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Comparison Between 1-Day and Inpatient Procedure of Holmium Laser Enucleation in Patients With Benign Prostate Hyperplasia

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Abstract

Holmium laser enucleation of the prostate (HoLEP) is one of the minimally invasive procedures that is used for patients with benign prostate hyperplasia. The procedure usually requires patients to stay in the hospital 2 nights or longer. The present study evaluated the safety and feasibility of HoLEP with discharge of the patients on Day 1 after surgery (1-day surgery). A total of 1,164 patients were included in the study, with 510 of them planned for 1-day surgery and others planned for inpatient surgery. The primary outcomes included complication rate and clinical outcomes. A total 489 out of 510 patients received 1-day HoLEP and were discharged on Day 1 after surgery. In a 30-day follow-up period, no significant differences were found between the 1-day and inpatient surgery groups in terms of the rate of complications and clinical outcomes. Patients in the 1-day surgery group had a significantly shorter waiting time for admission (9.5 $\pm$ 4.8 vs. 17.6 $\pm$ 7.4 days, $p < .05$), and the mean hospitalization cost was lower (CNY$ 9140.6 $\pm$ 1452.2 vs. 10533.4 $\pm$ 1594, $p < .05$).The 1-day HoLEP surgery was safe and had satisfactory clinical outcomes. This treatment strategy could reduce the waiting time for admission and cost of hospitalization. Majority of the patients found this 1-day surgery beneficial, especially elderly patients who prefer to have an early return home and rapid resumption of activities.

Keywords

benign prostate hyperplasia, lower urinary tract symptoms, 1-day surgery, holmium laser enucleation of the prostate

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Benign prostatic hyperplasia (BPH) is a common condition affecting senior men. About 15%–25% of men between 50 and 60 years experience lower urinary tract symptoms (LUTS; Irwin et al., 2006; Mobley et al., 2015). Of the fast increasing aging population in China, it has been estimated that by 2050, there will be 400 million Chinese citizens aged 65+ years, 150 million of whom will be 80+ years (Fang et al., 2015) and thus, a burden on the health-care system in China is expected. Efficiently utilizing medical resources is thus becoming an important issue. One-day surgery has been practiced in other countries and it has been reported that the procedure can reduce the cost of hospitalization and at the same time provide a high quality of medical care (Carmignani et al., 2015).

Holmium laser enucleation of the prostate (HoLEP) is a modern alternative to the standard transurethral resection of the prostate (TURP) procedure for bladder outflow obstruction due to BPH (Michalak et al., 2015; Pathak et al., 2017). It requires a short period of hospitalization and an anesthetic procedure. In addition, a catheter (a tube that drains the bladder) is needed for 1–2 days until the urine clears (Yu et al., 2008), and patients need to be followed up for 4 weeks after the surgery. Since holmium laser is a pulsed solid-state laser with a wave length of 2.1 μm, the wavelength is strongly absorbed by water, making its use in an aqueous environment safe (Cynk, 2014). The apparent advantage of HoLEP, a minimally invasive surgical treatment, is to reduce intraoperative hemorrhage and perioperative morbidity when

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Table 1. Treatment Indications for Patients Receiving HoLEP Treatment.

1. The patient was willing to receive the surgery with his knowledge and consent
2. The bladder outlet obstruction caused by BPH was responsible for the patient's LUTS
3. Repeated urinary retention
4. Poor therapeutic effect of medication
5. Overflow incontinence
6. Cystolith or bladder diverticulum
7. Poor improvement of LUTS and residual urine after conservative or drug therapy
8. The patient's level of serum creatinine was normal

Note. BPH = benign prostate hyperplasia; HoLEP = holmium laser enucleation of the prostate; LUTS = lower urinary tract symptoms.

compared to TURP (Mavuduru et al., 2009). Usually, HoLEP treatment requires patients to stay in hospital for approximately 2.2 to 2.6 days (Cornu et al., 2015; Eltabey et al., 2010; Gilling et al., 2012). However, in the 1-day surgery of HoLEP treatment, which has not been widely reported, patients were discharged from hospital within 24 hr after surgery, which included anesthesia awakening time, catheter removal, and postoperative care. Follow-up on the patients was done during ambulatory visits. In such settings, safety of the procedures must be fully evaluated to avoid various complications.

In the present study, a detailed surgical procedure was presented and the postoperative outcomes of patients who had undergone 1-day surgery of HoLEP were evaluated in comparison with those of traditional inpatient surgery (>1-day hospital stay). In addition, findings of 30-day postsurgery follow-up were also compared.

Patients and Methods

Patient and Study Design

This retrospective study was approved by the Institutional Review Board, Renji Hospital, Medical School of Shanghai Jiaotong University (RJUR3780335). A total of 1,164 patients with BPH/LUTS received HoLEP surgery at Renji Hospital (Shanghai, China) between August 2013 and March 2017. Of them, 654 patients received traditional surgery with longer than 1-day hospitalization (called the inpatient surgery group) between August 2013 and October 2015, while 510 patients received surgery with only 1-night stay in the hospital after surgery (called the 1-day surgery group) between November 2015 and March 2017.

All HoLEP procedures were performed by two experienced surgeons. Patients in the 1-day surgery group were discharged within 24 hr after surgery, while those in the inpatient group were discharged within 28–72 hr after surgery.

Patients with prostate cancer, diagnosed by digital rectal examination (DRE) combined with prostate-specific antigen (PSA) test or prostate biopsy, were excluded. The treatment indications of the study are presented in Table 1, which are in accordance with clinical practice guidelines (Gravas et al., 2019). Clinical information including medical history, symptoms index score, transrectal ultrasonography (TRUS), postvoid residual (PVR), uroflowmetry, and serum PSA were collected. Follow-up visit was scheduled 1 month after surgery, and postoperative pathological results were collected if malignant neoplasms were found. Postoperative complications were considered to be an important issue and were, therefore, carefully recorded during the follow-up procedure. The complications were graded according to the Clavien–Dindo classification (Mamoulakis et al., 2011).

One-Day Surgery Arrangement

The postoperative care, occurrence of potential complications, and expectations were explained to the patients before surgery. Patients were admitted to the hospital at a scheduled date after assessment at the anesthesia department. Patients who were taking aspirin or clopidogrel could undergo the surgery without cessation of the therapy. The main exclusion criteria for 1-day surgery included the following: (a) Unwillingness of patients to stay in the hospital for only 1 night; (b) American Society of Anesthesiologists (ASA) score >2; and (c) clinically significant medical conditions that might interfere with the surgical treatment, for example, unstable cardiovascular or respiratory disease.

During the surgical procedure, the patients received general anesthesia and intraoperative neuro monitoring. After the surgery, the patients returned to the inpatient unit for monitoring. The voiding trial was taken on the day following the surgery. Patients could be discharged when their situation met the standardized criteria.

Surgical Procedures

The operation was performed using a 550-um end-firing laser fiber (SlimLine, Lumenis Ltd, Yokneam, Israel) engaged with a 100-w holmium neodymium:yttrium-aluminum-garnet laser (VersaPulse Power-Suite, Lumenis

Ltd.). Saline was used as washing fluid, and a Storz 26F (Karl Storz GmbH&Co.,Tuttlingen, Germany) continuous flow resectoscope with a laser bridge was used. A versacut tissue morcellator (Lumenis Ltd.) was used to remove enucleated tissue from the bladder. Specifically, the step-by-step procedures were as following:

Median Lobe Enucleation

Step 1. Incisions were made at the bilateral borders of the verumontanum to the depth of the prostate capsule; then, longitudinal incisions were made at the 5 o'clock position from distal to the bladder neck.

Step 2. Incisions were made at the bilateral borders of the verumontanum to the depth of the prostate capsule; then, longitudinal incisions were made at the 7 o'clock position from distal to the bladder neck.

Step 3. The median lobe on the side of bladder neck was pressed by scope to effectively split the tissue. The surgeon should be careful not to undermine the related structures of the internal urethral sphincter.

Step 4. A complete dissection of the urethral mucosa and hyperplasia adenoma was made by the transverse incision at 1~2-cm proximal to the verumontanum.

Step 5. Combining the laser with rotating, moving, and torqueing the endoscope, the middle lobe adenoma can be enucleated in a retrograde manner.

Step 6. Careful wound healing and bleeding control should be checked.

Left Lobe Enucleation

Step 7. The endoscope was retracted distally to identify the verumontanum and the external urethral sphincter, finding a point at 5 o'clock of the apical adenoma. When a proper plane was identified, the plane was extended upward to 1 o'clock with the combination of sharp cutting and blunt lifting.

Step 8. A longitudinal incision along the 12 o'clock by rotating the scope was made for anterior lobe dissection. The conjoining incision lines should be at around two third depth of the capsule.

Step 9. The endoscope was retracted to show the external sphincter, urethral mucosa, and adenoma between 1o'clock and 12 o'clock. Special attention should be paid to save the urethral mucosa, then push the adenoma forward to the bladder neck.

Step 10. The scope was rotated and the prostate was separated from the capsule in a plane from 1 o'clock to 5 o'clock.

Step 11. Retracting the endoscope and making use of the beak, the left lobe was lifted and pushed to the bladder.

Step 12. Careful wound healing and bleeding control should be checked.

Right Lobe Enucleation

Step 13. The endoscope was retracted distally to identify the verumontanum and the external urethral sphincter, locating a point at 7 o'clock of the apical adenoma. When a proper plane was identified, the plane was extended upward to 1 1o'clock with the combination of sharp cutting and blunt lifting.

Step 14. The endoscope was retracted to show the external sphincter, urethral mucosa, and adenoma between 11 o'clock and 12 o'clock. Special attention should be paid to save the urethral mucosa, then the adenoma pushed forward to the bladder neck.

Step 15. The scope was rotated and the prostate was separated from the capsule in a plane from 11 o'clock to 7 o'clock.

Step 16. Retracting the endoscope and making use of the beak, the right lobe was lifted and pushed to the bladder.

Step 17. Careful wound healing and bleeding control should be checked.

Statistical Analyses

Statistical analysis was performed using the Statistical Package for Social Sciences, version 22.0 (IBM Corp., Armonk, NY). Continuous variables were indicated as mean ± standard deviation and were analyzed using Student's *t*-test. Categorical variables were analyzed using chi-square test. All statistical tests were two sided, and p value $< .05$ was considered as statistical significance.

Results

Of 1,164 patients with BPH/LUTS, 510 were planned to receive the 1-day surgery and 489 (95.9%) of them successfully received the treatment as such. Twenty-one (4.3%) patients could not be discharged in 24 hr after surgery as planned; these patients had a bleeding disorder that required bladder irrigation ($n = 14$, 2.9%), high fever ($n = 4$, 0.8%), and intolerable pain ($n = 2$, 0.4%). One patient experienced acute cerebral infarction and was transferred to the intensive care unit immediately. Overall, the 21 patients were discharged in 2–17 days (average = 3.06 days) after surgery.

The baseline characteristics, preoperative and intraoperative parameters, and cost of hospital stay were compared between the two groups (Table 2). Patients of the 1-day surgery group were significantly younger than those of the inpatient surgery group (69.9 ± 8.7 vs. 71.6 ± 8.3 years old, $p < .001$). The incidence of preoperative PVR urine volume was significantly higher in the 1-day surgery group than in the inpatient surgery group (189.5 ± 80.9 vs. 160.3 ± 54.3 ml, $p < .001$). Importantly, significantly shorter

Table 2. Comparison of Baseline Clinical Characteristics and Operative Parameters Between the Two Groups.

	Inpatient surgery $N = 654$	One-day surgery $N = 510$	p value
Age (years)	71.6 ± 8.3	69.9 ± 8.7	.000
Size of prostate (g)	53.4 ± 26.7	51.9 ± 24.7	.326
Preoperative PSA (ng/mL)	5.7 ± 4.8	5.9 ± 4.5	.468
Preoperative IPSS	28.5 ± 5.7	27.9 ± 5.4	.069
Preoperative Qmax (mL/s)	7.4 ± 2.4	7.7 ± 2.9	.054
Preoperative PVR (mL)	160.3 ± 54.3	189.5 ± 80.9	.000
Anticoagulation (*n*)	63	58	.335
Aspirin	48	40	
Plavix	16	18	
Waiting days for operation	17.6 ± 7.4	9.5 ± 4.8	.000
Mean surgery time (min)	47.9 ± 24.1	46.7 ± 18.2	.350
Resected weight (g)	33.4 ± 16.8	34.4 ± 19.5	.348
Total hospitalization cost (¥)*	10,533.4 ± 1,594.3	9,140.6 ± 1,452.2	.000

Note. *The cost included cost for laboratory and imaging examination as well as fees for anesthesia, surgery, medicine, hospital accommodation, and nursing care. IPSS = International Prostate Symptom Score; PSA = prostate-specific antigen; Q_{max} = maximal urinary flow rate; PVR = postvoid residual.

Table 3. Clinical Outcomes at 1-Month Follow-Up in the Two Groups.

	Inpatient surgery $N = 654$	One-day surgery $N = 510$	p value
IPSS	7.5 ± 4.4	7.3 ± 3.5	.839
Qmax (mL/s)	17.4 ± 3.1	17.6 ± 3.4	.296
PVR (mL)	24.6 ± 14.0	26.5 ± 11.3	.013
PSA (mL)	2.1 ± 1.8	2.4 ± 2.2	.014
Incidental prostate carcinoma (*n*)	15	12	

Note. IPSS = International Prostate Symptom Score; PSA = prostate-specific antigen; PVR = postvoid residual; Qmax = maximum urinary flow rate.

waiting time and lower hospitalization cost were found in the 1-day surgery group than in the Inpatient surgery group (9.5 ± 4.8 vs. 17.6 ± 7.4 days, $p < .001$; ¥ 9,140.6 ± 1,452.2 vs. 10,533.4 ± 1,594.3, $p < .001$), suggesting that 1-day surgery could save the resources of the hospital and shorten the waiting time of patients.

The clinical outcomes within 1 month after surgery were compared between the two groups (Table 3). The International Prostate Symptom Score (IPSS), which was defined by the American Urological Association, and maximal urinary flow rate (Q_{max}) were comparable between the two groups, while PVR and PSA were significantly higher in the 1-day surgery group than in the inpatient surgery group (26.5 ± 11.3 vs. 24.6 ± 14.0 ml, $p = .013$; 2.4 ± 2.2 vs. 2.1 ± 1.8 ml, $p = .014$).

The complications reported within 1-month follow-up after surgery were compared between the two groups (Table 4). The incident rate was similar in the two groups, with 26.9% (176/654) in the inpatient surgery group and 25.7% (131/510) in the 1-day surgery group. Majority of the adverse events were Clavien–Dindo grade I (inpatient surgery17.8% vs. 1-day surgery 17.1%, $p = .762$). There was no significant differences in terms of the complications that required intervention under regional or general anesthesia (Clavien–Dindo grade III–IV); the rate was 2.0% in the 1-day surgery group, which was nearly identical with the incident rate in the inpatient surgery group (2.1%, $p = .830$). Irritative symptoms were the most common Clavien–Dindo grade I complications observed in both groups, while urinary tract infection and recatheterization were the most common Clavien–Dindo grade II complications observed. Urinary stricture was the most common Clavien–Dindo grade III complication reported. One patient developed acute cerebral infarction after HoLEP and was transferred to the intensive care unit immediately.

So far, mean follow-up in the entire cohort was 475 days (range 62–1,942 days). At the most recent follow-up, eight patients in the inpatient surgery group (1.22%) and six patients in the 1-day surgery group (1.18%) suffered stress urinary incontinence. One patient in the inpatient surgery group voided spontaneously after 3 years postoperatively.

Table 4. Comparison of Complications at 1-Month Follow-Up After Surgery [*n* (%)].

Postoperative complications	Inpatient surgery $N = 654$	One-day surgery $N = 510$	*p* value
Clavien–Dindo grade I	116 (17.8%)	87 (17.1%)	.762
Bleeding	48 (7.3%)	41(8.0%)	
Urinary incontinence	27 (4.1%)	19 (3.7%)	
Irritative symptoms	75 (11.5%)	52 (10.2%)	
Clavien–Dindo grade II	46 (7.0%)	34 (6.7%)	.806
Urinary tract infection	16 (2.4%)	14 (2.7%)	
Blood transfusion	2 (0.03%)	0	
Urinary incontinence	8 (1.2%)	5 (1.0%)	
Irritative symptoms	10 (1.5%)	6 (1.2%)	
Recatheterization	19 (2.9%)	12 (2.4%)	
Clavien–Dindo grade III–IV	14 (2.1%)	10 (2.0%)	.830
Bleeding	1 (0.2%)	1(0.2%)	
Urinary stricture	9 (1.4%)	6 (1.7%)	
Bladder neck contracture	4 (0.6%)	2 (0.4%)	
Acute cerebral infarction	0	1 (0.2%)	
Readmission rate	11	7	.671

Discussion

The 1-day surgery procedure has been widely adapted not only in patients with BPH/LUTS but also in patients with hernia, colorectal polyp, benign breast mass, and senile cataract (Albert et al., 2017; Brebbia et al., 2008). As the aging population is increasing, the prevalence of BPH/LUTS reflects a medical burden. The treatment of HoLEP could improve postoperative life quality of the patients.

The current study showed that most of the patients (95.9%) could be discharged safely within 24 hr after HoLEP surgery. The first 24 hr after HoLEP surgery has been a critical period, which reflects the situation of hemorrhagic possibility, anesthesia recovery, infection, and wound pain. Hemorrhagic event has been a major postoperative complication because of bladder spasm. In the current study, 14 patients suffered from a hemorrhagic event, which was due to either the patients having used anticoagulants or as a consequence of bladder spasm after the surgery procedure. Totally, 21 patients suffered from various postoperative complications and were treated efficiently in time. Thus, it was extremely necessary for such patients to stay in the hospital overnight. When compared with outpatient surgery, 1-day surgery could reduce the risk of readmission or emergency adverse events.

The current study found that PVR before the surgery procedure was significantly different between the two groups (lower in the 1-day group), and the difference existed even after surgery although it was reduced after surgery in both groups. PSA was also significantly lower in the 1-day procedure group, although the difference was not altered before and after the surgery.

To increase the patient's comfort during the recovery at home, voiding test was performed in the 1-day surgery group before the patient was discharged in order to decide if the catheter should be kept in situ for an additional 2 days. A study, consisting of 65 patients who had 1-day surgery procedure, reported that patients were discharged with a catheter in situ and returned to the hospital for a voiding test on postoperative day 3 (Jumper et al., 2012). In the current study, with the voiding trial taken before discharge, only 12 patients (2.4%) were given recatheterization due to urethral edema, suggesting early removal of catheter before discharge was feasible and safe in the patients with 1-day HoLEP procedure.

One of the common postoperative complications of HoLEP is transient urinary incontinence (TUI). It has been reported that up to 12.5% of patients experienced that (Krambeck et al., 2013). To reduce the TUI complication rate, we developed a modified three-block enucleation with partial urethral mucosa preserved. The modification included the preservation of the muscle tissue and urethral mucosa of bladder neck, the partial urethral mucosa at the bilateral borders of the verumontanum from 5 o'clock to 7 o'clock, and the mucosa at the apex from 1 o'clock to 11 o'clock. The gentle pushing, splitting, and lifting of the adenoma tissue along with the laser ablation would help to reduce the blunt injury to the external urethral sphincter. Through this modification of the procedure, the rate of TUI in this study was reduced to 5.1% (59/1,164).

A limitation of the current study was that this was a retrospective study. A prospective and randomized clinical trial will be necessary to further confirm the findings

of the current study although it might be difficult to design such a trial in practice.

In conclusion, findings of the current study demonstrated that outcomes were comparable between the 1-day surgical procedure and traditional inpatient surgery on the basis of HoLEP treatment for BPH patients. Shortening hospitalization period after surgery did not increase the complication rate, but it significantly optimized medical resources by reducing operation waiting time and medical cost.

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Declaration of Conflicting Interests

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References

Albert, B. M., Lee, A., McLendon, T. W., Devereaux, R. S., Odum, C. C., & Foulkes, G. D. (2017). Is total elbow arthroplasty safe as an outpatient procedure? *J Surg Orthop Adv*, *26*(1), 25–28.

Brebbia, G., Carcano, G., Boni, L., Dionigi, G., Rovera, F., Diurni, M., & Dionigi, R. (2008). Audit in day surgery in general surgery. Quality and criticality are compared. *Int J Surg*, *6*(Suppl 1), S59–S64.

Carmignani, L., Macchi, A., Ratti, D., Finkelberg, E., Casellato, S., Maruccia, S., Marenghi, C., & Picozzi, S. C. (2015). One day surgery in the treatment of benign prostatic enlargement with thulium laser: A single institution experience. *Korean J Urol*, *56*(5), 365–369.

Cornu, J. N., Ahyai, S., Bachmann, A., de la Rosette, J., Gilling, P., Gratzke, C., Novara, G., Woo, H., & Madersbacher, S. (2015). 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*, *67*(6), 1066–1096.

Cynk, M. (2014). Holmium laser enucleation of the prostate: A review of the clinical trial evidence. *Ther Adv Urol*, *6*(2), 62–73.

Eltabey, M. A., Sherif, H., & Hussein, A. A. (2010). Holmium laser enucleation versus transurethral resection of the prostate. *Can J Urol*, *17*(6), 5447–5452.

Fang, E. F., Scheibye-Knudsen, M., Jahn, H. J., Li, J., Ling, L., Guo, H., Zhu, X., Preedy, V., Lu, H., Bohr, V. A., Chan, W. Y., Liu, Y., & Ng, T. B. (2015). A research agenda for aging in China in the 21st century. *Ageing Res Rev*, *24*(Pt B), 197–205.

Gilling, P. J., Wilson, L. C., King, C. J., Westenberg, A. M., Frampton, C. M., & Fraundorfer, M. R. (2012). Long-term results of a randomized trial comparing holmium laser enucleation of the prostate and transurethral resection of the prostate: Results at 7 years. *BJU Int*, *109*(3), 408–411.

Gravas, S., Cornu, J. N., Gacci, M., Gratzke, C., Herrmann, T. R. W., Madersbacher, S., Rieken, M., Speakman, M. J., Tikkinen, K. A. O., Karavitakis, M., Kyriazis, I., Malde, S., Sakalis, V., & Umbach, R. (2019, March). EAU Guidelines on Management of Non-Neurogenic Male Lower Urinary Tract Symptoms (LUTS), incl. Benign Protstatic Obstruction (BOP). http://www.uroweb.org/guideline/treatment-of-non-neurogenic-male-luts/.

Irwin, D. E., Milsom, I., Hunskaar, S., Reilly, K., Kopp, Z., Herschorn, S., Coyne, K., Kelleher, C., Hampel, C., Artibani, W., & Abrams, P. (2006). Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: Results of the EPIC study. *Eur Urol*, *50*(6), 1306–1314; discussion 1314–1305.

Jumper, C., Snyder, P., & Yap, R. L. (2012). Rapid ambulatory pathway laser prostatectomy is safe: Results within the global period. *BJU Int*, *110*(8), 1190–1193.

Krambeck, A. E., Handa, S. E., & Lingeman, J. E. (2013). Experience with more than 1,000 holmium laser prostate enucleations for benign prostatic hyperplasia. *J Urol*, *189*(1 Suppl), S141–S145.

Mamoulakis, C., Efthimiou, I., Kazoulis, S., Christoulakis, I., & Sofras, F. (2011). The modified Clavien classification system: A standardized platform for reporting complications in transurethral resection of the prostate. *World J Urol*, *29*(2), 205–210.

Mavuduru, R. M., Mandal, A. K., Singh, S. K., Acharya, N., Agarwal, M., Garg, S., & Kumar, S. (2009). Comparison of HoLEP and TURP in terms of efficacy in the early postoperative period and perioperative morbidity. *Urol Int*, *82*(2), 130–135.

Michalak, J., Tzou, D., & Funk, J. (2015). HoLEP: The gold standard for the surgical management of BPH in the 21(st) Century. *Am J Clin Exp Urol*, *3*(1), 36–42.

Mobley, D., Feibus, A., & Baum, N. (2015). Benign prostatic hyperplasia and urinary symptoms: Evaluation and treatment. *Postgrad Med*, *127*(3), 301–307.

Pathak, R. A., Broderick, G. A., Igel, T. C., Petrou, S. P., Young, P. R., Wehle, M. J., Heckman, M. G., Dieh, N. N., Vargas, E. R., Shah, K., & Thiel, D. D. (2017). Impact of minimally invasive benign prostatic hyperplasia therapies on 30- and 90-day postoperative office encounters. *Urology*, *99*, 186–191.

Yu, X., Elliott, S. P., Wilt, T. J., & McBean, A. M. (2008). Practice patterns in benign prostatic hyperplasia surgical therapy: The dramatic increase in minimally invasive technologies. *J Urol*, *180*(1), 241–245; discussion 245.