effect of estrogen and progesterone[1]. Bladder pressure and maximal intraurethral pressure increase[1]. The bladder is drawn upwards anteriorly as the uterus enlarge and is distorted by the fundus[2]. Accordingly, pregnant women often complaint about lower urinary tract symptoms (LUTS). There was a report of the incidence of urinary incontinence in late pregnancy in Thai women of 53.8% and at the three months postpartum period of 7.8%[3]. Similar results were reported in African pregnant women for incidence of stress urinary incontinence and urge incontinence at 69% and 55%, respectively[4]. The investigation for LUTS patients included the simple and advanced tests. The simple tests were the urine analysis and post void residual urine measurement. The advanced tests comprised of uroflowmetry, cystometry, and tests of urethral function. Uroflowmetry is one of the non-invasive advanced testing. It can be used as the diagnostic screening to evaluate the overall function of lower urinary tract and making decision for further invasive investigations such as cystometry or video urodynamic test[5]. There was a report of the lower mean voided volume in the antepartum group than the postpartum group[6]. In an observational study of bladder function during and after pregnancy, the maximum urine flow rates in each trimester were different[7]. The pregnancy had influence on the uroflowmetry data when compared to non-pregnant women due to the anatomic and physiologic changes.

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Table 1. Patients' characteristic in each trimester (n=148)

	First trimester (n=41) Mean±SD	Second trimester (n=60) Mean±SD	Third trimester (n=47) Mean±SD
Age (years)	29.88±4.87	28.73±5.31	29.38±5.67
BMI (kg/m^2)	21.94±4.83	21.70±3.38	24.80±5.77
Primigravida; n (%)	19 (46.3)	27 (45.0)	16 (34.0)
Multigravida; n (%)	22 (53.7)	33 (55.0)	31 (66.0)

BMI=body mass index; SD=standard deviation

Therefore, using the normal value from non-pregnant women is not appropriate. Racial difference is also a factor for the variation of uroflowmetric data. Up to now, there is no study of the uroflowmetry in Thai pregnant women without LUTS. The purpose of the present study was to measure the uroflowmetric parameters in pregnant women at King Chulalongkorn Memorial Hospital without LUTS, and the differences of uroflowmetric parameters in each trimester.

Materials and Methods

After Institutional Review Board approval, one hundred forty-eight asymptomatic pregnant women visiting antenatal clinic at the King Chulalongkorn Memorial Hospital between March 2015 and April 2016 were enrolled in the present study. They were categorized in three trimester, 41 pregnant women in the first trimester, 60 pregnant women in the second trimester, and 47 pregnant women in the third trimester. Sixty-two pregnant women were primigravida and 86 were multigravida. All participants completed the Thai version of the urogenital distress inventory (UDI) and incontinence impact questionnaires[8] to confirm that they have no LUTS. All participants were defined as having no LUTS if they answered no in all questions of UDI. The inclusion criteria were pregnant women 18 years of age or older with singleton gestation, non-laboring, normal sacral nerve examination, and received medication of only routine vitamins and all supplement. The exclusion criteria were women who had histories of LUTS, previous urinary tract surgery, urological or neurological disease, and diagnosed as having the benign or malignant abdominopelvic tumors.

After the patient characteristics and demographic data were collected, the uroflowmetry were performed. Mediwatch Plc model uroflowmeter (Mediwatch UK Ltd., Valley Drive, Rugby CV21 1TQ, United Kingdom) was used to measure the uroflowmetric parameters. The flowmeter is a rotating disk mechanism. When urine passed the disk, it electronically converted into voided volume and flow rate and interpreted into graph and table. The participants were asked to wait and inform the investigator when they felt first desire to void. Then, they micturated into the flowmeter in the sitting position. The uroflowmetric parameters that included in the present study were maximum urine flow rate, voided volume, voiding time, flow time, average urine flow rate, and time to maximum flow[9].

Test of normality was done by using Kolmogorov-Smirnov test. Continuous variables were presented as mean and standard deviation (SD). One-way analysis of variance with Bonferroni post hoc testing was performed to compare the differences between first, second, and third trimester. Univariate analysis was made to find the difference between patients' characteristic. A p-value less than 0.05 was considered to be a statistically significant difference. Statistical analyses were calculated with IBM SPSS Statistics software, version 22.0 (IBM Corp., Armonk, NY, USA).

Results

The mean age was 29.28±5.33 years. The mean weight was 57.12±13.10 kg. The mean height was 158.03±5.00 cm. The mean body mass index (BMI) was 22.82±4.93 kg/m² (Table 1).

The mean±SD of maximum urine flow rate in the first, second, and third trimesters were 18.85±6.10, 23.49±7.87, and 25.60±9.85 ml per second, respectively. There were statistically significant differences of the maximum urine flow rate of the first and second trimester (p=0.02), and the first and third trimester (p<0.01). The average urine flow rate in the first, second, and third trimesters were 10.06±2.81, 12.48±4.60, and 11.82±4.15 ml per second, respectively. There was statistically significant difference of the average urine flow rate between the first and the second trimester (p=0.01). The tenth percentile of the maximum flow rate were

Table 2. Uroflowmetric parameters in each trimester (n=148)

Uroflowmetric parameters	First trimester				Second trimester				Third trimester			
	Mean	SD	Min-max	P10, P90	Mean	SD	Min-max	P10, P90	Mean	SD	Min-max	P10, P90
Maximum urine flow rate (ml/second)	18.85[a,b]	6.10	9.90 to 39.60	12.38, 26.36	23.49[a]	7.87	10.20 to 40.50	13.40, 35.04	25.60[b]	9.85	7.30 to 50.00	13.08, 39.72
Voided volume (ml)	155.07	72.88	70.00 to 296.00	81.20, 275.40	163.63	78.35	56.00 to 308.00	60.20, 279.30	146.68	54.25	72.00 to 264.00	79.80, 222.80
Voiding time (second)	16.39	6.15	7.00 to 32.00	10.00, 24.80	14.77	8.03	7.00 to 42.00	7.10, 25.00	15.75	9.99	6.00 to 69.00	8.00, 26.20
Flow time (second)	15.32	5.17	7.00 to 27.00	9.20, 23.80	13.43	5.98	7.00 to 35.00	7.00, 20.90	12.96	4.61	6.00 to 24.00	8.00, 19.20
Average urine flow rate (ml/second)	10.06[c]	2.81	5.70 to 17.50	6.62, 13.82	12.48[c]	4.60	4.50 to 23.60	7.12, 18.89	11.82	4.15	3.30 to 21.60	6.26, 16.48
Time to maximum flow (second)	5.81	2.12	2.00 to 11.00	3.00, 9.00	6.33	5.13	2.00 to 33.00	3.00, 9.00	5.38	2.83	2.00 to 14.00	3.00, 10.00

P10=10th percentile; P90=90th percentile; SD=standard deviation

[a] p<0.05 comparing maximum urine flow rate of first trimester to second trimester, [b] p<0.05 comparing maximum urine flow rate of first trimester to third trimester, [c] p<0.05 comparing average urine flow rate of first trimester to second trimester

12.38, 13.40, and 13.08, respectively (Table 2). There was no different of all uroflowmetric parameters in each gravidity (p=0.20).

Discussion

From the present study, the authors found the differences of uroflowmetric parameters in each trimester in pregnant women. The present study result was different from the previous studies[7]. The uroflowmetric parameters in the present study were lower than in a previous report. Racial difference might be the reason of difference of the lower value of uroflowmetry as Thai women are smaller in size and BMI. Anatomical and physiologic variation have an influence on the uroflowmetric parameters.

The authors found that the maximum urine flow rates were statistically different for the first versus the second trimester and first versus the third trimester. It can be explained as the uterus was in the pelvic cavity and in a retroverted position in the first trimester to cause the urethral compression by the cervix. Therefore, the maximum urine flow rate of the first trimester was lower than the second and third trimester. Compared with the previous studies[6,7], the maximum urine flow rates were lower. These values were also lower than non-pregnant young adults and pre-elderly female[10] because of pregnancy-induced physiological and anatomical changes.

Because using the normal value of non-pregnant women to decide for further invasive test might not be appropriated in pregnant, the present study result is beneficial for the decision to do further invasive or expensive investigations in Thai pregnant women with LUTS. The authors found the uroflowmetry in pregnant women was lower than in non-pregnant women[10]. The result of the present study can help minimize unnecessary tests for pregnant women and they can be used as the reference for future study.

Strength

1. The present study is the first report of uroflowmetric parameters of pregnant women in Thailand and Asian country. This can be used as the reference and for consideration to further invasive investigation.

2. The authors used the standard validated questionnaire to classify patient without LUTS to increase the precision for the non-LUTS cases.

Limitation

1. This was a hospital-based study. The population of pregnant women in the present study were the volunteer at the antenatal clinic at King Chulalongkorn Memorial Hospital, Bangkok. Our data may not represent the characteristic of all pregnant women in Thailand. But from our experience, the characteristics of Thai pregnant women are similar in Bangkok and in the suburb. Further multicenter study in Thailand is advocated.

2. The participants were not asked for retesting for confirmation. However, the authors carefully explained the step for the uroflowmetry test in all cases to ensure the accuracy of the data.

Conclusion

The present study shows the uroflowmetric

parameters in pregnant women without LUTS. The maximum urine flow rate and the tenth percentile value can be used as the guide for further investigation.

What this study adds?

This study reports the first data of uroflowmetric parameters in Thailand and Asian country for decision to further invasive tests. It can be a reference for future research.

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Conflicts of interest

The authors declared no conflict of interest with respect to the authorship and publication of this article.

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