



Stress urinary incontinence following thulium fiber laser enucleation of the prostate: incidence and risk factors analysis

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Abstract

Introduction. Thulium fiber laser enucleation of the prostate (ThuFLEP) is an effective, minimally invasive surgical option for benign prostatic obstruction, enabling complete anatomical adenoma removal with excellent hemostasis and applicability across a wide range of prostate volumes. Despite the high efficacy of endoscopic enucleation techniques, early postoperative stress urinary incontinence (SUI) remains one of the most clinically relevant functional complications, adversely affecting patients' quality of life and satisfaction with surgery.

Objective. To determine the incidence and potential risk factors for SUI following ThuFLEP performed by a single surgeon with experience of more than 3000 endoscopic enucleations.

Materials & methods. Between May 2021 and September 2022, ThuFLEP was performed in 381 patients. The FiberLase U3 system (IRE Polus Ltd., Fryazino, Russia) was used as the laser source, with standard settings of 1.5 J, 40 Hz, 60 W.

Results. SUI occurred in 45 patients (11.8%) after ThuFLEP. Only one patient (0.3% of the cohort) had symptoms persisting beyond 3 months, whereas SUI resolved within 3 months in the remaining 99.7% of cases. Urethral pressure profilometry in the single patient with persistent SUI demonstrated marked sphincter insufficiency, which was successfully managed with comprehensive rehabilitation. On univariate regression analysis, preoperative IPSS was identified as a risk factor for SUI: each one-point increase in IPSS was associated with a 1.074-fold rise in the odds of SUI (95% CI 1.007–1.145, $p = 0.029$). Use of the en-bloc technique emerged as a protective factor, reducing the odds of SUI by 89.4% (95% CI 0.014–0.789, $p = 0.028$). Multivariate regression analysis showed a similar trend, although the differences did not reach statistical significance, in line with prior ThuFLEP series.

Conclusion. SUI after ThuFLEP is observed in 11.8% of patients and resolves within 3 months in 99.7% of cases. Greater baseline symptom severity as measured by IPSS increases the risk of postoperative SUI, whereas en-bloc ThuFLEP appears to confer a protective effect.

Keywords: thulium fiber laser enucleation of benign prostate hyperplasia; thulium fiber laser; stress urinary incontinence

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Частота и факторы риска стрессового недержания мочи после тулиевой волоконной энуклеации гиперплазии простаты

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Аннотация

Введение. Тулиевая волоконная энуклеация гиперплазии простаты (ThuFLEP) является эффективным малоинвазивным методом хирургического лечения гиперплазии простаты, позволяющим выполнять полное анатомическое удаление аденоматозной ткани с хорошим гемостазом и возможностью применения при всех объёмах предстательной железы. Несмотря на высокую эффективность эндоскопических методов энуклеации, раннее послеоперационное стрессовое недержание мочи остаётся одним из наиболее клинически значимых функциональных осложнений, влияющих на качество жизни пациентов и их удовлетворённость результатами операции.

Цель исследования. Оценить частоту и факторы риска стрессового недержания мочи после ThuFLEP, выполненной одним урологом с опытом более 3000 эндоскопических энуклеаций.

Материалы и методы. С мая 2021 года по сентябрь 2022 года ThuFLEP была выполнена 381 пациенту. В качестве источника лазерной энергии использовали аппарат Fiberlase U3 (IRE Polus Ltd, Фрязино, Россия) со стандартными настройками: 1,5 Дж, 40 Гц, 60 Вт.

Результаты. Стрессовое недержание мочи после ThuFLEP было выявлено у 45 пациентов (11,8%). Только у 1 пациента (0,3% от общей выборки) симптомы сохранялись более 3 месяцев, тогда как у остальных пациентов недержание регрессировало в течение 3 месяцев после операции. Исследование профиля уретрального давления у пациента с персистирующим стрессовым недержанием мочи выявило выраженную сфинктерную недостаточность, которая была успешно скорректирована на фоне комплексной реабилитации. По данным однофакторного регрессионного анализа было показано, что балл IPSS является фактором риска стрессового недержания: при увеличении показателя на каждый 1 балл вероятность недержания возрастала в 1,074 раза (95% ДИ 1,007 – 1,145; $p = 0,029$). Защитным фактором являлось использование техники en-bloc: вероятность стрессового недержания снижалась на 89,4% (95% ДИ 0,014 – 0,789; $p = 0,028$). Многофакторный регрессионный анализ показал аналогичную тенденцию, однако различия не достигли статистической значимости.

Заключение. Стрессовое недержание мочи после ThuFLEP выявляется у 11,8% пациентов и в 99,7% случаев регрессирует в течение 3 месяцев после операции. Фактором риска стрессового недержания мочи является выраженность симптомов по шкале IPSS, тогда как выполнение ThuFLEP в технике en-bloc выступает защитным фактором.

Ключевые слова: тулиевая волоконная энуклеация гиперплазии простаты; тулиевый волоконный лазер; стрессовое недержание мочи

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Introduction

The enucleation technique for benign prostatic hyperplasia (BPH) was proposed in the late 1990s and in a short time showed promising results, according to some reports, surpassing classical transurethral resection, which for many years was considered the «gold standard» of BPH treatment [1]. The primary energy source used in enucleation was monopolar, but in 1998 by M.R. Fraundorfer and P.J. Gillig the possibility of performing laser enucleation using a holmium laser (HoLEP) was shown, which later led to the active introduction of laser technologies into the endoscopic treatment of BPH [2].

The accumulated experience of performing enucleation has led to the emergence of a large number of works comparing different types of energy with each other [3, 4]. Nevertheless, most of the results indicated the lack of advantages of one or another energy, as a result of which in 2016 T.R. Herrmann, an expert in this field, concluded that all types of enucleation can be combined under a single name «endoscopic enucleation» and the functional results do not depend on the equipment used [5].

In the same year 2016, a thulium fiber laser (Tm-fiber) developed by Russian specialists, which had not previously been used in per-

forming surgical interventions on the prostate, entered clinical practice [6, 7]. Its convenience and ergonomics during the enucleation have already been recognized by leading experts in this field at the first stages of implementation. Among the physical advantages of Tm fiber, one can note the coincidence of its wavelength with the peak of water absorption (1.94) [8], which allows parallel tissue ablation, thereby ensuring parallel hemostasis without deep penetration into the layers, including in the area of the sphincter zone [9]. In this regard, one of the possible advantages of thulium fiber laser enucleation of the prostate (ThuFLEP) is a lower risk of complications, in the frequency of stress urinary incontinence (SUI) in the postoperative period, however, studies devoted to this issue are extremely limited.

SUI after endoscopic enucleation is one of the most common complications of surgery, which, despite its transient nature, significantly affects the quality of life of patients, and in rare cases can persist for more than 3 months and requires the specific therapy. The frequency of SUI after endoscopic enucleation varies according to different researchers and can reach 34,1% [10]. Among the possible risk factors, the type of energy used, the experience of the surgeon [11], surgery technique [12, 13], prostate volume [14 – 16], patient age [14] and even a variant of the anaesthetic technique [17] are considered. Nevertheless, similar data on ThuFLEP are very limited. In this regard, **the purpose of this study** was to assess the incidence and possible risk factors of SUI after ThuFLEP, performed by one urologist with more than 3000 endoscopic enucleation experience.

Materials and methods

Patient selection and parameters measured. The study on the assessment of SUI after ThuFLEP was retrospective. From May 2021 to September 2022, 381 patients with BPH were performed by one urologist with experience in performing more than 3000 endoscopic enucleations. Indications for surgery were set in accordance with the guidelines of the European Association of Urology and Russian Society of Urologists. The exclusion criteria were a history of previous prostate surgery, neurogenic urinary disorders, prostate cancer, urethral strictures or sclerosis of the bladder neck.

The following parameters were evaluated

in all patients: age, presence of concomitant diseases (diabetes mellitus, arterial hypertension, coronary heart disease, cerebrovascular diseases), prostate volume and postvoid residual (PVR) according to the results of transrectal ultrasound examination of the prostate and transabdominal ultrasound examination of the bladder, respectively, the IPSS and QoL scale. All patients underwent uroflowmetry to determine the maximum flow of urination (Qmax).

Intraoperatively, the duration of the operation, the duration of enucleation and the duration of morcellation, as well as the total laser energy expended were recorded. Additionally, the frequency of performing early sphincter release and the type of enucleation (en-bloc, two-lobe or three-lobe techniques) was evaluated.

In the postoperative period, all patients were assessed for the duration of catheterization, as well as the frequency of SUI. SUI was defined as involuntary leakage of urine in any condition associated with increased intra-abdominal pressure. SUI was assessed in accordance with the recommendations of the International Continence Society (7th Edition) [18]. Both objective (bladder diary) and subjective (patient reported outcomes) were used for assessment of type and symptoms and bother of UI. Additionally, the duration of SUI was recorded, divided into 3 time periods: up to 1 month, from 1 to 3 months and more than 3 months.

ThuFLEP procedure. All operations were performed by single high experienced surgeon. The operation was performed using a standard Iglesias 27 Ch OLYMPUS ("Olympus Medical Systems", Hinode Plant, Aizu Olympus, Nagano Olympus, Japan) type resectoscope with a standard laser fiber guide. The FIBER-LASE U3 laser device with standard settings of 1.5 J and 40 Hz, 60 W ("IRE Polus Ltd", Fryazino, Russia) was used as a source of laser energy. In all cases a PIRANHA ("Richard Wolf GmbH", Knittlingen, Germany) rotary morcellator was used to extract the removed tissue. Before the morcellation stage, all patients also underwent tissue coagulation using a bipolar loop using an Olympus ESG 400 power unit.

At the first stage of the operation, all patients underwent cystoscopy according to the standard procedure and the seminal tubercle was visualized. A U-shaped incision around the latter was performed to dissect the mucosa

and enter the layer between the pseudocapsule of the prostate adenoma. Each of the lobes was alternately mobilized before 3 and 9 o'clock of the conventional dial, after which most patients underwent early apical dissection. Further, depending on the volume of the prostate and its endoscopic anatomy, the standard enucleation technique was performed according to previously proposed methods (three-lobe, two-lobe, en-bloc).

In some cases, due to the large volume of the prostate and the difficulty in visualizing the layer, early apical dissection was not performed. The area of the sphincter was cut off, in this case, after greater mobilization of adenomatous tissue.

Statistical analysis. Statistical analysis was performed using IBM SPSS Statistics software ver. 26.0 ("IBM Corp.", Armonk, New York, USA). The normality was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk criteria. According to the results, it turned out that all quantitative variables were distributed abnormally, because of which they were expressed as a median and interquartile interval [Me; IQR Q1 – Q3]. Quantitative variables were compared using the Mann-Whitney test. Nominal variables were presented in the form of frequencies (%) and absolute values (n). The comparison of nominal variables was carried out using the Chi-square. To assess the predictive ability of variables, univariate and multivariate regression analyses were performed. In each analysis, the differences were considered statistically significant at $p < 0.05$.

Results

The median age of the 381 patients was 67 years (IQR 61.0 – 72.0). Among the concomitant diseases, arterial hypertension (67.2%) was most common in patients, less often coronary heart disease (18.4%), diabetes mellitus (17.1%) and cerebrovascular diseases (11.5%). The median prostate volume was 82 cm³ (IQR 60.0 – 115.0), and 23% had an indwelling catheter at the preoperative stage. Most patients underwent two-lobe enucleation (80.3%), 14.2% — ThuFLEP using en-bloc technique and only 5.5% — ThuFLEP using three-lobe technique. The median catheterization time of patients after ThuFLEP was two days. A detailed description of the sample is presented in table 1.

SUI was observed in 45 patients after ThuFLEP (11.8%), while 71.4% of patients (272

people) did not have urine leakage. Urge or mixed urinary incontinence was noted in the remaining 16.8% of patients (64 people) in the postoperative period and these patients were excluded from further analysis. Table 1 shows a comparison of patients with and without SUI according to the main preoperative and intraoperative parameters. It turned out that patients with SUI are characterized by a higher IPSS score than patients without SUI (median 28.0 points and 24.0 points; $p = 0.030$). ThuFLEP using the en-bloc technique was performed much more often in patients without SUI, while patients with SUI were more characterized by 2- and 3-lobed enucleation techniques ($p = 0.007$). The differences in other parameters turned out to be statistically insignificant, however, there was a tendency for these differences between groups with and without SUI in relation to the presence of indwelling catheter (13.3% and 24.6%; $p = 0.095$), PVR (90 ml and 72 ml; $p = 0.088$), total laser energy (65.9 kJ and 54.5 kJ; $p = 0.093$).

At the next stage of the study, we performed a univariate regression analysis for parameters significantly different between patients with SUI and patients without incontinence, as well as for parameters with a borderline significance level. The results are presented in Table 2.

It turned out that the risk factor for SUI is the IPSS score: with an increase of each point, the chance of SUI increases by 1.074 times (95% CI = 1.007 – 1.145; $p = 0.029$). The protective factor of SUI is the use of the en-bloc technique: the chance of SUI is reduced by 89.4% (95%CI = 0.014 – 0.789; $p = 0.028$). The parameter of total laser energy during ThuFLEP had a marginal significance level with the following trend: the higher the total laser energy is associated with the higher chance of SUI; however, this parameter was statistically insignificant ($p = 0.071$).

Based on the univariate analysis, we constructed a multifactorial model that includes 3 factors, 2 of which (IPSS and type of enucleation) were statistically significant in the univariate analysis, and 1 parameter (total laser energy) showed a boundary level of significance. The model is presented in Table 3. Based on the results obtained, it turned out that none of the parameters is an independent predictor of SUI in our sample, however, each of the parameters is characterized by a trend identified by a univariate regression Table 2.

Table 1. General patient characteristics and comparison of clinical and laboratory parameters in men with and without SUI**Таблица 1.** Общие характеристики выборки и сравнительные характеристики пациентов с недержанием мочи при напряжении и без него по основным клиническим и лабораторно-инструментальным параметрам

Parameters		Whole cohort (n = 381)	No SUI (n = 272)	SUI (n = 45)	P
Age, Me (IQR) years		67.0 (61.0 – 72.0)	67.0 (61.0 – 73.0)	67.0 (62.0 – 72.0)	0.409
Comorbid diseases:					
Diabetes mellitus	n (%)	17.1% (65)	18.0% (57)	13.3% (6)	0.381
Hypertension		67.2% (256)	68.5% (217)	64.4% (29)	0.532
Coronary heart disease		18.4% (70)	18.3% (58)	15.6% (7)	0.608
Cerebrovascular diseases		11.5% (44)	11.4% (36)	8.9% (4)	0.573
Preoperative parameters					
Total prostate volume, cm3	Me (IQR)	82.0 (60.0 – 115.0)	80.0 (60.0 – 109.2)	96.0 (58.0 – 120.0)	0.485
IPSS, score		25.0 (21.0 – 30.0)	24.0 (21.0 – 30.0)	28.0 (22.0 – 32.0)	0.030
QoL, score		5.0 (4.0 – 6.0)	5.0 (4.0 – 6.0)	4.0 (4.0 – 6.0)	0.286
Qmax, ml/s		9.2 (7.2 – 12.0)	9.6 (7.5 – 12.0)	9.2 (6.0 – 12.0)	0.264
PVR, ml		75.0 (46.0 – 120.0)	72.0 (40.0 – 120.0)	90.0 (69.0 – 150.0)	0.088
Indwelling catheter, n, (%)		23.0 (73)	24.6 (67)	13.3 (6)	0.095
Intraoperative parameters					
Total laser energy, kJ	Me (IQR)	55.0 (42.0 – 75.3)	54.5 (40.3 – 74.1)	65.9 (45.3 – 81.8)	0.093
Surgery time, min		75.0 (60.0 – 100.0)	75.0 (60.0 – 100.0)	75.0 (60.0 – 95.0)	0.943
Enucleation time, min		55.0 (40.0 – 75.0)	55.0 (40.0 – 70.0)	50.0 (40.0 – 70.0)	0.585
Morcellation time, min		25.0 (17.0 – 30.0)	20.0 (15.0 – 30.0)	25.0 (20.0 – 35.0)	0.282
Early sphincter release, n (%)		83.5% (318)	84.2% (267)	82.2% (37)	0.690
Enucleation technique:					
En-bloc	n (%)	14.2 (54)	17.6 (48)	2.2 (1)	0.007
Two-lobe		80.3 (306)	79.4 (216)	88.9 (40)	
Three-lobe		5.5 (21)	2.9 (8)	8.9 (4)	
Postoperative parameters					
Catheterization time, Me (IQR) days		2.0 (2.0 – 3.0)	2.0 (2.0 – 3.0)	2.5 (2.0 – 3.0)	0.925

Table 2. Results of a univariate regression analysis for possible predictors of SUI following ThuFLEP**Таблица 2.** Результаты одномерного регрессионного анализа возможных стресс-инконтиненции предикторов после ThuFLEP

Parameters	OR (95% CI)	P
Indwelling catheter	0.471 (0.191 – 1.161)	0.102
IPSS, score	1.074 (1.007 – 1.145)	0.029
PVR, ml	1.001 (0.998 – 1.004)	0.434
Total laser energy, kJ	1.012 (0.999 – 1.024)	0.071
Enucleation technique (en-bloc vs another)	0.106 (0.014 – 0.789)	0.028

Results of a univariate regression analysis for possible predictors of SUI following ThuFLEP

Таблица 2. Результаты одномерного регрессионного анализа возможных стресс-инконтиненции предикторов после ThuFLEP analysis: the higher IPSS score is associated with the higher the chance of SUI, and when

Table 3. Results of multivariate regression analysis for possible predictors of SUI following ThuFLEP**Таблица 3.** Результаты многомерного регрессионного анализа возможных стрессового недержания мочи предикторов после ThuFLEP

Parameters	OR (95% CI)	P
IPSS, score	1.060 (0.993 – 1.131)	0.081
Total laser energy, kJ	1.003 (0.989 – 1.018)	0.669
Enucleation technique (en-bloc vs another)	0.160 (0.021 – 1.245)	0.080

performing en-bloc ThuFLEP, on the contrary, the chance of SUI is lower.

Of the 45 patients with SUI after ThuFLEP, only 1 patient (0.3% of the total sample) had symptoms for more than 3 months. In the postoperative period, this patient was diagnosed with myasthenia gravis. In the remaining 99.7% SUI regressed: in 18 patients (4.7%) during the 1st month, and in 26 patients (6.8%)

— during the next 2 months, which indicates the transient nature of incontinence, which completely regresses during the first 3 months after ThuFLEP.

Fourteen weeks following ThuFLEP a complex invasive urodynamic study with profilometry was performed on a patient with persistent SUI (Figure 1A). The urethral pressure profile 3.5 months after ThuFLEP is a plateau with a Pura value within 10 – 15 cm H₂O, which indicates the presence of pronounced sphincter insufficiency (Figure 1A). As part of the rehabilitation, the patient was offered self-training of the pelvic floor muscles using a Kegel simulator for men according to the scheme of 10 minutes 4 times a week for 3 months, extracorporeal magnetic stimulation of the pelvic floor muscles according to the scheme 2 times a week for 15 sessions, and in accordance with the recommendations of the International Continence Society (7th Edition), the drug duloxetine was prescribed at a dose of 60 mg o.d. for 3 months. The effect of the proposed therapy was evaluated after 1 and 3 months (Figures 1B and 1C, respectively). After month (Figure 1B) after the start of strengthening the pelvic floor muscles, we saw a significant increase in the urethral pressure profile with an average value of Pura 30 cm H₂O with Pura max 34 cm H₂O. Along with this, the patient noted an improvement in the symptoms of SUI in the form of a decrease in episodes of leakage during the day, mainly with a sharp transition from horizontal to vertical position, as well as with pronounced cough. Three months after the start of therapy (Figure 1C), the Pura max value reached 50 cm H₂O, and the patient did not experience episodes of urine leakage.

Discussion

Transient SUI is the most common complication of endoscopic enucleation of the prostate according to both patients and urologists [19]. The incidence of SUI after endoscopic enucleation varies significantly and can reach 34.1% [10]. The age of patients, the volume of the enucleated tissue, the duration of surgery and total laser energy are considered as possible risk factors of SUI [15]. According to the data of current study none of the above parameters had a significant effect on the frequency of SUI although a certain trend was found for the total laser energy expended with ThuFLEP indicating that the higher laser

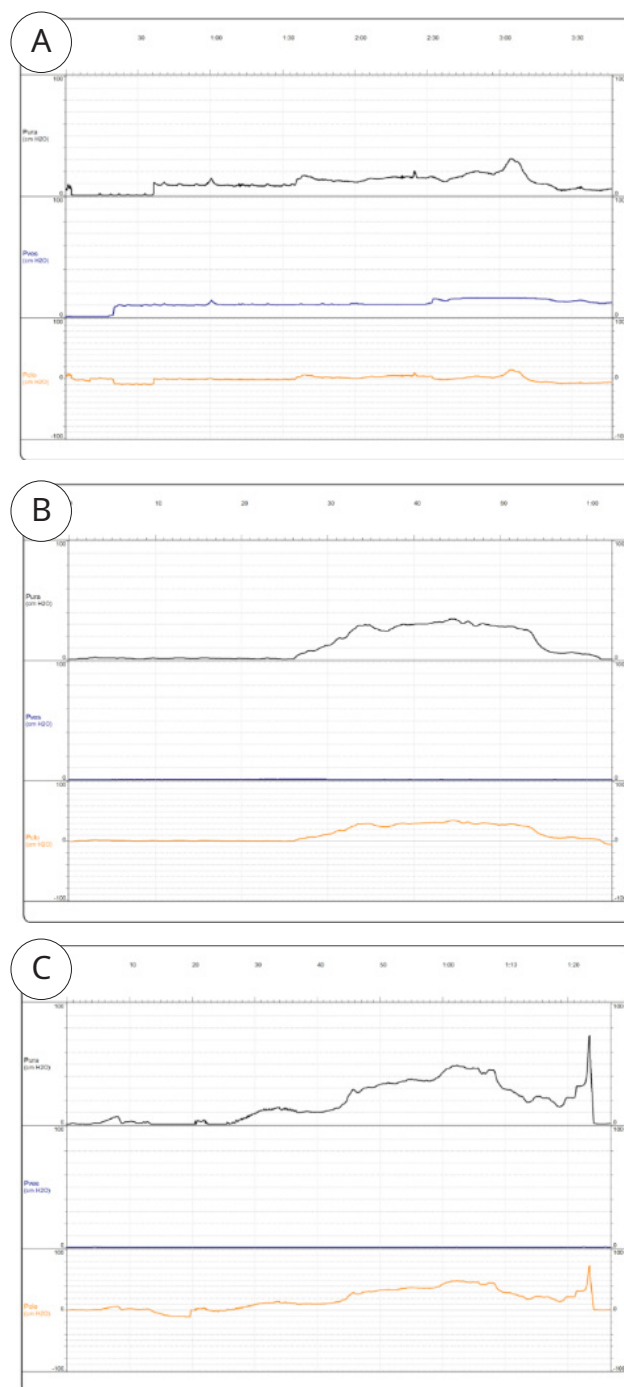


Figure 1. Profilometry of a patient with SUI after ThuFLEP before treatment (A) and after 1- and 3-months during rehabilitation (B and C, respectively)

Рисунок 1. Профилометрия пациента со стресс-инконтиненцией после ThuFLEP до лечения (А), через 1 и 3 месяца во время реабилитации (В и С, соответственно)

energy is associated with higher probability of SUI, however, this conclusion needs further research involving more patients. Additionally, the vast majority of work was carried out for patients after HoLEP, while Tm-fiber

entered clinical practice much later and according to some data ThuFLEP itself is associated with a lower risk of urinary incontinence in the postoperative period [20]. However, the works devoted to ThuFLEP are still few in number and differ in a small sample size of patients.

According to literature data, incidence of SUI following ThuFLEP varies as well as for another endoscopic enucleation procedures. V. Gauhar et al. (2023) reported about 16.0% SUI after ThuFLEP [21]. In randomized prospective trial conducted by D. Enikeev et al. (2022) was shown that SUI rate after ThuFLEP ($n = 86$) was 3.5% and 2.3% at 3- and 6 - months respectively [22]. And the similar data were shown before by the same group in retrospective analysis [23]. In our study we have just 0.3% on late SUI in patient with individual risk factor, while another 99.7% patients had regress of SUI during 3 months after ThuFLEP.

Modification of the surgical technique is considered as one of the possible ways to improve the postoperative results of endoscopic enucleation [10, 12, 19], in particular en-bloc technique [24]. One of the largest works devoted to this area was published in January 2024 by D. Castellani et al. The study is a multicenter involving more than 5000 people after laser endoscopic enucleation of prostate hyperplasia in which our center also took part. All patients were divided into 2 groups depending on the surgery technique used: the en-bloc endoscopic enucleation group ($n = 1711$) and the endoscopic enucleation group without using the en-bloc technique ($n = 3357$). It turned out that SUI was significantly less common in patients from the en-bloc group and persisted for more than 3 months in only 0.41% of patients (7 people), while in the endoscopic enucleation group without using the en-bloc technique — in 1.3% of patients (43 people). The overall prevalence of SUI lasting more than 3 months was 1%. Additionally, it was shown that among the lasers used, the use of Tm-fiber in the ThuFLEP is associated with the lowest probability of both early and late SUI and mixed urinary incontinence ($OR = 0.126$; 95% $CI = 0.060 - 0.214$; $p < 0.001$) [20]. The results obtained give this work special relevance in connection with the use in this study only ThuFLEP performed by the single operating urologist which deprives the work of several technical errors and biases. The prevalence

of SUI persisting for more than 3 months in our sample was 0.3% (1 patient), who, as it turned out, had an individual risk factor for incontinence (myasthenia gravis). At the same time SUI was successfully restored against the background of rehabilitation.

Some urologists pay special attention to the technique of early sphincter release which is also considered one of the protective factors against SUI in the postoperative period [25]. According to A. Tuccio et al. (2021), en-bloc endoscopic enucleation with early sphincter release was associated with less total laser energy expended, which, according to the researchers, led to a significant decrease in SUI 1 month after HoLEP [26]. J. Zhou et al. (2022) also showed that the technique of early apical dissection after HoLEP is associated with a lower frequency of SUI, both in the early and late postoperative period, however, the prevalence of SUI, according to researchers, was high: 11.5% after 1 month in the case of early sphincter release and 17.4% in the control group. Incontinence persisted for more than 3 months in 1% and 6.5% of the above-described groups, respectively [27]. According to the above-described multicenter study by D. Castellani et al. (2024) the absence of early sphincter release is also considered as a risk factor for long-term persistent SUI and mixed urinary incontinence after laser endoscopic enucleation of the prostate ($OR = 2.915$; 95% $CI = 1.540-5.826$; $p = 0.002$) [20]. Nevertheless, in the present study this factor did not have a significant effect on the frequency of SUI which could be due to the high frequency of performing early sphincter release during ThuFLEP — 83.5% in the total sample, 84.2% for patients without incontinence and 82.2% for patients with SUI ($p = 0.690$).

The A.K. Das et al. (2020) study examined the risk factors for SUI following HoLEP performed by a single urologist. The prevalence of SUI was 10.4% (61 patients out of 589). In 8.8% of the patients in the general sample SUI was short-term and successfully resolved 3 months after surgery, while in 1.5% incontinence persisted. The risk factor for SUI (general and short-term) was only the weight of the resected prostate, while no risk factors for long-term incontinence were identified. At the same time, univariate analysis indicated that additional risk factors SUI are total laser energy and the IPSS scale [28]. A similar prevalence as well as predictors of SUI were found

in the present study, however, the percentage of long-term incontinence was significantly lower and was associated with the presence of another disease (myasthenia gravis) in the patient.

The present study has several limitations. First, it is the retrospective nature of the study. Secondly, we did not use an assessment of SUI using a pad test, which did not give us the opportunity to assess the quantitative leakage of urine. Nevertheless, we managed to overcome several technical limitations by employing one highly experienced urologist performing endoscopic enucleation more than 3000. Additionally, performing a study on a large sample of patients after ThuFLEP makes a significant contribution to the study of this type of laser enucleation as the youngest, most effective and, as shown by the work above, the safest method.

Conclusion

The incidence of SUI after ThuFLEP may reach 11.8%; however, symptoms resolve completely within the first 3 months after surgery in 99.7% of cases, while the remaining 0.3% show improvement with comprehensive rehabilitation. The risk factor for SUI is the severity of lower urinary tract symptoms, as assessed by the IPSS questionnaire, whereas en-bloc ThuFLEP appears to be protective.

According to the literature, the risk factors for SUI after endoscopic prostate enucleation are highly variable, which we believe reflects the heterogeneity of study designs and the fact that the procedures were performed by different surgeons using different equipment. In the absence of such limitations in the present study, we are continuing to enrol additional patients after ThuFLEP in order to identify further predictors and confirm these findings.

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