The Effectiveness and Safety of Transurethral (Bipolar) Plasmakinetic Resection of Prostate Combined with Thulium Laser for Large Benign Prostatic Hyperplasia (>80ml)

Tiancheng Xie, Peng Lai, Ming Luo*, Yunfei Xu**

Purpose: To evaluate the clinical curative effect and safety of transurethral (bipolar) plasmakinetic resection of the prostate (PKRP) combined with thulium laser in the treatment of large prostates (> 80mL).

Materials and Methods: From January 2014 to December 2015, 61 patients with benign prostate hyperplasia (BPH) were treated with PKRP combined with thulium laser (n = 25) or PKRP only (n = 36). We retrospectively analyzed the perioperative status of patients status during 3-month follow-up.

Results: There was no significant difference between the two groups before treatment ($P > .05$). PKRP combined with thulium laser was significantly superior to PKRP in terms of surgical duration, intraoperative blood loss, postoperative bladder washing time, postoperative complications and time of hospital stay ($P < .05$). There were no significant improvements at international prostatic symptom score (IPSS), quality of life (QOL), maximum flow rate (Qmax), and post-void residual (PVR) urine between two groups after 3 months ($P > .05$).

Conclusion: PKRP combined with thulium laser is superior than PKRP only for better surgical duration, less bleeding, higher efficiency and much quicker recovery. It may be a better choice for the treatment of BPH with large prostate (> 80mL).

Keywords: large benign prostatic hyperplasia; transurethral (Bipolar) plasmakinetic resection; thulium laser.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common disease in middle and old aged men (over 50 years), which seriously decreases the quality of the patients' life[1]. Nowadays transurethral resection of the prostate (TURP) is still the gold standard for surgical treatment of BPH. However, the efficacy and safety of TURP was mostly shown on treating prostates less than 80 ml. It also has defects such as requiring mannitol or glucose solution as washing liquid, causing transurethral resection syndrome (TURS)[2], wrecking the external urethral sphincter as its high temperature, increasing the rate of transient urinary incontinence[3-4]. Complications more easily happen and are more serious in patients with larger prostates[5]. Although the transurethral bipolar plasmakinetic prostatectomy (PKRP) could avoid TURS[6], a higher risk of bleeding and long operative times for large gland still limits the practicality of this technique[7-8]. Additionally, as the rising efficacy of drug therapy, surgical treatment is postponed. More and more patients with larger prostate appear and, thus, a new surgical treatment is necessary to meet this challenge. Thulium laser is a new type of laser surgery. Its center wavelength can be adjusted between 1.75 ~ 2.22 μm for accurate and efficient cutting characteristics[9-10]. Thulium laser has effective tissue coagulation, vaporization and hemostatic effect. At the same time, because its large amount of energy can be absorbed by water, thermal damage is mainly generated in the surface structure, which limits the depth of energy penetration in tissue. The operative time is obviously longer than TURP. Thulium laser is used for small and medium prostates[11]. We intended to combine the advantages of PKRP and thulium laser. At the same time, we attempted to avoid the disadvantages of both. We designed a method of transurethral resection of the prostate using PKRP combined with thulium laser. The aim of this study was to compare the efficacy and safety of this method with PKRP alone for treating BPH with large prostates (> 80 mL).

PATIENTS AND METHODS

Patients

From January 2014 to October 2015, a total of 61 patients with BPH (> 80 mL) hospitalized in the Tenth People's Hospital of Tongji University were enrolled in this study. All patients had been treated with 5-alpha reductase inhibitors before surgery. Patients were candidate for surgery only if drug therapy was not effective or the effect was poor. Patients with first prostate operation, normal liver and kidney function, normal blood coagulation, no infection and prostate volume > 80ml were in-

Department of Urology, Shanghai Tenth People's Hospital, Tongji University, School of Medicine, Shanghai 200072, People's Republic of China

*,**Yunfei Xu and Ming Luo are both corresponding authors and contributed equally to this work.

**Department of Urology, Shanghai Tenth People's Hospital, Tongji University, School of Medicine, 301 Middle Yanchang Road, Shanghai 200072, People's Republic of China.

Tel: (+86)13817990948; Fax: (+86)13817990948; E-mail: xuyunfeibb@sina.com.

*Department of Urology, Shanghai Tenth People's Hospital, Tongji University, School of Medicine, 301 middle Yanchang road, Shanghai 200072, People's Republic of China.

Tel: (+86)18917684187; Fax: (+86)18917684187; E-mail: lm1191@126.com.

Received April 2016 & Accepted November 2016

Table 1. Basic medical data

	PKRP + Thulium (mean ± SD)	PKRP (mean ± SD)	*P* Value
Age, years	69.20 ± 3.27	68.80 ± 6.51	.982
Prostate volume, mL	88.00 ± 7.06	90.88 ± 8.29	.674
PSA, ng/mL	5.87 ± 2.34	5.98±4.29	.988
IPSS	23.20 ± 3.08	23.58±4.33	.157
PVR volume, mL	108.36 ± 6.22	114.75 ± 15.15	.594
Quality of life (QoL)	4.40 ± 1.19	4.56 ± 0.97	.257
Qmax, mL/s	7.60 ± 1.94	8.66 ± 2.76	.651

cluded. Patients with external orifice stricture of the urethra who underwent prostate resection were excluded. Among the 61 cases, 36 patients were treated with PKRP, and 25 patients were treated with PKRP combined with thulium laser. Intraoperative parameters and postoperative parameters at 3 month follow-up were obtained for analysis. Intraoperative parameters included operation time, hemoglobin decrease, irrigation time, catheterization time, hospital stay time. Postoperative parameters included international prostatic symptom score (IPSS), quality of life (QOL), maximum flow rate (Qmax), and post-void residual (PVR) urine. The study protocol was approved by the ethics committee of the Tenth People's Hospital (approval no.: SHSY-IEC-pap-16-7). All patients signed informed consent.

Surgical techniques

We used thulium laser cutting at the 4:00, 8:00, and 12:00 positions to make three marker grooves. There were three parts of prostate tissues between grooves. Then, bipolar resectoscope was used to push prostate tissue, find the gap between prostate tissue and surgical capsule. Then, three parts of the prostate tissue were enucleated. Enucleated prostate tissue was resected into strips and aspirated from the body. Finally, the remaining prostate tissue was cleaned by thulium laser.

Statistical analysis

Statistical differences were presented as mean ± SD. Categorical variables (such as recurrence rates and recurrence-free rates) were analyzed using Fisher's exact test. Numerical variables (such as Qmax values, stricture length and operative time) were analyzed using the Mann-Whitney U test. After Shapiro-Wilk test, Wilcoxon rank-sum test and *t*-test were used to compare the two groups for values in abnormal and normal distribution respectively. Unpaired t-test was used to compare means between two samples, and Chi-square test was used to compare proportions. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS ver. 12.0). Statistical significance was considered when $P < .05$.

RESULTS

Preoperative baseline indexes

We summarized the preoperative baseline characteristics of two groups in **Table 1**. There was no statistically significant difference between the two study groups ($P > .05$).

Intraoperative clinical indexes

As shown in **Table 2**, PKRP combined with thulium laser was superior to PKRP in term of surgical duration, irrigation time, catheterization time and hospital stay time ($P < .05$). There were 7 cases of severe bleeding in the PKRP group versus none in the PKRP combined with thulium laser group ($P < .05$).

Postoperative clinical indexes

Postoperative parameters of the two study groups at 3 months follow-up are shown in **Table 3**. Related indexes were significantly improved compared with the preoperative status in each group. There was no significant difference between two groups regarding assessed variables ($P > .05$).

DISCUSSION

TURP is still the gold standard for surgical treatment of BPH. However, TURP has some shortcomings such as bleeding, TURS, urine extravasation, urinary incontinence, erectile dysfunction, etc. These complications are more frequently encountered in patients with large

Table 2. Comparison of follow-up data at 3 months between treatment groups.

	PKRP+ Thulium (mean±SD)	PKRP (mean±SD)	*P* value
IPSS	12.48 ± 1.35	12.19 ± 2.03	.893
QoL	2.89 ± 0.75	3.16 ± 0.80	.179
PVR, mL	23.92 ± 1.41	24.13 ± 1.40	.564
Qmax, mL/s	15.84 ± 1.52	16.31 ± 1.43	.207
Urethral stricture	0	0	1

Table 3. Follow-up data at 3 months

	PKRP+ Thulium laser (mean±SD)	PKRP(mean±SD)	*P* value
IPSS	12.48 ± 1.35	12.19 ± 2.03	0.893
QoL	2.89 ± 0.75	3.16 ± 0.80	0.179
PVR	23.92 ± 1.41	24.13 ± 1.40	0.564
Qmax	15.84 ± 1.52	16.31 ± 1.43	0.207
Urethral stricture	0	0	/

There was no significant difference between the two groups after 3 months.

benign prostatic hyperplasia (> 80ml).The present study suggests that PKRP can achieve the same effect of TURP for the treatment of BPH. The incidence of some complications such as TURS, acute epididymitis and postoperative re-bleeding in PKRP was lower than TURP, but the operation time of PKRP was longer. As a new type of medical laser technology, thulium laser has the following advantages: efficient and precision cutting, less intraoperative bleeding, wide range of applications, using saline for irrigation which reduces the occurrence of transurethral resection syndrome (TURS), smaller beam diameter and reducing the damage of urethra[12-13]. We tried to combine the advantages of PKRP and thulium laser and avoid the disadvantages of both. In our present study, PKRP combined with thulium laser was superior to PKRP with regards to operation time, hemoglobin decrease, irrigation time, catheterization time and hospital stay time ($P < .05$). PKRP combined with thulium laser was associated with less complications than PKRP ($P < .05$). Three-month follow-up showed no significant difference in the efficacy between two groups ($P > .05$). The combined method does increase the cost of surgery. Because of medical insurance, the patient only pays a small part of the total medical cost. The higher price may be one of the factors that can limit the choice of this combination method, however some patients are more inclined to choice advanced, efficient and safe methods. There are also some shortcomings in this research. First, the sample size is small. Second, follow-up duration is limited. And third, the study is retrospective. In summary, the operative efficacy of PKRP combined with thulium laser compared with PKRP was not statistically different. PKRP combined with thulium laser was superior to PKRP alone for its shorter operation time, less bleeding, lower incidence of intraoperative and postoperative complications, shorter recovery and greater operation efficiency. PKRP combined with thulium laser could be considered as an ideal treatment for BPH with broad clinical prospects. The long-term efficacy of PKRP combined with thulium laser remains to be explored with long-term follow-up periods.

CONFLICT OF INTEREST

The authors report no conflict of interest.

REFERENCES

1. Bushman, W. Etiology, epidemiology and natural history of benign prostatic hyperplasia. Urol. Clin. North Am. 2009; 36: 403-15.
2. Van Peperstraten A, Proctor ML, Johnson NP, et al. Techniques for surgical retrieval of sperm prior to ICSI for azoospermia. Cochrane Database Syst Rev. 2006; 19: 2807.
3. Esteves SC, Miyaoka R, Agarwal A. Sperm retrieval techniques for assisted reproduction. Int Braz J Urol. 2011; 37: 570-83.
4. Argawal A, Deepinder F, Cocuzza M, et al. Efficacy of varicocelectomy in improving semen parqameters: new meta-analytical approach. Urology. 2007; 70: 532-8.
5. Rassweiler J, Teber D, and Kuntz R. Complications of transurethral resection of the prostate (TURP)–incidence, management, and prevention. Eur. Urol. 2006; 50: 969-79.
6. Xie CY, Zhu GB, Wang XH, Liu XB. Five-Year Follow-Up Results of a Randomized Controlled Trial Comparing Bipolar Plasmakinetic and Monopolar Transurethral Resection of the Prostate. Yonsei Med J. 2012; 53:734-41.
7. Geavlete B, Bulai C, Ene C, Checherita I, Geavlete P. Bipolar vaporization, resection, and enucleation versus open prostatectomy: optimal treatment alternatives in large prostate cases? J Endourol. 2015; 29: 323-31.
8. Abdallah MM, Badreldin MO. A short-term evaluation of the safety and the efficacy of bipolar transurethral resection of the prostate in patients with a large prostate (> 90 g). Arab J Urol. 2014;12: 251-5.
9. Yu H, Zhang Z, Zhu Y, Chen J, Jiang X, Meng H, Shi B. Long-term outcome following thulium vaporesection of the prostate. Lasers Surg Med. 2016; 4: 1-6.
10. FriedNM, MurrayKE. High-power thulium fiber laser ablation of urinary tissues at 1.94 microm. J Endourol. 2005; 19: 25-31.
11. Lee WC, Lin YH, Hou CP, Chang PL, Chen CL, Juang HH, Tsui KH. Prostatectomy using different lasers for the treatment of benign prostate hyperplasia in aging males. Clin Interv Aging. 2013; 8: 1483-8.
12. Kramer MW, Bach T, Wolters M, et al. Current evidence for transurethral laser therapy of non-muscle invasive bladder cancer. World J Urol, 2011; 29: 433-42.
13. Marks AJ, Teichman JM. Lasers in clinical urology: state of the art and new horizons.

World J Urol. 2007; 25: 227-33.