REVIEW

Recent advances in prostatectomy for benign prostatic hyperplasia [version 1; peer review: 2 approved]

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Abstract

This review provides a brief overview of and commentary on currently available technology for the surgical treatment of obstructive benign prostatic hyperplasia causing lower urinary tract symptoms. This review provides references relevant to review and understand current technology that is clinically available.

Keywords

BPH, LUTS, Transurethral Prostatectomy, Laser, Aquablation, Retrograde Ejaculation, Vapor Ablation, Thermoablation, Electroablation, TURP, Open prostatectomy, Prostatic Stents, Stents, Benign Prostatic Hyperplasia, Lower Urinary Tract Symptoms, Robotic Prostatectomy

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In the last five years, advances in surgical options for obstructive benign prostatic hyperplasia (BPH) have progressed with new technologies and refinement of current options. These developments reflect the ongoing needs to still perfect this surgical approach. The most recent advancement is aquablation, the first non-thermal technology to resect prostate tissue; studies demonstrate efficacy and safety at least equivalent to those of transurethral resection of the prostate (TURP) in glands up to 150 mL and improved outcomes in retrograde ejaculation¹⁻⁴.

As intermediate options to medical therapy and TURP, both prostatic urethral lift and vapor ablation are generally office procedures that demonstrate superior safety profiles, especially in regard to sexual function, and that have acceptable efficacy compared with TURP⁵⁻⁹. In the past, most studies-based superiority of procedures on efficacy outcome parameters such as International Prostate Symptom Score and urodynamic parameters assessing obstruction relief as well as intraoperative and perioperative safety parameters such as bleeding, lengths of hospital stay, and infections. However, with the increased availability of novel and minimally invasive procedures, there is an increasing perception/awareness of these therapies as viable alternatives to medical therapy. Studies such as the BPH-6 studies in which a combination of quality-of-life parameters have increased the importance in outcome parameters that affect procedure choice such as retrograde ejaculation, need for catheterization, and recovery time have made what were technically less efficacious procedures more “superior” in these studies¹⁰. As such, many novel and minimally invasive procedures, including various prostatic stents and new technologies to resect prostate tissue or relieve prostatic outlet resistance, are still being aggressively developed. Many of these novel techniques, such as prostatic urethral lift and vapor ablation, are also designed to be used in an outpatient or office setting with minimal or local anesthesia.

Not surprisingly, many currently used technologies, including many traditional therapies, have evolved. Because it removes the risk of dilutional hyponatremia by using normal saline as an irrigant, the standard TURP is now performed with bipolar technologies with equal efficacy and improved safety parameters¹¹⁻¹⁴. The open prostatectomy has also evolved to be incorporated in many robotic prostatectomy procedures, although its overall complication rate and hospital stay are still much higher than those of many transurethral procedures¹⁵⁻¹⁷. The well-known laser-assisted enucleation of the prostate, holmium laser enucleation of the prostate (HoLEP), is one of the most well-studied procedures, demonstrating efficacy and safety superior to those of traditional open prostatectomy and TURP. However, its high learning curve has limited its widespread acceptance and utility¹⁸⁻²⁰. Despite being initially limited to centers of excellence, it has undergone growing popularity due to the increasing number of trainees who have come from these

centers of excellence as well as the improved technology of morcellation and instrumentation. The procedure has been in use since its initial introduction 20 years ago. However, laser procedures did not undergo durable popularity and widespread clinical utility until the introduction of high-power 532-nm laser technology, or “GreenLight” laser. Initially known as photoselective vaporization (PVP) and introduced as a viable technology with the first multicenter article in 2004^{21,22}, it is now the most common laser procedure in the world as a pure laser vaporization procedure. This technology has also evolved from an 80-Watt technology to a 180-Watt technology capable of vaporizing prostate tissue more efficiently and faster²³. Many studies have demonstrated the laser’s clear superior safety profile in anticoagulated patients, high risk patients (high American Society of Anaesthesiologists score or Charlson index) and in large prostates²⁴⁻²⁸. Whereas most “GreenLight” procedures use pure vaporization techniques for glands up to about 80 g, vapoenucleations techniques have been applied to glands up to 376 mL²⁹. Although there are many competing laser technologies, none has yet to compare in terms of ease of use, widespread utility, and short learning curve with a high safety profile.

Over the last decade, the superior outcome efficacy and durability of HoLEP in comparison with open prostatectomy have suggested a modification in technique to incorporate enucleation with various technologies. Not surprisingly, laser enucleation of the prostate with GreenLight has evolved to demonstrate better efficacy with a maintained safety profile, especially in very large glands. The enucleation technique has expanded to include thulium laser technology as well as bipolar electrovaporization technology³⁰⁻³³. The vaporization enucleation technique with GreenLight has allowed enucleation and completion of prostatectomy without a mechanical morcellator with outcomes superior to those of standard PVP techniques, especially in larger glands²⁹.

With the goal of preserving sexual function, the preservation of antegrade ejaculation has become an area of focus and interest with current evolving technologies. Studies with prostatic urethral lift and vapor ablation and aquablation incorporate ejaculation outcomes and demonstrate increased preservation of antegrade ejaculation compared with traditional techniques. Although preservation of bladder neck structures is often associated with preservation of antegrade ejaculation, especially in those with large intravesical middle lobes, the current modern approach is the preservation of paracollicular structures in laser, aquablation, and bipolar electrosurgical prostatectomy techniques³⁴.

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References

1. **F** Gilling P, Barber N, Bidair M, *et al.*: **WATER: A Double-Blind, Randomized, Controlled Trial of Aquablation® vs Transurethral Resection of the Prostate in Benign Prostatic Hyperplasia.** *J Urol.* 2018; 199(5): 1252–61.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
2. **F** Gilling PJ, Barber N, Bidair M, *et al.*: **Randomized Controlled Trial of Aquablation versus Transurethral Resection of the Prostate in Benign Prostatic Hyperplasia: One-year Outcomes.** *Urology.* 2019; 125: 169–73.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
3. **F** Desai M, Bidair M, Bhojani N, *et al.*: **WATER II (80-150 mL) procedural outcomes.** *BJU Int.* 2019; 123(1): 106–12.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
4. **F** Chughtai B, Thomas D: **Pooled Aquablation Results for American Men with Lower Urinary Tract Symptoms due to Benign Prostatic Hyperplasia in Large Prostates (60-150 cc).** *Adv Ther.* 2018; 35(6): 832–8.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
5. Roehrborn CG, Barkin J, Gange SN, *et al.*: **Five year results of the prospective randomized controlled prostatic urethral L.I.F.T. study.** *Can J Urol.* 2017; 24(3): 8802–13.
[PubMed Abstract](#)
6. **F** Gupta N, Rogers T, Holland B, *et al.*: **Three-Year Treatment Outcomes of Water Vapor Thermal Therapy Compared to Doxazosin, Finasteride and Combination Drug Therapy in Men with Benign Prostatic Hyperplasia: Cohort Data from the MTOPS Trial.** *J Urol.* 2018; 200(2): 405–13.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
7. **F** McVary KT, Roehrborn CG: **Three-Year Outcomes of the Prospective, Randomized Controlled Rezum System Study: Convective Radiofrequency Thermal Therapy for Treatment of Lower Urinary Tract Symptoms Due to Benign Prostatic Hyperplasia.** *Urology.* 2018; 111: 1–9.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
8. **F** McVary KT, Gange SN, Gittelman MC, *et al.*: **Erectile and Ejaculatory Function Preserved With Convective Water Vapor Energy Treatment of Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia: Randomized Controlled Study.** *J Sex Med.* 2016; 13(6): 924–33.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
9. **F** McVary KT, Gange SN, Gittelman MC, *et al.*: **Minimally Invasive Prostate Convective Water Vapor Energy Ablation: A Multicenter, Randomized, Controlled Study for the Treatment of Lower Urinary Tract Symptoms Secondary to Benign Prostatic Hyperplasia.** *J Urol.* 2016; 195(5): 1529–38.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
10. **F** Gratzke C, Barber N, Speakman MJ, *et al.*: **Prostatic urethral lift vs transurethral resection of the prostate: 2-year results of the BPH6 prospective, multicentre, randomized study.** *BJU Int.* 2017; 119(5): 767–75.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
11. Erturhan S, Erbagci A, Seckiner I, *et al.*: **Plasmakinetic resection of the prostate versus standard transurethral resection of the prostate: a prospective randomized trial with 1-year follow-up.** *Prostate Cancer Prostatic Dis.* 2007; 10(1): 97–100.
[PubMed Abstract](#) | [Publisher Full Text](#)
12. Yoon CJ, Kim JY, Moon KH, *et al.*: **Transurethral resection of the prostate with a bipolar tissue management system compared to conventional monopolar resectoscope: one-year outcome.** *Yonsei Med J.* 2006; 47(5): 715–20.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
13. Xie CY, Zhu GB, Wang XH, *et al.*: **Five-year follow-up results of a randomized controlled trial comparing bipolar plasmakinetic and monopolar transurethral resection of the prostate.** *Yonsei Med J.* 2012; 53(4): 734–41.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
14. Geavlete B, Georgescu D, Multescu R, *et al.*: **Bipolar plasma vaporization vs monopolar and bipolar TURP-A prospective, randomized, long-term comparison.** *Urology.* 2011; 78(4): 930–5.
[PubMed Abstract](#) | [Publisher Full Text](#)
15. **F** Holden M, Parsons JK: **Robotic-Assisted Simple Prostatectomy: An Overview.** *Urol Clin North Am.* 2016; 43(3): 385–91.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
16. **F** Ferretti M, Phillips J: **Prostatectomy for benign prostate disease: open, laparoscopic and robotic techniques.** *Can J Urol.* 2015; 22 Suppl 1: 60–6.
[PubMed Abstract](#) | [F1000 Recommendation](#)
17. **F** 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(11): 1164–9.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
18. **F** Zhang MW, El Tayeb MM, Borofsky MS, *et al.*: **Comparison of Perioperative Outcomes Between Holmium Laser Enucleation of the Prostate and Robot-Assisted Simple Prostatectomy.** *J Endourol.* 2017; 31(9): 847–50.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
19. Gilling PJ, Wilson LC, King CJ, *et al.*: **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(3): 408–11.
[PubMed Abstract](#) | [Publisher Full Text](#)
20. **F** 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(4): 1108–14.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
21. Te AE, Malloy TR, Stein BS, *et al.*: **Photoselective vaporization of the prostate for the treatment of benign prostatic hyperplasia: 12-month results from the first United States multicenter prospective trial.** *J Urol.* 2004; 172(4 Pt 1): 1404–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
22. Te AE, Malloy TR, Stein BS, *et al.*: **Impact of prostate-specific antigen level and prostate volume as predictors of efficacy in photoselective vaporization prostatectomy: analysis and results of an ongoing prospective multicentre study at 3 years.** *BJU Int.* 2006; 97(6): 1229–33.
[PubMed Abstract](#) | [Publisher Full Text](#)
23. Chung DE, Te AE: **New techniques for laser prostatectomy: an update.** *Ther Adv Urol.* 2009; 1(2): 85–97.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
24. Sandhu JS, Ng C, Vanderbrink BA, *et al.*: **High-power potassium-titanyl-phosphate photoselective laser vaporization of prostate for treatment of benign prostatic hyperplasia in men with large prostates.** *Urology.* 2004; 64(6): 1155–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
25. Valdivieso R, Hueber PA, Meskawi M, *et al.*: **Multicentre international experience of 532-nm laser photoselective vaporization with GreenLight XPS in men with very large prostates.** *BJU Int.* 2018; 122(5): 873–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
26. Sandhu JS, Ng CK, Gonzalez RR, *et al.*: **Photoselective laser vaporization prostatectomy in men receiving anticoagulants.** *J Endourol.* 2005; 19(10): 1196–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
27. Chung DE, Wysock JS, Lee RK, *et al.*: **Outcomes and complications after 532 nm laser prostatectomy in anticoagulated patients with benign prostatic hyperplasia.** *J Urol.* 2011; 186(3): 977–81.
[PubMed Abstract](#) | [Publisher Full Text](#)
28. Lee DJ, Rieken M, Halpern J, *et al.*: **Laser Vaporization of the Prostate With the 180-W XPS-Greenlight Laser in Patients With Ongoing Platelet Aggregation Inhibition and Oral Anticoagulation.** *Urology.* 2016; 91: 167–73.
[PubMed Abstract](#) | [Publisher Full Text](#)
29. Stone BV, Chughtai B, Forde JC, *et al.*: **Safety and Efficacy of GreenLight XPS Laser Vapoenucleation in Prostates Measuring Over 150 mL.** *J Endourol.* 2016; 30(8): 906–12.
[PubMed Abstract](#) | [Publisher Full Text](#)
30. Elterman DS, Chughtai B, Lee R, *et al.*: **Comparison of techniques for transurethral laser prostatectomy: standard photoselective vaporization of the prostate versus transurethral laser enucleation of the prostate.** *J Endourol.* 2013; 27(6): 751–5.
[PubMed Abstract](#) | [Publisher Full Text](#)
31. **F** Becker B, Herrmann TRW, Gross AJ, *et al.*: **Thulium vapoenucleation of the prostate versus holmium laser enucleation of the prostate for the treatment of large volume prostates: preliminary 6-month safety and efficacy results of a prospective randomized trial.** *World J Urol.* 2018; 36(10): 1663–71.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
32. **F** Gross AJ, Orywal AK, Becker B, *et al.*: **Five-year outcomes of thulium vapoenucleation of the prostate for symptomatic benign prostatic obstruction.** *World J Urol.* 2017; 35(10): 1585–93.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
33. **F** Ou R, Deng X, Yang W, *et al.*: **Transurethral enucleation and resection of the prostate vs transvesical prostatectomy for prostate volumes >80 mL: a prospective randomized study.** *BJU Int.* 2013; 112(2): 239–45.
[PubMed Abstract](#) | [Publisher Full Text](#) | [F1000 Recommendation](#)
34. **F** Kim M, Song SH, Ku JH, *et al.*: **Pilot study of the clinical efficacy of ejaculatory hood sparing technique for ejaculation preservation in Holmium laser enucleation of the prostate.** *Int J Impot Res.* 2015; 27(1): 20–4.
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