DOI: https://doi.org/10.17816/uroved501787
Research Article

Thulium laser enucleation of the prostate in patients with large benign prostate hyperplasia and acute urinary retention

Nikolay Yu. Kostenkov [1, 2], Salman Kh. Al-Shukri [1], Evgeniy S. Nevirovich [1, 2], Oleg M. Mosiychuk [2], Igor V. Kuzmin [1], Ilia N. Tkachuk [1, 2]

[1] Academician I.P. Pavlov First St. Petersburg State Medical University, Saint Petersburg, Russia;
[2] City Hospital No. 15, Saint Petersburg, Russia

BACKGROUND: Benign prostatic hyperplasia is the most common urological disease in older men, leading to the development of bladder outlet obstruction and a decrease in the quality of life of patients. The choice of the method of surgical treatment of benign prostatic hyperplasia with large prostate volumes is the subject of discussion. There is also no unified approach to the management of patients with acute urinary retention due to benign prostatic hyperplasia.

AIM: To evaluate the results of thulium laser enucleation of the prostate in patients with large benign prostatic hyperplasia associated with acute urinary retention.

MATERIALS AND METHODS: The present study included the results of treatment of 237 patients with benign prostatic hyperplasia with a prostate volume of more than 80 cm^3, of which 97 were hospitalized in the urology department for acute urinary retention. The age of the patients ranged from 51 to 89 years (average 70.2 years). The volume of the prostate gland ranged from 80 to 150 cm^3 (mean 128.3 cm^3). The control examination was performed on the 2nd day, as well as 3, 6 and 12 months after the surgery.

RESULTS: Surgical intervention was performed using a thulium fiber laser device FiberLase U1 (IRE-Polyus, Russia) with a power of 120 W. The time of surgery ranged from 63 to 127 minutes (average 74.3 minutes). The irrigation system was turned off on the 1st day of the postoperative period. The duration of urethral catheterization averaged 2.7 days. None of the patients in the study required blood transfusion or repeated surgery to coagulate the vessels of the prostate bed. After removal of the urethral catheter, all patients urinated on the first attempt. In 7 patients (2.95%), after removal of the urethral catheter, urinary incontinence was observed, during the first 6 months after the operation, urinary retention was restored in all of them. We did not note significant differences during the intra-, early and late postoperative period in operated BPH patients with and without acute urinary retention.

CONCLUSIONS: ThuLEP is an effective and safe method of surgical treatment of patients with benign prostatic hyperplasia with a prostate volume of more than 80 cm^3, complicated by acute urinary retention.

Keywords: thulium laser; prostate enucleation; acute urinary retention; bladder outlet obstruction; benign prostatic hyperplasia; BPH; ThuLEP.

To cite this article:
Kostenkov NYu, Al-Shukri SKh, Nevirovich ES, Mosiychuk OM, Kuzmin IV, Tkachuk IN. Thulium laser enucleation of the prostate in patients with large benign prostate hyperplasia and acute urinary retention. *Urology reports (St. Petersburg)*. 2023;13(2):109–115. DOI: https://doi.org/10.17816/uroved501787

Received: 22.03.2023 **Accepted:** 12.04.2023 **Published:** 29.05.2023

DOI: https://doi.org/10.17816/uroved501787
Научная статья

Тулиевая лазерная энуклеация простаты у пациентов с доброкачественной гиперплазией предстательной железы больших размеров и острой задержкой мочи

Н.Ю. Костенков [1, 2], С.Х. Аль-Шукри [1], Е.С. Невирович [1, 2], О.М. Мосийчук [2], И.В. Кузьмин [1], И.Н. Ткачук [1, 2]

[1] Первый Санкт-Петербургский государственный медицинский университет им. акад. И.П. Павлова, Санкт-Петербург, Россия;
[2] Городская больница № 15, Санкт-Петербург, Россия

Актуальность. Доброкачественная гиперплазия предстательной железы — наиболее частое урологическое заболевание мужчин старшей возрастной группы, приводящее к развитию инфравезикальной обструкции и снижению качества жизни пациентов. Выбор метода хирургического лечения при больших объемах простаты является предметом дискуссий. Отсутствует также единый подход к тактике ведения пациентов с острой задержкой мочи вследствие этого заболевания.

Цель — оценить результаты тулиевой лазерной энуклеации предстательной железы у пациентов с доброкачественной гиперплазией предстательной железы больших размеров на фоне острой задержки мочи.

Материалы и методы. В настоящее исследование включены результаты лечения 237 пациентов с доброкачественной гиперплазией предстательной железы объемом простаты более 80 см^3, из которых 97 были госпитализированы в урологическое отделение по поводу острой задержки мочи. Возраст пациентов — от 51 до 89 лет (в среднем 70,2 года), объем предстательной железы — от 80 до 150 см^3 (в среднем 128,3 см^3). Контрольное обследование проводили на 2-е сутки, а также через 3, 6 и 12 мес. после операции.

Результаты. Оперативное вмешательство проводили с помощью тулий-волоконного лазера FiberLase U1 мощностью 120 Вт. Время оперативного вмешательства составляло от 63 до 127 мин (в среднем 74,3 мин). Систему орошения отключали в первые сутки послеоперационного периода. Длительность катетеризации в среднем составила 2,7 дня. Ни одному пациенту из исследования не потребовалось проведение гемотрансфузии, а также повторное оперативное вмешательство с целью коагуляции сосудов ложа предстательной железы. После удаления уретрального катетера все пациенты мочились с первой попытки. У 7 пациентов (2,95 %) после удаления уретрального катетера наблюдалось недержание мочи, в течении первых 6 мес. после операции удержание мочи восстановилось у всех. Мы не отметили существенных различий в течение интра-, раннего и позднего послеоперационного периода у оперированных больных доброкачественной гиперплазией предстательной железы с острой задержкой мочи и без нее.

Выводы. Метод тулиевой лазерной энуклеации предстательной железы ThuLEP является эффективным и безопасным методом хирургического лечения больных доброкачественной гиперплазией предстательной железы с объемом простаты более 80 см^3, осложнившейся острой задержкой мочи.

Ключевые слова: тулиевый лазер; энуклеация предстательной железы; острая задержка мочи; инфравезикальная обструкция; доброкачественная гиперплазия предстательной железы; ДГПЖ; ThuLEP.

Как цитировать:
Костенков Н.Ю., Аль-Шукри С.Х., Невирович Е.С., Мосийчук О.М., Кузьмин И.В., Ткачук И.Н. Тулиевая лазерная энуклеация простаты у пациентов с доброкачественной гиперплазией предстательной железы больших размеров и острой задержкой мочи // Урологические ведомости. 2023. Т. 13. № 2. С. 109–115. DOI: https://doi.org/10.17816/uroved501787

Рукопись получена: 22.03.2023 **Рукопись одобрена:** 12.04.2023 **Опубликована:** 29.05.2023

ЭКО•ВЕКТОР

BACKGROUND

Benign prostatic hyperplasia (BPH) is the most common urological disease in older men. Its significance is due to not only its high incidence but also associated infravesical obstruction and lower urinary tract symptoms (LUTS), which negatively affect the quality of life (QoL) of patients [1, 2]. With BPH progression, urethral obstruction occurs, which can cause an overdistended bladder. The latter impairs blood flow in the bladder wall, causing ischemia and hypoxic damage [3, 4]. Several treatment options are available for patients with BPH. With mild LUTS and absence of a significant deterioration in the outflow of urine from the bladder, expectant management or pharmacotherapy is necessary [1]. In cases of severe infravesical obstruction and the presence of complications and failure of conservative therapy, surgical treatment is recommended [1]. Acute urinary retention (AUR) is one of the most serious complications of BPH, which requires emergency bladder drainage by the placement of a urethral catheter or cystostomy drainage. Recently, conservative management of patients with AUR, that is, emptying the bladder using a single catheterization and subsequent administration of alpha-adrenoblockers, has become widespread. The analysis revealed that with this approach, unassisted urination is restored in >60% of patients with AUR [5]. Emergency surgical intervention in patients with BPH-related AUR remains debatable. Some researchers argue that immediate surgical treatment of patients with AUR may increase the mortality rate of such patients because of the high risk of purulent and septic complications and bleeding. In recent years, the number of transurethral resections of the prostate (TURP) performed in patients with new-onset AUR has been gradually decreasing [6]. Moreover, some authors testify that urgent transurethral interventions on the prostate show good results and are not a risk factor for the development of purulent and septic complications in patients with AUR [4, 6]. For the surgical treatment of patients with BPH, in addition to open surgeries and TURP, laser technologies have become widely used in recent years. One of them is thulium laser enucleation of the prostate (ThuLEP), which uses laser energy to remove prostate tissue [7, 8]. Clinical studies have revealed several advantages of ThuLEP over other surgical methods for the treatment of patients with BPH [9]. Moreover, studies on the use of ThuLEP in patients with BPH-related AUR are clearly not sufficient, which determined the relevance of this study.

The work aimed to evaluate the efficacy and safety of ThuLEP in patients with BP-related AUR.

MATERIALS AND METHODS

From January 2021 to February 2022, ThuLEP was performed on 472 patients with BPH at the Urology Department of St. Petersburg City Hospital No. 15. This study included the results of treatment of 237 patients with BPH having a prostate volume of >80 cm^3, including 97 patients who were hospitalized in the urology department for acute urinary retention. The mean age of the patients included in the study was 70.2 (51–89) years, the mean duration of LUTS was 63.1 months, and the mean prostate volume measured by transrectal ultrasound was 105.8 ± 23 (80–138.3) cm^3.

The inclusion criteria were as follows:

- Surgical treatment of BPH (recurrent urinary retention, severe infravesical obstruction, large residual urine volume, and ineffectiveness of previous drug therapy)
- Prostate volume >80 cm^3
- Moderate and severe LUTS (International Prostate Symptom Score [IPSS] >8 points, QoL > 3 points).
- The exclusion criteria were as follows:
- Acute or active chronic infectious and inflammatory diseases of the urinary and genital organs
- Suspected prostate or bladder cancer
- Surgical interventions on the lower urinary tract and prostate in history
- Neurogenic dysfunction of the bladder
- Bladder stones

All 237 patients with BPH included in this study were distributed into two groups. Group 1 included 97 patients with AUR admitted in an expedited manner, and group 2 included 140 patients without AUR and admitted on a scheduled basis. On the day of hospitalization, a Foley urethral catheter was inserted into patients with AUR, and antibiotic therapy and alpha-blocker tamsulosin at a dose of 0.4 mg once a day were administered. On day 3, the urethral catheter was removed. In 53 (55%) of 97 patients, unassisted urination was restored; however, the volume of residual urine in 40 (75.5%) of them was >100 mL. In 44 patients who had non-recovery of unassisted urination, the urethral Foley catheter was repeatedly inserted.

Upon admission to the urological hospital, all patients underwent preparation for surgical intervention, which included a comprehensive urological examination. Emergency surgery was defined as surgical intervention within 3–7 days of indwelling urethral catheter placement for AUR. Patients underwent a physical examination, clinical and biochemical blood tests, coagulography, clinical urine test, pulmonary radiography, electrocardiography, urine culture for microflora, ultrasonography of the kidneys, bladder, and prostate (using a transrectal sensor), and multiparametric magnetic resonance imaging of the small pelvis. Patients with unassisted urination underwent uroflowmetry and measurement of the maximum urine flow rate (Q_{max}) and residual urine volume. The severity of BPH symptoms was assessed using the IPSS questionnaire, and the QoL was evaluated

using the QoL scale. As the risk of purulent and septic complications increases during urgent surgical interventions in patients with AUR, attention was paid to identifying signs of symptomatic or asymptomatic urinary tract infection.

All patients included in the study underwent ThuLEP using a 120 W FiberLase U1 thulium fiber laser (IRE-Polyus, Russia). During surgery, a two- or three-lobe prostate enucleation technique was used, after which the prostatic tissue was subjected to morcellation. In addition, 135 (56.9%) patients underwent surgery using the three-lobe method, and the two-lobe method was used in 102 (43.1%) patients. Perioperatively, the duration of surgery, changes in blood hemoglobin levels, duration of irrigation and bladder catheterization, and duration of hospitalization were evaluated. Postoperative evaluation was performed on day 2 and 3, 6, and 12 months after surgery. The level of total prostate-specific antigen (PSA) was assessed 12 months after the surgery. All adverse events were recorded. The severity of postoperative complications was assessed according to the Clavien–Dindo classification of surgical complications.

Statistical processing of the study results was performed using Statistica v. 10.0. Quantitative variables were presented as the arithmetic mean (*M*) and standard deviation from the arithmetic mean (σ), whereas qualitative variables were described by absolute and relative frequencies (percentages). Differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

Clinical and laboratory parameters were not significantly different between the two groups in terms of their average age, prostate volume, IPSS score, and blood hemoglobin level. Moreover, group 1 had a significantly worse QoL indicator, a lower maximum urine flow rate, and a larger residual urine volume. In group 1, symptoms were assessed according to the IPSS questionnaire and the QoL according to the QoL scale, and uroflowmetry and measurement of residual urine volume were performed only in patients who recovered unassisted urination (Table 1).

Perioperative parameters were not statistically significantly different between groups 1 and 2 in terms of surgery duration, changes in intraoperative blood hemoglobin level, duration of postoperative irrigation, and postoperative catheterization of the bladder (Table 2). Since group 1 was hospitalized for AUR had an indwelling urethral catheter for 3 days and preoperative preparation was performed and group 2 underwent surgery on days 1–3 after hospitalization, the duration of hospital stay before surgery and the total duration of hospitalization in group 1 were significantly longer than that in group 2. Moreover, no differences were found in the duration of postoperative hospital stay between groups 1 and 2 ($p > 0.05$). No serious perioperative adverse events occurred in any patient.

Postoperatively, both groups had their first attempt at urination after the removal of the urethral catheters. However, 4 (4.4%) patients in group 1 and 7 (5%) in group 2 had difficulty urinating after the removal of the urethral catheter, which required re-catheterization. Catheters were indwelled for another 3 days in these patients, and after removal, all patients had unassisted urination.

On the next day after removal of the urethral catheter, the leukocyte counts in the urine of group 1 were significantly higher than that of group 2 (27 ± 6.3 versus 13 ± 7.7, $p < 0.01$), whereas no clinical signs of urinary tract infection were noted. In 5 (4.85%) patients in group 1 and 3 (4.2%) in group 2, signs of urinary incontinence were noted after the urethral catheter removal. Urine withholding was restored in all patients within the next 6 months.

The clinical indicators in both groups 3, 6, and 12 months after ThuLEP are presented in Table 3.

In the examination of both groups 3, 6, and 12 months after surgery, no statistically significant differences in all indicators assessed (IPSS questionnaire score, QoL

Table 1. Clinical and laboratory parameters of groups 1 and 2 before surgery ($n = 237$)

Таблица 1. Клинические и лабораторные показатели пациентов 1-й и 2-й групп до операции ($n = 237$)

Indicator	Group 1 ($n = 97$)	Group 2 ($n = 140$)	p
Age, years	71.2 ± 4.5	70.3 ± 3.9	0.75
Prostate volume, cm^3	103 ± 22.1	108 ± 19.5	0.22
IPSS, score	31.5 ± 2.8	23.6 ± 2.5	0.14
QoL, score	4.9 ± 0.3	3.2 ± 0.7	0.03
Blood hemoglobin, g/L	113 ± 7.2	118 ± 1.5	0.78
Residual urine volume, mL	199 ± 24.0	62 ± 28.0	0.001
Q_{max}, mL/s	4.7 ± 3.0	7.1 ± 2.0	0.03

Table 2. Perioperative parameters of groups 1 and 2 (*n* = 237)
Таблица 2. Периоперационные показатели пациентов 1-й и 2-й групп (*n* = 237)

Indicator	Group 1 (*n* = 97)	Group 2 (*n* = 140)	*p*
Duration of surgery, min	102 ± 15.0	93 ± 13	0.09
Decrease in blood hemoglobin, g/L	8.1 ± 1.4	7.3 ± 2.1	0.05
Duration of bladder irrigation, days	0.9 ± 0.2	0.6 ± 0.1	0.12
Duration of bladder catheterization, days	3.1 ± 0.9	3.6 ± 0.3	0.12
Total duration of hospitalization, days	10.7 ± 0.8	6.4 ± 0.9	<0.001
Duration of hospital stay before surgery, days	5.8 ± 0.8	1.6 ± 0.5	<0.001
Duration of hospital stay after surgery, days	4.9 ± 0.7	4.8 ± 0.6	0.64

Table 3. Clinical parameters of groups 1 and 2 at 3, 6 and 12 months after surgical treatment (*n* = 237)*
Таблица 3. Клинические показатели пациентов 1-й и 2-й групп через 3, 6 и 12 мес. после оперативного лечения (*n* = 237)*

Indicator	Group 1 (*n* = 97)	Group 2 (*n* = 140)
3 months after surgery		
IPSS, score	14.4 ± 3.2	11.9 ± 2.3
QoL, score	2.1 ± 0.3	1.9 ± 0.2
Q_{max}, mL/s	22.5 ± 2.7	23.1 ± 1.6
Residual urine volume, mL	28.9 ± 11.0	27.4 ± 11
6 months after surgery		
IPSS, score	7.7 ± 3.1	7.0 ± 2.5
QoL, score	1.9 ± 0.4	1.5 ± 0.3
Q_{max}, mL/s	19.8 ± 3.5	20.7 ± 2.9
Residual urine volume, mL	11.7 ± 14	15.7 ± 11
12 months after surgery		
IPSS, score	5.4 ± 2.3	5.2 ± 1.6
QoL, score	1.3 ± 0.2	1.2 ± 0.4
Q_{max}, mL/s	19.8 ± 3.4	19.1 ± 1.4
Residual urine volume, mL	7.6 ± 11.0	7.4 ± 13.0

*For all indicators of groups 1 and 2, the differences are not significant ($p > 0.05$).

according to the QoL scale, residual urine volume, and maximum urine flow rate) were noted. The PSA level in the blood serum 12 months after surgery did not differ between groups 1 and 2, with 2.3 ± 1.2 and 2.2 ± 1.6 ng/ml, respectively ($p > 0.05$).

In 21 (23.2%) patients in group 1, symptomatic urinary tract infections were registered during the follow-up period, which did not differ statistically significantly from their incidence in group 2 (*n* = 26, 18.6%, $p > 0.05$). After 12 months, bladder neck necrosis developed in 3 (3.3%) patients in group 1, which required surgical treatment (laser resection of the bladder neck), after which adequate urination was restored.

Thus, our results indicate the high efficiency of ThuLEP in patients with AUR because of large BPH. No significant differences were found in the intra-, early, and late postoperative period in patients with BPH who underwent surgery with and without AUR.

CONCLUSION

ThuLEP is an effective and safe method for the treatment of patients with BPH having a prostate volume of >80 cm^3, complicated by AUR. The surgery results in these patients were nearly identical to those without AUR. A wider introduction of ThuLEP for the surgical treatment of patients with BPH appears reasonable.

ADDITIONAL INFORMATION

Authors' contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis,

interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study. Personal contribution of each author: N.Yu. Kostenkov — collection of material, analysis of the data obtained, writing the text of the manuscript; S.Kh. Al-Shukri — development of the design of the study, editing the text of the manuscript; E.S. Nevirovich — collection of material, analysis of the data obtained, editing the text of the manuscript; O.M. Mosiychuk — analysis of the data obtained, editing the text of the manuscript; I.V. Kuzmin — analysis of the data obtained, editing the text of the manuscript; I.N. Tkachuk — collection of material, editing the text of the manuscript.

Funding source. This study was not supported by any external sources of funding.

Competing interests. The authors declare that they have no competing interests.

Consent for publication. Written consent was obtained from the patients for publication of relevant medical information within the manuscript.

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AUTHORS' INFO

***Nikolay Yu. Kostenkov,** postgraduate student; urologist, urological unit; address: 4 Avangardnaya st., Saint Petersburg, 198205, Russia;
ORCID: https://orcid.org/0000-0001-8246-8798;
eLibrary SPIN: 2041-8837; e-mail: drkostenkov@rambler.ru

Salman Kh. Al-Shukri, MD, Dr. Sci. (Med.), professor, head of the Department of Urology;
ORCID: https://orcid.org/0000-0002-4857-0542;
Scopus: 6506423220; eLibrary SPIN: 2041-8837;
e-mail: alshukri@mail.ru

Evgeniy S. Nevirovich, MD, Cand. Sci. (Med.), assistant professor; head of the urological unit;
ORCID: https://orcid.org/0000-0001-8427-5092;
eLibrary SPIN: 9362-4145; e-mail: enevirovich@gmail.com

Oleg M. Mosiychuk, deputy chief physician for medical affairs;
ORCID: https://orcid.org/0009-0003-7979-1086;
e-mail: oleg.mosichuk@yandex.ru

Igor V. Kuzmin, Dr. Sci. (Med.), professor of the Department of Urology;
ORCID: https://orcid.org/0000-0002-7724-7832;
eLibrary SPIN: 2684-4070; Scopus Author ID: 56878681300;
e-mail: kuzminigor@mail.ru

Ilia N. Tkachuk, Cand. Sci. (Med.), assistant professor of the Department of Urology; urologist, Urological Unit;
e-mail: tkachuk2@yandex.ru

* Corresponding author / Автор, ответственный за переписку

ОБ АВТОРАХ

***Николай Юрьевич Костенков,** аспирант кафедры урологии; врач-уролог; адрес: Россия, 198205, Санкт-Петербург, ул. Авангардная, д. 4;
ORCID: https://orcid.org/0000-0001-8246-8798;
eLibrary SPIN: 2041-8837; e-mail: drkostenkov@rambler.ru

Сальман Хасунович Аль-Шукри, д-р мед. наук, профессор, заведующий кафедрой урологии;
ORCID: https://orcid.org/0000-0002-4857-0542;
Scopus: 6506423220; eLibrary SPIN: 2041-8837;
e-mail: alshukri@mail.ru

Евгений Станиславович Невирович, канд. мед. наук, доцент кафедры урологии; заведующий урологическим отделением;
ORCID: https://orcid.org/0000-0001-8427-5092;
eLibrary SPIN: 9362-4145; e-mail: enevirovich@gmail.com

Олег Михайлович Мосийчук, заместитель главного врача по медицинской части;
ORCID: https://orcid.org/0009-0003-7979-1086;
e-mail: oleg.mosichuk@yandex.ru

Игорь Валентинович Кузьмин, д-р мед. наук, профессор кафедры урологии;
ORCID: https://orcid.org/0000-0002-7724-7832;
eLibrary SPIN: 2684-4070; Scopus Author ID: 56878681300;
e-mail: kuzminigor@mail.ru

Илья Николаевич Ткачук, канд. мед. наук, доцент кафедры урологии; врач-уролог;
e-mail: tkachuk2@yandex.ru