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Original Article

Efficacy and safety of an improved technique of holmium laser enucleation of the prostate versus open prostatectomy in treating enlarged prostates combined with multiple bladder stones: one-year of followup

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Abstract: Purpose: Holmium laser enucleation of the prostate (HoLEP) is an effective treatment for benign prostatic hyperplasia (BPH). In this study, we evaluated the efficacy and safety of combination of HoLEP with a small suprapubic incision (HSI) in treating BPH combined with multiple bladder stones. Patients and methods: In this retrospective study, we included 58 patients with enlarged prostates (> 100 g) combined with multiple bladder stones who underwent HSI or open prostatectomy (OP), respectively. Baseline characteristics of the patients were recorded. Peri- and postoperative outcomes were obtained during a 1-year followup. Results: Similar baseline characteristics of patients were observed in the HSI and OP groups. The HSI technique was associated with fewer perioperative complications, reduced postoperative catheterization duration and hospital stay, compared to the OP group. Great improvements in International Prostate Symptom Score, quality of life, and maximum urinary flow rate were detected in the two groups. Conclusion: The HSI technique represents a promising approach to treatment of enlarged prostates combined with multiple bladder stones.

Keywords: Benign prostatic hyperplasia, holmium laser enucleation of the prostate, prostatectomy, retrospective study, surgical approach

Introduction

In the past decades, open prostatectomy (OP) has been considered as the standard therapy for treatment of an enlarged prostate [1]. In the guideline of the European Association of Urology (EAU), OP is applicable for the prostate of > 80 ml in size [3]. However, OP is an invasive procedure associated with substantial blood loss, long hospital stay, and huge trauma [2]. Therefore, there is an urgent need to develop a novel surgical approach.

Holmium laser enucleation of the prostate (HoLEP) has been shown to be an effective and safe treatment for benign prostatic hyperplasia (BPH) of all sizes [4]. HoLEP is associated with less risk of haemorrhage and reduced bladder irrigation, catheter times and hospital stay [5]. Thus, HoLEP is emerging as the new standard treatment for BPH [6]. However, management of an enlarged prostate combined with multiple bladder stones with HoLEP is challenging.

In our hospital, combination of HoLEP with a small suprapubic incision (HSI) is used to treat enlarged prostates combined with multiple bladder stones. In this study, we conducted a retrospective study with a 1-year followup to analyze the efficacy and safety of the HSI technique in treating BPH (> 100 g) combined with multiple bladder stones.

Patients and methods

Patients

We retrospectively reviewed 58 patients with BPH (> 100 g) combined with multiple bladder stones who were treated by HSI (n = 28) or OP (n = 30) at our hospital between June 2009 and June 2013. All patients had been treated with

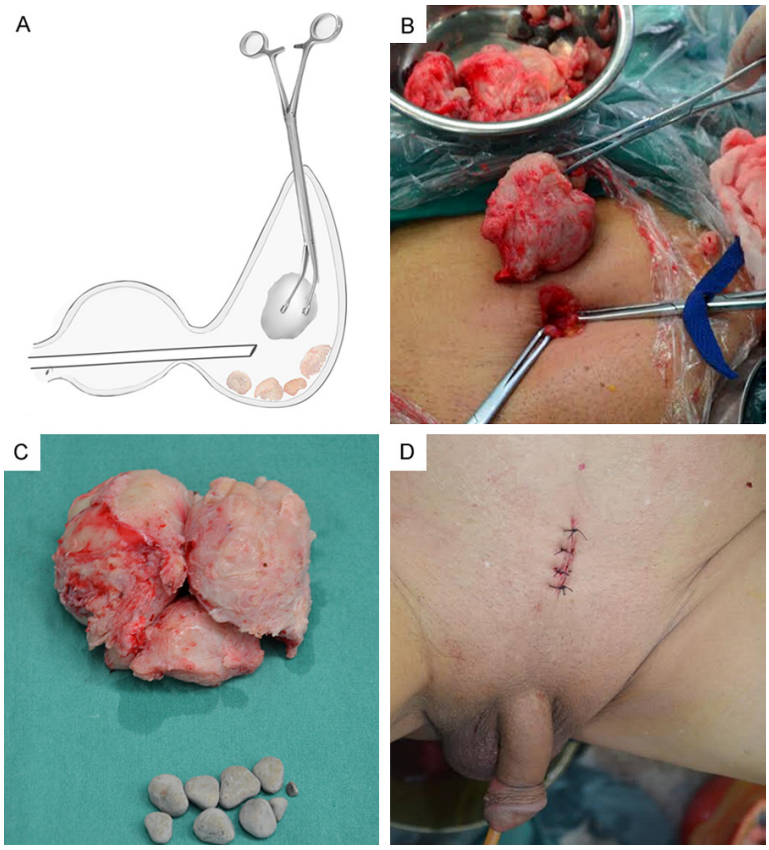

Figure 1. A representative case of an enlarged prostate combined with multiple bladder stones treated with holmium laser enucleation of the prostate followed by a small suprapubic incision. A. Schematic illustration of the surgical approach. B. A skin incision for cystotomy was made above the pubic bone in a representative case and the enucleated prostate was pulled out through the open incision using ring forceps. C. A represenative photograph shows the bladder stones that were retrieved through a small suprapubic incision with the guide of a cystoscope. D. A represenative photograph shows that the bladder wall was closed, leaving a three-way urethral catheter in place.

conservative medical therapy using α-blockers and/or 5α-reductase inhibitors prior to surgery. Patients with the following conditions were excluded: neurogenic bladder dysfunction, large bladder diverticula, severe lung or cardiovascular diseases, poorly controlled diabetes, or blood coagulation dysfunction. This study was approved by the Ethics Committee of Jiaotong University (Shanghai, China) and written informed consent were obtained from each patient.

Pre- and post-operative examination

Baseline characteristics of each patient were collected, including urological history, presence of concurrent diseases, previous drug therapy, prostate volume, post-void residual (PVR) volume, international prostate symptom score (IPSS), quality of life (QoL) score, and maximum urinary flow rate (Qmax). The number of bladder stones was assessed by plain film of kidney-ureter-bladder (KUB) or cystoscopy and the size of bladder stones was measured with both ultrasonography and KUB. The prostatic tissue was weighed immediately after surgery. Serum levels of prostate-specific antigen (PSA), sodium, and haemoglobin were measured. Operative time, resected prostatic weight, serum sodium decrease, haemoglobin decrease, and early complications were determined. The use of bladder irrigation, catheterisation time, and hospitalisation duration were recorded. Follow-up was assessed at 1, 6 and 12 months after surgery.

Surgical procedure

HoLEP was performed using a 550 μm end-firing laser fibre and a 100 W continuous flow VersaPulse® holmium laser and a 27 Fr resectoscope with a modified bridge to hold the laser fibre (Storz, Tuttlingen, Germany). Patients were in the lithotomy position during HoLEP. After HoLEP was accomplished, the enucleated prostate was pushed into the bladder. Then, a 4-5-cm incision for cystotomy was made approximately 3 cm above the pubic bone with the patient lying in a supine position. With the guide of a cystoscope, the bladder was carefully explored, and all of the stones were removed. The enucleated prostate was pulled out through the open incision using ring forceps (**Figure 1A-C**). Then, the bladder wall was closed with 2-0 polyglycolic acid running suture, leaving a three-way urethral catheter in place (**Figure 1D**).

OP was performed as described in previous studies [7, 8]. After a lower midline incision was made, the suprapubic approach was performed involving a transverse incision 1 to 2 cm above

Table 1. Baseline characteristics of patients

Parameter	HoLEP	OP	*P*
Age (y)	74.7 ± 6.1	74.2 ± 5.7	0.7
Residual volume (ml)	73.6 ± 40.0	76.2 ± 39.9	0.2
PSA (ng/ml)	2.9 ± 1.0	2.67 ± 1.24	0.3
Prostate volume (ml)	162.9 ± 25.0	170.7 ± 40.0	0.4
No. of calculi	6.8 ± 1.9	6.3 ± 1.6	0.3
Max calculi diameter (cm)	1.9 ± 0.5	2 ± 0.6	0.6

the bladder neck. The bladder was closed with interrupted figure-of-8 absorbable suture and an additional catheter was placed.

All of the patients received general anaesthesia throughout the whole procedure. The irrigation fluid used was normal saline (0.9%), and the irrigation bags were hung 60 cm above the operating table. In addition, all patients were administered perioperatively with appropriate antibiotics. The urethral catheter was removed after the bladder flushes became clear. The patients were discharged if satisfactory voiding was achieved.

Statistical analysis

All data are presented as mean ± standard deviation (SD) and were statistically analyzed with a 2-tailed Student's *t* test. Differences were considered statistically significant at $P < 0.05$.

Results

Table 1 lists the patients' baseline data. The PSA level in 52 of the 58 patients was less than 4.0 ng/ml. Notably, 6 patients with increased PSA levels had benign hyperplasia, which was pathologically confirmed. Pre-operative assessment of the prostatic weight via ultrasonography revealed an average weight of 171.0 ± 26.3 vs. 179.2 ± 42.0 g in the HSI and OP groups, respectively. The preoperative prostate volume was similar between the HSI and OP group (162.9 ± 25.0 ml vs. 170.7 ± 40.0 ml, respectively; $P = 0.400$). Each patient had at least 5 bladder stones, with a maximum diameter of > 1.5 cm.

All of the removed prostatic tissue was subjected to routine pathological evaluation. One case of incidental prostatic carcinoma was found. This patient was not excluded from our study, and a laparoscopic radical prostatectomy was performed three months later. The mean weight of prostate tissue retrieved was 132.4 ± 25.1 g in the HSI group vs. 135.5 ± 37.2 g in the OP group ($P = 0.700$) (**Table 2**). The mean haemoglobin was 1.1 ± 0.4 g/dl in the HSI group, 1.7 ± 0.5 g/dl in the OP group ($P < 0.01$). After urethral catheters had been removed, the patients were discharged after demonstrating normal urination. Preoperative and 1-, 6- and 12-month postoperative data for IPSS, QoL and Qmax assessments are shown in **Table 3**. Compared with their baselines, there was a marked improvement after surgery. However, no significantly differences were noted between the two groups.

Complications were reported within 1 year. No patient needed blood transfusion. No transurethral resection syndrome was detected. No patients required recatheterisation due to urinary retention after urethral catheter removal. In the HSI group, one patient had postoperative stricture of the external orifice of the urethra, and was cured by urethral dilation. A posterior urethral stricture occurred in another patient, and was resolved by internal urethrotomy. In the OP group, four patients with postoperative urethral stricture were observed. The initial pseudo-incontinence was present in two patients of the HSI group, but these two patients recovered urinary continence in the next 3 weeks. After the open surgery, three patients had urinary incontinence and one of them did not recover to normal after physical therapy. Bladder neck sclerosis or leakage of urine was not encountered.

Discussion

Although OP has been used as the standard therapy for BPH for many years [1], several new endoscopic technologies are being developed to treat this disease. It has been argued that OP is also a useful approach to the treatment of BPH because of its cost-effectness [9]. A randomized prospective trial comparing OP patients with HoLEP combination with morcellation demonstrated that HoLEP and OP were equally effective in the removal of large prostates, while HoLEP significantly decreased perioperative morbidity, postoperative catheterisation, hospital duration and operative time. However, for patients with BPH (≥ 100 g) and bladder disorders, especially bladder stones, OP is a preferable treatment. HoLEP procedure is less effective in treating patients with large

Table 2. Perioperative data

Parameter	HoLEP	OP	*P*
Operative duration (min)	73.8 ± 14.9	56.7 ± 10.8	< 0.01
Time of enucleation (min)	51.9 ± 12.4	-	-
Tissue retrieved (g)	132.4 ± 25.1	135.5 ± 37.2	0.7
Reduction in serum sodium (mM)	4.4 ± 2.6	3.8 ± 1.4	0.3
Reduction in serum hemoglobin (G/dl)	1.1 ± 0.4	1.7 ± 0.5	< 0.01
Time of bladder irrigation (h)	6.6 ± 3.4	15.3 ± 5.0	< 0.01
Catheter time (d)	3.5 ± 0.6	6.4 ± 0.9	< 0.01
Hospital stay (d)	4.3 ± 1.0	7.6 ± 0.9	< 0.01

Table 3. Follow-up data

Parameter	HoLEP	OP	*P*
Age (y)	74.7 ± 6.1	74.2 ± 5.7	0.7
Residual volume (ml)	73.6 ± 40.0	76.2 ± 39.9	0.2
PSA (ng/ml)	2.9 ± 1.0	2.67 ± 1.24	0.3
Prostate volume (ml)	162.9 ± 25.0	170.7 ± 40.0	0.4
No. of calculi	6.8 ± 1.9	6.3 ± 1.6	0.3
Max calculi diameter (cm)	1.9 ± 0.5	2 ± 0.6	0.6

or numerous bladder stones, because of its inability to remove bladder stones [10]. HoLEP required a longer operative time to manage BPH (≥ 100 g) compared with OP, which increases the risks of cardiovascular events and mortality in high-risk patients. Furthermore, the bladder mucosa could be injured during the enucleation of markedly enlarged prostates, which may partly involved in post-operative urinary incontinence [11].

To improve the outcome of HoLEP in the treatment of BPH with bladder stones, we made a small endoscope-guided suprapubic incision after HoLEP to remove the stones. Both enlarged prostates and bladder stones were retrieved from the bladder through the incision. In this way, the advantages of OP and HoLEP were combined. To our knowledge, this is the first report of using a combination of HoLEP and a small suprapubic incision to manage BPH and bladder stones.

In terms of resected tissue weight rate, the HSI technique yielded similar outcomes to OP. Though our results showed a lower resection rate than others, the preoperative prostate volumes were larger in the HSI vs. OP group. The amount of resected tissue was much higher than that in previously studies (132.4 g vs. 115.4 g) [12, 13]. A lower decrease in the mean haemoglobin was observed in the HSI group compared with the OP group. A much larger decrease was observed in other reports with OP, which supports the idea of a lower bleeding risk compared with open surgery [14, 15]. No transfusion was required in the 2 groups of our study, while there was 8.6% transfusion rate in the OP group in a previously published report [16]. Substantial advantages were determined with respect to catheterisation days and hospital stay. Compared with some other present studies (5.7 and 6.9 days) [16], it was prevailing in the catheterisation and hospital time of our study (3.5 ± 0.6 and 4.3 ± 1.0 days). Therefore, the HSI technique in the treatment of BPH tends to be associated with a shorter postoperative recovery.

It has been reported that large prostates increase the operative time with HoLEP [3]. We found that the mean operative time for prostate enucleation was 51.9 ± 12.4 min, and the operative time for the small incision was only 21.8 ± 5.5 min. In addition, the large or multiple stones were removed through the small incision in approximately only 1 or 2 min. In our study, operative duration was significantly shorter in the OP group. In the analyses with others, the total operative time for our therapeutic approach was 73.8 ± 14.9 min, which was less than the previously reported operative times [1, 3]. This outcome is most likely attributable to the fact that some urologists performed an open procedure only once every 2 years [9]. Though the operative times varied due to different surgeons, we argued that the HoLEP technique combined with a small incision was as fast as OP, especially for BPH (≥ 100 g).

There were two patients with initial pseudo-incontinence who eventually recovered to normal by 2 to 3 weeks after surgery in the HSI group. In the OP group two more patients was observed than the HSI group. A urethral stricture occurred in two patients of HSI group and three patients of OP group who subsequently underwent urethrotomy postoperatively. No bladder neck sclerosis or leakage of urine was detected in our research, while in another OP study, a 1.6% neck sclerosis rate was reported [16]. Re-catheterisation was not observed in our study either, though this complication

occurred in up to 8.6% of patients in the OP study published previously [16]. Thus, the short-term and mid-term complication rates were much lower in our surgical method compared with OP. In terms of long-term functional outcome, the IPSS, QoL and Qmax were similar in our two groups.

The main limitation of the present study is that it is retrospective. Future well-designed, randomized trials with an extended follow-up and larger sample sizes may be needed. Additionally, long-term effects of the HSI technique in the treatment of BPH combined with bladder stones still require further investigation.

In conclusion, HoLEP combined with a small suprapubic incision represents a promising approach to treatment of BPH (≥ 100 g) and multiple bladder stones. This technique demonstrates comparable or greater efficiency and safety, compared to OP. Further investigations should be undertaken to assess long-term outcomes of the HSI technique in the treatment of BPH combined with bladder stones.

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Disclosure of conflict of interest

None.

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