REVIEW PAPER

FUNCTIONAL UROLOGY

Is hospitalization still necessary? A systematic review of outpatient HoLEP over the last decade

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Introduction Holmium laser enucleation of the prostate (HoLEP) is a well-established, size-independent surgical intervention for benign prostatic hyperplasia (BPH). Traditionally performed with overnight hospitalization, there is increasing interest in same-day discharge to reduce healthcare costs and improve patient satisfaction.
This systematic review evaluates the feasibility, safety, efficacy, and cost-effectiveness of HoLEP as an outpatient procedure across all patient populations between 2015 and 2025.
Material and methods A systematic search of PubMed and Google Scholar was conducted in accordance with PRISMA guidelines, yielding 15 eligible studies including over 1,500 patients. Outcomes analyzed included same-day discharge rates, readmissions, complications, symptom improvement, and patient satisfaction. Subgroup analyses examined outcomes by age, comorbidities, prostate size, and anticoagulation status.
Results Same-day discharge (SDD) rates ranged from 60–90%, with contemporary studies achieving rates above 85% in unselected populations. Readmission rates were low (~2–5%), with no significant increase compared to inpatient care. Complication profiles were similar between outpatient and inpatient settings, with most being minor. Functional outcomes such as International Prostate Symptom Score and urinary flow rates showed marked improvement postoperatively, comparable to traditional HoLEP. Advanced laser technology, early surgery scheduling, and standardized post-anesthesia protocols were key facilitators. Cost analyses demonstrated per-case savings of $750–$840 with outpatient care. Older age and anticoagulation were not absolute contraindications for SDD when proper criteria were met.
Conclusions HoLEP can be safely and effectively performed as an outpatient procedure in most patients, offering comparable outcomes to inpatient care while reducing costs and enhancing patient satisfaction.

Key Words: HoLEP ‹› outpatient surgery ‹› same-day discharge ‹› benign prostatic hyperplasia ‹› ambulatory surgery ‹› day-case ‹› postoperative outcomes ‹› cost-effectiveness

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a prevalent condition in aging men that can lead to lower urinary tract symptoms (LUTS). Holmium laser enucleation of the prostate (HoLEP) has emerged over the past two decades as a size-independent, endoscopic alternative to transurethral resection of the prostate (TURP) and open prostatectomy. HoLEP achieves complete adenoma enucleation using a holmium:YAG laser, offering durable relief of obstruction with minimal invasiveness [1]. Numerous studies have demonstrated that HoLEP provides equivalent or superior outcomes to TURP in terms of symptom score improvement and urinary flow rates, with lower transfusion risk and virtually eliminating the need for re-operation within 5 years [1]. Traditionally, HoLEP has been performed in an inpatient setting with an overnight hospital stay for observation, primarily due to concerns

about post-operative hematuria, catheter management, and patient comorbidities. However, there is growing interest in performing HoLEP as a same-day outpatient surgery, given potential benefits including reduced healthcare costs, improved bed utilization, and patient convenience.

In the last 10 years, multiple centers have explored the feasibility, safety, and outcomes of same-day discharge following HoLEP. This systematic review critically evaluates HoLEP as an outpatient procedure, synthesizing evidence from 2015–2025. We include studies across all patient populations and stratify findings by age, comorbidities, prostate size, and other relevant factors. Key outcomes of interest were: readmission rates, safety and complications, efficacy (symptom and flow improvements), cost-effectiveness, and patient satisfaction with outpatient HoLEP. The review is conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, with a PRISMA flow diagram outlining the study selection process.

MATERIAL AND METHODS

Search strategy

A comprehensive literature search was performed in PubMed and Google Scholar for English-language studies published from 2015 through May 2025. The search combined terms for HoLEP (e.g., "Holmium laser enucleation") with terms indicative of outpatient management (e.g., "outpatient," "same-day discharge," "ambulatory surgery," "day-case"). Reference lists of relevant articles were also screened for additional studies. We included clinical studies (randomized trials, cohort studies, case series) that specifically reported outcomes of HoLEP with same-day discharge protocols or provided stratified data relevant to outpatient feasibility (such as data on short stay, catheter removal timing, etc.). Studies focusing on all patient populations were included; no upper age or prostate size limit was applied. We excluded reports not providing specific outcome data (e.g., commentaries) and those not in English.

Selection process

After removing duplicates, titles and abstracts were screened for relevance. Potentially eligible full-text articles were retrieved and assessed against inclusion criteria.

Figure 1 presents the PRISMA flowchart of the study selection. In total, 15 studies met all criteria and were included in the qualitative synthesis. (Figure 1: PRISMA flow diagram of study selection – Records identified: PubMed (61), Google Scholar (70); after removing duplicates, 70 records screened; 48 records excluded for irrelevance or not meeting criteria; 22 full-text articles assessed; 7 full-texts excluded (e.g., not focused on outpatient HoLEP, non-English, or incomplete outcomes); 15 studies included. Data Extraction and Synthesis: Data were extracted on study design, sample size, patient characteristics (age, prostate size, comorbidities), details of the outpatient protocol (e.g. same-day catheter removal, discharge criteria), and outcomes: rates of successful same-day discharge, unplanned admissions, 30-day readmissions, post-operative emergency department (ED) visits, complications (classified by Clavien–Dindo when available), functional outcomes (symptom scores, flow rates), cost or resource utilization, and patient reported satisfaction. Given heterogeneity in study designs (mostly non-randomized cohorts) and outcomes, a narrative synthesis is provided, with tabular summaries. Key findings are stratified by relevant subgroups (e.g., older vs younger patients, anticoagulated vs not, large vs small prostates) to examine how patient factors impact outpatient HoLEP outcomes. No formal meta-analysis

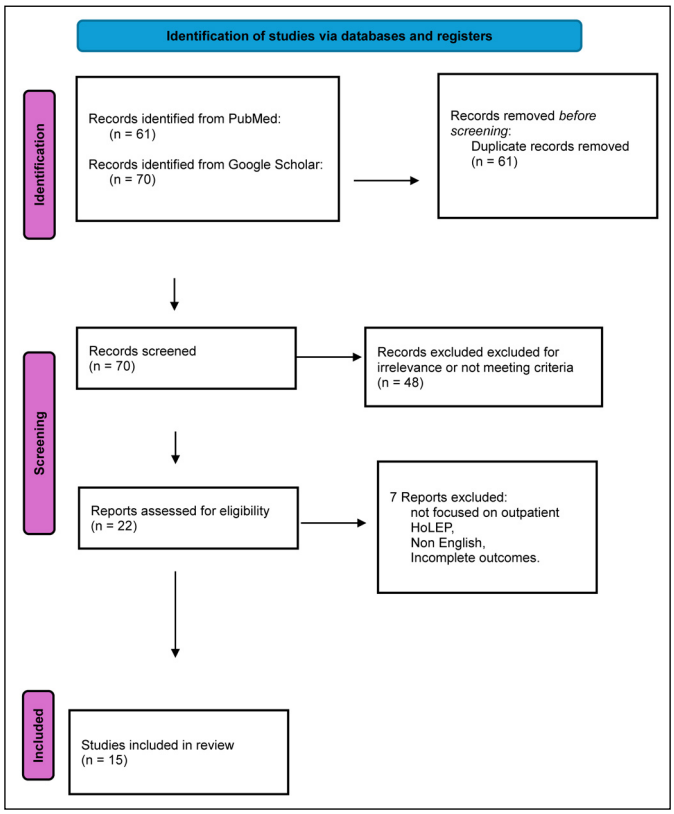

Figure 1. *PRISMA flowchart.*

was performed due to variability in outcome definitions between studies.

This review was not registered in PROSPERO as it was initiated retrospectively and did not meet the registration criteria at the time of project initiation. Nonetheless, we adhered strictly to PRISMA guidelines to ensure transparency and methodological rigor.

RESULTS

Study characteristics

Fifteen studies published between 2015 and 2023 were included in the qualitative synthesis, encompassing over 1500 patients in total. To facilitate detailed analysis, seven studies with comprehensive

Table 1. *Summary of included studies evaluating HoLEP with same-day discharge*

Study (year)	Design/Patients	Same-day discharge (SDD) rate	Readmissions /ED Visits	Complications	Notes
Comat et al. (2017) [2]	Prospective single-surgeon series (90 daycase HoLEP out of 211 HoLEP cases) in France	83.4% discharged <12 hours (15/90 required overnight)	Day-case failure 20% (includes 48hours readmissions)	36.7% overall; 3.3% Clavien ≥III (major)	Main failure reason: gross hematuria requiring irrigation (13/15) Concludes daycase HoLEP feasible with careful selection
Lee et al. (2018) [7]	Prospective single-surgeon UK series (210 patients)	35.3% true day-case; additional 40% discharged within 23 hours	5.5% readmission rate (all minor issues)	All complications Clavien I–II (no major complications)	Predictors of successful daycase: prostate ≤40 ml (OR ~3.1) and morning surgery list (OR ~6.1) Emphasizes planning to maximize daycase success
AbdulMuhsin et al. (2019) [5]	Retrospective cohort, Mayo Clinic (179 HoLEP; 47 preselected for outpatient attempt)	59.5% of selected outpatients (28/47) discharged same-day	17.8% readmission among SDD patients (5/28)	Among the patients who were successfully discharged home, there were six complications in four patients 4 complications of Clavien II and 2 complications of Clavien IIIa	~26% of all HoLEP were deemed SDD candidates; hematuria was the most common cause of failed same day discharge No significant predictors identified for SDD success or readmission (small sample)
Lwin et al. (2020) [3]	Retrospective comparative, U.S. (Univ. of Arizona); 377 patients (2013– 2018) – 199 SDS vs 178 overnight	~53% overall (199/377 met SDS criteria and were discharged)	2.5% readmission in SDS group (vs slightly higher 4.5% in inpatient, n.s.) no difference in 30-day ED visit rate	No difference in post-op complication rates between SDS and inpatient; 30-day complication rates low overall	No 1-year efficacy differences: IPSS, Q_max, PVR improvements similar in both groups. Authors conclude SDS is safe regardless of prostate size, age, comorbidities, or anticoagulation status if basic discharge criteria are met
Agarwal et al. (2022) [6]	Retrospective high-volume center (Indiana Univ.; 473 HoLEP cases 2018–2019)	87.4% successful SDD	Unplanned admission in ~12.6%. 90-day readmission or ER visit rates not higher for SDD vs admitted (no significant difference)	No increase in complications for SDD vs inpatient 90-day complication rate similar between groups	SDD possible for any patient not requiring admission for medical reasons. Predictors of unplanned admission: longer morcellation time, clot retention requiring irrigation. Required ~9 months training staff to adopt SDD as new norm
Badreddine et al. (2023) [8]	Retrospective singleinstitution (Cleveland; 155 patients during COVID era)	87% SDD rate (135/155); 13% required admission (unplanned or planned)	SDD group: 2.9% readmission, 5.2% ED visit; no statistical difference vs admitted group in 30-day readmissions or ED visits	Overall complications similar between SDD and overnight; no increase in any complication category	Patients with prostate >150 ml had much higher odds of failing SDD (OR ~7.2) and those on antiplatelet/ anticoagulants also had higher risk (OR ~6.6) Concludes liberal criteria can be used and most patients can undergo SDD safely
Carvalho et al. (2024) [16]	Prospective study included 34 patients	31 patients (91.1%) were discharged on the same day of the procedure after urinary catheter removal		Only 2 patients (5.8%) experienced urinary tract infections (Clavien-Dindo grade I). Additionally, 9 patients (26.4%) reported mild, self-limited dysuria that resolved spontaneously within 90 days. No complications required surgical reintervention.	The study prospectively confirmed that same-day catheter removal and hospital discharge following HoLEP is safe and feasible. With proper protocol, including early surgery scheduling, general anesthesia without opioids, and a structured voiding trial, outpatient HoLEP can be successfully implemented, improving patient comfort and reducing healthcare costs

IPSS – International Prostate Symptom Score; Q_max – peak urinary flow; n.s. – not significant; PVR – post-void residual urine; SDD – same-day discharge; SDS – same-day surgery

reporting of key outcomes – same-day discharge (SDD) rates, complication rates (preferably using the Clavien–Dindo system), and readmission data – are summarized in Table 1. These studies were also evaluated using the Newcastle–Ottawa Scale and presented in Table 2. The remaining eight studies, while included in the narrative synthesis, were excluded from the summary tables due to limitations such as incomplete outcome data, absence of standardized complication grading, or a focus on specific subpopulations (e.g., patients with large prostates or on anticoagulation). These studies contributed valuable qualitative insights, especially for subgroup analyses and contextual interpretation. A full list of these additional studies, along with their key characteristics, is provided in Suppl. Table S1.

The sample sizes ranged from small single-surgeon series of ~90 cases [2] to multi-year multi-surgeon cohorts of several hundred patients [3]. Mean patient age within studies ranged roughly from mid-60s to early 70s, reflecting the typical BPH population; several studies specifically included substantial numbers of octogenarian patients [4]. Many studies were conducted at centers with significant HoLEP experience, often after the surgeon's learning curve, which is important as outcomes can be operator dependent.

Outpatient protocols

The criteria and protocols for same-day discharge (SDD) varied slightly by center but had common elements. Generally, patients selected for planned outpatient HoLEP were those in relatively good health (e.g., ASA class I–III, good performance status) and without prohibitive social factors (such as living very far from the hospital or lack of support at home) [3]. Some protocols excluded patients with very large prostates preemptively or those unwilling to manage a catheter at home if needed [3]. A consistent procedural element was meticulous intraoperative hemostasis to minimize post-op hematuria. Most studies removed the Foley catheter either in the recovery unit prior to discharge or sent the patient home with a catheter for overnight self-removal or next-day removal in clinic [3,5]. Discharge criteria typically required the patient to void successfully (if catheter removed) or to have clear urine in the catheter with minimal clots if the catheter was left in. Monitoring periods in hospital prior to discharge ranged from 4–6 hours post-surgery up to ~8–12 hours, meaning some "outpatient" protocols were more accurately 23-hour observations (with discharge by the same evening). Notably, two studies explicitly mention that transitioning HoLEP to same-day surgery required a "culture change" and staff education over several months [6], underlining that institutional buy-in is important in implementing outpatient pathways.

As shown in Table 1, early feasibility studies (2017–2019) reported SDD success rates in the range of ~60– 83% among patients selected for outpatient HoLEP [2, 5]. More recent large-series in high-volume centers demonstrate that with refined technique and protocols, approximately 85–90% of unselected HoLEP patients can be discharged the same day of surgery without elevated risk [6, 8]. The few patients who still require overnight admission are usually identifiable by intraoperative or immediate postoperative factors (e.g., persistent bleeding requiring irrigation, inability to void, or unmanaged medical issues). Across all studies, the most common cause of unplanned admission or SDD "failure" was postoperative hematuria with clot retention necessitating continuous bladder irrigation [2, 5]. This was consistently noted as a key issue that can prolong hospitalization. In earlier series, clot retention issues limited same-day discharge success to ~60% even among pre-selected low-risk patients [5]. However, adoption of high-powered modulated-pulse lasers (e.g., 120 W systems with Moses technology) and meticulous hemostasis tech-

Table 2. *Risk-of-Bias assessment using the Newcastle–Ottawa Scale*

Study	Selection (0–4)	Comparability (0–2)	Outcome (0–3)	Total (0–9)	Risk Level
Comat et al. (2017) [2]	★★★★	★	★★	7	Moderate
Lee et al. (2018) [7]	★★★★	★★	★★	8	Low
Abdul-Muhsin et al. (2019) [5]	★★★	★	★★	6	Moderate
Lwin et al. (2020) [3]	★★★★	★★	★★★	9	Low
Agarwal et al. (2022) [6]	★★★★	★★	★★	8	Low
Badreddine et al. (2023) [8]	★★★	★★	★★	7	Moderate
Carvalho et al. (2024) [16]	★★★	★	★★	6	Moderate

niques have significantly reduced bleeding issues, thereby improving same-day discharge rates [6, 9]. For example, one center reported that upgrading to Moses 2.0 laser technology allowed them to achieve ~88% same-day discharge, compared to ~60% in an earlier series without it [9]. Another factor affecting SDD implementation was timing of surgery. Lee et al. [7] found that cases scheduled in the morning were far more likely to achieve discharge by evening than late-day cases (likely because late cases had less postoperative observation time). Scheduling adjustments (performing HoLEPs early in the day) can thus facilitate outpatient management. Additionally, having a streamlined post anesthesia care unit (PACU) protocol for HoLEP and coordinating early catheter trials were practical measures noted in successful programs [6].

Readmission rates and post-discharge utilization

A critical metric for outpatient surgery safety is the 30-day readmission rate. Across studies, readmissions after HoLEP were relatively low, and importantly, not significantly higher for same-day discharges compared to those who stayed overnight. Reported readmission rates for patients discharged same-day ranged from ~2–6% in most modern series [7, 8]. For instance, Badreddine et al. [8] noted a 2.9% readmission rate in their SDD cohort, and Lwin et al. [3] reported ~2.5% readmission among same-day cases [10] – rates comparable to typical post-HoLEP readmissions historically. No study found a statistically significant increase in readmissions for outpatient HoLEP relative to those kept overnight [3, 8]. The most common reasons for readmission were treatable issues such as hematuria requiring irrigation, urinary retention, or urinary tract infection [9]. Notably, Abdul-Muhsin et al. [5] observed a somewhat higher readmission proportion (5 of 28 patients, 17.8%) in their early outpatient cohort, but that study's small sample and strict selection (with older patients and those with prior UTIs possibly included) likely influenced this rate. In that study, history of UTI was associated with readmission, suggesting infection risk management is important [5]. Overall, in larger cohorts, readmissions around 2–5% indicate that outpatient HoLEP does not pose an undue risk of return to hospital.

Besides formal readmissions, some patients present to the Emergency Department (ED) or require urgent clinic visits post-discharge. Reported ED visit rates after SDD HoLEP were ~5% in one series and similarly low in others, with no significant difference versus inpatient cases [8]. This suggests that most postoperative issues can be managed outpatient via phone triage or scheduled follow-up, rather than requiring emergency care. Importantly, proactive patient counseling and accessible on-call urology support were emphasized in some protocols to safely handle minor issues at home, potentially averting unnecessary ED visits.

Safety and complications

Overall safety outcomes for outpatient HoLEP were excellent. No study reported any mortality or lifethreatening complication related to same-day discharge. The postoperative complication rates in these cohorts were consistent with general HoLEP series in the literature, and critically, did not increase when HoLEP was done outpatient. Agarwal et al. [6] explicitly found no difference in 90-day complication rates among patients discharged same-day versus those admitted overnight. In Lee et al.'s series, all complications in day-case patients were minor (Clavien–Dindo grade I or II), and there were zero major complications reported [7]. Comat et al. [2] similarly noted only a 3.3% rate of serious (grade ≥III) complications despite an 83% day-case rate. These data indicate that when proper selection and intraoperative precautions are in place, outpatient HoLEP does not compromise patient safety. Typical minor complications included transient urinary retention requiring recatheterization, urinary tract infection, or self-resolving hematuria [9] – all within expected ranges for HoLEP. For example, transient urinary retention occurs in a small fraction of patients after HoLEP due to post-operative swelling or atonic bladder and is usually managed by a short-duration catheter; this was not notably more frequent in SDD patients. A key consideration is whether certain patient subgroups (e.g., very elderly or those on blood thinners) have higher complication rates that might preclude same-day discharge. Evidence from stratified analyses is reassuring: HoLEP appears safe even in older and high-risk populations, although these groups understandably have slightly higher baseline complication rates regardless of discharge timing. A large study of octogenarian and nonagenarian patients (aged ≥80) undergoing HoLEP found that while overall 30-day complications were higher in this older group (20.8% vs 9.3% in <80 years, $p = 0.008$), the vast majority of these were minor (grade I–II) events [4]. The rate of major complications (grade ≥III) did not significantly differ by age (3.4% in ≥80 vs 1.8% in younger, $p > 0.1$) [4]. In other words, elderly patients did experience more low-grade issues (e.g., UTIs or retention), but

serious adverse events were rare and comparable to younger counterparts. Moreover, functional outcomes (symptom relief and flow improvement) at follow-up were equally good in the older group [4]. These findings suggest that advanced age alone is not a contraindication to HoLEP or to early discharge, provided any minor issues are appropriately managed. Elsaqa et al. have concluded HoLEP is a "safe and very effective option" even in octogenarians and nonagenarians [4], which supports offering outpatient HoLEP to fit elderly patients on a case-by-case basis.

Patients on anticoagulation or antiplatelet (AC/AP) therapy present another important subgroup, as bleeding risk is a concern. Several studies specifically examined HoLEP outcomes in men requiring AC/AP. One retrospective study of 250 patients (129 on AC/AP, 121 not on AC) demonstrated no significant differences in perioperative outcomes: operative time, hemoglobin drop (~0.1 g/dl in both), transfusion rate (~2.3% vs 0.8%, p >0.6), and overall complication rates were statistically similar between anticoagulated patients and controls [11], Deuker et al. also concluded that although patients on antithrombotic therapy (AT) had higher overall complication rates, the incidence of major complications was not increased. HoLEP remains a safe and effective procedure in anticoagulated patients [12]. Postoperative functional results (IPSS, urinary flow, continence) at 1 and 6 months were likewise equivalent [11].

The authors concluded that HoLEP can be safely performed in patients on AC/AP with "no operation-related disadvantage" and low bleeding complication rates, thanks to HoLEP's excellent hemostasis under direct visualization [11, 12]. This underscores that even anti-coagulated patients – who traditionally might be kept longer for observation – can often be discharged the same day if their immediate postoperative course is stable. In the Badreddine 2023 series [8], history of antiplatelet/ anticoagulation therapy was associated with a higher chance of admission (OR ~6.6 for SDD failure), but importantly, those patients were not ineligible for outpatient surgery; many still achieved SDD. It likely reflects that such patients have a slightly higher incidence of immediate bleeding requiring overnight monitoring. With careful management (e.g., temporary perioperative hold of anticoagulants when appropriate and meticulous coagulation during surgery), many AC/AP patients can be safely included in outpatient HoLEP pathways [11].

Prostate size is often considered when planning HoLEP admission status. Historically, very large glands (>150 ml) might prompt a more cautious approach (e.g., elective overnight stay) due to longer morcellation times and potentially greater tissue bed oozing. Indeed, Badreddine et al. [8] identified prostate volume >150 ml as a strong independent predictor of failing same-day discharge (OR ~7.2). In their cohort, patients with very large prostates were more often admitted, and they had significantly longer enucleation times and tissue weights [8]. However, other data suggest that even large glands can be managed outpatient with modern techniques. Lwin et al. [3] explicitly reported that prostate size did not limit outpatient success in their experience, as long as the patients met other discharge criteria. The use of the Moses laser has been reported to particularly facilitate same-day discharge in large prostates by reducing hemostasis time and improving efficiency [9]. One center noted they routinely achieved same-day catheter removal and discharge even for prostates ≥175 g when using the latest technology [9]. A retrospective study by Assmus et al. [15] evaluated the feasibility of same-day discharge following HoLEP in patients with large prostates (≥175 cc). Among 55 patients, 45 were scheduled for same-day discharge, and 84% (38/45) were successfully discharged on the same day. The average length of stay for all patients was 11.8 hours, with a catheterization duration of 21.2 hours. At 3-month follow-up, patients demonstrated significant improvements in urinary symptoms, including reductions in the American Urological Association Symptom Score (AUASS) from 22.3 to 6.7, prostate-specific antigen (PSA) levels from 8.58 to 0.87 ng/ml, and an increase in maximum urinary flow rate (Qmax) from 8.8 to 20.4 ml/s. These findings suggest that with technological advancements and optimized surgical techniques, same-day discharge after HoLEP is a safe and effective option for patients with large prostate glands [15].

Therefore, while larger prostate size correlates with certain intraoperative challenges, it should not be seen as an absolute barrier to outpatient HoLEP – expert centers have demonstrated success in this group by optimizing technique.

Efficacy and patient outcomes

All included studies that reported functional outcomes show that outpatient HoLEP remains highly efficacious in relieving obstruction and improving symptoms. At follow-ups ranging from 6 weeks to 1 year, patients had large improvements in symptom scores and urinary flow rates comparable to published HoLEP outcomes in general.

For example, one study noted no significant differences in 1-year outcomes between their same-day and overnight groups: both achieved similar increases in maximum flow rate (Qmax) and similar drops in IPSS, reflecting effective tissue removal regardless of length of stay [3]. Typically, HoLEP results in an IPSS reduction on the order of 15–18 points and a Qmax increase of ~10–15 ml/s or more, and these benefits were preserved in outpatient cases. In the cohort of Lee et al. [13], which had rigorous follow-up, 99.4% of patients reported subjective improvement in symptoms by 6 months post-HoLEP. This remarkable figure underscores HoLEP's effectiveness; nearly all patients experienced relief, including those treated as day-case. Moreover, durability is a well-known strength of HoLEP – it virtually eliminates the need for re-intervention for regrowth at 5+ years in most series [1]. None of the included studies suggested any compromise in durability or completeness of enucleation due to early discharge. The quality of surgery (in terms of adenoma removed) is not impacted by whether a patient stays overnight; it is determined by surgical technique and experience. Indeed, some authors argue that by freeing up hospital beds, outpatient HoLEP may allow high-volume surgeons to treat more patients efficiently without wait times, indirectly benefiting outcomes.

Patient-reported satisfaction with HoLEP is generally high, and this holds true for those undergoing outpatient management. In a large prospective survey of post-HoLEP patients (not limited to outpatients), 91.8% of patients were satisfied with their treatment at 6 months and 94% said they would choose the surgery again [13]. A prospective study by Boulet et al. [14] assessed patient anxiety and fear associated with ambulatory HoLEP. Seventy patients (mean age 72.3 years) completed the Surgical Fear Questionnaire (SFQ) and the Hospital Anxiety and Depression Scale (HADS) before and after surgery. The mean SFQ score was 18.4/90, with the highest concerns being postoperative pain and side effects. Preoperative and postoperative HADS scores were 4.6 and 3.9, respectively, showing a non-significant decrease ($p = 0.059$). Notably, 90% of patients expressed willingness to undergo the procedure again in the same setting, indicating high satisfaction and low anxiety levels. The overall satisfaction reflects the significant symptomatic improvement patients experience. The small minority who were dissatisfied most often cited persistent or new-onset urinary issues (particularly urgency incontinence) as the reason [13]. Importantly, there is no indication that being discharged the same day reduces satisfaction – if anything, many patients appreciate recovering in the comfort of their home. While specific satisfaction comparisons between outpatient vs inpatient HoLEP have not been rigorously quantified, anecdotal reports and the context of the COVID-19 pandemic suggest patients value avoiding a hospital stay when safely possible [8]. Key to maintaining satisfaction in outpatient cases is thorough patient education: patients should be counseled on what to expect (e.g., blood-tinged urine for several days, the possibility of temporary catheter at home) so they are not alarmed by these normal occurrences. Several studies noted that implementing an outpatient HoLEP program required extensive pre-operative counseling and ensuring patients had clear instructions for post-discharge care [6]. With these measures, patient satisfaction remains high, as the excellent symptomatic outcomes of HoLEP are unchanged by early discharge, and many men are pleased to return home the same day.

Cost-effectiveness

One of the driving motivations for same-day discharge in HoLEP is the potential cost savings for the healthcare system and patients. By eliminating an overnight hospital stay (which in many regions is a significant expense), outpatient HoLEP can reduce direct hospital costs and resource utilization. Studies have addressed cost-effectiveness both by modeling and by institutional cost analysis. Krambeck and colleagues reported that adopting a same-day discharge protocol for HoLEP at their institution saved approximately $840 per case in direct hospital costs for the initial surgery episode, even after accounting for costs of any 30-day readmissions or ED visits, the net savings remained around $750 per case [9]. One analysis noted that although same-day discharge patients had a few more ED checks (mostly for minor issues like hematuria), the average duration of those ED visits was shorter (often not requiring admission) and thus their costs were comparatively low [9]. Overall, the data strongly suggest that outpatient HoLEP is more cost-efficient than the traditional overnight model.

In summary, cost analyses consistently favor outpatient HoLEP, with significant per-case savings and no compromise in outcomes.

DISCUSSION

This systematic review indicates that HoLEP can be effectively and safely performed as an outpatient

procedure in the majority of patients. Over the last decade, as centers have gained experience and optimized perioperative protocols, same-day discharge rates for HoLEP have climbed from roughly 60–80% in early trials to almost 90% in recent reports [6, 8]. Crucially, this transition has not led to higher readmission or complication rates. Patients discharged on the day of surgery have outcomes equivalent to those observed overnight, provided they meet key discharge criteria and receive proper follow-up. Minor increases in immediate postoperative issues (like the need for brief catheter reinsertion or ER checks) have been manageable and do not outweigh the benefits of avoiding routine hospitalization. Stratified findings reinforce that patient factors such as age, comorbidity, or prostate size, while relevant to perioperative management, do not absolutely preclude outpatient HoLEP. Octogenarian patients, for example, tolerated HoLEP well with slightly higher but predominantly minor complications, suggesting we should base discharge decisions on physiological status rather than age alone [4]. Patients on anticoagulation did surprisingly well with HoLEP due to its excellent hemostasis, supporting its use as a safer alternative to TURP in this population and indicating many can still be discharged same-day if bleeding is controlled [11]. Large prostates may warrant caution, and some will need overnight observation, but even 100–200 ml glands have been successfully handled as outpatients by high-volume surgeons using advanced lasers [8, 9, 15]. The overarching theme is that patient selection should be individualized: any patient who is hemodynamically stable, with adequate hemostasis and either catheter-free or comfortable managing a catheter, and without uncontrolled medical issues post-op, can be considered for same-day discharge. Conversely, those with significant bleeding, inadequate urine drainage, or medical needs (e.g., cardiac monitoring) should be admitted – which is a minority when proper selection and technique are applied.

The findings of this review must be interpreted in light of certain limitations. The included studies were largely observational and from high-volume centers with experienced HoLEP surgeons. Results might differ in lower-volume settings or during a surgeon's learning curve, where operative times and bleeding could be greater. Also, institutional infrastructure (24/7 on-call support, patient education resources) contributes to outpatient success – not all hospitals may have equivalent systems in place. There was a degree of heterogeneity in what counted as "outpatient" (some studies included 23-hour stay as a success), so direct comparisons should be made cautiously. Nonetheless, the consistency of positive outcomes across diverse settings (North America, Europe, Asia) strengthens the generalizability of the conclusion that outpatient HoLEP is feasible and safe. Future prospective studies or randomized trials could further validate these findings, and cost-benefit analyses in different healthcare systems would be useful. Additionally, patientreported outcome measures specific to outpatient experience (comfort, convenience, quality of recovery) would be valuable to document formally, though high overall satisfaction rates suggest patients do well.

CONCLUSIONS

Outpatient HoLEP has emerged as a safe, effective, and cost-efficient approach for managing BPH. Current evidence supports same-day discharge in appropriately selected patients, with comparable outcomes to inpatient care in terms of complication rates, readmission rates (~2–5%), and symptom relief. Most complications are minor and manageable without extended hospitalization. Age is not a contraindication, and even healthy octogenarians can benefit from outpatient HoLEP. Key to successful implementation are structured perioperative protocols, careful patient selection, staff education, and robust follow-up. Outpatient HoLEP aligns with modern healthcare goals of enhanced recovery and cost containment, offering high patient satisfaction and broader access to definitive BPH treatment.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

ETHICS APPROVAL STATEMENT

The ethical approval was not required.

Appendix 1: Search Strategy Details

To ensure transparency and reproducibility, we provide below the full search strings used for each database queried in our systematic review.

PubMed Search String (Executed on June 8, 2025):
((„Holmium Lasers"[Mesh] OR holmium OR HoLEP OR „holmium laser enucleation") AND („Prostatic Hyperplasia"[Mesh] OR prostate*) AND („Ambulatory Surgical Procedures"[Mesh] OR outpatient OR „same-day" OR „day-case"[tiab] OR ambulatory[tiab]) AND („2015/01/01"[PDAT] : „2025/06/08"[PDAT]))
- Total records retrieved: 61

Google Scholar Search Strategy:
Due to limitations in reproducibility of Google Scholar search results and lack of Boolean operators support, we used the following queries:
„HoLEP", outpatient, same-day discharge, ambulatory surgery
- 70 relevant records before de-duplication.

Database Inclusion Summary:
- PubMed: 61 records
- Google Scholar: 70 records
- After de-duplication: 70 unique records screened
- Final studies included in synthesis: 15

Suppl. Table S1. *Characteristics of additional studies included in qualitative synthesis (not included in Tables 1 and 2)*

Study (Year)	Design	Population Focus	Key Contribution
Elsaqa et al. (2023) [4]	Retrospective	Octogenarian/nonagenarian patients	Stratified analysis of age and frailty
Yılmaz et al., (2023) [11]	Retrospective	Patients on anticoagulants/antiplatelets	Safety and efficacy in anticoagulated patients
Deuker et al., (2021) [12]	Retrospective	Patients on antithrombotic therapy	Safety profile and outcomes on AT therapy
Assmus et al. (2021) [15]	Retrospective	Patients with large prostates (≥175 cc)	Feasibility of SDD in large glands
Boulet et al. (2025) [14]	Prospective	Ambulatory HoLEP patients	Anxiety and fear assessment pre/post HoLEP
Lee et al. (2017) [13]	Prospective cohort	General HoLEP patients	Long-term satisfaction and symptom improvement
Kaplan (2020) [10]	Editorial Commentary	–	Contextual endorsement of same-day HoLEP safety
Michalak et al. (2015) [1]	Review article	–	Background on HoLEP as a surgical gold standard

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