

# The urethral closure function status in pregnant women suffering from overactive bladder syndrome

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The ultrasound method of investigation was proposed as the first step in the diagnosis of urinary incontinence, since the average value of the thickness of the bladder wall and the size of the urethral sphincter in the works of many urologists are correlated with the presence of overactive bladder.

**The objective:** was to determine the sonographic parameters of the urethral closure in pregnant women with overactive urinary bladder.

**Materials and methods.** In this article, an estimation of such ultrasound signs of the urethral closure apparatus, such as funnel-like urethral enlargement, bladder wall thickness measurement, bladder volume, residual urine volume, were performed. The diagnostic value of the cervical-bulk test in pregnant women with overactive urinary bladder is assessed. The obtained results were compared with the same in healthy pregnant women.

**Results.** The index of bladder wall thickness with age increases, as in women with overactive bladder, and in practically healthy women. However, significantly higher value of this indicator ( $p < 0,001$ ) was found in the group of women with overactive bladder. In the third trimester of pregnancy, a positive cervical-bleb test was found in all patients with overactive bladder. In the group of pregnant women with overactive bladder, significantly less volume of the bladder and increased volume of residual urine, which confirms the world data.

**Conclusion.** Data of spontaneous contractions of detrusor in pregnant women suggest that this indicator is a characteristic diagnostic feature of overactive bladder.

**Key words:** pregnancy, ultrasound examination, urethral closure, overactive bladder.

Urinary incontinence is a general medical problem associated with poor perceptions of personal health, impairment of quality of life, social isolation and symptoms of depression [1, 3, 11].

Ultrasound is a general diagnostic method in obstetrics and gynecology. The role of ultrasound in urogynecology is becoming increasingly important [5, 6]. Urological ultrasound is today the most effective, safe and at the same time available method for diagnosing diseases of the urogenital sphere [2, 8, 9]. Compared with other studies this method is less invasive, non-radioactive, inexpensive and widely available. In addition, ultrasound is a gold standard for measuring the volume of the urinary bladder and residual urine, which makes it possible to dynamically evaluate pelvic structures [4, 7, 8, 10].

**The objective:** to determine some sonographic parameters of urethral closure apparatus in pregnant women with urinary incontinence by transvaginal ultrasound and compare them with the same signs in practically healthy patients in the main group.

## MATERIALS AND METHODS

In the study, during the ultrasound scan of pregnant women, we estimate the position of the kidneys, ureter and bladder, their structure, the presence of tumors, sand or stones. In kidney ultrasound such diseases as kidney stones, pyelonephritis, defects in the kidney, kidney cysts, kidney polyps and bladder polyps were detected. Pregnant women with identified pathological conditions were excluded from the study.

In the course of further study, the volume of the bladder and residual urine in it, the thickness of the walls (BWT), contours and tissues surrounding it, and also the cough and cervical-bleb test were estimated.

The volume of residual urine was estimated by the formula:

$$\text{Volume (ml)} = \text{width (cm)} \times \text{depth (cm)} \times \text{length (cm)} \times 0,5$$

The measurements were carried out 3 times in a row. The average value was chosen.

A cough test and a cervical-bleb test of ligation (Bonney-test) can confirm the fact and identify the causes of urinary incontinence [1, 3, 6]. During the cough test, the doctor injects fluid into the patient's bladder and watches its flow during coughing. The pullobular test has a lot to do with cough breakdown. The only difference is to raise the patient's cervix with a finger or a special tool (in our case, a vaginal ultrasound sensor) inserted into the vagina during the cough test [8, 10].

The study was carried out with the help of ultrasonic device «Voluson E 8» GE Healthcare, Sumsung Medison, US Systems, USA (4 convection sensors 3 + 1 CW) in the position of the patient lying on the back to exclude the presence of infravesical obstruction with the obligatory observance of the generally accepted conditions to the measurement residual urine volume. The norm was the amount of residual urine not exceeding 30 ml.

In this article, an analysis of such ultrasound parameters of the urethral closure device was performed, such as funnel-shaped urethral dilatation, bladder wall thickness, bladder volume, residual urine volume. A cervical pulmonary test was also performed, however, for greater accuracy, this test was not performed by an obstetrician-gynecologist on a gynecological arm, but especially during an ultrasound diagnostics.

All studies were conducted three times – in the first and third trimesters of pregnancy, as well as in the 16 weeks of the postpartum period.

## RESULTS

In the course of analysis of the funnel-like expansion of the urethra in the first trimester of pregnancy, significantly higher values of the funnel-shaped deformation of the urethra in the group of patients with overactive bladder in general and in different age groups, compared to healthy women, were found to be significantly ( $p < 0,001$ ). Thus, funnel-like urethral enlargement was detected in all patients with overactive bladder in women. In healthy women, this indicator was not detected at all. Moreover, the same indicators were established in studies of this indicator in pregnant III trimester and at 16 weeks postpartum period.

While comparing the thickness of the walls of the urinary bladder in the I, III trimesters of pregnancy and at 16 weeks of the postpartum period, the value of this indicator in the general group of patients with overactive bladder was significantly higher than in the general group of practically healthy women as well as in different age groups ( $p < 0,001$ ).

Thus, in the first trimester of pregnancy, significantly higher values of the urinary bladder thickness index in the general group ( $4,873 \pm 0,295$  mm;  $p < 0,001$ ) and in all age groups of women with overactive bladder were revealed in comparison with the general group of healthy women ( $2,255 \pm 0,472$  mm). When comparing

this indicator between the different age groups of practically healthy women, significantly higher values were found in the age groups of 26–35 years ( $2,443 \pm 0,294$  mm;  $p < 0,001$ ) and older than 35 years ( $2,791 \pm 0,070$  mm;  $p < 0,001$ ) in comparison with this age group indicator to 25 years ( $1,724 \pm 0,189$  mm;  $p < 0,001$ ), as well as between women 26–35 years of age and 35 years of control group. Among patients with overactive bladder of women, significantly higher values of the thickness of the bladder walls were found in the age groups of 26–35 years ( $4,902 \pm 0,170$  mm;  $p < 0,05$ ) and older than 35 years ( $4,976 \pm 0,239$  mm;  $p = 0,078$ ) compared with the age indicator groups up to 25 years ( $4,522 \pm 0,593$  mm;  $p < 0,05$ ).

In the third trimester of pregnancy, significantly higher values of the urinary bladder thickness index in the general group ( $5,188 \pm 0,206$  mm;  $p < 0,001$ ) and in all age groups of women with overactive bladder were revealed in comparison with the group of healthy women ( $2,473 \pm 0,479$  mm). When comparing this indicator between different age groups of practically healthy women, a reliable tendency to increase this value with age is revealed.

Thus, in the group of practically healthy women in 16 weeks of the postpartum period, significantly higher values of the thickness of the bladder walls in the general group ( $2,484 \pm 0,496$  mm;  $p < 0,001$ ) and in all age groups of women with overactive bladder were detected in comparison with the group of healthy women in general ( $5,197 \pm 0,214$  mm) and different age groups (respectively  $5,033 \pm 0,387$ ;  $5,193 \pm 0,133$ ;  $5,294 \pm 0,241$  mm). Comparison of this indicator among practically healthy women revealed a significant increase in the value of this indicator with age.

When comparing spontaneous contractions of detrusor in the first trimester of pregnancy, the value of this indicator was significantly higher in the general group of patients with overactive bladder (68%,  $p < 0,001$ ) and in age groups up to 25 years (54,4%;  $p < 0,001$ ), 26–35 years (71,4%;  $p < 0,001$ ) and older than 35 years (62,9%;  $p < 0,01$ ) of women with overactive bladder. In the group of healthy women in general and in different age groups, this indicator is absent at all.

In the third trimester of pregnancy, spontaneous reductions of detrusor were found in all pregnancies of the general group of patients with overactive bladder and different age groups, compared with the absence of this indicator in the general group of healthy women and in different age groups ( $p < 0,001$ ).

When comparing spontaneous contractions of detrusor in 16 weeks of the postpartum period, the value of this indicator was significantly higher in the general group of patients with overactive bladder (98,7%;  $p < 0,001$ ) and in the age group up to 25 years (88,9%;  $p < 0,001$ ). Spontaneous reductions of detrusor in 4 months postpartum are available in all women with urinary incontinence at the age of 26–35 years ( $p < 0,001$ ) and over 35 years old ( $p < 0,01$ ). For comparison, in the general group of healthy women and in different age groups, this indicator missing.

Thus, in the first trimester of pregnancy, significantly lower values of the bladder volume index in the general group ( $290,3 \pm 38,9$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $291,4 \pm 35,8$  ml;  $p < 0,001$ ), 26–35 years ( $294,9 \pm 33,8$  ml;  $p < 0,001$ ) and older than 35 years ( $276,5 \pm 51,8$  ml;  $p < 0,001$ ) in women with overactive bladder compared to the general group of healthy women ( $426,4 \pm 21,5$  ml). When comparing this indicator between the different age groups of practically healthy women, there were significantly lower values in the age groups of 26–35 years ( $415,1 \pm 12,1$  ml;  $p < 0,001$ ) and older than 35 years ( $407,3 \pm 6,8$  ml;  $p < 0,001$ ) in comparison with this indicator of the age group up to 25 years ( $451,2 \pm 10,2$  ml;  $p < 0,001$ ), as well as between women 26–35 years and 35 years of control group ( $p < 0,05$ ).

In the third trimester of pregnancy, significantly lower values of the bladder volume in the general group ( $250,0 \pm 43,5$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $246,3 \pm 39,9$  ml;  $p < 0,001$ ), 26–35 years ( $256,7 \pm 39,4$  ml;  $p < 0,001$ ) and over 35 years old ( $232,9 \pm 53,2$  ml;  $p < 0,001$ ) of women with urinary

incontinence compared with the general group of healthy women ( $395,7 \pm 24,3$  ml). When comparing this indicator between the different age groups of practically healthy women, there were significantly lower values in the age groups of 26–35 years ( $382,9 \pm 15,7$  ml;  $p < 0,001$ ) and over 35 years old ( $375,5 \pm 6,6$  ml;  $p = 0,078$ ) compared to this indicator of the age group up to 25 years ( $423,2 \pm 12,0$  ml;  $p < 0,01$ ). Among women with overactive bladder, a tendency ( $p = 0,052$ ) was found to be lower in women over the age of 35 control group compared with women aged 26–35 years.

Thus, in the group of practically healthy women in 16 weeks of the postpartum period, significantly lower values of the bladder volume in the general group ( $253,0 \pm 45,2$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $260,4 \pm 40,7$  ml;  $p < 0,001$ ), 26–35 years ( $258,2 \pm 39,8$  ml;  $p < 0,001$ ) and over 35 years old ( $234,0 \pm 57,9$  ml;  $p < 0,01$ ) compared with the overall group of healthy women ( $406,8 \pm 24,0$  ml) and different age groups. When comparing this indicator between the practically healthy women, significantly lower values were found in the age groups of 26–35 years ( $394,0 \pm 17,4$  ml;  $p < 0,001$ ) and over 35 years old ( $388,5 \pm 6,2$  ml;  $p = 0,078$ ) of women with overactive bladder compared with this indicator in the age group up to 25 years ( $433,5 \pm 10,6$  ml;  $p < 0,001$ ).

Thus, in the first trimester of pregnancy, significantly higher values of the residual urine volume in the general group ( $40,49 \pm 3,98$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $38,89 \pm 4,46$  ml;  $p < 0,001$ ), 26–35 years ( $40,31 \pm 3,86$  ml;  $p < 0,001$ ) and over 35 years old ( $41,88 \pm 3,89$  ml;  $p < 0,001$ ) of women with overactive bladder compared with the general group of healthy of women ( $15,23 \pm 2,37$  ml). Comparison of this indicator between the different age groups of practically healthy women revealed significantly higher values in the age groups of 26–35 years ( $16,32 \pm 1,12$  ml;  $p < 0,001$ ) and over 35 years old ( $17,45 \pm 0,52$  ml;  $p < 0,01$ ) in comparison with the indicator of the age group up to 25 years ( $12,62 \pm 1,77$  ml;  $p < 0,001$ ), as well as between women 26–35 years and 35 years of control group ( $p < 0,001$ ).

In the third trimester of pregnancy, the values of the indicator of residual urine in the general group ( $51,11 \pm 4,55$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $51,50 \pm 3,76$  ml;  $p < 0,001$ ), 26–35 years old ( $50,66 \pm 4,77$  ml;  $p < 0,001$ ) and over 35 years ( $52,21 \pm 4,30$  ml;  $p < 0,001$ ) of women with overactive bladder compared with the general group of healthy of women ( $27,35 \pm 4,27$  ml). Comparison of this indicator between the different age groups of practically healthy women revealed significantly higher values in the age groups of 26–35 years ( $30,04 \pm 1,64$  ml;  $p < 0,001$ ) and older than 35 years ( $29,36 \pm 1,21$  ml;  $p < 0,001$ ) of women with overactive bladder compared with this indicator in age groups up to 25 years ( $22,71 \pm 3,82$  ml;  $p < 0,01$ ). Among women with overactive bladder, the tendency towards a lower significance of this indicator was found in women over 35 years of control group compared with women age 26–35 years ( $p = 0,079$ ).

In the group of practically healthy women in the 16 weeks of the postnatal period, significantly higher values of the residual urine volume in the general group ( $48,11 \pm 5,86$  ml;  $p < 0,001$ ) and in age groups up to 25 years ( $46,00 \pm 5,41$  ml;  $p < 0,001$ ), 26–35 years ( $47,41 \pm 5,50$  ml;  $p < 0,001$ ) and over 35 years old ( $51,24 \pm 6,26$  ml;  $p < 0,01$ ) of women with overactive bladder compared to the general group of healthy women ( $20,03 \pm 3,94$  ml) and different age groups. Comparison of this indicator among practically healthy women revealed significantly higher values in the age groups of 26–35 years ( $22,43 \pm 2,85$  ml;  $p < 0,001$ ) and older than 35 years ( $21,64 \pm 1,03$  ml;  $p = 0,078$ ) of women with overactive bladder compared with this indicator in age groups up to 25 years ( $16,00 \pm 2,81$  ml;  $p < 0,001$ ). Among women with overactive bladder, there was a significantly lower significance of this indicator in women 25 and 26 to 35 years of age compared with women over 35 years old ( $p < 0,05$ ).

When comparing the cervical-bulk test in the first trimester of pregnancy, the value of this indicator was significantly higher in the general group of patients with overactive bladder (60%;  $p < 0,001$ ) and in age groups up to 25 years (44,4%;  $p < 0,001$ ), 26–35 years (59,2%;  $p < 0,001$ ) and over 35 years old (70,6%;  $p < 0,01$ ) of women with overactive bladder compared to the absence of this indicator in the general group of healthy women and in different age groups.

In the third trimester of pregnancy, a positive cervical-pulmonary test was found in all pregnancies of the general group of patients with overactive bladder and different age groups, compared with the absence of this indicator in the general group of healthy women and in different age groups ( $p < 0,001$ ).

When comparing the cervical bipolar test in 16 weeks of the postpartum period, the value of this indicator was significantly higher in the general group of patients with overactive bladder (90,7%;  $p < 0,001$ ) and in age groups up to 25 years (77,8%;  $p < 0,001$ ), 26–35 years (91,8%;  $p < 0,001$ ) and over 35 years old (94,1%;  $p < 0,01$ ) of women with overactive bladder compared with the absence of this indicator in the general group of healthy women and in different age groups.

### CONCLUSIONS

1. The index of thickness of walls of the bladder with age increases, as in women with overactive bladder, and in practically healthy women. However, the values of this indicator ( $p < 0,001$ ) were significantly higher in the general and in all age groups of women with overactive bladder compared with the same data in a group of practically healthy women.

Also, when comparing this indicator in different gravidity periods, larger values of the bladder wall thickness index in the postpartum period were detected, compared with the third and third trimesters in women of both groups ( $p < 0,001$ ).

2. If in the first trimester of pregnancy in women with overactive bladder spontaneous reduction of detrusor was found in 68% of the general group of women ( $p < 0,01$ ), then in the third trimester of pregnancy spontaneous reductions of detrusor were found in all

pregnant women with urinary incontinence. In the 16 weeks of the postpartum period, the presence of this indicator was established in 98,7% of patients with overactive bladder in general ( $p < 0,001$ ) and in the age group up to 25 years (88,9%;  $p < 0,001$ ).

Spontaneous reduction of detrusor after delivery is available in all women with urinary incontinence aged 26–35 years. and older than 35 years ( $p < 0,01$ ).

For comparison, in the general group of healthy women and in different age groups, this indicator is not available at all stages of the study.

3. Comparing the volume of the bladder in the I, III trimesters of pregnancy and at 16 weeks of the postpartum period, the value of this indicator in the general group of patients with overactive bladder was significantly ( $p < 0,001$ ) higher than in the general group of practically healthy women as well as in different age groups.

4. When comparing the residual urine volume in I, III trimesters of pregnancy and at 16 weeks of the postpartum period, the value of this indicator in the general group of patients with overactive bladder was significantly ( $p < 0,001$ ) more than in the general group of practically healthy women, as well as in different age groups.

5. When comparing the cervical-bulk test in the first trimester of pregnancy, this indicator was found in 60% of pregnant women in the general group of patients with overactive bladder ( $p < 0,001$ ). In the third trimester of pregnancy, a positive cervical-bleb test was found in all patients with overactive bladder. At 16 weeks postpartum, this figure was established in 90,7% of patients with overactive bladder in general ( $p < 0,001$ ).

In the group of healthy women, this indicator is not available at all stages of the study.

Thus, we noted that the spontaneous reduction of the detrusor is a characteristic diagnostic feature of overactive bladder, the thickness of the wall of the bladder is more in the group of women with overactive bladder, which have less volume of the bladder and increased volume of residual urine, which confirms the world data.

### Статус функції закриття сечівника у вагітних із синдромом гіперактивного сечового міхура

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Ультразвуковий (УЗ) метод дослідження був спочатку запропонований як перший крок у діагностиці нетримання сечі, оскільки середня величина товщини стінки сечового міхура та розмірів уретрального сфінктера у роботах багатьох урологів пов'язані з наявністю гіперактивного сечового міхура (ГАСМ).

**Мета дослідження:** визначення сонографічних показників замикального апарату сечівника у вагітних із синдромом ГАСМ.

**Матеріали та методи.** Було проведено оцінювання таких УЗ-показників замикального апарату сечівника, як воронкоподібне розширення сечівника, товщина стінки сечового міхура, об'єм сечового міхура та об'єм залишкової сечі. Проведено оцінювання діагностичної цінності шийково-міхурового тесту у вагітних із синдромом ГАСМ. Отримані результати порівнювали з такими самими у практично здорових вагітних.

**Результати.** Показник товщини стінки сечового міхура з віком збільшується, як у жінок з ГАСМ, так і у практично здорових жінок. Однак достовірно більші значення даного показника ( $p < 0,001$ ) виявлено у групі жінок із синдромом ГАСМ. У III триместрі вагітності позитивний шийково-міхуровий тест був виявлений у всіх пацієнтів з ГАСМ. У групі вагітних з ГАСМ значно менший розмір сечового міхура і збільшений об'єм залишкової сечі, що підтверджує світові дані.

**Заключення.** Дані спонтанних скорочень детрузора у вагітних дозволяють зробити висновок, що цей показник є характерною діагностичною ознакою ГАСМ.

**Ключові слова:** вагітність, ультразвукове дослідження, замикальний апарат сечівника, гіперактивний сечовий міхур.

### Статус функции закрытия мочеиспускательного канала у беременных с синдромом гиперактивного мочевого пузыря

*И.Ю. Костюк, Г.В. Чайка, Ю.С. Гарнец*

Ультразвуковой (УЗ) метод исследования был изначально предложен как первый шаг в диагностике недержания мочи, поскольку среднее значение толщины стенки мочевого пузыря и размеры уретрального сфинктера в работах многих урологов соотносены с наличием гиперактивного мочевого пузыря (ГАМП).

**Цель исследования:** определение сонографических показателей замыкательного аппарата мочеиспускательного канала у беременных с синдромом ГАМП.

**Материалы и методы.** Была проведена оценка таких УЗ-показателей замыкательного аппарата мочеиспускательного канала, как воронкообразное расширение мочеиспускательного канала, толщина стенок мочевого пузыря, объем мочевого пузыря и объем остаточной мочи. Проведено определение диагностической ценности шеечно-пузырчатого теста у беременных с ГАМП. Полученные результаты сравнивали с такими же у практически здоровых беременных.

**Результаты.** Показатель толщины стенок мочевого пузыря с возрастом увеличивается, как у женщин с ГАМП, так и у практически здоровых женщин. Однако достоверно большие значения данного показателя ( $p < 0,001$ ) обнаружено в группе женщин с ГАМП. В III триместре беременности положительный шеечно-пузырчатый тест был обнаружен у всех больных с ГАМП. В группе беременных с ГАМП значительно меньший объем мочевого пузыря и увеличенный объем остаточной мочи, что подтверждает мировые данные.

**Заключение.** Данные спонтанного сокращения детрузора у беременных позволяют сделать вывод, что этот показатель является характерным диагностическим признаком ГАМП.

**Ключевые слова:** беременность, ультразвуковое исследование, замыкательный аппарат мочеиспускательного канала, гиперактивный мочевой пузырь.

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