CEOG Clinical and Experimental Obstetrics & Gynecology

The size of posterior urethrovesical angle change affects the success of sling operations

E. Unlubilgin[1], Y. Karasu[2], S. Ozdogan[3], B. Karadag[2], I. Dolen[1]

[1] Department of Gynecology, Etlik Zubeyde Hanim Training and Research Hospital, Ankara
[2] Department of Obstetrics and Gynecology, Ankara Teaching and Research Hospital, Ankara; [3] Private Hospital, Istanbul (Turkey)

Summary

Purpose: To analyze the effect of the size of posterior urethrovesical angle (PUVA) changes on the efficacy of surgical incontinence treatments. *Materials and Methods:* This study included 126 patients with stress urinary incontinence. The patients were randomized into transobturator tape (TOT) and retropubic sling (RPS) groups. Ultrasonographic PUVA measurements were taken at rest and during the Valsalva maneuver before and after the operation. The efficiency of the operation and the size of the changes in PUVA measurements in the TOT and RPS groups were analyzed. *Results:* There were 66 patients in the TOT group and 60 patients in the RPS group. In both groups, there were statistically significant differences between preoperative and postoperative PUVA values ($p < 0.05$). When all patients were analyzed, the objective cure rates in patients with changes of < 20° or > 20° were 65.9% and 87.8%, respectively ($p = 0.009$: OR: 3.52 (1.33–9.28). *Conclusion:* Intraoperative efforts to maintain a PUVA difference of more than > 20° may help to increase the surgical success of TOT and RPS operations.

Key words: Retropubic; Sling; Transobturator; Urethrovesical angle.

Introduction

Involuntary loss of urine with activity is known as stress urinary incontinence (SUI), which occurs with increased intra-abdominal pressure, such as with coughing, sneezing, and walking. SUI is a major health problem, affecting 5–30% of women aged 30 to 60 years [1]. It has a substantial effect on an individual's perception of wellbeing, body image, and quality of life. Although SUI is very common, most patients do not seek help from their physicians for treatment. The diagnostic steps of SUI include a complete history of the symptoms, a quality of life (QoL) questionnaire, a voiding diary, a physical examination, urinalysis, uroflowmetry, and post-voiding residual (PVR), urodynamic tests, pad and dye tests, and imaging techniques. Although ultrasound has limited use in the diagnosis of SUI, it allows the clinician to determine the dynamic geometry of the pelvic organs, and it can also identify movement of the pelvic structures, the position and mobility of the bladder neck, and the location of implanted tapes and meshes. Urethral hypermobility can be directly involved in the pathogenesis of SUI, and therefore restoration of vaginal support to the bladder neck and urethra can cure incontinence. By using ultrasound, the degree of urethral hypermobility and the effect of mid-urethral slings on hypermobility can be easily detected.

The primary aim of the present study was to evaluate the effects of retropubic sling (RPS) and transobturator tape (TOT) on the posterior urethrovesical angle (PUVA). The secondary aim was to explore the size difference of the PUVA and its relationship to an objective cure.

Materials and Methods

This study included 126 patients with SUI who were admitted to the Urogynecology Unit at Etlik Zübeyde Hanim Women's Health Teaching and Research Hospital between July 2009 and January 2011. Patients with pelvic organ prolapse and previous incontinence surgery were excluded from the study. All of the patients gave informed consent, and the hospital's ethics committee approved the study (report number and date: 33-31/26.06.2009). A complete clinical history, pelvic examination, neurological examination (clitoral reflex, anal reflex, and cough reflex), urinalysis, and cultures were performed for each patient. Stress tests, stress cough pad tests, urodynamic tests, the Marshall–Marchetti test, and the Bonney test were also performed, and the patients were then randomly allocated into two groups according to a computer program, before the ultrasonographic assessment. The sample size of the study was determined by the power analysis. In order to achieve 80% power, the number of patients for each group was estimated to be 50. The authors decided to add approximately 20 patients to this after considering losses to follow-up. Therefore, the total sample size was calculated to be 140 patients (70 in each arm) ($\alpha = 0.1$).

Ultrasonographic PUVA measurements were performed introitally in the supine position. Before the measurement, each patient was catheterized with a 16-gauge Foley catheter and the bladder was filled with 300 ml of saline solution, then the catheter was removed. The aim of this practice was to standardize all ultrasonographic measurements. A Logic P5 ultrasound machine with an eight-MHz vaginal probe was used for the measurements, but the probe did not encroach into the vagina, so there was no

Revised manuscript accepted for publication March 9, 2016

Table 1. — *Demographic and clinical characteristics.*

	TOT (n= 66)	RPS (n=60)	*p*-value
Age (years)	48.44	46.9	0.082
Parity (number)	3.35	3.14	0.374
BMI (kg/m^2)	31.47	29.41	0.076
Postmenopausal state (%)	28.8	29.5	0.138
Follow up (days)	364	366.6	0.423
Hospital stay (days)	1.65	1.58	0.095

Table 2. — *Cure rates of the operations.*

	TOT (n= 66)	RPS (n=60)	*p*-value
Objective cure rates	50 (75.8%)	51 (85%)	0.210
Subjective cure rates	52 (78.8%)	53 (88.3%)	0.133

Table 3. — *The comparison of preoperative and postoperative PUVA measurements between groups.*

	TOT (n= 66)	RPS (n=60)	*p*-value
Preoperative			
Resting	137	136.3	0.727
Valsalva	146.7	143.5	0.134
p-value	0.024	0.028	
Postoperative day 1			
Resting	113	108.8	0.063
Valsalva	119.1	115.1	0.108
p-value	0.036	0.031	
Postoperative long-term			
Resting	112.7	113	0.921
Valsalva	120	118.3	0.521
p-value	0.029	0.038	

Table 4. — *The comparison of preoperative and postoperative PUVA changes in groups.*

PUVA	Preoperative	Postoperative day 1	*p*-value
TOT (n=66)			
Resting	137	113	< 0.001
Valsalva	146.7	119.1	< 0.001
RPS (n=60)			
Resting	136.3	108.8	< 0.001
Valsalva	143.5	115.1	< 0.001

PUVA	Postoperative day 1	Postoperative long-term	*p*-value
TOT (n=66)			
Resting	113	112.7	0.858
Valsalva	119.1	120	0.466
RPS (n=60)			
Resting	108.8	113	0.02
Valsalva	115.1	118.3	0.03

distortion of the anatomy of the PUVA. The same physician performed all of the ultrasonographic examinations and angle measurements. PUVA was measured automatically with a program that is used for pediatric hip angle measurements. The first axis of the PUVA was determined according to the anterior wall of urethra, and the second axis was at the base of the bladder. In each patient, the mean of three PUVA measurements was used.

Quality of life assessments were performed with Wagner's QoL questionnaire [2]. The authors performed the TOT procedure as described by Delorme *et al.* in 2001 for the first group, and the RPS procedure for the second group [3]. The patients were operated under regional anesthesia by two surgeons who regularly perform both procedures. Monofilament polypropylene mesh was used for both of the procedures. PUVA was measured again the day after the surgery. Postoperative long-term control visits were documented after approximately a year, when the patients were re-evaluated with a history, physical examination, QoL questionnaire, and PUVA measurements. An objective cure was defined as the patient staying dry (stress-negative) during the cough test with a full bladder. At this control visit, each patient was questioned whether or not any benefit had been gained.

The frequency distribution of data and mean ± standard deviation values were calculated with the SPSS 17.0 statistical software package. Student's *t*-test and the Mann–Whitney U test were used for continuous data, and the chi-square test was used for categorical data. Statistical significance was defined as $p < 0.05$.

Results

This study included 126 patients with SUI (patients were not included for statistical analyses who were lost to follow-up). According to the surgery performed, the patients were divided into two groups: the TOT group (n=66) and the RPS group (n=60). There were no statistically significant differences in the demographic characteristics between the two groups (Table 1). The mean follow-up period was 12.9 (range: 9–20) months. In the TOT group, the mean hospital stay was 1.65 ± 0.03 days, and in the RPS group it was 1.95 ± 0.71 days. There were no major intraoperative complications in either group. Three patients in the TOT group (4.5%) and four patients in the RPS group (6.6%) complained of postoperative *de novo* urgency, but the difference was not statistically significant ($p = 0.374$). Mesh erosion was detected in only one patient (1.5%) in the TOT group, who was treated with topical estrogen and oral antibiotic therapy. The authors carried out intermittent catheterizations for one patient in the TOT group (1.5%) because of postoperative voiding difficulty, and she had no further problems after one week. The objective and subjective cure rates in the RPS group were better than those of the TOT group, but there was no statistical significance ($p > 0.05$) (Table 2). As seen in Table 3, the PUVA values at rest and with the Valsalva maneuver for both groups were assessed pre- and postoperatively. Although there were no statistically significant differences between the groups for every measurement period ($p > 0.05$), the Valsalva maneuver had an increasing effect on the PUVA ($p < 0.05$). In both groups, the preoperative PUVA values were clearly decreased on the postoperative assessments ($p < 0.05$) (Table 4). In the TOT group, PUVA values were similar on the

Table 5. — *PUVA change at rest and objective cure rate.*

	< 20°	> 20°	*p*-value	Odds ratio
TOT	65.4% (n= 17 / 26)	82.5% (n= 33 / 40)	0.078	2.49 (0.792-7.86)
RPS	66.7% (n= 12 / 18)	92.8% (n= 39 / 42)	0.026	7 (1.07-45.4)
Total	65.9% (n= 29 / 44)	87.8% (n= 72 / 82)	0.009	3.52 (1.33-9.28)

Table 6. — *I-QOL results.*

	TOT (n= 66)	RPS (n=60)
Preoperative I-QOL questionnaire (%)		
Mild	1 (1.5%)	3 (5%)
Moderate	17 (25.8%)	14 (23.3%)
Severe	48 (72.7%)	43 (71.7%)
Postoperative I-QOL questionnaire (%)		
Mild	43 (65.2%)	48 (80%)
Moderate	20 (30.3%)	8 (13.3%)
Severe	3 (4.5%)	4 (6.7%)

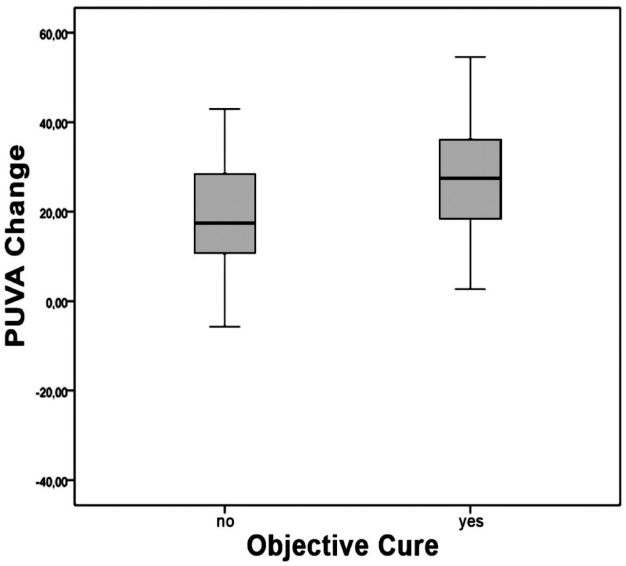

Figure 1. — PUVA and objective cure changes.

postoperative first day and at the long-term control visit, while in the RPS group, both at rest and during Valsalva, a statistically significant difference was observed ($p < 0.05$). At the beginning of the study, the authors did not know what size of PUVA change would have a critical importance for objective cure, but as a result of the statistical evaluation, they determined that the cure rates increased at > 20°. If the PUVA difference in TOT group was < 20°, the objective cure rate was 65.4%, but if the change was > 20°, the objective cure rate was increased to 82.5% (Table 5). Although there was no statistically significant difference, the authors observed an increase in the objective cure rate in this group. In the RPS group, the objective cure rate was 66.7% when the PUVA difference was < 20°, but if the PUVA difference was > 20°, the objective cure rate was increased to 92.8%, which was statistically significant ($p = 0.026$; OR: 7 [1.07–45.4]). Analysis of all of the patients revealed that the objective cure rates in patients with a PUVA difference of < 20° or > 20° were 65.9% and 87.8%, respectively ($p = 0.009$; OR: 3.52 [1.33–9.28]) (Figure 1). After the operations, there was an obvious improvement in the I-QOL questionnaires, which was correlated with the objective cure rates in both groups (Table 6).

Discussion

A common anatomic abnormality found in women with SUI is urethral hypermobility, with an increase in the PUVA value. The aim of this study was to evaluate whether or not such a change exists in the PUVA, and to show the effects of two commonly used surgical techniques on the PUVA. Ultrasound (US) in urogynecology can be used to assess the structure of the bladder, urethra, and pelvic diaphragm. Urethral mobility, PUVA, bladder neck position, residual bladder volume, and surgical implant volume can be evaluated with US [4]. PUVA measurements can be performed via transvaginal, transperineal, or introital approaches. The transvaginal approach may exert excessive pressure and induce a compressive effect on the lower urinary tract [5]. The perineal (translabial) or introital approaches can prevent distortion of the anatomy of the lower urinary tract, and are the most commonly used. Introital US can provide high resolution of urethral and paraurethral tissues [4]. PUVA is accepted as normal when it measures 90°–120° [6, 7]. In this study, the authors determined that almost all patients had increased PUVA values before the surgery. Increased PUVA with SUI was also shown in other studies [8, 9]. The authors found differences in the objective cure rates according to PUVA changes in both groups. However, this difference was statistically significant only in the RPS group ($p = 0.026$). In this group, the objective cure rate was 66.7% in patients with a < 20° angle change, but when the change was > 20°, the objective cure rate increased to 92.8%. Although it was not statistically significant, there was an important difference in the objective cure rates of the patients in the TOT group (65.4% *vs*. 82.5%). The authors estimate that intraoperative efforts to control changes in the PUVA and maintaining this difference at > 20° may help to increase the surgical success of TOT and RPS operations. Since these operations are tension-free, it is advised to ensure that the tape exerts no tension by allowing a clamp to pass easily between the tape and the urethra. It can be difficult to decide to perform tension in these operations because over-tension may cause complications, such as difficulty voiding and urethral erosion. In this study, only one patient experienced postoperative voiding difficulty,

and she was treated with intermittent catheterizations. In this patient, the PUVA difference was 27.3° at rest and 34° during Valsalva, and the stress test was negative at the long-term control visit. Since there were not many patients with voiding difficulty or urethral erosion, the authors cannot comment on the safe upper limit of PUVA differences in these operations. However, they believe that it will be possible to control this change without creating over-tension on the urethra. Of course, more studies are needed to test this idea. There have been other studies evaluating PUVA as a marker of SUI and pelvic organ prolapse [10, 11]. However, the present study is the first to attempt to identify a marker that can be used both to increase the objective cure rates and to predict postoperative success. In the present study, there were no major changes in PUVA measurements one year after the operations. At the long-term control visits, the PUVA measurements were still similar to the PUVA values taken just after the operations. Only in the RPS group there were statistically significant differences between postoperative day 1 values and postoperative long-term control values, both at rest and during the Valsalva maneuver, but they were still within the normal range. The authors concluded that meshes adhere to the tissues well just after the surgery, and that this does not change much over time. They believe that PUVA measurements taken before and immediately after the operation may provide information about the expected success of TOT and RPS operations. The success rates of the TOT and RPS operations in this study were similar to those of other studies in the literature [12-14]. The objective cure rates in this study were 75.8% and 85% in the TOT and RPS groups, respectively.

Conclusion

TOT and RPS operations are effective in the treatment of stress urinary incontinence. Both of these procedures cause statistically significant changes in the PUVA. The authors believe that the PUVA difference calculated postsurgically can be used to predict the expected cure rate of TOT and RPS operations. If the change in PUVA can be maintained at > 20°, the success rate of these procedures will increase. However, more studies are needed to test the effects of intraoperative efforts to control changes in the PUVA.

References

[1] Hampel C., Artibani W., Espuña Pons M., Haab F., Jackson S., Romero J., *et al.*: "Understanding the burden of stress urinary incontinence in Europe: a qualitative review of the literature". *Eur. Urol.,* 2004, *46*, 15.

[2] Wagner T.H., Patrick D.L., Bavendam T.G., Martin M.L., Buesching D.P.: "Quality of life of persons with urinary incontinence: Development of a new measure". *Urology,* 1996, *47*, 67.

[3] Delorme E., Droupy S., de Tayrac R., Delmas V.: "Transobturator tape (Uratape). A new minimally invasive method in the treatment of urinary incontinence in women". *Prog. Urol.,* 2003, *13*, 656.

[4] Ling-Hong T.: "Ultrasound in Urogynecology: An Update on Clinical Application". *J. Med. Ultrasound,* 2007, *15*, 45.

[5] Koelbl H., Hanzal E.: "Imaging of the lower urinary tract". *Curr. Opin. Obstet. Gynecol.,*1995, *7*, 382.

[6] Dietz H.P.: "Pelvic floor ultrasound: a review". *Am. J. Obstet. Gynecol.*, 2010, *202*, 321.

[7] Green T.H.: "Urinary stress incontinence: differential diagnosis, pathophysiology and management". *Am. Obstet. Gynecol.,* 1975, *122*, 368.

[8] Alper T., Cetinkaya M., Okutgen S., Kokcu A., Malatyalioglu E.: "Evaluation of Urethrovesical Angle by Ultrasound in Women with and without Urinary Stress Incontinence". *Int. Urogynecol. J.,* 2001, *12*, 308.

[9] Pregazzi R., Sartore A., Bortoli P., Grimaldi E., Troiano L., Guaschino S.: "Perineal ultrasound evaluation of urethral angle and bladder neck mobility in women with stress urinary incontinence". *BJOG,* 2002, *109*, 821.

[10] Şener T., Özalp S., Hassa H., Yalçin Ö.T., Zeytinoğlu S.: "Preoperative and postoperative transperineal ultrasonographic assessment of the posterior urethrovesical angle in stress incontinent women". *J. Gynecol. Surg.*, 1997, *13*, 109.

[11] Sumi T., Ishiko O., Hirai K., Yoshida H., Ogita S.: "Is measuring the posterior urethrovesical angle of clinical value for controlling pelvic organ Prolapse? Retrospective analysis of 107 postoperative cases". *Gynecol. Obstet. Invest.*, 2000, *49*, 183.

[12] Delorme E., Droupy S., de Tayrac R., Delmas V.: "Transobturator tape (Uratape): a new minimally invasive procedure to treat female urinary incontinence". *Eur. Urol.*, 2004, *45*, 203.

[13] Cindolo L., Salzano L., Rota G., Bellini S., D'Afiero A.: "Tension-free transobturator approach for female stress urinary incontinence". *Minerva Urol. Nefrol.*, 2004, *56*, 89.

[14] Costa P., Grise P., Droupy S., Monneins F., Assenmacher C., Ballanger P., *et al.*: "Surgical treatment of female stress urinary incontinence with a transobturator-tape (T.O.T.) Uratape: short term results of a prospective multicentric study". *Eur. Urol.*, 2004, *46*, 102.

Corresponding Author:
E. UNLUBILGIN, M.D.
Kardelen Mah. Ugur Sitesi No:43
Batikent / Ankara (Turkey)
e-mail: eylembilgin@gmail.com