



Impact of Transobturator Tape Treatment on Overactive Bladder Symptoms, Particularly Nocturia, in Patients With Mixed Urinary Incontinence

Sang Keun Lee, Ho Won Kang, Won Tae Kim, Yong-June Kim, Seok Joong Yun, Sang-Cheol Lee, Wun-Jae Kim

Department of Urology, Chungbuk National University Hospital, Cheongju, Korea

Purpose: We assessed the impact of transobturator tape (TOT) treatment on overactive bladder (OAB) symptoms with a particular focus on nocturia in patients with mixed urinary incontinence (MUI).

Materials and Methods: In this retrospective cohort study, the medical records of 237 women who underwent TOT surgery for the treatment of MUI were reviewed. Of these, 86 patients (36.4%) had preoperative nocturia. Patients with neurological diseases or sleep disorders that could affect the voiding pattern were excluded. Patients who were being treated with anticholinergics and antidiuretic hormones were also excluded, which left 70 subjects eligible for analysis. Pre- and postoperative evaluations consisted of a physical examination, 3-day frequency-volume chart, and health-related quality of life questionnaires (King's health questionnaire, overactive bladder symptom score, and OAB-questionnaire).

Results: TOT treatment resulted in an overall significant improvement in OAB symptoms including nocturia. Frequency-volume charts revealed that TOT treatment significantly decreased the actual number of nightly voids (ANV) and the nocturnal bladder capacity index (NBCi) in the entire cohort. However, in a subgroup of women with nocturnal polyuria, there was no significant change in ANV or NBCi after the sling operation. Correlation analysis of the whole cohort revealed that the postoperative changes in NBCi correlated positively with postoperative changes in ANV. The nocturia-persisting group was more likely to have nocturnal polyuria and lower preoperative functional bladder capacity compared with the nocturia-improved group ($p=0.024$ and $p=0.023$, respectively).

Conclusions: Our results demonstrated that the TOT procedure resulted in an overall significant improvement in OAB symptoms including OAB-related nocturia in patients who presented with MUI.

Keywords: Nocturia; Questionnaires; Transobturator tape; Stress urinary incontinence

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article History:

received 9 April, 2014
accepted 5 June, 2014

Corresponding Author:

Seok Joong Yun
Department of Urology,
Chungbuk National University
College of Medicine and Institute
for Tumor Research, 410
Sunbong-ro, Heungdeok-gu,
Cheongju 361-763, Korea
TEL: +82-43-269-6371
FAX: +82-43-269-6144
E-mail: sjoyun@chungbuk.ac.kr

INTRODUCTION

Nocturia and urinary incontinence (UI) are common bothersome symptoms that are well known to affect health-related quality of life (HRQoL) [1-3]. Stress UI (SUI) is often accompanied by overactive bladder (OAB) syndrome,

which is urgency with or without urge incontinence that is usually accompanied by frequency and nocturia [4,5]. Mixed urinary incontinence (MUI) is defined as the complaint of involuntary loss of urine, associated with urgency and also with effort or physical exertion or on sneezing or coughing. Compared with women with other types of UI,

women with MUI often report that their symptoms are more troublesome in terms of quality of life. There are multiple contributing etiologies for nocturia, including decreased bladder capacity, which also causes OAB-related nighttime micturition [6-8]. Numerous studies have suggested that the midurethral sling procedure significantly reduces not only SUI but also OAB symptoms [9-14]. Our hypothesis was that improvement in OAB-related symptoms or urge incontinence after the transobturator tape (TOT) procedure in patients who present with MUI may also influence nocturia symptoms. To the best of our knowledge, however, the influence of the sling operation on nocturia has rarely been addressed in published reports. The present study thus determined the effects of the TOT procedure on OAB symptoms, with a particular focus on nocturia, in patients with MUI.

MATERIALS AND METHODS

1. Study population and data collection

The medical records of 237 patients with MUI who underwent the TOT operation between January 2007 and May 2012 were reviewed retrospectively. Of these, 86 patients (36.4%) had preoperative nocturia as recorded in a frequency-volume chart (actual number of nightly voids $[ANV] \geq 1$). Patients with conditions that could affect urinary function, such as neurological diseases, sleep disorders, urinary tract infection, pelvic organ prolapse, or global polyuria (24-hour urine volume that exceeded 40 mL/kg, as measured in a frequency-volume chart) were excluded. Patients who were being treated with anticholinergics and antidiuretic hormones were also excluded. In total, 70 subjects were eligible for analysis.

All patients were evaluated by history taking, where details such as the severity of UI and parity were recorded. To assess their HRQoL, the patients were asked to complete the King's health questionnaire (KHQ), the OAB-questionnaire (OAB-q), and the overactive bladder symptom score (OABSS) [4,15,16]. Before the operation, the patients underwent a physical examination, completed a 3-day frequency-volume chart, and underwent urodynamic studies (uroflowmetry, postvoid residual volume assessment, multichannel cystometry, urethral pressure profilometry, and electromyography). Three months after the operation, all patients again underwent a physical examination and completed a 3-day frequency-volume chart. They also completed the KHQ, OAB-q, and OABSS again. The operation-related complications and the objective surgical outcomes were assessed by the same urologist for all patients.

Postoperative assessment consisted of clinical examination, flowmetry with measurement of postvoid residual urine by ultrasonography, and a cough test with a full bladder. The patients were considered as cured when they did not present any stress urine leakage during a cough test with a full bladder and without the need of any pad during the past month.

2. Definition of variables

The variables in the 3-day frequency-volume chart were expressed as the average of the 3 days. The grade of SUI was classified by using the Stamey grade [17]. Nocturia was defined according to the International Continence Society as an $ANV \geq 1$ [18]. All patients who had nocturia ($ANV \geq 1$) before the operation were initially managed conservatively with fluid intake management and bladder training. Nocturnal polyuria (NP) was defined as a nocturnal urine volume of more than 20% to 33% of 24-hour urine volume, namely, a nocturnal polyuria index ($NPI \geq 0.20-0.33$ (percentage adjusted according to age: more than 20% of daily urine output at night in young patients and more than 33% in elderly patients) [19]. Reduced nocturnal bladder capacity was defined as a nocturnal bladder capacity index ($NBCi > 0$). Mixed-type nocturia was defined as a combination of NP and reduced nocturnal bladder capacity [7]. The subjective nocturia symptoms were assessed by using the KHQ and the OAB-q [4,15,16]. The subscale scores focused on the problems affecting the sleep of the patient. A patient was deemed to have obtained an objective improvement of nocturia if her mean ANV before the operation was ≥ 1 and it changed to $ANV < 1$ in the postoperative 3-day frequency-volume chart.

3. TOT procedure

The operation was performed by using outside-in obturator tape (Iris-TOT, Dow Medical, Seoul, Korea) in the usual manner [20], in which the patient was sedated with an intravenous propofol infusion with local infiltration of bupivacaine. A Foley catheter was removed the next morning. All operations were performed by a single surgeon (S.J.Y.).

4. Statistical analysis

The results are expressed as means \pm standard deviations. The differences between groups in terms of urodynamic and demographic parameters were assessed by using the Mann-Whitney U test. A Wilcoxon signed rank test was used to compare the values before and after surgery. Categorical variables were compared by using the chi-square test or Fisher exact test, as appropriate. All statistical analyses were performed by using IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA). All tests were 2-tailed analyses and $p < 0.05$ was considered to indicate statistical significance.

RESULTS

1. Baseline characteristics

The baseline characteristics of the 70 enrolled patients are presented in Table 1. The mean age of the patients was 54.8 years (range, 33-73 years). Use of the Stamey grading system revealed that 26 patients (37.1%) had grade 1 SUI and 44 patients (62.9%) had grade 2 SUI. The overall subjective and objective cure rates of SUI were 88.6% and 82.9%, respectively. Acute urinary retention was observed in 4 pa-

tients (5.7%), but all cases were improved in a short period of time without removal or release of the sling. No case of severe hemorrhage or injury to the bladder, obturator nerves, or vessels occurred.

2. Changes in OAB symptoms

Assessments of the pre- and postoperative OABSS questionnaire are presented in Table 2. Placement of a mid-urethral sling resulted in an overall significant improve-

TABLE 1. Baseline clinical characteristics and surgical outcomes after transobdurator tape treatment in female mixed urinary incontinence (n=70)

Variable	Value
Age (y), mean±SD (range)	54.80±8.58 (33-73)
Body mass index (kg/m ²)	25.62±3.46
Parity	68 (97.1)
Vaginal delivery	63 (90.0)
Vaginal delivery (no. of children)	2.48±1.28
Menopause	49 (70.0)
Duration of symptom (y)	5.55±5.09
Incontinence episodes (no./wk)	4.86±3.51
Pad use	51 (72.9)
Symptom grade	
Grade I	26 (37.1)
Grade II	44 (62.9)
Nocturia type	
Nocturnal polyuria	17 (24.3)
Reduced nocturnal bladder capacity	21 (30.0)
Mixed	32 (45.7)
Urodynamic study	
Uninhibited detrusor contraction	41 (58.6)
Valsalva leak point pressure (mmHg)	87.31±25.95
Maximal urethral closure pressure (mmHg)	51.43±21.36
Functional urethral length (cm)	3.48±0.57
Surgical outcomes	
Objective cure rate of SUI	58 (82.9)
Subjective cure rate of SUI	62 (88.6)
Operative and postoperative complications	
Urinary retention	4 (5.7)
<i>De novo</i> urgency	1 (1.4)
Vaginal erosion	1 (1.4)

Values are presented as mean±SD or number (%) unless otherwise indicated.

SD, standard deviation; SUI, stress urinary incontinence.

TABLE 2. Pre- and postoperative changes of overactive bladder symptom score after transobturator tape in female mixed urinary incontinence (n=70)

Variable	Preoperative	Postoperative	Change	p-value ^a
Daytime frequency	1.37±0.64	0.78±0.74	0.59±0.91	<0.001
Nocturia	2.02±0.92	0.88±0.48	1.14±0.94	<0.001
Urgency	2.46±1.35	1.25±1.48	1.21±1.98	<0.001
Urgency incontinence	1.92±1.54	0.67±1.29	1.25±1.95	<0.001

Values are presented as mean±standard deviation.

^a:A p-value was based on the Wilcoxon signed ranks test.

ment in all OAB symptoms including nocturia.

3. Subjective and objective nocturia symptom changes after the TOT procedure

We particularly focused on nocturia symptoms after the TOT procedure. As shown in Table 3, the sling operation significantly improved the subjective nocturia symptoms of the patients. Specifically, the KHQ sleep/energy domain score dropped from 51.04±30.44 to 18.40±22.08, and the OAB-q HRQoL sleep subscales score rose from 47.71±26.22 to 85.57±14.04 (both p<0.001). The sling operation significantly improved the objective nocturia symptoms of the patients, as indicated by the frequency-volume charts: 39 patients (55.7%) obtained an objective improvement of nocturia (ANV<1) after the operation. Analysis of the preoperative and postoperative 3-day frequency-volume charts revealed that the operation significantly decreased the mean 24-hour total void number from 10.27±2.71 to 7.66±2.35, the mean daytime frequency from 8.60±2.45 to 6.76±2.00, the mean ANV from 1.68±0.80 to 0.90±0.82, and the mean NBCi from 0.45±0.67 to 0.01±0.55 (all p<0.05) (Table 3). However, the mean 24-hour urine volume, functional bladder capacity, nocturnal urine volume, NPi, and Ni were not significantly different after treatment (all p>0.05). Correlation analysis of the whole cohort revealed that the postoperative changes in NBCi (preoperative NBCi-postoperative NBCi) correlated positively with postoperative changes in ANV (preoperative ANV-postoperative ANV) (p<0.001, r=0.547).

4. Change in actual number of nightly voids and nocturnal bladder capacity index according to severity and type of nocturia after the TOT procedure

After stratification by nocturia severity, the mean ANV and mean NBCi were significantly decreased after the sling operation regardless of nocturia severity (all p<0.05). Subgroup analysis was also performed in patients with and without NP. There were significant reductions in the mean ANV and mean NBCi after the TOT procedure in patients with reduced nocturnal bladder capacity and mixed-type nocturia (all p<0.05). In contrast, the mean ANV and mean NBCi were not significantly different before and after the TOT procedure in patients with NP (each p>0.05) (Table 4).

TABLE 3. Nocturia symptom changes after transobturator tape in female mixed urinary incontinence (n=70)

Variable	Preoperative	Postoperative	p-value ^a
HRQoL questionnaires			
KHQ sleep/energy score	51.04±30.44	18.40±22.08	< 0.001
OAB-q sleep score	47.71±26.22	85.57±14.04	< 0.001
3 Day frequency-volume chart			
24-Hour urine volume (mL)	1,605.26±472.98	1,550.67±485.39	0.470
24-Hour total void number	10.27±2.71	7.66±2.35	< 0.001
Daytime frequency	8.60±2.45	6.76±2.00	< 0.001
MVV	367.38±115.17	371.86±117.87	0.669
ANV	1.68±0.80	0.90±0.82	< 0.001
NUV	511.57±165.73	478.46±171.33	0.235
NPi	0.34±0.11	0.32±0.11	0.366
Ni	1.71±0.47	1.71±0.57	0.880
NBCi	0.45±0.67	0.01±0.55	< 0.001

Values are presented as mean±standard deviation.

HRQoL, health-related quality of life; KHQ, King's health questionnaire; OAB-q, overactive bladder questionnaire; MVV, maximal voiding volume; ANV, actual number of nightly voids; NUV, nocturnal urine volume; NPi, nocturnal polyuria index; Ni, nocturnal index; NBCi, nocturnal bladder capacity index.

^a:A p-value was based on the Wilcoxon signed ranks test.

TABLE 4. Change in actual number of nightly voids and nocturnal bladder capacity index according to severity and type of nocturia after transobturator tape in female mixed urinary incontinence (n=70)

Variable	ANV		p-value ^a	NBCi		p-value ^a
	Preoperative	Postoperative		Preoperative	Postoperative	
Nocturia severity						
Mild (1 ≤ preop. ANV < 2) (n=28)	1.20±0.26	0.72±0.69	< 0.001	0.12±0.30	-0.08±0.38	0.026
Moderate (2 ≤ preop. ANV < 3) (n=32)	2.23±0.28	0.99±0.78	0.001	0.69±0.70	0.08±0.67	0.019
Severe (preop. ANV ≥ 3) (n=10)	3.42±0.46	1.78±1.13	0.043	1.26±0.82	0.20±0.81	0.018
Nocturia type						
Nocturnal polyuria (n=17)	1.42±0.68	1.33±1.13	0.593	0.29±0.71	0.13±0.56	0.285
Reduced nocturnal bladder capacity (n=21)	1.73±0.89	0.73±0.52	< 0.001	0.62±0.69	0.06±0.48	0.028
Mixed (n=32)	1.77±0.80	0.79±0.74	< 0.001	0.43±0.63	-0.08±0.59	0.001

Values are presented as mean±standard deviation.

ANV, actual number of nightly voids; NBCi, nocturnal bladder capacity index.

^a:A p-value was based on the Wilcoxon signed ranks test.

5. Comparison of the nocturia-improved and nocturia-persisting groups in terms of preoperative clinical and urodynamic characteristics

As shown in Table 5, the nocturia-improved group tended to have a higher mean preoperative functional bladder capacity than did the nocturia-persisting group (403.78±116.44 vs. 329.23±70.02, p=0.023). Moreover, the nocturia-improved group was significantly less likely to have nocturnal polyuria than was the nocturia-persisting group (p=0.024). However, the two groups did not differ in terms of other baseline demographic, clinical, urodynamic variables (all p > 0.05).

DISCUSSION

UI is associated with significant morbidity and can have a considerable impact on HRQoL [5,21]. Approximately

50%, 10%–20%, and 30%–40% of women with UI have pure SUI, pure urge UI, and MUI, respectively [22]. MUI is defined as the complaint of involuntary loss of urine, associated with urgency and also with effort or physical exertion or on sneezing or coughing [14]. Compared with women with other types of UI, women with MUI often report that their symptoms are more troublesome in terms of quality of life [23,24]. In the past decade, two minimally invasive sling procedures have been developed. Ulmsten and Petros [25] introduced the tension-free vaginal tape (TVT) procedure in 1996, whereas Delorme [26] introduced the TOT procedure in 2001. Since then, midurethral sling techniques have become standard procedures for the surgical treatment of SUI. Many studies, albeit not all, have shown that midurethral slings improve the storage symptoms in MUI [11,14]. When Choe et al. [13] assessed the impact of the TVT procedure on OAB in women with SUI, they

TABLE 5. Comparison of the preoperative clinical and urodynamic features of the nocturia-cured and -persisting groups

Preoperative variable	Nocturia-cured group (n=39)	Nocturia-persisting group (n=31)	p-value
Age (y)	53.94±8.29	54.14±8.44	0.910 ^a
Body mass index (kg/m ²)	25.43±4.00	25.42±2.45	0.685 ^a
Nocturia type			0.024 ^c
Nocturnal polyuria	4 (10.3)	13 (41.9)	
Reduced nocturnal bladder capacity	15 (38.5)	6 (19.4)	
Mixed	20 (51.3)	12 (38.7)	
Symptom grade			0.319 ^b
Grade I	12 (30.8)	14 (45.2)	
Grade II	27 (69.2)	17 (54.8)	
Urodynamic study			
DO	21 (53.8)	20 (64.5)	0.466 ^b
VLPP (mmHg)	88.62±27.96	84.04±24.64	0.395 ^a
MUCP (mmHg)	52.15±23.04	50.96±18.82	0.911 ^a
FUL (cm)	3.37±0.55	3.61±0.54	0.088 ^a
Preoperative frequency-volume chart			
24-Hour urine volume (mL)	1,605.09±467.00	1,493.75±412.12	0.418 ^a
Daytime frequency	8.28±2.38	9.10±2.23	0.152 ^a
MVV	403.78±116.44	329.23±70.02	0.023 ^a
ANV	1.52±0.66	1.77±0.83	0.251 ^a
NUV	506.13±163.82	489.62±178.08	0.601 ^a
NPi	0.34±0.12	0.33±0.09	0.983 ^a
Ni	1.64±0.44	1.67±0.41	0.732 ^a
NBCi	0.38±0.65	0.50±0.67	0.468 ^a

Values are presented as mean±standard deviation or number (%).

DO, detrusor overactivity; VLPP, valsalva leak point pressure; MUCP, maximum urethral closure pressure; FUL, functional urethral length; MVV, maximal voiding volume; ANV, actual number of nightly voids; NUV, nocturnal urine volume; NPi, nocturnal polyuria index; Ni, nocturnal index; NBCi, nocturnal bladder capacity index.

^a:A p-value was based on the Mann-Whitney U test. ^b:Fisher exact test. ^c:Linear-by-linear association.

found that the preoperative urge UI resolved in approximately 50% of patients with detrusor overactivity. The study by Lee et al. [10] of 713 patients with SUI also showed that TVT improved several bladder storage symptoms, namely, urgency (47.1%), urgency incontinence (90.1%), frequency (31.6%), and nocturia (23.4%). In addition, Morgan et al. [9] reported that 74% of patients with preoperative UI improved after pubovaginal sling surgery, whereas Duckett and Tamilselvi [12] reported that TVT treatment yielded an objective cure of urodynamically diagnosed detrusor overactivity in 47% of patients and a subjective cure of urge symptoms in 63%. Our study yielded similar results, showing a significant reduction in 24-hour total void number and daytime frequency in the frequency-volume chart after TOT surgery. The HRQoL questionnaires also revealed that the patients showed significant symptom improvements in other storage symptoms.

Nocturia is a highly prevalent symptom that increases with age [1,27]. Nocturia frequently results from primary sleep disorders, from overproduction of urine at night (NP) or from conditions that cause low voided volumes (e.g., benign prostatic hyperplasia or detrusor overactivity) [28]. Nocturia also has a significant impact on HRQoL because it is associated with poor sleep quality, increased daytime fatigue, and lower levels of general well-being [1,29]. When

Tchey et al. [30] compared nocturia episodes before and after TOT, they observed that the operation significantly reduced the number of nocturia episodes from 1.41±0.99 to 1.07±0.75 in the nonobese group and from 1.55±0.87 to 0.91±0.70 in the obese group. However, the literature has not clearly shown the influence of the sling operation on OAB-related nocturnal micturition. To our knowledge, this is the first study that was designed to evaluate the clinical effectiveness of the TOT procedure in patients with MUI accompanied by nocturia symptoms. Our study showed that TOT treatment results in a significant improvement in the number of nocturia episodes in patients who present with MUI. The TOT procedure significantly improved the subscale scores focused on the problems affecting the sleep of the patient in the KHQ and the OAB-questionnaire. We also observed that the sling-induced reduction of ANV correlated closely with decreased NBCi (which indicates increased nocturnal bladder capacity). In addition, in a subgroup of women with NP, there was no significant change in ANV or NBCi after the sling operation. This finding suggests that nocturia improvement after the TOT procedure was associated with increased nocturnal bladder capacity.

Our study had both strengths and limitations. Strict exclusion criteria were adopted to reduce the confounding factors, resulting in the exclusion of patients with neuro-

logical diseases or sleep disorders that could affect the voiding pattern. HRQoL was analyzed in all patients by using three validated questionnaires. The average values of 3-day frequency-volume chart variables were calculated and patients with missing data were excluded. A limitation of the present study is that it had a retrospective design, which could have introduced a sampling bias. In addition, there may be some potential for bias due to the fact that patients who received antidiuretic hormones or antimuscarinics were excluded. This suggests that those with more severe symptoms or who were more bothered were perhaps excluded. Another concern was the short follow-up period after the operation; long-term follow-up series will be required to confirm our findings.

CONCLUSIONS

Our study suggested that the TOT procedure resulted in an overall significant improvement in OAB symptoms including OAB-related nocturia in patients who presented with MUI. Over half of the patients (55.7%) achieved improvement of nocturia after TOT. Patients with pure NP did not experience significant improvement in their nocturia. Improvement in nocturnal bladder capacity after TOT treatment may be attributed to a reduction in episodes of nocturia.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

ACKNOWLEDGMENTS

This work was supported by a research grant of Chungbuk National University in 2013.

REFERENCES

- Coyne KS, Zhou Z, Bhattacharyya SK, Thompson CL, Dhawan R, Versi E. The prevalence of nocturia and its effect on health-related quality of life and sleep in a community sample in the USA. *BJU Int* 2003;92:948-54.
- Kwon BE, Kim GY, Son YJ, Roh YS, You MA. Quality of life of women with urinary incontinence: a systematic literature review. *Int Neurourol J* 2010;14:133-8.
- Coyne KS, Zhou Z, Thompson C, Versi E. The impact on health-related quality of life of stress, urge and mixed urinary incontinence. *BJU Int* 2003;92:731-5.
- Homma Y, Yoshida M, Seki N, Yokoyama O, Kakizaki H, Gotoh M, et al. Symptom assessment tool for overactive bladder syndrome: overactive bladder symptom score. *Urology* 2006;68:318-23.
- Irwin DE, Milsom I, Hunskaar S, Reilly K, Kopp Z, Herschorn S, et al. Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: results of the EPIC study. *Eur Urol* 2006;50:1306-14.
- Tikkinen KA, Johnson II TM. Epidemiology of nocturia: evaluation of prevalence, incidence, impact and risk factors. In: Weiss JP, Blaivas JG, Van Kerrebroeck PE, Wein AJ, editors. *Nocturia*. New York: Springer; 2012. p. 77-107
- Cornu JN, Abrams P, Chapple CR, Dmochowski RR, Lemack GE, Michel MC, et al. A contemporary assessment of nocturia: definition, epidemiology, pathophysiology, and management: a systematic review and meta-analysis. *Eur Urol* 2012;62:877-90.
- Park HK, Kim HG. Current evaluation and treatment of nocturia. *Korean J Urol* 2013;54:492-8.
- Morgan TO Jr, Westney OL, McGuire EJ. Pubovaginal sling: 4-year outcome analysis and quality of life assessment. *J Urol* 2000;163:1845-8.
- Lee GB, Kim HS, Koh JS, Kim HW, Lee YS, Suh HJ, et al. The changes of storage symptoms after tension-free vaginal tape procedures in stress urinary incontinence patients. *Korean J Urol* 2007;48:1289-95.
- Jain P, Jirschele K, Botros SM, Latthe PM. Effectiveness of mid-urethral slings in mixed urinary incontinence: a systematic review and meta-analysis. *Int Urogynecol J* 2011;22:923-32.
- Duckett JR, Tamilselvi A. Effect of tension-free vaginal tape in women with a urodynamic diagnosis of idiopathic detrusor overactivity and stress incontinence. *BJOG* 2006;113:30-3.
- Choe JH, Choo MS, Lee KS. The impact of tension-free vaginal tape on overactive bladder symptoms in women with stress urinary incontinence: significance of detrusor overactivity. *J Urol* 2008;179:214-9.
- Athanasidou S, Grigoriadis T, Giannoulis G, Protopapas A, Antsaklis A. Midurethral slings for women with urodynamic mixed incontinence: what to expect? *Int Urogynecol J* 2013;24:393-9.
- Coyne K, Revicki D, Hunt T, Corey R, Stewart W, Bentkover J, et al. Psychometric validation of an overactive bladder symptom and health-related quality of life questionnaire: the OAB-q. *Qual Life Res* 2002;11:563-74.
- Okamura K, Usami T, Nagahama K, Maruyama S, Mizuta E. "Quality of life" assessment of urination in elderly Japanese men and women with some medical problems using International Prostate Symptom Score and King's Health Questionnaire. *Eur Urol* 2002;41:411-9.
- Stamey TA. Endoscopic suspension of the vesical neck for urinary incontinence in females. Report on 203 consecutive patients. *Ann Surg* 1980;192:465-71.
- van Kerrebroeck P, Abrams P, Chaikin D, Donovan J, Fonda D, Jackson S, et al. The standardisation of terminology in nocturia: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:179-83.
- van Kerrebroeck P, Andersson KE. Terminology, epidemiology, etiology, and pathophysiology of nocturia. *Neurourol Urodyn* 2014;33:S2-5.
- Lee KS, Choo MS, Lee YS, Han JY, Kim JY, Jung BJ, et al. Prospective comparison of the 'inside-out' and 'outside-in' trans-obturator-tape procedures for the treatment of female stress urinary incontinence. *Int Urogynecol J* 2008;19:577-82.
- Tennstedt SL, Fitzgerald MP, Nager CW, Xu Y, Zimmern P, Kraus S, et al. Quality of life in women with stress urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct* 2007;18:543-9.
- Contreras Ortiz O. Stress urinary incontinence in the gynecological practice. *Int J Gynaecol Obstet* 2004;86 Suppl 1:S6-16.
- Abdel-Fattah M, Hopper LR, Mostafa A. Evaluation of trans-obturator tension-free vaginal tapes in the surgical management of mixed urinary incontinence: 3-year outcomes of a randomized controlled trial. *J Urol* 2014;191:114-9.
- Frick AC, Huang AJ, Van den Eeden SK, Knight SK, Creasman JM, Yang J, et al. Mixed urinary incontinence: greater impact on quality of life. *J Urol* 2009;182:596-600.

25. Ulmsten U, Petros P. Intravaginal slingplasty (IVS): an ambulatory surgical procedure for treatment of female urinary incontinence. *Scand J Urol Nephrol* 1995;29:75-82.
26. Delorme E. Transobturator urethral suspension: mini-invasive procedure in the treatment of stress urinary incontinence in women. *Prog Urol* 2001;11:1306-13.
27. Tikkinen KA, Tammela TL, Huhtala H, Auvinen A. Is nocturia equally common among men and women? A population based study in Finland. *J Urol* 2006;175:596-600.
28. Tikkinen KA, Johnson TM 2nd, Tammela TL, Sintonen H, Haukka J, Huhtala H, et al. Nocturia frequency, bother, and quality of life: how often is too often? A population-based study in Finland. *Eur Urol* 2010;57:488-96.
29. Takao T, Tsujimura A, Kiuchi H, Takezawa K, Okuda H, Yamamoto K, et al. Correlation between overactive bladder symptoms and quality of life in Japanese male patients: focus on nocturia. *Urology* 2013;82:189-93.
30. Tehey DU, Kim WT, Kim YJ, Yun SJ, Lee SC, Kim WJ. Influence of obesity on short-term surgical outcome of the transobturator tape procedure in patients with stress urinary incontinence. *Int Neurourol J* 2010;14:13-9.