

Study on the effect of completely preserving the ejaculatory duct during prostatectomy on reducing postoperative retrograde ejaculation in benign prostatic hyperplasia patients

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Abstract

Introduction: Preserving the sexual function of benign prostatic hyperplasia (BPH) patients and reducing the incidence of postoperative retrograde ejaculation are critical for BPH patients with sexual needs.

Aim: To explore the effect of complete preservation of the seminal tract during transurethral prostatectomy (TURP) on reducing retrograde ejaculation in BPH patients.

Material and methods: BPH patients meeting the inclusion criteria were randomly divided into the Control group (traditional TURP) and the Experimental group (complete reserved ejaculatory duct) in a ratio of 1 : 1. Finally, data of 64 BPH patients – 34 in the Control group and 30 in the Experimental group – were analyzed. We measured the preoperative and postoperative maximum urinary flow rate (Qmax), International Prostate Symptom Score (IPSS), Quality of Life (QOL) score, semen volume, and ejaculation function.

Results: Compared with pre-operation values, patients in the two groups exhibited increased Qmax and decreased IPSS and QOL scores after the operation. However, there was no significant difference in Qmax, IPSS, or QOL between the Control and Experimental groups after the operation. The two groups of patients had a significant reduction in postoperative ejaculation. Compared with the Control group, the semen volume of patients was higher, and the incidence of retrograde ejaculation was lower in the Experimental group.

Conclusions: Prostatectomy with complete preservation of the seminal tract is not different from conventional electrosurgical resection in improving urination symptoms, while the incidence of retrograde ejaculation is significantly lower.

Key words: benign prostatic hyperplasia, transurethral prostatectomy, ejaculatory duct, retrograde ejaculation.

Introduction

Benign prostatic hyperplasia (BPH) is a common disease in men over 50. The study by Litman *et al.* reported that the prevalence of lower urinary tract symptoms (LUTS) in men under 70 has increased to 80% [1]. A previous study conducted a questionnaire survey on the sexual life of BPH patients and found that about 75% of BPH patients aged 40–65 years

old still have sexual activity at least once a week [2]. Transurethral prostatectomy (TURP) is still the standard gold therapy for the treatment of BPH [3]. In the surgical treatment of BPH, many surgeons pay more attention to the postoperative urination function of the patient and remove the glands as completely as possible, leading to an increase in the incidence of retrograde ejaculation after surgery. Preserving the

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sexual function of BHP patients and reducing the incidence of postoperative retrograde ejaculation are critical for BPH patients with sexual needs.

Aim

We used TURP and modified resection (complete preservation of the seminal tract) to explore the effect of complete preservation of the seminal tract during prostatectomy on reducing retrograde ejaculation in BPH patients.

Material and methods

Patient specimens

This study was conducted following the Declaration of Helsinki. The institutional Review Board of Hefei Second People's Hospital approved the study. Informed consent was obtained by all subjects when they were enrolled. The inclusion criteria were: males 55–70 years old with normal ejaculation function, signed the approved informed consent, diagnosis of BPH based on clinical history, digital rectal examination, urinalysis, transrectal ultrasound, and prostate-specific anti-

gen and TURP indicated. The exclusion criteria were: neurogenic bladder, history of prostate surgery, combined with bladder neck contracture, urethral stricture and other diseases that may cause bladder outlet obstruction, and postoperative pathological examination confirmed prostate cancer. The same surgeon performed all operations. BPH patients meeting the inclusion criteria were randomly divided into the Control group (traditional TURP) and the Experimental group (complete reserved ejaculatory duct) in a ratio of 1 : 1. Finally, a total of 64 BPH patients were included in the analysis, including 34 cases in the Control group and 30 cases in the Experimental group. Figure 1 summarizes the flow diagram.

Surgical methods

Control group: (1) After the bladder was filled, the verumontanum, hyperplastic prostate and bladder were observed. The stones were broken using holmium laser, ultrasound, or pneumatic ballistics for patients with bladder stones. (2) A groove was cut at 6 and 12 loci of the bladder neck, reaching the depth of the prostate surgical capsule. The left, right and

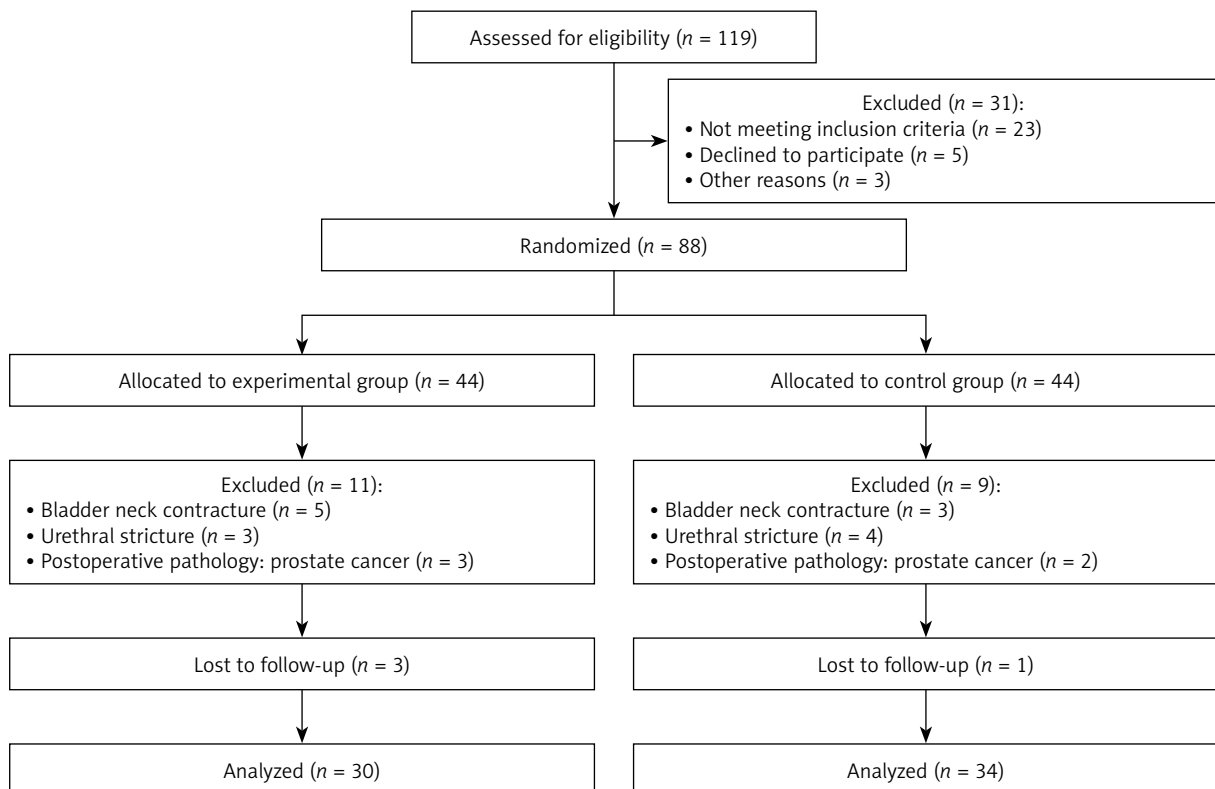


Figure 1. Study enrolment and randomization (CONSORT flow diagram)

middle lobes of the prostate were removed between 6 and 12 loci of the bladder neck. (3) After most of the glands had been removed, the remaining glands were trimmed and removed to avoid damaging the urethral sphincter. The surgical wound was treated with electrocoagulation to stop bleeding.

Experimental group: (1) After the bladder was filled, the verumontanum, hyperplastic prostate and bladder were observed. The stones were broken using holmium laser, ultrasound, or pneumatic ballistics for patients with bladder stones. (2) A groove was cut at 5 and 7 loci of the bladder neck to the verumontanum, reaching the depth of the prostate surgical capsule. Another groove was cut at 12 loci of the bladder neck. The left and right lobes of the prostate were removed between 12 and 5 or 7 loci. (3) After most of the glands had been removed, the wounds at the 5 and 7 loci were repaired at an oblique angle of 45°, so that the “dam” at 5 and 7 loci could be higher than the wound. (4) After most of the glands had been removed, the remaining glands were trimmed and removed to avoid damaging the urethral sphincter. The surgical wound was treated with electrocoagulation to stop bleeding.

Observational index

The maximum urinary flow rate (Qmax), the International Prostate Symptom Score (IPSS) and the Quality of Life (QOL) score were measured before the operation. The semen volume before the operation was measured, and the mid-section urine was collected immediately after ejaculation. Three months after the operation, the Qmax, IPSS, QOL score, and semen volume were measured. The midstream urine was collected immediately after ejaculation.

Retrograde ejaculation judgment

Retrograde ejaculation refers to the patient's sexual intercourse when there is ejaculation action and pleasure, but minimal to no seminal fluid is expelled antegrade through the urethral meatus, and instead, passes backward into the bladder. Urinate immediately after the sperm was taken, and the midstream urine was collected for microscopic examination. Sperm and/or fructose were detected in centrifugal urine as retrograde ejaculation. No sperm and/or fructose were detected in centrifugal urine as antegrade ejaculation.

Statistical analysis

Data were analyzed using SPSS 22.0 statistical software (IBM, Armonk, NY, USA). Quantitative data were presented as mean \pm standard deviation. The two-tailed Student's *t*-test was used to compare the two groups. The difference was considered statistically significant at $p < 0.05$. The count data were presented as a percentage and analyzed using the χ^2 test at a significance level of $\alpha = 0.05$.

Results

Comparison of baseline characteristics and perioperative variables

Prostatectomy with complete preservation of the seminal tract was technically successful in all 64 patients. The immediate postoperative outcomes were recorded.

Control group: The prostate volume of patients (aged between 59 and 70, 65.85 \pm 4.36) was 46 to 91 ml (53.42 \pm 9.25), and 4 (14.29%) patients had bladder stones. Experimental group: The prostate volume of patients (aged between 57 and 70, 64.62 \pm 5.46) was 44 to 96 ml (58.64 \pm 8.60), and 3 (10.71%) patients had bladder stones. There was no statistically significant difference in general information between the Control and Experimental groups ($p > 0.05$). No major life-threatening complication was observed during the hospital stay (Table I).

Comparison of clinical data

Compared with the preoperative clinical data of the Control group and Experimental group, the Qmax was significantly increased, and the IPSS and QOL scores were significantly decreased in the two groups after the operation ($p < 0.05$). After the operation, there was no significant difference in Qmax, IPSS, and QOL between the Control and Experimental groups ($p > 0.05$) (Table II).

Comparison of sexual function

There was no significant difference in preoperative IIEF-5 score between the two groups, and no significant difference in postoperative IIEF-5 score between the two groups. Postoperative IIEF scores showed a slight improvement compared to preoperative scores, although the difference was insignificant ($p > 0.05$). Compared with the Control and Experimental groups before the operation, the two

Table I. Baseline characteristics and perioperative variables for study participants

Variable	Control group	Experimental group
Number of cases (n)	34	30
Age [years]	65.85 ±4.36	53.42 ±9.25
Prostate volume [ml]	53.42 ±9.25	58.64 ±8.60
Perioperative time [min]	78.54 ±20.32	69.96 ±18.60
Blood transfusion (n)	0 (0%)	0 (0%)
TURS (n)	0 (0%)	0 (0%)
Duration of catheterization [days]	4.07 ±0.98	3.93 ±0.94
Hospital stay [days]	5.82 ±0.94	6.04 ±0.92

SD – standard deviation, EBL – estimated blood loss, TURS – transurethral resection syndrome.

Table II. Comparison of clinical data

Variable	Control group		Experimental group	
	Pre-operation	Post-operation	Pre-operation	Post-operation
Qmax [ml/s]	(7.1 ±1.7) [#]	(21.9 ±1.9)	(7.3 ±1.5) [#]	(21.1 ±1.5) ^{ns}
IPSS (score)	(20.7 ±5.3) [#]	(6.3 ±1.7)	(21.0 ±5.6) [#]	(6.7 ±1.8) ^{ns}
QOL (score)	(4.4 ±1.0) [#]	(1.6 ±0.8)	(4.7 ±1.3) [#]	(1.4 ±0.7) ^{ns}

[#]P < 0.05 vs. Post-operation; ^{ns}p > 0.05 vs. Post-operation in the Control group. Qmax – maximum urinary flow rate, QOL – quality of life, IPSS – International Prostate Symptom Score.

groups of patients had significantly reduced post-operative ejaculation ($p < 0.05$). After surgery, the semen volume of patients in the Experimental group was significantly higher compared with the patients in the Control group ($p < 0.05$). The incidence of retrograde ejaculation in the Experimental group (10%) was significantly lower than in the Control group ($p < 0.05$) (Table III).

Discussion

BPH is one of the most common diseases among middle-aged and elderly men, and its incidence increases with age. Clinically, about 20% of BPH patients require surgical treatment [4]. TURP is still the gold standard for surgical treatment. A previous study found that retrograde ejaculation after surgery

is as high as 70%, indicating that TURP has a greater impact on postoperative ejaculation function [5].

We found that the Qmax of the Experimental group and Control group significantly increased after surgery, and the IPSS and QOL scores notably decreased. The urination symptoms of the two groups were significantly improved after surgery. This shows that although we have preserved the prostate tissue at 5 to 7 loci, it does not affect the smooth urination of the patients. A survey conducted by Nadeem *et al.* [6] confirmed that transurethral incision of the prostate (TUIP) and TURP have the same effect in improving urination, suggesting that the residual prostate tissue does not affect urination function and the patient's quality of life. Bladder neck mobility is closely associated with urinary incontinence [7]. Protecting the bladder neck can effectively reduce urinary in-

Table III. Comparison of semen volume

Variable	Control group		Experimental group		t/ χ^2 (Post-operation)
	Pre-operation	Post-operation	Pre-operation	Post-operation	
IIEF-5	(13.57 ±2.81) ^{ns}	(14.64 ±3.41) ^{no}	(13.85 ±3.04) ^{ns}	14.93 ±3.16	0.325
Semen volume [ml]	(3.5 ±0.4) [#]	(1.8 ±1.1)	(3.7 ±0.6) [#]	(2.5 ±0.8) [*]	2.680
Retrograde ejaculation	21 (62%)		3 (10%)		18.221

[#]P < 0.05 vs. Post-operation; ^{*}p < 0.05 vs. Post-operation in the Control group; ^{no}p > 0.05 vs. Post-operation in the Control group; ^{ns}p > 0.05 vs. Post-operation.

continence. The reason may be the protection of the internal urethral sphincter. In the Control group, 1 patient had temporary urinary incontinence when the catheter was removed on the same day and recovered on the next day. However, the patients in the Experimental group did not have urinary inconti-

nence. Therefore, our data suggest that keeping the bladder neck at 5 to 7 loci may reduce the incidence of urinary incontinence in patients (Photo 1).

Seminal plasma is the liquid component of semen, and the main seminal plasma components are prostate fluid and seminal vesicle fluid [8]. The

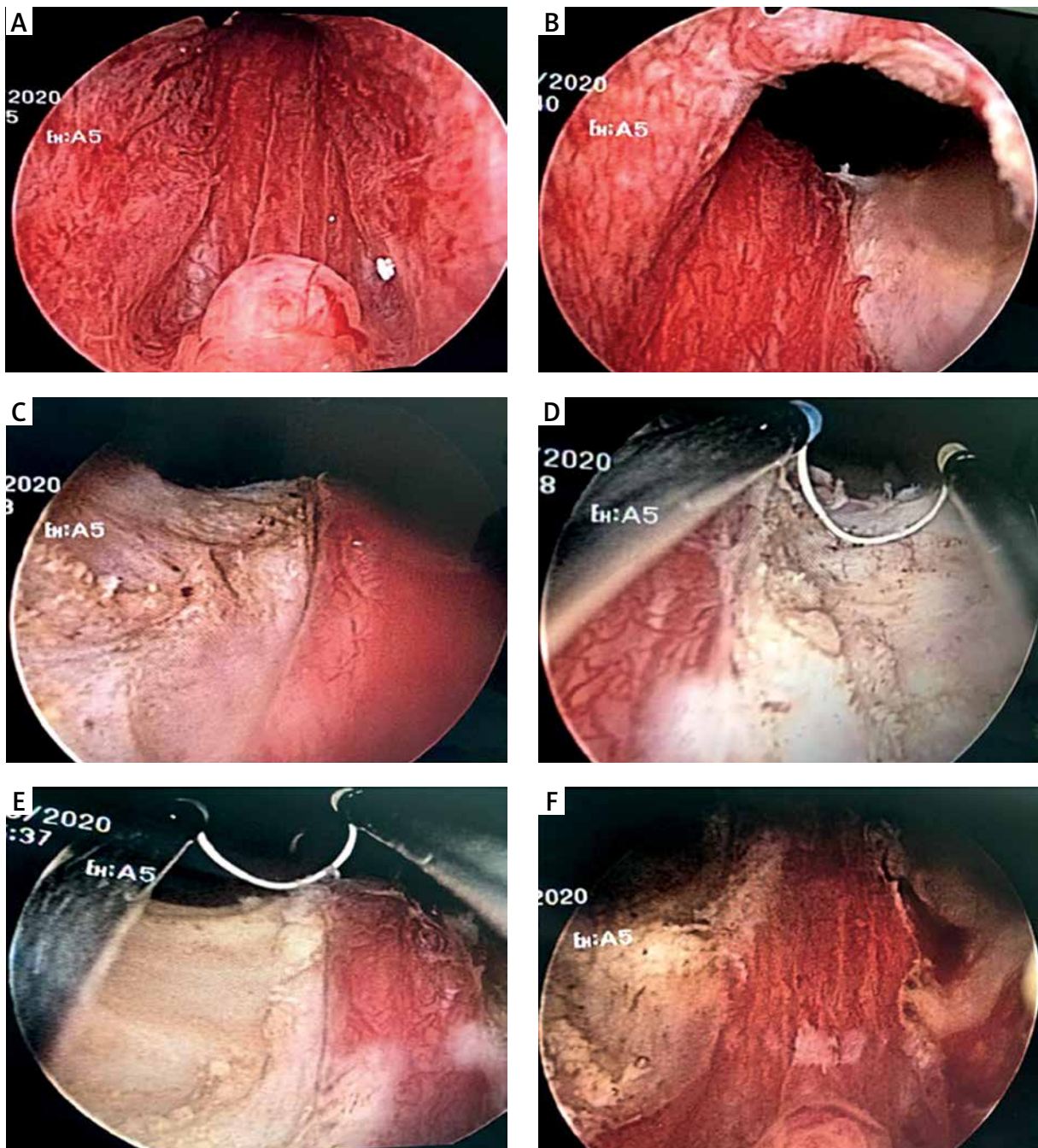


Photo 1. Images of bladder neck in the Experimental group. **A** – Pre-operation. **B** – Removal of 5 loci of tissues. **C** – Removal of 7 loci of tissues. **D** – Smooth the 5 loci of incisional edge of the retained prostate tissue. **E** – Smooth the 7 loci of incisional edge of the retained prostate tissue. **F** – Post-operation

semen volume of the two groups of patients decreased significantly after surgery. A study showed that 43.6% of patients experienced a decrease in semen volume compared to the preoperative level [9]. This may reduce prostate fluid secretion caused by surgical removal of the prostate gland. After the operation, the semen volume in the Experimental group was more than that in the Control group. On the one hand, we believe that residual prostate tissue is secreting prostatic fluid. On the other hand, in the Control group, the ejaculatory duct is destroyed during the operation, resulting in obstruction of the ejaculatory duct and the inability to discharge seminal vesicle fluid. There are also some patients in the Control group whose semen flows into the bladder during ejaculation, resulting in a small amount of semen.

The occurrence of retrograde ejaculation after transurethral resection of the prostate is mainly related to the following factors: (1) The integrity of the bladder neck is compromised [10]: Prostatectomy requires the bladder neck to be fully open to solve the urination function, but this often leads to over-excision of the bladder neck, which destroys the annular fibers with the function of the internal sphincter and makes them unable to close during ejaculation, resulting in retrograde ejaculation [11]. Li *et al.* [9] reported that retrograde ejaculation after holmium laser enucleation with intact bladder neck was 11.7%. Yang *et al.* [12] reported that the incidence of retrograde ejaculation after transurethral incision of the bladder neck, preserving a portion of the superior temporal tissue, was only 15.4. (2) Injury of the ejaculator muscle *musculus ejaculatorius*, whose contractions can cause semen secretion and ejaculation and play a leading role in ejaculation [13]. During surgery, the system is damaged, leading to retrograde ejaculation. Alloussi *et al.* [14] also reported that 89 BPH patients underwent TURP to preserve proximal of the verumontanum, and the proportion of retrograde ejaculation after surgery was only 9.2%. (3) The destruction of the integrity of the ejaculatory duct: According to the anatomy of the prostate and seminal tract, we found that the ejaculatory duct enters the prostate parenchyma at an acute angle of 10 to 15° from the midline, opening at 5 and 7 loci on both sides of the prostatic capsule opening. The ejaculatory duct passes through the prostate parenchyma. When we remove the prostate completely, the ejaculatory duct may inevi-

tably be severed, resulting in retrograde ejaculation, or it may cause the opening of the ejaculatory duct to close, causing no ejaculation. Our results showed that the Experimental group had significantly lower retrograde ejaculation than the Control group. The Control group had 21 (75%) cases of retrograde ejaculation, broadly consistent with Jaidane *et al.* [5]. Moreover, the Experimental group had only 1 (3.6%) case of retrograde ejaculation. The incidence of retrograde ejaculation in the Control group was as high as 75%. The reason may be that the integrity of the seminal tract is destroyed during the operation, and the Experimental group can preserve the seminal tract, thereby reducing the occurrence of retrograde ejaculation.

New technologies such as prostatic urethral lift (PUL), prostatic arterial embolization (PAE), and Rezum are recently accepted by patients who want to preserve sexual function. McVary *et al.* [15] conducted a 1-year follow-up of BPH patients treated with Rezum, during which there was no surgically induced ejaculatory dysfunction. We know that these techniques do not damage the bladder neck, the ejaculation muscles, or the ejaculation structure, so they do a good job of protecting the patient's antegrade ejaculation. We completely preserve the tissue between 5 and 7 loci of the prostate during the operation to avoid damage to the ejaculatory muscle. Meanwhile, the bladder neck tissue at 5–7 points is also preserved, which effectively protects ejaculation function.

We found that there was still 1 case of retrograde ejaculation in the Experimental group, which may be due to the following reasons: (1) The intraoperative operation may not be fine enough and damage the ejaculatory structures. (2) According to research, most men's ejaculatory structures are located in the tissues at 5 to 7 loci in the prostate, but a few may not be located there. (3) The bladder neck is only reserved for 5 to 7 loci. Perhaps the retention of the bladder neck should be increased, which may further reduce the occurrence of retrograde ejaculation.

Conclusions

Prostatectomy with complete preservation of the seminal tract is not different from conventional electrosurgical resection in improving urination symptoms, while the incidence of retrograde ejaculation is significantly reduced. Complications of the

new operation did not appear after the operation, and a second operation caused by recurrence of the residual gland did not occur. Therefore, this procedure can be considered for BPH patients with sexual needs.

Conflict of interest

The authors declare no conflict of interest.

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