AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

HOLMIUM LASER ENUCLEATION OF THE PROSTATE VERSUS TURP AND OPEN PROSTATECTOMY FOR BENIGN PROSTATIC HYPERPLASIA: A SYSTEMATIC REVIEW

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Abstract. Benign prostatic hyperplasia (BPH) is one of the most prevalent urological conditions affecting aging men and represents a major cause of lower urinary tract symptoms (LUTS). Surgical intervention is indicated when conservative and pharmacological treatments fail. Traditionally, transurethral resection of the prostate (TURP) has been considered the surgical gold standard for moderate-sized prostates, while open prostatectomy (OP) has been reserved for large glands. Over the past two decades, holmium laser enucleation of the prostate (HoLEP) has emerged as a minimally invasive, size-independent alternative. This systematic review evaluates and compares HoLEP, TURP, and OP in terms of efficacy, safety, perioperative outcomes, long-term durability, and complications. Current evidence suggests that HoLEP provides equivalent or superior functional outcomes with reduced morbidity and retreatment rates, positioning it as a preferred surgical option for BPH when expertise is available.

Keywords. Benign prostatic hyperplasia; HoLEP; TURP; Open prostatectomy; Lower urinary tract symptoms; Laser surgery

Introduction

Benign prostatic hyperplasia is a progressive, nonmalignant enlargement of the prostate gland that occurs in aging men. Histological evidence of BPH is present in approximately 50% of men by the age of 60 and up to 90% by the age of 85. The condition leads to bladder outlet obstruction and is responsible for a wide spectrum of LUTS, including urinary frequency, urgency, nocturia, weak urinary stream, and incomplete bladder emptying.

Although medical therapy using α-blockers and 5-α-reductase inhibitors is effective in many patients, surgical intervention remains the definitive treatment for moderate to severe symptoms, acute urinary retention, recurrent urinary tract infections, bladder stones, or renal impairment. Over the years, surgical management has evolved significantly, transitioning from open surgery to minimally invasive endoscopic techniques.

TURP has long been regarded as the reference standard. However, limitations such as bleeding risk, TUR syndrome, and reduced efficacy in large prostates have prompted the development of alternative techniques. HoLEP has gained widespread acceptance due to its anatomical enucleation approach, minimal bleeding, and applicability across all prostate sizes. This systematic review critically compares HoLEP with TURP and OP based on contemporary evidence.

Methods

Search Strategy

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

A systematic literature search was conducted using PubMed, MEDLINE, and the Cochrane Library. Searches included articles published in English using combinations of the following keywords:

"HoLEP"

"TURP"

"Open prostatectomy"

"Benign prostatic hyperplasia"

"Laser enucleation"

Inclusion Criteria

Randomized controlled trials

Prospective and retrospective comparative studies

Meta-analyses and systematic reviews

Studies reporting functional, perioperative, or long-term outcomes

Exclusion Criteria

Case reports

Non-comparative studies

Studies with insufficient outcome data

Outcome Measures

Primary outcomes:

International Prostate Symptom Score (IPSS)

Maximum urinary flow rate (Qmax)

Secondary outcomes:

Blood loss and transfusion rate

Operative time

Catheterization duration

Length of hospital stay

Complication and retreatment rates

Surgical Techniques Overview

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

Holmium Laser Enucleation of the Prostate (HoLEP)

HoLEP involves anatomical enucleation of the prostatic adenoma from the surgical capsule using a holmium:YAG laser. The enucleated tissue is subsequently morcellated and removed. This technique closely resembles open prostatectomy but is performed endoscopically.

Transurethral Resection of the Prostate (TURP)

TURP removes obstructing tissue using monopolar or bipolar electrocautery. Prostate tissue is resected in small chips, which limits efficiency in large glands.

Open Prostatectomy (OP)

OP involves open enucleation of the adenoma via retropubic or suprapubic approaches. Although effective, it is associated with higher morbidity.

Functional Outcomes

Symptom Improvement

All three procedures demonstrate significant postoperative improvement in IPSS. Multiple studies report that HoLEP and OP achieve more durable symptom relief compared to TURP, particularly in large prostates.

Urinary Flow Rate

Postoperative Qmax increases significantly following all techniques. HoLEP consistently shows comparable or superior improvements relative to TURP and similar outcomes to OP.

Perioperative Outcomes

Operative Time

HoLEP may initially require longer operative times, particularly during the learning curve. However, experienced surgeons achieve times comparable to or shorter than TURP and OP.

Blood Loss

HoLEP demonstrates the lowest intraoperative blood loss and transfusion rates due to superior laser coagulation. OP carries the highest bleeding risk.

Hospital Stay and Catheterization

HoLEP is associated with the shortest catheterization duration and hospital stay. TURP requires intermediate recovery, while OP necessitates prolonged hospitalization and recovery.

Complications

Urinary Incontinence

Transient stress urinary incontinence is more frequently reported after HoLEP, particularly in the early postoperative period. Most cases resolve within 3–6 months.

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

Sexual Dysfunction

Erectile function is generally preserved across all procedures. Retrograde ejaculation is common following HoLEP, TURP, and OP and should be discussed preoperatively.

Reoperation Rates

HoLEP and OP demonstrate significantly lower retreatment rates compared to TURP due to more complete adenoma removal.

Learning Curve and Resource Considerations

HoLEP has a steep learning curve, often cited as a limitation. Surgeon experience strongly correlates with improved outcomes and reduced complications. Additionally, the requirement for laser and morcellation equipment increases initial costs.

Discussion

HoLEP represents a paradigm shift in BPH surgery. By combining the effectiveness of open prostatectomy with the advantages of minimally invasive surgery, HoLEP offers superior durability with reduced morbidity. TURP remains suitable for smaller prostates and centers lacking laser expertise, while OP is increasingly reserved for select cases.

Limitations of the Review

Heterogeneity in study design

Variability in surgeon experience

Limited long-term randomized trials

Future Directions

Standardized training pathways for HoLEP

Long-term comparative randomized trials

Cost-effectiveness analyses in different healthcare systems

Conclusion

Current evidence supports HoLEP as a highly effective, safe, and durable surgical option for BPH across all prostate sizes. When performed by experienced surgeons, HoLEP should be considered a first-line surgical treatment, surpassing TURP and largely replacing open prostatectomy.

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