

Original Article

Low-power holmium laser enucleation of prostate can improve clinical efficacy on and postoperative quality of life of patients with prostatic hyperplasia

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Abstract: Objective: This study aimed to analyze the effects of low-power holmium laser enucleation of the prostate (HoLEP) on the clinical efficacy and the quality of life (QOL) of patients with prostatic hyperplasia. Methods: One hundred and ten patients with prostatic hyperplasia, who received surgical treatment in our hospital from May 2017 to August 2019, were enrolled as research objects. According to different therapeutic methods, 56 cases in an observation group were treated with low-power transurethral HoLEP, and 54 cases in a control group were treated with transurethral resection of the prostate (TURP). The two groups were compared regarding perioperative indicators, efficacy, scores of the International Prostate Symptom Score (IPSS), pain severity, postoperative QOL scores, serum prostate specific antigen (PSA), and the incidence of complications. Results: Intraoperative blood loss, the preserved time of installing catheter (PTIC), the postoperative time of flushing the bladder, and the total incidence of complications in the observation group were remarkably lower than those in the control group ($P < 0.05$). The efficacy was also remarkably better in the observation group ($P < 0.05$). Before operation, there were no significant differences between both groups in residual urine volume (RUV), scores of the 5-item version of the International Index of Erectile Function (IIEF-5), scores of the Chinese Index of Premature Ejaculation-5 (CIPE-5), IPSS scores, and QOL scores ($P > 0.05$). After operation, scores of IIEF-5, CIPE-5, and QOL were remarkably higher but the IPSS scores and the RUV were remarkably lower in the observation group ($P < 0.05$) than in the control group. In both groups, postoperative PSA was remarkably lower than preoperative PSA ($P < 0.05$), both of which were not significantly different between the two groups ($P > 0.05$). Conclusion: Low-power HoLEP is effective in treating patients with prostatic hyperplasia and can obviously relieve their prostate symptoms, so it is of clinical application.

Keywords: Low-power holmium laser enucleation of the prostate, clinical efficacy, prostatic hyperplasia, quality of life

Introduction

As a common and frequently-occurring disease of the urinary system in middle-aged and elderly men, benign prostatic hyperplasia (BPH) is manifested as frequent micturition and progressive dysuria, which seriously affects the quality of life (QOL) of patients [1, 2]. With the development of medical technology, the average life expectancy of Chinese people has been gradually prolonged, and the incidence of BPH has been also rising year by year [3]. At present, the most effective way to treat prostatic hyperplasia is surgery [4]. Compared with traditional open surgery, transurethral resec-

tion of the prostate (TURP) has the advantages of less trauma and fast postoperative recovery, so it is the golden standard for treating BPH [5, 6]. However, patients undergoing this surgery easily develop intraoperative dilutional hyponatremia (TUR syndrome), postoperative hemorrhage and perforation, and other complications, which have a certain influence on the rehabilitation of the patients. For instance, bladder neck contracture affects the long-term effect of this surgery [7, 8].

As various laser technologies have developed in recent years, electrocision has been gradually replaced with laser surgery. A holmium

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laser that is a solid pulse laser generates blasting energy in water and gouges out tissues, and the generated heat energy has a satisfactory hemostatic effect [9]. High-power holmium laser is commonly used laser surgery, because it cuts fast, causes few complications, and enucleates thoroughly, as well as cuts and enucleates prostates of any size [10]. As reported by previous studies, holmium laser enucleation of the prostate (HoLEP) has obvious advantages in treating BPH. The holmium laser can accurately locate, precisely cut hyperplastic prostate tissues, and fully coagulate the bleeding point to reduce intraoperative blood loss, but its high price limits its use [11, 12]. Low-power (60 W) holmium lasers are mainly applied to intracavitary lithotripsy, and their principle is the same as that of high-power holmium lasers, so they are used to treat BPH clinically [13]. However, at present, there is little research on low-power HoLEP that can improve the clinical efficacy on BPH patients.

In this study, 110 patients, who were confirmed with BPH in our hospital, were treated with low-power HoLEP and TURP, respectively, so as to compare their efficacy and their effects on postoperative QOL.

Materials and methods

Clinical data

One hundred and ten patients with prostatic hyperplasia, who received surgical treatment in Qiandeng people's Hospital from May 2017 to August 2019, were enrolled as research objects. According to different therapeutic methods, 56 cases in the observation group were treated with low-power transurethral HoLEP, and 54 cases in the control group were treated with TURP. Both surgical methods were performed by the same physicians. All patients had a history of progressive dysuria. The patients' average age in the observation group was (70.41±7.62), and that in the control group was (70.89±6.59). This experiment was approved by the Hospital Ethics Committee. All patients were informed of and consented to this study, and they signed an informed consent form. The differences were not significant between both groups in the preoperative indicators such as preoperative prostate volume, maximum urine flow rate (Q_{max}), serum Na⁺, blood Hb, and scores of the International

Prostate Symptom Score (IPSS) [14] (P>0.05). Inclusion criteria: Patients who were confirmed with BPH after a series of examinations in our hospital; patients whose physical conditions were suitable to participate in this study. Exclusion criteria: Those with other diseases of the urinary system besides BPH; those with serious physiological dysfunction of heart, liver, kidney, and other important organs; those with unstable bladder contraction and neurogenic bladder dysfunction; those with mental disorders or who were unable to communicate with and cooperate in treatment; and those with poor compliance.

Surgical methods

Patients in the observation group were treated with HoLEP. After the energy of the holmium laser was set at 60 W (2.0 J, 30 Hz), epidural anesthesia was performed on the patients who were placed in a lithotomy position. The endoscope was inserted through the urethra, and normal saline was used for flushing the bladder. From 5 and 7 o'clock directions of the neck of bladder to the colliculus seminalis, a groove was incised deeply to the surgical capsule, and the middle lobe tissues of the prostate between the two directions were excised from the colliculus seminalis towards the neck of bladder. Then, the left lobe was cut outward and upward from the 5 o'clock direction of the colliculus seminalis at the capsule level, and the whole left lobe was cut outward and downward from the 1 o'clock direction of the neck of bladder. The right lobe at 7-11 o'clock directions was cut by the same method. After the joint tissues of the prostate were excised at the capsule level, the residual gland in the prostatic fossa was trimmed, and hemostasis-related surgery was conducted. After cutting, masses of the prostate tissues were introduced into a pulverizer, and then crushed and sucked out. After the surgery, a urinary catheter was inserted and the bladder was continuously flushed with normal saline. Patients in the control group were treated with a WolfF27 common monopolar resectoscope, with the electrocision power of 180 W and the electrocoagulation power of 80 W. Marks for the electrocoagulation were made at the proximal end and both sides of the colliculus seminalis, and the gland was cut with the shovel-shaped electrode deeply to the surgical

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Table 1. General information

Groups	Observation group (n=56)	Control group (n=54)	t/ χ^2 value	P
Age (Years)	70.41±7.62	70.89±6.59	0.333	0.740
Prostate volume (mL)	67.54±3.17	68.12±4.56	0.742	0.460
Course of disease	2.87±0.85	2.74±0.65	0.845	0.400
PSA (ng/mL)	5.06±0.38	4.97±0.31	1.279	0.204
Qmax (mL/s)	9.17±2.28	8.93±2.42	0.536	0.593
IPSS scores (points)	31.08±6.15	30.87±6.25	0.178	0.859
Serum Na ⁺ /(mmol·L ⁻¹)	138.67±8.34	138.05±10.43	0.328	0.743
Hb/g·L	131.56±10.54	129.67±8.54	0.334	0.334

capsule. After there was no active bleeding, 5% mannitol was used to flush out the tissue fragments in the bladder.

Outcome measures

The clinical efficacy on the patients was compared between both groups. Judgment criteria for the efficacy were as follows: markedly effective: the patients' clinical symptoms (such as frequent micturition, urgent micturition, and dysuria) disappeared; after examinations, there was no residual stone in the bladder and the patients recovered well. Effective: The clinical symptoms had been remarkably relieved; after examinations, there was a small amount of residual stone debris in the bladder, but this did not affect the patients' normal lives. Ineffective: The clinical symptoms had not been relieved, and even aggravated; after examinations, there was a large number of residual stones in the bladder, and this seriously affected the patients' normal lives. The effective rates of treatment in the markedly effective and effective patients were counted. The situation of the patients during the perioperative period was compared between both groups, which consisted of operative time (OT), postoperative hospitalization time (PHT), time of flushing the bladder, and removal time of the urinary catheter. Postoperative complications [urinary incontinence (UI), secondary hemorrhage (SH), urinary tract infection (UTI)] of the patients were compared between both groups. The prognostic quality of sexual life was also compared through the 5-item version of the International Index of Erectile Function (IIEF-5) [15] and the Chinese Index of Premature Ejaculation-5 (CIPE-5) [16]. The IIEF-5 mainly evaluates the status of erectile function, and the CIPE-5 mainly evaluates the ejaculation status. Lower

scores indicate more serious dysfunction [17]. Before and at 3 months after operation, IPSS scores, Qmax, and residual urine volume (RUV) were also compared between both groups. Higher IPSS scores indicate more serious prostate symptoms. On admission and at 6 months after operation, QOL scores were also compared between the two groups. The QOL scale was applied to assessment with a total score

of 100 points. The higher the scores are, the better the QOL is.

Statistical methods

SPSS22.0 statistical software was applied to data analysis. Graphpad software was applied to figure plotting. Measurement data were expressed as ($\bar{x} \pm s$) and compared by a t test. Count data were expressed as rate and compared by a χ^2 test. $P < 0.05$ indicated a statistically significant difference.

Comparison of general information

The differences were not significant between the observation and control groups in terms of age, prostate volume, course of disease, prostate specific antigen (PSA), Qmax, IPSS scores, and other general information ($P > 0.05$). See **Table 1**.

Comparison of perioperative indicators

Compared with those in the control group, OT, weight of excised specimens (WES), and Hb content were remarkably higher in the observation group, while postoperative flushing time (PFT), preserved time of installing catheter (PTIC), and PHT were remarkably lower in this group ($P < 0.05$). See **Table 2**.

Comparison of therapeutic effects

The effective rate of treatment in the observation group was remarkably higher than that in the control group ($P < 0.05$). See **Table 3**.

Comparison of complications

In the observation group, there was 1 case of SH, 1 case of UTI, and 0 case of UI. In the control group, there was 1 case of UI, 3 cases of

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Table 2. Comparison of perioperative indicators

Categories	WES	Hb/gL ⁻¹	OT/min	PFT/d	PTIC/d	PHT/d
Observation group (n=56)	54.87±9.54	117.53±7.9	90.47±14.77	1.06±0.48	1.48±0.43	3.86±0.56
Control group (n=54)	30.46±9.89	95.47±9.26	83.77±14.31	3.64±0.62	3.71±0.42	6.59±0.41
t value	13.180	13.460	2.415	24.460	27.500	29.090
P value	<0.01	<0.01	0.017	<0.01	<0.01	<0.01

Table 3. Therapeutic effects

Categories	Markedly effective	Effective	Ineffective	Effective rate
Observation group (n=56)	32 (57.14)	15 (26.79)	9 (16.07)	47 (83.93)
Control group (n=54)	22 (40.74)	14 (25.93)	18 (33.33)	36 (66.67)
t value				4.423
P value				0.036

Table 4. Comparison of complications

	UI	SH	UTI	Total incidence
Observation group (n=56)	0 (0)	1 (1.79)	1 (1.79)	2 (3.57)
Control group (n=54)	1 (1.85)	3 (5.56)	4 (7.41)	8 (14.81)
t value				4.205
P value				0.040

Comparison of IIEF-5 and CIPE-5 scores before and after operation

Preoperative IIEF-5 and CIPE-5 scores were not significantly different between both groups ($P>0.05$). At 6 months after operation, the two scores in both groups were remarkably improved, and those were remarkably higher in the observation group ($P<0.05$). This reveals that the lower urinary tract obstruction in both groups is obviously relieved and the patients' erectile function is recovered after treatment. See **Figure 1**.

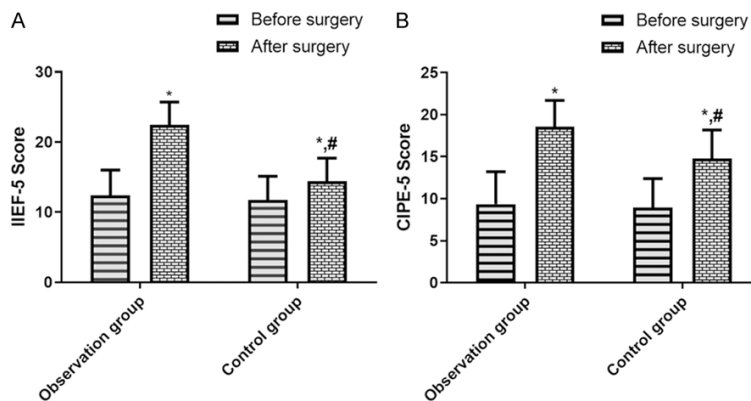


Figure 1. Comparison of IIEF-5 and CIPE-5 scores before and after operation. The comparison of IIEF-5 scores before and after operation. A. Preoperative IIEF-5 scores were not significantly different between both groups ($P>0.05$), but postoperative IIEF-5 scores were remarkably better in the observation group ($P<0.05$). The comparison of CIPE-5 scores before and after operation. B. Preoperative CIPE-5 scores were not significantly different between both groups ($P>0.05$), but postoperative CIPE-5 scores were remarkably better in the observation group ($P<0.05$). Note: *indicates a significant difference compared with before treatment ($P<0.05$). #indicates a significant difference compared with the observation group after treatment ($P<0.05$).

Comparison of IPSS scores, Qmax, and RUV

Before and at 6 months after operation, there were no significant differences in IPSS scores, Qmax, and RUV between both groups ($P>0.05$). In both groups, these postoperative indicators were remarkably better than preoperative ones; postoperative IPSS scores and RUV were

SH, and 4 cases of UTI. The total incidence of complications in the observation group (3.57%) was remarkably lower than that in the control group (14.81%) ($P<0.05$). See **Table 4**.

remarkably lower in the observation group ($P<0.05$). Postoperative Qmax was not significantly different between both groups ($P>0.05$). See **Table 5**.

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Table 5. Comparison of IPSS scores, Qmax, and RUV before and at 6 months after operation ($\bar{x} \pm s$)

Groups	IPSS scores (points)		Qmax (mL/s)		RUV (mL)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n=56)	31.08±6.15	4.26±1.49*	9.17±2.28	21.51±3.27*	135.32±51.41	15.26±3.65*
Control group (n=54)	30.87±6.25	6.28±1.47*	8.93±2.42	22.38±3.24*	143.47±51.75	14.35±3.12*
t value	0.1776	10.700	0.536	0.140	0.829	2.945
P value	0.859	<0.001	0.593	0.164	0.409	0.004

Note: *indicates a significant difference compared with before treatment ($P<0.05$).

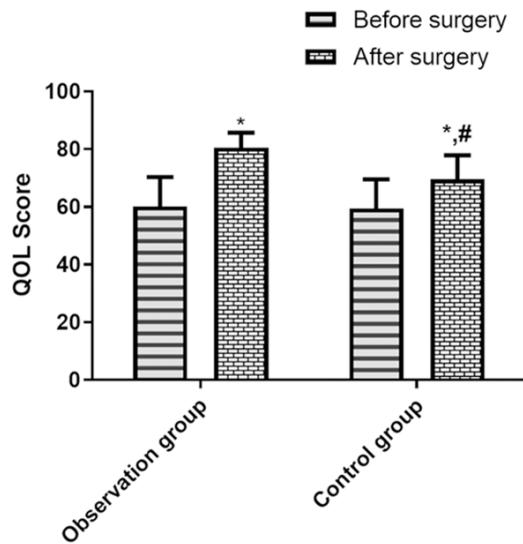


Figure 2. Comparison of QOL scores before and after operation. Preoperative QOL scores were not significantly different between both groups ($P>0.05$). In both groups, postoperative scores were remarkably higher than preoperative ones ($P<0.05$), and the postoperative scores were remarkably higher in the observation group ($P<0.05$). Note: *indicates a significant difference compared with before treatment ($P<0.05$). #indicates a significant difference compared with the observation group after treatment ($P<0.05$).

Comparison of QOL scores before and after operation

Preoperative QOL scores were not significantly different between both groups ($P>0.05$). In both groups, the postoperative scores were remarkably higher than preoperative ones, and the postoperative scores were remarkably higher in the observation group ($P<0.05$). See **Figure 2**.

Comparison of PSA before and after operation

In both groups, postoperative PSA was remarkably lower than preoperative PSA ($P<0.05$),

both of which were not significantly different between the two groups ($P>0.05$). See **Table 6**.

Discussion

Prostate is an important organ in the reproductive system of males. BPH is not a malignant disease, but hypertrophic prostate tissues compress the urethra and the bladder outlet, and further result in frequent micturition, urgent micturition, dysuria, and other symptoms in patients. Therefore, the untimely and improper treatment of BPH induces bladder calculi, renal function damage, and urinary retention, which seriously reduce the patients' QOL [18, 19]. Currently, TURP is the clinically recognized gold standard for treating BPH. However, with the rapid development of minimally invasive technologies in recent years, its surgical defects have been gradually exposed, such as the large amount of bleeding, the great damage to patients, and many postoperative complications. Additionally, some patients undergoing TURP suffer from SH, UTI, and urinary extravasation, which seriously lower their QOL [20]. Therefore, seeking safe and effective surgical methods with less trauma has become a crucial concern in clinical practice [21].

Low-power HoLEP belongs to minimally invasive surgery, and holmium lasers belong to solid pulse lasers. Compared with electrocision, HoLEP mainly uses blasting energy to remove hyperplastic tissues, and the generated heat energy has a hemostatic effect. Low-power holmium lasers have higher safety and less complications, and they can enucleate the hyperplastic tissues more thoroughly [13, 22]. In this study, OT, WES, and Hb content were remarkably higher in the observation group, while PFT, PTIC, and PHT were remarkably lower in this group. This suggests that low-power HoLEP has relatively long OT, but the

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Table 6. Comparison of PSA before and after operation (ng/mL)

Categories	Before operation	After operation
Observation group (n=56)	5.06±0.38	2.69±0.44*
Control group (n=54)	4.97±0.31	2.78±0.51*
t value	1.279	0.992
P value	0.204	0.323

Note: *indicates a significant difference compared with before treatment (P<0.05).

patients undergoing this surgery recover faster and suffer from less intraoperative damage. Patients in the observation group had less intraoperative blood loss, shorter PFT, PTIC, and PHT, and more excised hyperplastic tissues, which indicates that the excision of low-power HoLEP is more thorough. The effective rate of treatment was remarkably higher in the observation group, but the total incidence of complications was remarkably lower in this group. Low-power HoLEP separates the capsule and the gland to stop bleeding, which reduces tissue tension and is more beneficial for hemostasis. During this surgery, the enucleation of the gland is smooth, and the enucleation amount is large, with more thorough excision. In addition, the holmium laser beam is small, which is conducive to positioning accurately and reducing damage to tissues. The setting of lower power can reduce the damage to other healthy tissues at the time of cutting tissues, so low-power HoLEP has higher safety and fewer complications. Minagawa and other researchers have also pointed out the safety and effectiveness of this surgery [23]. These findings suggest that low-power HoLEP has relatively better efficacy on treating prostatic hyperplasia. Sexual dysfunction is related to the lower urinary tract obstruction of BPH patients, and the two are positively correlated [24, 25]. The postoperative QOL scores were remarkably higher in the observation group (P<0.05), while the postoperative IPSS scores were lower in this group (P<0.05). According to Elshal et al., low-power HoLEP can improve patients' IPSS scores and Qmax [26], which is similar to our findings. This demonstrates that this surgery can relieve the prostate symptoms and improve the QOL of patients with prostatic hyperplasia.

This retrospective study has confirmed the clinical efficacy of low-power HoLEP on patients with prostatic hyperplasia and its effects on

their QOL. However, the impact of this surgery on the prognosis of the patients was not analyzed, so it is hoped that this shortcoming can be made up for in future research.

In summary, low-power HoLEP is effective in treating patients with prostatic hyperplasia and can obviously relieve their prostate symptoms, so it is worthy of clinical application.

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Disclosure of conflict of interest

None.

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