

COMPARISON OF PERIOPERATIVE OUTCOMES BETWEEN HOLMIUM LASER ENUCLEATION OF THE PROSTATE AND ROBOTIC ASSISTED SIMPLE PROSTATECTOMY

Mimi W. Zhang¹, Marawan M. El Tayeb², Michael S. Borofsky³, Casey A. Dauw⁴,
Kristofer R. Wagner², Patrick S. Lowry², Erin T. Bird², Tillman C. Hudson², James E. Lingeman¹

¹Indiana University School of Medicine, Department of Urology, Indianapolis, IN

²Baylor Scott and White Health, Temple, TX

³University of Minnesota, Minneapolis, MN

⁴University of Michigan, Ann Arbor, MI

Address all correspondence to:

James E. Lingeman, M.D., FACS
Indiana University School of Medicine
1801 North Senate Blvd., Suite 220
Indianapolis, IN 46202
Tel: 317/962-2485
Fax: 317/962-2893
Email: jlingeman@iuhealth.org

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Abstract

Objectives: To compare perioperative outcomes for patients undergoing holmium laser enucleation of the prostate (HoLEP) and robotic assisted simple prostatectomy (RSP) for benign prostatic hypertrophy (BPH).

Methods: Patient demographics and perioperative outcomes were compared between 600 patients undergoing HoLEP and 32 patients undergoing RSP at two separate academic institutions between 2008 and 2015.

Results: Patients undergoing HoLEP and RSP had comparable ages (71 vs. 71, $p=0.96$) and baseline AUA symptom scores (20 vs. 24, $p=0.21$). There was no difference in mean specimen weight (96 vs. 110 g, $p=0.15$). Mean operative time was reduced in the HoLEP cohort (103 vs. 274 minutes, $p<0.001$). Patients undergoing HoLEP had lesser decreases in hemoglobin, decreased transfusions rates, shorter hospital stays, and decreased mean duration of catheterization. There was no difference in the rate of complications Clavien grade 3 or greater ($p=0.33$).

Conclusions: HoLEP and RSP are both efficacious treatments for large gland BPH. In expert hands, HoLEP appears to have a favorable perioperative profile. Further studies are necessary to compare long-term efficacy, cost, and learning curve influences, especially as minimally invasive approaches become more widespread.

Introduction

Benign prostatic hyperplasia (BPH) is a common diagnosis that has increasing prevalence with age affecting 70% of men 60-69 and 80% of men >70.¹ It is a chronic and progressive condition that accounts for \$4 billion of medical expenditure annually in the United States² with expected increases concomitant with the aging population. Individuals over 65 are the fastest growing segment of the United States population with an estimated 53.2% growth by 2020.³

For patients with urinary retention, bladder stones, azotemia, recurrent infection, hematuria, or worsening lower urinary tract symptoms refractory to medical therapy, surgical resection of the obstructive prostate is indicated.⁴ Transurethral resection of the prostate (TURP) has been the gold standard treatment for small to medium sized prostates.^{5, 6} Despite technologic advances, TURP remains suboptimal for large glands >80-100 grams with higher rates of complications including longer operative time, higher rates of transfusion, reoperation, and electrolyte abnormalities.⁷

Men with large gland BPH have historically been treated with open simple prostatectomy (OSP).⁵⁻⁶ However, several new procedures have been proposed as possible alternatives that allow for complete removal of the obstructing adenoma in a minimally invasive fashion. These procedures are holmium laser enucleation of the prostate (HoLEP) and robotic assisted laparoscopic simple prostatectomy (RSP). Prior comparisons between HoLEP and OSP demonstrated that patients undergoing HoLEP experienced decreased rates of transfusion and shorter hospital stays but similar improvements in voiding outcomes at 5 years post-operatively.⁸ Similarly, laparoscopic simple prostatectomy has been found to achieve comparable voiding outcomes relative to OSP with decreased blood loss and shorter length of stay.⁹ To date, only one recent publication in press compares the two procedures.¹⁰ Herein we seek to compare the safety and efficacy associated with these two procedures.

Materials and Methods

Patients undergoing RSP for large gland BPH (>80 grams) by two surgeons at Baylor Scott and White starting in 2010 and extending through 2015 were identified and a retrospective chart review was performed on 32 consecutive patients to identify pre-operative, operative, and immediate post-operative data. RSP was performed as previously described by Fagin et al.¹¹ After the bladder is mobilized anteriorly and the dorsal venous complex is ligated, a transverse incision on the anterior prostate is made 1 cm distal to the bladder neck. With the assistance of a stay stitch in the adenoma and a fourth robotic arm, the adenoma is then separated from the surgical capsule using a combination of blunt dissection and electrocautery. The posterior bladder neck is tacked down to the prostatic fossa with a running 2-0 V-Loc suture. A large 3-way Foley catheter is then placed and the anterior capsulotomy is closed. The patient is admitted for continuous bladder irrigation (CBI), discharged with a catheter in place, and returns in 7-10 days for a cystogram and voiding trial.

For comparison, a prospectively maintained HoLEP database of six surgeons beginning in 2008 at IU Health Methodist Hospital was queried for the same data. Between 2008 and 2015, 600 consecutive patients with large gland BPH were captured for analysis. HoLEPs were performed as first described by Gillig et al.¹² A 28 F continuous-flow resectoscope (Karl Storz Endoscopy, Culver City, CA, USA) with a laser bridge housing a 7 F stabilizing catheter (Cook Urologic, Spencer, IN, USA) was used to enucleate the prostate. Normal saline was used as the irrigant in all cases. Briefly, the enucleation required laser settings of 2 J and 40-50 Hz for the lateral lobes, 2 J and 20 Hz for the apical dissection and to divide the apical mucosal bridges. At the conclusion of enucleation, tissue removal was conducted using the Lumenis Versacut morcellator. The patient is admitted for CBI and given a voiding trial on post operative day one; the majority are discharged without a catheter in place.

Pre-operative data collected included demographic data, absence or presence of retention, and hemoglobin. Retention was defined as requiring indwelling Foley or intermittent catheterization. Intra-operative data included surgical time and specimen weight. For HoLEP, the operative time included

enucleation plus morcellation time. Post-operative data included decrease in hemoglobin, need for transfusion, length of stay, catheterization time, and Clavien 3 or greater complications.¹³ Post-operative catheter reinsertion rate was also examined. In the HoLEP cohort it was defined as requiring a catheter at discharge or having a catheter placed post discharge for voiding dysfunction, whereas in the RSP arm, the definition is limited to catheter placement post initial voiding trial.

Student's T test was used to compare interval data. Fischer exact test was used to compare nominal variables. A p value <0.05 was set to define statistical significance.

Results

Pre-operative demographics were comparable between groups (Table 1). Intra-operatively, there was no difference in mean specimen weights but operative time was significantly less in the HoLEP cohort (103 versus 274 minutes, $p < 0.001$). Post-operatively, patients undergoing HoLEP experienced a shorter stay with less blood loss (Table 2). Catheter re-insertion rates at 30 days were not statistically significantly different.

There was no difference in the rate of complications Clavien grade 3 or greater (1.2% in HoLEP cohort versus 3.1% in RSP cohort, $p = 0.34$). In the RSP arm, a single patient (3.1%) experienced a recognized small bowel perforation requiring exploratory laparotomy. In patients undergoing HoLEP, one patient (0.2%) experienced a peri-operative MI, one patient (0.2%) required pressors for septic shock, and four patients (0.7%) were admitted to the ICU, two (0.3%) for symptomatic hyponatremia and two others (0.3%) for symptomatic hypotension.

Discussion

Comparisons of treatment modalities for large gland BPH are sparse in the literature. In this cohort of patients, HoLEP and RSP are evaluated. Although patients underwent HoLEP and RSP at separate

institutions, several important baseline characteristics were statistically similar. In both groups, the mean AUASS (American Urological Association Symptom Score) was in the severe category with at least 20% of the patients in retention. The patients in both groups had large prostates with mean weight over 80 grams and significant symptoms requiring appropriate surgical management.

Patients undergoing endoscopic management experienced an improved peri-operative profile. Mean operating time for HoLEP was reduced in comparison to RSP with similar size of resected specimens. When examining the trend of operative times, there was no correlation between date of surgery and length of procedure for either technique suggesting that the learning curve was not a significant factor. In previously published series, the mean operative time for RSP by a transvesical approach for prostates larger than 100 grams ranged from 150-180 minutes.^{14,15} The mean operative time for RSP in our series is 270 minutes. Two patients undergoing RSP had glands greater than 200 grams with long operative times which are outliers and contribute to the observed increase in operative times.

Additionally, in the HoLEP cohort, there was less change in hemoglobin with lower rates of transfusion. Hemostasis is attained by direct energy application in both modalities. However, the endoscopic method allows quick control of bleeding as enucleation is performed. The length of stay was reduced in the HoLEP group as well. The increase in hospitalization time in the RSP cohort is largely attributed to need for continuous bladder irrigation (CBI). In 16 (50%) of the patients, CBI was necessary for one day. Only 3 patients required CBI for longer than two days with the rest of the patients being weaned from CBI between one and two days. Patients undergoing HoLEP required CBI in most cases for less than 24 hours. Likewise, the length of catheterization is statistically significantly less in the HoLEP patient group. The majority of patients were discharged without a catheter after HoLEP versus a 7-13 day catheterization time for those undergoing RSP. RSP patients' catheters were removed in the office only after a cystogram showed no leak. Mottrie et al recently reported catheter removal after RSP at an average of 3 days despite a transvesical approach.¹⁰ Additional work is necessary to determine if

catheterization time after transvesical RSP can be reduced safely. Notably, the catheter re-insertion rate at 30 days for voiding dysfunction was similar, as both procedures remove the entire transition zone.

Both procedures are safe in expert hands as peri-operative complications were similar. Clavien 3 and greater events were minimal in both arms. These complications are known risks to either procedure and they were recognized and addressed. Notably, both patients with symptomatic hyponatremia in the HoLEP cohort had normal serum sodium levels on post-operative day one labs and the acute change in mental status was the result of overzealous hydration.

Other functional characteristics such as incontinence, sexual function, and other lower urinary tract symptoms of urgency and frequency were not assessed in this comparison. The study is further limited by its retrospective nature as well as incorporation of non-randomized patients from two separate institutions. Additionally, learning curve issues are important to consider. Specifically, HoLEP has a long learning curve as noted by AUA Guidelines on Benign Prostatic Hyperplasia.⁵ Others have noted a learning curve of 40-60 cases with variability in performance even late in the surgeon's experience.¹⁶ In comparison, robotic simple prostatectomy is thought to have a shorter learning curve. While no studies exist to establish the learning curve for RSP, 5-10 cases are estimated for a surrogate –laparoscopic simple prostatectomy after familiarity with laparoscopic procedures.¹⁷ The learning curve for laparoscopic and robotic radical prostatectomy is reported to be 350 and 100 cases respectively.¹⁸

Conclusion

Large gland BPH poses a unique challenge for urologists. Both HoLEP and RSP are safe and efficacious in expert hands with significant improvement in peri-operative morbidity relative to OSP. Patients undergoing HoLEP experience a more favorable peri-operative profile with decreased rates of transfusion, reduced catheterization times, and shortened length of stay. Further study is necessary to compare post

operative voiding outcomes. Additional considerations such as cost analysis and learning curve issues are important to examine as new treatments for large gland BPH become more widespread.

Table 1: Pre-operative demographic characteristics

Demographic	HoLEP (std)	N	RSP (std)	N	<i>p</i> value
Age	71 (8)	600	71 (8)	32	0.96
AUASS	20 (7)	346	24 (4)	8	0.21
Retention	140 (23%)	597	11 (34%)	32	0.20

Table 2: Perioperative comparisons

Variable	HoLEP (std)	N	RSP (std)	N	<i>p</i> value
Specimen weight (grams)	96 (54)	600	110 (44)	31	0.15
Procedure time (min)	103 (47)	600	274 (49)	32	<0.001
Hemoglobin decrease (g/dL)	1.8 (1.3)	553	2.5 (1.1)	32	0.004
Transfusion	11 (1.8%)	600	3 (9.4%)	32	0.03
Length of stay (days)	1.3 (1)	599	2.3 (2.3)	32	<0.001
Catheterization time (days)	0.7 (0.4)	590	8 (2)	32	<0.001
Clavien 3+ complications	7 (1.2%)	600	1 (3.1%)	32	0.34
Post-operative retention	13 (2.2%)	600	2 (6.3%)	32	0.17

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