

## CLINICAL OUTCOMES OF TRANSURETHRAL THULIUM LASER ENUCLEATION OF THE PROSTATE IN THE MANAGEMENT OF BENIGN PROSTATIC HYPERPLASIA

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### Abstract

**Objectives:** To evaluate the safety and efficacy of Thulium laser enucleation of the prostate (ThuLEP) as a treatment for benign prostatic hyperplasia (BPH), with a focus on clinical, functional, and anatomical outcomes. **Methods:** A prospective, cross-sectional study was conducted on 92 patients diagnosed with BPH at Military Hospital 175 from September 2023 to December 2024. Data were collected on preoperative and postoperative clinical symptoms (IPSS score), urinary function (Qmax and PVR), anatomical outcomes, and quality of life (QoL). Comparative analyses were performed, and results were benchmarked against international literature. **Results:** A total of 92 patients diagnosed with BPH, with an average prostate volume of 72.48mL, were included in the study. The average surgery duration was 84.5 minutes, and hemoglobin dropped by 1.1 g/dL postoperatively. The mean IPSS improved significantly from 28.7 preoperatively to 1.3 at six months postoperatively. Qmax increased from 2.7 mL/s to 23.1 mL/s, and prostate volume decreased by more than 50% on average. At six months, 94.2% of patients achieved excellent treatment outcomes, with no severe complications observed. Additionally, patients reported substantial improvements in QoL, with mean QoL scores dropping from 5.8 preoperatively to 0.1. **Conclusion:** ThuLEP demonstrates safety and efficacy in managing BPH, offering significant symptom relief, functional improvements, and favorable anatomical outcomes.

**Keywords:** Lower urinary tract symptom; Benign prostatic hyperplasia; Thulium laser enucleation of the prostate.

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## INTRODUCTION

Benign prostatic hyperplasia is a prevalent condition among aging men, significantly affecting their QoL due to lower urinary tract symptoms (LUTS). Cornu JN et al. (2015) highlighted that traditional surgical techniques such as monopolar transurethral resection of the prostate (TURP) and open prostatectomy (OP) have been longstanding standards for managing BPH. However, these methods are associated with considerable perioperative risks, prolonged hospital stays, and higher complication rates [1]. Chen CH et al. (2020) demonstrated that anatomical endoscopic enucleation of the prostate (AEEP) represents a transformative advancement in BPH management. Techniques such as holmium laser enucleation of the prostate (HoLEP) and ThuLEP offer minimally invasive alternatives with efficacy and safety profiles surpassing traditional TURP and OP. These approaches are particularly effective for managing larger prostates [2]. ThuLEP, as highlighted by Herrmann TR et al. (2010) and Bozzini G et al. (2021), combines precise tissue dissection with exceptional hemostatic capabilities. Advantages such as reduced operative blood loss, shorter catheterization times, and reduced hospitalization durations position ThuLEP as a strong alternative to conventional procedures [3, 4].

Moreover, You C et al. (2021) emphasized that the en-bloc enucleation technique further enhances surgical efficiency and precision, particularly for large prostates [5]. Despite its advantages, ThuLEP's adoption remains limited in some regions due to its steep learning curve and the variability of available equipment. Zhang Y et al. (2019) noted that in Vietnam, the application of ThuLEP is still in its early stages, with few centers performing the procedure or studying its outcomes [6]. This study aims to: *Evaluate treatment results of BPH by ThuLEP at Military Hospital 175.*

## MATERIALS AND METHODS

### 1. Subjects

Including 92 patients diagnosed with BPH.

\* *Inclusion criteria:* Indication for surgical intervention due to complications such as recurrent urinary retention, bladder stones, or failed medical therapy; ability to tolerate spinal or general anesthesia; histopathological confirmation of BPH postoperatively.

\* *Exclusion criteria:* Patients with neurogenic bladder, prostate cancer, or prior prostate surgeries.

\* *Location and time:* At the Department of Urology, Military Hospital 175, from September 2023 to December 2024.

The study focused on evaluating clinical outcomes, urinary function, and safety of Transurethral ThuLEP in the management of BPH.

## 2. Methods

\* *Study design:* A prospective, cross-sectional study.

\* *Surgical procedure:* All patients underwent ThuLEP using a continuous-wave Thulium laser system and morcellator. The enucleation technique involved three key steps: Creating an initial incision, enucleating the prostate lobes en bloc, and morcellating the extracted tissue for removal. Saline was used as the irrigation fluid to minimize electrolyte disturbances.

\* *Data collection:*

Preoperative assessments: International Prostate Symptom Score (IPSS), maximum urinary flow rate (Qmax), and QoL scores; prostate volume measured via transabdominal ultrasound; hematological and biochemical parameters.

Intraoperative data encompassed operative time, enucleation speed, blood loss (measured by hemoglobin reduction), and complications. Postoperative outcomes, including IPSS, Qmax, QoL, and residual prostate volume, were recorded at 1, 3, and 6 months follow-up. The treatment efficacy recorded postoperatively is shown in table 1.

**Table 1.** Estimate criteria for the efficacy of BPH treatment.

| Efficacy  | Symptoms<br>(Post/Pre IPSS) | Function<br>(Post - Pre Qmax) | Anatomy<br>(Post/Pre PV) | QoL<br>(Post - Pre QoL) |
|-----------|-----------------------------|-------------------------------|--------------------------|-------------------------|
| Excellent | $\leq 0.25$                 | $\geq 10$                     | $\leq 0.5$               | $\geq 4$                |
| Good      | $\leq 0.5$                  | $\geq 5$                      | $\leq 0.75$              | 3                       |
| Fair      | $\leq 0.75$                 | $\geq 2.5$                    | $\leq 0.9$               | 2 or 1                  |
| Poor      | $> 0.75$                    | $< 2.5$                       | $> 0.9$                  | $\leq 0$                |

*(Overall outcomes are determined by the average results of three primary criteria: Symptoms, function, and QoL)*

*Source: Homma Y et al. (1996) [7].*

\* *Statistical analysis:* Data were analyzed using SPSS software. Continuous variables were expressed as Mean  $\pm$  Standard Deviation (SD) and compared using paired T-tests. Categorical variables were expressed as percentages and compared using Chi-square tests. A p-value of  $< 0.05$  was considered statistically significant.

3. Ethics

The study was approved by the Ethics Council in Biomedical Research of the Vietnam Military Medical University with approval number 07/2022/CNChT-HĐĐĐ on December 12, 2022, and the Ethics Council in Biomedical Research of the Military

Hospital 175 with approval number 3377/GCN-HĐĐĐ on September 6, 2023. Military Hospital 175 granted permission for the use and publication of the research data, in full compliance with relevant legal regulations. The authors declare to have no conflicts of interest related to this study.

RESULTS

This study was conducted on 92 patients with BPH treated using the ThuLEP technique at Military Hospital 175, from September 2023 to December 2024. The findings are summarized in the tables below.

Table 2. Baseline characteristics and preoperative clinical data.

| Parameter                          | Mean ± SD     | Range       |
|------------------------------------|---------------|-------------|
| Age (years)                        | 69.38 ± 7.09  | 50 - 87     |
| Prostate volume (mL)               | 72.48 ± 33.79 | 31 - 183    |
| IPSS (score)                       | 28.65 ± 4.23  | 12 - 35     |
| Qmax (mL/s)                        | 2.66 ± 3.10   | 0 - 9.6     |
| QoL (score)                        | 5.79 ± 0.41   | 5 - 6       |
| Surgical time (minutes)            | 84.46 ± 35.63 | 30 - 180    |
| Reduction in red blood cells (T/L) | 0.34 ± 0.39   | 0.01 - 1.60 |
| Reduction in hemoglobin (g/dL)     | 1.06 ± 1.12   | 0.02 - 5.10 |
| Sodium reduction (mmol/L)          | 0.06 ± 2.83   | -8 - 9      |
| Catheterization duration (days)    | 2.45 ± 1.53   | 1 - 13      |
| Hospital stay (days)               | 3.51 ± 1.72   | 1 - 14      |

The majority of patients were aged 60 - 79 years. Most presented with severe LUTS, poor QoL, and impaired urinary function preoperatively.

**Table 3.** Surgical outcomes and symptom improvement postoperatively.

| Parameter             | IPSS<br>(score) | Qmax<br>(mL/s) | QoL<br>(score) | Prostate<br>volume (mL) |
|-----------------------|-----------------|----------------|----------------|-------------------------|
| Preoperative (n = 92) | 28.65 ± 4.23    | 2.66 ± 3.10    | 5.79 ± 0.41    | 72.48 ± 33.79           |
| 1 month (n = 82)      | 3.18 ± 2.03     | 19.06 ± 6.52   | 0.62 ± 0.54    | 25.47 ± 12.64           |
| 3 months (n = 58)     | 1.98 ± 1.69     | 19.62 ± 6.46   | 0.34 ± 0.55    | -                       |
| 6 months (n = 52)     | 1.25 ± 1.01     | 23.09 ± 9.17   | 0.13 ± 0.35    | -                       |

Significant improvements were observed across all postoperative timepoints in LUTS, urinary function, and QoL, with progressive enhancement noted up to 6 months. Prostate volume reduction was sustained postoperatively.

**Table 4.** Overall treatment effectiveness rates.

| Timepoint         | Excellent (%) | Good (%) | Fair (%) | Poor (%) |
|-------------------|---------------|----------|----------|----------|
| 1 month (n = 82)  | 93.1          | 5.7      | 0.4      | 0.8      |
| 3 months (n = 58) | 92.6          | 6.3      | 1.1      | 0        |
| 6 months (n = 52) | 94.2          | 5.1      | 0.6      | 0        |

Excellent outcomes were maintained across all time points, reflecting sustained treatment effectiveness. No poor outcomes were observed after 3 or 6 months of follow-up.

## DISCUSSION

### 1. Patient characteristics

Our study population had a mean age of  $69.38 \pm 7.09$  years, primarily within the 60 - 79 age range, consistent with the demographic most affected by BPH. Preoperative assessments revealed severe LUTS, with a mean IPSS of  $28.65 \pm 4.23$ , and a markedly low mean Qmax of  $2.66 \pm 3.10$  mL/s. These findings

indicate significant urinary obstruction and reduced QoL preoperatively.

When compared to other studies, Zhang Y et al. (2019) and Huang SW et al. (2019) similarly reported severe LUTS in BPH patients within comparable age groups. Their work highlights the consistent burden of BPH across populations, validating the clinical profiles observed in our cohort [6].

Additionally, Pang KH et al. (2022) emphasized the substantial urinary obstruction, comparable to our findings, underscoring the urgent need for effective surgical intervention in these patients [8].

## **2. Intraoperative outcomes**

The operative metrics in our study demonstrated the efficacy of the ThuLEP procedure. The mean operative time of  $84.46 \pm 35.63$  minutes and minimal blood loss (mean reductions in red blood cell count:  $0.34 \pm 0.39$  T/L; hemoglobin:  $1.06 \pm 1.12$  g/dL) highlight the precision and hemostatic advantages of this technique. The negligible sodium reduction ( $0.06 \pm 2.83$  mmol/L) further underscores the safety of saline as the irrigation fluid. These findings suggest that ThuLEP not only ensures surgical efficiency but also minimizes perioperative complications.

Comparatively, Kim YJ et al. (2015) reported similar operative times for ThuLEP, confirming the reproducibility of efficient surgical workflows [9]. Herrmann TR et al. (2010) highlighted the hemostatic benefits of the Thulium laser, which align with the minimal blood loss observed in our study [3]. Cornu JN et al. (2015) corroborated the safety of saline irrigation, emphasizing its role in maintaining electrolyte stability during enucleation [1].

## **3. Overall treatment effectiveness**

Our findings demonstrated sustained and significant improvement in LUTS, urinary function, and QoL across all follow-up intervals. At six months, the mean IPSS reduced from  $28.65 \pm 4.23$  to  $1.25 \pm 1.01$ , while the mean Qmax increased from  $2.66 \pm 3.10$  mL/s to  $23.09 \pm 9.17$  mL/s. Notably, 94.2% of patients achieved excellent treatment outcomes, with no poor outcomes observed beyond 3 months. This underscores the durability and consistency of ThuLEP in addressing both functional and anatomical aspects of BPH.

In comparison, Chen CH et al. (2020) and Huang SW et al. (2019) reported similarly high rates of symptom relief and functional improvement with laser enucleation techniques [2, 10]. Anatomical outcomes in our study, characterized by a reduction in prostate volume exceeding 50%, align closely with the criteria established by Homma Y et al. (1996) for excellent anatomical improvement. The findings of Zhang Y et al. (2019) further reinforce the consistency of our results, highlighting the broad applicability of ThuLEP in diverse patient populations [6].

## **4. Comparison with other techniques**

Compared to other enucleation techniques, such as HoLEP, ThuLEP

demonstrated superior hemostatic control and faster recovery times. You C et al. (2021) noted that ThuLEP had lower complication rates than TURP and HoLEP, particularly in patients with large prostates exceeding 80mL [5]. The "All-in-One" ThuLEP technique described by Kim YJ et al. (2015) further optimized operative efficiency and success rates, consistent with our findings [9]. Additionally, Bozzini G et al. (2021) emphasized the suitability of ThuLEP for treating large prostates, underscoring its versatility [4].

### CONCLUSION

This study demonstrates the safety and efficacy of ThuLEP in treating BPH, involving 92 patients with an average prostate volume of 72.48mL. The procedure resulted in over 90% of patients experiencing excellent outcomes in terms of symptom relief, urinary function, and anatomical improvements. These results reinforce ThuLEP as a reliable treatment option for BPH with proven outcomes. Further research with larger cohorts and longer follow-ups is necessary to evaluate its long-term results.

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