Minimally Invasive Surgeries for Benign Prostatic Hyperplasia (BPH)

Reviewed by:

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Introduction

Benign prostatic hyperplasia (BPH) is a non-cancerous enlargement of the prostate gland, common in older men, and a leading cause of lower urinary tract symptoms (LUTS). Its prevalence increases with age, affecting up to 60% of men in their 60s and nearly 90% of those over 70. BPH involves histological changes, while benign prostatic enlargement (BPE) refers to the increased size of the prostate, often leading to bladder outlet obstruction (BOO). This results from cell proliferation in the prostate's transition zone, causing urethral compression and urinary issues. Treatment ranges from watchful waiting to medical and surgical interventions, with risk factors including age, genetics, and lifestyle factors such as obesity.[1]

Transurethral Resection of the Prostate (TURP)[2]

TURP remains the gold standard for treating BPH due to its proven and consistent outcomes. TURP is especially effective for patients with moderate to severe LUTS and larger prostate volumes.

Key Points Supporting TURP as the Gold Standard:

1. **Effective Symptom Relief:** TURP provides significant and sustained improvements in urinary symptoms, such as frequency, urgency, nocturia, and weak urine flow. It also improves the International Prostate Symptom Score (IPSS) and quality of life.
2. **Improved Urinary Flow:** TURP enhances peak urinary flow rates (Qmax) by removing obstructing prostatic tissue, with results superior to many newer, less invasive therapies.
3. **Durable Long-Term Outcomes:** TURP offers lasting symptom relief, with lower rates of re-treatment compared to other techniques. Many patients might benefit for 10-15 years or more.
4. **Safety Profile:** TURP has an established safety record with low rates of serious complications when performed by experienced surgeons. Most side effects, like temporary bleeding or urinary incontinence, are manageable.
5. **Broad Applicability:** TURP is effective for a wide range of prostate sizes and patient comorbidities, making it a versatile treatment, particularly for larger prostates.
6. **Comparative Advantage Over Newer Techniques:** Despite advances in minimally invasive therapies, TURP remains superior or comparable, especially for severe cases or larger prostate volumes.

Conclusion

TURP remains the preferred option for surgically managing BPH because of its superior efficacy, durable outcomes, safety, and suitability for a wide range of patients, solidifying its position as the gold standard.

Robotic Simple Prostatectomy[3]

Surgery for large BPH presents challenges, especially for prostates weighing 80-100 g or more. Traditional open simple prostatectomy (OSP) is effective but invasive and carries risks like significant bleeding.

Robotic simple prostatectomy (RSP), using systems like the da Vinci Surgical System, offers a less invasive alternative with reduced bleeding and the ability to address concurrent bladder diseases. RSP can be performed by surgeons experienced in robotic pelvic surgeries and is increasingly considered a replacement for OSP.

Advantages of RSP for large BPH

- **Reduced Bleeding and Transfusion Rates:** Less bleeding and a lower need for transfusions than Open Simple Prostatectomy (OSP).
- **Faster Recovery:** Patients recover more quickly than with OSP.
- **Ease for Surgeons:** Comparable surgical outcomes to laparoscopy, with reduced surgeon fatigue and easier performance.
- **Lower Risk of Complications:** There is minimal risk of requiring transfusions or experiencing major complications, even for beginners.
- **Reduced Risk of Urethral Stricture:** Less likely to cause urethral damage or stricture compared to HoLEP, especially in cases with small-caliber urethras.
- **Preservation of Continence Mechanisms:** Lower risk of urinary incontinence since RSP spares the external sphincter and tissues associated with continence; unlike HoLEP, which has higher rates of transient incontinence.
- **Simultaneous Treatment of Associated Conditions:** Allows concurrent surgery for bladder stones, diverticula, and inguinal hernia without additional incisions or repositioning.

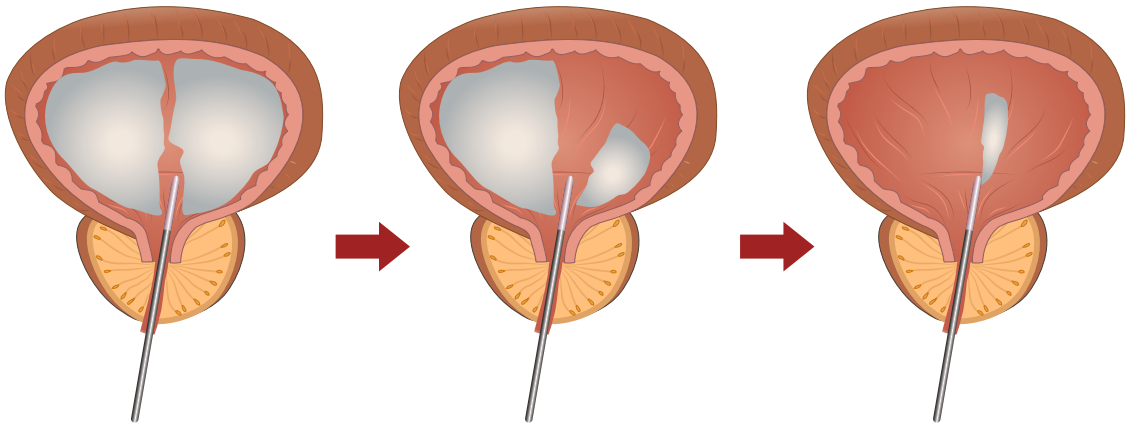
HoLEP: Emerging Gold Standard for BPH Surgery[4,5]

Holmium enucleation of the prostate (HoLEP) is endorsed by the American Urological Association (AUA) for treating LUTS due to BPH, effective regardless of prostate size.

Figure 1: Illustrating the total excision of the obstructive inner section of the prostate achieved through HoLEP.

- **Advantages Over Other Procedures**
  - Supported by a growing body of literature for its efficacy, long-term durability, and favorable risk profile.
  - Superior to TURP, open prostatectomy (OP), and various laser therapies in terms of outcomes and morbidity.
- **Technological Advancements:**
  - Since its introduction in 1998, HoLEP has benefited from improved laser technology, endoscopic morcellation devices, and refined techniques.
  - New techniques like the modified 2-lobe and en-bloc approaches have enhanced its effectiveness and ease of learning.
- **Clinical Benefits:**
  - Greater improvements in post-operative Qmax and symptom scores.
  - Lower rates of repeat procedures (<1% vs. 7.4% for TURP and 5.6% for PVP).
  - Shorter catheterization times and reduced hospital stays.
- **Effectiveness for Large Prostates:**
  - HoLEP can effectively enucleate adenomas >100 grams with similar efficacy to OP but with significantly reduced morbidity, including shorter hospitalization, less blood loss, and fewer transfusions.

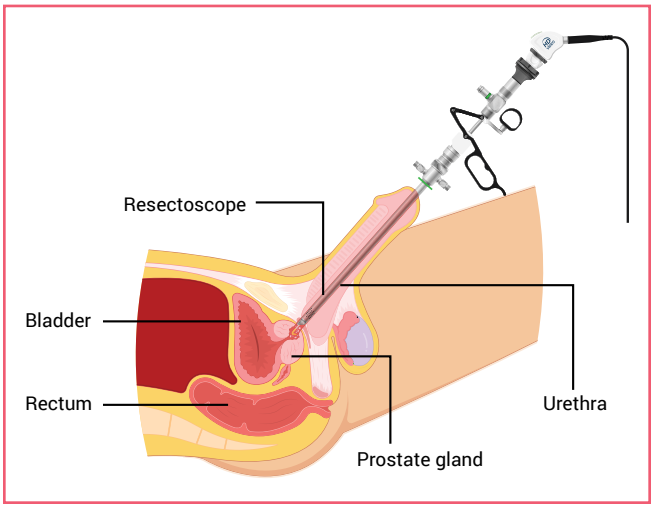
Figure 1



Transurethral Incision of the Prostate (TUIP)[6]

Transurethral incision of the prostate (TUIP) is a surgical procedure designed to improve urinary function in men with benign prostatic hyperplasia (BPH).

- Unlike transurethral resection of the prostate (TURP), TUIP does not involve removing prostate tissue.
- The procedure uses an electrocautery device or laser to make incisions in the prostate from the bladder neck to the verumontanum, which helps relieve urinary obstruction by separating the hypertrophied tissue.
- TUIP is typically recommended for men with smaller prostates (less than 30 cc) and generally offers better outcomes for ejaculatory function compared to TURP but is less effective in improving peak flow rates.
- TUIP is not recommended for patients with a large median lobe due to the risk of ongoing blockage.



Transurethral Electrovaporization of the Prostate (TUVP)[6]

TUVP is a minimally invasive surgical technique (MIST) that uses heat from monopolar or bipolar high-voltage electrical current to ablate prostate tissue, similar to TURP.

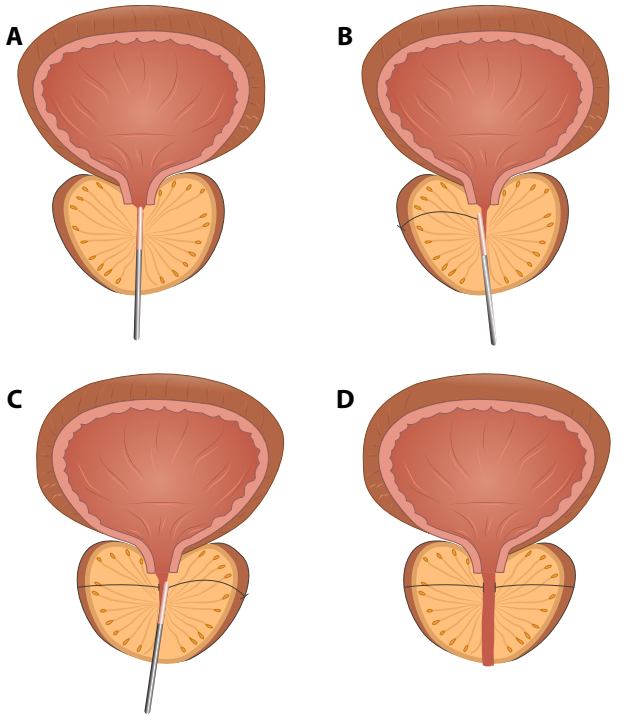
- TUVP has shown similar symptomatic benefits to TURP, with significant reductions in International Prostate Symptom Score (IPSS) and improvements in peak urine flow rate of around 10 mL/s.
- A randomized controlled study comparing bipolar TUVP with monopolar TURP found both techniques effective in reducing IPSS (49.7% for TUVP and 70.6% for TURP at 6 months). However, TURP showed more statistically significant improvements in IPSS and peak flow rates.
- TUVP was associated with shorter catheterization duration, reduced post-procedure hematuria risk, less hematocrit drop, and fewer perioperative complications compared to TURP.
- Despite its advantages, TUVP had higher rates of secondary intervention for clinical failure than TURP.
- The introduction of continuous energy bipolar TUVP has shown benefits over conventional TUVP and monopolar TURP, including reduced operating time, lower rates of postoperative hematuria, shorter catheterization periods, and fewer perioperative complications.

Urolift (Prostatic Urethral Lift)[7]

Urolift is a minimally invasive treatment for lower urinary tract symptoms (LUTS) in men.

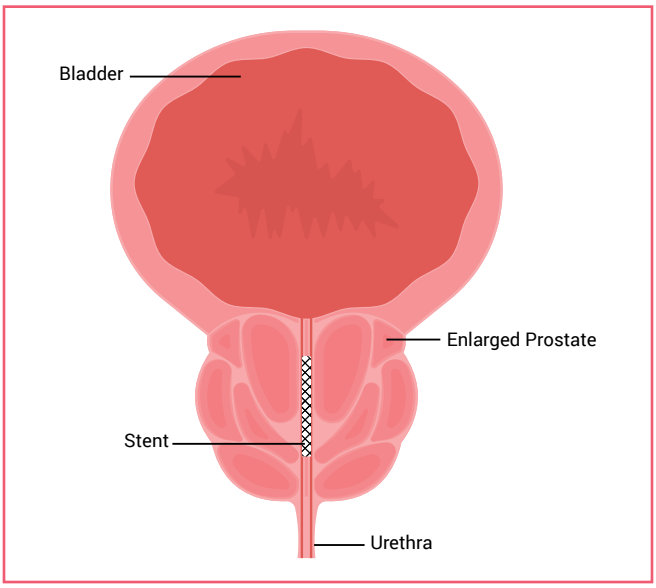
- It involves placing non-absorbable sutures with a nitinol prostate capsular anchor and a stainless-steel urethral end piece to mechanically open the anterior prostatic fossa and relieve urethral obstruction.
- **Advantages:** Urolift does not use thermal energy, which helps reduce adverse effects such as erectile dysfunction and ejaculatory dysfunction, commonly associated with traditional treatments like TURP.

Sequence for delivering the Urolift device



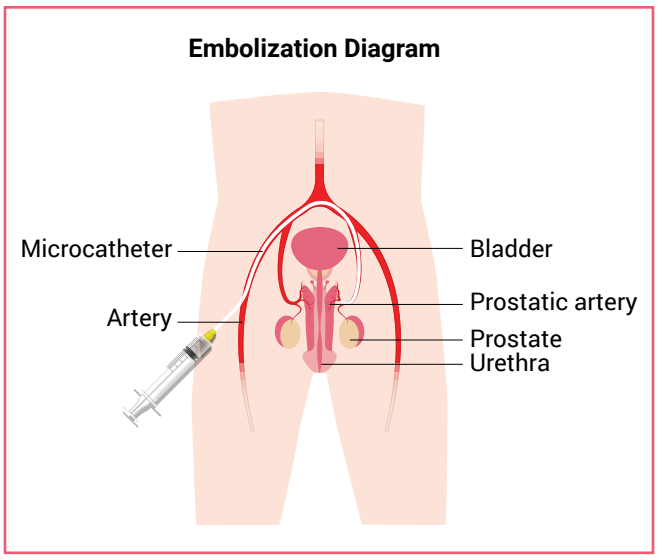
Intraprostatic Stents[6]

Intraprostatic stenting, performed transurethrally under endoscopic guidance, uses either temporary biodegradable or permanent devices to alleviate prostatic obstruction. A recent study by Yildiz et al. on 51 Allium Triangular Prostatic Stent patients showed significant improvements, with IPSS scores dropping from 26.4 to 7.7 and peak urine flow rates increasing from 5.5 mL/s to 16.0 mL/s. However, complications led to stent removal in two cases, and intermittent stent-related pain was common. Risks like stent migration and recurrent infection limit the long-term use of these devices, warranting further large-scale studies to assess their efficacy.



Prostate Artery Embolization (PAE)[8]

- Prostate Artery Embolization (PAE) is a minimally invasive procedure that reduces blood flow to the prostate to alleviate LUTS caused by benign prostatic hyperplasia (BPH).
- It involves catheterizing the femoral artery, guiding it to the prostate arteries, and delivering embolic agents to shrink the prostate. PAE requires no hospitalization or general anesthesia and has fewer sexual side effects compared to traditional surgeries.
- Indications for PAE include symptomatic LUTS unresponsive to conservative treatments, refractory hematuria from BPH or prostate cancer, palliative care for advanced prostate cancer, and chronic catheter use due to BPH.
- Clinical outcomes show significant improvements in IPSS, peak urine flow rates, and high rates of hematuria resolution, and successful catheter removal.



- PAE is generally safe, though potential complications include stent migration and infection.

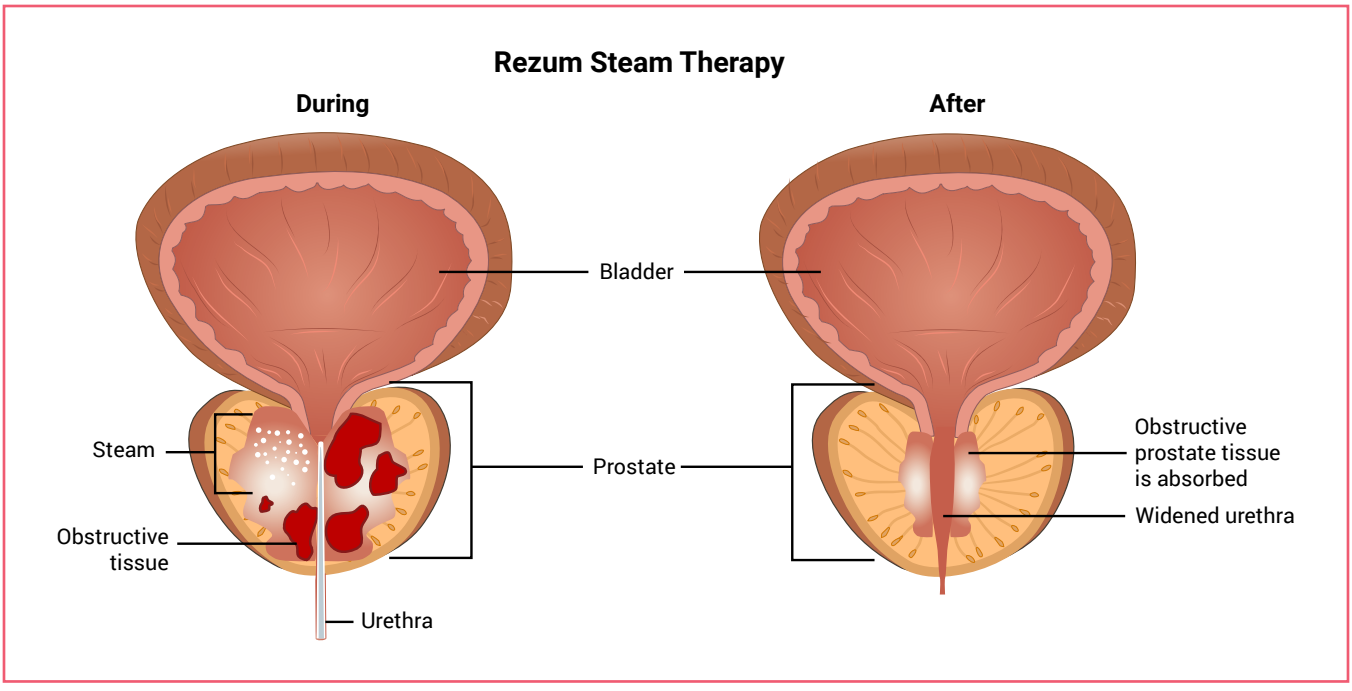
Rezum Therapy[9]

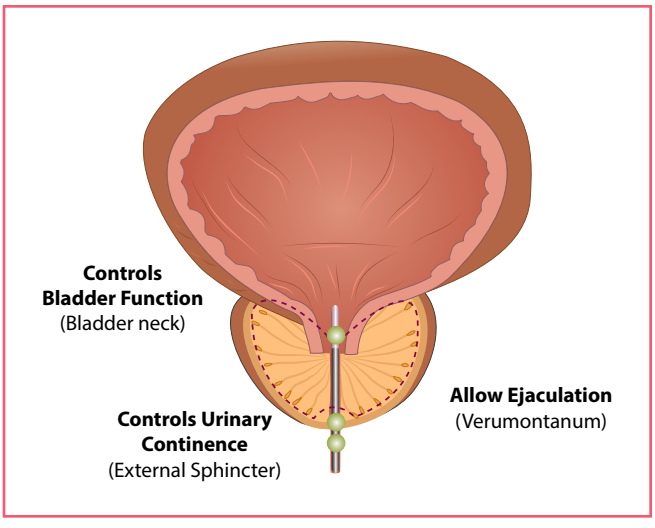
Rezum is a minimally invasive therapy designed to treat lower urinary tract symptoms (LUTS) caused by benign prostatic enlargement (BPE). The procedure involves the use of radiofrequency-generated water vapor, which is injected into the prostate tissue via a retractable needle under cystoscopic control. The rapid increase in tissue temperature leads to cell necrosis, reducing the size of the prostate and alleviating symptoms. Approved by the US FDA in 2015, Rezum is known for its short operation time, excellent safety profile, and minimal impact on sexual function, making it a viable option for patients with prostate volumes under 80g, including those with a median lobe. The American Urological Association (AUA) also recommends Rezum for patients with prostate volumes under 80g. Clinical trials have demonstrated significant improvements in symptom relief, quality of life, and urine flow, with benefits lasting up to five years post-treatment.

Aquablation[10]

Aquablation is a novel minimally invasive treatment for benign prostatic hyperplasia (BPH), which uses a waterjet controlled by robotic technology to remove prostate tissue. The procedure is conducted under anesthesia and combines ultrasound imaging with cystoscopy to create a precise surgical map of the prostate, ensuring the targeted removal of tissue while preserving critical areas related to sexual function and urinary control.

Aquablation has shown to be effective across various prostate sizes, including larger glands, providing





durable symptom relief with a low risk of complications such as incontinence or sexual dysfunction. The technology's precision and the heat-free method contribute to its favorable safety profile. Clinical studies report significant improvements in symptoms and quality of life, with results sustained over time. This approach is particularly beneficial for patients who prioritize maintaining sexual function while seeking relief from BPH symptoms.

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