

URETHROVESICAL SEGMENT ULTRASOUND FOR THE EFFICACY EVALUATION OF SURGICAL TREATMENT OF STRESS URINARY INCONTINENCE

© K.E. Kira¹, V.F. Bezhenar², V.S. Prokhorova³

¹ Leningrad Regional Clinical Hospital, Saint Petersburg, Russia;

² Academician I.P. Pavlov First St. Petersburg State Medical University of the Ministry of Healthcare of the Russian Federation, Saint Petersburg, Russia;

³ The Research Institute of Obstetrics, Gynecology, and Reproductology named after D.O. Ott, Saint Petersburg, Russia

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■ **Hypothesis/Aims of study.** At present, there is no doubt about the importance of the problem of female stress urinary incontinence (SUI) and the search for the best way to eliminate it. Sling operations in SUI treatment are the most popular in world and domestic practice. However, they are not without certain complications. In this regard, it becomes relevant to determine the factors for predicting their effectiveness and safety. The aim of this study was to conduct a comparative study of the effectiveness of two anti-stress operations: TVT-Obturator[®] and urethrovesicopexy with vaginal flap, by using echography of the urethrovvesical segment.

Study design, materials and methods. During the period from 2011 to 2018, 105 incontinent patients were examined and operated on. Two groups were formed: Group 1 consisted of 52 patients who underwent TVT-Obturator[®] surgery, Group 2 included 52 patients who underwent urethrovesicopexy with vaginal flap. In all patients, the anatomical topographic position of the bladder and urethrovvesical segment, the internal urethral sphincter status, as well as the angles α and β were determined, based on which the conclusion about the type of SUI was made and, accordingly, the adequate method of surgical intervention was determined.

Results. Before the operation, the angle α averaged 37.2 ± 10.11 , with 24.7 ± 4.64 a year after the operation and 26.8 ± 3.72 five years after the operation. Rotation of the angle α in the study groups $>20^\circ$ before surgery did not significantly affect the presence of long-term complications, urinary retention after a year and five years, and recurrence of urinary incontinence. After the operation, there was an increase in the angle β after a year ($p = 0.0032$) and five years ($p = 0.0035$) and in the total urethral length after a year ($p = 0.0022$), but after five years, this parameter did not differ significantly from that before surgery ($p = 0.29$).

Conclusion. TVT-Obturator[®] and urethrovesicopexy with vaginal flap are equally effective ($p > 0.05$) in the surgical treatment of female SUI in both the nearest postoperative period (96.2% and 94.3%, respectively) and the distant period (90.4% and 88.7%, respectively).

■ **Keywords:** stress urinary incontinence; TVT-Obturator[®]; vaginal flap; urethrovesicopexy; urethrovvesical segment ultrasound.

УЛЬТРАЗВУКОВОЕ ИССЛЕДОВАНИЕ УРЕТРОВЕЗИКАЛЬНОГО СЕГМЕНТА КАК МЕТОД ОЦЕНКИ ЭФФЕКТИВНОСТИ ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ СТРЕССОВОГО НЕДЕРЖАНИЯ МОЧИ

© К.Е. Кира¹, В.Ф. Беженар², В.С. Прохорова³

¹ Государственное бюджетное учреждение здравоохранения «Ленинградская областная клиническая больница», Санкт-Петербург;

² Федеральное государственное бюджетное образовательное учреждение высшего образования «Первый Санкт-Петербургский государственный медицинский университет им. акад. И.П. Павлова» Министерства здравоохранения Российской Федерации, Санкт-Петербург;

³ Федеральное государственное бюджетное научное учреждение «Научно-исследовательский институт акушерства, гинекологии и репродуктологии им. Д.О. Отта», Санкт-Петербург

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▪ **Актуальность.** Сегодня не вызывает сомнения важность проблемы стрессового недержания мочи у женщин и поиска оптимального способа его устранения. Слинговые операции в лечении стрессового недержания мочи наиболее популярны в мировой и отечественной практике. Однако они не лишены определенных осложнений. В связи с этим актуально определение факторов прогноза их эффективности и безопасности.

Цель — провести сравнительное изучение эффективности двух антистрессовых операций — TVT-Obturator® и уретровезикопексии влагалищным лоскутом — при помощи эхографии уретровезикального сегмента.

Материалы и методы исследования. За период с 2011 по 2018 г. обследовано и прооперировано 105 пациенток с недержанием мочи при напряжении. Были сформированы две группы: первая включала 52 пациентки, которым была проведена операция TVT-Obturator®, вторая — 52 пациентки, которым была выполнена подлонная уретровезикопексия влагалищным лоскутом. У всех пациенток определяли анатомо-топографическое положение мочевого пузыря, уретровезикального сегмента, состояние внутреннего сфинктера уретры, углов α и β , на основании чего определяли тип стрессового недержания мочи и выбирали метод хирургического вмешательства.

Результаты исследования. До операции показатель «угол α » составлял в среднем $37,2 \pm 10,11$, через год после операции — $24,7 \pm 4,64$, а через пять лет после операции — $26,8 \pm 3,72$. Ротация угла α в группах до операции $>20^\circ$ значительно не повлияла на отдаленные осложнения, удержание мочи через год, удержание мочи через пять лет и рецидив недержания мочи. В результате операции достоверно значимо увеличилась величина угла β как через год ($p = 0,0032$), так и через пять лет ($p = 0,0035$) и достоверно значимо увеличилось суммарное значение показателя «длина мочеиспускательного канала» через год ($p = 0,0022$), но через пять лет показатель значимо не отличался от показателя до операции ($p = 0,29$).

Выводы. Операции TVT-Obturator® и уретровезикопексия влагалищным лоскутом одинаково эффективны ($p > 0,05$) при хирургическом лечении стрессового недержания мочи у женщин как в ближайшем послеоперационном (96,2 и 94,3 % соответственно), так и в отдаленном периоде (90,4 и 88,7 % соответственно).

▪ **Ключевые слова:** стрессовое недержание мочи; TVT-Obturator®; влагалищный лоскут; уретровезикопексия; УЗИ уретровезикального сегмента.

Introduction

The problem of urinary incontinence is a leading factor in the decrease in the quality of life of women in premenopausal and postmenopausal periods and childbearing age [1]. Urinary incontinence is a widespread disease registered in 12%–55% of women [1, 2].

To date, many surgical techniques have been developed to correct this condition. Preference is given to minimally invasive loop surgeries using mesh implants [3]. The Tension Free Vaginal Tape (TVT)-Obturator® surgery, a sling surgery using obturative access according to the De Laval technique, is leading because of its simplicity and speed of performing. However, it is not ideal and is associated with certain complications, including implant extrusion, urinary tract obstruction, and recurrent urinary incontinence. Public attitudes toward mesh implants for genital pathology became negative after their complications were published in the public domain. Implants can be offered in any patient with stress urinary incontinence (SUI). It is obvious that surgical correction of SUI using autogenous tissues is still relevant [4, 8]. During the 49th Congress of the International Continence Society in Sweden, the reemergence of classical techniques and their

modifications using autogenous tissues was noted in almost all the participating countries. Thus, the tendency to use autogenous tissues to correct SUI is a relevant vector in urogynecology.

Urethrovesical segment echography is widely used by many international and Russian clinicians [5–7]. It is used to clarify urinary incontinence type and damage degree to the pelvic floor structures before surgery and to assess surgical correction quality after surgery. In particular, the angle α is a differential sign that distinguishes types I and II stress incontinence. Type I SUI is characterized by the absence of angle α change, whereas type II is an increase in the angle α to 45° and more, sometimes reaching 90° (Green T., 1968).

This study aimed to determine the role of urethrovesical segment echography when using suburethral sling surgeries and the method of subpubic urethrovesicopexy with a vaginal graft in patients with SUI.

Materials and methods

This study was conducted from 2010 to 2018. Materials of surgical treatment of SUI from the Department of Operative Gynecology of the D.O. Ott Scientific Research Institute of

Obstetrics, Gynecology, and Reproductology, the A.Y. Krassovsky Clinic of Obstetrics and Gynecology of the S.M. Kirov Military Medical Academy, and the Department of Gynecology of the Leningrad Regional Clinical Hospital (St. Petersburg) were used. The follow-up period for the patients in the study groups ranged from 1 to 5 years or longer. Ultrasonic scanning devices, namely, SonoLine Elegra from SIEMENS (Erlangen, Germany) and Voluson-730 expert (GE Medical Systems) were used. Echography of the urethrovesical segment and dynamic volumetric reconstruction of the urethral sphincter were performed using a multifrequency (4–9 MHz) transvaginal transducer with a volumetric image reconstruction and a linear multifrequency transducer. The studies were conducted with the patient in a supine position at rest and during the Valsalva test. This method was used to both clarify the genital pathology at the examination stage and identify ultrasound signs of SUI, which included a decrease in urethral length, dilatation of the urethra to more than 8 mm, and increase in the inclination angle to more than 15° (angle α is the angle between the proximal part of the urethra and vertical axis of the body) and the posterior urethrovesical angle to more than 90°–110° (angle β is the angle between the proximal part of the urethra and the posterior wall of the bladder at the level of its neck). During the Valsalva test, there was a rotation of the angle α , namely, the proximal part of the urethra moved in the posterior inferior direction, while the change in angle α reflected the rotation degree of the urethra. An increase in the angle α by more than 20° from the initial one was considered a sign of urethral hypermobility or type II SUI. To assess urethral hypermobility using two-dimensional ultrasound scanning, the following signs were considered: (a) dislocation and pathological mobility of the urethrovesical segment, that is, the rotation of the angle α by 20° or more and the posterior urethrovesical angle (β) during the Valsalva test, (b) reduction of the anatomical urethral length, and (c) expansion of the urethra in the proximal and middle sections. Ultrasound examination was also performed for postoperative control. To assess the state of the lower urinary tract, perineal scanning was predominantly performed.

Statistical analysis

All data obtained after history taking and physical, laboratory, and instrumental examination were entered into an electronic record created in Microsoft Excel 2016 application. Statistica 12.0 software from Statsoft was used for statistical analysis.

Results and discussion

A total of 105 patients were included in the study. It was an almost homogeneous female cohort stratified according to the main comparable indicators (age, obstetric and gynecological history, comorbid conditions, and urethrovesical segment echography data with measurement of the angle α and its rotation before surgery, angle β measurement, urethral length [mm] before surgery, and urethral diameter [mm] before surgery). Descriptive statistics on the values of the angle α and the results of checking the influence of the surgery type on the angle α values are presented in Table 1. Before surgery, both groups were homogeneous in this indicator ($p = 0.09$). The initial angle α values in groups 1 and 2 (34.77 and 38.55 before surgery, respectively) differed significantly from 1 (25.7 and 23.7, respectively; $p = 0.027$) and 5 years (31.1 and 26.0, respectively; $p < 0.0001$) after surgery. The change dynamics in the angle α value after surgery is presented in Fig. 1.

In total, the general trend of the angle α change among all 105 patients examined in both groups is presented in Fig. 2. This indicator averaged 37.18 ± 10.11 before surgery, 24.67 ± 4.64 one year after surgery, and 26.81 ± 3.72 five years after surgery.

According to the analysis of variance repeated measures, the value of this indicator was significantly lower both 1 and 5 years after surgery to eliminate SUI (both $p < 0.0001$). These data indicate that both surgical options for SUI were equally effective in correcting anatomical defect.

Angle α rotation. The rotation of angle α by more than 20° in group 1 before surgery did not significantly affect the development of long-term complications ($p = 0.32$), such as urinary retention after 1 and 5 years ($p = 1.0$ and 0.36, respectively) and urinary incontinence recurrence ($p = 0.60$). The angle α rotation by more than 20° in group 2 did not also significantly affect the development of long-term complications after 1 year ($p = 0.81$),

Changes in angle α in the study groupsИзменения угла α у больных в сравниваемых группах

Parameter		Group 1	Group 2	All patients	<i>p</i>
Angle α before surgery	<i>M</i> , average	34.77	38.55	37.18	0.09
	Number	30	53	83	
	σ	11.14	9.31	10.11	
	Q_1 , quantile 1	27.00	32.00	29.00	
	Me, median	33.50	37.00	37.00	
	Q_3 , quantile 3	42.00	46.00	44.00	
Angle α 1 year after surgery	<i>M</i> , average	25.71	23.70	24.67	0.027
	Number	49	53	102	
	σ	5.07	4.01	4.64	
	Q_1 , quantile 1	21.00	20.00	21.00	
	Me, median	26.00	23.00	24.00	
	Q_3 , quantile 3	29.00	26.00	28.00	
Angle α 5 years after surgery	<i>M</i> , average	31.10	26.00	26.81	<0.0001
	Number	10	53	63	
	σ	2.81	3.31	3.72	
	Q_1 , quantile 1	28.00	24.00	24.00	
	Me, median	31.50	26.00	27.00	
	Q_3 , quantile 3	33.00	28.00	29.00	

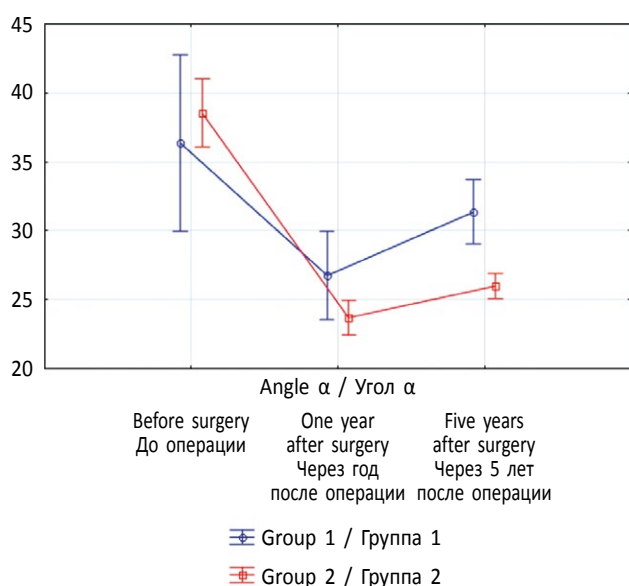


Fig. 1. Mean value angle α dynamics in the study groups, $M \pm m$

Рис. 1. Динамика средних значений показателя «угол α » в первой и во второй группах, $M \pm m$

including urinary retention after 1 and 5 years (both $p = 1.0$) and urinary incontinence recurrence ($p = 0.73$; Fig. 3).

Angle β . Before surgery, the angle β averaged 126.72 ± 11.86 ; the values were 131.62 ± 12.58 and 132.14 ± 10.01 one and five years after surgery, respectively (Fig. 4).

According to the Wilcoxon test, the value of this indicator increased significantly following surgery and remained at the same level after 1 ($p = 0.0032$) and 5 ($p = 0.0035$) years.

Urethral length and diameter. Urethral length in the postoperative period of the compared groups after 1 and 5 years increased compared with the initial value before the surgery, but these results were not statistically significant. Before surgery, the total indicator of urethral length averaged 25.48 ± 4.11 mm, 26.52 ± 3.26 mm 1 year after surgery, and 26.25 ± 3.47 mm 5 years after surgery in both groups. According to the

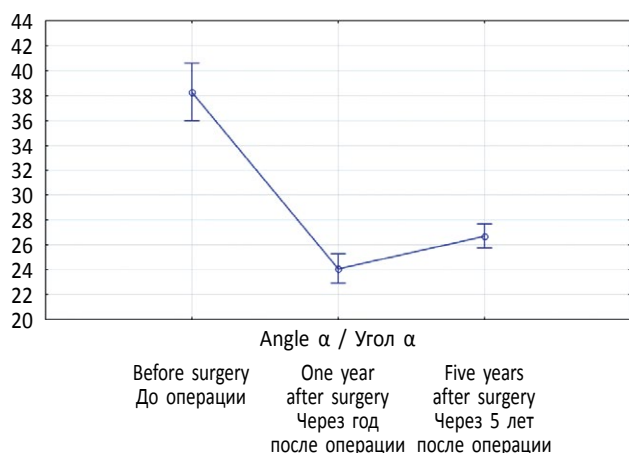


Fig. 2. Total angle α dynamics in the study groups

Рис. 2. Динамика суммарного показателя «угол α » в двух изученных группах

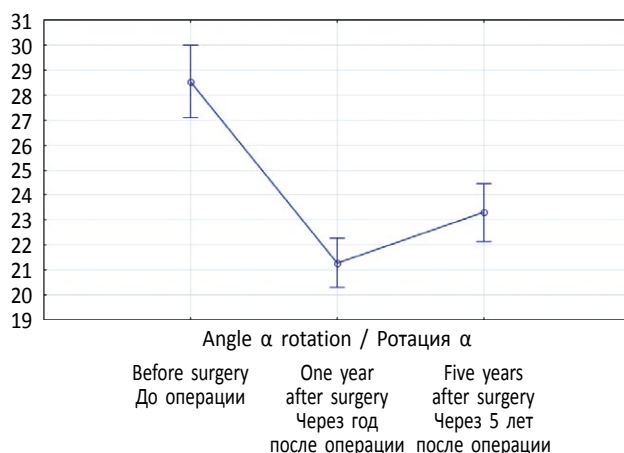


Fig. 3. Total angle α rotation dynamics

Рис. 3. Динамика суммарного показателя «ротация угла α »

Wilcoxon test, following surgery, the total value of this indicator was significantly higher after 1 year ($p = 0.0022$), but after 5 years, this indicator did not significantly differ from the urethral length before the surgery ($p = 0.29$). The total indicator of urethral diameter averaged 8.56 ± 1.79 mm before surgery, 8.43 ± 1.56 mm 1 year after surgery, and 8.67 ± 1.47 mm 5 years after surgery. According to the Wilcoxon test, following surgery, the urethral diameter did not change significantly after 1 ($p = 0.17$) and 5 ($p = 0.85$) years. We did not reveal a significant effect of the parameters studied on the complications (all $p > 0.05$), but there was a tendency toward the influence of urethral diameter after 1 year on urinary retention after 5 years ($p = 0.06$).

Conclusions

1. Echography of the urethrovesical segment of the bladder is a noninvasive, affordable research method that is used to identify urethral hypermobility in patients with SUI.
2. Surgery using a synthetic sling (TVT-Obturator®) is a pathogenetically and anatomically acceptable method for treating SUI. Following this surgery, urethral length increased (26.91 ± 3.73 mm before surgery, 27.5 ± 3.08 mm 1 year after surgery, and 27.00 ± 3.95 mm 5 years after surgery; $p < 0.05$), and the anatomical and topographic position of the urethrovesical segment (bladder neck and proximal urethra) was restored. This is confirmed by a decrease in the angle α (34.77 ± 11.14 mm before surgery, 25.71 ± 5.07 mm 1 year after surgery, and

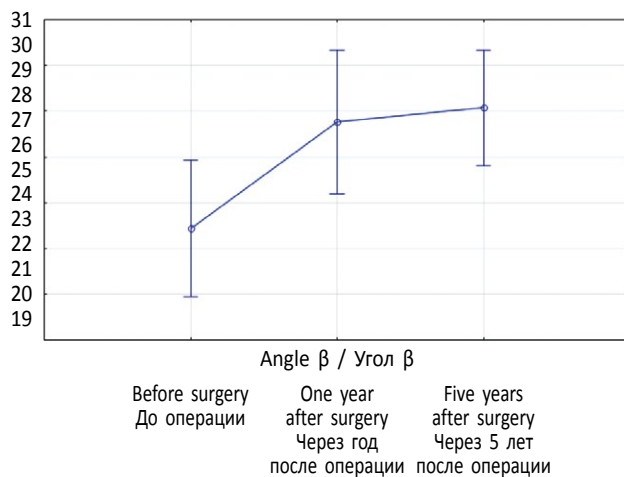


Fig. 4. Total angle β dynamics

Рис. 4. Динамика суммарного показателя «угол β »

3. Urethrovesicoplexy with a vaginal graft in the treatment of SUI is anatomically and functionally reasonable because of the formation of a suburethral ridge, used as a support for the middle third of the urethra, which contributes to the restoration of urethral length in the short-term and long-term postoperative periods (25.50 ± 3.42 mm before surgery, 26.30 ± 3.26 mm 1 year after surgery, and 26.05 ± 3.33 mm 5 years after surgery; $p < 0.05$), decrease in the angle α (38.55 ± 9.31 mm before surgery, 23.70 ± 4.01 mm 1 year after surgery; $p < 0.05$), decrease in the angle α rotation (23.20 ± 8.20 mm before surgery, 16.60 ± 3.66 mm 1 year after surgery, and 19.11 ± 3.14 mm 5 years after surgery; $p < 0.05$), and increase in the posterior urethrovesical angle.

surgery, and 26.00 ± 3.31 mm 5 years after surgery; $p < 0.05$), decrease in the rotation of angle α (28.48 ± 3.15 mm before surgery, 18.71 ± 1.35 mm 1 year after surgery, and 20.81 ± 3.21 mm 5 years after surgery; $p < 0.05$), and increase in the posterior urethrovesical angle. Restoration of optimal anatomical and topographic relationships leads to the normalization of urination function due to the higher position of the fundus of the bladder, which enables the increase of the maximum urethral pressure and the functional length of the urethra. An additional advantage of urethrovesicopexy with a vaginal graft is the ability to eliminate grade I–II cystocele by cutting out the graft from the anterior vaginal wall.

4. Surgeries with the use of a synthetic loop (TVT-Obturator®) and urethrovesicopexy with a vaginal graft are equally effective ($p > 0.05$) in the surgical treatment of SUI in women in both the immediate postoperative (96.2% and 94.3%, respectively) and long-term periods of more than 5 years (90.4% and 88.7%, respectively).

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Information about the authors (Информация об авторах)

Ksenia E. Kira — MD, Leningrad Regional Clinical Hospital, Saint Petersburg, Russia. **E-mail:** ksenia_kira@mail.ru.

Vitaly F. Bezhenar — MD, PhD, DSci (Medicine), Professor, Head of the Department of Obstetrics, Gynecology, and Reproductive Sciences, Head of the Department of Obstetrics, Gynecology, and Neonatology, Chief of the Obstetrics and Gynecology University Hospital. Academician I.P. Pavlov First St. Petersburg State Medical University, Saint Petersburg, Russia. <https://orcid.org/0000-0002-7807-4929>. **E-mail:** bez-vitaly@yandex.ru.

Victoria S. Prokhorova — MD, PhD, Head of the Ultrasound Department. The Research Institute of Obstetrics, Gynecology, and Reproductology named after D.O. Ott, Saint Petersburg, Russia. <https://orcid.org/0000-0002-4421-7901>. SPIN-code: 2450-7154. **E-mail:** viprokhorova@yandex.ru.

Ксения Евгеньевна Кира — врач — акушер-гинеколог. ГБУЗ «Ленинградская областная клиническая больница», Санкт-Петербург. **E-mail:** ksenia_kira@mail.ru.

Виталий Федорович Беженарь — д-р мед. наук, профессор, заведующий кафедрой акушерства, гинекологии и репродуктологии, заведующий кафедрой акушерства, гинекологии и неонатологии, руководитель клиники акушерства и гинекологии. ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. акад. И.П. Павлова» Минздрава России, Санкт-Петербург. <https://orcid.org/0000-0002-7807-4929>. **E-mail:** bez-vitaly@yandex.ru.

Виктория Сергеевна Прохорова — канд. мед. наук, заведующая отделением ультразвуковой диагностики. ФГБНУ «НИИ АГиР им. Д.О. Отта», Санкт-Петербург. <https://orcid.org/0000-0002-4421-7901>. SPIN-код: 2450-7154. **E-mail:** viprokhorova@yandex.ru.