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. 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. Neurourolog. Urodynam. 28:197–201, 2009. © 2008 Wiley-Liss, Inc.

Key words: BPH; OAB; urodynamics
estimated by transrectal ultrasound) and full urodynamics including a pressure-flow study (PFS). BOOI (BOO index) was determined by the formula $p_{\text{det.Q max}}$ (detrusor pressure at maximum flow rate)$-2Q_{\text{max}}$ 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 pre-operative 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 post-operative 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 $\geq 40$) with mean age of $69.9 \pm 7.1$ years and mean follow-up since surgery of $15.8 \pm 2.2$ (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 $\geq 3$ for 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. 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: $p_{\text{det.Q max}} + 5Q_{\text{max}}$. The grade of the BOO was also quantified based on the Schafer nomogram (0, no obstruction to 6, severe obstruction) and the BOOI (BOOI = $p_{\text{det.Q max}}-2Q_{\text{max}}$). The $p_{\text{det.max}}$ (maximum detrusor pressure) and the $p_{\text{det.Q max}}$ 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 urgency, frequency and nocturia, if each score demonstrated a $\geq 50%$ 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.

![Flow chart](image-url)

**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 (BOOI index: BOOI $\geq 40$) without any of the exclusion criteria were divided into three categories based on a preoperative individual score $\geq 3$ 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.

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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 (≥50% improvement over the preoperative value following TURP) were 81.8% (108/132), 72.9% (124/170), and 48.6% (84/173), respectively.

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

<table>
<thead>
<tr>
<th>Symptom</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractility grade</td>
<td>9.52 (2.60–34.5)</td>
<td>0.01</td>
</tr>
<tr>
<td>N/W</td>
<td>6.67 (1.34–33.3)</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractility grade</td>
<td>3.41 (1.52–7.63)</td>
<td>0.02</td>
</tr>
<tr>
<td>N/W</td>
<td>2.16 (0.74–6.25)</td>
<td></td>
</tr>
<tr>
<td>Nocturia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.93 (0.88–0.98)</td>
<td>0.01</td>
</tr>
<tr>
<td>F-Qmax (ml/sec)</td>
<td>0.20 (0.05–0.84)</td>
<td>0.03</td>
</tr>
<tr>
<td>Contractility grade</td>
<td>3.00 (1.41–6.41)</td>
<td>0.02</td>
</tr>
<tr>
<td>N/W</td>
<td>2.56 (0.99–6.67)</td>
<td></td>
</tr>
</tbody>
</table>

Predictive Factors Associated With the Outcome

Table III lists the preoperative variables that appear to multivariately affect the treatment outcome of each OAB related symptom.
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\textsubscript{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\textsubscript{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,\textsuperscript{9} as well as in men with a symptomatic BPO evaluated in clinic-based studies.\textsuperscript{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.\textsuperscript{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 ≥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,\textsuperscript{12} in the current analysis, a significant correlation with age was only found for score on nocturia 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,\textsuperscript{12,13} thus suggesting that persistent OAB related symptoms may only partially be attributable to residual or recurrent BPO. The patient cohorts were investigated were a relatively insufficient proportion (298/628: 47.5%) of the patients who pre-operatively met the grade of a BOO for the improvement of overall 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\textsubscript{max}. Similar to the findings in other studies, approximately 50% of the cases had baseline DO.\textsuperscript{6,14,15} The relatively lower occurrence of DO may partially be 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 ≥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,\textsuperscript{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.\textsuperscript{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,\textsuperscript{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.\textsuperscript{6} 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.\textsuperscript{6} 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,\textsuperscript{19,20} there is limited data regarding the relationship between the improvement of OAB related symptoms and 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.\textsuperscript{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. Although the current study included a relatively short-term follow-up (average 16 months after the TURP), the improvement of each OAB-related symptom 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, nocturia is the least specific symptom associated with a BPO and is least sensitive to treatment. This is consistent with the current results. Yoshimura et al. 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\text{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**


