Modified early apical release vs. non-early apical release in holmium laser prostatic enucleation

Impact on stress urinary incontinence

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ABSTRACT

INTRODUCTION: We aimed to compare the incidence of de novo stress urinary incontinence (SUI) of two apical release techniques for holmium laser prostatic enucleation (HoLEP): modified early apical release (EAR) and non-early apical release (non-EAR).

METHODS: We conducted a retrospective database review analyzing the records of patients who underwent HoLEP with the modified EAR and non-EAR techniques for symptomatic benign prostatic hyperplasia. The study period spanned from January 2012 to December 2021 in a single center. Patient demographics, perioperative data, and functional and technical outcomes were compared between the techniques.

RESULTS: The study included a total of 786 patients; 556 patients underwent the non-EAR technique (group 1), and 230 underwent the modified EAR technique (group 2). The mean enucleated prostate weight in group 1 was 68.2±45.6 g compared to 93.3±51.9 g in group 2 ($p<0.001$). De novo SUI within a month of surgery was reported in 34 cases (6.1%) in group 1 compared to eight cases (3.5%) in group 2. The percentage of patients with persistent SUI at one year postoperatively dropped to 2.7% and 0.9% in the non-EAR and modified EAR groups, respectively. Moreover, persistent SUI after one year from surgery was reported in 1.4 % of the non-EAR group compared to 0.44% in the modified EAR group. Multivariate regression analysis demonstrated that age >70 years ($p=0.06$), operative time >90 minutes ($p=0.011$), and the non-EAR technique ($p=0.004$) were significantly associated with the onset of postoperative de novo SUI.

CONCLUSIONS: Our research indicates that both modified EAR and non-EAR techniques employed during HoLEP yield comparable efficacy and safety outcomes. Nonetheless, the modified EAR technique is associated with reduced postoperative de novo SUI.

INTRODUCTION

Holmium laser enucleation of the prostate (HoLEP) is a widely used, minimally invasive surgery for treating benign prostatic hyperplasia (BPH). It is recognized as a standard of care due to its high success rate, long-lasting outcomes, and minimal adverse events. HoLEP significantly improves urinary quality of life.[1]

Since its introduction in 1998, various technical variations and modifications have been described and adopted.[2,3] These ongoing modifications aim to optimize functional clinical outcomes, reduce operative time, enhance surgical efficiency, and minimize complications. In recent times, surgeons have focused on preserving the postoperative continence mechanism by prioritizing the protection of the external urinary sphincter during surgery, thus avoiding any direct injury or prolonged sphincteric traction. This protective technique is known as early apical release (EAR);[4,5] however, the integrity of postoperative continence depends on multiple factors related to the procedure and the patients.[6]

Our previously published, 18-year experience with the conventional non-EAR HoLEP technique revealed a transient postoperative de novo stress urinary incontinence (SUI) rate of 4.3% at one month and 0.8% after 12 months.[1] In 2017, we integrated the modified EAR technique into our HoLEP practice to minimize the impact on the external urethral sphincter; however, there is limited

evidence regarding the benefit and role of EAR in post-operative de novo SUI.

There is a lack of literature comparing EAR and non-EAR techniques, and this question remains insufficiently investigated. Consequently, this study aimed to evaluate both techniques regarding functional outcomes, notably de novo SUI rates, and to analyze the perioperative and technical outcomes conducted at a high-volume laser enucleation center.

METHODS

We retrospectively reviewed 786 patients who underwent HoLEP surgery for symptomatic BPH. Group 1 included 556 patients who underwent the non-EAR HoLEP technique (between January 2012 and February 2017), and group 2 consisted of 230 patients with the modified EAR HoLEP technique (between March 2017 and December 2021). All cases were performed at a single institution.

The patients' data were obtained from a database maintained prospectively at our center. Patients were evaluated preoperatively, one month, three months, six months, and 12 months postoperatively. An experienced surgeon performed all non-EAR HoLEP cases. In contrast, two other skilled HoLEP surgeons who had previously used the non-EAR technique conducted all the procedures in the modified EAR group. We excluded cases within the learning curve for both groups to minimize bias. To ensure a fair comparison, we collected the most recent cases from each cohort, which reflected the surgeons' established proficiency with their respective techniques.

Technically, the term EAR refers to releasing the prostatic apex from the striated external urinary sphincter during the initial steps of the surgery before beginning the prostatic enucleation. In contrast, non-EAR release refers to releasing the apex from the external sphincter at the end of the procedure after completing enucleation.

Demographic and perioperative data and functional outcomes of both techniques, including de novo SUI rates, uroflowmetry, the International Prostate Symptoms Score (IPSS), and the quality-of-life score (QoL), were collected and analyzed. De novo SUI was defined as any new episode of involuntary urinary leakage of any amount reported by the patient in the followup clinic.

We excluded all files with missing data for variables critical to our study and any cases involving a previous history of prostatic, urethral, or sphincter surgeries. Additionally, we excluded patients who underwent concomitant or adjunct procedures during HoLEP and those who had received Holmium laser ablation or incision of the prostate. Furthermore, we excluded all patients with pre-existing SUI (15 patients in the non-EAR group and four patients in the modified EAR group).

Surgical technique

The HoLEP operative steps were performed according to established techniques described by various authors.[1,7] HoLEP incorporates anatomical endoscopic dissection of the prostatic adenoma from the surgical capsule in a retrograde manner starting from the apex. We use a 120-Watt holmium laser generator (PulseTM P120H, Lumenis Inc.) connected to a 550 nm quartz end-firing fiber (SlimLineTM 550, Lumenis Inc.) through a modified continuous-flow 26 Fr resectoscope with a distal bridge and video system. Our standard settings for laser machine generator are 2.5 joules and 40 hertz (cutting mode, short pulse width) and 1.5 joules and 30 hertz (coagulation mode, long pulse width). We use an enucleation loop with a retracting beak and working element as a laser guide.

The procedures were performed under general or regional anesthesia, with warmed normal saline used as irrigation. We start with meatal calibration up to 30 Fr (Van Buren sounds). The choice between a one-lobe, two-lobe, or three-lobe technique was based on the prostate anatomy and whether a notable median lobe was present. The modified EAR technique involves making an initial traverse incision 1.5 cm proximal to the verumontanum and then extending the incision bilaterally to release the sphincteric mucosa to the 11 and one o'clock positions on each lobe. It is important to note that a complete 360-degree EAR was not considered in our practice to avoid any potential direct anterior sphincteric injury from the first incision; we believe doing so helps to localize the mucosal bridge at the end of the procedure visually to safely separate the bridge in an atraumatic fashion. The remaining surgical steps were performed without any modifications.[1] The enucleation time within the cohort was defined as the interval commencing with initiating the enucleation procedure (laser activation) and concluding with the complete separation of the adenoma.

Prostatic morcellation was carried out using either the DrillCut™ (Karl Storz Inc., Tuttlingen, Germany) or the Piranha (Richard Wolf, Knittlingen, Germany) instrument, introduced through a rigid indirect nephroscope with a 5 mm working channel and continuous double irrigation of the urinary bladder.

Table 1. Demographic and operative characteristics for the study groups

	Group 1: Non-early apical release HoLEP (m=556)	Group 2: Modified early apical release HoLEP (m=230)	p
Age, mean ± SD	71.1–7.98	76.6–9.16	<0.001
ASA index, m (%) 1 2 3 4	 444 (79.9%) 82 (14.7%) 30 (5.4%) 0	 11 (4.8%) 132 (57.4%) 81 (35.2%) 6 (2.6%)	0.002
Prostate medications, n (%) No treatment Alpha-blockers 5-alpha reductase inhibitors Combination	 56 (10.1%) 364 (65.5%) 16 (2.9%) 120 (21.6%)	 2 (0.9%) 73 (31.7%) 16 (6.9%) 139 (60.4%)	<0.001
Indications for surgery, n (%) Urinary retention LUTS Hematuria Renal insufficiency Prostate cancer-causing BOO	 186 (33.5%) 340 (61.2%) 3 (0.5%) 6 (1.1%) 21 (3.8%)	 145 (63%) 73 (31.7%) 6 (2.6%) 0 6 (2.6%)	<0.001
Preoperative catheter time (weeks), mean ± SD	3.44±7.56	18.53±21.68	<0.001
Preoperative prostate volume (g), mean ± SD	93.37±44.6	119.89±52	<0.001
Imaging modalities for preoperative prostate volume assessment, n (%) TRUS US pelvis MRI CT	 405 (72.8%) 99 (17.8%) 38(6.8%) 14 (2.5%)	 126 (54.8%) 38 (16.5%) 41 (17.8) 15 (10.9%)	<0.001
Prostate morphology, n (%) Obstructing median lobe/high bladder neck Bi-lobar Tri-lobar	 1 (0.2%) 542 (97.5%) 13 (2.3%)	 18 (7.8%) 87 (37.8%) 125 (54.3%)	<0.001
Enucleation time (minutes), mean ± SD	86.64±38	99.86±36.7	<0.001
Morcellation time (minutes), mean ± SD	16.84±13.75	28.5±21.2	<0.001
Operative time (minutes), mean ± SD	103.47±44.4	131.4±49.2	<0.001
Total energy (Joules), mean ± SD	184.59±83.1	160.6±71.7	<0.001
Prostate enucleated weight (g), mean ± SD	68.2±45.6	93.3±51.9	<0.001
Prostate dry specimen weight (g), mean ± SD	57.1±39	66.4±42	0.003
Catheter time (days), mean ± SD	1.23±1.4	1.39±1.1	0.119
Hospital stay (days), mean ± SD	1.23±1.23	1.2±0.65	0.331

ASA: American Society of Anesthesia; BOO: Bladder outlet obstruction; HoLEP: holmium laser enucleation of prostate; LUTS: lower urinary tract symptoms; PSA: prostate-specific antigen; SD: standard deviation.

Statistical analysis

We analyzed the data using the Statistical Package for Social Science (SPSS) software, version 29 (SPSS Inc., Chicago, IL, U.S.). Descriptive statistics encompassed percentages, frequencies, means, and medians. Categorical variables were compared between the two groups using the Fisher's exact test. In contrast, the Student's t-test or the Mann-Whitney U test was employed for normally and abnormally distributed continuous variables, respectively. Multivariate logistic regression analysis was performed to ascertain postoperative de novo SUI predictors. Statistical significance was defined as a two-tailed p-value of <0.05.

RESULTS

A total of 556 patients underwent HoLEP using the non-EAR technique (group 1), and 230 underwent the modified EAR (group 2). The mean age of patients was 71.1±7.98 years in group 1 and 76.6±9.16 years in group 2. The mean preoperative prostate volume measured by transrectal ultrasound (TRUS) in group 1 was 93.37±44.6 cc, compared to 119.89±52 cc in group 2 (p<0.001). Table 1 compares patient demographics and preoperative data between the study groups.

In group 1, the mean enucleated prostate weight was 68.2±45.6 gm, and the mean enucleation time was 86.64±38 minutes compared to 93.3±51.9 gm and 99.86±36.7 minutes, respectively, in group II (p< 0.001). Table 1 demonstrates the differences between the study groups regarding intraoperative parameters.

In group 1, intraoperative injuries to the urethral sphincter were reported in two cases (0.4%); injury to the bladder and urethra were encountered in 12/556 patients (2.2%) and were managed conservatively with prolonged urinary catheterization for one week. Eight patients (1.4%) in group 1 developed postoperative mild to moderate visible hematuria that was treated conservatively with continuous bladder irrigation, and another two patients (0.4%) had severe hematuria that required cystoscopy and hemostasis.

In comparison, one case (0.4%) in group 2 experienced postoperative gross hematuria that necessitated readmission to the hospital and required bladder irrigation and blood clot removal. Blood transfusion was needed in 5/556 patients (0.9%) in group 1 compared to 3/230 patients in group 2 (1.3%) (p=0.2) (Table 2).

The mean postoperative catheter duration and hospital stay were 1.23 and 1.2 days, respectively, in group 1, compared to 1.39 and 1.2 days in group 2 (p>0.05) (Table 2). In group 1, six patients (1.1%) failed an initial trial of void (TOV), and of these, five (83.3%) successfully voided one week later in the outpatient clinic. In contrast, four patients in group 2 (1.7%) failed initial TOV, and all voided after one week (Table 2).

At one-year followup, urethral stricture was reported in 16/556 patients in group 1 (2.9%) compared

to one patient in group 2 (0.4%) (p=0.317). Patients were treated with visual internal urethrotomy (Table 3). Bladder neck contracture was noted in 8/556 patients (1.4%) in group 1; these patients were effectively treated with laser incision of the bladder neck. There were no reported cases in group 2 (Table 2).

In the non-EAR group, de novo SUI within a month of surgery was reported in 34/556 cases (6.1%) compared to 8/230 cases (3.5%) in the modified EAR group (p=0.035); however, the percentage of patients with SUI present at the end of the first postoperative year dropped to 2.7% and 0.9% in the non-EAR and modified EAR groups, respectively. Moreover, persistent SUI one year from surgery was reported in 1.4% of patients in the non-EAR group compared to 0.44% in the modified EAR group (Table 2).

Notably, over 60% of patients who experienced de novo SUI after HoLEP improved within 30 days of surgery, and 78.6% improved within the first postoperative year. Table 3 illustrates the functional outcomes among the treatment groups.

Multivariate regression analysis demonstrated that age >70 years (p=0.06), operative time >90 minutes (p=0.011), and non-EAR technique (p=0.004) were significantly associated with postoperative de novo SUI (Table 4).

DISCUSSION

In the last 25 years, the development of Holmium:YAG laser technology has revolutionized the treatment of BPH, progressing from basic vaporization techniques to the complete enucleation of prostatic adenoma. The HoLEP procedure, when paired with mechanical morcellation, now allows for the effective treatment of larger glands while minimizing hospital stays, often serving as a replacement for open prostatectomy.[1]

HoLEP has demonstrated better improvements in prostate symptom scores and flow rates when compared to other BPH treatments, as supported by meta-analyses and randomized controlled trials (RCTs).[8,9] Although transient SUI occurs in 20–40% of HoLEP patients, this rate is similar to that of transurethral resection of prostate (TURP), which can reach up to 40%.[10-14] A recent study showed low rates of transient SUI, with 6.0% for enucleation, 3.0% for monopolar TURP, and 2.4% for bipolar TURP. The rates of persistent SUI are also similar across these procedures, showing 1.7% for both enucleation and monopolar TURP, and 1.0% for bipolar TURP. This suggests that the incidence of SUI is comparable between TURP and enucleation.[15]

Urinary incontinence (UI) is a frequent concern that can impact QoL following HoLEP surgery. Both SUI and urge urinary incontinence (UUI) may present in the early stages after the procedure, but usually improve with time. Hypothesized factors that can contribute to this issue include weakened pelvic floors in older patients, extended surgical duration due to a larger prostate, and possible overextension of the sphincter caused by scope manipulation. Furthermore, the removal of an adenoma close to the external sphincter may also play a role in post-HoLEP UI.[1,6]

Table 2. Comparison of perioperative complications and incidence of postoperative de novo stress urine incontinence between the study groups

	Modified Clavien grade	Group 1: Non-early apical release HoLEP (n=556)	Group 2: Modified early apical release HoLEP (n=230)	p
Intraoperative complications, n (%)				
Total		34 (6.1%)	6 (2.6%)	0.304
Bleeding	I	11 (2%)	3 (1.3%)	
Bladder injury	I	10 (1.8%)	0	
Urethral injury	I	2 (0.4%)	0	
Anesthesia complication	I	2 (0.4%)	0	
Capsular perforation	I	2 (0.4%)	0	
Urethral sphincter injury	IIIb	2 (0.4%)	0	
Blood transfusion	II	5 (0.9%)	3 (1.3%)	
Early postoperative complications, n (%)				
Total		19 (3.4%)	5 (2.2%)	0.6
Failed trial of void	II	6 (1.1%)	4 (1.7%)	
Hematuria requiring conservative	I	8 (1.4%)	1 (0.4%)	
Hematuria requiring hemostasis	IIIb	2 (0.4%)	0	
Dysuria requiring analgesia	II	1 (0.2%)	0	
Epididimo-orchitis	II	1 (0.2%)	0	
Thrombo-embolic event	II	1 (0.2)	0	
Post-HoLEP				
De novo stress urinary incontinence, n (%)	II			
First month		34 (6.1%)	8 (3.5%)	0.035
Within the first year		15 (2.7%)	2 (0.9%)	
Persistent after 1st year		8 (1.4%)	1 (0.4)	
Late postoperative complications, n (%)				
Total		56 (10.1%)	6 (2.6%)	0.066
Acute urinary retention	II	1 (0.2%)	0	
Chronic urinary retention on CSIC persistent LUTS (requiring cystoscopy)	II	1 (0.2%)	0	
	IIIa	8 (1.4%)	0	
LUTS (requiring medications)	II	1 (0.2%)	0	
Bladder neck contracture (BNI)	IIIb	8 (1.4%)	0	
Urethral stricture (VIU)	IIIb	16 (2.9%)	1 (0.4%)	
Hematuria (conservative)	II	1 (0.2%)	0	
Recurrent UTI	II	4 (0.7%)	0	
Bladder/urethral stone	IIIb	4 (0.7%)	0	
Persistent urgency	II	9 (1.6%)	3 (1.3%)	
Total urinary incontinence	II	3 (0.5%)	1 (0.4%)	

BNI: bladder neck incision; CSIC: clean sterile intermittent catheterization; HoLEP: holmium laser enucleation of prostate; LUTS: lower urinary tract symptoms; UTI: urinary tract infection; VIU: visual internal urethrotomy.

Table 3. Comparison of post-HoLEP urinary function outcomes between the study groups

	Group 2: Non-early apical release HoLEP (n=556)	Group 2: Modified early apical release HoLEP (n=230)	Difference in differences, mean ± SD	p
IPSS				
Preoperative, mean ± SD	21.2±8	26.8±8	–	<0.001
After 1 month, mean ± SD	6.9±5.5	9.2±7.5	2.6±1.3	0.10
After 3 months, mean ± SD	5.1±4.9	7.2±4.9	5.3±1.5	0.001
After 6 months, mean ± SD	4.5± 4.5	9.3± 6.9	4.1±2.6	0.13
After 12 months, mean ± SD	4.59 ± 4.5	6.3 ± 4.8	7.2±1.8	<0.001
QoL				
Preoperative, mean ± SD	4.1±1.6	5.1±1.1	–	<0.001
After 1 month, mean ± SD	1.7±1.6	2.8±1.8	0.35±0.3	0.241
After 3 months, mean ± SD	1.3±1.3	2.3±4.6	0.03±0.4	0.942
After 6 months, mean ± SD	1.2±1.2	2.1±1.9	0.07±0.5	0.88
After 12 months, mean ± SD	1.3±1.3	2.3±4.6	0.76±0.4	0.06
Qmax				
Preoperative, mean ± SD	5.4±4.6	3.8±4.9	–	<0.001
After 1 month, Mean ± SD	22.7±10.6	18.5±10.3	2.4±0.9	0.006
After 3 months, mean ± SD	22.9±10.9	16.9±10.9	3.9±1.5	0.010
After 6 months, mean ± SD	23.7±11.5	20.7±11.8	1.7±1.8	0.35
After 12 months, mean ± SD	23.99± 11.5	18.9±11.2	4.1±1.7	0.016
PVR				
Preoperative, mean ± SD	309.7±332	353±300	–	0.088
After 1 month, mean ± SD	42.9±57	37.3±47.2	48.3±24.4	0.042
After 3 months, mean ± SD	30±44.8	30.1±49.6	75.3±41	0.031
After 6 months, mean ±SD	29.1± 60	28.1±31.6	33.9±42.7	0.410
After 12 months, mean ± SD	27±57	34.2 ± 73.6	14.7±44.9	0.732

HoLEP: holmium laser enucleation of prostate; IPSS: International Prostate Symptom Score; PVR; postvoid residual; QoL; quality of life; Qmax: maximum urine flow; SD: standard deviation.

The HoLEP method focuses on locating the surgical capsule and executing retrograde enucleation along a specific plane. The procedure begins with incisions in the prostate at the five and seven o'clock positions, starting with the enucleation of the middle lobe, followed by the lateral lobes. Gilling et al first presented the three-lobe HoLEP technique, which has been further improved by numerous surgeons.[16-19]

The "en bloc" technique, developed by Scoffone and Cracco,[20] uses a holmium laser to make a single incision for the enucleation of adenomas in one piece, resulting in a horseshoe-shaped incision. This method includes a full mucosal incision at the apex of the prostate, with the goal of preserving the sphincter and possibly enhancing postoperative continence.

The en bloc technique provides better visualization and capsule recognition than the three-lobe approach, thanks to less bleeding and effective irrigation.[4] It facilitates early release, enhances sphincter preservation, and offers a more manageable learning curve, which contributes to improved urinary flow and overall QoL. By concentrating on the "white line" of dissection, this technique helps minimize the risk of postoperative SUI by limiting sphincter stretching. On the other hand, the traditional three-lobe method may lead to sphincter stretching and temporary dysfunction. Additionally, factors such as prolonged catheterization or hypoactive sphincters in patients with larger prostates can also contribute to post-surgical UI.

The en bloc technique with EAR effectively addresses issues by preserving the mucosa of the sphincter and clearly defining the "white line" to prevent stretching. The sphincter is completely detached from the apex of the adenoma, which minimizes damage during the movement of the scope. A gradual antero-lateral release of the adenoma helps avoid splitting the sphincter, in contrast to the traditional 12 o'clock incision. This method provides better visibility, efficient irrigation, and a smooth flow within a defined area, enhancing dissection and recognition of the adenoma. Additionally, it maintains controlled irrigation between the adenoma and its capsule.

The EAR en bloc enucleation technique, created by Dr. Gómez-Sancha, is a reliable method for treating BPH that maintains urinary continence by safeguarding the external urinary sphincter during the dissection process.[4,5] Research, including the present study, indicates that the EAR technique significantly lowers the incidence of postoperative de novo SUI, with results that are both clinically and statistically significant.

Before the introduction of the EAR technique, several approaches were used to alleviate symptoms of SUI. Gong et al modified the holmium laser enucleation method, leading to only 1.58% of patients experiencing temporary SUI, which resolved within three months.[21] Minagawa et al managed to lower the risk of postoperative SUI to 3% by combining anteroposterior dissection with enucleation, effectively removing the adenoma en bloc and avoiding median lobe enucleation.[22] Endo et al suggested the anteroposterior HoLEP technique, which begins at the bladder neck and resulted in a 2.7% SUI rate, significantly lower than the traditional method (25%, $p<0.05$);[23] however, this technique poses challenges when dealing with large-volume adenomas.

Several studies on non-EAR HoLEP techniques have reported different outcomes related to UI. Montorsi et al found that 44% of patients experienced UUI at one month post-surgery.[14] Nam et al noted a 16.6% rate of postoperative UI, with nearly all cases resolving by the 12-month mark; identified risk factors included age over 65 and an operative time exceeding 65 minutes.[24] Ibrahim et al reported a transient SUI rate of 3.1% and

a persistent SUI rate of 0.8% within the first 30 days.[1] Vavassori et al observed a decrease in transient SUI from 7.3% to 0.6% over a 36-month period,[25] while Cho et al found a 16.2% incidence of de novo UI, most of which resolved within six months.[26] The risk factors highlighted included age, prostate volume, and operative time.

In a large HoLEP series, Krambeck et al found that 12.8% of patients experienced UI immediately after surgery, which decreased to 4.5% at the three-month mark.[17] By the time of the final followup, only 0.8% had SUI and 0.6% had UUI. The rates of SUI at various intervals were 12.5% in the short-term, 3.4% in the intermediate-term, 1.8% in the long-term, and 4.8% for those over five years. For UUI, the rates were 11.5%, 3.1%, 1.5%, and 2.2%, respectively. Notably, <2% of patients experienced persistent UUI or SUI after one year.

Sapetti et al (non-EAR) found that 42.7% of patients experienced UI one month after surgery, with the majority being SUI at 86.1%. At the six-month mark, the rate of UI dropped to 32.7%.[6] They associated the use of laser energy during the procedure with SUI at one month, although they acknowledged the challenge in pinpointing its precise impact. The learning curve and the presence of large adenomas (>90 cc) were factors that led to increased UI rates. They recommended that HoLEP be initiated with smaller adenomas as a preferable option to TURP for improved results.

Shigemura et al observed that novice surgeons performing non-EAR HoLEP cases had higher rates of UI post-operation and at one, three, and six months (39.5%, 29.4%, 16.8%, 5.04%, respectively) compared to expert surgeons (39.3%, 38.1%, 13.1%, 4.76%, respectively).[27] The presence of mentorship significantly lowered the risk of UI (odds ratio [OR] 0.358, p=0.026). Additionally, Soto-Mesa et al noted that beginners had longer enucleation times (111.10±74.50 min vs. 65.98±29.65 min, p<0.01) and reported higher UI rates at six months in their initial 50 cases (18% vs. 12%).[28]

Minagawa et al reported that the rates of SUI were 12.7% at one month and 5.5% at three months after surgery using a 30W laser.[29] Although it was suggested that energy diffusion might impact the sphincter, the pulsed characteristics of Holmium make this less probable. A more likely explanation is the traction on the sphincter caused by the urethral mucosa at the apex of the adenoma in non-EAR techniques.

The incidence of SUI following EAR HoLEP is low, with Saitta et al reporting rates of 5.8%, 1.5%, and 0.7% at one, three, and six months, respectively.[4] Socarrás et al observed a 2.5% SUI rate in the EAR group compared to 5.1% in the non-EAR HoLEP group, with no cases of incontinence reported in the EAR group after three months.[30]

Table 4. Univariable and multivariable subgroup analysis of patients with postoperative de novo stress urinary incontinence

	Univariable OR (95% CI), p	Multivariable OR (95% CI), p
Age (<70 vs. ≥70)	0.743 (0.066–0.320), 0.002	0.033 (0.518–0.119), 0.06
Preoperative		
ASA index	0.001 (0.000–0.005), 0.865	
IPSS	0.035 (0.000–0.015), 0.797	
QoL	0.001 (0.000–0.000), 0.979	
Catheter time	0.064 (0.000–0.038), 0.317	
PVR	0.455 (0.000–0.000), 0.990	
PSA	0.499 (0.000–0.086), 0.602	
Qmax	0.166 (0.000–0.069), 0.180	
TRUS (<90 vs. ≥90 ml)	0.000 (0.000–0.006), 0.802	
Enucleated prostate weight	0.178 (0.000–0.013), 0.933	0.022 (0.013–0.099), 0.011
Operative time (<90 vs. ≥90 minutes)	0.006 (0.000–0.021), 0.035	
Enucleation time	0.148 (0.000–0.010), 0.941	0.024 (0.117–0.022), 0.004
Enucleation technique (early vs. non-early apical release)	0.006 (0.000–0.021), 0.037	
Postoperative catheter days	0.024 (0.000–0.032), 0.119	

ASA: American Society of Anesthesia; CI: confidence interval; IPSS: International Prostate Symptom Score; OR: odds ratio. symptom score; PSA: prostate-specific antigen; PVR: postvoid residual; QoL: quality of life. Qmax; maximum urine flow; TRUS: transrectal ultrasound.

This retrospective study at a single center focused on the modified EAR HoLEP technique. The findings indicate that the EAR group exhibited a higher incidence of preoperative urinary retention, larger prostate volumes, and longer operative times in comparison to the non-EAR group. Notwithstanding these adverse factors, the modified EAR technique demonstrated a significantly lower de novo SUI incidence. This finding underscores the potential benefits of the EAR technique in reducing the risk of postoperative SUI, even among patients with baseline characteristics that are commonly associated with an increased likelihood of incontinence.

Limitations

Our study's limitations include its retrospective design, unequal distribution of the study groups, and different surgeon experience (where experienced surgeon performed all non-EAR HoLEP cases and two other skilled HoLEP surgeons conducted all the procedures in the modified EAR group). Furthermore, we lacked data from the International Index of Erectile Function

and did not use a pad test to quantify SUI. We did not include patients with UUI, as this outcome is not related to surgical technique.

CONCLUSIONS

Both modified EAR and non-EAR HoLEP techniques demonstrate similar effectiveness and safety, but EAR notably decreases the occurrence of postoperative de novo SUI.

COMPETING INTERESTS: Dr. Carrier has participated in advisory boards for Acerus; has been a speakers' bureau member for MD briefcase; has received grants and/or honoraria from Boston Scientific, Coloplast, and Tersera; and has participated in clinical trials supported by Urotronic. Dr. Aubé-Peterkin has received honoraria from AMT Surgical and Laborie. The remaining authors do not report any competing personal or financial interests related to this work.

REFERENCES

1. Ibrahim A, Alharbi M, Elhilali MM, et al. 18 years of holmium laser enucleation of the prostate: A single center experience. *J Urol* 2019;202:795-800. https://doi.org/10.1097/JU.0000000000000280
2. Parsons JK, Dahm P, Köhler TS, et al. Surgical management of lower urinary tract symptoms attributed to benign prostatic hyperplasia: AUA guideline amendment 2020. *J Urol* 2020;204:799-804. https://doi.org/10.1097/JU.0000000000001298
3. Rivera ME, Lingeman JE, Krambeck AE. Holmium laser enucleation of the prostate. *J Endourol* 2018;32(S1):S7-9. https://doi.org/10.1089/end.2017.0710
4. Saitta G, Becerra JEA, Del Álamo JF, et al. 'En bloc' HoLEP with early apical release in men with benign prostatic hyperplasia. *World J Urol* 2019;37:2451-8. https://doi.org/10.1007/s00345-019-02671-4
5. Rodríguez Socarrás M, Fernández Del Álamo J, Gómez Rivas J, et al. MoLEP (MOSES HoLEP) en bloque avec libération apicale précoce et préservation de la muqueuse sphinctérienne. *Arch Esp Urol* 2020;73:689-98.
6. Sapetti J, Sakat J, Saad E, et al. Incontinence urinaire après énucléation endoscopique de la prostate au laser Holmium: Fréquence, évolution, et facteurs prédictifs de survenue. *Prog Urol* 2019;29:101-7. https://doi.org/10.1016/j.purol.2018.12.008
7. Kuo RL, Paterson RF, Kim SC, et al. Holmium laser enucleation of the prostate (HoLEP): A technical update. *World J Surg Oncol* 2003;1:6. https://doi.org/10.1186/1477-7819-1-6
8. Kuntz RM, Ahyai S, Lehrich K, *et al.* Transurethral holmium laser enucleation of the prostate versus transurethral electrocautery resection of the prostate: A randomized prospective trial in 200 patients. *J Urol* 2004;172:1012-6. https://doi.org/10.1097/01.ju.0000136218.11998.9e
9. Yin L, Teng J, Huang CJ, et al. Holmium laser enucleation of the prostate versus transurethral resection of the prostate: A systematic review and meta-analysis of randomized controlled trials. *J Endourol* 2013;27:604-11. https://doi.org/10.1089/end.2012.0505
10. Mayer EK, Kroeze SGC, Chopra S, et al. Examining the 'gold standard': A comparative critical analysis of three consecutive decades of monopolar transurethral resection of the prostate (TURP) outcomes. *BJU Int* 2012;110:1595-601. https://doi.org/10.1111/j.1464-410X.2012.11119.x
11. Rassweiler J, Teber D, Kuntz R, et al. Complications of transurethral resection of the prostate (TURP): Incidence, management, and prevention. *Eur Urol* 2006;50:969-79. https://doi.org/10.1016/j.eururo.2005.12.042
12. Cornu JN, Ahyai S, Bachmann A, et al. A systematic review and meta-analysis of functional outcomes and complications following transurethral procedures for lower urinary tract symptoms resulting from benign prostatic obstruction: An update. *Eur Urol* 2015;67:1066-96. https://doi.org/10.1016/j.eururo.2014.06.017
13. Reich O, Gratzke C, Bachmann A, et al. Morbidity, mortality and early outcome of transurethral resection of the prostate: A prospective multicenter evaluation of 10,654 patients. *J Urol* 2008;180:246-9. https://doi.org/10.1016/j.juro.2008.03.058
14. Montorsi F, Naspro R, Salonia A, et al. Holmium laser enucleation versus transurethral resection of the prostate: Results from a 2-center, prospective, randomized trial in patients with obstructive benign prostatic hyperplasia. *J Urol* 2004;172:1926-9. https://doi.org/10.1097/01.ju.0000140501.68841.a1
15. Castellani D, Rubilotta E, Fabiani A, et al. Correlation between transurethral interventions and their influence on type and duration of postoperative urinary incontinence: Results from a systematic review and meta-analysis of comparative studies. *J Endourol* 2022;36:1331-47. https://doi.org/10.1089/end.2022.0222
16. Kelly DC, Das A. Holmium laser enucleation of the prostate technique for benign prostatic hyperplasia. *Can J Urol* 2012;19:6131-4.
17. Krambeck AE, Handa SE, Lingeman JE. Experience with more than 1,000 holmium laser prostate enucleations for benign prostatic hyperplasia. *J Urol* 2010;183:1105-9. https://doi.org/10.1016/j.juro.2009.11.034
18. Baazeem AS, Elmansy HM, Elhilali MM. Holmium laser enucleation of the prostate: Modified technical aspects. *BJU Int* 2010;105:584-5. https://doi.org/10.1111/j.1464-410X.2009.09111.x
19. Gilling PJ, Cass CB, Malcolm AR, et al. Combination holmium and Nd:YAG laser ablation of the prostate: Initial clinical experience. *J Endourol* 1995;9:151-3. https://doi.org/10.1089/end.1995.9.151
20. Scoffone CM, Cracco CM. The en-bloc no-touch holmium laser enucleation of the prostate (HoLEP) technique. *World J Urol* 2016;34:1175-81. https://doi.org/10.1007/s00345-015-1741-y
21. Gong YG, He DL, Wang MZ, et al. Holmium laser enucleation of the prostate: A modified enucleation technique and initial results. *J Urol* 2012;187:1336-40. https://doi.org/10.1016/j.juro.2011.11.093
22. Minagawa S, Okada S, Sakamoto H, et al. En-bloc technique with anteroposterior dissection holmium laser enucleation of the prostate allows a short operative time and acceptable outcomes. *Urology* 2015;86:628-33. https://doi.org/10.1016/j.urology.2015.06.009
23. Endo F, Shiga Y, Minagawa S, et al. Anteroposterior dissection HoLEP: A modification to prevent transient stress urinary incontinence. *Urology* 2010;76:1451-5. https://doi.org/10.1016/j.urology.2010.03.071
24. Nam JK, Kim HW, Lee DH, et al. Risk factors for transient urinary incontinence after holmium laser enucleation of the prostate. *World J Mens Health* 2015;33:88. https://doi.org/10.5534/wjmh.2015.33.2.88
25. Vavassori I, Valenti S, Naspro R, et al. Three-year outcome following holmium laser enucleation of the prostate combined with mechanical morcellation in 330 consecutive patients. *Eur Urol* 2008;53:599-606. https://doi.org/10.1016/j.eururo.2007.10.059
26. Cho MC, Park JH, Jeong MS, et al. Predictor of de novo urinary incontinence following holmium laser enucleation of the prostate. *Neurourol Urodyn* 2011;30:1343-9. https://doi.org/10.1002/nau.21050
27. Shigemura K, Tanaka K, Yamamichi F, et al. Comparison of predictive factors for postoperative incontinence of holmium laser enucleation of the prostate by the surgeons' experience during learning curve. *Int Neurourol J* 2006;20:59-68. https://doi.org/10.5213/inj.1630396.198
28. Soto-Mesa D, Amorín-Díaz M, Pérez-Arviza L, et al. Enucleación prostática con láser holmio y adenomectomía prostática retropúbica: Análisis de morbilidad y consideraciones anestésicas. *Actas Urol Esp* 2015;39:535-45. https://doi.org/10.1016/j.acuro.2015.03.005
29. Minagawa S, Okada S, Morikawa H. Safety and effectiveness of holmium laser enucleation of the prostate using a low-power laser. *Urology* 2017;110:51-5. https://doi.org/10.1016/j.urology.2017.08.034
30. Socarrás MR, del Álamo JF, Espósito F, et al. En bloc enucleation with early apical release technique using MOSES (En Bloc MoLEP) vs. classic En Bloc HoLEP: A single arm study comparing intra- and postoperative outcomes. *World J Urol* 2022;41:159-65. https://doi.org/10.1007/s00345-022-04205-x

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