

HoLEP vs TURP in Benign Prostatic Hyperplasia: A Systematic Review

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Abstract

Purpose: This review evaluates the efficacy, safety, and durability of HoLEP versus TURP, addressing the research gap concerning their comparative long-term stability and performance across varying prostate volumes. The study focuses on functional outcomes, complication profiles, and the scalability of each technique.

Research Methodology: A systematic search (2020–2025) identified RCTs and meta-analyses comparing HoLEP and TURP in BPH patients. Parameters analyzed included IPSS, Qmax, PVR, perioperative outcomes, and reoperation rates.

Results: Both procedures show comparable functional gains. However, HoLEP offers a superior perioperative profile, significantly lower bleeding risk, and higher long-term durability. Furthermore, HoLEP's efficacy is independent of prostate size, whereas TURP efficiency diminishes in larger glands. **Conclusions:** Despite a steeper learning curve, HoLEP's safety and versatility position it as the primary modern surgical standard. TURP remains a relevant alternative depending on institutional facilities.

Conclusions: Despite having a longer learning curve, HoLEP is worthy of consideration as the primary choice in modern surgical management of BPH, while TURP remains relevant in certain conditions and facilities.

Limitations: Limitations of this systematic review are the heterogeneity of study designs, populations, and follow-up durations, which may affect the comparability of results.

Contributions: This review provides a contemporary evidence-based guide for clinicians in selecting optimal surgical interventions.

Keywords: Benign Prostatic Hyperplasia; HoLEP; Long-Term Outcomes; Perioperative Outcomes; TURP

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1. Introduction

Benign Prostatic Hyperplasia (BPH) is a progressive disorder characterized by the non-cancerous proliferation of stromal and epithelial cells within the prostate gland. While its prevalence increases sharply with age, BPH remains a leading cause of lower urinary tract symptoms (Xie, Liu, Hu, & Dong), such as urinary hesitancy, nocturia, and acute urinary retention. These symptoms not only compromise urinary function but also substantially diminish quality of life and increase the global healthcare burden (Faraon et al., 2024; Wei et al., 2025). Although initial management typically involves pharmacological therapies like α -blockers and 5- α -reductase inhibitors (Haile, Sotimehin, & Gill, 2024). Nevertheless, surgical intervention remains the leading strategy for alleviating bladder outlet obstruction in cases where pharmacological treatments are ineffective, symptoms are moderate to severe, or complications such as recurrent urinary retention, recurrent urinary tract infections, or renal dysfunction, surgical intervention is the primary option to reduce intravesical obstruction.

For decades, transurethral resection of the prostate (TURP) has served as the benchmark surgical treatment for BPH, especially for small to medium-sized prostates. This procedure has been proven effective in improving urine flow and significantly reducing symptom scores. However, TURP is associated with significant morbidity in larger prostates, including higher risks of hemorrhage, transfusion requirements, and the potentially life-threatening TUR syndrome ([Leslie, Chargui, & Stormont, 2023](#)). To address these limitations, Holmium Laser Enucleation of the Prostate (HoLEP) has emerged as a versatile alternative. HoLEP facilitates complete adenoma enucleation along the anatomical capsule, mimicking open prostatectomy through a minimally invasive transurethral approach ([Lee et al., 2024](#)). Unlike TURP, which is volume-restricted, HoLEP offers a size-independent solution with superior hemostatic control and long-term durability ([Chen et al., 2023](#); [Daryanto, Suryanullah, & Putra, 2025](#); [Sun et al., 2022](#)). Despite its growing adoption, there remains a lack of updated consensus regarding its comparative efficacy against TURP in the context of recent technological refinements and long-term functional stability. Consequently, a contemporary systematic review is urgent to synthesize latest clinical evidence. This study aims to evaluate and compare HoLEP and TURP, focusing on functional outcomes, perioperative safety, and their respective performance across varying prostate volumes to guide evidence-based surgical selection.

2. Literature Review and Hypothesis Development

2.1 Pathophysiology and Clinical Manifestations of BPH

Benign prostatic hyperplasia (BPH) is a condition defined by nonmalignant proliferation of prostatic tissue ([Ng, Leslie, & Baradhi, 2024](#)). Beyond simple cellular multiplication, this condition represents a progressive mechanical and dynamic obstruction of the prostatic urethra, leading to lower urinary tract symptoms ([Xie et al., 2024](#)). While the etiology is multifactorial—encompassing the Dihydrotestosterone (DHT) Theory, Estrogen-Testosterone Imbalance, and Decreased Apoptosis ([Xiang et al., 2025](#); [Xu et al., 2024](#)). Meanwhile, risk factors for BPH can be classified into non-modifiable factors and lifestyle factors. These include age, genetics, metabolic syndrome, and obesity, as well as lifestyle factors such as diet, and heart conditions ([Siqueira, 2025](#)). Because BPH causes mechanical obstruction of the urinary tract, which can then manifest as LUTS, intervention is necessary ([Zubair et al., 2022](#)).

2.2 Current Therapies for BPH

Interventions for BPH follow a tiered approach aimed at symptom relief and preventing disease progression ([Husted, Gray, Golding, & Hindley, 2022](#)). Initial management typically combines lifestyle changes with pharmacotherapy, including alpha-1 blockers (e.g., Tamsulosin) and 5-alpha-reductase inhibitors (5ARIs) like Finasteride ([Halawani et al., 2024](#)). Although this combination of medications is often effective in the early stages, its success depends heavily on patient compliance and the initial size of the prostate gland. However, when medical therapy fails or when complications arise, clinician focus shifts toward surgical procedures. While options like Water Vapor Thermal Therapy (Rezūm), Prostatic Arterial Embolization (PAE), and Urolift offer lower morbidity, they often serve as bridge therapies rather than definitive solutions for significant adenoma debulking, unlike the established roles of HoLEP and TURP. The inability of certain minimally invasive procedures to completely remove hyperplastic tissue often leads to a higher risk of reoperation in the long term compared to standard enucleation or resection techniques ([De Cillis et al., 2022](#); [Franco et al., 2021](#)).

2.3 Comparative Analysis of HoLEP and TURP

Holmium Laser Enucleation of the Prostate (HoLEP) has emerged as a size-independent endoscopic solution ([Elmansy, Abbas, et al., 2023](#); [Shah et al., 2025](#)). Following the anatomical principle of open prostatectomy, HoLEP allows for complete enucleation of the adenoma through a minimally invasive transurethral approach. Critical evidence suggests that HoLEP provides superior hemostatic control, with over 90% of cases being discharged within 24 hours ([Elmansy, Hodhod, et al., 2023](#); [Shah et al., 2025](#)). Modern refinements, such as ejaculation-preserving and "double-n" techniques, have further enhanced its post-operative profile compared to the standard technique ([Eliwa, Aldarraji, Abdelwahab, & Salem, 2025](#)); ([Gao et al., 2025](#)). Nevertheless, a steep learning curve remains a major challenge in the widespread implementation of HoLEP ([Elmansy, Abbas, et al., 2023](#); [Shah et al., 2025](#)).

In contrast, Transurethral Resection of the Prostate (TURP) remains the historical benchmark for small-to-medium glands, especially in patients with significant residual urine volume and an enlarged prostate ([Hasan et al., 2022](#); [Lebani et al., 2023](#)). Nevertheless, postoperative outcomes may vary depending on the patient's condition; lower improvements in Qmax were observed in patients with detrusor underactivity, although improvements in symptom scores remained consistent ([Lebani et al., 2023](#)). Additionally, TURP has been shown to accelerate the time to urination and shorten the length of hospital stay without increasing complications ([Song et al., 2022](#)). However, analysis of its limitations reveals a "volume ceiling," where larger prostates increase the risk of TUR syndrome, hematuria, and longer hospital stays ([Pogula, Galeti, Ahmad, & Kanchi, 2021](#)); ([Basirun, 2024](#)).

Comparative data consistently points toward HoLEP as more efficient for complete adenoma clearance (PSA reduction) and faster catheter removal ([Altuntas et al., 2026](#)). HoLEP demonstrates more significant symptomatic improvement and greater PSA reduction as a surrogate for more complete adenoma resection ([Maheshwari et al., 2025](#)). TURP is associated with higher rates of bladder neck contracture and urinary incontinence compared to HoLEP, making the laser technique more recommended for high-risk patients ([Hu et al., 2025](#)). Although both procedures show comparable six-month outcomes in moderate BPH, the steeper learning curve of HoLEP is increasingly viewed as the only major barrier to its status as the absolute gold standard ([Altuntas et al., 2026](#); [Maheshwari et al., 2025](#)); ([Mostafa, Khallaf, Khalil, Elgammal, & Mahdy, 2022](#)).

2.4 Hypothesis Development

Based on the synthesis of contemporary evidence, this review is guided by the hypothesis that HoLEP provides a superior perioperative safety profile and higher long-term functional durability compared to TURP. It is anticipated that HoLEP will demonstrate consistent clinical efficacy across all prostate volumes, effectively addressing the size-dependent morbidity risks associated with traditional resection. Furthermore, this study posits that HoLEP results in significantly shorter catheterization times and lower re-intervention rates, ultimately positioning it as the more versatile and definitive surgical standard for the modern management of BPH.

3. Methodology

To ensure the highest standards of transparency and scientific integrity, this research followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Since the study was based on a secondary evaluation of existing data, institutional ethical approval and informed consent were not required. We performed a comprehensive literature search across the PubMed/MEDLINE, Scopus, and Cochrane Library databases, focusing on papers published between 2020 and 2025. The search strategy combined keywords and Boolean operators as follows: ("holmium laser enucleation" OR "HoLEP") AND ("transurethral resection of the prostate" OR "TURP") AND ("benign prostatic hyperplasia" OR "BPH"). Eligibility was restricted to English-language studies involving human participants. Furthermore, we manually audited the reference lists of identified articles to capture any additional relevant research.

The selection process was conducted in distinct phases as illustrated in the PRISMA flow diagram (Figure 1). Initial database searching yielded 348 records. After removing duplicates (n = 8) and records marked as ineligible by automation tools (n = 9), 331 records underwent title and abstract screening. Of these, 290 were excluded for not meeting the Randomized Controlled Trial (RCT) design. Subsequently, 41 reports were sought for retrieval, and 19 full-text articles were assessed for eligibility. After excluding 10 studies published prior to 2020, a total of 9 studies were ultimately included in the review. To ensure clarity, the specific inclusion and exclusion criteria are summarized in Table 1 below.

Table 1. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population	Patients with confirmed BPH	Patients with prostatic malignancy
Intervention	HoLEP vs. TURP	Procedures other than HoLEP/TURP

Study Design	RCTs, Cohort studies, Meta-analyses	Case reports, editorials, narrative reviews
Outcome	Functional (IPSS, Qmax), perioperative, safety	Insufficient data or duplicate publications
Time Frame	Published between 2020 – 2025	Published prior to 2020

Articles were selected by initial screening of titles and abstract then continued by full-text examination by two independent reviewers and disagreement resolved through discussion. Methodological quality was examined using the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle–Ottawa Scale (NOS) for observational studies. Data synthesis was performed using a narrative approach, focusing on the qualitative comparison of functional outcomes and complication rates across the 9 included studies, as the heterogeneity of the data precluded a formal meta-analysis. Results used for critical interpretation without excluding studies based on quality scores alone.

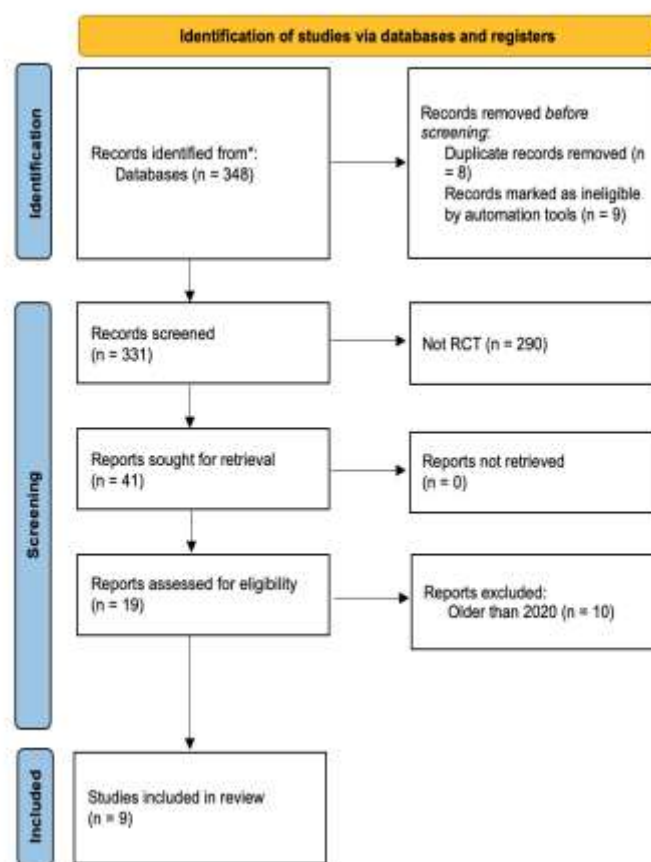


Figure 1. PRISMA chart

4. Results and Discussions

4.1 Results

4.1.1 Functional Outcomes

Evidence from the reviewed literature suggests that both Holmium Laser Enucleation of the Prostate (HoLEP) and Transurethral Resection of the Prostate (TURP) lead to substantial gains in primary functional parameters for individuals with BPH. Specifically, significant enhancements were noted in International Prostate Symptom Scores (IPSS), Post-Void Residual (PVR) Volumes, and Peak Urinary Flow Rates (Qmax). Synthesis of data from meta-analyses indicates that HoLEP provides comparable and occasionally superior IPSS decline across all intervals, suggesting high efficacy in symptom relief. A critical interpretation of long-term data shows that improvements achieved through HoLEP tend to be more stable and longer-lasting compared to TURP. This addressing of long-term durability is a key finding, as enhancements in Qmax and PVR reductions after HoLEP remain consistent even in complex

cases involving large prostate volumes. Consequently, there is no evidence of HoLEP inferiority, with most studies highlighting its superior functional longevity and durability in the HoLEP group.

4.1.2 Perioperative Outcomes

The review results show that HoLEP consistently has a more favorable perioperative profile compared to TURP. Intraoperative blood loss is reported to be lower with HoLEP, contributing to a significant reduction in the need for blood transfusions compared to TURP, both in general patients and in the elderly. This hemodynamic advantage is primarily due to the hemostatic properties of the holmium laser, which is capable of coagulating blood vessels simultaneously during the enucleation process. In addition, shorter postoperative catheterization and hospital stays (LOS) were observed in the HoLEP group in most comparative studies. In addition to improving patients' subjective comfort, this also reduces the risk of nosocomial infections and the burden of hospital operating costs. While HoLEP may require longer operating times in some randomized trials, a critical analysis shows this does not correlate with increased complications. Instead, the longer duration reflects the thoroughness of the enucleation technique, which prioritizes complete adenoma removal over the speed of resection, thereby directly supporting the study's objective to evaluate procedural safety and efficiency.

4.1.3 Safety and Complications

Safety analyses show that the frequency of significant adverse events, such as the formation of urethral strictures and persistent urinary incontinence, is relatively similar between HoLEP and TURP. However, HoLEP demonstrates a superior safety profile regarding intraoperative and postoperative blood loss and the complete elimination of TUR syndrome, facilitated by the use of laser energy and isotonic irrigation fluid. This finding is particularly significant for high-risk patients with cardiovascular comorbidities. Furthermore, long-term follow-up reveals lower reoperation rates and less need for reintervention in the HoLEP cohort, reflecting better durability of results compared to the conventional resection method. Although HoLEP presents a steeper learning curve that may influence early outcomes, its long-term safety benefits remain a decisive factor in its clinical adoption.

4.1.4 Prostate Size

Analysis based on prostate size shows that HoLEP maintains consistent efficacy and safety across various volume categories, from small to very large. This confirms the research objective regarding "size-independence," as HoLEP provides stable functional outcomes in large prostates without a significant increase in the risk of complications or reintervention. The ability of the holmium laser to operate in the anatomical space between the adenoma and the surgical capsule allows surgeons to remove tissue efficiently without being constrained by the technical limitations typically associated with conventional electrosurgical resection. Furthermore, in cases of extremely enlarged prostates that historically required open surgery, HoLEP has emerged as the new gold standard, offering comparable effectiveness but with significantly lower morbidity. These findings validate HoLEP's unique capability to manage a diverse spectrum of BPH patients, positioning it as a more flexible and relatively size-independent surgical tool compared to traditional resection.

Table 2. HoLEP and TURP Comparison in the Management of Benign Prostatic Hyperplasia

Sample	Variables	Study Design	Result	Reference
220 patients	IPSS, Qmax, PVR, complication, reoperation	Retrospective comparative study	HoLEP demonstrated better stability of IPSS and Qmax improvement in long-term follow-up compared to TURP, as well as a lower reoperation rate. No increase in major complications was found in the HoLEP group.	(Daryanto et al., 2025)

>2.000 patients	IPSS, Qmax, reoperation	Systematic review & meta-analysis	HoLEP has a significantly lower reintervention rate compared to TURP, reflecting better long-term durability of results.	(Adriansyah et al., 2021)
>3.000 patients	Transfusion, complication, LOS	Systematic review	HoLEP demonstrates a superior perioperative profile, characterized by reduced intraoperative blood loss, abbreviated hospital stays, and expedited postoperative recovery relative to TURP.	(Pyrgidis et al., 2025)
>1.800 patients	IPSS, Qmax, complications	Systematic review & meta-analysis	HoLEP provides equivalent or better functional results and lower bleeding complication rates. No evidence suggests that HoLEP is inferior to TURP in any measured outcome.	(Chen et al., 2023)
140 patients	Complication, LOS, transfusion	RCT	HoLEP demonstrates a favorable safety profile in elderly patients with elevated perioperative risk, yielding lower blood transfusion rates and reduced hospital stays in comparison to TURP.	(Fuschi et al., 2022)
180 patients	Complication, recovery	Cohort study	HoLEP expedites postoperative recovery while mitigating the risk of hemorrhagic complications in elderly patients.	(Bayraktar & Başeskioglu, 2024)
>900 patients	IPSS, Qmax	Meta-analysis	HoLEP demonstrates the best durability of results compared to other techniques.	(Yu, Jeong, Jeon, Lee, & Lee, 2021)
1.500 patients	IPSS, Qmax, PVR, outcome	Systematic review and meta-analysis	HoLEP and TURP remain effective for BPH, with HoLEP offering modest benefits. Therapeutic decision-making should be guided by individual patient preferences and the prevailing clinical context.	(Swedan et al., 2025)
160 patients	LOS, catheterization	Prospective study	HoLEP is associated with shorter catheterization and hospitalization durations compared to TURP.	(Deori et al., 2025)

4.2 Discussion

The synthesis of this review highlights that HoLEP provides a safer and more effective approach with superior long-term outcomes compared to TURP. These findings align with prior studies which consistently demonstrate significant improvements in key functional parameters, including the IPSS, Qmax, and PVR, with complication rates comparable to or lower than TURP. This clinical superiority is fundamentally rooted in the procedural mechanism; the principal advantage of HoLEP stems from its anatomical approach, in which enucleation follows the prostatic capsule plane. By enabling complete removal of obstructive adenoma tissue down to the capsule, HoLEP facilitates a more thorough urinary tract decompression than the partial resection seen in TURP, which often leaves residual tissue. This anatomical precision explains the superior durability of its functional outcomes and the lower reoperation rates observed, directly fulfilling the research objective to identify a more permanent surgical solution.

From a perioperative standpoint, this review corroborates that the hemorrhagic profile of HoLEP is markedly more favorable than TURP. The application of holmium laser energy—characterized by shallow tissue penetration and effective hemostatic properties—acts as a critical safety buffer by significantly reducing intraoperative blood loss and transfusion requirements. Furthermore, the complete elimination of TUR syndrome risk through the use of isotonic irrigation is not merely a technical advantage but a vital clinical benefit for high-risk populations, particularly elderly patients and those with cardiovascular comorbidities or coagulation disorders.

Perhaps the most significant finding regarding procedural versatility is the consistency of HoLEP's effectiveness across various prostate sizes. Unlike TURP, which faces technical limitations and increased risks as prostate volume grows, HoLEP's efficacy remains stable even in "large-to-very-large" prostates (40–200 grams). This confirms HoLEP as a "size-independent" technique, validating its potential to replace invasive open prostatectomy for complex cases. In high-risk groups, such as patients over 75 years of age, HoLEP further proves its utility by shortening catheterization times and hospital stays without sacrificing functional outcomes. This indicates that HoLEP is not just an alternative, but often a safer primary option even in patient groups with higher perioperative risk.

However, this review also highlights a critical implementation trade-off: the relatively long learning curve associated with HoLEP. While early adoption may lead to longer operating times and minor complications among limited-experience operators, the data suggests that these risks are transient. Once the learning curve is passed, the outcomes significantly surpass TURP in nearly every metric, justifying the need for structured training and adequate case volume to ensure safety. Conversely, the continued relevance of TURP in resource-limited settings indicates that surgical selection should not be "one-size-fits-all" but must remain individualized, taking into account technology availability and operator experience. Overall, the findings of this systematic review support a paradigm shift in BPH surgical management toward a more evidence-based and long-term approach. While TURP remains a valid alternative for smaller glands in specific infrastructures, HoLEP emerges as a superior technique in terms of durability, perioperative safety, and flexibility across a wide spectrum of BPH patients. The rational integration of these two techniques is essential for optimizing the quality of urological care and overall clinical outcomes.

5. Conclusions

5.1. Conclusion

This systematic review confirms that HoLEP represents a significant paradigm shift in BPH management, offering a size-independent surgical standard that effectively overcomes the volume-related limitations of TURP. HoLEP demonstrates superior perioperative safety, characterized by enhanced hemostatic control and significantly reduced hospitalization times. The primary contribution of this study is the verification that HoLEP's anatomical precision provides more durable functional outcomes, making it a more versatile modality for a broader range of patients. Practically, HoLEP should be considered the preferred surgical approach for large prostates and high-risk patients, whereas TURP remains a reliable alternative for small-to-moderate glands in resource-limited settings.

5.2. Research Limitations

Several limitations of this systematic review are noted, including the heterogeneity of the selected studies in terms of study design, patient population, and follow-up duration, that may affect the comparability of results. Inclusion of both randomized controlled trials and observational studies has the potential for bias, especially selection and reporting bias. The inclusion of observational data alongside RCTs introduces potential selection bias, particularly concerning the varying levels of surgical expertise across institutions. Furthermore, differences in reporting standards for complications and perioperative outcomes may limit the consistency of the data synthesis.

5.3 Suggestions and Directions for Future Research

Subsequent investigations should prioritize large-scale, multi-institutional randomized clinical trials that employ standardized reporting metrics for functional and sexual outcomes. Future research must specifically address the economic cost-effectiveness of HoLEP versus TURP to guide healthcare policy.

It is also necessary to evaluate the long-term durability of these procedures beyond the five-year mark. Furthermore, developing standardized training protocols to mitigate the HoLEP learning curve will be essential in ensuring consistent clinical outcomes across different surgical settings and patient populations.

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Author Contributions

KAHK conceptualized the study, designed the research methodology, and supervised the project. NB was responsible for data collection, data analysis, and manuscript drafting. Both authors contributed to the revision of the manuscript and approved the final version of the manuscript for submission.

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