Int J Clin Exp Med 2018;11(3):2572-2576
www.ijcem.com /ISSN:1940-5901/IJCEM0054035

Original Article

Holmium laser enucleation of the prostate prevents postoperative stress incontinence in patients with benign prostate hyperplasia

Wenhui Song, Jianhui Wu, Junwei Gai, Zhanpo Yang, Shiqiang Yang, Qingtong Ma, Hongshun Ma

Department of Urinary Surgery, Tianjin First Center Hospital, Tianjin 300192, China

Received August 29, 2016; Accepted December 15, 2017; Epub March 15, 2018; Published March 30, 2018

Abstract: Objective: We aimed to compare the safety and efficacy of the transurethral electrovaporization resection of the prostate (TUEVP) and holmium laser enucleation of the prostate (HoLEP) in treating BPH, especially in preventing the postoperative stress urinary incontinence, which has been rarely studied. Methods: A total of 100 patients with BPH admitted in our department from August 2013 to October 2015 were prospectively enrolled and randomly divided into two groups who underwent TUEVP (n = 50) or HoLEP (n = 50), respectively. The demographic and clinical characteristics including the procedural parameters and hospitalization duration were collected and analyzed. Results: HoLEP had advantages over TUVEP, which was evidenced by the statistically significant differences found on less operative duration (P<0.01), intraoperative blood loss (P<0.01) and resected prostate weight (P<0.01), intraoperative bladder irrigation duration (P<0.05), urinary catheter indwelling time (P<0.05), postoperative blood loss (P<0.05) and hospitalization duration (P<0.05) between the two groups. The 2-week and 3-month incidence of stress incontinence in HoLEP group were both lower than those in TUEVP group (P<0.05), while there was no significant difference on the IPSS and Qmax at 3-month follow-up after the surgery (P>0.05). Conclusion: HoLEP is comparable with TUEVP in safety and therapeutic effect, but HoLEP could protect the integrity and function of urethral mucosal tissue, which is vital to the prevention of postoperative stress incontinence.

Keywords: Benign prostate hyperplasia, transurethral electrovaporization resection of the prostate, holmium laser enucleation of the prostate, stress incontinence, therapeutic efficacy, safety

Introduction

In the recent years, the senior population has increased greatly all over the world, especially in China. Benign prostate hyperplasia (BPH) is one of the commonest diseases in aged male patients, which could manifested as frequent micturition, urgent urination, vesical tenesmus, greatly impairing their life quality and increasing their anxiety [1]. For such patients, early diagnosis and effective treatment could alleviate the clinical symptoms and reduce the severity of the disease. Currently, the treatment for BPH includes medication, interventional therapy and surgery. However, the medication could not radically cure the patients. Transurethral resection of the prostate (TURP) has been the standard treatment for BPH, but this technique could damage the urethra and the complication rate is relatively high, especially postoperative stress incontinence as the most important complication after surgery, which limits its clinical application [2]. So far, great progress has been made on the minimally invasive laparoscopy, transurethral electrovaporization resection of the prostate (TUEVP) and holmium laser enucleation of the prostate (HoLEP) have been developed and introduced to the management of BPH [3, 4].

Previous studies have reported that TUVEP and HoLEP could effectively alleviate the symptoms of patients with BPH with low complication rate [5, 6]. These results indicate that these two techniques have advantages over traditional TURP and may become the new standard treatment for BPH. However, the safety and therapeutic effect of TUVEP and HoLEP have been rarely investigated and compared, which could benefit the identification of the indications for

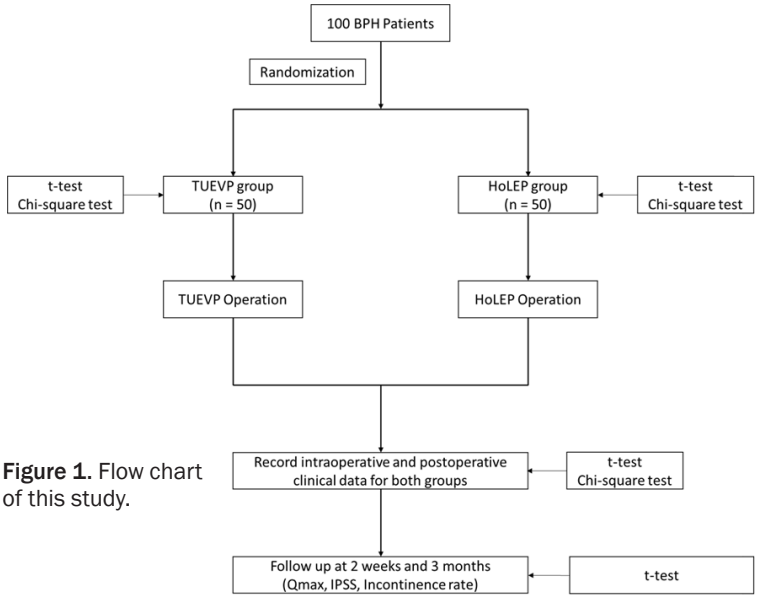

Figure 1. Flow chart of this study.

each technique. Thus, we conducted this prospective cohort study, aiming at comparing TUVEP and HoLEP in treating patients with BPH and the incidence of postoperative stress incontinence.

Patients and methods

Patients

A total of 100 patients diagnosed with BPH admitted in our department from August 2013 to October 2015 who had indications for prostate resection were prospectively enrolled and randomly divided into two groups who underwent TUEVP (n = 50) or HoLEP (n = 50), respectively. The demographic and clinical characteristics were retrieved from the computerized database and collected. The flow chart of this study was shown in **Figure 1**.

The study protocol was approved by the Ethic Committee of our hospital and conducted in accordance with Helsinki's Declaration. All the patients gave their written information consent.

TUVEP and HoLEP

The indications for TUVEP and HoLEP were BPH patients who had ineffective medication for 3 months and serious lower urinary tract symptoms (LUTS). General anesthesia or continuous epidural anesthesia was administrated and prophylactic antibiotics were given before operation.

TUVEP and HoLEP were conducted as previously reported [6, 7]. A continuous-flow resectoscope (Richard Wolf GmBh, Germany) with the Wing (Richard Wolf) loop was used for TUVRP with a setting of 50-70 W coagulation. The starting resection of TUVRP at the bladder neck at the 5 and 7 o'clock position, the resection being carried down to the surgical capsule. HoLEP was performed using an Olympus continuous-flow resectoscope (Olympus, Japan) with a 550 μm end-firing laser fiber and a 100 W holmium-YAG laser source (Coherent Inc., Santa Clara, CA, USA). Power settings for HoLEP were 80-90 W at 2.0 J and 40-45 Hz. During HoLEP the inner mucosal tissue surrounding the bladder neck was kept and both sides of the anterior muscle matrix were cut in the shape of ") (". The prostate was removed by enucleation method.

At the end of the procedure, a urinary catheter was left indwelling and continuous irrigation was commenced to maintain a clear return. Irrigation was discontinued depending on the color of the returning fluid.

Procedural measurements

Digital rectal examination (DRE), laboratory tests, international prostate symptom score (IPSS), maximum urinary flow rate (Qmax), measurement of prostate weight and postvoid urine residue by ultrasound were conducted and compared before and after surgery. The operative time, intraoperative and postoperative blood loss, intraoperative bladder irrigation duration, resected weight, urinary catheter indwelling time and hospitalization duration were also recorded. Patients were followed up at 2 weeks and 3 months after surgery. The incidence of postoperative stress incontinence was also calculated. The patients were also asked to complete Quality of Life (QOL) questionnaire before surgery.

Statistical analysis

All the statistical analyses were conducted using SPSS 19.0 software. The continuous

Table 1. Preoperative demographic and clinical data

	HoLEP Group	TUEVP Group	*t*	*P* value
Age, years	71.27±6.74	71.91±7.75	0.7806	0.250
Prostate weight, g	79.4±19.7	77.2±18.9	0.7598	0.270
Postvoid urine residue, ml	247.5±24.6	194.9±26.5	10.2864	<0.0001
No. of cases with urinary retention	18	15	X^2 = 0.407	0.510
IPSS	24.8±4.7	26.7±5.4	1.8767	0.0635
QOL	5.7±1.0	5.6±0.9	0.5256	0.550
Qmax, ml/s	6.9±3.2	6.6±2.9	0.6412	0.380

Table 2. Intraoperative and postoperative clinical data

	HoLEP Group	TUEVP Group	*t*	*P* value
Operative duration, min	78.0±34.8	102.0±38.4	3.2747	<0.01
Intraoperative blood loss, ml	78.5±43.1	120.9±61.5	3.9922	<0.01
Intraoperative bladder irrigation duration, h	22.4±10.3	30.6±24.1	2.2123	0.030
Postoperative blood loss, ml	31.8±15.7	44.4±24.5	3.0618	<0.01
Resected weight, g	41.3±17.6	30.7±16.4	3.1157	<0.01
Urinary catheter indwelling time, h	44.5±18.7	71.6±24.8	6.1695	<0.01
Hospitalization duration, days	4.3±1.1	6.6±1.7	8.0319	<0.01

data were shown as mean ± standard deviation (SD) and categorical data were presented as percentage (%). The differences on continuous data between two groups were compared by independent t-test and differences before and after surgery were tested by paired t-test, respectively. A two-tailed *P* value less than 0.05 was considered to be statistically significant. Chi-square test, or Fisher's exact test were also used in statistical analysis of clinical data.

Results

Demographic and clinical features

The mean age of the patients in TUVEP and HoLEP Group were 71.27±6.74 and 71.91±7.75 years old, respectively (P = 0.25). The percentage of the cases with urinary retention was 36% (18/50) and 30% (15/50) (P = 0.51). The IPSS and QOL were also evaluated and there were no statistical differences between two groups (P>0.05). The prostate weight evaluated by ultrasound was 79.4±19.7 g in HoLEP Group and 77.2±18.9 in TUVEP Group (P = 0.27), and the postvoid urine residue was 247.5±24.6 ml and 194.9±26.5 ml, respectively (P = 0.40). Qmax was not significantly different in the two groups (6.9±3.2 vs. 6.6±2.9, P = 0.38). The demographic and clinical characteristics were shown in **Table 1**.

TUVEP and HoLEP

The operative duration in TUVEP and HoLEP Group was 78±34.8 min and 102±38.4 min, respectively (P<0.01) (**Table 2**). The intraoperative and postoperative blood less in HoLEP Group was less than those in TUVEP Group (78.5±43.1 ml vs. 120.9±61.5 ml, P<0.01; 1.8±15.7 ml vs. 44.4±24.5 ml, P = 0.04). The resected prostate in HoLEP Group was also less than that in TUVEP Group (41.3±17.6 g vs. 30.7±16.4 g, P<0.01). Significant differences were found on the intraoperative bladder irrigation duration (22.4±10.3 h vs. 30.6±24.1 h, P = 0.03), urinary catheter indwelling time (44.5±18.7 h vs. 71.6±24.8 h, P = 0.04) and hospitalization duration (4.3±1.1 d vs. 6.6±1.7 d, P = 0.033).

Immediate and long-term outcome

Qmax in HoLEP Group increased from 8.6±2.3 mmol/L before operation to 19.4±5.7 mmol/L 3 months after operation, while Qmax in TUEVP Group increased from 9.1±3.2 mmol/L before operation to 18.7±5.4 mmol/L 3 months after operation (**Table 3**). IPSS was decreased after surgery (TUEVP Group from 24.1±4.7 to 4.8±2.3, HoLEP Group from 23.8 ±5.2 to 4.7±2.1). However, no significant differences were observed on Qmax and IPSS between groups before and after surgery

Table 3. The clinical outcomes were evaluated between two groups

	HoLEP Group	TUEVP Group	*t*	*P* value
Qmax, mol/L				
Before operation	8.6±2.3	9.1±3.2	0.8972	0.130
At 3 months	19.4±5.7	18.7±5.4	0.8304	0.220
IPSS				
Before operation	24.1±4.7	23.8±5.2	0.8026	0.270
At 3 months	4.8±2.3	4.7±2.1	0.7270	0.310

Table 4. The incontinence rates were compared between two groups

	HoLEP Group	TUEVP Group	X^2	*P* value
Total urinary incontinence rate, n (%)				
At 2 weeks	3 (6)	8 (16)	4.554	0.030
At 3 months	0 (0)	3 (6)	4.293	0.040*
Stress incontinence rate, n (%)				
At 2 weeks	1 (2)	5 (10)	4.537	0.030*
At 3 months	0 (0)	2 (4)	4.541	0.030*

*Fisher's exact test.

(P>0.05). We then further investigate the incidence of postoperative stress incontinence. The results indicated that the total urinary incontinence rate and postoperative stress incontinence rate was lower in HoLEP Group than those in TUEVP Group 2 weeks (6% vs. 16%, P = 0.030; 2% vs. 10%, P = 0.030) and 3 months after surgery (0% vs. 6%, P = 0.040; 0% vs. 4%, P = 0.030) (**Table 4**).

No electric resection syndrome was observed in both groups. In TUEVP Group, there were 6 patients who had urinary retention after removing the urinary catheter and alleviated by urinary catheter indwelling for another week. In HoLEP Group, no urinary retention occurred after removing the urinary catheter. Five patients in TUEVP Group and 0 patients in HoLEP Group received blood transfusion. Three patients in TUEVP Group underwent a second surgery for the obstruction in bladder neck and 2 patients had urethrostenosis, while no patients had obstruction in bladder neck, and only 1 patient had urethrostenosis and were cured by intermittent urethral dilation.

Discussion

BPH has very high incidence in old men, which could increase their discomfort and impair their routine life [8]. Early and proper treatment could efficiently alleviate the clinical symptoms and help prevent the progression of this disease [9]. So far, HoLEP and TUEVP is comparable in alleviating the symptoms of BPH patients and the complication rate is relatively lower than the traditional TURP [10]. Postoperative incontinence is one of the commonest complications of prostate resection, which could affect the quality of life [11]. The urinary incontinence rate after TURP is around 30-40% and permanent urinary incontinence accounts for 0.5%, the treatment of which remains a clinical challenge. Recent researches have demonstrated that protecting the anterior lobe of prostate during TURP could decrease the risk of urinary incontinence after surgery [12, 13]. However, there is great controversy on this technique. Here in this study, we evaluated and compared the therapeutic efficacy and safety of HoLEP and TUEVP, especially their effect on the occurrence of postoperative incontinence.

Studies on the anatomy of urethral sphincter in men have shown that urethral sphincter as a complex is closely near the anterior lobe of prostate in the shape of half moon above the level of verumontanum, which surrounds the urethra in the shape of Ω below verumontanum [14, 15]. Muscle fibers are absent in the posterior part of urethral sphincter, making it the weakest. Thus, we hypothesize that it is very important to protect the Ω shaped urethral sphincter. HoLEP could keep the anterior muscle matrix, which may help decrease the incidence of incontinence after surgery. Compared with traditional TURP, HoLEP could protect the anterior muscle matrix and keep the external and internal sphincter intact as well as the urethral muscosa surrounding the external sphincter and prostate [7, 16]. BPH usually arises from the transitional zone and the hyperplasia in the lateral and middle lobe of prostate is commonly observed. Considering that the anterior lobe contributes little to the development of BPH, it is not necessary to resect the anterior lobe. Furthermore, its enucleation will increase the risk for the injury of sphincter by direct contact with laser or heat stimulus, resulting in urinary incontinence. This might explain why HoLEP has advantages over

TUEVP in preventing postoperative incontinence.

There were also limitations in this study. First, only 100 patients from one center were enrolled and a multi-center large scale clinical trial may be more reliable. Second, the long-term follow-up was not conducted. This present study could serve as a pilot investigation on the comparison of TUEVP and HoLEP, and we plan to further examine the long-term clinical efficacy of these techniques in treating BPH patients, which could help the clinicians determine the optimal therapeutic strategy.

Taken together, our findings demonstrated that both HoLEP and TUEVP could be an efficient treatment for BPH with comparable therapeutic efficacy, while HoLEP can decrease the incidence for postoperative incontinence by protecting the anterior muscle matrix and urethral mucosa, indicating that HoLEP is associated with higher safety and fasted recovery after surgery. Moreover, HoLEP is recommended for the treatment of patients with symptomatic BPH, especially when medication is ineffective.

Disclosure of conflict of interest

None.

Address correspondence to: Hongshun Ma, Department of Urinary Surgery, Tianjin First Center Hospital, 24 Fukang Road, Nankai District, Tianjin 300192, China. Tel: +86-22-23626850; Fax: +86-22-23626849; E-mail: 15822661308@163.com

References

[1] Jarvis TR, Chughtai B and Kaplan SA. Testosterone and benign prostatic hyperplasia. Asian J Androl 2015; 17: 212-216.

[2] Rassweiler J, Teber D, Kuntz R and Hofmann R. Complications of transurethral resection of the prostate (TURP)--incidence, management, and prevention. Eur Urol 2006; 50: 969-979; discussion 980.

[3] Tan AH and Gilling PJ. Holmium laser prostatectomy. BJU Int 2003; 92: 527-530.

[4] Kim SW. Phytotherapy: emerging therapeutic option in urologic disease. Transl Androl Urol 2012; 1: 181-191.

[5] Winters JC, Appell RA and Rackley RR. Urodynamic findings in postprostatectomy incontinence. Neurourol Urodyn 1998; 17: 493-498.

[6] Kamat NN. Comparison of standard transurethral resection, transurethral vapour resection and holmium laser enucleation of the prostate for managing benign prostatic hyperplasia of >40 g. BJU Int 2006; 98: 918.

[7] Lerner LB and Rajender A. Laser prostate enucleation techniques. Can J Urol 2015; 22 Suppl 1: 53-59.

[8] Djavan B, Eckersberger E, Finkelstein J, Espinosa G, Sadri H, Brandner R, Shah O and Lepor H. Benign prostatic hyperplasia: current clinical practice. Prim Care 2010; 37: 583-597, ix.

[9] Sivarajan G, Borofsky MS, Shah O, Lingeman JE and Lepor H. The role of minimally invasive surgical techniques in the management of large-gland benign prostatic hypertrophy. Rev Urol 2015; 17: 140-149.

[10] Elshal AM, Mekkawy R, Laymon M, El-Assmy A and El-Nahas AR. Towards optimizing prostate tissue retrieval following holmium laser enucleation of the prostate (HoLEP): assessment of two morcellators and review of literature. Can Urol Assoc J 2015; 9: E618-625.

[11] Shah HN, Mahajan AP, Hegde SS and Bansal MB. Peri-operative complications of holmium laser enucleation of the prostate: experience in the first 280 patients, and a review of literature. BJU Int 2007; 100: 94-101.

[12] Klingler HC. New innovative therapies for benign prostatic hyperplasia: any advance? Curr Opin Urol 2003; 13: 11-15.

[13] Elshal AM, Mekkawy R, Laymon M, Barakat TS, Elsaadany MM, El-Assmy A and El-Nahas AR. Holmium laser enucleation of the prostate for treatment for large-sized benign prostate hyperplasia; is it a realistic endourologic alternative in developing country? World J Urol 2015; 34: 399-405.

[14] de Groat WC and Yoshimura N. Anatomy and physiology of the lower urinary tract. Handb Clin Neurol 2015; 130: 61-108.

[15] Keihani S and Kajbafzadeh AM. Concomitant anterior and posterior urethral valves: a comprehensive review of literature. Urology 2015; 86: 151-157.

[16] Barboza LE, Malafaia O, Slongo LE, Meyer F, Nassif PA, Tabushi FI, Wendler E and Beraldi RA. Holmium Laser enucleation of the prostate (HoLEP) versus transurethral resection of the prostate (TURP). Rev Col Bras Cir 2015; 42: 165-170.