Salvage Holmium laser enucleation of prostate to treat residual benign prostatic hyperplasia

Jin Kyu Oh, MD;[*] *Jungbum Bae, MD;*[†] *Chang Wook Jeong, MD, PhD;*[§] *Jae-Seung Paick, MD;*[§] *Seung-June Oh, MD, PhD*[§]

[*]Department of Urology, Gachon University Gil Hospital, Incheon, Korea; [†]Department of Urology, Dongguk University Ilsan Hospital, Goyang, Korea; [§]Department of Urology, Seoul National University Hospital, Seoul, Korea

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Abstract

Introduction: The Holmium laser enucleation of the prostate (HoLEP) technique to remove residual adenoma has not been reported. Salvage HoLEP enables anatomical enucleation of residual adenoma in patients who have previously undergone surgical treatment. We describe not only anatomical insights into the frequent location of adenoma recurrence, but also the feasibility of the salvage HoLEP technique.

Methods: We retrospectively reviewed a database containing HoLEP video records for 35 patients out of a total of 535 individuals on whom HoLEP was performed by 2 surgeons (SJO & JSP) between July 2008 and June 2011. Group 1 consisted of patients who underwent salvage HoLEP due to recurring adenoma and Group 2 of patients who underwent HoLEP as an initially surgical management to treat benign prostate hyperplasia (BPH). We compared the dataset of pre-, intra- and postoperative parameters between Groups 1 and 2.

Results: In the analysis of the video records of Group 1 (n = 35), there was significant remnant tissue around the verumontanum and the lateral lobes were also incompletely removed by previous conventional procedures. When we compared pre-, intra- and postoperative parameters between the 2 groups, there were no significant differences, including operation time, duration of hospital stay. However, the duration of the catheterization of Group 1 was shorter than that of Group 2 (1.38 ± 0.55 vs. 1.90 ± 1.81 days, $p < 0.001$).

Conclusions: Even for cases of residual BPH, salvage HoLEP is a feasible and effective procedure for treating residual adenoma along the anatomical plane.

Introduction

Transurethral resection of prostate (TURP) is considered the gold standard for symptomatic benign prostatic hyperplasia (BPH). However, the long-term results of TURP have been 3% to 14.5%.[1,2] Insufficient resection and progression of BPH can result in reoperation.[2] Newly emerging, minimally invasive modalities have not demonstrated its equality to TURP with respect to long-term effectiveness. Therefore, BPH recurrence during long-term postoperative follow-up has been reported in a significant percentage of patients.[3] If adenoma tissue regrowth and the reappearance of obstructive symptoms are observed, reoperation is needed for symptom relief.

Holmium laser enucleation of the prostate (HoLEP) is a treatment option distinct from conventional surgical procedures. HoLEP enables surgeons to perform anatomical dissection of the adenoma by separating the outer prostatic capsule from the inner adenomatous tissue; it has the same surgical enucleation concept with open prostatectomy. Therefore, HoLEP is suitable to remove larger prostates, while safely preserving the distal urethral sphincter. We named "salvage HoLEP" as a reoperation performed on patients with residual BPH who have previously undergone surgical treatment. Most reoperations are expected to be accompanied by adhesion and bleeding resulting in operation difficulties. To the best of our knowledge, we present the first report on the technical aspect and feasibility of BPH reoperation using a Holmium laser. We discuss the anatomical location of recurrent adenoma, the technique for removing the regrown tissue, and the feasibility and safety of the salvage HoLEP procedure to treat residual BPH.

Methods

We enrolled 535 consecutive patients who visited Seoul National University Hospital for symptomatic lower urinary tract symptoms who underwent HoLEP. These procedures were performed by 2 surgeons (SJO & JSP) from July 2008 to June 2011. The dataset of all patients who underwent HoLEP due to BPH, including medical and video records, were reviewed retrospectively and 35 patients were identified

as having had a reoperation for residual BPH. All patients were divided into 2 groups: Group 1 (salvage HoLEP group, n = 35) included patients who underwent HoLEP due to BPH progression after previous BPH manipulation; and Group 2 (initial HoLEP group, n = 500) included patients who underwent HoLEP initially as a surgical manipulation.

Patient demographics, including comorbidities and medications, were noted. The International Prostate Symptom Index (IPSS) and quality of life (QoL), maximal flow rate (Qmax) and post-void residual (PVR) were examined preoperatively and postoperatively during follow-up. Prostate volume measured by transrectal ultrasound, serum prostate-specific antigen levels (PSA) and urodynamic parameters were taken preoperatively and at 6 months postoperatively. We also analyzed operative time, weight of the removed tissue, intra-operative findings and immediate complications, catheter indwelled duration and length of hospitalization.

Equipment for HoLEP comprised of a 100 W holmium:YAG laser (VersaPulse PowerSuite (Lumenis, Yokneam, Israel) with a 550-μm end fire laser fibre (SlimLine, Lumenis), and a 26-Fr continuous-flow resectoscope with an inner sheath and 30° telescope (27040 XAL and 27005 BA (Karl Storz, Tuttlingen, Germany). Enucleated tissue was removed using a 26-Fr nephroscope with an adapter (27 293 AA and 27040 LB, Karl Storz) and a VersaCut morcellator (Lumenis). The enucleated tissue was immediately weighted after retrieval in the operation room.

All descriptive analyses of pre-, intra- and post-operative parameters between the 2 groups were performed using an independent Student *t*-test and chi-square test. *P* value <0.05 was considered statistically significant. All statistical analyses were performed using SPSS 12.0 (Chicago, IL).

All data were retrieved from the registered database and analyzed with the approval of the institutional review board (IRB) of the Seoul National University Hospital.

Results

Preoperative data

Patients of Group 1 (n = 35) underwent previous endoscopic procedures, including TURP (16 cases), photo-selective vaporization of prostate (PVP: 17 cases), and transurethral needle ablation (TUNA: 2 cases). The average interval between salvage HoLEP and TURP was 10.3 years, PVP was 3.5 years and TUNA was 7.0 years (Table 1). The mean prostate volume (± standard deviation [SD]) was 59.7 ± 21.9 and 59.3 ± 26.1 mL, respectively. There were no significant differences in preoperative parameters including age, body mass index, presence of comorbidities, serum PSA, volume of prostate and transitional zone, symptom score and urodynamic variables between 2 groups.

Surgical technique

The routine surgical procedure started with an incision on both sides of the verumontanum at the apex area.[4] Bilateral longitudinal incisions from the bladder neck to the verumontanum were made at the 5 and 7 o'clock positions. Next, careful retrograde enucleation of the median lobe was performed. Another longitudinal incision at the 12 o'clock position was made from the bladder neck to the opposite side of the verumontamum to differentiate the right and left

Table 1. Demographics and preoperative parameters between group 1 and 2

	Group 1 (Salvage HoLEP)	Group 2 (Initial HoLEP)	*p* value*
No.	35	500	
Age (years)	70.1 ± 6.5	68.6 ± 6.8	0.198
BMI (kg/m²)	23.8 ± 2.1	24.1 ± 2.9	0.582
Comorbidities			
Hypertension	17	228	0.733
Diabetes	4	86	0.378
Neurologic disease	4	41	0.776
Cardiovascular disease	2	36	0.741
Preoperative parameters			
Serum PSA (ng/dL)	3.6 ± 2.5	3.7 ± 4.5	0.744
Serum creatinine	1.1 ± 0.2	1.1 ± 0.5	0.764
Total prostate volume (mL)	59.7 ± 21.9	59.3 ± 26.1	0.938
Transitional zone volume (mL)	33.0 ± 18.2	32.0 ± 21.2	0.783
Symptom score			
Total score	17.8 ± 9.1	17.9 ± 8.4	0.955
QoL score	4.0 ± 1.2	4.1 ± 1.1	0.642
Urodynamic variables			
Uroflowmetry			
Maximal flow rate (mL/sec)	10.6 ± 4.6	9.6 ± 4.4	0.233
Voided volume (mL)	159.8 ± 84.8	175.2 ± 119.1	0.465
Post-void residual (mL)	43.2 ± 6.2	76.6 ± 109.5	0.085
Filling cystometry			
First desire to void (mL)	206.7 ± 81.8	189.6 ± 78.2	0.247
Normal desire to void (mL)	276.7 ± 136.6	278.3 ± 101.0	0.949
Strong desire to void (mL)	353.7 ± 118.1	365.4 ± 117.8	0.611
Maximal bladder capacity (mL)	365.2 ± 123.5	365.6 ± 127.3	0.985
Voiding cystometry			
PdetQmax (cmH_2O)	52.5 ± 21.3	61.7 ± 26.9	0.059
Maximal flow rate (mL/sec)	8.5 ± 3.9	8.0 ± 6.5	0.676
Post-void residual (mL)	75.7 ± 65.2	127.8 ± 123.7	0.025

All values represent the mean ± SD. *Student's t-test and chi-square test were used for data analysis. HoLEP: Holmium laser enucleation of prostate; BMI: body mass index; PSA: prostate-specific antigen; PdetQmax: detrusor pressure at maximum flow rate.

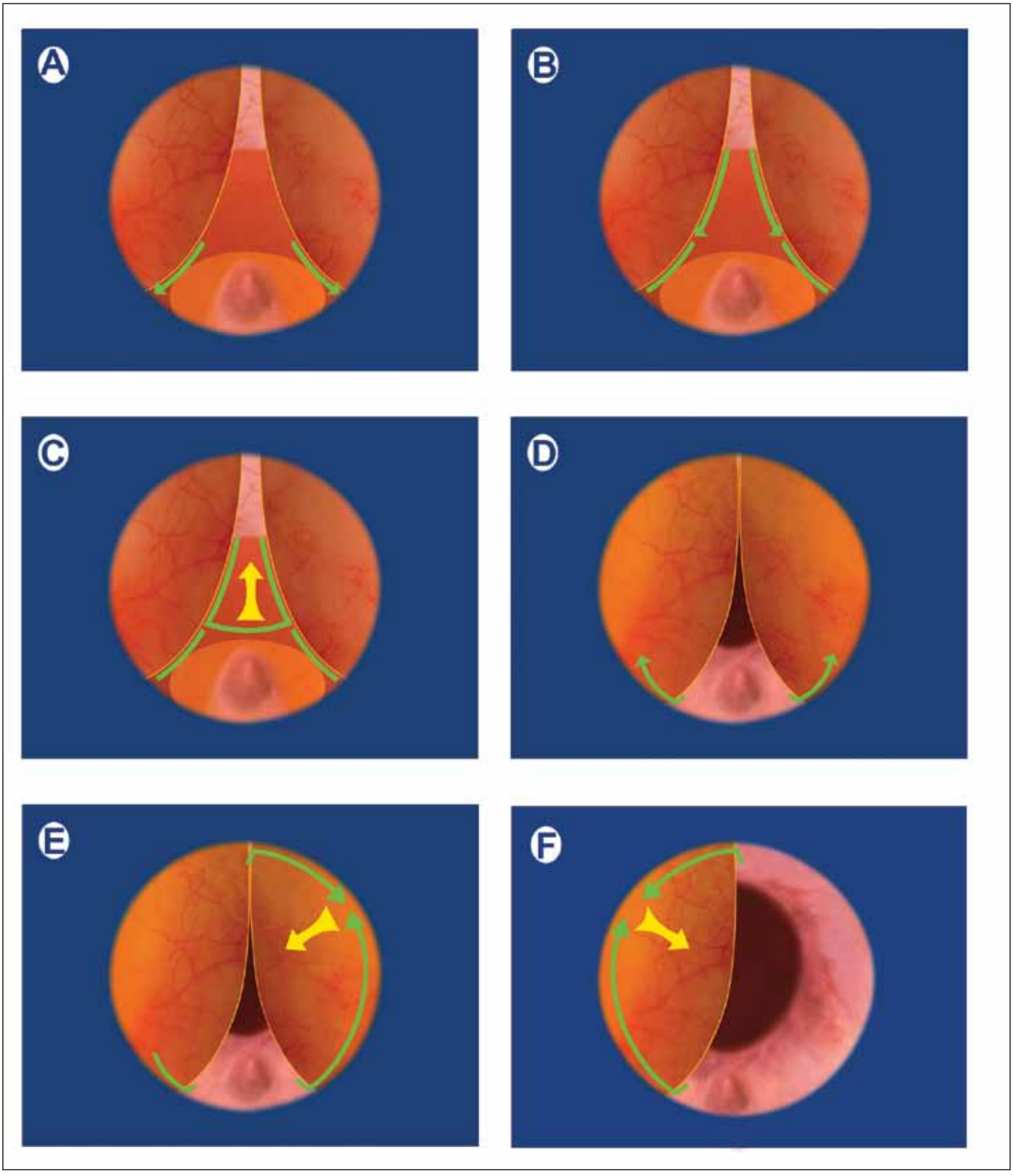

Fig. 1. The procedure of Holmium laser enucleation of prostate (HoLEP). A: Apical incision (lateral to verumontanum). B: Bladder neck incision (5 and 7 o'clock) and conjoining transverse incision. C: Median lobe enucleation. D: Upward separation of lateral lobes. E: Connecting mucosal incision of apical prostate and enucleation of the left lateral lobe. F: Same procedure in the right lateral lobe.

lateral lobes. After the apical capsular plane was identified near the verumontanum, the entire unilateral lateral lobe was carefully raised to separate each lateral lobe from the prostatic capsule. The lateral lobe was dissected by creating an anatomical plane between the prostatic capsule and adenoma, which was pushed into and positioned within the bladder cavity (Fig.1). The enucleated tissue within the bladder was removed using a morcellator.

Surgical outcomes

The mean resected tissue weight was 22.5 g (range: 1.2-130). The mean operation time was 69.2 minutes (range: 15-225), which included a mean enucleation time of 52.0 minutes (range: 10-180) and mean morcellation time of 11.1 minutes (range: 3-90). In most Group 1 patients, the lateral lobe hypertrophy was prominent and 5 patients had tissue regrowth around the verumontanum. Despite previous surgeries, bladder neck elevation or intravesical prostate protrusion were found in 8 of the 35 Group 1 patients. Three patients had bladder stones and 1 patient had severe trabeculation. Dissection was primarily performed along the surgical plane; however, several patients had ill-defined dissection planes.

Intraoperative parameters are presented in Table 2. There were no major complications in Group 1 according to the modified Clavien classification.[5] One patient had persistent postoperative bleeding and another sustained mucosal injury during morcellation. The prostatic capsule was ruptured in 1 case, which resolved after delayed removal of the urethral catheter. Transient urinary incontinence (UI) was observed postoperatively in 3 patients and disappeared within 3 months.

The mean age and mean resected tissue weight, mean prostate volume, and mean transitional zone volume were comparable between the 2 groups. Furthermore, the mean enucleation and morcellation times of Group 2 were not different from Group 1 ($p = 0.913$, $p = 0.463$, respectively).

Postoperative voiding parameters

Almost all patients of Group 1 were discharged within 2 days postoperatively. Only 1 patient who had been prescribed aspirin visited the emergency room for voiding difficulties secondary to persistent hematuria. We tallied the postoperative voiding parameters of the 2 groups (Table 2). All parameters improved 6 months postoperatively. When we compared postoperative parameters between the 2 groups, there were no significant differences, including duration of hospital stay and results of uroflowmetry. However, the duration of the catheterization of Group 1 was shorter than that of Group 2 (1.38 ± 0.55 vs. 1.90 ± 1.81 days, respectively, $p < 0.001$).

Table 2. Analysis of intra- and postoperative parameters between group 1 and 2

	Group 1 (Salvage HoLEP)	Group 2 (Initial HoLEP)	*p* value*
Intraoperative parameters			
Operative time (min)	66.6 ± 30.8	69.4 ± 34.2	0.637
Enucleation time (min)	52.4 ± 20.2	52.0 ± 23.2	0.913
Morcellation time (min)	9.9 ± 6.2	11.2 ± 10.1	0.463
Total used energy (J)	107.3 ± 45.8	91.2 ± 37.0	0.067
Enucleated weight (g)	21.0 ± 14.2	22.6 ± 18.6	0.61
Enucleated weight per time (g/min)	0.40 ± 0.24	0.43 ± 0.30	0.545
Immediate postoperative parameters			
Duration of catheterization (day)	1.38 ± 0.55	1.90 ± 1.81	<0.001
Duration of hospital stay (day)	2.51 ± 0.61	2.81 ± 1.52	0.246
Voided volume (mL)	181.3 ± 85.2	175.9 ± 105.5	0.808
Post-void residual (mL)	43.0 ± 25.6	58.9 ± 58.1	0.202
Postoperative 6 month parameters			
Serum PSA (ng/dL)	0.90 ± 0.63	0.97 ± 0.84	0.822
Symptom score			
Total score	8.7 ± 4.2	7.9 ± 6.6	0.722
QoL score	2.1 ± 1.3	1.7 ± 1.5	0.476
Maximal flow rate (mL/sec)	22.3 ± 10.6	18.4 ± 9.7	0.095
Voided volume (mL)	201.2 ± 160.0	170.3 ± 104.0	0.405
Post-void residual (mL)	21.3 ± 24.0	23.2 ± 33.5	0.816

All values represent the mean ± SD. *Student's t-test and chi-square test were used for data analysis. HoLEP: Holmium laser enucleation of prostate; PSA: prostate-specific antigen; QoL: quality of life.

Discussion

The calculated reoperation rate for TURP is 1.8% per year.[6] Eight years after undergoing TURP, 12.0% to 15.5% of patients need re-intervention.[7] Minimally invasive treatments, such as PVP, TUNA and transurethral microwave treatment (TUMT), have reoperation rates of 11%, 8%, and 7%, respectively, after 1 year.[8] Reported long-term reoperation rates are 22% for PVP and 23% for electrovaporization after 10 years of follow-up.[9] For HoLEP, the reoperation rate is 4.2% after 6 years of follow-up and is estimated at 25% after 10 years.[10] The reasons for reoperation are insufficient tissue removal and the natural course of BPH.[2] In addition, applied treatment modalities account for reoperation after BPH surgery. Minimally invasive modalities are associated with a trend for more reoperation.[3] In the present series, most patients had previously undergone TURP and PVP. Due to an increasing number of patients who receive minimally invasive treatment for BPH, there will be more cases of

reoperation in South Korea.[11] Therefore, there is an increasing necessity to prepare measures for treating residual BPH.

In general, surgeons encounter difficulties associated with adhesion and longer operation times during secondary reoperation than the initial operation. Reoperation following BPH surgery is more difficult for cases of radical prostatectomy.[12] HoLEP involves the anatomical dissection of adenoma, and shares the same surgical concept of enucleation with open prostatectomy. However, repeated BPH surgery also raises the issue of dissection through the correct surgical plane with minimal bleeding. Operation time can be a measure of operative difficulties. The enucleated tissue and operative time in this study were not different from that of naïve HoLEP as previously reported, which indicated the operative efficiency was not inferior to that of conventional HoLEP.[5]

In patients with residual BPH, there was significant remnant tissue around the verumontanum which may have been predominantly responsible for recurrent obstructive symptoms. Tissue around the verumontanum was presumed to be a result of incomplete resection. Many surgeons try not to perform resections distal to the verumontanum to preserve the distal sphincter, resulting in remnant tissue at the apex.[13] This has been a common problem with conventional endoscopic BPH surgery when surgeons attempt to remove apical tissue close to the urinary sphincter.[14] Resection of the tissue around the verumontanum is more difficult to perform with TURP using the loop of a resectoscope than other modalities using needle-like tips.[2,15]

In the present study, apex tissue was enucleated using the HoLEP technique.[16] A significant amount of lateral lobe tissue was found near the prostatic capsule, particularly in patients with larger prostates. Most patients had regrowth of the lateral lobe and lateral lobes kissing sign which indicated moderate to severe prostatic enlargement and anatomical obstruction. Additionally, some patients in this series had a severely elevated bladder neck. This finding also suggested prior inadequate removal of the prostatic tissue or regrowth. In reoperation cases, the dissection plane between the prostate capsule and adenoma was less prominent during enucleation due to adhesion caused by previously the performed procedures.[9,17] However, anatomical enucleation was successfully performed in most cases in this study.

Urinary incontinence after HoLEP is common.[18] In present study, no urinary incontinence secondary to sphincteric injury was observed. Three patients had transient urge incontinence. Urinary incontinence disappeared within 6 months postoperatively spontaneously. As previously mentioned, the surgical capsule can remain adhered to the prostatic tissue after resecting the prostatic tissue.[15] As a result, surgical complications, such as prostate capsule tearing or bleeding, can occur. However, no major surgical complications were seen in our study except for minor capsular tearing in 1 patient in whom a urethral catheter was kept for several days. According to the operative records, 3 patients had an indeterminate surgical plane.

TURP remains the standard treatment modality for the surgical management of BPH. However, incomplete resection of BPH adenoma is still a postoperative problem during long-term follow-up. In our study, 16 cases of TURP were applied with salvage HoLEP due to residual BPH.

Recent studies demonstrated HoLEP showed better surgical outcomes than TURP in postoperative Qmax and IPSS.[19] In the comparision of pre- and postoperative parameters between Groups 1 and 2 in our study, salvage HoLEP group (Group 2) showed no significant differences compared with initial HoLEP group in surgical outcomes at month 6 postoperatively. After HoLEP for the management of BPH, the improvement of voiding parameters, including increased maximal flow rate and decreased residual urine volume, were observed in both groups. Also, comparing IPSS of both Groups 1 and 2, subjective symptom relief was observed after HoLEP. We believe these findings might demonstrate HoLEP as a feasible treatment modality to manage not only initial BPH, but also residual BPH after previous manipulation.

This study had several limitations. First of all, our study was performed retrospectively. It also included a relatively small number of patients when comparing the difference between the initial HoLEP group and salvage HoLEP group. Since the numbers of salvage HoLEP cases will accumulate in the future, more concrete data can be available for future studies.

To the best of our knowledge, this is the first study to demonstrate the feasibility of HoLEP to treat residual BPH surgically using the analysis of video records. Also, we believe our study has clinical significance because it was designed using clinical data of consecutive patients. More research with larger sample sizes are warranted to clarify the feasibility of salvage HoLEP.

Conclusion

Our study demonstrated that enucleation of adenoma along the anatomical plane is feasible even for cases of residual BPH. The HoLEP procedure was effective and safe for residual BPH following conventional procedures.

Competing interests: Dr. J. Oh, Dr. Bae, Dr. Jeong, Dr. Paick and Dr. S. Oh all declare no competing financial or personal interests.

This paper has been peer-reviewed.

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Correspondence: Dr. Seung-June Oh, Department of Urology, Seoul National University Hospital, 101 Daehangno, Jongno-gu, Seoul, Korea; sjo@snu.ac.kr