Implementing HoLEP without fellowship training

A stepwise learning curve from a single surgeon's first 200 cases

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INTRODUCTION

Holmium laser enucleation of the prostate (HoLEP) is increasingly recognized as a size-independent, durable treatment for benign prostatic hyperplasia (BPH). Nearly 25% of patients have large (>80 g) prostates that would not be effectively managed by other emerging interventions;[1,2] however, adoption of HoLEP remains limited, due in large part to its perceived steep learning curve.[3] While fellowship training in endourology is one proposed pathway to safely acquiring HoLEP proficiency, there is a growing desire to characterize the learning process for those who do not plan to undertake fellowship training. Limited data are available to guide expectations for non-fellowship-trained surgeons who wish to incorporate HoLEP into their practice.

In this research letter, we describe the implementation of a HoLEP program by a single, non-fellowship-trained urologist at an academic center. We highlight the development of our institution's HoLEP program and learning curve across the surgeon's first 200 consecutive cases. Our goal is to provide a practical roadmap for established surgeons looking to safely and effectively incorporate HoLEP into their practice without formal fellowship training.

METHODS

Program development

To prepare, the surgeon conducted an extensive literature review to better understand indications, benefits, risks, and alternatives. He complemented this with over 20 hours of viewing publicly available surgical atlas videos on YouTube, carefully studying each procedural step and documenting common pitfalls. Recognizing the importance of technology in HoLEP, the surgeon consulted with industry experts to understand the clinical and logistical considerations for implementing the MOSES 2.0 laser platform (Boston Scientific Inc, Marlborough, MA, U.S.). He identified a regional care gap for patients with >80 g prostates eligible for transurethral resection of the prostate (TURP) and secured institutional support to establish a HoLEP program at our academic center.

To gain hands-on exposure, the surgeon arranged visits to three high-volume HoLEP centers, where he observed six live cases. He then assembled a dedicated surgical team and led team training sessions to ensure familiarity with equipment and procedural flow.

Before performing his first live case, he conducted dry-run simulations to identify workflow inefficiencies, plan equipment layout in the room, and improve team cohesion. The surgeon performed his first HoLEP cases in April 2019, with industry-supported proctoring from experienced HoLEP surgeons for his initial five cases. He recorded all his cases and carefully reviewed them to identify areas of strength and improvement for subsequent cases.

Patient selection

While there was no explicit size cutoff, our surgeon aimed to select individuals with prostate volumes of 60–100 g to minimize anatomical complexity while allowing for meaningful enucleation. Each patient was counseled about the surgeon's experience level and informed of the potential need to convert to TURP if technical challenges arose. Every operating room (OR) was fully equipped for a conversion to a TURP if necessary.

Special attention was paid to the identification and preservation of key anatomical landmarks, particularly during apical dissection and morcellation. The Wolf Piranha prostate morcellator with a 26 Fr laser resectoscope was used for all procedures. The type of HoLEP performed was either a standard multi-incisional technique or an en bloc enucleation with early apical release. While the standard technique was

KEY MESSAGES

- The adoption HoLEP for BPH remains limited due to its perceived steep learning curve, especially among non-fellowship-trained urologists.
- We demonstrate a structured, self-directed training model to enable safe and effective HoLEP implementation by a single, non-fellowship-trained surgeon.
- Progressive improvements in operative efficiency and complication rates were observed across 200 cases. These findings provide a practical roadmap for HoLEP adoption outside of formal fellowship training for urologists.

used early in the surgeon's learning curve, there was a deliberate transition toward the en bloc method, which involves early apical release and circumferential enucleation of the prostatic adenoma while maintaining a single plane, allowing for continuous dissection without frequent repositioning or re-identification of anatomical landmarks.

Every patient was counseled on how to perform Kegel exercises at their preoperative visit, with reinforcement included in their postoperative discharge instructions. If there was an ongoing concern for stress urinary incontinence (SUI) that would benefit from additional intervention at the one-month postoperative visit, patients were referred for pelvic floor physical therapy or evaluated for further surgical management.

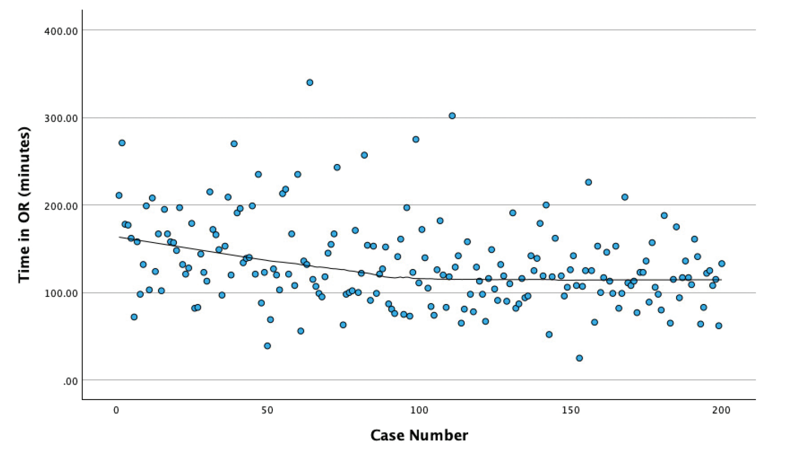

Figure 1. LOESS-smoothed trend of operative time over the first 200 holmium enucleation of the prostate (HoLEP) cases. *Each dot equals one case.

Study design and statistical analysis

From April 2019 to May 2021, a total of 200 consecutive HoLEP procedures were performed by our surgeon. Patient demographics, operative characteristics, and postoperative outcomes were prospectively collected and maintained in an institutional review board-approved database (IRB protocol no. 20000296). Cases were divided into five equal case quintiles based on chronological order.

The primary outcomes of interest included operative time, operative efficiency (grams of tissue removed per minute of total OR time), laser energy efficiency (grams removed per kJ), urinary incontinence (≥ 1 pad used per day) at three, six, and 12 months, pads/day at one month and 3–6 months, duration of Foley catheter, duration of hospital stay, and postvoid residual (PVR) at 3–6 months.

Secondary outcomes included prostate volume, the incidence of Clavien-Dindo grade II or higher complications, American Urological Association Symptom Score (AUA-SS), and quality of life (QoL) scores at one month and 3–6 months.

All statistical tests were two-tailed, and a p-value <0.05 was considered statistically significant. Analyses were performed using IBM SPSS Statistics, version 27.0 (IBM Corp., Armonk, NY, U.S.) and R version 4.3.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Over the first 200 cases, operative time decreased from 155.8 to 117.2 minutes (25% reduction) (p<0.001) and operative efficiency improved from 0.37 to 0.66 g/min (p-trend<0.001) (Figure 1). Laser energy efficiency also increased over time (p<0.001). Based on plateauing measures of efficiency, proficiency appeared to be reached between 80–120 cases.

Although three-month incontinence rates fluctuated without a clear trend (p=0.410), six-month incontinence rates declined significantly from 15% in the first quintile to 2.5% in quintiles two and four (p=0.018), suggesting improved apical dissection technique. Twelve-month incontinence rates fluctuated slightly but decreased to 5% in the final two quartiles (p=0.144). Mean prostate volume increased modestly over the case series, and the rate of Clavien-Dindo grade ≥II complications remained low and stable across quintiles (p=0.89). The largest prostate volume recorded for the first 200 cases was 238 mL.

Table 1. Learning curve metrics by case quintile

Metric	1–40	41–80	81–120	121–160	161–200	p
Operative time (min)	155.77 (46.88)	139.41 (59.97)	129.37 (54.27)	118.00 (39.25)	117.15 (32.80)	<0.001
Operative efficiency (pathology grams/total OR time)	0.37 (0.19)	0.42 (0.17)	0.53 (0.31)	0.55 (0.28)	0.66 (0.20)	<0.001
Laser energy efficiency (g/kJ)	0.26 (0.14)	0.32 (0.31)	0.46 (0.82)	0.30 (0.14)	0.33 (0.09)	<0.001
Mean prostate volume (mL)	94.46 (40.33)	84.81 (49.37)	102.73 (56.46)	94.81 (47.25)	109.47 (50.96)	0.175
Protruding median lobe	28 (70.0%)	29 (72.5%)	26 (65.0%)	32 (80.0%)	30 (75.0%)	0.727
3-month incontinence	8 (20%)	7 (17.5%)	9 (22.5%)	3 (7.5%)	8 (20%)	0.410
6-month incontinence	6 (15%)	1 (2.5%)	7 (17.5%)	1 (2.5%)	5 (12.5%)	0.018
12-month incontinence	5 (12.5%)	1 (2.5%)	4 (10.0%)	2 (5.0%)	2 (5.0%)	0.144
Pads/day (1 mo)	1.91 (2.54)	1.00 (1.36)	1.85 (2.51)	1.38 (2.13)	1.65 (2.97)	0.590
Pads/day (3–6 mo)	0.94 (1.31)	0.80 (1.06)	1.17 (2.39)	1.03 (2.92)	0.72 (1.68)	0.322
Foley catheter time (days)	1.55 (1.41)	2.15 (2.76)	2.02 (2.19)	2.00 (1.05)	1.85 (0.58)	<0.001
Hospital stay (days)	1.00 (0.45)	0.90 (0.59)	0.78 (1.07)	0.33 (0.57)	0.28 (0.45)	<0.001
PVR (3–6 mo)	26.43 (39.02)	31.00 (40.23)	101.61 (143.33)	26.85 (62.41)	17.90 (57.54)	<0.001
Clavien-Dindo grade complication ≥II	6 (15%)	5 (12.5%)	7 (17.5%)	4 (10%)	6 (15%)	0.89
AUA symptom score (1 mo)	13.60 (9.84)	6.55 (8.39)	7.00 (3.61)	9.73 (8.61)	7.47 (6.56)	0.355
Quality of life score (1 mo)	2.33 (1.97)	1.42 (2.11)	1.62 (2.07)	1.67 (1.76)	1.35 (1.46)	0.827
AUA score (3–6 mo)	6.50 (7.04)	5.24 (4.87)	7.07 (4.76)	4.67 (5.47)	3.92 (4.66)	0.192
Quality of life score (3–6 mo)	1.56 (1.95)	1.25 (1.21)	1.71 (1.44)	2.00 (2.00)	2.50 (6.22)	0.643

AUA: American Urological Association; OR: operating room; PVR: postvoid residual.

The presence of a protruding median lobe fluctuated throughout the five quintiles, ranging from 65–80% (p=0.727). The number of pads per day also remained low and stable at one month and 3–6 months (p=0.590, 0.322, respectively). Foley catheter time exhibited some initial variation but ultimately trended down significantly to 1.85 days (p<0.001). Hospital stay significantly declined from 1.00 to 0.28 days (p<0.001). PVR at 3–6 months exhibited variation but also trended downward to 17.90 (p<0.001). AUA-SS (out of 35) decreased from 13.60 in quartile one to 7.47 in quartile five (p=0.355) at one month and 6.50 in quartile one to 3.92 in quartile five (p=0.192) at 3–6 months. QoL scores (out of 6) showed a modest decrease at one month but a modest increase at 3–6 months (p=0.827, p=0.643, respectively)

Two patients in our case series had to be converted to a TURP intraoperatively. Two patients required further surgical management of their SUI postoperatively; both received male urethral mesh slings. One patient received a transfusion of pRBC on postoperative day 1 for acute on chronic anemia.

Learning curve metrics by case quintile are shown in Table 1.

DISCUSSION

The perception that HoLEP is difficult to learn with a steep learning curve has been a key limitation restricting its wider adoption.[4,5] In this research letter, we present a structured, self-directed implementation of HoLEP by a non-fellowship-trained urologist, and demonstrated that, with deliberate preparation and institutional support, the learning curve can be safely navigated.

Over the first 200 cases, operative time decreased by 25% ,while operative efficiency nearly doubled, despite a progressive increase in prostate volume. A reduction in six-month and 12-month incontinence rates, particularly after case 80, further supports the growing technical refinement of apical dissection, which is widely considered one of the most challenging steps during the learning curve.[6]

Similar incontinence rates have been reported in other mini-fellowship studies and single-surgeon case series. A retrospective study of 1113 patients from five surgeons performing HoLEP found incontinence rates of 11–15% in early cases within a 3–6-month followup period.[7] Other studies have shown considerable variation in transient stress incontinence rates, ranging from 2–16% in the months following surgery, consistent with our findings.[8,9] In a single-surgeon case series of 589 patients, Das et al identified a significant association between transient SUI and laser-on time.[8] This supports our results, suggesting that improved efficiency with surgeon experience contributes to reduced incontinence rates.

Notably, a multicenter evaluation of HoLEP adoption in centers without formal training revealed significant challenges, with high rates of procedural failure or discontinuation across participating institutions.[10] Reported reasons for not meeting study endpoints included prolonged operative times, procedural stress, conversions to TURP, and protocol violations. The authors noted that the success criterion was an operative time of 90 minutes; however, a higher success rate would likely have been observed if 120 minutes had been used instead. Reported average operative times in the literature are highly variable, ranging anywhere from 50–175 minutes.[8,9,11]

In our study, the increasing use of en bloc enucleation over time may have contributed to the observed improvements along the learning curve. Compared to standard multi-incisional techniques, en bloc HoLEP allows for a single, continuous dissection plane, reducing the risk of creating false planes. This experience also underscores the value of modern endoscopic tools, such as the MOSES 2.0 holmium laser platform, which may facilitate safer and more efficient enucleation. This is supported by other studies, which demonstrate that improved surgical technique is associated with reduced enucleation time and enhanced operative efficiency.[11]

Furthermore, we postulate that a high initial case density is a key metric in managing the learning curve for this procedure. Our institution benefited from being an academic center with a high referral volume. Prior studies have shown that increased early case density is indeed associated with lower postoperative rates of urinary incontinence.[4,12] A higher volume of early cases likely facilitates better retention of procedural knowledge and technical skills, promoting more rapid improvement and efficient mastery of the surgical technique.[12] Overall Clavien Dindo ≥2 complications in our study decreased from 17.5% to 7.5% from quintiles 1–5, demonstrating patient outcome improvements throughout the learning curve. Other studies have noted Clavien Dindo ≥2 complications ranging from 10–25%, in line with our findings as well.[13,14]

Broader adoption of our roadmap for HoLEP proficiency is limited by the substantial upfront investment required to acquire the surgical equipment necessary for implementation, which may pose challenges for community-based practices. Additionally, operative efficiency was calculated using total OR time, which includes both enucleation and morcellation. The true increase in enucleation efficiency is likely significantly higher than reported, as morcellation times were generally consistent and dependent on prostate size. Nonetheless, the high procedural volume over a relatively short time frame enhances the internal validity of our learning curve analysis and reduces the influence of time-dependent confounders.

Newer technologies, such as Aquablation, are being explored as alternative surgical options to both TURP and laser enucleation procedures. Promising data from the WATER III trial suggest comparable success rates to HoLEP, with low rates of SUI and ejaculatory dysfunction.[15] While innovation aimed at improving patient outcomes is welcome, the WATER III trial focused on patients with prostate sizes between 80–180 mL. In contrast, a key advantage of HoLEP is its size-independent efficacy. Further studies directly comparing HoLEP and Aquablation outcomes for patients with very large prostates are required.

Furthermore, effectively assessing Aquablation will require comprehensive, long-term re-treatment data. HoLEP, by comparison, has a well-established and consistently low re-treatment rate, supporting its role as a highly effective and durable option for the management of BPH-related lower urinary tract symptoms.[16]

CONCLUSIONS

For practicing urologists considering HoLEP adoption outside of fellowship training, our single surgeon's experience can serve as a practical roadmap for safe and progressive implementation. Through a deliberate approach to preparation, team training, case selection, and technique evolution, proficiency can be achieved and sustained in a real-world setting.

COMPETING INTERESTS: Dr. Kellner has been a consultant for Boston Scientific. The remaining authors have no competing personal or financial interests to disclose.

This paper has been peer-reviewed.

REFERENCES

1. Li BH, Deng T, Huang Q, et al. Body mass index and risk of prostate volume, international prostate symptom score, maximum urinary flow rate, and postvoid residual in benign prostatic hyperplasia patients. *Am J Mens Health* 2019;13. https://doi.org/10.1177/1557988319870382
2. Sandhu JS, Bixler BR, Dahm P, et al. Management of lower urinary tract symptoms attributed to benign prostatic hyperplasia (BPH): AUA guideline amendment 2023. *J Urol* 2024;211:11-9. https://doi.org/10.1097/JU.0000000000003698
3. Abdelaziz A, Bhandari M, Elshabrawy A, et al. Contemporary trends of holmium laser enucleation of the prostate utilization in the United States: A comprehensive analysis using the national surgical quality improvement program database (2011-2020). *J Endourol* 2024;38:521-8. https://doi.org/10.1089/end.2023.0612
4. Kampantais S, Dimopoulos P, Tasleem A, et al. Assessing the learning curve of holmiuml laser enucleation of prostate (HoLEP). A systematic review. *Urology* 2018;120:9-22. https://doi.org/10.1016/j.urology.2018.06.012
5. Elzayat EA, Elhilali MM. Holmium laser enucleation of the prostate (HoLEP): Long-term results, reoperation rate, and possible impact of the learning curve. *Eur Urol* 2007;52:1465-71. https://doi.org/10.1016/j.eururo.2007.04.074
6. Chavali JSS, Rivera ME, Lingeman JE. HoLEP Learning curve-resident perspective: Survey of senior residents from high-volume tertiary center. *J Endourol* 2024;38:977-81. https://doi.org/10.1089/end.2024.0054
7. Shigemura K, Yamamichi F, Kitagawa K, et al. Does surgeon experience affect operative time, adverse events and continence outcomes in holmium laser enucleation of the prostate? A review of more than 1000 cases. *J Urol* 2017;198:663-70. https://doi.org/10.1016/j.juro.2017.04.087
8. Das AK, Teplitsky S, Chandrasekar T, et al. Stress urinary incontinence post-holmium laser enucleation of the prostate: A single-surgeon experience. *Int Braz J Urol* 2020;46:624-31. https://doi.org/10.1590/s1677-5538.ibju.2019.0411
9. Seki N, Mochida O, Kinukawa N, et al. Holmium laser enucleation for prostatic adenoma: Analysis of learning curve over the course of 70 consecutive cases. *J Urol* 2003;170:1847-50. https://doi.org/10.1097/01.ju.0000092035.16351.9d
10. Robert G, Cornu JN, Fourmarier M, et al. Multicentre prospective evaluation of the learning curve of holmium laser enucleation of the prostate (HoLEP). *BJU Int* 2016;117:495-9. https://doi.org/10.1111/bju.13124
11. Wenk MJ, Hartung FO, Egen L, et al. The long-term learning curve of holmium laser enucleation of the prostate (HoLEP) in the en-bloc technique: A single surgeon series of 500 consecutive cases. *World J Urol* 2024;42:436. https://doi.org/10.1007/s00345-024-05097-9
12. Sie M, Saussine C, Munier P, et al. Analyzing the learning curve of prostate enucleation with the Holmium laser: A retrospective, single-center experience. *Progres En Urol J* 2023;33:79-87. https://doi.org/10.1016/j.purol.2022.06.002
13. Schmidt J, Krediet J, Beutel H, et al. Comparison of perioperative outcomes of holmium laser enucleation of the prostate for standard (≤149 ml) vs. very large (≥150 ml) prostate glands: Retrospective analysis of a propensity score matched cohort of 326 patients. *Eur Urol Open Sci* 2025;71:15-21. https://doi.org/10.1016/j.euros.2024.10.019
14. Pan T ting, Li SQ, Dai Y, et al. Observation of complications assessed by Clavien-Dindo classification in different endoscopic procedures of benign prostatic hyperplasia: An observational study. *Medicine* 2023;102:e32691. https://doi.org/10.1097/MD.0000000000032691
15. Globenewswire.com. WATER III randomized controlled trial results announced at European Association of Urology comparing Aquablation® therapy to laser enucleation. [Updated 2025 Mar 24] Available at: https://www.globenewswire.com/news-release/2025/03/24/3047778/0/en/WATER-III-Randomized-Controlled-Trial-Results-Announced-at-European-Association-of-Urology-Comparing-Aquablation-Therapy-to-Laser-Enucleation.html (accessed Aug. 8, 2025)
16. Ahyai SA, Lehrich K, Kuntz RM. Holmium laser enucleation vs. transurethral resection of the prostate: 3-year followup results of a randomized clinical trial. *Eur Urol* 2007;52:1456-63. https://doi.org/10.1016/j.eururo.2007.04.053

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