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Analysis of the Prognostic Factors for Overactive Bladder Symptoms Following Surgical Treatment in Patients With Benign Prostatic Obstruction

Narihito Seki,[1]* Kohei Yuki,[1] Mineo Takei,[2] Akito Yamaguchi,[2] and Seiji Naito[1]

[1]*Department of Urology, Graduate School of Medicine Sciences, Kyushu University, Fukuoka, Japan*
[2]*Department of Urology, Harasanshin Hospital, Fukuoka, Japan*

Aims: To identify the prognostic variables concerning the improvement of overactive bladder syndrome (OAB) related symptoms following a transurethral resection of the prostate (TURP) in patients with benign prostatic obstruction (BPO). **Methods:** A retrospective review was conducted in 298 patients with BPO who had undergone TURP. All patients had completed the preoperative evaluations including OAB related symptoms and full urodynamics, as well as symptomatic assessment postoperatively. OAB related symptoms were defined by the International Prostate Symptom Score questionnaires (questions 2, 4 and 7 stand for frequency, urgency and nocturia). They were divided into three categories based on an individual score $\geq$3 for on urgency, frequency and nocturia in the preoperative state. The association between the baseline variables and the improvement in each symptom score was analyzed. **Results:** A multivariate analysis suggested that the baseline degree of detrusor contractility was consistently associated with the improvement in each OAB symptom (The odds ratio in normal/weak detrusor: 9.5, 3.4, 3.0 for score on urgency, frequency and nocturia, respectively). Both the patient's age (Odds ratio: 0.93) and the maximum flow rate (Odds ratio: 0.20) influenced the improvement in the score on nocturia. **Conclusion:** The observation of a positive and consistent correlation between the baseline degree of detrusor contractility and the improvement in OAB related symptoms, suggests that good detrusor contractility is essential for the symptomatic benefits after the surgical relief of bladder outlet obstruction. Aging males with good urinary flow rates appear to experience a reduced improvement of nocturia symptoms after undergoing TURP. *Neurourol. Urodynam. 28:197–201, 2009.* © 2008 Wiley-Liss, Inc.

Key words: BPH; OAB; urodynamics

INTRODUCTION

The prevalence of lower urinary tract symptoms (LUTS) associated with a benign prostatic obstruction (BPO) increases with age. Overactive bladder (OAB) is a symptom syndrome defined as "urgency, with or without urge incontinence, usually with frequency and nocturia".[1] OAB symptoms are highly prevalent in patients with "benign prostatic hyperplasia".[2] The impact of LUTS on patients with BPO is directly related to their quality of life (QOL), and the most troublesome are the storage (OAB related) symptoms, such as urgency, frequency and nocturia.[2,3] Managing such symptoms, therefore, should be a primary consideration when choosing a therapy. Although transurethral resection of the prostate (TURP) is considered to be the most effective therapy for the improvement of LUTS observed in BPO, a higher rate of storage symptoms than voiding symptoms tends to remain after a TURP.[4] Those symptoms tend to be more inconvenient to patients than voiding symptoms, resulting in a negative impact on the QOL.[5] Previous studies have reported that the OAB symptoms remain in 20–40% of patients after the surgery.[6,7] In addition, long term follow up shows that OAB related symptoms recur in over 60% of the patients in whom a TURP had been performed during the long-term follow-up, thus suggesting that postoperatively observed OAB related symptoms should not be attributed to the recurrence of a bladder outlet obstruction (BOO), but to factors other than BOO such as aging.[8]

Few studies have been conducted in a cohort of BPO patients with an OAB related symptoms which address the accurate association of factors with the symptomatic outcome following TURP. In this study, an objective statistical analysis was conducted to elucidate whether initial factors, including urodynamics, have any predictive value regarding the outcome of OAB related symptoms following TURP while focusing on patients with a BPO.

PATIENTS AND METHODS

A retrospective review was conducted on a total of 1,417 men who had undergone TURP at this hospital between January 1993 and December 2002. The therapeutic decision to perform TURP was based on both the clinical assessment and the patient's desire for surgical treatment. Prior to performing surgical intervention, patients underwent basic clinical evaluations, as well as an assessment of their International Prostate Symptom Score (IPSS), QOL score, ultrasound estimated post-void residual (PVR), the prostate volume (PV, as

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*Correspondence to: Narihito Seki, Department of Urology, Graduate School of Medical Sciences, Kyushu University, 3-1-1 Maidashi, Higashi-Ku, Fukuoka, 812-8582 Japan. E-mail: narihito@uro.med.kyushu-u.ac.jp.
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estimated by transrectal ultrasound) and full urodynamics including a pressure-flow study (PFS). BOOI (BOO index) was determined by the formula pdet.Q_{max} (detrusor pressure at maximum flow rate)-2Q_{max}. Of the 1,417 patients, 628 patients with BOO completed full pre-operative evaluations without any of the exclusion criteria. The exclusion criteria in the preoperative state was: (1) younger than 50 years of age, (2) a PV of less than 20 ml, (3) neurogenic bladder dysfunction, (4) BOO not due to BPO, (5) a history of prostatic and/or urethral surgery, (6) previously diagnosed or suspected carcinoma of the prostate, (7) a known bladder neoplasm and/or stones, and (8) acute and/or chronic prostatitis. The exclusion criteria for the postoperative state was: (1) a BOO due to a bladder neck and/or urethral stricture, (2) patients who received 5α-reductase inhibitors and (3) a urinary tract infection or prostatitis within 1 month before the evaluation. The treatment outcomes were assessed by an evaluation of the IPSS at 12 months or longer after surgery. All anticholinergics and/or sympathomimetics had been washed out at least 2 weeks before both the preoperative and/or postoperative evaluations. According to the selection procedure, a total 298 patients with a BPO (BOOI≧40) with mean age of 69.9 ± 7.1 years and mean follow-up since surgery of 15.8 ± 2.2 (range: 12.2–19.5) months, without any of the exclusion criteria, were selected (Fig. 1). Each OAB related symptom was defined by the IPSS. Question 2 of the IPSS questionnaires stands for frequency, the question 4 for urgency and question 7 for nocturia. respectively. Because the current study was designed to conduct an analysis on patients with severe OAB, in whom each symptom occurred in about 50% or more of total times of voiding (=score of 3 or more for each symptom), the 298 patients were divided into three categories based on an individual score ≧3 for on urgency in 132 (44%) patients (category 1), on frequency in 170 (57%, category 2) and on nocturia in 173 (58%, category 3) in the preoperative state, and enrolled into the final analysis (Fig. 1). One hundred fifty six patients (52.3%) had a score 3 or more for two or more symptoms (24 patients in category 1 and 2, 16 in category 1 and 3, 40 in category 2 and 3, and 76 in category 1, 2 and 3), and they belonged to each category.

The best result with a voided volume of more than 150 ml during one or more free uroflowmetries was adopted for the analysis of free-uroflowmetry. A multichannel system (UD-2000, MMS Co., Enschede, Netherlands) was used for the urodynamic evaluations. Water-filling cystometry was performed with a filling rate of 50 ml/min. Subsequently, the patients were asked to void in the upright position with a suprapubically placed 6F cystostomy in order to monitor the bladder pressure. Detrusor overactivity (DO) was judged according to the definition of the International Continence Society.[1] The grade of detrusor contractility was quantified based on the Schafer nomogram (very weak to weak, normal, strong) and the bladder contractility index (BCI), which was determined by the formula: pdet.Q_{max} + 5Q_{max}. The grade of the BOO was also quantified based on the Schafer nomogram (0, no obstruction to 6, severe obstruction) and the BOOI (BOOI = pdet.Q_{max}−2Q_{max}). The pdet.max (maximum detrusor pressure) and the pdet.Q_{max} were determined from the pressure-flow chart.

Preoperative variables including the patient age, estimated PV, the subjective symptoms (each question of IPSS, total IPSS, sub-total score of storage symptoms comprising the summation of nocturia, urgency and an increased frequency score, and sub-total score of voiding symptoms comprising the summation of hesitancy, intermittency and weak stream score), the QOL score and urodynamic parameters including, the maximum cystometric capacity (MCC), the presence of DO, free-Q_{max}, PVR, pdet.max, pdet.Q_{max}, the Schafer contractility grade, BCI, the Schafer obstruction grade and BOOI were all statistically investigated to identify any factors that could influence the symptomatic improvement. The patients were considered to have improved in terms of individual symptoms including urgency, frequency and nocturia, if each score demonstrated a ≧50% improvement over the pre-operative value at 12 months or longer following a TURP.

Mann–Whitney's *U*-test for continuous variables and the chi-square test for categorical variables were used to determine these preoperative variables which univariately affected each symptomatic improvement according to the previously definition. Next, a multiple logistic regression analysis using the forward stepwise regression method was performed to select a set of variables. The odds ratios with a significance level of 0.05 were calculated to include or remove any of the factors at each step. $P < 0.05$ was considered to indicate significance.

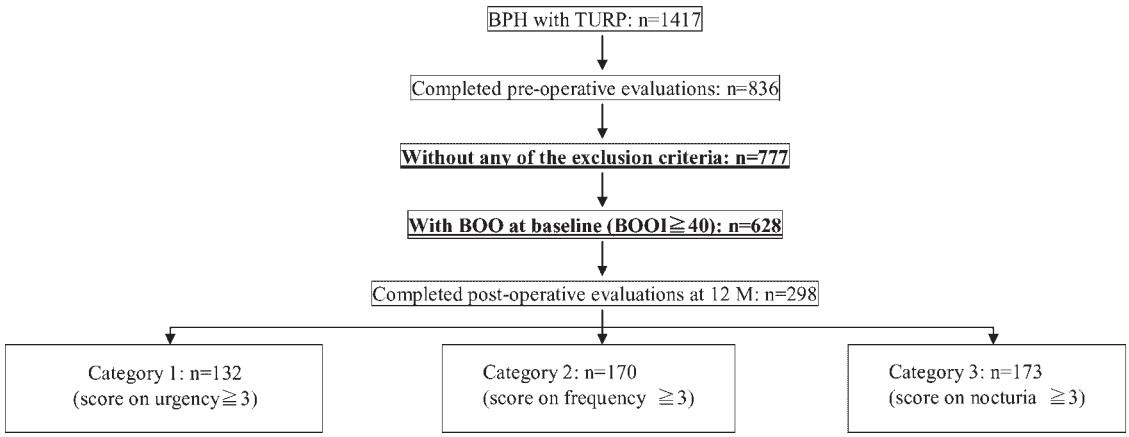

Fig. 1. Flow chart of case selection of the study population. A total 298 patients with completed pre-operative and post-operative evaluations at 12 months and a BPO (BOO index: BOOI ≧40) without any of the exclusion criteria were divided into three categories based on a preoperative individual score ≧3 for on urgency (category 1), on frequency (category 2) and on nocturia (category 3), and enrolled into the final analysis. One hundred fifty six patients (52.3%) had a score 3 or more for two or more symptoms, and they belonged to each category.

TABLE I. Baseline Clinical and Urodynamic Characteristics of the 298 Patients With 12 Months Follow-Up (With 12 M), 330 Patients Without 12 Months Follow-Up (Without 12 M), and of Patients in Each Category

	Category 1	Category 2	Category 3	With 12 M	Without 12 M
Number of patients	132	170	173	298	330
Age (years)	**70.0 (65.0, 75.0)**	**70.0 (66.0, 74.0)**	**71.0 (66.0, 76.0)**	**70.0 (65.0, 74.8)**	**71.0 (66.0, 76.0)**
Prostate volume (ml)	**38.8 (29.1, 50.7)**	**38.3 (29.2, 51.2)**	**38.2 (29.6, 51.3)**	**39.2 (30.1, 52.4)**	**39.6 (29.1, 53.3)**
MCC (ml)	**288 (241, 330)**	**284 (234, 329)**	**280 (224, 330)**	**295 (238, 340)**	**299 (232, 350)**
Detrusor overactivity (%)	48.5	46.5	49.1	43.6	43.3
Free-Q_{max} (ml/sec)	7.3 (5.3, 9.7)	7.0 (5.1, 9.7)	7.0 (5.1, 9.5)	7.8 (5.5, 10.5)	7.7 (5.3, 10.1)
PVR (ml)	67 (31, 111)	62 (30,123)	60 (25, 131)	60 (30, 120)	60 (30, 130)
pdet.max (cm H_2O)	99 (82, 127)	98 (80, 119)	97 (80, 122)	96 (79, 121)	97 (74, 127)
pdet.Q_{max} (cm H_2O)	88 (71, 110)	85 (70, 106)	83 (70, 110)	83 (70, 106)	86 (68, 112)
Schafer obstruction grade	4 (3, 5)	4 (3, 5)	4 (3, 5)	4 (3, 5)	4 (3, 5)
BOOI	69 (56, 92)	68 (51, 90)	68 (53, 92)	68 (52, 91)	67 (51, 95)
Schafer contractility grade					
Very weak + weak	18	31	28	52	56
Normal	87	109	110	189	212
Strong	27	30	35	57	62
BCI	132 (114, 147)	127 (108, 147)	127 (108, 148)	127 (109, 147)	130 (108, 152)

Each category includes the patients with a score of 3 or more on urgency (category 1), frequency (category 2), and nocturia (category 3), respectively. If a patient has a score 3 or more for two or more symptoms, he can belong to the each category (not mutually exclusive). MCC, maximum cystometric capacity; PVR, post-void residual; pdet.max, maximum detrusor pressure; pdet.Q_{max}, detrusor pressure at maximum flow rate; BOOI, bladder outlet obstruction index; BCI, bladder contractility index.
Median (25%, 75%).

RESULTS

Patient Characteristics

The baseline clinical and urodynamic characteristics of the 298 patients and of patients divided into each symptom category are summarized in Table I. The patient age, estimated PV and all urodynamic parameters evaluated were not significantly different among the categories. Detrusor underactivity (detrusor contractility grades of very weak or weak, quantified according to the Schafer nomogram) was observed in 17.4%, 13.6%, 18.2%, and 16.2% of the overall patients and the patients in each category (1–3), respectively.

OAB Related Symptoms

Tables IIA and IIB summarize the preoperative distributions and the changes in mean values, seen after a TURP, of the individual symptom scores for urgency, frequency and nocturia observed in the three categories of patients. There was a significant improvement in each of the symptoms following TURP. The overall rates of improvement in terms of the symptom score on urgency, frequency and nocturia were 71.4%, 60.0%, and 43.2%, respectively. The rates of treatment success regarding the symptom score for urgency, frequency and nocturia according to the definition ($\geqq$50% improvement over the preoperative value following TURP) were 81.8% (108/132), 72.9% (124/170), and 48.6% (84/173), respectively.

TABLE IIA. Distributions of the Number of Patients According to the Scores for Each OAB Symptom at Baseline

Score on IPSS	Urgency	Frequency	Nocturia
3	23	44	92
4	65	79	40
5	44	47	41

TABLE IIB. Mean Values of the Scores for Each OAB Symptom at Baseline and Follow-Up

Symptom	Urgency	Frequency	Nocturia
Average value			
Baseline	4.2 ± 0.7	4.0 ± 0.7	3.7 ± 0.8
Follow-up	1.2 ± 1.3	1.6 ± 1.3	2.1 ± 1.1
Improved ratio (%)	71.4	60.0	43.2

Quantification of the improvement by a TURP of the score for each symptom (Improved ratio) was calculated according to the formula, Improved ratio = 1-post/pre.
Mean ± SD.

Predictive Factors Associated With the Outcome

Table III lists the preoperative variables that appear to multivariately affect the treatment outcome of each OAB related

TABLE III. Multiple Logistic Regression Analysis of the Factors at Baseline Influencing Each OAB Symptom Postoperatively (OR, odds ratio; CI, confidence interval)

	OR (95% CI)	*P*
Urgency		
Contractility grade		0.01
N/W	9.52 (2.60–34.5)	
ST/W	6.67 (1.34–33.3)	
Frequency		
Contractility grade		0.02
N/W	3.41 (1.52–7.63)	
ST/W	2.16 (0.74–6.25)	
Nocturia		
Age (years)	0.93 (0.88–0.98)	0.01
F-Q_{max} (ml/sec)	0.20 (0.05–0.84)	0.03
Contractility grade		0.02
N/W	3.00 (1.41–6.41)	
ST/W	2.56 (0.99–6.67)	

The baseline degree of detrusor contractility was positively (Odds ratio >1) associated with the improvement in each OAB symptom. Both the patient's age and the maximum flow rate negatively (Odds ratio <1) influenced the improvement in the score on nocturia. The patients in each group (categories 1, 2, and 3) were categorized according to their detrusor contractility: W, weak detrusor contractility; N, normal detrusor contractility; ST, strong detrusor contractility. Next, the differences between N and W, as well as ST and W inside each group were examined.

symptom following the TURP. The baseline degree of detrusor contractility was identified as the only invariable factor that independently correlated with the postoperative improvement in each OAB symptom. The baseline patient age and their baseline value of the Q_{max} were identified as factors which correlated with an improvement in the score for nocturia after TURP. A lower age and a lower preoperative Q_{max} were associated with a greater improvement in the nocturia score after TURP.

DISCUSSION

Regarding LUTS, the degree of trouble that this condition can cause and its impact on patients' QOL are the primary considerations when choosing a treatment for a BPO. Altogether, the most troublesome symptoms are associated with the storage phase, such as urgency, frequency, and nocturia. This correlation has been observed in studies with community-based men,[9] as well as in men with a symptomatic BPO evaluated in clinic-based studies.[10] Surgical intervention such as TURP produces significant symptomatic benefits not only regarding voiding symptoms but also storage (OAB related) symptoms, however, not all patients demonstrate a successful resolution of these symptoms after the prostate intervention. Previous reports have noted that OAB related symptoms including urgency and frequency persist in 20–35% of patients after a prostatectomy.[6,11] This finding was consistent with the current results. Generally, higher rates of storage symptoms than voiding symptoms remain after a TURP, thus resulting in a negative effect on the QOL. In addition, the current study showed that the rate of patients who could achieve $\geqq$50% improvement, over the preoperative value, on each symptom score after TURP, was consistently greater for voiding symptoms than for OAB related symptoms (81.8%, 72.9% and 48.6% for urgency, frequency and nocturia vs. 90.3%, 92.6%, 85.4% for on straining, intermittency and slow stream). Although it has been reported that the persistence of an OAB after TURP is more frequent in men of over 80 years of age,[7] in the current analysis, a significant correlation with age was only found for score on noctria but not for the score on urgency or frequency.

A previous study reported that less than 20% of those men with persistent OAB related symptoms after a TURP had any evidence of a recurrent or persistent BOO,[12,13] thus suggesting that persistent OAB related symptoms may only partially be due to the persistent BOO following surgical intervention. The current study with its retrospective design has several shortcomings, especially the tendency to have selection bias. We could conduct an analysis in a selected patient group. Due to the lost of follow-up at 12 months after surgery, the patients who were investigated were a relatively insufficient proportion (298/628: 47.5%) of the patients who pre-operatively met all inclusion criteria with BOO. Nevertheless, stratifying the patients with and without a 12-month follow-up yielded results comparable to each other regarding the preoperative background (Table I), thus leading to the hypothesis that patients with a 12-month follow-up may be representative of the entire patient cohort in the present study (the proportions in category 1, 2, and 3 were 46%, 59%, and 58% of the 330 patients without a 12-month follow-up). Another shortcoming may be due to the lack of a systemic postoperative urodynamic analysis. Nevertheless, a PFS performed on some subjects in whom the informed consent for post-operative urodynamics was successfully obtained in the present patient cohort (114/298: 38.3%) suggested the BOO of those subjects to be substantially relieved after TURP [the median value (25%, 75%) of BOOI in pre-operative and post-operative state was 70 (52, 94) and 5 (−4, 18), respectively, and only 4 patients (3.5%) were classified as obstructed (BOOI $>$ 40) postoperatively], thus supporting the notion that the postoperative minimal improvement in OAB related symptoms might not be attributable to residual or recurrent BOO. The patient cohorts for each symptomatic evaluation in this study were apparently typical of those with moderate to severe symptoms relating to an OAB together with a BOO and a decreased Q_{max}. Similar to the findings in other studies, approximately 50% of the cases had baseline DO.[14,15] The relatively lower occurrence of DO may partially attributable to methodological difference. Because the patients in the current study were placed in the supine position during bladder filling, as the results, no DO was demonstrated in many patients, in comparison to when such patients are placed in the upright position. There are no standard criteria established for the estimation in OAB. The current analysis was conducted on patients in whom each symptom occurred in 50% or more of the total voiding (=score of 3 or more for each symptom), and therefore they were diagnosed as having severe OAB related symptoms, based on the assumption that the answers to the IPSS questionnaires (questions 2, 4, and 7) obtained from patients adequately describe OAB related symptoms. In addition, we defined successful treatment as a $\geqq$50% improvement over the preoperative values. However, there is a shortcoming in that the IPSS does not record urgency incontinence, thereby requiring caution before drawing definite conclusions from these data.

The current results of a multivariate analysis indicate that the improvement in each OAB related symptom did not correlate at all with the presence of baseline DO. As discussed above, the lower occurrence of DO in the current patient cohort may partially be attributable to this poor correlation. Furthermore, the lack of data regarding urgency incontinence in IPSS may also account for the poor correlation. Although a previous study suggested that the preoperative DO has a negative impact on total IPSS outcome,[16] it remains controversial as to whether a DO at baseline is an independent predictor for the improvement of OAB related symptoms in patients with a BPO after a TURP. DO is reported to persist in about 30–50% of those patients who have undergone a prostatectomy.[17,18] Nevertheless, a previous study reported that no significant difference has been documented in postoperative storage symptom scores among patients with and without DO,[13] thereby supporting the results in the current analysis. Most of those men with preoperative OAB related symptoms, who show an initial resolution of OAB related symptoms after surgery, experience recurrence of their symptoms over time in the absence of discernible changes in urodynamic findings.[8] In addition, the development of de novo OAB during an extended follow-up was reported in a few men in whom no OAB related symptoms had been recognized before operation.[8] Presumably, ongoing age-related changes in the lower urinary tract partially complicate the interpretation of the current results.

Despite several previous reports that document the prognostic value of baseline detrusor contractility in conjunction with the grade of a BOO for the improvement of overall symptoms,[19,20] there is limited data regarding the relationship between the improvement of OAB related symptoms with the detrusor contractility grade following a prostatectomy. An extended longitudinal study showed that long-term (average 14 years after the intervention) symptomatic failure was principally associated with postoperative detrusor underactivity rather than BOO or DO, in patients with BPO who had undergone a TURP.[21] However, that study simply

conducted a comparison between the background urodynamics and total IPSS (no comparison was focused on the OAB related symptoms). Furthermore, they suggested that preoperative detrusor contractility appeared to be a predictor of long-term detrusor underactivity and, consequently of symptomatic failure.[21] Although the current study included a relatively short-term follow-up (average 16 months after the TURP), the improvement of each OAB related symptoms after TURP consistently correlated with the grade of the background detrusor contractility in the multivariate analysis, thereby suggesting that the detrusor contractility has an independent prognostic impact on the outcome of OAB related symptoms.

Although an association between nocturia and BPH has been reported,[22] nocturia is the least specific symptom associated with a BPO and is least sensitive to treatment.[23] This is consistent with the current results. Yoshimura et al.[24] examined the degree of improvement of nocturia after TURP and, also suggested that the degree of improvement was lowest among the seven individual symptoms included in the IPSS. These findings suggest that there are many other factors, other than a BPO, including nocturnal polyuria and natriuresis, involved in nocturia. In the current study, although etiology is unclear, patient age and the value of the Q_{max} at baseline, as well as the detrusor underactivity, were identified to be independent predictors for an improvement in the frequency of nocturia, thus, indicating that these factors may therefore make it possible to determine the impact of TURP for a BPO regarding the resolution of nocturia.

CONCLUSIONS

Data from this retrospective analysis suggest that patients with lower detrusor contractility have a reduced chance of improving their storage (OAB related) symptoms following TURP in patients with BPO. Aging males with good urinary flow rates at baseline appear to experience a reduced improvement of nocturia symptom following TURP. Preoperative PFS may help to identify patients at risk of demonstrating a poor improvement in OAB related symptoms following surgery.

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REFERENCES

1. Abrams PH, Cardozo L, Fail M, et al. The standardisation of terminology of lower urinary tract function: Report from the Standardisation Subcommittee of the International Continence Society. Neurourol Urodyn 2002;21:167–78.
2. Peters TJ, Donovan JL, Kay HE, et al. The International Continence Society "Benign Prostatic Hyperplasia" Study: The bothersomeness of urinary symptoms. J Urol 1997;157:885–9.
3. Eckhardt MMD, Van Venrooij GEPM, Van Melick HHE, et al. Prevalence and bothersomeness of lower urinary tract symptoms in benign prostatic hyperplasia and their impact on well-being. J Urol 2001;166:563–8.
4. Seki N, Kai N, Seguchi H, et al. Predictives regarding outcome after transurethral resetion for prostatic adenoma associated with detrusor underactivity. Urology 2006;67:306–10.
5. Hakenberg OW, Pinnock CB, Marshall VR. Does evaluation with the international prostate symptom score predict the outcome of transurethral resection of the prostate? J Urol 1997;158:94–9.
6. Abrams PH, Farrar DJ, Turner-Warwick RT, et al. The results of prostatectomy: A symptomatic and urodynamic evalution analysis of 152 patients. J Urol 1979;121:640–2.
7. Gormley EA, Griffiths DJ, McCracken PN, et al. Effects of transurethral resection of the prostate on detrusor instability and urge incontinence in elderly males. Neurourol Urodyn 1993;12:445–53.
8. Thomas AW, Cannon A, Barlett E, et al. The long term urodynamic follow-up of TURP: A study of the prevalence of detrusor instability. J Urol Suppl 1999;161:257.
9. Tan HY, Choo WC, Archibald C, et al. A community based study of prostatic symptoms in Singapore. J Urol 1997;157:890–3.
10. DuBeau CE, Yalla SV, Resnick NM. Implications of the most bothersome prostatism symptom for clinical care and outcomes research. J Am Geriatr Soc 1995;43:985–92.
11. Abrams PH. The urodynamic changes following prostatectomy. Urol Int 1978;33:181–6.
12. Abrams PH. Post-prostatectomy problems. Urology 1980;15:209–12.
13. Nitti VW, Kim Y, Combs AJ. Voiding dysfunction following transurethral resection of the prostate: Symptoms and urodynamic findings. J Urol 1997;157:600–3.
14. Machida R, Kakizaki H, Ameda K, et al. Detrusor instability with equivocal obstruction: A predictor of unfavorable symptomatic outcomes after transurethral prostatectomy. Neurourol Urodyn 2002;21:444–9.
15. Porru D, Jallous H, Cavalli V, et al. Prognostic value of a combination of IPSS, flow rate and residual urine volume compared to pressure-flow studies in the preoperative evaluation of symptomatic BPH. Eur Urol 2002;41:246–9.
16. Seki N, Takei M, Yamaguchi A, et al. Analysis of prognostic factors regarding the outcome after a transurethral resection for symptomatic benign prostatic enlargement. Neurourol Urodyn 2006b;25:428–32.
17. Van Venrooij GE, Van Melick HH, Eckhardt MD, et al. Correlations of urodynamic changes with changes in symptoms and well-being after transurethral resection of the prostate. J Urol 2002;168:605–9.
18. De Nunzio C, Franco G, Rocchegiani A, et al. The evolution of detrusor overactivity after watchful waiting, medical therapy and surgery in patients with bladder outlet obstruction. J Urol 2003;169:535–9.
19. Javle P, Jenkins SA, West C, et al. Quantification of voiding dysfunction in patients awaiting transurethral prostatectomy. J Urol 1996;156:1014–9.
20. Javle P, Jenkins SA, Machin DG, et al. Grading of benign prostatic obstruction can predict the outcome of transurethral prostatectomy. J Urol 1998;160: 1713–7.
21. Thomas AW, Cannon A, Bartlett E, et al. The natural history of lower urinary tract dysfunction in men: Minimum 10-year urodynamic followup of transurethral resection of prostate for bladder outlet obstruction. J Urol 2005;174:1887–91.
22. Blanker MH, Bohnen AM, Groeneveld FPMJ, et al. Normal voiding patterns and determinants of increased diurnal and nocturnal voiding frequency in elderly men. J Urol 2000;164:1201–5.
23. Homma Y, Yamaguchi T, Kondo Y, et al. Significance of nocturia in the international prostate symptom score for benign prostatic hyperplasia. J Urol 2002;167:172–6.
24. Yoshimura K, Ohara H, Ichioka K, et al. Nocturia and benign prostatic hyperplasia. Urology 2003;61:786–90.