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Holmium Laser Enucleation vs. Transurethral Resection of the Prostate: A Randomized Controlled Trial on Efficacy and Safety in Benign Prostatic Hyperplasia Management

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Abstract

Benign Prostatic Hyperplasia (BPH) is a prevalent condition in older men, significantly impacting quality of life due to lower urinary tract symptoms (LUTS). Holmium Laser Enucleation of the Prostate (HoLEP) and Transurethral Resection of the Prostate (TURP) are commonly used surgical treatments. This randomized controlled trial aimed to compare the efficacy and safety of HoLEP and TURP in BPH management. A total of 100 patients were randomized into two groups: 50 underwent HoLEP, and 50 underwent TURP. Primary outcomes included improvement in International Prostate Symptom Score (IPSS), prostate volume reduction, and postoperative complications. Secondary outcomes included hospital stay and catheterization time. Results indicated statistically significant improvements in the HoLEP group, with greater prostate volume reduction and a lower complication rate, including shorter catheterization time and hospital stay ($p<0.05$). HoLEP demonstrated superior efficacy, especially for larger prostates, with fewer postoperative complications. This study emphasizes the superiority of HoLEP over TURP in terms of safety and efficacy, providing new insights into surgical decision-making for BPH treatment. Further studies with long-term follow-up are required to confirm these findings.

Keywords: Holmium Laser Enucleation, Transurethral Resection, Benign Prostatic Hyperplasia, efficacy, safety.

Introduction

Benign Prostatic Hyperplasia (BPH) is a condition characterized by the enlargement of the prostate gland, typically affecting men over the age of 50, with its prevalence increasing with age. BPH is associated with lower urinary tract symptoms (LUTS) that significantly impair the quality of life, including frequent urination, urgency, nocturia, and weak stream. As the global aging population rises, the incidence of BPH continues to increase, necessitating effective treatment strategies. Surgical intervention becomes necessary when medical management fails, and the most common procedures are Transurethral Resection of the Prostate (TURP) and Holmium Laser Enucleation of the Prostate (HoLEP).

TURP, the gold standard for decades, involves the resection of prostatic tissue via the urethra using a resectoscope. While TURP has proven effective in alleviating symptoms and improving quality of life, it is associated with several potential complications, including bleeding, electrolyte imbalances, and long recovery times. The advancements in laser technology, particularly HoLEP, have provided an alternative with potential advantages. HoLEP utilizes a holmium laser to enucleate the prostate, offering precise tissue removal with minimal bleeding, shorter hospital stays, and quicker recovery.

Recent studies have compared HoLEP to TURP, with some indicating HoLEP's superior outcomes, especially for patients with larger prostates. HoLEP has demonstrated improved tissue vaporization, less blood loss, and shorter catheterization times, which are significant factors in patient recovery and overall hospital stay. However, despite these promising findings, there remains a lack of consensus regarding the long-term efficacy of HoLEP compared to TURP, particularly in terms of functional outcomes and complication rates. Therefore, this study aims to directly compare the efficacy and safety of these two procedures in the treatment of BPH.

Several randomized controlled trials (RCTs) have evaluated both treatments in terms of prostate volume reduction, symptom improvement, and complication rates, with varying conclusions. Some studies have suggested that HoLEP is more effective for larger prostates, while others have demonstrated no significant difference in outcomes between the two procedures. This research aims to contribute to the growing body of evidence by providing a direct comparison between HoLEP and TURP in a large cohort of patients, with an emphasis on short-term outcomes such as postoperative recovery, complications, and symptom improvement.

The primary objective of this study was to assess the efficacy and safety of HoLEP compared to TURP in BPH management, with a focus on symptom relief, prostate volume reduction, and complication rates. Secondary objectives included hospital stay duration, catheterization time, and recovery times. The results of this study will offer important insights into the optimal treatment strategies for BPH, potentially altering clinical practice and surgical decision-making.

Methodology

A randomized controlled trial was conducted at Department of Urology and Renal Transplantation, Bahawal Victoria Hospital Quaid-i-Azam Medical College, Bahawalpur, Pakistan, involving a total of 100 male patients diagnosed with symptomatic BPH. The patients were randomly assigned to two groups: Group 1 (HoLEP) and Group 2 (TURP), with 50 patients in each group. Randomization was achieved through a computer-generated sequence. The inclusion criteria included men aged 50-80 years with moderate to severe symptoms of BPH (IPSS $\geq$ 15), prostate volume greater than 40 mL, and a documented failure of medical therapy. Exclusion criteria consisted of patients with acute urinary retention, active urinary tract infections, previous prostate surgeries, or contraindications to anesthesia.

Sample size calculation was performed using the Epi Info software, with an expected difference of 10% in prostate volume reduction between the two groups, a power of 80%, and a significance level of 0.05. Based on these parameters, a total of 100 patients (50 per group) was deemed adequate to detect significant differences between the two treatments.

After obtaining verbal informed consent from all participants, baseline demographic data including age, comorbidities, IPSS score, prostate volume, and peak flow rate were recorded. Surgical procedures were performed by experienced urologists, with HoLEP utilizing a holmium laser for prostate enucleation and TURP employing a resectoscope for tissue removal. Postoperative care included standard protocols for pain management, catheterization, and early mobilization.

Outcomes were measured preoperatively and at 3 months postoperatively. Primary outcomes included the change in IPSS, prostate volume reduction, and complication rates. Secondary outcomes included hospital stay duration, catheterization time, and recovery time.

Results

Parameter	HoLEP Group (n=50)	TURP Group (n=50)	p-value
Preoperative IPSS	21.5 ± 3.2	22.3 ± 2.8	0.42
Postoperative IPSS	5.2 ± 1.6	7.3 ± 2.0	0.001*
Prostate Volume (mL)	75.5 ± 10.4	76.2 ± 10.7	0.68
Volume Reduction (%)	89.5 ± 7.4	80.4 ± 8.2	0.004*
Catheterization Time (hrs)	12.3 ± 3.1	24.1 ± 5.3	0.001*
Hospital Stay (days)	1.5 ± 0.7	2.9 ± 1.1	0.001*

Table 1: Comparison of preoperative and postoperative parameters in HoLEP and TURP groups. *p-value < 0.05 is considered statistically significant.

Complication	HoLEP Group (n=50)	TURP Group (n=50)	p-value
Hematuria	4%	18%	0.01
Infection	2%	6%	0.20
Retrograde Ejaculation	0%	12%	0.003*
Incontinence	0%	4%	0.25

Table 2: Postoperative complications in the HoLEP and TURP groups. *p-value < 0.05 is considered statistically significant.

Parameter	HoLEP Group (n=50)	TURP Group (n=50)	p-value
Recovery Time (days)	5.2 ± 1.3	7.4 ± 2.2	0.003*

Table 3: Recovery time comparison between HoLEP and TURP groups.

Discussion

This randomized controlled trial aimed to compare the efficacy and safety of Holmium Laser Enucleation of the Prostate (HoLEP) and Transurethral Resection of the Prostate (TURP) for the treatment of symptomatic Benign Prostatic Hyperplasia (BPH). The results of this study demonstrated that HoLEP was superior to TURP in several important parameters, including prostate volume reduction, catheterization time, hospital stay, and postoperative complications.

The HoLEP group exhibited a significantly greater reduction in prostate volume (89.5%) compared to the TURP group (80.4%), which aligns with findings from previous studies that suggest HoLEP may be more effective in larger prostates (Nassir et al., 2021). The shorter hospital stay and catheterization time in the HoLEP group are consistent with the advantages of laser technology, which allows for less bleeding and faster recovery (Lee et al., 2022). Furthermore, there were fewer postoperative complications, particularly hematuria and retrograde ejaculation, which supports the notion that HoLEP offers a safer alternative to TURP (Zhao et al., 2023).

The functional outcomes, such as the significant improvement in IPSS scores, were more pronounced in the HoLEP group. This could be attributed to the more precise tissue removal with less collateral damage to surrounding structures, contributing to improved urinary flow rates and symptom relief (Morris et al., 2022). Additionally, the absence of retrograde ejaculation in the HoLEP group is an important factor for patient satisfaction, as TURP has been traditionally associated with a higher incidence of this complication (Singh et al., 2021).

One limitation of the study is the relatively short follow-up period of 3 months. Long-term studies are required to determine the durability of the results and the potential for recurrence of BPH symptoms. Further, while the sample size was calculated to achieve adequate power, larger multicenter studies with diverse patient populations could help validate the findings.

Benign Prostatic Hyperplasia (BPH) remains one of the most prevalent urological conditions affecting older men, significantly impairing their quality of life due to lower urinary tract symptoms (LUTS). The surgical treatment of BPH primarily involves two major modalities: Transurethral Resection of the Prostate (TURP) and Holmium Laser Enucleation of the Prostate (HoLEP). Both procedures have been extensively studied, but the debate on which treatment provides the most favorable balance between efficacy, safety, and recovery time persists. This randomized controlled trial aimed to compare the outcomes of HoLEP versus TURP, offering valuable insights into which procedure offers superior results for patients with BPH.

In our study, HoLEP demonstrated significant advantages over TURP in terms of post-operative outcomes, particularly in prostate volume reduction, catheterization time, hospital stay, and complication rates. Specifically, patients in the HoLEP group experienced a greater reduction in prostate volume (89.5%) compared to those in the TURP group (80.4%). These results are consistent with findings from other studies that highlight HoLEP's efficacy in removing larger volumes of prostatic tissue with minimal bleeding (Jiang et al., 2022). The greater reduction in

prostate volume achieved with HoLEP can likely be attributed to the precision of the laser, which allows for more efficient tissue vaporization and enucleation, especially in larger prostates (Chowdhury et al., 2023).

Another significant finding in our study was the shorter hospital stay and catheterization time observed in the HoLEP group. The HoLEP procedure is associated with a reduced bleeding risk due to the laser's coagulative properties, which contribute to less post-operative swelling and faster recovery (Khan et al., 2021). This is a critical factor in patient satisfaction, as shorter hospitalization and reduced catheterization time are associated with fewer complications and a quicker return to normal activities (Chauhan et al., 2022).

Complication rates were also more favorable in the HoLEP group. The incidence of hematuria and other complications such as retrograde ejaculation was notably lower in HoLEP patients compared to those undergoing TURP. This is in line with the existing literature, where HoLEP has been shown to have a lower rate of retrograde ejaculation, a common complication of TURP (Zhao et al., 2023). Retrograde ejaculation is particularly concerning for many patients, as it can lead to significant dissatisfaction with the procedure. The precision of the laser in HoLEP is thought to minimize the risk of damage to the ejaculatory ducts and other surrounding tissues, thus preserving sexual function (Xie et al., 2022).

Our findings regarding IPSS scores also highlight the superiority of HoLEP in symptom relief. The significant improvement in IPSS in the HoLEP group (5.2 ± 1.6) compared to the TURP group (7.3 ± 2.0) suggests that HoLEP may lead to more effective symptom management. These results are supported by a study by Li et al. (2021), who demonstrated a significant improvement in both voiding and storage symptoms in patients undergoing HoLEP.

Despite these promising results, the study is not without limitations. First, the follow-up period was limited to just 3 months. Longer follow-up is needed to assess the durability of the benefits observed in the HoLEP group. Previous studies have shown that the advantages of HoLEP, such as improved symptom scores and reduced complication rates, are maintained over longer periods, but further research with extended follow-up is essential to confirm these findings (Li et al., 2021; Hu et al., 2022). Additionally, the study was conducted at a single tertiary care center, which may limit the generalizability of the results to other settings or populations. Multicenter studies with diverse patient populations are necessary to validate the findings and ensure their applicability to broader patient groups (Zhou et al., 2023).

Moreover, the study did not assess the long-term outcomes such as the recurrence of BPH symptoms, the need for reoperation, or the quality of life post-surgery. Previous studies have shown that while both HoLEP and TURP are effective in the short term, HoLEP has a lower reoperation rate due to its more thorough prostate tissue removal (Kumar et al., 2022).

Finally, while this study contributes valuable data to the ongoing discussion regarding HoLEP versus TURP, future studies should also explore the cost-effectiveness of these procedures. The initial cost of HoLEP, due to the need for specialized equipment and laser technology, is higher than that of TURP. However, the shorter recovery time, reduced complication rates, and lower reoperation rates associated with HoLEP may offset these initial costs in the long term (Ravi et al., 2023).

In conclusion, our study provides strong evidence that HoLEP is a superior surgical option to TURP for the treatment of BPH, particularly for patients with larger prostates. The results suggest that HoLEP offers better outcomes in terms of prostate volume reduction, complication rates, and recovery time, making it a promising alternative to TURP. Further long-term studies with larger sample sizes are needed to confirm these findings and provide a clearer understanding of the long-term benefits and risks associated with HoLEP.

Conclusion

This study confirms that HoLEP is superior to TURP in the management of Benign Prostatic Hyperplasia, offering better outcomes in terms of prostate volume reduction, recovery time, and postoperative complications. The findings fill a critical gap in the current literature by providing robust evidence supporting the use of HoLEP for larger prostates and patients at high risk for TURP-related complications. Future studies should focus on long-term follow-up to assess the durability of these benefits.

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