

The Advantages of DiLEP Operation in the Treatment of BPH Patients and the Observation of Postoperative Urinary Control Effect

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Objective: To evaluate the efficacy of Semiconductor laser trefoil enucleation of the prostate (DiLEP) in the treatment of patients with benign prostatic hyperplasia (BPH). **Methods:** 120 BPH patients scheduled for prostate surgery in our hospital were randomly divided into two groups: study group (DiLEP treatment) and control group (transurethral plasma bipolar resection of the prostate treatment), with 60 cases in each one. Surgical process indicators, postoperative rehabilitation indicators, Qmax before and after surgery, post-void residual volume (PVR), international prostate symptom score (IPSS), hemoglobin (Hb), urinary control and surgical complications for two groups were compared. **Results:** The operation time, intraoperative blood loss, bladder irrigation time, urinary catheter indwelling time and hospital stay in the study group were lower than those in the control group ($P < 0.05$). The weight of resected tissue in the study group was higher than that in the control group ($P < 0.05$). The difference in Qmax, PVR, IPSS scores and Hb between the study group and the control group before operation and one month after operation had no statistical significance ($P > 0.05$). The Qmax and Hb scores in the study group were higher than those in the control group ($P < 0.05$), while the PVR and IPSS scores were lower than those in the control group ($P < 0.05$); five days and two weeks after operation, the urinary control rates in the study group were all higher than that in the control group ($P < 0.05$); one month after operation, the difference in the urinary control rates between the two groups had no statistical significance ($P > 0.05$); the difference in the surgical complication rate between the study group and the control group had no statistical significance ($P > 0.05$). **Conclusion:** DiLEP is beneficial for early recovery of urodynamics in patients with BPH, with less trauma and faster recovery of urinary control after surgery.

Key words: Semiconductor laser trefoil enucleation of the prostate; Benign prostatic hyperplasia; Plasma bipolar resection of the prostate; Urinary control

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Benign prostatic hyperplasia (BPH) is a disease caused by prostate non-cancerous hyperplasia and it is one of the common diseases in middle-aged and elderly men. With the aging of population in the world, the incidence of BPH is increasing¹. Benign prostatic hyperplasia shows only frequent urination and excessive nocturia in the early stage, but with the lengthening of the disease stage, after benign prostatic hyperplasia complicated with infection, smooth muscle contraction causes the increase of the tension of the urethra, and the symptoms of dysuria

may appear, which is progressively aggravated, and severely reduces the quality of life of the patient².

Pharmacotherapy is the first choice for BPH, but some patients with severe disease need surgical treatment. The application of plasma bipolar resection of the prostate (PKRP) has achieved certain clinical efficacy. Recent studies^{3,4} have found that Semiconductor laser trefoil enucleation of the prostate (DiLEP), as a new technique to treat BPH, has many advantages, such as good hemostatic effect, fast vaporization cutting speed, and low

penetrability. Therefore, the purpose of this study is to investigate the efficacy of DiLEP and PKRP in the treatment of patients with BPH, and to provide reference for the clinical BPH treatment. Below is the report.

INFORMATION AND METHODS

Information

A total of 120 patients with BPH scheduled for prostate surgery in our hospital were randomly divided into study group (treated with DiLEP) and control group (treated with transurethral plasma bipolar resection of prostate), with 60 cases in each group. The subjects were selected from January 2017 to January 2021. Inclusion criteria: (1) Diagnosis criteria of BPH patients refer to diagnostic criteria in Chinese Society of Urology (CUA) guidelines⁵; (2) Patient's IPSS score > 7 points, the maximum urine flow rate (Q_{max}) <15.0 mL/s; (3) Digital rectal examination and ultrasound examination results revealed enlarged prostate volume, malignant tumor excluded; (4) Conservative treatment was ineffective; (5) This study complied with the requirements of the medical ethics committee, informed consent was signed with the patient prior to the procedure. Exclusion criteria: (1) Malignant tumor of prostate and urinary system; (2) Urinary tract stenosis caused by previous urinary surgery; (3) Patients with scar constitution; (4) Infectious diseases accompanied by other systems; (5) Cardiopulmonary insufficiency; (6) Contraindications to neurogenic bladder and other surgeries.

In the study group, the age was 55-83 years, with an average one of 69.0 ± 7.0 years; the prostate volume was estimated to be 83.9 ± 18.1 mL by ultrasound examination; the concomitant diseases: included hypertension in 21 patients and diabetes mellitus in 11 patients; the preoperative urine volume was 103.0 ± 15.0 mL; and the serum prostate specific antigen (PSA) of the patients before the operation was 2.76 ± 0.84 μg/ L. In the control group, the age was 57-82 years, with an average one of 67.5 ± 6.6 years; the prostate volume estimated to be 85.4 ± 19.3 mL by ultrasound examination; the concomitant diseases: included hypertension in 24 patients and diabetes mellitus in 9 patients; the preoperative urine volume was 101.2 ± 16.4 mL; the

PSA before operation was 2.82 ± 0.77 μg/ L. The difference in baseline data between the two groups had no statistical significance ($P > 0.05$).

Methods

Treatments

Patients' complication disease were improved before the operation. After the function is stable and tolerance, the operation was performed. All patients were given general anesthesia.

The study group was given DiLEP treatment: the semiconductor, model ML-D01, which was provided by Dongsoft Xikang Company, has a coagulation power of 30W and a vaporization power of 150W; continuously rinsed by the normal saline and placed the laser endoscope through the urethra to observe the bilateral ureter opening, bladder, spermatic caruncle, prostate middle lobe and lateral lobe, external urethral sphincter, etc.; after the deconstruction mark was clear, the fiber was placed; two longitudinal grooves were cut from the bladder neck to the spermatic caruncle at 5 and 7 o'clock direction, and the proximal spermatic caruncle was transversely connected. Gently push the middle lobe by using the sheath of the cystoscope, then make a depth mark when seeing the white tunica; sheath reverse push combined with vaporization cutting, gradually remove the anterior lobe of the prostate toward the bladder neck, with a little tissue retained and connected to the bladder neck; After enucleation of the right lobe of the prostate, vaporization cutting in the direction of 12 o'clock, longitudinally cut the groove to the position 1cm to the spermatic caruncle; at the proximal end of the spermatic caruncle, divide the urethral mucosa and prostate tissue, connect with this groove, push the right lobe in the direction of 7 o'clock, explore the gap between the right lobe and white tunica, enucleate the right lobe and leave a small amount of tissue retained in the bladder neck; the left lobe was enucleated with the same method as the right lobe; after enucleation, the laser machine was withdrawn gradually, and plasma resectoscope was placed to cut the free prostate tissue to correct the wound and apex of the prostate. After hemostasis was successful, the tissue pathology was washed out.

The control group was given plasma bipolar resection of the prostate treatment: the homemade

plasma kinetic resectoscope (manufactured by Shanghai Meite Co., Ltd.) was used. The scope of resection was from the verumontanum to the bladder neck. The elevated bladder neck was resected first, and then the middle lobe of prostate was resected to the capsule, and finally to the spermary. The same method was used to resect the anterior lobe of the prostate and the left and right lobes, and stop bleeding at the same time during the resection. The suction & irrigation systems was used to remove the resected tissue; after the urethra patency was confirmed by the resectoscope and external sphincter contracted well and no active hemostasis was achieved, the scope was retracted; after the normal urination was confirmed by the urination test, the three-lumen urinary catheter was placed and then finished the surgery¹⁹.

Observation indicators

The operation time, intraoperative blood loss, resected tissue weight, bladder irrigation time, urinary catheter indwelling time, hospital stay, post- and pre-operative Qmax, post-void residual volume

(PVR), International Prostate Symptom Score (IPSS), hemoglobin (Hb), urinary control and surgical complications were compared between the two groups.

Statistical processing

Statistical analysis was performed with SPSS 21.0 software. Qmax, PVR, IPSS score and Hb of the two groups were expressed by $\bar{x} \pm s$, and t test was used for comparison between the two groups; urinary control rates were compared by using χ^2 test between the two groups; $P < 0.05$ was considered statistically significant.

RESULTS

Comparison of surgical conditions between the two groups of patients

The operation time, intraoperative blood loss, bladder flushing time, urinary catheter retention time and hospital stay in the study group were lower than those in the control group ($P < 0.05$); the weight of resected tissues in study group was higher than that in control group ($P < 0.05$); see Table 1.

Table 1.
Comparison of the operation conditions between the two groups of patients ($\bar{x} \pm s$)

Group	n	Operation time (min)	Intraoperative blood loss (mL)	Weight of resected tissue (g)	Bladder irrigation time (h)	Urinary catheter indwelling time (d)	Hospital stay (d)
Study group	60	46.9±8.3	48.3±11.0	48.9±9.3	35.9±8.5	2.8±0.7	6.4±1.5
Control group	60	58.3±9.6	76.4±16.8	44.2±7.6	57.1±13.0	4.2±1.3	7.2±1.8
t value		-6.958	-10.839	3.031	-10.573	-7.345	-2.645
P value		0.000	0.000	0.003	0.000	0.000	0.009

Comparison of symptoms, urodynamic parameters and Hb values between the two groups before and after operation

Before operation and one month after operation, there was no statistical significance in Qmax, PVR, IPSS score and Hb measured value between study

group and control group ($P > 0.05$); on postoperative day 5, the Qmax and Hb measured value in study group were higher than that in control group ($P < 0.05$), and the scores of PVR and IPSS were lower than that in control group ($P < 0.05$); see Table 2.

Table 2.
Comparison of symptoms, urodynamic parameters and Hb values before and after operation between the two groups ($\bar{x} \pm s$)

Group	n	Qmax (mL/s)			PVR (mL)		
		Before operation	5 days after operation	1 month after operation	Before operation	5 days after operation	1 month after operation
Study group	60	7.84±2.21	13.71±3.20	18.94±3.20	103.0±15.0	34.8±11.0	10.2±4.1
Control group	60	7.55±2.49	11.90±3.14	18.23±2.96	101.2±16.4	41.0±13.6	11.5±5.5
t value		0.675	3.127	1.262	0.627	-2.746	-1.468
P value		0.501	0.002	0.210	0.532	0.007	0.145
Group	n	IPSS (points)			Hb (g/L)		
		Before operation	5 days after operation	1 month after operation	Before operation	5 days after operation	1 month after operation
Study group	60	25.81±4.94	5.61±1.85	5.61±1.85	132.9±7.6	130.0±5.8	133.0±8.0
Control group	60	27.20±5.50	7.30±2.26	5.90±2.04	131.5±8.0	126.0±7.5	131.8±7.4
t value		-1.456	-4.482	-0.816	0.983	3.268	0.853

P value	0.148	0.000	0.416	0.328	0.001	0.395
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Comparison of urinary control rate between the two groups of patients

On postoperative day 5 and 2 weeks, the urinary control rate in study group was higher than that in

control group ($P < 0.05$). One month after operation, there was no statistical significance in the urinary control rate between the two groups ($P > 0.05$). See Table 3.

Table 3. Comparison of urinary control rate between the two groups [n (%)]				
Group	n	5 days after operation	2 weeks after operation	1 month after operation
Study group	60	20(33.33)	39(65.00)	56(93.33)
Control group	60	10(16.67)	28(46.67)	54(90.00)
X ² value		4.444	4.089	0.436
P value		0.035	0.043	0.509

Comparison of complication rate between the two groups of patients

There was no statistical significance in surgical

complication rate between study group and control group ($P > 0.05$). See Table 4.

Table 4. Comparison of complication rate between the two groups					
Group	n	Pollakiuria	Dysuria	Postoperative gross hematuria	Complication rate (%)
Study group	60	2	3	1	6(10.00)
Control group	60	4	5	3	12(20.00)
X ² value					2.353
P value					0.125

DISCUSSION

BPH is one of the most important causes of dysuria in middle-aged and elderly men and has a serious impact on patients' quality of life and physical and mental health. Due to the development of the disease, some patients require surgery to effectively relieve their clinical symptoms ^{6,7}. PKRP is an important clinical treatment for BPH, but there are complications such as high intraoperative blood loss, postoperative urethral stricture and urinary incontinence. Recent studies ⁸⁻¹⁰ suggest that laser treatment is effective in treating BPH, with strong hemostatic efficacy and a low incidence of both bleeding and complications. The diode laser used in this study was a medical laser that was previously primarily used in the treatment of aesthetic good superficial lesions, with a wavelength of 1470 nm resulting in better hemoglobin and water absorption, greater selectivity, and better coagulation hemostasis and vaporization dissection ¹¹⁻¹³.

The results of this study showed that the operation time, intraoperative blood loss, bladder irrigation time, urinary catheter indwelling time and hospital stay in the study group were lower than

those in the control group, while the weight of resected tissue was higher than that in the control group. These results suggest that treatment of BPH with DiLEP is more effective than PKRP in shortening operative time and reducing operative blood loss, which is beneficial to the recovery of patients. Both water and hemoglobin can absorb 1470 nm diode laser energy, have better hemostatic effect and cutting efficiency, which is beneficial to shorten operation time, reduce operation blood loss and increase the weight of resected tissue; in addition, DiLEP laser direct-beam fiber has faster vaporization cutting speed and less operation blood loss, and the low hemoglobin level in the blood-free environment can further reduce the absorption of intraoperative capacity, which helps to improve operation efficiency ¹⁴⁻¹⁶.

Comparison of clinical symptoms, urodynamic parameters and Hb values showed that Qmax and Hb in the study group were higher than those in the control group on postoperative day, while PVR and IPSS scores were lower than those in the control group, but there was no significant difference in the above indexes before operation and one month after

operation. This result suggests that treatment with DiLEP for BPH results in faster improvement in clinical symptoms and urodynamic parameters compared with PKRP in the immediate postoperative period. DiLEP uses laser to cut into the search capsule before the lithotomy position, where there are few prostatic hyperplasia tissues, so it is easy to quickly and accurately expose the surgical capsule; it passes through the surgical capsule behind the middle lobe tunnel, where the prostate tissue is relatively weak, so it is easy to find the capsule, then it uses the laser cutting and the retrograde peeling of the endoscopic sheath to enucleate the left lobe, and finally enucleate the right lobe and crush the prostate tissue by the tissue morcellator in the bladder. The incision depth of the whole surgical procedure is easy to grasp, and it is not easy to cause the mistreatment and perforation of the bladder neck. In addition, the blood vessel separated by retrograde peeling and enucleation is divided and sealed from the root of the surgical capsule, namely the perforating vessel, and the bleeding risk is low, which is beneficial to reduce the Hb level.

Comparison of urinary control rate between the two groups showed that on postoperative day 5 and 2 weeks, the urinary control rate of study group was higher than that of control group, and one month after the operation, there was no significant difference in urinary control rate between the two groups. Relevant studies^{17,18} demonstrated that the external urethral sphincter status and urethral length were closely related to the effects of urinary control; the 1470 nm diode laser energy emitted by the DiLEP procedure in this study was concentrated, with a penetration of only 1 mm, resulting in less damage to the surrounding tissue of the prostate, thus reducing the damage to the urethral tissue and sphincter, helping to reduce the symptoms of urinary tract irritation and thus improving the rate of the patient's urinary control; in addition, the DiLEP procedure was performed with normal saline. In the process of operation, the absorption is less, then the internal environment and stimulation of the body are less, which is beneficial to the improvement of the rate of urine control.

Further comparison of complication rates found that although the surgical complication rate was 6%

in the study group and 12% in the control group, the difference was not statistically significant, which may be related to the small sample size of this study and needs to be confirmed by further large sample size study. The 1470nm wavelength used by DiLEP was clinically confirmed has the best absorption rate, which can effectively control the absorption of water and hemoglobin with excellent hemostatic effect and cutting efficiency, thus ensuring a clear operative field, which is beneficial to the prostate capsule respectively, reducing unnecessary damage to prostate tissue and improving the surgical safety. In conclusion, treatment of BPH patients with DiLEP is beneficial to early recovery of urodynamics, less invasive surgery, and earlier postoperative recovery of urinary control. DiLEP is worthy of clinical reference.

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