Endoscopic transvesical adenomectomy of the prostate, a new minimally invasive approach for large benign prostatic hyperplasia. What has our experience taught us?

Luís Vale¹,²,³, Laurent Fossion¹

¹Maxima Medical Centre, Department of Urology, Veldhoven, The Netherlands
²Centro Hospitalar Universitário São João, Department of Urology, Porto, Portugal
³Faculty of Medicine, University of Porto, Department of Biomedicine, Porto, Portugal

Introduction
Recent technical advances have made new minimally invasive techniques possible to treat large volume (>80 ml) benign prostatic hyperplasia (BPH). The endoscopic transperitoneal adenomectomy of the prostate (ETAP) is a new minimally invasive technique developed in our centre. The aim of this study was to describe the safety, efficacy and to evaluate our learning curve in ETAP.

Material and methods
This was a single-centre study that enrolled eighty-eight consecutive patients with large BPH who underwent ETAP. Pre-, per- and postoperative data were prospectively collected. Statistical analysis compared the first 40 patients submitted to ETAP (Group A) with the subsequent 48 patients (Group B).

Results
There were no significant differences in the surgical procedure between groups. The median operating time was 94 (80–110) minutes and the estimated blood loss 150 (100–300) ml. There were no perioperative blood transfusions nor any conversions to open approach needed. Median hospital stay was 3 (3–5) days and catheter was removed mainly at day 9 (5–11). The median Qmax improved from 8.0 (6.2–9.9) ml/s to 15.0 (11.5–23.0) ml/s postoperatively and the median International Prostate Symptom Score (IPSS) score decreased from 20 (15–24) to 6 (4–11) after the procedure.

Conclusions
ETAP is a secure and feasible minimally invasive technique for treatment of large BPH. The functional outcomes of this technique are consistent and promising.

Key Words: endoscopic transvesical adenomectomy of the prostate ⊗ benign prostatic hyperplasia ⊗ new minimally invasive surgery
The endoscopic transperitoneal adenomectomy of the prostate (ETAP) was developed in our centre. We wanted to develop a new technique with the advantages of minimally invasive surgery, in a familiar anatomy and with the possibility of performing it with standard low-cost laparoscopic instruments. The ETAP technique and the results of the first 40 patients in our centre were presented in 2019 [9]. The goal of this study is to describe the safety and efficacy of the procedure and to evaluate the results of our learning curve for this new minimally invasive technique in order to validate it and promote its widespread use amongst the urological community. For this reason, we compared the results of the first 40 patients who underwent ETAP with the subsequent 48 patients.

MATERIAL AND METHODS

Patients

Eighty-eight consecutive patients with lower urinary tract symptoms (LUTS) due to BPH larger than 80 ml, measured by transrectal ultrasound of the prostate (TRUS), were included in the study. Prostate cancer was excluded by prostate-specific antigen (PSA) level measurement and digital rectal examination (DRE) and, if necessary, with prostate biopsy. Informed consent was given by all patients after a detailed explanation of the procedure, possible complications, and alternative treatment options. The study protocol was approved by the local ethical committee.

Data

Patients were included from March 2014 to December 2019. Data was collected prospectively regarding pre-, per- and postoperative data and complemented as needed with the electronic patient file. Preoperative data included: age, body mass index (BMI, kg/m²), prostate volume (ml), PSA (ng/ml), International Prostate Symptom Score (IPSS), Qmax (ml/s), and post-void residual volume (PVR, ml). Perioperative data included: estimated blood loss (ml), operating time (min), complications, and transfusion rate. Postoperative data included: hospital stay (days), catheterization time (days), resected specimen weight (g), Qmax (ml/s), and PVR (ml). The IPSS was assessed preoperatively and 6 months after surgery. Complications were registered using the Clavien-Dindo classification [10]. The statistical analysis was based on the comparison of the first 40 patients who underwent ETAP (Group A) and the subsequent 48 patients who underwent the same procedure (Group B). The qualitative values comparison was performed by the Chi-squared Pearson or Fisher’s exact test and the quantitative values by Student’s t test. The level of significance was set at p <0.05. All statistical analyses were performed using IBM SPSS Statistics version 24.0 (IBM Corp.).

Technique

All patients were treated in a single-centre general hospital, by a single urologist with extensive laparoscopic experience having performed over 1500 laparoscopic procedures. According to the IDEAL model of surgical innovation and evaluation this study is assigned to a stage 2a [11]. The ETAP surgical procedure was carefully explained step-by-step previously [9]. Firstly, all patients undergo general anesthesia. The patient is positioned in the dorsal decubitus position. A 16 Fr catheter is placed in the bladder and filled with 300 ml of water. A 2 cm mid-line incision is made below the umbilicus. Through this incision a cystotomy of the bladder dome is performed and a 10 mm camera trocar is placed into the bladder. Both lateral 5 mm balloon trocars are then placed under direct vision in a transcutaneous and transvesical way. The adenomectomy starts with circumferential incision of the bladder mucosa 1 cm distal from the trigonum and ureteral orifices. Placement of ureteral stents to prevent ureteral injury is not routinely performed. The enucleation is then performed. At the apex, the urethra is transected and the adenoma placed in an endobag. Hemostasis of the prostate bed is performed using bipolar coagulation. Finally, a Dufour bladder catheter of 22 Fr is introduced, the endobag is removed and the cystotomy is closed in 2 layers. A drain is placed in the Retzius space through one of the 5 mm ports. The drain is removed at day 1 if no urinary leakage occurs. The catheter is standardly removed after 7–10 days. Bladder irrigation is continued until the urine is clear.

Follow-up

On the first postoperative day, all patients received a blood test: hemoglobin, creatinine, leukocytes, and CRP. After this, patients visited our outpatient clinic at 3 and 6 months. In addition to clinical evaluation, a new IPSS-score and uroflowmetry was also performed.

RESULTS

Between March 2014 and December 2019, a total of 88 patients underwent an ETAP at our institu-
To assess the impact of surgical experience on the outcomes, we divided our population into 2 groups. In Group A were included the first 40 patients who underwent ETAP and in Group B were included the subsequent 48 patients who underwent the same procedure.

As displayed in Table 1, there were no major significant differences in the baseline population characteristics between Group A and Group B. The median age of the whole study cohort was 70 (65–75) years, with a median BMI of 26.7 (24.8–29.3) and an American Society of Anesthesiologists (ASA) co-morbidity score of 2. Group B patients were more commonly catheterized preoperatively relative to patients from Group A (54% vs. 25%; p = 0.006, respectively). We observed a tendency towards patients with greater PVR and greater prostate volumes in Group B. In the whole cohort, preoperative median PVR was 237 (88–500) ml and the TRUS estimation of prostate volume showed a median volume of 112 (95–150) ml. 66 patients (75%) received 5α-reductase inhibitor therapy preoperatively.

With regards to the surgical procedure itself (Table 2) there were no significant differences between the two groups. The median operating time was 94 (80–110) minutes and the estimated blood loss 150 (100–300) ml. There were no perioperative transfusions or conversions needed. The catheter was removed mainly at day 9 (5–11) in both groups. There was a tendency towards earlier discharge in Group B patients with a median of 3 (2–4) days of hospital staying compared to 4 (3–6) days in Group A patients. The mean volume of the enucleated prostate adenoma was 83 (64–110) grams in the pathology report.

The functional outcomes are displayed in Table 3. There were no significant differences between the two groups. After removal of the catheter, only 3 patients experienced urinary retention, but at the 90-day re-evaluation all of them were spontaneously voiding and without need for any surgical intervention. The median Qmax improved from 8.0 (6.2–9.9) ml/s preoperatively to 15.0 (11.5–23.0) ml/s postoperatively in the entire cohort. Also, the median IPSS score decreased from 20 (15–24) before the procedure to 6 (4–11) after the procedure.

All complications were registered according to the Clavien-Dindo classification. Intraoperatively, in Group A we observed seven (18%) cases of a small perforation in the prostate-capsule and in 1 (3%)
case a small bladder defect occurred, all corrected with a V-lock suture. These patients did not have any problems in the postoperative follow-up. In Group B there was a bladder perforation which was treated conservatively.

Postoperative complications are displayed in Table 4. Two patients suffered from wound complications, all treated successfully with antibiotics. A further 16 of the 88 (18%) patients suffered from urinary tract infection after catheter removal and required antibiotics. Two (2%) of these patients developed urosepsis and were readmitted for intravenous treatment.

We observed an increased rate of stress urinary incontinence in the immediate post-operative period of Group B patients compared to Group A (29% vs. 18%; p = 0.003, respectively). All of them were
referred for pelvic floor training, with clinical improvement. In fact, 90 days after the surgical procedure, this difference was not significant. A total of 5 patients (6%) suffered from persisting urinary incontinence. Three patients from Group A (8%) required a bladder neck incision due to bladder neck sclerosis while in Group B there were no interventions due to this complication (p = 0.04). Two patients (2%) suffered from a rectovesical fistula and were referred to a high-volume academic centre for fistula repair. Six of the 88 patients (7%) suffered from persisting severe hematuria postoperatively and required an endoscopic revision and transurethral coagulation in the operating room. Seven (8%) patients had a prolonged hospital stay due to hematuria or suffered from bleeding after discharge needing readmission for continuous irrigation of the bladder. Only two patients required blood transfusions in our series. One (3%) patient suffered a severe complication. He underwent an endoscopic revision because of persisting hematuria. After this procedure he developed TURP-syndrome, requiring admission to the intensive care unit. The patient then presented necrosis of part of the glans penis, most likely due to continuous traction of the bladder catheter and penile edema, which was managed with debridement and skin grafting.

**DISCUSSION**

In the last years, surgical options for BPH have progressed with new technologies arising and refinements of established options. Simple adenomectomy of the prostate and Holmium laser enucleation of prostate (HoLEP) are nowadays the surgical treatment options recommended for patients with BPH due to large prostate gland [12]. HoLEP has demonstrated efficacy and safety superior to that of traditional open prostatectomy. However, its high learning curve has limited its widespread acceptance and utility, thus simple prostatectomy is still the most disseminated procedure [13, 14, 15]. However, simple prostatectomy is associated with some cons such as bleeding, long hospital stay, and catheterization time [16]. To overcome these disadvantages, a new minimally invasive technique was developed in our centre, the ETAP. Using standard laparoscopic instruments, and so with a low-cost profile, this procedure has a similar approach as the open prostatectomy described by Hryntschak. It has the advantage of clear vision, good vascular control, and the whole prostate is available for pathology analysis. The easy learning curve for surgeons already performing laparoscopy is another advantage of this technique. The main benefit of this transvesical approach is the direct access to the bladder with less surgical trauma. It does not require Trendelenburg positioning and there is no peritoneal violation or tissue dissection, and therefore no risk of injury to adjacent organs or tissue. The insufflation of the bladder also provides tamponade of venous channels reducing intraoperative bleeding, which often occurs in open surgery. The final benefit of the transvesical approach is the excellent exposure of the prostatic capsule after the enucleation, which is helpful in creating adequate hemostasis.

In the present study, we show that ETAP procedure was successfully performed in 88 patients, without

---

**Table 4. Complications**

| Grade | Complications                                      | N < 90 days | N > 90 days | P value (A–B) | P value (A–B) |
|-------|----------------------------------------------------|-------------|-------------|---------------|---------------|
|       |                                                   | A           | B           | All           | A             | B             | All           | P value (A–B) |
| Grade I | Stress incontinence | 7 (17.5%) | 14 (29%) | 21 (24%)           | 0.003*              | 3 (5%)        | 10 (20.8%) | 13 (15%)          | 0.08*              |
|        | Wound infection | –           | 2 (4%) | 2 (2%) | 0.50† | – | – | – | – |
| Low-grade | Urinary tract infection | 8 (20%) | 8 (17%) | 16 (18%) | 0.10† | 2 (5%) | 2 (4%) | 4 (5%) | 1† |
| Grade II | Hematuria after discharge | 4 (10%) | 3 (6%) | 7 (8%) | 0.17† | 4 (10%) | 2 (4%) | 6 (7%) | 0.41† |
|        | Urge LUTS | –           | 1 (2%) | 1 (1%) | 0.25† | 1 (2.5%) | 2 (4%) | 3 (3%) | 1† |
|        | Urinary retention | –           | 3 (6%) | 3 (3%) | – | – | – | – |
| Grade III | Hematuria and need for TUR-coagulation | 2 (5%) | 4 (8%) | 6 (7%) | 0.69† | – | – | – | – |
|        | Bladder neck obstruction | – | – | – | – | 3 (7.5%) | – | 3 (3.4%) | 0.04† |
|        | Recto-vesical fistula | – | – | – | – | 1 (2.5%) | 1 (2.3%) | 2 (2.3%) | 1† |
| High-grade | Hematuria, TUR-coagulation, TUR-syndrome with ICU-admission and partial glans necrosis | 1 (2.5%) | – | 1 (1%) | – | – | – | – | – |

ICU – intensive care unit; LUTS – lower urinary tract symptoms; TUR – transurethral resection; A – First 40 patients submitted to ETAP; B – The last 48 patients submitted to ETAP; * Chi-square Pearson; † Fisher’s exact test
conversion to open approach. There were no severe complications during surgery. Postoperatively, patients remained an average of 3 days in the hospital and had urethral catheter for 9 days, which is comparable to most treatment options (Table 5). We observed that with experience, there was a tendency towards performing the ETAP surgery in patients with larger prostate size and an earlier hospital discharge. We could hypothesize that it affects the continence rates, but in fact, at 90-day re-evaluation, there was no significant differences between the groups. Retrospective studies comparing open techniques with laparoscopic or endoscopic techniques show the common advantages of minimally invasive surgery; less blood loss, shorter hospitalization, less days with catheter, less urinary tract infections, and similar percentages of postoperative hematuria are seen in the laparoscopic series (Table 5).

In our series, postoperatively 6 patients had bleeding, which required transurethral coagulation. Two patients required blood transfusions as mentioned above, resulting in a transfusion rate of 2% in our study. This is much lower than the average 7–18% transfusion rate in the open adenomectomy (Table 5). With longer follow-up, 3 patients required a bladder neck incision due to bladder neck obstruction; this is comparable to the number occurring in the open adenomectomy [17]. There were no urine-leakage complications or abdominal sepsis. Two patients developed a vesicorectal fistula and were referred to an academic hospital for operative correction. Ultracision has a quick and efficient sealing effect. However, the use of high-frequency electrosurgical energy has a known risk of deep thermal injury that the surgeon must be aware every time he or she uses this instrument.

Nine patients suffered from incontinence after the procedure. Seven of them showed improvement after standard pelvic floor muscle physiotherapy.

The ETAP procedure shows good functional outcomes with a significant decrease in the IPSS-score (-14 points) and an increase in Qmax (+7 ml/s). All the patients who had urinary retention preoperatively were able to void spontaneously after surgery. These numbers are comparable to open surgery and HoLEP [4, 15, 18]. One of the major concerns with HoLEP is the higher incidence of urge LUTS and pollakiuria which is bothersome in more than 20% of the treated population [16]. These kinds of symptoms tend to decrease with time, however data on the real impact of hyperactive syndrome complications on patient satisfaction rate is scarce. In our series, only 7% of the population complains of urge LUTS which is a positive result.

### Table 5. Surgical outcomes of different procedures for bladder outlet obstruction due to large prostatic adenoma

| Study          | Year | Procedure       | n   | Specimen weight (g) | Operation time (min) | Blood loss | Transfusion rate (n) | Hospital stay (days) | Catheter stay (days) | Early incontinence |
|----------------|------|-----------------|-----|---------------------|----------------------|-----------|----------------------|----------------------|----------------------|-------------------|
| ETAP           | 2020 | Laparoscopic    | 88  | 83                  | 94                   | 150 ml    | 2 (2.3%)             | 3                    | 9                    | 24%               |
| Serretta et al. | 2002 | Open            | 1804| (75)*               | .                    | .         | 148 (8.2%)           | 7                    | 5                    | 3.7%              |
| Gratzke et al. | 2007 | Open            | 902 | 84.8                | 80.8                 | .         | 7.5%                 | 11.9                 | .                    | .                 |
| Naspro et al.  | 2006 | Open            | 39  | 87.9                | 58                   | 3.15 g/dl | 7 (17.9%)            | 5.4                  | 4.1                  | 41.1%             |
| Porpiglia et al. | 2006 | Laparoscopic    | 20  | 69.5                | 107.3                | 412 ml    | 2 (10%)              | 7.8                  | 6.3                  | .                 |
|                |      | Open            | 20  | 88.1                | 95.5                 | 688 ml    | 3 (15%)              | 7.0                  | 5.6                  | .                 |
| McCullough et al. | 2009 | Laparoscopic    | 96  | (111.3)*            | (117.2)*             | 350 ml    | 15.8%                | 6.3                  | 5.2                  | .                 |
| Sorokin et al. | 2017 | Robotic         | 59  | 82.9                | 161.4                | 339 ml    | 2%                   | 1.5                  | 5.7                  | 1.7%              |
|                |      | Open            | 59  | 91.8                | 93.0                 | 587 ml    | 4%                   | 2.6                  | 3.1                  | 1.7%              |
| Pokorny et al. | 2015 | Robotic         | 67  | 84                  | 97                   | 200 ml    | 1.5%                 | 4                    | 3                    | 3                 |
| Autorino et al. | 2015 | Robotic         | 487 | 75                  | 155                  | 200 ml    | 3.5%                 | 2                    | 7                    | 0.8%              |
|                |      | Laparoscopic    | 843 | 75                  | 95                   | 280 ml    | 4%                   | 4                    | 4                    | 0.1%              |
| Garzon et al.  | 2016 | Robotic         | 79  | 68.5                | 162.3                | 390 ml    | 6.3%                 | .                    | 9.1                  | 15.2%             |
|                |      | Laparoscopic    | 82  | 76.3                | 161.2                | 331 ml    | 9.8%                 | .                    | 11.9                 | 13.5%             |
| Umari et al.   | 2017 | Robotic         | 81  | 89                  | 105                  | .         | 1.2%                 | 4                    | 3                    | 8.9%              |
|                |      | HoLEP           | 45  | 112                 | 105                  | .         | 0%                   | 2                    | 2                    | 1.2%              |
| Elmansy et al. | 2011 | HoLEP           | 949 | (81)*               | 96                   | .         | 4 (0.4%)             | .                    | .                    | 4.9%              |
| Elkousy et al. | 2015 | HoLEP           | 1216| 94.8                | 108                  | 2.2 g/dl  | 1.2%                 | 1.3                  | 1.4                  | .                 |
| Jhanwar et al. | 2017 | HoLEP           | 72  | 48.5                | 90                   | 0.47 g/dl | 0 (0%)               | 1.8                  | 1.3                  | 2.8%              |

ETAP – endoscopic transperitoneal adenomectomy of the prostate; HoLEP – Holmium laser enucleation of the prostate; * pre-operative transrectal ultrasound of the prostate measurement.
This study has few limitations. It is a single-centre, single-surgeon study. There is no control group, therefore comparative analysis versus other treatment options is lacking. Also, the ETAP procedure was performed by a very experienced surgeon. The learning curve of this technique needs to be evaluated by someone less experienced. In the future, a prospective multicenter randomized controlled trial is necessary to further evaluate the technique. Furthermore, with the increasing variability of treatments available, patient reported outcomes such as quality of life and satisfaction rates questionnaires are essential in a future evaluation.

**CONCLUSIONS**

This study suggests ETAP as a safe and technically feasible alternative to open surgery in the surgical treatment of large BPH. The functional outcomes of this technique are also consistent and promising. A prospective, multicentric comparison with other surgical approaches in a larger group of patients and a longer follow-up is necessary to determine its definitive place in the treatment of large BPH.

**CONFLICTS OF INTEREST**

The authors declare no conflicts of interest.

**References**

1. Gravas S CJ, Gacci M, Gratzke C, et al. Management of non-neurogenic male lower urinary tract symptoms (LUTS). EAU Guidelines. Edn. presented at the EAU Annual Congress Barcelona 2019.

2. Millin T. Retropubic prostatectomy a new extravesical technique: report on 20 cases. Lancet. 1945; 246: 693-696.

3. Freyer PJ. A Clinical Lecture on Total Extration of the Prostate for Radical Cure of Enlargement of that Organ: With Four Successful Cases. Delivered at the Medical Graduates’ College, London, June 26th. Br J Med. 1901; 2: 125-129.

4. Gratzke C, Schlenker B, Seitz M, et al. Complications and Early Postoperative Outcome After Open Prostatectomy in Patients With Benign Prostatic Enlargement: Results of a Prospective Multicenter Study. J Urol. 2007; 177: 1419-1422.

5. Jones P, Rai BP, Somani BK, Aboumarzouk OM. A review of thulium laser vapo-enucleation of the prostate: A novel laser-based strategy for benign prostate enlargement. Arab J Urol. 2015; 13: 209-211.

6. Sivarajan G, Borofsky MS, Shah O, Lingeman JE, Lepor H. The Role of Minimally Invasive Surgical Techniques in the Management of Large-gland Benign Prostatic Hypertrophy. Rev Urol. 2015; 17: 140-149.

7. Asimakopoulos AD, Mugnier C, Hoeppfner JL, et al. Laparoscopic treatment of benign prostatic hyperplasia (BPH): overview of the current techniques. BJU Int. 2011; 107: 1168-1182.

8. Lucca I, Shariat SF, Hofbauer SL, Klatte T. Outcomes of minimally invasive simple prostatectomy for benign prostatic hyperplasia: a systematic review and meta-analysis. World J Urol. 2015; 33: 563-570.

9. van der Sanden WMM, Fossion L, de Laet K. Endoscopic Transvesical Adenomectomy of the Prostate, a New Minimal Invasive Approach for Large Benign Prostate Hyperplasia. A Description of the Technique and the Results of the First 40 Patients. Urology. 2019; 125: 174-178.

10. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004; 240: 205-213.

11. McCulloch P, Altman DG, Campbell WB, et al. No surgical innovation without evaluation: the IDEAL recommendations. Lancet. 2009; 374: 1105-1112.

12. Foster HE, Dahm P, Kohler TS, et al. Surgical Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia: AUA Guideline Amendment 2019. J Urol. 2019; 202: 592-598.

13. Gilling PJ, Wilson LC, King CJ, Westenberg AM, Frampton CM, Fraundorfer MR. 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. 2012; 109: 408-411.

14. Umari P, Fossati N, Gandaglia G, et al. Robotic Assisted Simple Prostatectomy versus Holmium Laser Enucleation of the Prostate for Lower Urinary Tract Symptoms in Patients with Large Volume Prostate: A Comparative Analysis from a High Volume Center. J Urol. 2017; 197: 1108-1114.

15. Kuntz RM, Lehrlch K, Ahyai SA. Holmium Laser Enucleation of the Prostate versus Open Prostatectomy for Prostates Greater than 100 Grams: 5-Year Follow-Up Results of a Randomised Clinical Trial. Eur Urol. 2008; 53: 160-168.

16. Baldini A, Fassi-Fehri H, Duarte RC, et al. Holmium Laser Enucleation of the Prostate versus Laparoscopic Transcapsular Prostatectomy: Perioperative Results and Three-Month Follow-Up. Curr Urol. 2016; 10: 81-86.

17. Li M, Qiu J, Hou Q, et al. Endoscopic Enucleation versus Open Prostatectomy for Treating Large Benign Prostatic Hyperplasia: A Meta-Analysis of Randomized Controlled Trials. PLOS ONE. 2015; 10: e0121265.

18. Tooher R, Sutherland P, Costello A, Gilling P, Rees GUY, Maddern GUY. A Systematic Review of Holmium Laser Prostatectomy for Benign Prostatic Hyperplasia. J Urol. 2004; 171: 1773-1781.

19. Serretta V, Morgia G, Fondacaro L, et al. Open prostatectomy for benign prostatic enlargement in southern Europe in the late 1990s: a contemporary series of 1800 interventions. Urology. 2002; 60: 623-627.

20. Naspro R, Suardi N, Salonia A, et al. Holmium laser enucleation of the prostate versus open prostatectomy...
for prostates >70 g: 24-month follow-up. Eur Urol. 2006; 50: 563-568.

21. Porpiglia F, Terrone C, Renard J, et al. Transcapsular adenomectomy (Millin): a comparative study, extraperitoneal laparoscopy versus open surgery. Eur Urol. 2006; 49: 120-126.

22. McCullough TC, Heldwein FL, Soon SJ, et al. Laparoscopic versus open simple prostatectomy: an evaluation of morbidity. J Endourol. 2009; 23: 129-133.

23. Sorokin I, Sundaram V, Singla N, et al. Robot-Assisted Versus Open Simple Prostatectomy for Benign Prostatic Hyperplasia in Large Glands: A Propensity Score-Matched Comparison of Perioperative and Short-Term Outcomes. J Endourol. 2017; 31: 1164-1169.

24. Pokorny M, Novara G, Geurts N, et al. Robot-assisted simple prostatectomy for treatment of lower urinary tract symptoms secondary to benign prostatic enlargement: surgical technique and outcomes in a high-volume robotic centre. Eur Urol. 2015; 68: 451-457.

25. Autorino R, Zargar H, Mariano MB, et al. Perioperative Outcomes of Robotic and Laparoscopic Simple Prostatectomy: A European-American Multi-institutional Analysis. Eur Urol. 2015; 68: 86-94.

26. Martin Garzon OD, Azhar RA, et al. One-Year Outcome Comparison of Laparoscopic, Robotic, and Robotic Intrafascial Simple Prostatectomy for Benign Prostatic Hyperplasia. J Endourol. 2016; 30: 312-328.

27. Elmansy HM, Kotb A, Elhilali MM. Holmium laser enucleation of the prostate: long-term durability of clinical outcomes and complication rates during 10 years of followup. J Urol. 2011; 186: 1972-1976.

28. Elkoushy MA, Elshal AM, Elhilali MM. Reoperation After Holmium Laser Enucleation of the Prostate for Management of Benign Prostatic Hyperplasia: Assessment of Risk Factors with Time to Event Analysis. J Endourol. 2015; 29: 797-804.

29. Jhanwar A, Sinha RJ, Bansal A, Prakash G, Singh K, Singh V. Outcomes of transurethral resection and holmium laser enucleation in more than 60 g of prostate: A prospective randomized study. Urol Ann. 2017; 9: 45-50.