

## Voiding Dysfunction

# Analysis of the Factors Causing Bladder Irritation after Transurethral Resection of the Prostate

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**Purpose:** Approximately 20% to 30% of patients with benign prostatic hyperplasia (BPH) require medication or supplementary treatment for their continuous irritative bladder symptoms after transurethral resection of the prostate (TURP). The purpose of this study was to identify any factors related to continuous bladder irritation in patients after TURP.

**Materials and Methods:** Of all patients who underwent TURP from January 2000 to December 2007, 160 who underwent long-term follow-up were selected for this study. The International Prostate Symptom Score (IPSS) was assessed 12 months after TURP, and the patients were divided into two groups: one group with an irritative bladder symptom score on the IPSS of 7 or less (non-irritative group) and another group with an irritative bladder symptom score on the IPSS of 8 or greater (irritative group). Preoperative urodynamic study variables, preoperative and postoperative IPSS, and the shape of the prostate upon transrectal ultrasonography (TRUS) were analyzed.

**Results:** Of the 160 patients, 93 patients were assigned to the non-irritative group, and 67 were assigned to the irritative group. Initial irritative bladder symptoms were significantly different between the two groups ( $p < 0.05$ ). Also, a retrourethral enlarged prostate was more frequently observed upon TRUS in the irritative group. Symptoms of urinary frequency, incontinence, and urgency were significantly greater in the irritative group. Although there was no significant difference in the preoperative quality of life between the two groups, postoperative quality of life was significantly worse in the irritative group.

**Conclusions:** The shape of the prostate and the preoperative irritation score correlated significantly with the postoperative severity of irritative bladder symptoms. Therefore, physicians should be cautious when performing TURP in patients with a retrourethral enlarged prostate and severe irritative symptoms.

**Key Words:** Prostatic hyperplasia; Transurethral resection of prostate; Treatment

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## INTRODUCTION

Benign prostatic hyperplasia (BPH) is a urologic disease that affects males 50 years of age and older. It is a common disease of the elderly that has rapidly increased in incidence with the growing elderly population, economic growth, and the ubiquity of the Western diet.

A traditional surgical approach to BPH is transurethral resection of the prostate (TURP). This operation is per-

formed if there is recurrent acute urinary retention, persistent hematuria, urinary tract infection due to BPH, decreased kidney function due to impaired urine flow, or another severe symptom [1-3].

Complications arising after TURP are decreasing due to recent improvements in both the resectoscope and surgical techniques, but recent studies have reported that 20% to 30% of patients require postoperative medication to treat continuous urinary symptoms. These complications are

important factors in the patients' decreased quality of life after surgery [4,5].

In selecting patients for TURP, predicting the persistence of irritative bladder symptoms is important, but studies investigating the prognostic factors of bladder irritation are uncommon. According to a recent report, postoperative irritative bladder symptoms may remain if there is a severe irritative bladder symptom before the surgery or if there is frequent nocturia [6]. A domestic study also investigated the factors leading to persistence of irritative bladder symptoms, but this study involved the use of invasive urodynamic studies and included patients without bladder obstruction, thus limiting the clinical applicability to our patient population [7].

The present study investigated the factors influencing the postoperative persistence of irritative bladder symptoms in patients who underwent TURP. Ideally, the results of this study will be helpful in selecting appropriate patients for TURP and will provide information as to which patients may require close attention during surgery.

## MATERIALS AND METHODS

From January 2000 to December 2007, 400 patients visited the urology department for treatment of bladder obstruction, and 160 were chosen to undergo TURP and were included in this study. All subjects received treatment from the same physician and could be followed up for at least 12 months. Patients whose urinary symptoms were affected by a urologic tumor, neurogenic bladder, urinary tract infection, bladder stones, or other diseases or anti-muscarinic medications were excluded.

Patients were evaluated by using the International Prostate Symptom Score (IPSS) before and 12 months after surgery and were divided into two groups: the irritative group (IPSS  $\geq$  8) and the nonirritative group (IPSS  $\leq$  7). There are 3 categories in the IPSS that evaluate irritative symptoms. Each category is assigned a maximum of 5 points, thus making the total score 15 for all 3 categories. The irritative and nonirritative groups were divided on the basis of a more than 50% improvement in irritative symp-

toms. In order to study the factors affecting the persistence of irritative symptoms, the two groups were retrospectively compared in the following categories: age, preoperative and postoperative IPSS, preoperative shape and size of the prostate as seen on transrectal ultrasonography (TRUS), and volume of the resected prostate.

A single physician reviewed all TRUS studies. The prostate size was calculated by using the formula for an ellipsoid (anteroposterior diameter calculated operative size of the prostate), and the volume of the two groups was retrospectively compared with the following scheme set forth by Wasserman: hyperplasia limited to the transition zone or posterior urethral hyperplasia [8].

Uroflowmetry was performed and compared by use of Duet-logic G II (Dantect, Germany). The maximal flow rate (Q<sub>max</sub>) was measured in ml/sec, and the volume of the resected prostate was measured after surgery.

Statistical analysis was performed by using SPSS 12.0. A paired t-test was used to evaluate the effects of TURP before and after surgery. To evaluate the postoperative persistence of irritative symptoms, a chi-square test was used. A p-value  $<$  0.05 was set as the threshold for statistical significance.

## RESULTS

Of the 160 patients, 67 (41.8%) belonged to the irritative group and 93 (58.2%) belonged to the nonirritative group. There were no significant differences in age, prostate size, Q<sub>max</sub> before surgery, or the volume of the resected prostate between the two groups (Table 1).

The mean IPSS score was 23.5 before surgery and 11.6 at 12 months after surgery, suggesting an improvement in symptoms. The Q<sub>max</sub> increased from 7.6 ml/sec before surgery to 12.98 ml/sec after surgery, and the prostate size decreased from 51.28 cm<sup>3</sup> to 29.75 cm<sup>3</sup>. All of these factors indicated a clear therapeutic effect of the surgery (Table 2).

The IPSS score was not significantly different between the two groups, but the irritative group had significantly more severe preoperative irritative symptoms than did the nonirritative group (10.55  $\pm$  3.45 vs. 8.69  $\pm$  3.69,  $p <$  0.05).

Both groups showed a decrease in severity of irritation symptoms postoperatively, but the degree of change was smaller in the irritative group, and three individual types of irritative symptoms—urgency, urinary frequency, and nocturia—constituted the majority of the IPSS in the irrita-

TABLE 1. Patient characteristics

Parameters	Nonirritative group	Irritative group	p-value
Age (yr)	67.97 $\pm$ 5.99	68.88 $\pm$ 6.84	0.423
IPSS	21.26 $\pm$ 7.74	24.96 $\pm$ 7.57	0.281
Prostate volume (cm <sup>3</sup> )	47.99 $\pm$ 20.25	52.09 $\pm$ 25.55	0.122
Transition zone volume (cm <sup>3</sup> )	24.93 $\pm$ 16.23	29.89 $\pm$ 20.21	0.324
Resection volume (g)	14.66 $\pm$ 14.13	11.07 $\pm$ 9.46	0.212
Q <sub>max</sub> (ml/sec)	8.44 $\pm$ 7.60	7.60 $\pm$ 4.29	0.386

IPSS: International Prostate Symptom Score, Q<sub>max</sub>: maximal flow rate

TABLE 2. Changes in clinical symptoms

Parameters	Preoperative	Postoperative	p-value
IPSS	23.5 $\pm$ 4.14	11.6 $\pm$ 3.57	0.017
Prostate volume (cm <sup>3</sup> )	51.28 $\pm$ 21.04	29.75 $\pm$ 11.64	0.025
Q <sub>max</sub> (ml/sec)	7.6 $\pm$ 8.42	12.98 $\pm$ 3.17	0.039

IPSS: International Prostate Symptom Score, Q<sub>max</sub>: maximal flow rate

**TABLE 3.** Clinical symptoms correlated to retention of irritative bladder syndromes

Parameters	Nonirritative group	Irritative group	p-value
Pre-op IPSS	21.26±7.74	24.96±7.57	0.281
Pre-op irritative symptom score	8.69±3.69	10.55±3.45	0.047
Pre-op QoL	3.57±1.2	4.01±1.31	0.42
Post-op IPSS	7.42±5.67	16.14±4.42	0.025
Post-op irritative symptom score	4.14±0.47	10.42±5.34	0.02
Post-op QoL	1.95±1.2	3.46±1.6	0.018

op: operation, IPSS: International Prostate Symptom Score, QoL: quality of life

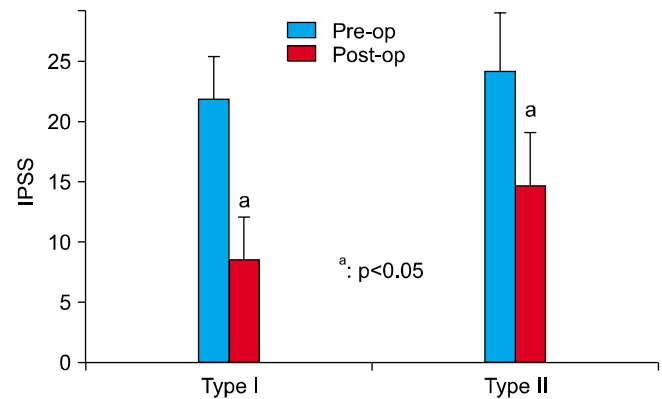
tive group. Quality of life was not significantly different between the two groups preoperatively, but was higher in the nonirritative group postoperatively (Table 3).

The individual types of irritative symptoms on the IPSS (urgency, urinary frequency, and nocturia) were assessed independently. The irritative group showed a significantly higher degree of severity of each of the three categories of specific symptoms.

An analysis of prostate shape as seen on TRUS revealed that enlargement of the retrourethral prostate correlated with a significantly higher IPSS score compared with hyperplasia of the bilateral transition zone, which did not (Fig. 1).

## DISCUSSION

BPH is the most common cause of micturition dysfunction in elderly men. Bladder obstruction due to prostate hyperplasia causes a structural change in the bladder as part of a compensatory mechanism, ultimately causing irritative bladder symptoms. Bladder obstruction causes hypertrophy of the bladder wall and bladder stiffness. Hypertrophy of the bladder wall leads to increased extracellular storage of collagen, which leads to changes in the innervation pattern and neurologic hypertrophy. It also activates unmyelinated C nerve fibers, a phenomenon unseen in the normal bladder, also causing bladder with irritative symptoms [9-11]. Treatment options for bladder obstruction caused by BPH include medication and surgery, and TURP is known to be the most effective of all the traditional surgical methods. Once the bladder is free from the obstruction, the thickened bladder wall undergoes atrophy, and its elasticity is restored, thus improving the irritative symptoms. The degree of improvement is reported to be especially high in patients with severe preoperative irritative symptoms [12]. However, a recent study suggested that TURP does not improve irritation symptoms in every patient, and 20% to 30% of patients require medication postoperatively due to persistent irritative symptoms, thus leading to a decrease in quality of life [13]. A study by Seki et al reported that bladder irritation persisted more frequently in patients whose IPSS consisted mainly of irritative bladder



**FIG. 1.** Change in IPSS according to prostate shape. Type I is a hyperplasia limited to the transition zone only and having no retrourethral enlargement. Type II is a retrourethral enlarged prostate. Both types showed a decrease in IPSS score postoperatively, but the degree of change was smaller in Type I. IPSS: International Prostate Symptom Score, op: operation.

symptoms [14]. Of the irritative symptoms, frequent nocturia before surgery led to the persistence of irritative symptoms more often. Loss of bladder contractility and the presence of bladder obstruction before surgery were also related to the persistence of irritative symptoms. Chung et al reported that the rate of postoperative improvements in irritative bladder symptoms was higher in the group with bladder obstruction, and they concluded that the presence of bladder obstruction is an important factor in symptom etiology [15].

In our study, 42% of the patients reported persistence of postoperative irritative bladder symptoms, and the rate of persistence was significantly higher among patients reporting severe preoperative irritative bladder symptoms (urgency, urinary frequency, and nocturia). Unlike previous studies, the rate of persistence was higher in groups with more severe irritative symptoms; this can be explained by the fact that this study enrolled only patients with bladder obstruction, whereas other studies included patients free of bladder obstruction. This difference suggests a need for a larger study that includes patients both with and without bladder obstruction.

Clinically, the presentation of BPH is caused by bladder obstruction, but there are various morphological variations of BPH. Wasserman et al classified BPH into 7 morphological types and compared their ultrasonographic characteristics to their pathology [8]. He reported that the most clinically common types include hyperplasia of the transition zone, retrourethral hyperplasia, and concomitant hyperplasia of the transition zone and retrourethra. Song et al reported that most BPH patients showed either hyperplasia limited to the transition zone or retrourethral hyperplasia [16]. They also reported that the postoperative severity of irritative bladder symptoms was different between the two groups, and that the rate of persistence of irritative symptoms was especially high in patients with retrourethral hyperplasia. They suggested that hyper-

trophy of the bladder neck as well as an increased chance of bladder neck injury during surgery was associated with the persistence of irritative symptoms in patients with retrourethral hyperplasia. Housami and Abrams reported that desensitization of the bladder neck nerves via injection of botulinum toxin improved irritative symptoms in their study population, suggesting that a change in bladder neck innervation is an important factor in the pathogenesis of irritative symptoms [17]. Their study also showed a higher rate of persistent irritative symptoms in patients with retrourethral hyperplasia. This may be due to bladder neck injury, changes in bladder neck innervation, or injury to the contractor muscle of the trigone. Further neurologic and anatomical studies are required for clarification.

In patients with bladder obstruction due to BPH, TURP does lead to a significant decrease in symptoms associated with bladder obstruction in most patients and increases the patients' quality of life. However, patients whose preoperative IPSS comprised mainly irritative bladder symptoms and those with retrourethral hyperplasia showed a significantly higher rate of persistence of irritative symptoms postoperatively. Therefore, before undergoing TURP, patients with severe irritative bladder symptoms or retrourethral hyperplasia should be informed about the persistence of bladder irritation after surgery. In addition, excessive resection of the bladder neck must be avoided in patients with retrourethral hyperplasia to minimize damage to the bladder neck in order to prevent potential postoperative irritative symptoms.

## CONCLUSIONS

Many patients show improvements in symptoms after TURP, but 20% to 30% of patients show persistent irritative bladder symptoms and a decreased quality of life postoperatively, eventually requiring medication.

Irritative bladder symptoms are more likely to persist in patients with retrourethral hyperplasia and those with a high proportion of irritative symptoms upon preoperative IPSS. Such patients may need careful analysis of preoperative bladder function through urodynamic studies, and excessive resection of the bladder neck should be avoided in these patients.

## Conflicts of Interest

The authors have nothing to disclose.

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