

# Comparison of 120 W 2- $\mu$ m laser resection of the prostate outcomes in patients with or without preoperative urinary retention

Xiaolong Liu, Yongchang Wang, Jie Gao, Yuxi Shan

Department of Urology, The Second Affiliated Hospital of Soochow University, Suzhou, China

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## Abstract

**Introduction:** The 2- $\mu$ m (thulium) laser is a new surgical laser for benign prostatic hyperplasia (BPH).

**Aim:** To report on the long-term outcome of 120 W TmLRP-TT in BPH patients with or without preoperative urinary retention.

**Material and methods:** The study was conducted from May 2013 to April 2015 among patients who were diagnosed with BPH and underwent TmLRP-TT. Patients were divided into two groups: with and without preoperative urinary retention. Pre- and post-operative data were evaluated for prostate-specific antigens (PSA), International Prostate Symptom Score (IPSS), Quality Of Life Score (QOLS), maximum flow rate (Qmax), and post-void residual urine volume (PVR).

**Results:** A total of 310 patients were enrolled for a follow-up period of more than 12 months. Overall 95 (30.6%) patients had urinary retention before TmLRP-TT, while 215 (69.4%) did not. We found that patients with urinary retention tended to have larger prostates and a higher PSA score. So a longer operation time and catheterization time were observed in them. Yet there was no difference in other perioperative and postoperative parameters. Postoperatively IPSS, QOLS, Qmax, and PVR showed a significant improvement in each group, but no significant difference was identified between the two groups.

**Conclusions:** This study represents the first direct comparison of TmLRP-TT outcomes in patients with or without urinary retention. With safe use, resultant excellent homeostasis, high cutting efficiency and rapid vaporization, 120 W 2- $\mu$ m laser resection of the prostate has been proved to be safe and effective, and there was no increased risk for patients with urinary retention.

**Key words:** 2- $\mu$ m laser, benign prostatic hyperplasia, urinary retention.

## Introduction

Benign prostatic hyperplasia (BPH) is one of the most common causes of urinary obstruction in aged men. Different kinds of treatments have been introduced and implemented from medications regulating BPH symptoms to surgical methods of removing the enlarged part of the prostate. Transurethral resection of the prostate (TURP) is considered to be the gold standard for surgically removing the en-

larged part of the prostate. However, because of the relatively high rate of complications associated with TURP, various laser devices have been introduced in clinical practice, which include: potassium-titanyl-phosphate (KTP) laser photoselective vaporization prostatectomy (PVP), holmium laser enucleation of the prostate (HoLEP), 2- $\mu$ m (thulium) laser resection of the prostate-tangerine technique (TmLRP-TT), and so on.

### Address for correspondence

Jie Gao MD, Yuxi Shan MD, Department of Urology, The Second Affiliated Hospital of Soochow University, 1055 SanXiang Road Suzhou, 215004 Suzhou, China, e-mail: [gaojie2005@yeah.net](mailto:gaojie2005@yeah.net), [shanyuxi1002@126.com](mailto:shanyuxi1002@126.com)

The 2- $\mu$ m (thulium) laser is a new surgical laser for BPH, which has been asserted to be efficacious and safe by some groups. The purpose of this study was to report on the long-term outcome of 120 W TmLRP-TT in BPH patients with or without preoperative urinary retention.

## Material and methods

### Study population

Between May 2013 and April 2015, a total of 310 symptomatic BPH patients from the second affiliated hospital of Soochow University were enrolled. All patients were evaluated with a basic history, physical examination and urine culture. Transrectal ultrasonography (TRUS) was used to determine prostate size. Preoperative evaluation included prostate-specific antigens (PSA), International Prostate Symptom Score (IPSS), Quality Of Life Score (QOLS), maximum flow rate (Qmax), and post-void residual urine volume (PVR). Patients were divided into two groups: with and without preoperative urinary retention (urinary retention and non-retention groups). Patients in the urinary retention group were defined as those using an indwelling catheter or intermittent catheterization for bladder drainage preoperatively. The study was conducted under institutional review board approval of the second affiliated hospital of Soochow University.

### Instruments and surgical techniques

All operations were performed while patients were in the lithotomic position under spinal anesthesia. A 2- $\mu$ m (thulium) laser with maximum average power of 120 W from China Tianjin Kun Company (Model: TK-2120) was used in continuous-wave mode for the procedure. The energy was delivered through 550  $\mu$ m end-firing PercuFib fibers. The laser fibers were introduced through a Karl Storz 26-Fr continuous flow resectoscope. Saline irrigation was used in all the cases, with an irrigation pressure of 40–60 cm. First, emitting laser under direct vision, an inverted U-shape incision distal to the resection border was made around the verumontanum, and an additional linear incision was made at 5 and 7 o'clock. Then we used left and right rotation, moving back and forth to cut and vaporize prostate tissue. The median lobe and both lateral lobes were vaporized until the prostate capsule was identi-

fied. During vaporization, it was important that the prostate tissue was cut into pieces small enough to pass through the resectoscope. A 20-Fr urethral catheter was placed after the operation and removed on the second or third day, taking into consideration the degree of hematuria. All procedures were performed by two surgeons (YX S and J G).

### Follow-up

All patients visited the outpatient clinic at 1, 3, 6 and 12 months after the operation. At every visit, IPSS, QOLS, Qmax, and PVR were checked. Prostate-specific antigens was checked at 6 and 12 months. In addition, the presence of postoperative complications was verified at every follow-up visit.

### Statistical analysis

Using SPSS 18.0 statistical software to analyze the data in the study, comparative analysis was performed using Student's *t*-test for continuous data and the  $\chi^2$  test for categorical data ( $p < 0.05$  indicated a significant difference).

## Results

All 310 patients underwent 120 W TmLRP-TT between May 2013 and April 2015 for symptomatic BPH, of whom 95 had urinary retention before the operation and 215 did not. Of the patients with retention 73 had indwelling catheters and 22 were on intermittent catheterization with an overall mean catheterization time of 1.1 months.

Preoperative parameters are presented in Table I. Patients with retention tended to be older (72.3 vs. 68.7 years,  $p < 0.05$ ), with larger prostate volumes as measured on TRUS (74.4 vs. 54.5 ml,  $p < 0.05$ ), as well as higher PSA (7.9 vs. 3.4 ng/dl,  $p < 0.05$ ). Ninety-four percent of patients in the retention group and 88% of those without retention had been treated with an  $\alpha$ -blocker and/or 5 $\alpha$  reductase inhibitor therapy before TmLRP-TT. No patient had undergone prior BPH operation.

The perioperative data are listed in Table II. A longer operation time was observed in the patients with urinary retention (78.3 vs. 60.7 min,  $p < 0.05$ ). Mean mass of resected tissue was greater in the retention group (52.9 vs. 32.3 g,  $p < 0.05$ ), as was median duration of catheterization postoperatively (3.1 vs. 2.3 days,  $p < 0.05$ ). However, mean decrease

**Table I.** Preoperative parameters of the patients

Parameter	Urinary retention group	Non-retention group	Overall	<i>P</i> -value
No. of patients (%)	95 (30.6)	215 (69.4)	310	
Age [years]	72.3 $\pm$ 7.4	68.7 $\pm$ 8.3	69.2 $\pm$ 8.1	< 0.05
Prostate volume [ml]	74.4 $\pm$ 39.8	54.5 $\pm$ 31.2	59.7 $\pm$ 35.6	< 0.05
PSA [ng/dl]	7.9 $\pm$ 5.2	3.4 $\pm$ 2.7	4.0 $\pm$ 3.8	< 0.05
IPSS	23.4 $\pm$ 8.3	21.8 $\pm$ 9.4	22.6 $\pm$ 8.6	0.136
QOLS	4.7 $\pm$ 1.4	4.3 $\pm$ 1.7	4.5 $\pm$ 1.5	0.831
Qmax [ml/s]	8.9 $\pm$ 7.2	10.3 $\pm$ 7.8	9.6 $\pm$ 7.6	0.085
PVR [ml]	178.4 $\pm$ 210.3	76.4 $\pm$ 138.5	105 $\pm$ 147.3	< 0.05

**Table II.** Perioperative data of the patients

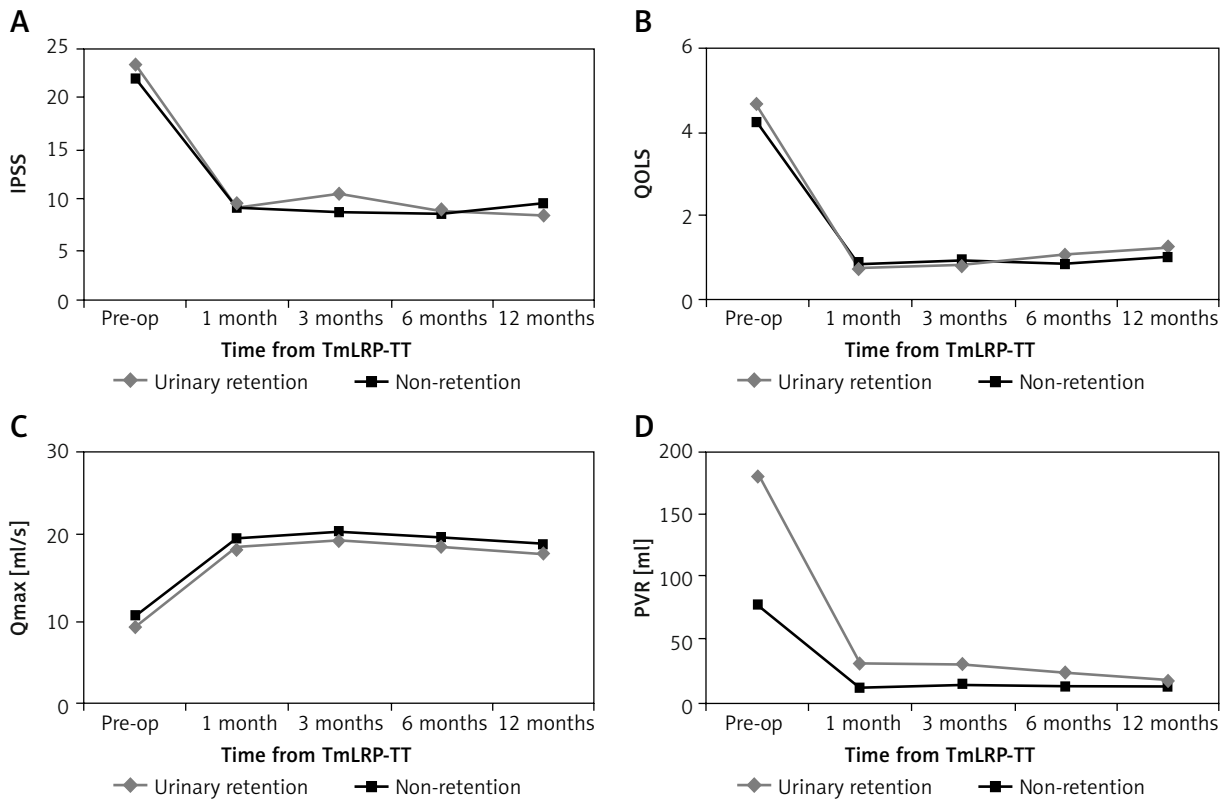
Parameter	Urinary retention group	Non-retention group	Overall	<i>P</i> -value
Operation time [min]	78.3 $\pm$ 29.5	60.7 $\pm$ 18.1	65.8 $\pm$ 23.2	< 0.05
Resected weight [g]	52.9 $\pm$ 23.7	32.3 $\pm$ 19.6	40.4 $\pm$ 22.4	< 0.05
Hemoglobin decrease [g/dl]	2.4 $\pm$ 1.9	2.0 $\pm$ 1.6	2.1 $\pm$ 1.7	0.672
Catheterization time [days]	3.1 $\pm$ 1.8	2.3 $\pm$ 1.0	2.6 $\pm$ 1.5	< 0.05
No. of complications (%)	11 (11.6)	20 (9.3)	32 (10.1)	0.538
Urinary tract infection	4 (4.2)	7 (3.3)	12 (3.9)	0.675
Incontinence	2 (2.1)	4 (1.9)	6 (1.9)	0.762
Retention	3 (3.2)	4 (1.9)	7 (2.3)	0.769
Urethral stricture/bladder neck contracture	2 (2.1)	5 (2.3)	7 (2.3)	0.769
Blood transfusion	0	0	0	

in hemoglobin after TmLRP-TT was 2.4 g/dl for the retention group and 2.0 g/dl for the non-retention group ( $p > 0.05$ ).

The incidence of complications between the two groups are listed in Table II (11.6% vs. 9.3%,  $p > 0.05$ ). The most common adverse event was postoperative urinary tract infection. The cumulative incidence of urinary tract infections at the 12-month follow-up was 4.2% in the retention group and 3.3% in the non-retention group. Temporary incontinence occurred in 2 patients and 4 patients, respectively; however, these conditions changed for the better 3 months afterward. Urinary retention occurred in 3 (3.2%) patients and 4 (1.9%) patients, respectively; all patients improved after recatheterization for 5 to 7 days. Seven patients (2 vs. 5) required later intervention for urethral stricture disease or bladder

neck contracture. No blood transfusion was required in the two groups.

As shown in Figure 1, postoperative characteristics were significantly improved at all follow-up points in both groups compared with the baseline value. Postoperative evaluation included PSA, IPSS, QOLS, Qmax, and PVR (in Table III). The PSA level had decreased dramatically by 6 months postoperatively in both groups (3.6 vs. 3.2 ng/dl), and remained stable up to 12 months postoperatively (2.9 vs. 2.7 ng/dl). The IPSS and QOLS were significantly improved from preoperative assessments to each of the postoperative visits (all  $p < 0.05$ ), with no significant difference between groups ( $p > 0.05$ ). We knew patients without preoperative retention had significantly higher Qmax measures, yet median Qmax was not significantly different between the groups ( $p > 0.05$ ).



**Figure 1.** The improvements of IPSS, QOLS, Qmax and PVR in the 1-year follow-up durations

**Table III.** Mean PSA, IPSS, QOLS, Qmax and PVR values at various follow-up durations

Variable	Preoperative	Follow-up duration			
		1 month	3 months	6 months	12 months
Urinary retention:					
Number	95	93	85	71	59
PSA [ng/dl]	7.9	–	–	3.6	3.2
IPSS	23.4	9.3	10.6	8.9	8.5
QOLS	4.7	0.7	0.8	1.0	1.2
Qmax [ml/s]	8.9	18.5	19.1	18.4	17.7
PVR [ml]	178.4	30.1	28.5	23.1	17.4
Non-retention:					
Number	215	206	174	162	137
PSA [ng/dl]	3.4	–	–	2.9	2.7
IPSS	21.8	9.2	8.7	8.5	9.6
QOLS	4.3	0.8	0.9	0.8	1.0
Qmax [ml/s]	10.3	19.6	20.1	19.4	18.9
PVR [ml]	76.4	10.2	13.1	12.3	11.7
Total, n (%)	310 (100)	299 (96.5)	259 (83.5)	233 (75.2)	196 (63.2)

and remained more than 15 ml per second for both groups at all postoperative points. Although patients with urinary retention still had higher PVR after the operation, median PVR remained less than 40 ml for both groups at all follow-up points as well, and were about the same at the 12-month follow-up.

## Discussion

The 2- $\mu$ m (thulium) laser, which was first used in prostate practice in 2005, is one of the surgical lasers available for BPH [1]. Then the thulium laser vapo-enucleation (ThuLEP) and thulium laser resection of the prostate tangerine technique (TmLRP-TT) were introduced [2, 3]. In 2008, the high-powered 70 W thulium laser was applied clinically [4]. Recently, efficacy and safety of the 120 W thulium laser for BPH patients have been reported [5, 6]. In this study we describe the efficacy and safety of 120 W TmLRP-TT for the treatment of symptomatic BPH in patients with or without preoperative urinary retention.

Our data showed a longer operation time in the retention group. Obviously, this is because of larger prostate volume. We found that patients with and without urinary retention had a mean of 52.9 and 32.3 ml of tissue resected, respectively. Our data showed that only 3 patients in the retention group and 4 patients in the non-retention group required temporary recatheterization, while no patient in either group remained catheter-dependent. Our data also showed that no patient in the two groups required reoperation during a one-year period of postoperative follow-up. Similarly, there was no significant difference in the incidence of complications. Most importantly, in the 1-year follow-up study, immediate and sustained improvements of IPSS, QOLS, Qmax, and PVR were observed in both groups (Figure 1). Also there was no significant difference between the two groups. So this study showed that patients who undergo TmLRP-TT for urinary retention have objective and subjective outcomes similar to those who undergo the procedure for other indications.

Some studies have reported a higher risk of adverse outcomes for BPH patients with urinary retention. Pickard *et al.* performed a study of 3,966 men undergoing open prostatectomy, of whom 1242 patients had urinary retention. They found that men in the retention cohort had a fourfold increased rate of postoperative urinary retention (9.2% vs. 2.3%), an increased risk of perioperative complications and

a significantly increased risk of mortality after prostatectomy [7]. Similar to data from open prostatectomy, Mebust *et al.*, in a multicenter trial involving 3,885 patients who underwent TURP, reported that men with urinary retention had an 11% rate of postoperative retention and an almost threefold higher rate of infection than patients without urinary retention [8, 9]. However, patients with urinary retention treated with HoLEP and PVP did not experience such a significant rate of adverse events, and all patients exhibited improvements in subjective and objective voiding parameters [10–12].

The current data of 120 W TmLRP-TT appear to be similar to those presented in the HoLEP and PVP literature, so we suggest that TmLRP-TT may be an ideal treatment for men with urinary retention due to BPH.

## Conclusions

The current study demonstrates that 120 W TmLRP-TT is safe and efficient for the treatment of symptomatic BPH in patients with or without urinary retention. Although patients with a history of urinary retention may have a longer operation time and a risk of more PVR, a preoperative history of retention did not seem to have a great influence on postoperative progress.

## Conflict of interest

The authors declare no conflict of interest.

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