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Treatment Results of Transurethral Resection of the Prostate by Non-Japanese Board-Certified Urologists for Benign Prostate Hyperplasia: Analysis by Resection Volume

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Introduction: Transurethral resection of the prostate (TURP) is the gold standard for surgical treatment of benign prostatic hyperplasia (BPH), but it has complications such as bleeding and transurethral resection syndrome. The treatment results of TURP performed by non-Japanese board-certified urologists were examined, and the results were analyzed according to the resection volume to determine how much resection volume was suitable for non-Japanese board-certified urologists.

Materials and Methods: A total of 72 cases that underwent TURP for BPH at our hospital were examined. The patients were divided into three groups by resection volume (<20 g, 20–30 g, >30 g). The operators were five non-Japanese board-certified urologists. Various clinical factors were examined among the three groups before and after TURP.

Results: The average operation time and resection volume were significantly different among the groups. There were more transfused cases with greater resection volume. The changes from before to after TURP in the International Prostate Symptom Score, total prostate volume, and maximum flow rate were significantly different among the three groups, but the rates of these changes were not.

Conclusions: In this study, TURP performed by non-Japanese board-certified urologists was relatively safe and achieved sufficient efficacy. Cases with resection volume less than 20 g appear the most appropriate for non-Japanese board-certified urologists. (J Nippon Med Sch 2017; 84: 73–78)

Key words: transurethral resection of the prostate, benign prostatic hyperplasia, non-Japanese Board-Certified Urologists, resection volume

Introduction

The Medical Therapy of Prostatic Symptoms and Combination of Avodart and Tamsulosin studies proved the usefulness of medical therapy combining an α_1 blocker and a 5α reductase inhibitor for patients with moderate to severe benign prostatic hyperplasia (BPH)[1,2]. However, these established medical therapies are inferior to surgical treatments[3]. In fact, the number of surgical procedures did not show a clear decrease after these studies were announced[4,5].

Transurethral resection of the prostate (TURP) is the gold standard for surgical treatment of BPH, but it has complications such as bleeding and transurethral resection (TUR) syndrome[6,7]. Therefore, minimally invasive surgeries, such as holmium laser enucleation of the prostate and bipolar TURP, were developed and have spread worldwide[4,5]. For this reason, the opportunity for urologists to perform TURP, especially inexperienced young surgeons, has decreased[8,9]. However, these minimally invasive surgeries have some drawbacks. For example, costs increase when they are introduced. Furthermore, holmium laser enucleation of the prostate requires experience and is difficult for transurethral resection of a bladder tumor because it differs from the TUR method[10,11].

It is useful for inexperienced urologists who can per-

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form TURP to master the TUR maneuver. However, it has been reported that experience with TURP in educational institutions has recently decreased, and, as a result, adverse events have increased[12]. Now, senior specialists need to teach inexperienced urologists about effective and safe TURP in the minimally invasive surgery era.

In this study, the treatment results of TURP performed by non-specialists with monitoring by one specialist in our institution were examined retrospectively. Generally, it has been reported that the difficulty of TURP increases with longer operative time and more bleeding and with increased resection volume[7]. Therefore, the analysis was performed according to the resection volume to determine how much resection volume is suitable for non-specialists.

Materials and Methods

A total of 72 cases that underwent TURP for BPH from November, 2008 to January, 2013 at Nippon Medical School Hospital were analyzed. All patients provided a detailed history and underwent a physical examination that included a digital rectal examination, and the serum prostate-specific antigen (PSA) level was evaluated. Patients with suspected prostate cancer underwent prostate needle biopsy. Lower urinary tract symptoms (LUTS) were graded according to the International Prostate Symptom Score (IPSS) and the Overactive Bladder Symptom Score (OABSS)[13]. Uroflowmetry was used to obtain the maximum urinary flow rate (Qmax). Total prostate volume (TPV) and postvoid residual volume (PVR) were measured by transabdominal ultrasonography. Patients with a previous history of lower urinary tract surgery, neurogenic bladder, or prostate cancer were excluded. TURP was performed after the patients gave their informed consent.

The operators were five non-specialist surgeons who had less than 6 years of urological experience, and their supervisor was a urological specialist. The supervisor decided whether a cystostomy needed to be constructed, and, if it did, that the method and contents were carried out according to Suzuki et al.[14].

IPSS, OABSS, Qmax, TPV, PVR, and PSA were determined 6 months after the TURP in all patients. The 72 patients were divided into three groups by resection volume (group A, <20 g; group B, 20–30 g; group C, >30 g), and various clinical factors were compared among the three groups, including operating time, changes in hemoglobin and sodium levels, blood transfusions, and complications during TURP. In addition, the amounts and rates of change in IPSS, OABSS, TPV, PSA, and PVR and the amount of change in Qmax were evaluated. All data are expressed as averages±standard deviation. Significant differences were determined using Student's *t*-test; $P < 0.05$ was considered significant.

Results

Patient Characteristics

The patient characteristics are shown in **Table 1**. The patients' average age was 70.6±6.5 years. In the pre-TURP evaluation, the average IPSS, quality of life, and OABSS scores were 28.0±7.1, 5.6±0.6, and 7.8±2.7, respectively, with no significant difference among the three groups. In the pre-TURP Benign Prostatic Enlargement (BPE) evaluation, TPV was 72.0±5.7 (31.0–185.9) mL, and it was significantly different between groups A and B ($p < 0.001$), but not between groups B and C. Furthermore, the average PSA was 7.9±5.7 (0.5–36.2) ng/mL, with the same differences among the three groups as for TPV. For evaluation of Bladdder Outlet Obstruction (BOO), average Qmax and PVR values were 5.4±5.0 (0.0–18.5) mL/sec and 173.0±178.0 (0–700) mL, respectively. Qmax was significantly different between groups A and B, but not between groups B and C. PVR was not significantly different among the three groups.

Intraoperative evaluations are shown in **Table 2**. Cystostomies were constructed in 33 cases (45.8%), with four cases in group A (16.7%), nine in group B (37.5%), and 20 in group C (83.3%). A total of 16 patients (22.2%) were transfused, with seven (29.1%) in group B and nine in group C. Moreover, all transfused cases, except one, received autologous blood transfusion. There were no cases of TUR syndrome. The adverse events after TURP were three cases of postoperative bleeding that resolved with conservative management, and two cases of urethral stricture that were cured with a urethral bougie.

The changes in the clinical factors between pre- and post-TURP are shown in **Table 3, 4**.

Evaluation of LUTS

The IPSS, quality of life, and OABSS scores decreased significantly from pre- to post-TURP, from 28.0±7.1, 5.6±0.6, and 7.8±2.7 to 6.4±5.7, 1.8±1.5, and 3.6±3.0, respectively. No differences in the changes in the LUTS amount and rate were seen between groups A and B, but significant differences in the changes in LUTS were seen between groups B and C.

Evaluation of BPE

TPV decreased significantly from pre- to post-TURP, from 72.0±5.7 mL to 23.0±17.0 mL. The decrease in pros-

Table 1 Patients' characteristics

	Group A	Group B	Group C	Total	p-value	
	<20 g	20–30 g	>30 g		Group A vs. B	Group B vs. C
Number	24	24	24	72		
Age (y)	72.3±6.9 (65–84)	69.1±5.4 (60–77)	70.4±7.2 (61–81)	70.6±6.5 (60–84)	0.439	0.850
IPSS	27.0±7.0 (13–35)	28.9±6.6 (18–35)	28.3±8.2 (14–35)	28.0±7.1 (13–35)	0.158	0.546
QOL	5.6±0.6 (4–6)	5.5±0.7 (4–6)	5.6±0.6 (4–6)	5.6±0.6 (4–6)	0.605	0.797
OABSS	7.9±3.3 (3–13)	7.3±2.3 (2–12)	8.3±2.5 (4–13)	7.8±2.7 (2–13)	0.539	0.278
TPV (mL)	43.0±9.6 (31.0–60.7)	77.8±17.0 (52.0–100.0)	95.1±32.5 (51.7–185.9)	72.0±5.7 (31.0–185.9)	<0.001	0.071
PSA (ng/mL)	4.0±1.9 (0.5–6.3)	8.5±3.8 (1.7–17.3)	11.2±7.7 (2.4–36.2)	7.9±5.7 (0.5–36.2)	<0.001	0.226
Qmax (mL/sec)	7.5±4.5 (0.0–16.4)	3.9±4.3 (0.0–11.3)	4.8±5.7 (0.0–18.5)	5.4±5.0 (0.0–18.5)	0.030	0.629
PVR (mL)	120.8±157.2 (0–600)	166.4±129.3 (0–400)	232.1±230.7 (0–700)	173.0±178.0 (0–700)	0.378	0.331
Hb	13.7±1.4 (10.8–16.0)	14.6±1.0 (13.0–16.9)	13.9±1.6 (10.2–16.7)	14.1±1.4 (10.2–16.9)	0.040	0.181
Na	142.1±3.9 (134–149)	142.5±2.0 (139–146)	141.6±1.7 (139–146)	142.1±2.7 (134–149)	0.737	0.198

Abbreviations: IPSS, International Prostate Symptom Score; QOL, quality of life; OABSS, Overactive Bladder Symptom Score; TPV, total prostate volume; PSA, prostate-specific antigen; Qmax, maximum urinary flow rate; PVR, postvoid residual volume; Hb, hemoglobin; Na, sodium.

tate volume was significantly different among the groups (Group A vs. B: p<0.001, B vs. C: p<0.01), but the rate of decrease was not different among the groups (Group A vs. B: p=0.476, B vs. C: p=0.059). Moreover, PSA decreased significantly from pre- to post-TURP, from 7.9±5.7 ng/mL to 1.8±1.6 ng/mL, showing the same tendency as the TPV changes among the three groups.

Evaluation of BOO

Qmax increased significantly from pre- to post-TURP, from 5.4±5.0 mL/sec to 19.1±7.3 mL/sec, but there was no significant difference among the three groups. In addition, PVR decreased significantly from pre- to post-TURP, from 173.0±178.0 mL to 13.6±27.5 mL, with no significant difference among the groups.

Discussion

TURP is the gold standard for the surgical treatment of BPH, but there have been few reports that have examined the treatment results of inexperienced urologists[12,15]. It is apparent that the treatment results of inexperienced urologists were worse than those of experienced urologists. However, it is very important that inexperienced urologists obtain proficiency in more difficult surgery, such as TURP, in the minimally invasive surgery era. Once they can perform TURP, then they have demonstrated adequate minimally invasive surgery skills. Therefore, we thought it was necessary to examine the treatment results of TURP performed by inexperienced urologists and the clinical factors related to becoming proficient in TURP. Moreover, in this study, the analysis was performed according to the resection volume, in order to determine how much resection volume was suitable for non-specialists.

First, with respect to invasiveness, the average operation time in this study was 152.3 minutes, but it was under 60 minutes in previous reports[5,16]. It is obvious that the resection speed was slow[15]. Moreover, the transfusion rate was 22.2% in the present study, which was higher than the 2–5% in previous reports[7,11]. However, most blood transfusion cases, except one, involved autologous blood transfusions. Autologous blood was prepared in many cases to allow safe performance by non-specialists. It has been generally reported that about 2% of cases develop TUR syndrome[7], but there were no TUR syndrome cases in the present study, and the adverse events after TURP were similar to those of previous reports[7]. Therefore, the procedures in the present study were performed relatively safely.

In the analysis according to the resection volume, the

Table 2 Intraoperative evaluation

	Group A <20 g	Group B 20–30 g	Group C >30 g	Total	p-value Group A vs. B	p-value Group B vs. C
Number	24	24	24	72		
Resection volume	9.8±4.6	25.5±3.9	48.8±22.0	28.0±20.5	<0.001	<0.001
Operation time	112.3±28.6	156.4±29.6	188.3±38.1	152.3±44.2	0.001	0.001
Cystostomy	4 (16.7%)	9 (37.5%)	20 (83.3%)	33 (45.8%)		
Transfusion	0 (0%)	7 (29.1%)	9 (37.5%)	16 (22.2%)		
Adverse event						
Post-TURP bleeding	0 (0%)	2 (8.3%)	1 (4.2%)	3 (4.2%)		
Urethral stricture	1 (4.2%)	0 (0%)	1 (4.2%)	2 (2.8%)		

Abbreviation: TURP, transurethral resection of the prostate.

Table 3 Changes in the clinical factors in the three groups by resection volume

		Group A <20 g	Group B 20–30 g	Group C >30 g	Total	p-value Group A vs. B	p-value Group B vs. C
Number		24	24	24	72		
Hb	(pre)	13.7±1.4	14.6±1.0	13.9±1.6	14.1±1.4	0.040	0.181
	(post)	12.0±1.3	12.3±1.0	11.6±1.0	12.0±1.1	0.412	0.047
p-value		<0.001	<0.001	<0.001	<0.001		
Na	(pre)	142.1±3.9	142.5±2.0	141.6±1.7	142.1±2.7	0.737	0.198
	(post)	141.5±3.8	141.1±2.4	141.5±2.4	141.4±2.8	0.700	0.610
p-value		0.409	0.060	0.865	0.086		
PSA (ng/mL)	(pre)	4.0±1.9	8.5±3.8	11.2±7.7	7.9±5.7	<0.001	0.226
	(post)	1.3±1.0	2.3±2.2	1.8±1.4	1.8±1.6	0.098	0.473
p-value		<0.001	<0.001	<0.001	<0.001		
TPV (mL)	(pre)	43.0±9.6	77.8±17.0	95.1±32.5	72.0±5.7	<0.001	0.071
	(post)	17.0±5.8	27.8±20.5	24.2±20.3	23.0±17.0	0.057	0.623
p-value		<0.001	<0.001	<0.001	<0.001		
Qmax (mL/sec)	(pre)	7.5±4.5	3.9±4.3	4.8±5.7	5.4±5.0	0.030	0.629
	(post)	17.7±7.3	18.5±5.6	21.0±8.8	19.1±7.3	0.719	0.354
p-value		<0.001	<0.001	<0.001	<0.001		
PVR (mL)	(pre)	120.8±157.2	166.4±129.3	232.1±230.7	173.0±178.0	0.378	0.331
	(post)	20.9±36.5	3.7±7.4	12.3±26.5	13.6±27.5	0.085	0.224
p-value		0.006	<0.001	0.001	<0.001		
IPSS	(pre)	27.0±7.0	28.9±6.6	28.3±8.2	28.0±7.1	0.158	0.546
	(post)	9.6±7.9	6.4±3.7	3.3±3.0	6.4±5.7	0.165	0.013
p-value		<0.001	<0.001	<0.001	<0.001		
QOL	(pre)	5.6±0.6	5.5±0.7	5.6±0.6	5.6±0.6	0.605	0.797
	(post)	2.7±1.7	1.9±1.3	0.9±1.1	1.8±1.5	0.136	0.042
p-value		<0.001	<0.001	<0.001	<0.001		
OABSS	(pre)	7.9±3.3	7.3±2.3	8.3±2.5	7.8±2.7	0.539	0.278
	(post)	4.4±3.4	4.4±3.5	1.9±1.2	3.6±3.0	0.959	0.014
p-value		<0.001	<0.001	0.002	<0.001		

Abbreviations: Hb, hemoglobin; Na, sodium; PSA, prostate-specific antigen; TPV, total prostate volume; Qmax, maximum urinary flow rate; PVR, postvoid residual volume; IPSS, International Prostate Symptom Score; QOL, quality of life; OABSS, Overactive Bladder Symptom Score.

operation time increased significantly with greater resection volume (**Table 2**). There was a significant difference in the change in hemoglobin levels from pre to post-TURP between group A and group B, but there was no significant difference in the change in the rate. The group with greater resection (group B: seven cases and group C: nine cases) had more autologous blood prepared compared to the group with less resection (group A: no

Table 4 Changes in the amounts and rates of clinical factors

	Group A <20 g	Group B 20–30 g	Group C >30 g	Total	p-value Group A vs. B	p-value Group B vs. C
Number	24	24	24	72		
Hb	1.7±0.6	2.3±1.0	2.3±1.3	2.1±1.0	<0.001	0.181
%	0.1±0.0	0.2±0.1	0.2±0.1	0.1±0.8	0.095	0.798
PSA	2.7±1.7	6.2±3.7	9.4±6.7	6.1±5.2	0.003	0.116
%	66.7±26.3	73.5±26.0	82.4±10.6	74.2±22.7	0.470	0.222
TPV	26.1±9.7	49.9±22.6	71.3±21.1	49.1±26.2	0.001	0.010
%	59.4±13.2	64.1±22.2	75.9±8.2	66.5±16.8	0.476	0.059
Qmax	10.2±6.4	14.6±6.8	16.8±10.3	13.9±8.4	0.071	0.473
PVR	100.0±125.3	129.8±123.7	219.7±2,124.7	149.9±165.0	0.505	0.159
%	79.1±28.7	70.1±42.2	92.8±16.6	80.8±31.7	0.505	0.063
IPSS	17.4±7.9	22.4±6.3	25.1±9.0	21.7±8.3	0.057	0.347
%	65.8±25.3	77.6±12.2	87.1±12.5	76.8±19.5	0.105	0.038
QOL	2.9±1.7	3.6±1.3	4.6±1.4	3.7±1.6	0.136	0.038
%	52.3±27.6	66.5±21.1	82.3±21.0	67.0±26.1	0.196	0.043
OABSS	3.4±3.4	3.4±2.4	6.3±2.3	4.4±3.0	1.000	0.001
%	46.2±38.0	47.6±31.1	76.3±14.3	56.7±32.1	0.913	0.003

Abbreviations: Hb, hemoglobin; PSA, prostate-specific antigen; TPV, total prostate volume; Qmax, maximum urinary flow rate; PVR, postvoid residual volume; IPSS, International Prostate Symptom Score; QOL, quality of life; OABSS, Overactive Bladder Symptom Score.

cases). Although it has been reported that the rate of TUR syndrome is increased when the operation time is greater than 90 minutes[7], there were no changes in sodium levels from pre- to post-TURP, and there were no cases of TUR syndrome, despite the average operation time of 152.3 minutes in the present study. This discrepancy may be explained by the fact that more cystostomies were created with more resection volume. Thus, construction of cystostomies is appropriate in huge BPH cases[17]. Since the risk of TUR syndrome appears related to exposure of the sinus of the prostate, it appears that having the specialist guide the non-specialists with respect to the resection method of the side lobes prevents TUR syndrome[14].

Second, the efficacy of TURP performed by non-specialists was examined with respect to LUTS, BOO, and BPE.

LUTS: The changes in the amount and rates of IPSS were 21.7 points and 76.8%, respectively, and these data were similar to previous reports[3]. Moreover, storage symptoms were improved in OABSS. Therefore, this study showed that about half of the patients with OAB improved with TURP[18]. These data suggest that TURP performed by non-specialists improved LUTS.

The analysis according to resection volume also revealed the efficacy of TURP performed by non-specialists. The improvement of LUTS was not significantly different between groups B and A, but the change in group B was less than that in group C, except for the change in the point of IPSS. Although the reason for this result was unclear, greater resection volume may have contributed to the improvement of LUTS.

BOO: Qmax increased 13.9 mL/sec from pre- to post-TURP, and this result was superior to that of a previous report[3] of an increase of 10.77 mL/sec, and PVR was significantly improved. Therefore, with respect to BOO, non-specialists achieved sufficient efficacy.

Moreover, the analysis according to resection volume did not show a significant difference in the change in BOO from pre- to post-TURP among the three groups. The reason for this result was likely that Qmax was significantly higher in group A than in group B.

BPE: One concern was that non-specialists would not achieve sufficient resection of the prostate, especially in cases of huge BPH. In the analysis according to resection volume, the resection volume was significantly different among the three groups, but the rate was not significantly different among them. Given this result, it appears that there is no effect of resection volume when non-specialists perform adequate TURP.

In this study, TURP by non-specialists appeared relatively safe and achieved sufficient efficacy with respect to LUTS, BOO, and BPE. In addition, cases with a resection volume under 20 g appear suitable for non-specialists.

However, there were some limitations in this study. First, the number of cases (72) was relatively small. Moreover, the duration of postoperative follow-up was only 6 months, and it has been reported that recurrence of BPH after TURP occurs in 7.4% of cases[19]. Second, the effect of technical skills on the results of TURP in specialists and non-specialists was not examined. Third, these results in non-specialists are not comparable to those of the specialist doctors used in this study. Overall, the major limitation of this study was that it was retrospective. Therefore, a prospective study with longer follow-up is needed to resolve these issues.

Conclusion

It appears that non-Japanese board-certified urologists could perform safe and effective TURP if directed by a specialist with respect to appropriate skills and measures to avoid adverse events. Especially, cases with resection volume less than 20 g appear the most appropriate for non-Japanese board-certified urologists.

Conflict of Interest: The authors have no conflicts of interest or financial or commercial relationships to declare with respect to publication of this work.

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