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Research Article

Short-Term Quality of Life Outcomes: A Comparative Analysis of Thulium Laser Vaporization (ThuVap) vs. Transurethral Resection of the Prostate (TURP)

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Abstract

Objective: This study aimed to compare short-term quality of life (QOL) outcomes and perioperative parameters between transurethral resection of the prostate (TURP) and thulium laser vaporization of the prostate (ThuVap) in patients with benign prostatic hyperplasia (BPH). *Materials and Methods:* A retrospective analysis was conducted on 106 patients with BPH who underwent either TURP (n = 58) or ThuVap (n = 48) at our institution between April 2021 and August 2024. Preoperative and postoperative evaluations included the International Prostate Symptom Score (I-PSS), Overactive Bladder Symptom Score (OABSS), QOL index, and uroflowmetry. Perioperative outcomes, including operative time, catheterization duration, and hemoglobin (Hb) reduction, were also analyzed. *Results:* Both TURP and ThuVap showed sustained improvements in I-PSS, OABSS, and QOL index during the 3-month follow-up period, with no significant differences between the groups. ThuVap demonstrated a significantly lower rate of Hb reduction on the first postoperative day compared to TURP (5.9% vs. 8.5%, $P < 0.05$), likely due to reduced intraoperative bleeding. Although ThuVap had a shorter mean operative time (82.3 vs. 99.3 minutes), this difference was not statistically significant ($P = 0.1$). *Discussion:* The findings indicate that both TURP and ThuVap effectively improve postoperative QOL. ThuVap's reduced bleeding may provide advantages in patients with higher cardiovascular or bleeding risks. However, variations in operative time between studies may be influenced by factors such as surgeons' experience and institutional protocols. *Conclusion:* Both TURP and ThuVap are effective surgical options for improving QOL in BPH patients. However, surgical efficiency and outcomes may be influenced by the surgeon's expertise and the preoperative condition of the patients. ThuVap offers additional benefits of reduced intraoperative bleeding, which may support its use in selected cases.

Keywords

Thulium Laser Vaporization, Quality of Life, Benign Prostatic Hyperplasia, Lower Urinary Tract Symptoms

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1. Introduction

Lower urinary tract symptoms (LUTS) due to BPH are prevalent among aging men [1-3]. LUTS caused by BPH directly and adversely impact the QOL [2, 4]. A primary goal in treating BPH is enhancing QOL by alleviating LUTS [5]. For men with severe symptoms, surgical intervention can be an effective approach to improving both LUTS and QOL [6]. TURP has long been the standard surgical option for BPH [3, 7, 8]. In recent years, ThuVap has emerged as a popular, minimally invasive alternative to TURP. Research indicates that ThuVap is associated with fewer perioperative complications, which can positively impact QOL during the recovery period [9]. Additionally, ThuVap demonstrates comparable efficacy to TURP for LUTS, with added advantages such as reduced bleeding and shorter catheterization times [9]. This makes ThuVap a suitable option for patients at higher cardiovascular and bleeding risk [10]. Since lower complication rates are generally associated with better QOL, ThuVap may be an ideal choice for LUTS patients seeking to enhance their QOL. The present study aimed to compare the postoperative QOL changes over time between ThuVap (using a 200-W thulium laser system) and TURP in patients with BPH. Additionally, it sought to identify factors influencing QOL improvement in the short-term follow-up period post-surgery.

2. Materials and Methods

This study received approval from the Institutional Review Board at Hitachi Medical Center, and all procedures adhered to applicable guidelines and regulations. Due to the retrospective nature of the study, written informed consent was not required. We retrospectively analyzed data from 106 patients who underwent either ThuVap (n = 48) or TURP (n = 58) at our facility between April 2021 and August 2024. All patients presented with LUTS due to BPH and underwent preoperative evaluations, including medical history review, physical examination, I-PSS assessment, OABSS, QOL index, urinalysis, serum prostate-specific antigen (PSA) measurement, transrectal prostate ultrasound, and multichannel urodynamic studies (UDS). From April 2021 to March 2024, TURP was the standard surgical technique for BPH at our center, performed by two experienced surgeons using conventional methods. Starting in April 2024, ThuVap replaced TURP as the standard technique, performed by two surgeons using a 200 W thulium laser system set to 100 W for tissue vaporization. We compared operative time, postoperative urethral catheterization duration, and the rate of Hb decrease from preoperative levels to postoperative day 1 between the TURP and ThuVap groups. Follow-up evaluations were conducted at 1 and 3 months postoperatively. Patients were assessed preoperatively and at follow-up visits using I-PSS, OABSS, QOL-index, serum PSA levels, and uroflowmetry.

3. Results

3.1. Baseline Characteristics

In comparing the baseline characteristics of the TURP and ThuVap groups, no significant differences in age, body mass index (BMI), serum PSA levels, or prostate volume (PV) were observed in the preoperative data (Table 1).

Table 1. *Baseline Characteristics of Patients Undergoing TURP and ThuVap.*

Characteristic	TURP (n=58)	ThuVap (n=48)	*P*-Value
Age (years)	77.6±6.2	76.4±7.0	0.3
BMI (kg/m²)	22.7±3.3	23.0±3.3	0.3
PSA (ng/mL)	6.63±9.9	4.22±3.2	0.1
PV (mL)	69.9±25.1	71.7±33.8	0.8
I-PSS	21.4±5.3	20.8±5.8	0.6
OABSS	8.4±3.0	8.6±2.8	0.7
QOL-index	5.2±1.0	5.2±1.0	0.9

TURP: Transurethral Resection of the Prostate; ThuVap: Thulium Laser Vaporization of the Prostate; BMI: Body Mass Index; PSA: Prostate-Specific Antigen; PV: Prostate Volume. I-PSS: International Prostate Symptom; OABSS: Overactive Bladder Symptom Score Score; QOL-index: quality of life-index; Data are presented as mean ± standard deviation. Statistical comparisons were performed using Student's t-test.

Furthermore, no significant differences were found in the total I-PSS, OABSS score, QOL index. Similarly, there were no significant differences in preoperative total I-PSS, OABSS scores, or QOL index between the two groups (Table 1). In the

TURP group, 52 out of 58 patients required urethral balloon catheter placement due to preoperative urinary retention. Similarly, in the ThuVap group, 42 out of 48 patients required urethral balloon catheter placement for the same reason. Notably, all 106 patients had been on oral α-blockers, PDE inhibitors, or 5α-reductase inhibitors, but their condition was resistant to drug therapy.

3.2. Comparison of Perioperative Parameters Between TURP and ThuVap

The mean operative time was 99.3 minutes in the TURP group and 82.3 minutes in the ThuVAP group, showing an average reduction of approximately 17 minutes with ThuVap. However, this difference did not reach statistical significance (P = 0.1) (Figure 1).

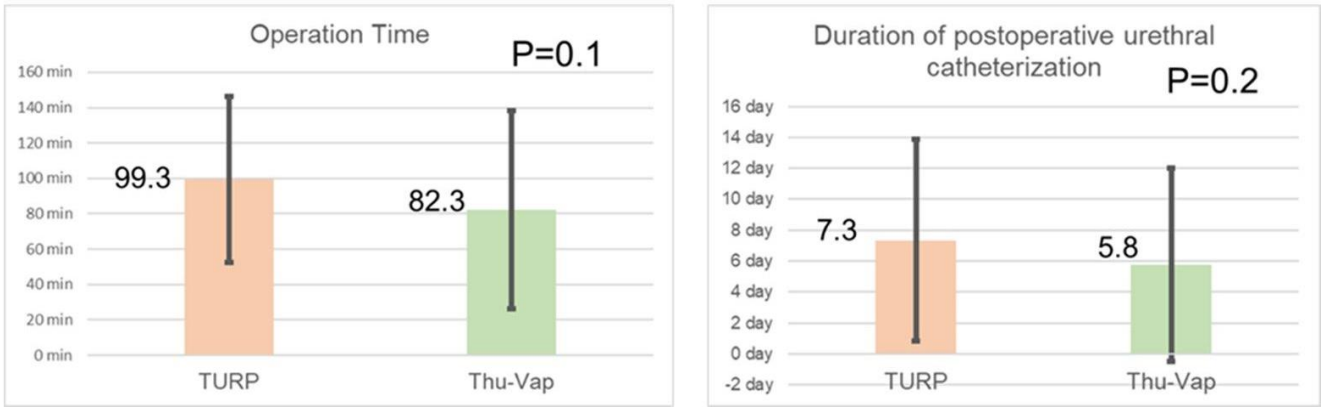

Figure 1. *Comparison of Operation Time and Postoperative Catheterization Duration.*

Bar graphs showing the mean operation time (minutes) and mean duration of postoperative urethral catheterization (days) in patients undergoing TURP (orange) and ThuVap (green). Error bars indicate standard deviation.

Similarly, the mean duration of postoperative urethral catheterization was 7.3 days in the TURP group compared to 5.8 days in the ThuVAP group, indicating a reduction of about 1 day. Nevertheless, this difference was also insignificant (P = 0.2) (Figure 1). The preoperative hemoglobin (Hb) level was 13.5 g/dL in the TURP group and 13.4 g/dL in the ThuVap group, with no significant difference observed between the two groups. However, the postoperative Hb reduction rate on the first postoperative day was significantly lower in the ThuVap group (5.9%) compared to the TURP group (8.5%) (Figure 2).

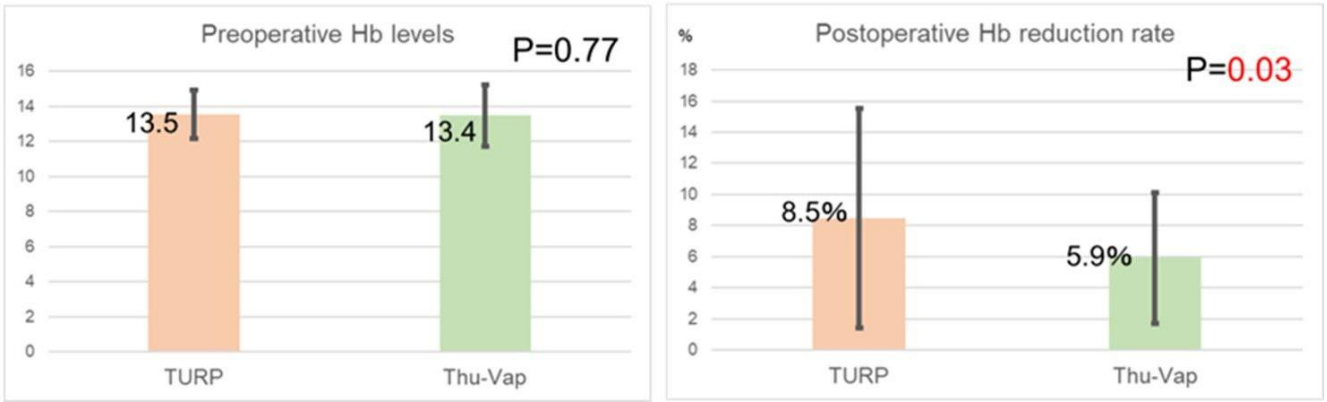

Figure 2. *Preoperative and postoperative hemoglobin (Hb) levels.*

Preoperative hemoglobin (Hb) levels showed no significant difference between TURP and ThuVap groups (P = 0.77), while Hb reduction rates on the first postoperative day were significantly lower in the ThuVap group (5.9%) compared to the TURP group (8.5%, P = 0.03); error bars indicate standard deviation.

The improvements in all outcome parameters, including total I-PSS, OABSS, QOL index, maximum flow rate (Qmax), and post-void residual (PVR), were observed in both groups at 1 and 3 months postoperatively and were maintained

throughout the follow-up period after TURP or ThuVap. At 1 month postoperatively, the I-PSS showed significant improvement in both the TURP and ThuVap groups, with no significant difference observed between the two groups (P=0.96). At 3 months postoperatively, the improvements in I-PSS were sustained in both groups without deterioration, and there remained no significant difference between them (P=0.92) (Figure 3).

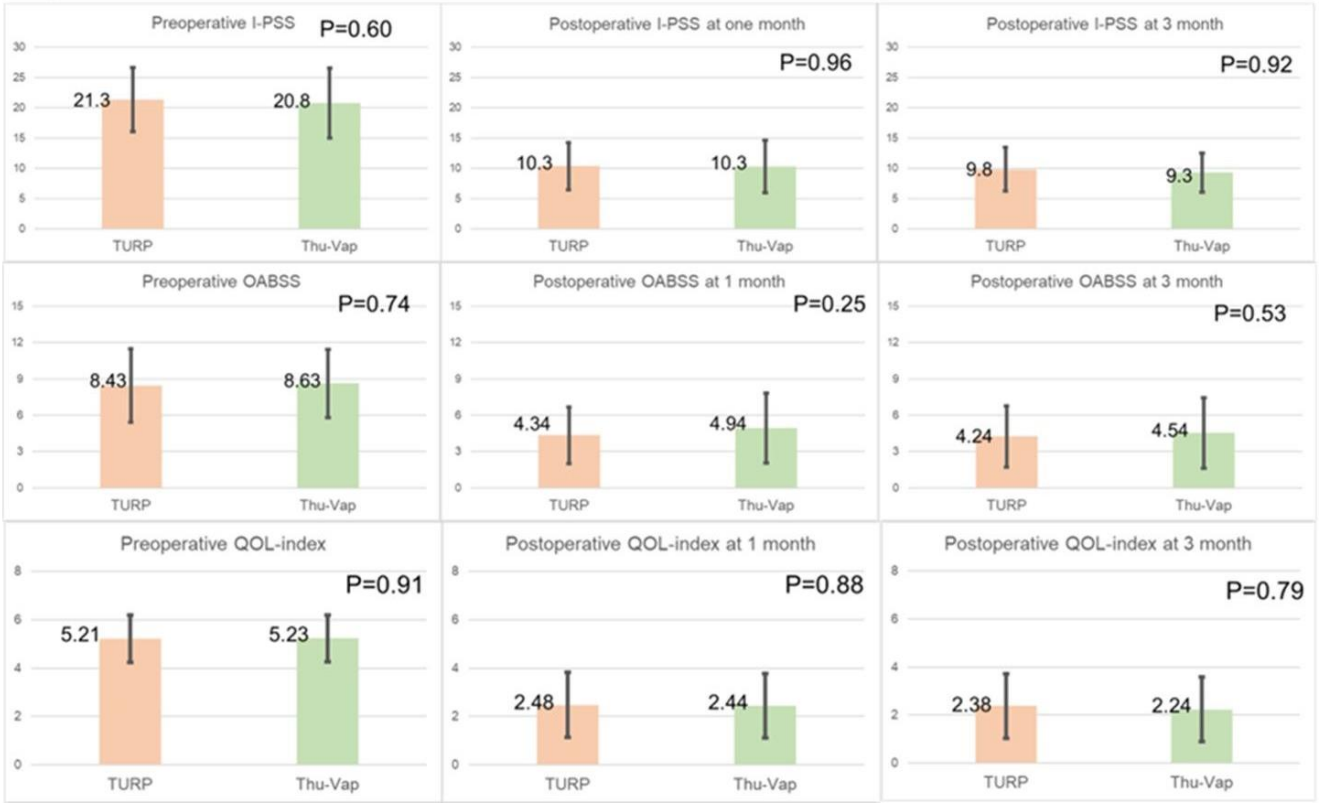

Figure 3. *Changes in I-PSS, OABSS, and QOL Index at 1 and 3 Months Postoperatively.*

This figure illustrates the postoperative changes in the International Prostate Symptom Score (I-PSS), Overactive Bladder Symptom Score (OABSS), and Quality of Life (QOL) index in the TURP and ThuVap groups. Significant improvements were observed in all scores at 1 month postoperatively in both groups, with no significant differences between the groups. The improvements were sustained at 3 months postoperatively, and no significant differences between the groups were observed at either time point. Data are presented as mean ± standard deviation.

At 1 month postoperatively, the OABSS showed significant improvement in both the TURP and ThuVap groups, with no significant difference observed between the two groups (P=0.25). At 3 months postoperatively, the improvements in OABSS were sustained without deterioration in either group, and there remained no significant difference between them (P=0.53) (Figure 3). At 1 month postoperatively, the QOL index significantly improved in both the TURP and ThuVap groups, with no significant difference observed between the two groups (P=0.88). At 3 months postoperatively, the improvements in the QOL index were sustained without deterioration in either group, and there remained no significant difference between them (P=0.79) (Figure 3).

3.3. Preoperative and Postoperative Uroflowmetry

In the TURP group, 52 out of 58 patients (89.7%) required preoperative urethral balloon catheterization due to urinary retention, compared to 42 out of 48 patients (87.5%) in the ThuVap group. Postoperatively, catheter removal was successful in all patients in the TURP group. In the ThuVap group, catheter removal was achieved in all but one case.

At 1 month postoperatively, the maximum urinary flow rate (Qmax) was 19.1 ± 2.2 mL/s in the TURP group and 19.0 ± 2.5 mL/s in the ThuVap group, with no significant difference between the groups (P=0.74). Both groups demonstrated favorable outcomes. At 3 months postoperatively, spontaneous voiding was achieved in all patients except for one in the ThuVap group. The Qmax was 19.4 ± 2.3 mL/s in the TURP group and 18.7 ± 2.6 mL/s in the ThuVap group, with no significant difference observed between the groups (P=0.65). Both groups maintained good postoperative progress (Figure 4). At 1 month postopera-

tively, the mean residual volume (RV) was 37.3 ± 24.8 mL in the TURP group and 37.4 ± 29.8 mL in the ThuVap group, with no significant difference between the groups (P=0.99). At 3 months postoperatively, the mean RV was 31.3 ± 21.8 mL in the TURP group and 27.4 ± 19.8 mL in the ThuVap group. Both groups showed favorable outcomes, and no significant difference was observed between the groups at this time point either (P=0.67) (Figure 4).

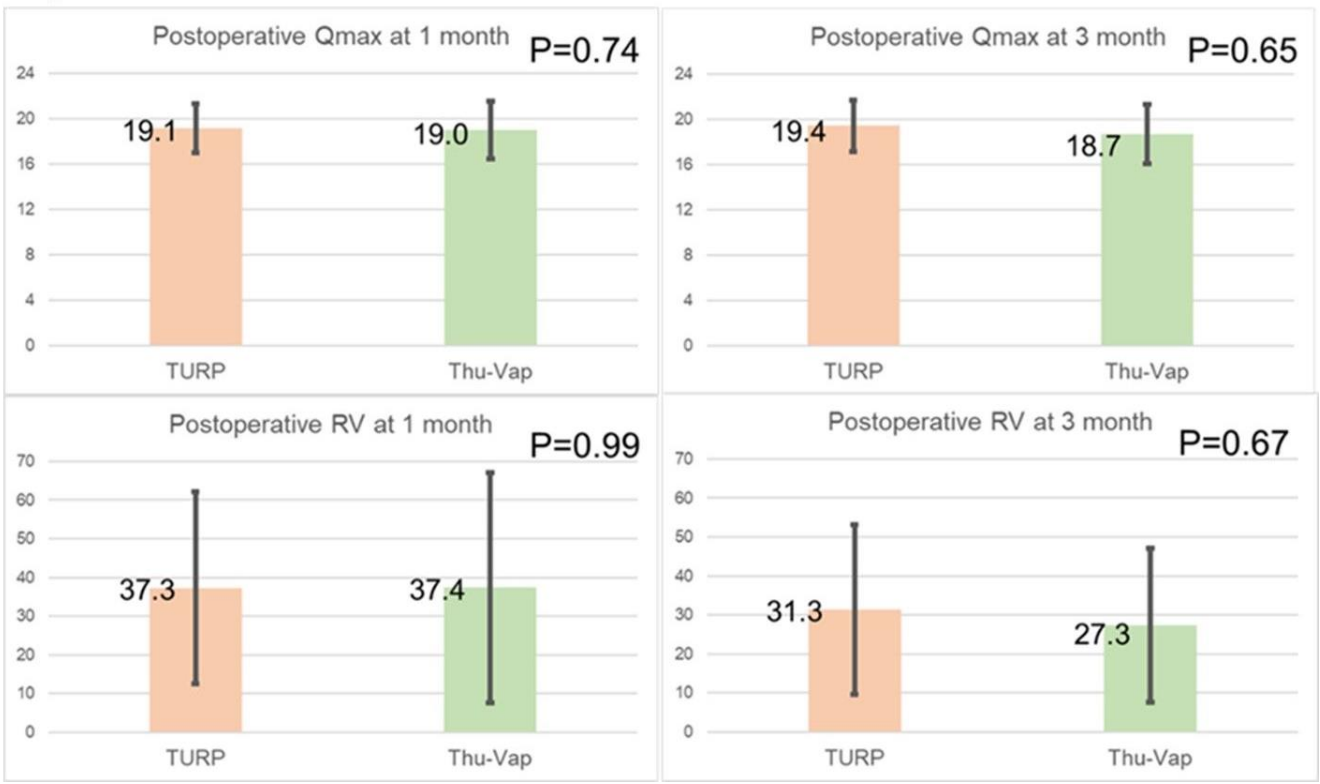

Figure 4. *Postoperative Qmax and Residual Volume (RV) at 1 and 3 Months.*

This figure shows the comparison of postoperative maximum urinary flow rate (Qmax) and residual volume (RV) between the TURP and ThuVap groups at 1 and 3 months.

4. Discussion

LUTS are known to have a detrimental impact on QOL [2, 4]. Therefore, improving QOL has been recognized as a key objective in the management of BPH [11]. In recent years, laser surgery has emerged as a promising alternative to traditional surgical approaches for BPH, such as TURP or open prostatectomy. This is largely due to its comparable efficacy to TURP while offering the advantage of reduced postoperative complications [12, 13]. Given that surgical outcomes for BPH significantly affect patients' QOL, this study has the potential to contribute to and expand the current understanding of these outcomes. The key findings of our study are as follows:

1, Postoperative improvements in IPSS, OABSS, and QOL-index were sustained throughout the short-term follow-up period after both TURP and ThuVap."

2. No significant differences were observed between the TURP and ThuVap groups in changes from baseline in IPSS, OABSS, and QOL-index during the 3-month follow-up period."

3. On the first postoperative day, the rate of hemoglobin decline was significantly lower in the ThuVap group compared to the TURP group. Reduced intraoperative bleeding likely contributed to better surgical visibility, which resulted in a mean reduction of 17 minutes in operative time. However, this difference did not reach statistical significance.

Our study demonstrated that the improvements in postoperative QOL following ThuVap were sustained during the short-term follow-up period. Consistent with our findings, Yu Lan et al. reported no significant differences in the effectiveness of TURP and ThuVap in terms of postoperative QOL, as well as improvements in IPSS and OABSS [14]. Similarly, they also found that ThuVap was associated with reduced intraoperative blood loss compared to TURP, aligning with our results. However, they reported that TURP had a shorter operative time than ThuVap, which contrasts with the findings of our study.

The discrepancy in operative time between our study and the findings of Yu Lan et al. could be attributed to several factors [14]. First, differences in patient characteristics, such as prostate volume or comorbidities, might have influenced the duration of the procedures. Second, variations in the surgeons' experience

and familiarity with ThuVap may have contributed to longer operative times in some studies. Additionally, technical factors, such as the settings of the laser equipment or differences in surgical technique, could play a role. Lastly, institutional protocols or perioperative management strategies might also account for the differences observed. Further research is warranted to elucidate these factors and their impact on operative time. In this study, the procedures for both TURP and ThuVap were performed by multiple surgeons with varying levels of experience, rather than being limited to a single surgeon. It is well-documented that HoLEP has a relatively steep learning curve, stabilizing after approximately 20–50 cases [15, 16]. In contrast, for photoselective-vaporization (PVP), it has been reported that surgeons with extensive experience in endoscopic procedures demonstrate lower early complication rates and higher surgical efficiency compared to less experienced surgeons [17]. Although specific data regarding the learning curve for ThuVap is not currently available, it is reasonable to assume that it follows a similar trajectory to PVP, given the comparable surgical techniques aside from differences in devices. Inyoung Sun et al. reported that PVP efficiency was stable from the initial cases and improved further after approximately 150 cases [18]. With an increased number of cases in our study, further reductions in operative time for ThuVap may be expected.

5. Conclusion

Both TURP and ThuVap effectively improve postoperative quality of life. However, their unique characteristics and the preoperative condition of patients can influence postoperative recovery. Furthermore, the experience and skill level of the surgeon play a critical role in determining surgical efficiency and the risk of complications.

Abbreviations

QOL	Quality of Life
TURP	Transurethral Resection of the Prostate
ThuVap	Thulium Laser Vaporization of the Prostate
BPH	Benign Prostatic Hyperplasia
I-PPS	International Prostate Symptom Score
OABSS	Overactive Bladder Symptom Score
Hb	Hemoglobin
LUTS	Lower Urinary Tract Symptoms
PSA	Prostate-specific Antigen
UDS	Urodynamic Studies
BMI	Body Mass Index
PV	Prostate Volume
Qmax	Maximum Flow Rate
PVR	Post-void Residual

Author Contributions

Yuki M wrote the initial draft of the manuscript. Yuki M and Wahei Y performed data analysis and interpretation and were involved in writing the initial draft of the manuscript. Yuki M, Jun M, and Takashi F designed the study, performed data analysis and interpretation, and was involved in manuscript drafting and revision.

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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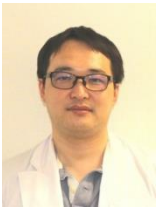
Biography



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Research Field

Wahei Yanagida: Benign prostatic hyperplasia treatment, Laser applications in urology, Quality of life in urology, Urinary stone management, Male lower urinary tract symptoms, Urological device innovations.

Jun Morita: Benign prostatic hyperplasia treatment, Endoscopic urological surgery, Laser applications in urology, Quality of life in urology, Urological minimally invasive techniques, Urinary stone management, Male lower urinary tract symptoms, Surgical outcomes analysis, Renai cancer management, Urological device innovations.

Takashi Fukagai: Benign prostatic hyperplasia treatment, Endoscopic urological surgery, Laser applications in urology, Quality of life in urology, Urological minimally invasive techniques, Male lower urinary tract symptoms, Surgical outcomes analysis, Prostate cancer management, Urological device innovations.