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*Ch.D. Dibiraliev, Ch.N. Abdulaev, S.P. Danilov, A.M. Dymov, R.B. Sukhanov, E.A. Bezrukov*

# ANALYSIS OF PERI- AND POSTOPERATIVE RESULTS OF LASER ENUCLEATION OF THE PROSTATE USING VARIOUS TECHNIQUES

Institute for Urology and Reproductive Health, I.M. Sechenov First Moscow State Medical University, Moscow, Russia

Corresponding author: Ch.D. Dibiraluev – urologist, Ph.D. student, Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: chinghiz.dibiraliev@yandex.ru

*Introduction. Several techniques are used for laser enucleation of benign prostate hyperplasia, including two- and three-lobe enucleation, enucleation of all lobes in a single block (en-bloc), and enucleation of all nodes in a single block without longitudinal incisions (total en-bloc).*
*Aim. A prospective and retrospective analysis of the results of two-lobe, en-bloc, and total en-bloc using thulium fiber laser enucleation of the prostate (ThuFLEP) techniques was performed.*
*Methods. The study included a retrospective and prospective comparative analysis of the peri- and post-operative results of ThuFLEP using several techniques. Patients with benign prostatic hyperplasia causing bladder outlet obstruction (IPSS>20, Qmax<15) were undergone to ThuFLEP from January 2015 to May 2022. All patients were examined prior to and 1, 3, and 6 months after the procedure. In the pre- and postoperative period, the age of the patients, prostate volume, level of prostate-specific antigen, functional parameters (IPSS, post-void residual, Qmax, and QoL), the stress urinary incontinence were evaluated. In addition, the following intraoperative parameters were assessed: duration of the procedure, enucleation rate, morcellation rate, and mass of enucleated tissue.*
*Results. We found 450 patients who underwent thulium fiber laser enucleation of prostate hyperplasia (ThuFLEP). Three laser enucleation techniques were used, including two-lobe (n=148; group A), en-bloc (n=150; group B), and total en-bloc without longitudinal incision (n=152; group C). The mean prostate volume was comparable between groups. The mean operation time for the total en-bloc technique (group C) was less compared to the other two techniques (58.9±30.1 vs. 68.8±30.6 for group A and 67.4±30.1 min for group B, respectively; p<0.005). The mean enucleation rate in group C was higher compared to groups A and B (2.3±0.78 vs. 1.9±0.74 and 1.9±0.69 g/min, respectively; p<0.005). The mean morcellation rate in all three groups was comparable (2.8±1.7, 3.0±1.1, and 2.9±2.1 g/min; p>0.05). After 6 months, there were no differences in functional results, according to the IPSS, PVR, Qmax, and QoL.*
*Conclusion. The two-lobe, en-bloc, and total en-bloc techniques were comparable in functional results and the complication rate. Total en-bloc enucleation showed the higher enucleation efficiency.*

*K e y w o r d s: laser enucleation, prostate hyperplasia, en-bloc, total en-bloc, two-lobe technique*

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**Introduction.** Currently, surgical treatment remains the most effective for patients with benign prostatic hyperplasia (BPH). The "gold" standard are transurethral procedures, such as transurethral resection (TUR) and laser enucleation of the prostate [1, 2]. According to the European Association of Urologists (EAU) and Russian guidelines, transurethral laser enucleation is recommended for patients with a prostate volume of more than 30 cc. This procedure is the method of choice and is considered preferable for patients taking anticoagulants or antiplatelet agents without the possibility of their discontinuation [3-5]. Several techniques for performing laser enucleation have been developed, all of them involve identification of the proper layer between the surgical capsule and adenomatous tissue, followed by retrograde enucleation within this plane [6, 7]. The first technique included prostate incisions at 5, 7, and 12 o'clock. If a middle lobe present, it is initially enucleated, followed by the lateral lobes [8–10]. The next step in the development of laser enucleation techniques was the development of a two-lobe technique, which began from the incisions of bladder neck at 5 or 7 o'clock. According to this technique, the middle lobe was enucleated together with one of the lateral lobes, and then the second lateral lobe was dissected separately [7, 11, 12]. A.E. Krambeck and A.S. Baazeem were the first to propose a two-lobe technique for enucleation of the prostate (*Fig. 1*). This technique begins with an incision from bladder neck at 6 o'clock in the absence of the middle lobe (in case of the middle lobe, the incision was made at 7 o'clock) in the direction of the verumontanum until the circular fibers of the surgical capsule are visualized. Next, one of the lateral lobes is excised together with the middle lobe. The incision continues counterclockwise towards the bladder neck to 2–3 o'clock. Then an incision is made at 12 o'clock from the bladder neck towards the verumontanum. Further, the incisions at 6 and 12 o'clock are connected, thus enucleating the left lobe and pushing it into the bladder. The same is done for enucleation of the right lobe [11, 12].

In 2015, C.M. Scofone et al. [14] proposed the en-bloc technique for laser enucleation (*Fig. 2*) to simplify the

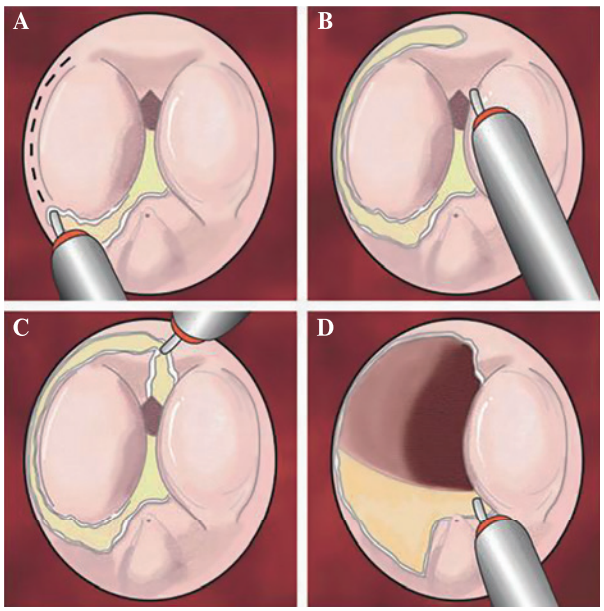



**Fig. 1. Scheme of the two-lobe laser enucleation technique**
A – tissue dissection at the verumontanum on the right and dissection of the layer between the adenomatous tissue and the surgical capsule; B – enucleation of the right lobe; C – tissue dissection at 12 o'clock; D – enucleation of the left lobe [13]

learning process and improve treatment outcomes. This technique was an evolutionary step, during which a single longitudinal incision is made and the prostate lobes are enucleated in a single horseshoe-shaped manner. This technique proved to be superior in terms of identifying and visualizing the surgical capsule, the proper layer for enucleation, and early apical release, which allows for better sphincter preservation.

With the accumulation of experience in performing en-bloc laser enucleation, surgeons began to modify it, since the incision of adenomatous tissue often led to bleeding and disorientation, which ultimately increased the operating time. A modified total en-bloc laser enucleation technique without a longitudinal incision was first described in 2019 by F. Gomez-Sancha (*Fig. 3*) [7].

**Aim.** To compare the results of thulium fiber laser enucleation of the prostate using different techniques.

**Materials and methods.** This study is retro- and prospective in nature and was carried out between January 2015 and May 2022. Patients with a history of prostate surgery, prostate cancer, urethral strictures, or bladder stones were excluded. For ThuFLEP, UROLAZ laser device from NTO IRE-Polus (Russia) with a wavelength of 1940 nm and laser fibers of 600 and 550 μm was used. All stages of the procedure were performed at a laser power of 60 W. Thulium enucleation of the prostate was done using a 26 Ch resectoscope from Karl Storz (Germany) or Richard Wolf (Germany), which provide continuous irrigation, and have a working element with a channel for the laser fiber. All procedures were performed by three surgeons with extensive experience in transurethral laser enucleations of the prostate. 450 patients were divided into three groups (A, B and C) according to the enucleation techniques. In group A, traditional two-lobes technique was done, in group B a classical technique of enucleation in a single block with longitudinal incision (en-bloc) was used, and in group C total enucleation in a single block without additional longitudinal incisions (total en-bloc) was performed. These techniques were used sequentially during the following period: two-lobes from January 2015 to October 2018, traditional en-bloc technique from October 2018 to November 2021 and total en-boc technique from November 2021 to May 2022.

Laser enucleation of the prostate using the two-lobe technique was done according to the scheme described by A.E. Krambeck and A.S. Baazeem. When performing laser enucleation using the en-bloc technique, we adhered to the basic principles described in the works of C. M. Scoffone.

A detailed description of the en-bloc technique performed by our surgeons is presented below.

Initially, it is important to identify the fold of the external sphincter (Nesbit's sign), which determines the border between adenomatous tissue and the urethral sphincter. The procedure begins with tissue dissection to the left and right of the verumontanum. This area is most

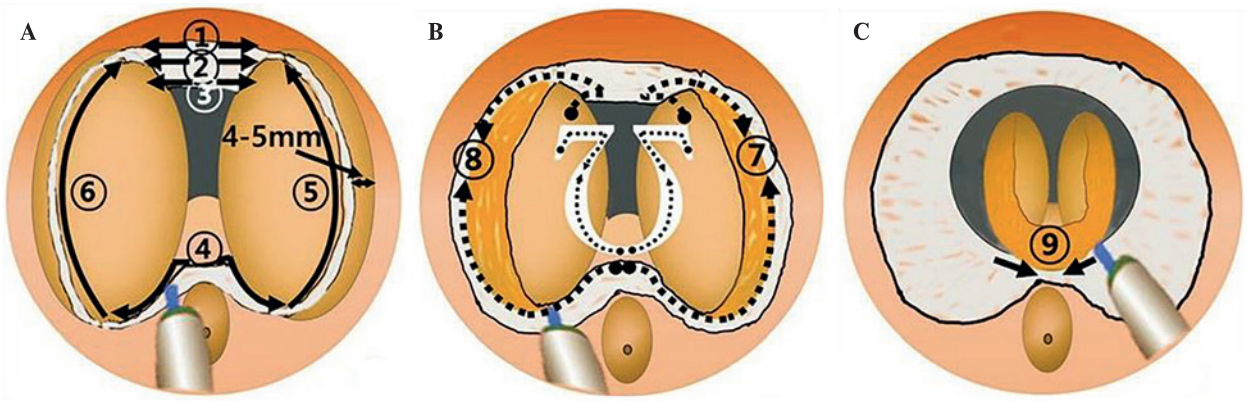



**Fig. 2. Scheme of the en-bloc laser enucleation technique**
A – tissue dissection to the right and left of the verumontanum, continuation of the incisions along the circumference on both sides; B – the process of enucleation of adenomatous tissue in a single block with dissection at 12 o'clock; C – the enucleated tissue is pushed into the bladder in a single block [15]

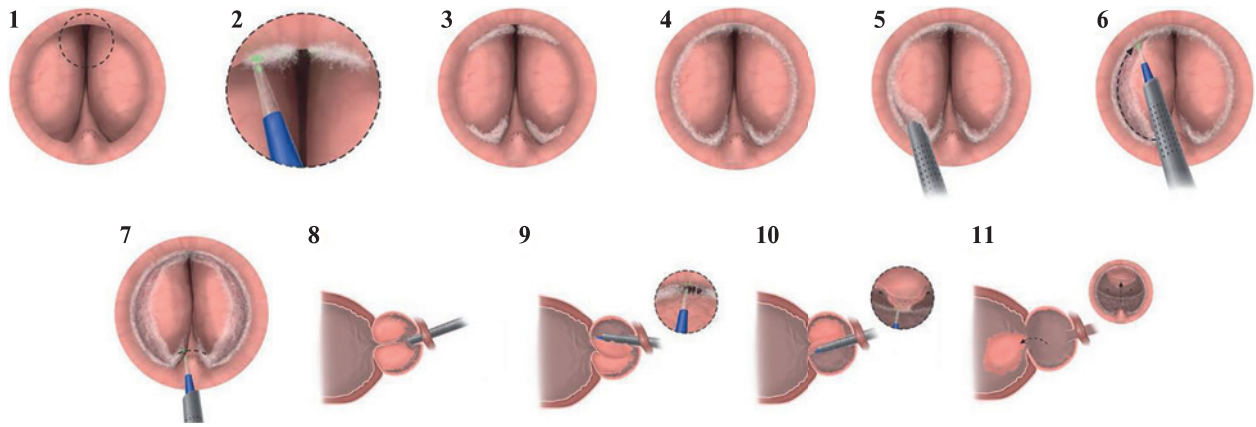



**Fig. 3. Scheme of total en-bloc laser enucleation technique**

1 – visualization of the external sphincter fold (Nesbitt sign); 2 – tissue dissection in the area of the external sphincter fold; 3 – tissue dissection to the right and left of the verumontanum; 4 – continuation of incisions on both sides along the circumference up to 12 o'clock; 5 – enucleation of the right and left lobes along the lateral surfaces; 6 – transverse incision at 6 o'clock; 8 – enucleation of the right and left lobes along the lateral surfaces; 9 – enucleation of adenomatous tissue along the upper semicircle; 10 – enucleation of adenomatous tissue along the lower semicircle; 11 – enucleated adenomatous tissue is pushed into the bladder [7]

convenient for determining the proper layer between the lobes and the surgical capsule. The incision continues from the verumontanum to 3 o'clock on the left and 9 o'clock on the right lobe, respectively. Then one can proceed to a circular incision at the level of the prostate apex at the proximal edge of the external sphincter. This maneuver leads to separation of the apex of the prostate from the sphincter, which minimizes a risk of sphincter injury. Subsequent enucleation of adenomatous tissue is performed within this layer. Enucleation of one of the lateral lobes is done in a circle with the surgical capsule as a reference point. The same is completed on the opposite side. In this case, a plane is formed along the surgical capsule in the direction from the verumontanum to the bladder with the displacement of all adenomatous tissue forward in a single block almost to the bladder neck. Next, prostatic lobes are dissected at 6 o'clock in the direction from the bladder neck to the verumontanum, visually focusing on the surgical capsule. Then, the adenomatous tissue is cut off from the bladder neck along its circumference [10, 14, 16].

When performing the enucleation using the total en-bloc technique, we followed the basic principles described by F. Gómez Sancha, making minor changes to the sequence of stages.

A description of the technique of enucleation without additional longitudinal incisions (total en-bloc), performed by our surgeons, is presented below.

The total en-bloc technique has been described relatively recently. Like the standard en-bloc technique, it begins with early apical release, i.e. with determining the strip of the external sphincter and a circular incision at the level of the apex at the proximal edge of the sphincter. Then, tissue is also dissected to the left and right of the verumontanum, where the plane between the adenomatous tissue and the surgical capsule is easily determined due to the protrusion in this place and the minimal amount of tissue regardless of the prostate size. Next, the incision is retrogradely expanded circumferentially towards the left lobe, thus continuing it at the verumontanum along the existing plane between the left lobe and the surgical capsule. Further, enucleation of the left lobe is continued, rising circumferentially from 5 to 3 o'clock, then to 12 o'clock behind the external sphincter until reaching the bladder neck. After that, one can return to the original incision at the verumontanum and continue the incision, reaching the apical part of the right lobe, and enucleation of the right and middle lobes is performed in the same way as described for the opposite side, connecting circumferentially with the already enucleated left lobe at 12 o'clock. Thus, we obtain an almost completely enucleated tissue in a single block, fixed along the lower semicircle from 10 to 2 o'clock. It is important to correctly incise the remaining fixing mucous membrane without damaging the external sphincter. Then, the enucleated tissue is pushed into the bladder for subsequent morcellation [7, 17].

After completing the enucleation stage, if the hemostasis was unsatisfactory, additional coagulation of the bleeding vessels was performed with electrical loop.

Removal of the enucleated tissue from the bladder in all three techniques was performed using a Piranha mechanical morcellator (Richard Wolf, Germany).

At the end of the procedure, a 18F three-way Rusch catheter was put for continuous irrigation of the bladder with saline in order to avoid bladder tamponade. Continuous irrigation was stopped in most cases on the 1st day after surgery, provided that there was no bleeding. The urethral catheter was removed in most patients on the 2nd day. The patients were followed up for 6 months.

The following parameters were assessed after 1, 3 and 6 months: prostate-specific antigen (PSA) level, the International Prostate Symptom Score (IPSS) and quality of life (QoL) scores, maximum (Qmax) and average (Qave) urine flow rates. The primary endpoint of the study was the efficiency (enucleation time, morcellation time and duration of procedure) of each of the techniques. The secondary endpoint was the incidence

of complications, particularly the rate of postoperative stress urinary incontinence.

For statistical analysis IBM SPSS Statistics 23.0 was used. Patient data are presented as mean ± standard deviation. To compare mean values, analysis of variance (ANOVA) was performed. Post hoc analysis was done using the Mann–Whitney U-test. The $\chi 2$ criterion was used to determine the significance of differences between frequencies. A p-value of 0.05 was chosen as the threshold for statistical significance.

**Results.** A total of 450 patients who underwent ThuFLEP were analyzed. Three techniques of laser enucleation were used, including two-lobe ($n$=148), en-bloc ($n$=150) and total en-bloc ($n$=152). The mean preoperative prostate volume was comparable (75.21; 76.12 and 75.82 cc in groups A, B and C, respectively, $p$>0.05) with the minimum and maximum volume of 34 and 205 cc, respectively. The mean age of patients was 64, 65 and 66 years ($p$>0.05). The mean baseline IPSS score, Qmax, Qave and QoL did not differ between groups. The average duration of the procedure when performing the total en-bloc technique was shorter compared to two-lobe and the en-bloc techniques (58.9±30.1 versus 68.8±30.6 and 67.4±30.1 min, respectively, $p$<0.05). The average weight of the enucleated tissue (dry residue) was equivalent (56.41±30.65, 57.09±31.87 and 56.87±32.45 g, respectively; $p$>0.05). Postoperatively, the prostate volume was also comparable in three groups (14.12±6.87, 15.14±7.78 and 14.21±7.56 cc, respectively; $p$>0.05). For a more reliable assessment of the differences in enucleation and morcellation times, it was decided to divide patients into three subgroups depending on the prostate volume: <80 cc, 80–150 cc, and >150 cc. The enucleation rate became higher with increasing prostate volume. For the two-lobe technique, it increased from 1.59 to 2.01 g/min; for the en-boc technique from 1.81 to 2.3 g/min and for the total en-bloc technique from 1.95 to 2.81 g/min.

The average enucleation rate when using the total en-bloc technique was higher compared to other two techniques (2.71±0.78 versus 1.9±0.74 and 2.02±0.69 g/min; $p$<0.05). The average morcellation speed was similar for all three techniques (2.8±1.7, 2.9±1.1, and 2.8±2.1 g/min; $p$>0.05). All three techniques were quite effective; no significant differences were found between groups. After 1 and 3 months, significant differences were seen between the groups in rate of stress urinary incontinence and QoL. After 6 months of follow-up, no differences were found in functional results (IPSS, PVR, Qmax, QoL). In addition, no significant differences were documented in PSA levels. The number of postoperative complications did not differ significantly. Stress urinary incontinence in the early postoperative period after removal of the urethral catheter was recorded in 38 (25.6%) patients in group A, in 29 (19.3%) patients in group B and in 27 (18%) patients in group C. After 3 months, stress urinary incontinence was found in 21 (13.9%) patients in group A, in 19 (12.4%) patients in group B and in 9 (5.4%) patients in group C. In the late postoperative period after 6-month follow-up, mild stress urinary incontinence (1 pad within 24 hours) was presented in 14 (9.3%), 6 (4%) and 4 (2.6%) cases, respectively ($p$=0.505). Formation of blood clots that resulted in urethral catheter obstruction, but did not require repeated endoscopic intervention and hemostasis, occurred in 67 (44.6%), 43 (28.6%) and 42 (28%) men in group A, B and C, respectively ($p$=0.291). Complications such as TUR syndrome, bladder wall trauma and blood loss requiring blood transfusion were not observed in any of groups.

**Discussion.** Retrograde dissection of the prostate lobes from the apical part to the bladder neck helps to better identify the proper plane and prevents damage to the bladder neck. With this technique, one need to determine the proper plane between the lobes and the surgical capsule only once, and not three times (at 5, 7 and 12 o'clock), which in turn reduces the risk of erroneous choosing of the enucleation plane. When continuing the procedure, one can focus on the existing plane throughout the enucleation, trying not to go beyond it, which eliminates the risk of incomplete removal of adenomatous tissue or perforation of the surgical capsule.

With the use of laser energy for the surgical treatment of lower urinary tract symptoms associated with BPH, new surgical treatment methods have been introduced. Currently, several laser devices with different sources of laser energy are available [18]. Surgical methods ranging from vaporization to resection and enucleation were developed.

In 1986, Y. Huraoka et al. [19] firstly described a technique for endoscopic enucleation of the prostate. This technique was technically imperfect, which prevented its widespread introduction. It involved using a loop to resect the lobes and was time-consuming.

In 1996, P.J. Gilling was the first to describe holmium laser resection of the prostate (HoLRP). The adenomatous tissue was resected with a laser in small pieces in the same way as with a loop during TURP [20].

With the advent of the tissue morcellator, laser enucleation of the prostate became widespread and gradually began to replace TUR. The development of enucleation of the entire prostate lobes in the existing layer between the surgical capsule and adenomatous tissue allowed for a significant reduction in surgical time compared to HoLRP. The laser fiber and the resectoscope tip in this technique act like a surgeon's finger during simple prostatectomy [21].

Laser enucleation of the prostate is currently the most evolutionarily developed and technically effective method of surgical treatment of BPH, which is essentially an endoscopic replication of simple prostatectomy [22].

Previous studies confirm the usefulness of modification and improvement of surgical techniques of laser enucleation, including the en-bloc technique. All previously developed techniques require one or more incisions in the adenomatous tissue. The prostate most often has three lobes, and quite often the problem is to find proper anatomical layer between the lateral and middle lobes, which requires a separate incision. This leads to unnecessary blood loss and loss of anatomical orientation. Considering these factors, a new technique of total en-bloc enucleation without additional incisions was developed, which allows enucleation in a single block without longitudinal incisions.

In our study, the clinical outcomes of three different techniques of laser enucleation of the prostate were compared, including two-lobe, classical en-bloc and relatively recently developed total en-bloc. No significant differences in functional outcomes (IPSS, residual urine volume, Qmax and QoL) were found. However, the total en-bloc technique was associated with significantly lower operating time and higher enucleation efficiency compared to the other two techniques.

Study limitations. The first important limitation is the retrospective and non-randomized design. The second limitation is that different time periods were analyzed, including skill acquisition and advanced training, which may influence on results. The third limitation was the short follow-up period (6 months), precluding assessment of possible late complications, such as urethral strictures, bladder neck stenosis, or recurrence of BPH.

**Conclusion.** All laser enucleation techniques are effective and safe for treating patients with BPH. Peri- and postoperative results, as well as the number of complications, were equivalent in all groups. However, when performing laser enucleation using the total en-bloc technique, the duration of the procedure, particularly the enucleation stage, was significantly lower compared to two other techniques. Laser enucleation of the prostate using the total en-bloc technique is a safe procedure that allows for easier recognition of the surgical capsule and preservation of the external sphincter mucosa, which ensures a low incidence of postoperative stress incontinence.

## REFERENCES


1. *Glybochko P.V., Alyaev Yu.G.* Urology: textbook. 2019; 325 p. Russian. (Глыбочко П.В., Аляев Ю.Г. Урология: учебник. 2019; 325 с.).
2. *Becker B., Netsch C., Bozzini G., Herrmann T.R.W., Bach T., Enikeev D., Gross A.J.* Reasons to go for thulium-based anatomical endoscopic enucleation of the prostate. World J. Urol. 2021;39(7):2363–2374. Doi: 10.1007/S00345-021-03704-7.
3. *Rasner P.I., Sivkov A.V., Kharchilava R.R.* Clinical guidelines: Benign prostatic hyperplasia. 2022; 36–37 p. Russian (Раснер П.И., Сивков А.В., Харчилава Р.Р. Клинические рекомендации: Доброкачественная гиперплазия предстательной железы. 2022;36–37 с.).
4. EAU Guidelines. Edn. presented at the EAU Annual Congress Milan March 2023. Russian (Рекомендации EAU. Издание. представлено на Ежегодном конгрессе EAU в Милане в марте 2023 г.).
5. *Taratkin M., Shpikina A., Morozov A., Novikov A., Fokin I., Petov V., Herrmann T.R., Misrai V., Lusuardi L., Teoh J.Y.C., McFarland J., Kozlov V., Enikeev D.* Enucleation vs. vaporization of benign prostatic hyperplasia: a head-to-head comparison of the various outcomes and complications. A systematic review and meta-analysis. Minerva Urol. Nephrol. 2022;74(5):559–569. Doi: 10.23736/S2724-6051.21.04639-5.
6. *Enikeev D., Morozov A., Taratkin M., Misrai V., Rijo E., Podoinitsin A., Gabdullina S., Herrmann T.R.W.* Systematic review of the endoscopic enucleation of the prostate learning curve. World J. Urol. 2021;39(7):2427–2438. Doi: 10.1007/S00345-020-03451-1.
7. *Saitta G., Becerra J.E.A., del Álamo J.F., González L.L., Elbers J.R., Suardi N., Gómez-Sancha F.* 'En Bloc' HoLEP with early apical release in men with benign prostatic hyperplasia. World J. Urol. 2019;37(11):2451–2458. Doi: 10.1007/s00345-019-02671-4.
8. *Enikeev D., Taratkin M., Babaevskaya D., Morozov A., Petov V., Sukhanov R., Shpot E., Misrai V., Chinenov D., Enikeev M., Herrmann T.* Randomized prospective trial of the severity of irritative symptoms after HoLEP vs ThuFLEP. World J. Urol. 2022;40(8):2047–2053. Doi: 10.1007/S00345-022-04046-8.
9. *Miernik A., Schoeb D.S.* Three horse shoe-like incision" holmium laser enucleation of the prostate: first experience with a novel en bloc technique for anatomic transurethral prostatectomy. World J. Urol. 2019;37(3):523–528. Doi: 10.1007/s00345-018-2418-0.
10. *Rapoport L.M., Sorokin N.I., Sukhanov R.B., Dymov A.M., Enikeev D. V., Davydov D.S., Danilov S.P.* En bloc holmium laser enucleation of the prostate (HOLEP EN BLOC): our experience. Urologiia. 2018;(3):83–87. Doi: 10.18565/urology.2018.3.83-87. Russian. (Рапопорт Л.М., Сорокин Н.И., Суханов Р.Б., Дымов А.М., Еникеев Д.В., Давыдов Д.С., Данилов С.П. Гольмиевая лазерная энуклеация гиперплазии простаты единым блоком (HOLEP EN BLOC): наш опыт. Урология. 2018;3: 83–87).
11. *Krambeck A.E., Handa S.E., Lingeman J.E.* Experience With More Than 1,000 Holmium Laser Prostate Enucleations for Benign Prostatic Hyperplasia. J. Urol. 2010;183(3):1105–1109. Doi: 10.1016/j.juro.2009.11.034.
12. *Baazeem A.S., Elmansy H.M., Elhilali M.M.* Holmium laser enucleation of the prostate: Modified technical aspects. BJU Int. 2010;105(5):584–585, Doi: 10.1111/j.1464-410X.2009.09111.x.
13. *Rivera M.E., Lingeman J.E., Krambeck A.E.* Holmium Laser Enucleation of the Prostate. J. Endourol. 2018;32(S1):S7–9. Doi: 10.1089/end.2017.0710.
14. *Scoffone C.M., Cracco C.M.* The en-bloc no-touch holmium laser enucleation of the prostate (HoLEP) technique. World J. Urol. 2016;34(8):1175–1181, Doi: 10.1007/s00345-015-1741-y.
15. *Kim D.H., Kang C.S., Choi J.W., Jeh S.U., Choi S.M., Lee C.W., Kam S.C., Hwa J.S., Hyun J.S.* The Efficacy and Safety of "Inverted Omega En-bloc" Holmium Laser Enucleation of the Prostate (HoLEP) for Benign Prostatic Hyperplasia: A Size-Independent Technique for the Surgical Treatment of LUTS. World J. Mens. Health. 2023;41. Doi: 10.5534/wjmh.220225.
16. *Tuccio A., Grosso A.A., Sessa F., Salvi M., Tellini R., Cocci A., Viola L., Verrienti P., Di Camillo M., Di Maida F., Mari A., Carini M., Minervini A.* En-Bloc Holmium Laser Enucleation of the Prostate with Early Apical Release: Are We Ready for a New Paradigm? J. Endourol. 2021;35(11):1675–1683. Doi: 10.1089/end.2020.1189.
17. *Ito T., Tamura K., Otsuka A., Shinbo H., Takada S., Kurita Y., Miyake H.* Development of a Complete En-Bloc Technique with Direct Bladder Neck Incision: A Newly Modified Approach for Holmium Laser Enucleation of the Prostate. J. Endourol. 2019;33(10):835–840. Doi: 10.1089/end.2018.0773.
18. *Hiraoka Y., Akimoto M.* Transurethral enucleation of benign prostatic hyperplasia. J. Urol. 1989;142(5):1247–1250. Doi: 10.1016/S0022-5347(17)39047-X.
19. *Hiraoka Y., Lin T., Tsuboi N., Nakagami Y.* Transurethral enucleation of benign prostatic hyperplasia. Nippon Ika Daigaku Zasshi. 1986;53(2):212–215. Doi: 10.1272/jnms1923.53.212.
20. *Gilling P.J., Cass C.B., Cresswell M.D., Fraundorfer M.R.* Holmium laser resection of the prostate: Preliminary results of a new method for the treatment of benign prostatic hyperplasia. Urology. 1996;47(1):48–51. Doi: 10.1016/S0090-4295(99)80381-1.
21. *Tan A.H.H., Gilling P.J.* Holmium laser prostatectomy: Current techniques. Urology. 2002;60(1):152–156. Doi: 10.1016/S0090-4295(02)01648-5.
22. *Kuntz R.M., Lehrich K.* Transurethral holmium laser enucleation versus transvesical open enucleation for prostate adenoma greater than 100 gm.: A randomized prospective trial of 120 patients. J. Urol. 2002;168(4 I):1465–1469. Doi: 10.1016/s0022-5347(05)64475-8.



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**Author information:**

Dibiraliev Ch.D. – urologist, Ph.D. student, Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: chinghiz.dibiraliev@yandex.ru

Abdulaev Ch.N. – resident, Ph.D. student, Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: abdulaev.ch@yandex.ru

Danilov S.P. – Ph.D., urologist, Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: spdanilov@gmail.com

Sukhanov R.B. – Ph.D., assistant, Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: rb_suhanov@mail.ru

Dymov A.M. – Ph.D., Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: alimdv@mail.ru

Bezrukov E.A. – Ph.D., MD, professor of the Institute for Urology and Reproductive Health, FGAOU VO I.M. Sechenov First Moscow State Medical University, Moscow, Russia; e-mail: eabezrukov@rambler.ru