

Received: 27 June 2022 / Accepted: 15 August 2022 / Published online: 31 August 2022

DOI 10.34689/SH.2022.24.4.023

UDC 616.65-002-089.87

MODERN APPROACHES FOR DIAGNOSTICS AND TREATMENT OF URETHRAL STRICTURES AFTER ADENOMECTOMY: REVIEW

Yerbol M. Kairambayev¹, <https://orcid.org/0000-0002-1399-1451>

Tolkyn A. Bulegenov¹, <https://orcid.org/0000-0001-6392-2748>

Muratkan T. Kuderbayev¹,

Sabit M. Zhussupov², <https://orcid.org/0000-0002-0551-126X>

Assylzhan M. Messova¹, <https://orcid.org/0000-0001-5373-0523>

Oxana A. Yurkovskaya¹, <https://orcid.org/0000-0002-6251-5574>

Anton Yurkovsky³, <https://orcid.org/0000-0002-4336-159X>

¹ NCJSC «Semey Medical University», Semey c., Republic of Kazakhstan;

² Pavlodar branch of NCJSC «Semey Medical University», Pavlodar city, Republic of Kazakhstan;

³ Novosibirsk State Medical University, Novosibirsk c., Russian Federation.

Abstract

The aim of this study was to analyze scientific information on risk factors, methods of diagnosis, and surgical treatment of urethral strictures after adenomectomy.

Search strategy: The search for relevant scientific publications was conducted in databases of evidence-based medicine (PubMed and Cochrane Library), and specialized search systems (Google Scholar, Cyberleninka, and e-library).

Inclusion criteria: studies performed on people published in English, and Russian, as well as full versions of articles.

Results. Benign prostatic hyperplasia is one of the most common chronic diseases in men over the age of fifty. Transurethral resection of prostate adenoma is currently the most effective and common surgical option. Iatrogenic urethral strictures are a common complication of this intervention, which are caused by trauma, prolonged catheterization, infectious inflammation, and the use of hemostasis. Diagnostic techniques for urethral strictures include physical examination, urinalysis, questionnaire, uroflowmetry, ultrasound, urethrocystoscopy, retrograde urethrography, vocal cystourethrography, or ultrasound urethrography. The main methods of emergency surgical treatment of strictures are endoscopic methods (bougienage of the urethra, internal optical urethrotomy, drainage of the bladder, and cystostomy drainage). The effectiveness of urethroplasty in the treatment of strictures in the long-term period reaches 80%.

Conclusion. Success in the treatment of patients with urethral strictures directly depends on the high-quality preoperative diagnosis, tactics of surgical treatment, and prevention. Endourethral techniques are the most common among urologists around the world.

Keywords: *benign prostatic hyperplasia, urethral strictures, risk factors, treatment.*

Резюме

СОВРЕМЕННЫЕ ПОДХОДЫ К ДИАГНОСТИКЕ И ЛЕЧЕНИЮ СТРИКТУР УРЕТРЫ ПОСЛЕ АДЕНОМЭКТОМИИ: ОБЗОР ЛИТЕРАТУРЫ

Ербол М. Кайрамбаев¹, <https://orcid.org/0000-0002-1399-1451>

Толкын А. Булегенов¹, <https://orcid.org/0000-0001-6392-2748>

Мураткан Т. Кудербаев¹,

Сабит М. Жусупов², <https://orcid.org/0000-0002-0551-126X>

Асылжан М. Месова¹, <https://orcid.org/0000-0001-5373-0523>

Оксана А. Юрковская¹, <https://orcid.org/0000-0002-6251-5574>

Антон Юрковский³, <https://orcid.org/0000-0002-4336-159X>

¹ НАО «Медицинский университет Семей», г. Семей, Республика Казахстан;

² Павлодарский филиал НАО «Медицинский университет Семей», г. Павлодар, Республика Казахстан;

³ Новосибирский государственный медицинский университет, г. Новосибирск, Российская Федерация.

Целью исследования был анализ научной информации о факторах риска, методах диагностики и хирургического лечения стриктур уретры после аденомэктомии.

Стратегия поиска. Поиск релевантных научных публикаций проводился в базах данных доказательной медицины (PubMed и Cochrane Library), специализированных поисковых системах (Google Scholar, Cyberleninka, e-library). *Критерии включения:* исследования, выполненные на людях, опубликованные на английском, русском языках, а также полные версии статей.

Результаты. Доброкачественная гиперплазия предстательной железы является одним из наиболее частых хронических заболеваний у мужчин старше пятидесяти лет. Трансуретральная резекция аденомы предстательной железы в настоящее время является наиболее эффективным и распространенным хирургическим методом. Ятрогенные стриктуры уретры являются частым осложнением данного вмешательства, что обусловлено травмой, длительной катетеризацией, инфекционным воспалением и применением гемостаза. Методы диагностики стриктур уретры включают физикальное обследование, анализ мочи, опросник, урофлоуметрию, УЗИ, уретроцистоскопию, ретроградную уретрографию, цистоуретрографию или ультразвуковую уретрографию. Основными методами экстренного хирургического лечения стриктур являются эндоскопические методы (бужирование уретры, внутренняя оптическая уретротомия или дренирование мочевого пузыря, цистостомическое дренирование). Эффективность пластики уретры при лечении стриктур в отдаленном периоде достигает 80%.

Заключение. Успех в лечении больных со стриктурами уретры напрямую зависит от качественной предоперационной диагностики, тактики хирургического лечения и профилактики. Эндоуретральные методики наиболее распространены во всем мире.

Ключевые слова: доброкачественная гиперплазия предстательной железы, стриктуры уретры, факторы риска, лечение.

Түйіндеме

АДЕНОМЭКТОМИЯДАН КЕІІНГІ УРЕТРА СТРИКТУРАСЫНЫҢ ЕМІ МЕН ДИАГНОСТИКАСЫНЫҢ ЖАНАМА АДІСТЕРІ: ӘДЕБИ ШОЛУ

Ербол М. Кайрамбаев¹, <https://orcid.org/0000-0002-1399-1451>

Толкын А. Булегенов¹, <https://orcid.org/0000-0001-6392-2748>

Мураткан Т. Кудербаев¹,

Сабит М. Жусупов², <https://orcid.org/0000-0002-0551-126X>

Асылжан М. Месова¹, <https://orcid.org/0000-0001-5373-0523>

Оксана А. Юрковская¹, <https://orcid.org/0000-0002-6251-5574>

Антон Юрковский³, <https://orcid.org/0000-0002-4336-159X>

¹ Семей медицина университеті КеАҚ, Семей, Қазақстан Республикасы;

² Павлодар филиалы Семей медицина университеті КеАҚ, Павлодар, Қазақстан Республикасы;

³ Новосибирск Мемлекеттік медицина университеті, Новосибирск қ., Ресей Федерациясы.

Мақсат: Аденомэктомия операциясынан кейінгі уретра стриктурасының диагностикасының және де хирургиялық емінің ғылыми ақпараттық анализін және де қауіп қатер факторларын зерттеу.

Іздеу стратегиясы: Дәлелді медицина қорынан, арнайы іздеу системасынан релевантты ғылыми басылымдарды іздеу. (PubMed и Cochrane Library), (Google Scholar, Cyberleninka, e-library). *Қосылым критериялары:* Косылым критериялары: адамға жасалған зерттеулер, ағылшын және де орыс тілдерінде басылмаға шыққан толық нұсқаудағы статьялар.

Нәтижелер: Қуық асты безінің гиперплазиясы, елу 50 жастан асқан ер адамдардың жиі кездесетін созылмалы аурулардың бірі болып саналады. Қуық асты безінің трансуретральді кесу әдісі қазіргі заманда ең тиімді және де ең жиі қолданатын әдіс болып саналады. Ятрогенді уретраның стриктурасы осы адистің ең жиі асқинуы болып саналады, уретраның жарақаты, катетердің ұзақ тұруы, гемостаз адістері, инфекциялық қабынулар шартты түрде стриктуралардың себебі болып табылады. Уретраның стриктурасының диагностикалық адісіне жатады: физикальды қарау, зәр анализы, урофлоуметрия, сурау қағазы, УДЗ, уретроцистоскопия, ретроградная уретрография, цистоуретрография немесе ультродыбыстық уретрография. Уретраның стриктурасының жедел хирургиялық емінің негізгі эндоскопия әдісі болып (уретраның бужированиясы, оптикалық уретротомия, қуықты дренирлеу, цистостомия) Уретраның пластикасының тиімділігі кейбір жағдайларда 80% ға дейін жетеді

Корытанды: Уретраның стриктурасының емінің жақсы жетістігі, науқастың толық операция алдының диагностикасы, тиімді хирургиялық емінің тактикасы және де профилактикасы болып табылады.

Түйінді сөздер: Қуық асты безінің катерсіз гиперплазиясы, уретра стриктурасы, қауіп қатер факторы, емі.

Bibliographic citation:

Kairambayev Ye.M., Bulegenov T.A., Kuderbayev M.T., Zhussupov S.M., Messova A.M., Yurkovskaya O.A., Yurkovsky A. Modern approaches for diagnostics and treatment of urethral strictures after adenectomy: review // *Nauka i Zdravookhraneniye* [Science & Healthcare]. 2022, (Vol.24) 4, pp. 188-195. doi 10.34689/SH.2022.24.4.023

Кайрамбаев Е.М., Булегенов Т.А., Кудербаев М.Т., Жусупов С.М., Месова А.М., Юрковская О.А., Юрковский А. Современные подходы к диагностике и лечению стриктур уретры после аденомэктомии: обзор литературы // *Наука и Здравоохранение*. 2022. 4(Т.24). С. 188-195. doi 10.34689/SH.2022.24.4.023

Кайрамбаев Е.М., Булегенов Т.А., Кудербаев М.Т., Жусупов С.М., Месова А.М., Юрковская О.А., Юрковский А. Аденомэктомиядан кейінгі уретра стриктурасынын емі мен диагностикасынын жанама адістері: әдеби шолу // *Ғылым және Денсаулық сақтау*. 2022. 4 (Т.24). Б. 188-195. doi10.34689/SH.2022.24.4.023

Introduction

Benign prostatic hyperplasia (BPH) takes one of the leading positions in the structure of chronic non-infectious diseases in middle-aged and elderly men. Its histological structure is based on hyperplasia of fibroepithelial tissue in the periurethral part of the prostate [36]. The prevalence of BPH among men aged 51 to 60 years is approximately 40%, for men 61-70 years old it is 70%, and for the age group 81-90 years it is about 90%. The disease leads to a significant decrease in the quality of life of patients, their labor potential, and frequent hospitalizations in urological departments, which is a significant socio-economic problem [15]. The need for surgical treatment of BPH in men under the age of fifty is approximately 13%, from 50 to 59 years - about 25%; men over sixty years of age in 40% of cases require such treatment. The prevalence of this disease suggests that about forty percent of working-age men are subject to surgical treatment for BPH [52].

The surgical method of BPH is currently the most radical, despite the possibility of conservative treatment of BPH. The type of surgical intervention chosen affects the postoperative results of treatment, the duration of the operation itself, the length of stay of the patient in the hospital, the survival rate, the types and number of post-surgical complications, and methods of rehabilitation [60, 42].

Urethral stricture is a condition manifested by recurrent urinary tract infection, acute or chronic urinary retention, urinary incontinence, and sometimes it can be a renal failure. Urethral stricture is a common and complex urological pathology. The incidence has been steadily growing in recent decades, varies from 0.6% to 0.9% in the population, and depends on the age structure of patients. Establishing the cause of urethral stricture, and assessing the location, length, and degree of narrowing of the urethra is an important factor in determining the choice of surgical treatment option. Iatrogenic injury to the urethra is the leading etiological factor in the development of urethral stricture in men in developed countries and the second one after traumatic injury in developing countries. Extended and subtotal lesions are diagnosed in 15-18% of cases of urethral stricture disease [3, 41, 48]. In the United States, about 1,500,000 patients visit a urologist annually and an average of 5,000 patients receive specialized inpatient care. At the same time, the average individual costs per patient with stricture disease are three times higher than for other urological pathology [53]. In countries with a high level of medicine, strictures of iatrogenic etiology are most common. The reason for the increase in the incidence is the widespread use of "minimally invasive" transurethral

endoscopic operations. Catheterization, cystoscopy, in addition to the damage to the mucous membrane, contribute to the formation of compression zones and ischemia of the urethra [41].

The aim of this study was to analyze scientific information on risk factors, methods of diagnosis, and surgical treatment of urethral strictures after adenectomy.

Search strategy: The search for relevant scientific publications was conducted in databases of evidence-based medicine (PubMed and Cochrane Library), and specialized search systems (Google Scholar, Cyberleninka, and e-library). Inclusion criteria: studies performed on people published in English, and Russian, as well as full versions of articles. Preference was given to studies of high methodological quality (systematic reviews and surveys of studies of various designs), in the absence of which the publications of the results of cross-sectional studies were taken into account. Studies were obtained by searching for the following keywords (date of search: August 29, 2022): benign prostatic hyperplasia, surgical methods for BPH treatment, risk factors for urethral strictures, and treatment of urethral strictures. In total, 353 literary sources were found, 65 of which were selected for analysis.

Results and discussion**Comparative characteristics of surgical methods for BPH treatment**

Of the surgical approaches to BPH treatment, in most cases, preference is given to the methods of open adenectomy and transurethral resection [38]. Open adenectomy is usually performed in the case of a large (> 100 cm³) hyperplastic prostate; this intervention is indicated when BPH is associated with bladder diverticulosis, if it is impossible to perform cystolithotripsy in the presence of stones in the urinary bladder, and if it is necessary to use semi-rigid penile endoprotheses [52, 16, 51]. The disadvantages of this method are the unjustified removal of the prostate part of the urethra together with adenomatous tissue, and the possibility of damage to the urethral vascular plexus and dorsal vessels of the prostate [43].

Despite the high efficiency of open adenectomy with respect to the postoperative characteristics of urination, the possibility of early and late postoperative complications (about 20% of all cases) requires a search for alternative methods of treatment. One such effective approach is transurethral resection (TUR) of the prostate. This operation was first performed by M. Stern and J. McCarthy, who used a self-developed wire loop with visual monitoring [5]. Until now, this type of surgical intervention is considered as the

"gold standard" of surgical treatment of BPH; it is optimal in 95% of patients with prostate volume not exceeding 80 cm³ [58]. The main advantages of this technique are relatively low trauma, the ability to eliminate bladder outlet obstruction, a short rehabilitation period, and the high speed of its implementation with the possibility of simultaneous radical resection of a pathological tumor. However, it cannot be performed in the case of stones and diverticula in the bladder [40, 55]. In the long term after surgery, it is possible the formation of a stricture of the urethra (3.7%), cicatricial stenosis of the bladder neck (2.5%), or urinary incontinence (1%). After surgery, a part of unremoved adenomatous tissues remains in the gland and can be a defect in the lower part of the bladder, which is associated with the risk of numerous complications and repeated surgical interventions. At the wound surface, there is a layer of tissue damaged as a result of electrothermal action, which is subsequently rejected after the growth of urothelium tissue. The period of cleaning the wound surface and replacing it with urothelium tissues is 6-15 months, which dictates the need for long-term outpatient monitoring and appropriate treatment [38].

The methods of interstitial laser therapy, needle ablation, microwave therapy, vaporization, rotoresction, laser resection, on and enucleation, which has been developed in recent years, are the alternative methods of surgical treatment of BPH that give a minimum number of postoperative complications. These methods make it possible to treat without the use of open access with good results, allowing in most cases to avoid open surgery [17, 13].

Another type of endoscopic intervention aimed at reducing the prevalence of early and late postoperative complications is transurethral enucleation of the prostate with a bipolar loop or Trans Urethral Enucleation with Bipolar (TUEB). With this method, the electric current does not affect the entire human body but passes in the form of a loop, which ensures the absence of tissue burns, good hemostasis, and practically no TUR syndrome. This method belongs to the "cold" methods of exfoliation of hyperplastic tissues even with large adenomas. It reduces the average time of surgery to 119 minutes with a significant average volume of the resected tumor (122 cm³). Another advantage of this intervention is the early removal of the urethral catheter, the minimum percentage of infectious and inflammatory complications (0.95% of patients), dysuric manifestations, incontinence (3.3% of patients), and postoperative bleeding (2.3% of patients) [9, 45].

Another effective, minimally invasive method of surgical treatment of large BPH, introduced in the last decade, is extraperitoneoscopic adenectomy [32, 4]. In 2015, the results of an analysis of the effectiveness of robotic adenectomy performed in four European centers were published. The patients with an average prostate volume of 129 cm³ were included in the study. Complications in the early postoperative period were found in 30% of patients, 5% of them had bleeding which necessitated cystoscopy and vascular coagulation. The need for urethral catheterization disappeared on average on the third day after surgery, and the period of hospital stay after surgery was on average 4 days. Six months later, the mean IPSS score was three (0-8) points, Q max - 23 ml / s (16-35 ml /

s), and residual urine was absent in almost all study participants. The results allowed the authors to conclude that this method is highly effective and clinically safe [50].

Analysis of the literature indicates that the surgical method remains the main method of BPH treatment. Transurethral resection of the prostate is comparable to open adenectomy in terms of clinical efficacy; it is the intervention of choice or the "gold standard" for surgical treatment of BPH. TUR has significantly expanded the range of indications for surgery, not only for small volumes of hyperplastic tissue but also for large tumor volumes. It is accompanied by fewer postoperative complications and reduces the length of hospital stay in the postoperative period.

Risk factors for the development of ureteral strictures after open adenectomy and transurethral resection in BPH

Disturbances of urination in the long-term period after surgical treatment of BPH are observed in 10-35% of patients [62]. Clinical manifestations of such disorders are increased frequency of urination, urge to urinate, difficulty urinating and urinary incontinence [23, 46]. With prolonged urinary incontinence, aggravated by an increase in intra-abdominal pressure, it is necessary to think about possible damage to the external sphincter, whose muscles are located concentrically behind the seminal tubercle. This symptom is due to anatomical features of hyperplastic tumor growth, leading to diffuse dissection of the bladder sphincter. This feature can dramatically increase the risk of external sphincter fibers during the enucleation of hyperplastic adenoma tissues [63].

The choice of tactics for the correction of dysuric disorders depends on the results of the urodynamic examination. Most often, urinary disorders are caused by detrusor overactivity (37% of patients), which disappears after surgical removal of bladder outlet obstruction in 70-75% of patients [10]. In the absence of hyperactivity, symptoms of dysuria persist in almost all patients, even after repeated surgery [23]. In approximately 25% of patients, there is a combination of hyper- and hypoactivity of the detrusor, and in 16% of patients, there are signs of its hypoactivity [6]. Patients with detrusor hypoactivity are significantly more likely to require conservative treatment than reoperation [62]. In 16% of patients with dysuric disorders after adenectomy, intravesical obstruction is observed, which is most often caused by urethral stricture, recurrent BPH, and bladder neck deformity [6].

Analysis of the causal relationship between the development of complications in the late period after surgery and the course of the early postoperative period showed that the presence of bleeding or purulent complications was associated with the formation of sclerosis of the bladder neck (about 70% of all cases of late post-surgical complications). The main mechanisms of its development are re-infection of the urinary tract with microbial flora through a catheter, and trauma leading to the formation of destructive disorders in the bladder wall. The factor that reduces the risk of sclerotic cicatricial changes in this area is the rapid recovery of spontaneous urination [12].

The development of urethral strictures can be the result of excessive trauma to the mucosa during endoscopy of the bladder and the use of a resectoscope, sclerotic changes in

the wall of the urethra preceding surgery and in the prostate gland due to the peculiarities of its morphological structure. These features include the presence of sclerotic processes and vascular hyalinization in the prostate, which increase the risk of postoperative bleeding due to loss of elasticity and the ability of the vessel to retain blood clots when exposed to temperature during surgery. This is also facilitated by the development of productive inflammation and granulation formations containing a large number of blood vessels, which increase the possibility of bleeding of the prostate bed after surgery [26]. Infectious inflammation of the urinary tract associated with bladder catheterization is one of the leading causes of late postoperative complications of adenomectomy and increased treatment costs [19, 25].

Another factor that can enhance the formation of late postoperative complications of adenomectomy is the method of hemostasis of the prostate bed. In a single-stage operation, hemostasis with removable catgut ligatures can lead to exacerbation of chronic prostatitis or secondary cystitis. The use of transverse non-removable sutures on the bladder neck is accompanied by inflammatory reactions in 16-33% of patients even in the absence of bladder outlet obstruction, and the proportion of obstructive complications reaches 50-75%. This technique leads to the fusion of the edges of the defect and isolation of the adenoma bed from the bladder cavity, with the development of difficulties in performing bed debridement [54]. The development of urethral stricture can be caused by the stretching and tearing of the part of the urethra located in the prostate during the exfoliation of the adenoma. It can also be associated with transection of the urethra distal to the apex of the tumor. In such situations, prolonged drainage of the urethra does not have a preventive effect on urethral stricture. Tamponade of the prostate bed with gauze tampons with the simultaneous use of a Foley catheter is characterized by a twofold increase in postoperative inflammatory complications [61].

The King C (2019) study retrospectively analyzed the incidence of complications and clinical manifestations associated with urethral stricture in a cohort of 1,851 patients from 2005 to 2016. Acute urinary retention, complex catheterization requiring urgent urological intervention, or renal failure, urosepsis, or urethral abscess were considered significant complications. The mean stricture length was 5.0 cm. 40.6% of patients had at least one complication directly related to urethral stricture, including acute urinary retention (32.6%), complex catheterization (16.0%), abscess urethra/urosepsis (5.0%) or renal failure (3.1%). Multivariate analysis established an association between stricture length, the presence of posterior stenosis (OR 3.0, 95% CI 1.3-6.8, $P = 0.01$) and strictures due to trauma (OR 1.6, 95% CI 1.1-2.4, $P = 0.02$). 7.0% of patients had complications that were considered life-threatening. The authors concluded that patients with longer strictures, posterior stenosis, no antecedent lower urinary tract symptoms, and traumatic strictures are at the greatest risk of complications associated with urethral strictures [28].

Diagnostic approaches for detecting urethral stricture after adenomectomy

Clinical guidelines for the diagnosis and treatment of urethral strictures were published in 2016 by the American Urological Association (AUA) [35, 61]. The guideline emphasizes that about 35% of urethral strictures in most countries are a consequence of complicated plastic surgery for hypospadias and endoscopic procedures for prostate diseases. The main localization of urethral strictures is the bulbar part of the urethra. However, in some diseases, such as lichen sclerosis, strictures form in the penile part, and strictures associated with traumatic injury are most often located in the bulbar part or in the posterior part of the urethra [56, 33]. The diagnosis of urethral stricture should be based on patient complaints of insufficient urine flow rate, feeling of incomplete emptying of the bladder, dysuric disorders, symptoms of urinary tract infection, and increased residual urine volume [35]. Also, diagnostic manifestations of urethral strictures can be epididymitis, erectile dysfunction, and ejaculation. There may be symptoms of urinary infection, dysuria and stranguria (split urine stream). Long-term strictures can lead to the formation of bladder stones, purulent complications in the urethra, malignancy, and chronic kidney disease with the development of renal failure [44, 14].

Examination methods for urethral strictures include physical examination, urinalysis, questionnaire methods (index of dysuria symptoms AUA-SI), determination of urine stream velocity using uroflowmetry, and ultrasound method to determine the amount of residual urine [34, 64, 30]. Instrumental methods for diagnosing urethral strictures include urethroscopy, retrograde urethrography, vocal cystourethrography, or ultrasound urethrography, which are most informative in this case for determining the localization and area of the lesion, as well as the severity of urethral narrowing and the presence of fibrotic wall changes [2, 7, 18, 21, 39, 49, 57].

Analysis of various tests used to assess and control urethral strictures suggests that urethrogram and urethroscopy are the most commonly used methods for assessing stenosis in the dynamics and planning of surgery. Questioning and uroflowmetry play a key role in the long-term follow-up of these patients. Ultrasonography is highly sensitive and specific for assessing spongiofibrosis, and computed tomography / MRI is recommended for assessing pelvic injury associated with fractures [11].

Surgical treatment of urethral stricture

If an urgent surgical intervention is necessary for urethral strictures, for example, in the presence of acute urinary retention, it is permissible to use rather traumatic endoscopic methods, such as bougienage of the urethra using a guidewire, internal optical urethrotomy, or drainage of the bladder. If the patient requires permanent bladder catheterization, cystostomy drainage is acceptable [59].

The effectiveness of internal optical urethrotomy or urethral bougienage reaches 35 to 70% in the presence of strictures, it is most pronounced with strictures not exceeding one centimeter in length; strictures more than two centimeters long are less susceptible to treatment with this method. The effectiveness of urethroplasty is the most pronounced (from 80 to 95% in the long-term period after the intervention), however, the use of this method is limited by the high economic cost, a significant number of

complications, and the need to use complex anesthetic methods [31, 22, 29, 65]. Some studies have demonstrated a statistically significant reduction in the incidence of recurrent urethral strictures after the use of bladder catheterization performed by the patient himself (autocatheterization) [1].

Given the high percentage of recurrences after endoscopic correction, patients with strictures of the penile urethra need urethroplasty, the effectiveness of which in the long term is up to 80% [47, 24, 37, 20]. For urethroplasty, the buccal mucosa of the mouth is commonly used as a flap [27].

A 2018 study retrospectively analyzed data from 183 patients with urethral stricture, including etiology, location of the obstruction, length of stricture, therapeutic strategy, and associated complications. Traumatic damage to the urethra was observed in 52.4%, and in 29.5% it was of iatrogenic origin. Posterior urethral stricture occurred in 45.9% of patients, followed by anterior urethral stricture (44.8%) and stenosis (6.6%). The methods of treatment included the imposition of a thorough anastomosis (54.1%), 21.9% of patients underwent intracavitary surgery, such as endoscopic holmium laser, scar removal with an endoscopic electric knife, balloon dilatation, and urethral dilatation. In patients over 65 years of age, the incidence of urethral stricture was 14.8%, and the complication rate (70.4%) with transurethral resection of the prostate was significantly higher than after other methods of surgical intervention ($P < 0.01$). The main treatment for urethral stricture has shifted from endoscopic surgery to urethroplasty [8].

Conclusion.

Urethral stricture is a common disease that significantly affects the quality of life of patients. Treatment and rehabilitation of patients with this pathology are associated with significant costs to the health care system. In recent years, approaches to the treatment and prevention of this disease have been significantly revised. Success in the treatment of patients with urethral strictures directly depends on the high-quality preoperative diagnosis, tactics of surgical treatment, and prevention. Endourethral techniques are the most common among urologists around the world.

Conflict of interest: the authors declare no conflict of interest

Authors' contribution:

Kairambayev Y - concept and design, literature search, analysis or interpretation, writing

Bulegenov T, Yurkovskaya O. - interpretation, writing

Kuderbayev M., Zhussupov S., Messova A.M., Yurkovsky A. - search and selection of articles for inclusion in the review.

The results of this study are published for the first time

This study is initiative

Funding. This research did not receive any financial support

References:

1. Afridi N.G., Khan M., Nazeem S., Hussain A., Ahmad S., Aman Z. Intermittent urethral self-dilatation for prevention of recurrent stricture // *J Postgrad Med Inst.* 2010. Vol.24. N3. P.239–243.

2. Akano A.O. Evaluation of male anterior urethral strictures by ultrasonography compared with retrograde

urethrography // *West Afr J Med.* 2007. Vol.26. N2. P.102–105.

3. Anger J.T., Buckley J.C., Santucci R.A., Elliott S.P., Saigal C.S. Trends in stricture management among male Medicare beneficiaries: underuse of urethroplasty // *Urology* 2011. Vol.77. N2. P.481–485.

4. Autorino R., Zargar H., Mariano M.B., Sanchez-Salas R., Sotelo R.J., Chlosta P.L. Outcomes of robotic and laparoscopic simple prostatectomy: a European-American multi-institutional analysis // *Eur Urol* 2015. Vol.68. N1. P. 86-94.

5. Barnes R.W., Bergman R.T., Hadley H.L. Technique with the Stern-McCarthy electrothome. In: *Endoscopy // Handbuch der Urologie.* 1959. 6. Berlin, Heidelberg.

6. Chapple C., Osman N., Birder L., van Koeveeringe G., Oelke M., Nitti V., Drake M. The underactive bladder: a new clinical concept? // *Eur. Urol.* 2015. Vol.68. P.351–353.

7. Chaloupka M., Beck V., Kretschmer A., Tritschler S., Stief C.G., Strittmatter F. Diagnostic workup of urethral strictures // *Urologe A.* 2018. Vol.57. N 1. P. 6-10.

8. Chen C., Zeng M., Xue R., Wang G., Gao Z., Yuan W., Tang Z. Causes and management for male urethral stricture // *Zhong Nan Da Xue Xue Bao Yi Xue Ban.* 2018. Vol.43. N5. P.520-527.

9. Chiruvella M., Enganti B., Bendigeri M.T., Ghose S.M., Ragoori D., Reddy P. Transurethral Enucleation With Bipolar Energy (TUEB): AINU Technique and Short-term Outcomes // *Urology.* 2018. Vol.122.P.147-151.

10. Cho M.C., Yoo S., Park J., Cho S.Y., Son H., Oh S.J., Paick J.S. Effect of preoperative detrusor underactivity on long-term surgical outcomes of photovaporization and holmium laser enucleation in men with benign prostatic hyperplasia: a lesson from 5-year serial follow-up data // *BJU Int.* 2019. Vol.123. N5A. E34-E42.

11. Cogorno Wasylkowski L., Ríos González E., Martínez-Piñero Lorenzo L. Diagnosis of urethral stenosis and follow-up after Urethroplasty // *Arch Esp Urol.* 2016. Vol.69. N7. P.416-422.

12. Cornu J.N., Ahyai S., Bachmann A., de la Rosette J., Gillling P., Gratzke C., McVary K., Novara G., Woo H., Madersbacher S. A Systematic Review and Meta-analysis of Functional Outcomes and Complications Following Transurethral Procedures for Lower Urinary Tract Symptoms Resulting from Benign Prostatic Obstruction: An Update // *Eur Urol.* 2015. Vol.67. N6. P.1066-1096.

13. Descazeaud A., Robert G., Delongchamps N.B., Cornu J.N., Saussine C., Haillet O. Comité des troubles mictionnels de l'homme de l'association française d'urologie. Bilan initial, suivi et traitement des troubles mictionnels en rapport avec hyperplasie bénigne de prostate: recommandations du CTMH de l'AFU [Initial assessment, follow-up and treatment of lower urinary tract symptoms related to benign prostatic hyperplasia: guidelines of the LUTS committee of the French Urological Association] // *Prog Urol.* 2012. Vol.22. N16. P.977-988. French.

14. Erickson B.A., Elliott S.P., Voelzke B.B., Myers J.B., Broghammer J.A., Smith III T.G., McClung C.D., Alsikafi N.F., Brant W.O. Multi-institutional 1-Year bulbar urethroplasty outcomes using a standardized prospective

cystoscopic follow-up protocol // *Urology*. 2014 Jul; Vol.84. N1. P.213–216.

15. European Association of Urology «Guidelines on Benign Prostatic Hyperplasia» Update March 2004 http://www.urotoday.com/images/stories/documents/prod/pdf/eau/BPH_August_2004.pdf.

16. European Association of Urology. Guidelines on the management of non-neurogenic male lower urinary tract symptoms (LUTS), incl. benign prostatic obstruction (BPO). 2014 [Electronic resource] / S. Gravas, A. Bachmann, A. Descazeaud et al. – URL: http://www.uroweb.org/gls/pdf/Non-Neurogenic%20Male%20LUTS_%282705%29.pdf

17. Gómez de Vicente J.M., Trelles Guzmán C. Uso de la tecnología láser en urología funcional y uroginecología [Laser technology applications in functional urology and urogynecology] // *Arch Esp Urol*. 2020. Vol.73. N8. P.709-723.

18. Gong E.M., Arellano C.M.R., Chow J.S., Lee R.S. Sonourethrography to manage adolescent anterior urethral stricture // *J Urol*. 2010. Vol.184. N4. P.1699–1702.

19. Gould C.V., Umscheid C.A., Agarwal R.K. Guideline for prevention of catheter-associated urinary tract infections 2009. CDC Online Publication Available at: <http://www.premierinc.com/safety/topics/guidelines/downloads>.

20. Fall B., Zeondo C., Sow Y., Sarr A., Sine B., Thiam A. et al. Results of anastomotic urethroplasty for male urethral stricture disease // *Prog Urol*. 2018. Vol.28. N7. P.377-381.

21. Favorito L.A. Urethral stricture: the oldest urologic disease in 2017 // *Int Braz J Urol*. 2017. Vol.43. N1. P.1-2.

22. Hafez A.T., ElAssmy A., Dawaba M.S., Sarhan O., Bazeed M. Long-term outcome of visual internal urethrotomy for the management of pediatric urethral strictures // *J Urol*. 2005. Vol.173. N2. P.595–597.

23. Han H.H., Ko W.J., Yoo T.K. Factors associated with continuing medical therapy after transurethral resection of prostate // *Urology*. 2014. Vol.84. P.675–680.

24. Hussein M.M., Moursy E., Gamal W., Zaki M., Rashed A., Abozaid A. The use of penile skin graft versus penile skin flap in the repair of long bulbo-penile urethral stricture: A prospective randomized study // *Urology*. 2011. Vol.77. N5. P.1232–1237.

25. Iacovelli V., Gaziev G., Topazio L. Nosocomial urinary tract infections: A review // *Urologia*. 2014. Vol.81. N4. P. 222–227.

26. Jackson M.J., Ivaz S.L. Quality and length of life, money and urethral stricture disease // *Curr Opin Urol*. 2015; Vol.25(4):346-51.

27. Kamp S., Knoll T., Osman M., Hacker A., Michel M.S., Alken P. Donor-site morbidity in buccal mucosa urethroplasty: lower lip or inner cheek? // *BJU Int*. 2005. Vol.96. N4. P.619–623.

28. King C., Rourke K.F. Urethral Stricture is Frequently a Morbid Condition: Incidence and Factors Associated With Complications Related to Urethral Stricture. *Urology*. 2019. Vol.132. P.189-94.

29. Kumar S., Kapoor A., Ganesamoni R., Nanjappa B., Sharma V., Mete U.K. Efficacy of holmium laser urethrotomy in combination with intralesional triamcinolone

in the treatment of anterior urethral stricture // *Korean J Urol*. 2012. Vol.53. N9. P.614–618.

30. Lambert E., Denys M.A., Poelaert F., Everaert K., Lumen N. Validated uroflowmetry-based predictive model for the primary diagnosis of urethral stricturedisease in men // *Int J Urol*. 2018. Vol.25. N9. P.792-798.

31. Launonen E., Sairanen J., Ruutu M., Taskinen S. Role of visual internal urethrotomy in pediatric urethral strictures // *J Pediatr Urol*. 2014. Vol.10. N3. P.545–559.

32. Lucca I., Shariat S.F., Hofbauer S.L., Klatt T. Outcomes of minimally invasive simple prostatectomy for benign prostatic hyperplasia: a systematic review and meta-analysis // *World J Urol*. 2015. Vol.33. N4. P.563-570.

33. Lumen N., Hoebeke P., Willemsen P., De Troyer B., Pieters R., Oosterlinck W. Etiology of urethral stricture disease in the 21st century // *J Urol*. 2009. Vol.182. N3. P.983–987.

34. Mahmud S.M., El K.S., Rana A.M., Zaidi Z. Is ascending urethrography mandatory for all urethral strictures? // *J Pak Med Assoc*. 2008. Vol.58. N8. P.429–431.

35. Male Urethral Stricture: American Urological Association Guideline. 2016. 33p.

36. María Molero J., Miñana B., Palacios-Moreno J.M., Téllez Martínez-Fornes M., Lorite Mingot D., Agra Rolán A., Carreño Á., Cuervo Pinto R. Real-world assessment and characteristics of men with benign prostatic hyperplasia (BPH) in primary care and urology clinics in Spain // *Int J Clin Pract*. 2020. Vol.74. N11. E13602.

37. Mathur R.K., Sharma A. Tunica albuginea urethroplasty for panurethral strictures // *Urol J*. 2010. Vol.7. N 2. P.120–124.

38. McVary K.T., Chughtai B., Miller L.E., Bhattacharyya S.K., Dornbier R.A., Elterman D.S. Putting Patients Ahead by Leaving Nothing Behind: An Emerging Treatment Paradigm in Minimally Invasive Surgical Therapy for Benign Prostatic Hyperplasia // *Med Devices (Auckl)*. 2021. N14. P.59-64.

39. Mitterberger M., Christian G., Pinggera G.M., Bartsch G., Strasser H., Pallwein L., Frauscher F. Gray scale and color Doppler sonography with extended field of view technique for the diagnostic evaluation of anterior urethral strictures // *J Urol*. 2007. Vol.177. N3. P.992–997.

40. Mostafid H., Kamat A.M., Daneshmand S., Palou J., Taylor J.A., McKiernan J. et al. Best Practices to Optimize Quality and Outcomes of Transurethral Resection of Bladder Tumours // *Eur Urol Oncol*. 2021. Vol.4. N1. P.12-19.

41. Mundy A.R., Andrich D.E. Urethral strictures // *BJU International* 2011. Vol.107. N1. P.6–26.

42. Noble S.M., Ahern A.M., Worthington J., Hashim H., Taylor H., Young G.J. et al. The cost-effectiveness of transurethral resection of the prostate vs thulium laser transurethral vaporization of the prostate in the UNBLOCS randomised controlled trial for benign prostatic obstruction // *BJU Int*. 2020. Vol.26. N5. P.595-603.

43. Noguera R.S., Rodríguez R.C. Open adenectomy: past, present and future // *Curr Opin Urol*. 2008. Vol.18. N1. P.34-40.

44. Nuss G.R., Granieri M.A., Zhao L.C., Thum D.J., Gonzalez C.M. Presenting symptoms of anterior urethral stricture disease: A disease specific, patient reported

questionnaire to measure outcomes // *J Urol*. 2012. Vol.187. N2. P.559–562.

45. Okugi H., Makino T., Kato H., Oyama Y., Okazaki H., Nakamura T. [Clinical evaluation of transurethral enucleation with bipolar (TUEB)] // *Nihon Hinyokika Gakkai Zasshi*. 2011. Vol.102. N1. P.2-8. Japanese.

46. Osman N.I., Chapple C.R., Abrams P., Dmochowski R., Haab F., Nitti V. et al. Detrusor underactivity and the underactive bladder: a new clinical entity? A review of current terminology, definitions, epidemiology, aetiology and diagnosis. *Eur. Urol*. 2014. Vol.65. P. 389–398.

47. Pahwa M., Gupta S., Pahwa M., Jain B.D., Gupta M. A comparative study of dorsal buccal mucosa graft substitution urethroplasty by dorsal urethrotomy approach versus ventral sagittal urethrotomy approach // *Adv Urol*. 2013.124836.

48. Palminteri E., Berdondini E., Verze P., De Nunzio C., Vitarelli A., Carmignani L. Contemporary urethral stricture characteristics in the developed world // *Urology* 2013. Vol.81. N1. P.191–196.

49. Peskar D.B., Perovic A.V. Comparison of radiographic and sonographic urethrography for assessing urethral strictures // *Eur Radiol*. 2004. Vol.14. N1. P.137–144.

50. Pokorny M., Novara G., Geurts N., Dovey Z., De Groot R., Ploumidis A. Robot-assisted simple prostatectomy for treatment of lower urinary tract symptoms secondary to benign prostatic enlargement: surgical technique and outcomes in a high-volume robotic centre // *Eur Urol* 2015. Vol.68. N3. P.451-457.

51. Rigatti P., Cestari A., Gilling P. The motion: large BPH should be treated by open surgery, *Eur. Urol*. 2007. Vol.51. P. 845–847.

52. Roehrborn C., McConnell J. Etiology, Pathophysiology, Epidemiology and Natural History of Benign Prostatic Hyperplasia. In: Walsh, P., Retik, A., Vaughan, E. and Wein, A., Eds., *Campbell's Urology*, 8th ed., Saunders, Philadelphia. 2002. P.1297-1336.

53. Santucci R.A., Joyce G.F., Wise M. Male urethral stricture disease. *J Urol* 2007. Vol.177. P.1667–1674.

54. Sergienko N.F., Vasil'chenko M.I., Begaev A.I., Shekochikhin A.V., Shershnev S.P., Reiniuk O.L., Lototskiĭ M.M. Transvesical extraurethral adenectomy and transurethral prostatic resection in adenoma: specific features. *Urologia*. 2010. N5. P.29-35.

55. Srinivasan A., Wang R. An Update on Minimally Invasive Surgery for Benign Prostatic Hyperplasia: Techniques, Risks, and Efficacy // *World J Mens Health*. 2020. Vol.38. N4. P.402-411.

56. Stein D.M., Thum D.J., Barbagli G., Kulkarni S., Sansalone S., Pardeshi A., Gonzalez C.M. A geographic analysis of male urethral stricture aetiology and location // *BJU Int*. 2013. Vol.112. N6. P.830–834.

57. Strittmatter F., Beck V., Stief C.G., Tritschler S. Urethral stricture: From diagnostics to appropriate treatment // *Urologe A*. 2017. Vol.56. N8. P.1047-1057.

58. Stormont G., Chargui S. Transurethral Resection of The Prostate. 2021. In: StatPearls [Internet] // Treasure Island (FL): StatPearls Publishing.

59. Terlecki R.P., Steele M.C., Valadez C., Morey A.F. Urethral rest: role and rationale in preparation for anterior urethroplasty // *Urology*. 2011. Vol.77. N6. P.1477–1481.

60. Tubaro A., Speakman M., de la Taille A., Martínez-Piñero L., Berges R., Patel A. et al. European Registry Evaluating Symptomatic Effectiveness of Pharmacologically Treated Patients with Lower Urinary Tract Symptoms due to Benign Prostatic Enlargement: Lessons Learned // *J Urol*. 2021. Vol.205. N4. P.1145-1152.

61. Wessells H., Angermeier K.W., Elliott S., Gonzalez C.M., Kodama R., Peterson A.C. et al. Male Urethral Stricture: American Urological Association Guideline // *J Urol*. 2017. Vol.197. N1. P.182-190.

62. Woo M. J., Ha Y., Lee J. N., Kim B.S., Kim H.T., Kim T., Yoo E.S. Comparison of surgical outcomes between holmium laser enucleation and transurethral resection of the prostate in patients with detrusor underactivity // *International Neurourol. J*. 2017. N21. P.46–52.

63. Verla W., Oosterlinck W., Spinoit A.F., Waterloos M. A Comprehensive Review Emphasizing Anatomy, Etiology, Diagnosis, and Treatment of Male Urethral Stricture Disease // *Biomed Res Int*. 2019. Vol.2019. P.9046430.

64. Zaid U.B., Lavien G., Peterson AC. Management of the Recurrent Male Urethral Stricture // *Curr Urol Rep*. 2016. Vol.17. N4. P.33.

65. Zehri A.A., Ather M.H., Afshan Q. Predictors of recurrence of urethral stricture disease following optical urethrotomy // *Int J Surg*. 2009. Vol.7. N4. P.361–364.

Contact Information

Kairambayev Yerbol M. – Assistant Professor, Faculty Surgery Department, NCJSC «Semey Medical University», Semey c., Republic of Kazakhstan;

Address: Republic of Kazakhstan, 071400, Semey c., Abaya 103.

Phone: +7 777-368-56-56

E-mail: kayrambaev-11@mail.ru