

ХИРУРГИЯ SURGERY

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Modern Methods of Treating Diseases of the Bulbo-Membranous Part of Urethra

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Strictures of the bulbous-membranous urethra are a common cause of obstructive urination disorder. Modern trends in the development of medicine lead to a wider application of endoscopic method, a more frequent cause of iatrogenic injury of the urethra. At present, conservative, endourologic and reconstructive methods of care are used to treat urethral strictures.

There are several conservative, endourological and reconstructive methods for treating patients with urethral stricture. Conservative methods include interventions that do not involve the destruction of urethral stricture or its reconstruction, such as stenting, blind dilatation, and recanalization of the urethra. Performing blind dilatation strictures of the bulbo-membranous urethra is not recommended because of the high risk of false path formation and low efficiency. Endourological operations refer to surgical methods of care and suggest the natural restoration of urethral tissues after the destruction of stricture. Because of the low effectiveness of correction of strictures of the posterior urethra (more than 90 % of relapses in five years), this method is a variant of temporary or palliative care.

Currently, two approaches to the reconstruction of the bulbo-membranous urethra are used: anastomotic and replacement operations. Anastomotic surgery involves excision of the affected area and juxtaposition of healthy urethral tissues without tension. Replacement plastic allows to restore patency of the urethra by increasing the diameter of the lumen due to the implantation of various grafts.

The article shows that, based on international clinical studies, the most effective method of reconstructing the bulbo-membranous urethra is reconstructive surgical methods.

Key words: bulbo-membranous urethra, urethral stricture, urethral stenosis, anastomotic urethroplasty, buccal-mucosa urethroplastic, direct visual internal urethrotomy (DVIU)

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Современные методы лечения поражений бульбо-мембранозного отдела уретры

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Стриктуры бульбо-мембранозного отдела уретры являются частой причиной обструктивного нарушения мочеиспускания. Современные тенденции развития медицины ведут к более широкому применению эндоскопических методов, более частой причине ятрогенной травмы мочеиспускательного канала. В настоящее время для лечения стриктур уретры применяются консервативные эндуурологические и реконструктивные методы помощи.

Существует несколько консервативных, эндуурологических и реконструктивных методов лечения пациентов со стриктурной болезнью уретры. К консервативным методам относятся вмешательства, не предполагающие разрушения стриктуры уретры или её реконструкцию, такие как стентирование, бужирование и реканализация уретры.

Эндуурологические операции относятся к хирургическим методам помощи и предполагают естественное восстановление тканей уретры после разрушения стриктуры. Из-за низкой эффективности коррекции стриктур задней уретры (более 90 % рецидивов через пять лет) данный метод является вариантом временной или паллиативной помощи.

В настоящее время применяется два подхода к реконструкции бульбо-мембранозного отдела уретры: анастомотические и заместительные операции. Анастомотическая операция предполагает иссечение поражённого участка и сопоставление здоровых тканей уретры без натяжения. Заместительная пластика позволяет восстановить проходимость уретры путём увеличения диаметра просвета за счёт имплантации различных трансплантатов. Перспективным новым методом лечения является регенеративный подход, когда трансплантируют ткане-инженерную конструкцию, выращенную из клеток самого пациента.

В статье продемонстрировано, что на основании международных клинических исследований наиболее эффективным методом восстановления бульбо-мембранозного отдела уретры являются реконструктивные хирургические методы.

Ключевые слова: бульбо-мембранозный отдел уретры, стриктура уретры, стеноз уретры, анастомотическая уретропластика, буккальная пластика уретры, внутренняя оптическая уретротомия (ВОУТ)

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RELEVANCE

Stricture disease of the urethra is a partial or complete narrowing of the urethral lumen. It can occur as a result of trauma or inflammation, which leads to irreversible violations of urination and, possibly, death. Treatment of this disease is still a difficult task.

At present, there is no generalized exact information on the incidence of stricture disease. Hypothetical calculations predict that approximately 0.6 % of men over the age of 55 have a narrowing of the urethral lumen. In a few studies authors report about different incidence rates, ranging from 30 to 627 cases per 100,000 of population. Thus, in Denmark, between 1977 and 2013, the total incidence of stricture disease was 34.8 per 100,000 of population [37]. In this case, men over 60 years accounted for 66.9 % of cases of urethral strictures. In the United States, according to the American Urological Association (AUA) in 2003, the incidence was 193 cases per 100,000 of population [51]. Thus, there is a significant statistical dispersion even in the developed countries of the world.

In Russia, there is no statistical account of the incidence of urethral stricture. This group of patients in statistical reports is combined with other diseases (benign prostatic hyperplasia, neurogenic urination disorders and others). Thus, the frequency of detection of diseases of the urinary system with obstructive symptoms in the city of Moscow for the period of 2011-2012 was 275–291 cases per 100,000 of population.

Information on the incidence of urethral stricture in the hospitals of Irkutsk for the period from 2012 to 2014 is presented in Table 1.

Based on the above reasons, it is difficult to estimate the incidence of urethral strictures and, especially, of its bulbo-membranous part. The average frequency of detection of the narrowing of the bulbo-membranous urethral part (BMP) calculated indirectly is about 8 % of the total incidence of urethral stricture [45].

Currently, two methods of surgical treatment of strictures of the proximal part of the bulbar urethra and the BMP are used: endourologic intervention and reconstructive surgery.

Usually, when an BMP stricture is detected, an endourological operation is performed – direct visual internal urethrotomy (DVIU) with a probable efficacy of 20 to 75 % [32, 33, 38, 39] compared with 24 of 29 patients with shorter strictures (p = 0.001. This method is simple and has the greatest efficiency in lesions less than 10 mm in length. When the stricture is more than 2 cm, the performance of the DVIU is practically ineffective [20, 30, 57] including age, etiology, length and site of the strictures, and catheter duration. Only patients with a minimum followup of 2 years were included. Regular self-catheterization was not used by any child. RESULTS A total of 31 patients (mean age 11.2 years, range 2 to 18. Primary and repeated use of this technique can worsen the course of the disease [22, 24, 34] thus excluding those with hypospadias, lichen sclerosus, pelvic radiation, prior urethroplasty, incomplete data, or pure penile or posterior urethral stenosis. Cases were divided into 2 groups based on the history of transurethral treatment for urethral stricture before urethroplasty, including group 1-0 or 1 and group 2-2 or greater treatments. RESULTS Of 101 patients with bulbar urethral stricture and all data available 50 and 51 underwent 0 to 1 and 2 or greater previous transurethral treatments, respectively. Repeat transurethral manipulation was strongly associated with longer strictures and the need for complex reconstruction. Repeat transurethral manipulation of bulbar urethral strictures was also associated with an eightfold increase in disease duration between stricture diagnosis and curative urethroplasty. CONCLUSIONS Repeat transurethral manipulation of bulbar strictures is associated with increased stricture complexity and a marked delay to curative urethroplasty.”;author":{"dropping-particle":"","family":"Hudak","given":"Steven J","non-dropping-particle":"","parse-names":false,"suffix":"","dropping-particle":"","family":"Atkinson","given":"Timothy H","non-dropping-particle":"","parse-names":false,"suffix":"","dropping-particle":"","family":"Morey","given":"Allen F","non-dropping-particle":"","parse-names":false,"suffix":""},"container-title":"The Journal of urology","id":"ITEM-1","issue":"5","issued":{"date-parts":["2012","5"]},"page":"1691-5","title":"Repeat

Table 1

Incidence of urethral stricture in Irkutsk's hospitals

Year	Cases, n (%)	Surgical, n (%)	Urgent operations, n (%)	Duration of hospitalization, days	Total urological patients
2012	48 (1,8 %)	48 (4,3 %)	12 (2,7 %)	12,6	2532
2013	48 (1,8 %)	47 (3,7 %)	16 (2,8 %)	15,5	2571
2014	37 (1,4 %)	36 (2,7 %)	2 (0,3 %)	10,3	2518
Total	133 (1,7 %)	132 (3,5 %)	30 (1,9 %)	12,8	7621

transurethral manipulation of bulbar urethral strictures is associated with increased stricture complexity and prolonged disease duration.”,”type”:”article-journal,”volume”:”187”},”uris”:[”http://www.mendeley.com/documents/?uuid=b4763632-561f-3f1e-a85f-083522465819”]},{”id”:”ITEM-2,”item-Data”:{”DOI”:”10.1016/j.juro.2013.01.014,”IS SN”:”1527-3792,”PMID”:”23313208,”abstract”:”PURPOSE The long-term success rate of dilation and/or internal urethrotomy is low in cases of recurrent urethral stricture. We investigated the ability of the Memokath™ 044TW stent to maintain urethral patency after dilation or internal urethrotomy for recurrent urethral stricture. MATERIALS AND METHODS A total of 92 patients with recurrent bulbar urethral strictures (mean length 2.7 cm, and data on long-term follow-up of such patients indicate more than 90 % recurrence within five years [50]second, third, fourth and fifth urethrotomy. Patients with complex strictures [36.

Anastomotic reconstruction is also used to treat strictures (efficiency 85–98 % [13, 29, 40]1-stage delayed repairs of complete posterior urethral ruptures in 60 men with at least 1-year followup were reviewed. Two ruptures were due to gunshot wounds and 58 were secondary to a pelvic fracture. There were 58 repairs done by the perineal approach and 5 required an abdominal perineal approach. RESULTS Surgical complications included 2 (3%). This method involves excision of the affected part of the urethra, which leads to its shortening. Additionally performed Webster techniques aimed at creating conditions for anastomosing without tension, increase the risk of injury to blood vessels and nerves. Such an operation can lead to a violation of the erectile function, the development of urine incontinence and the shortening of the penis [36, 41, 43]. In addition, there is a risk of failure to apply anastomosis even with Webster receptions and combined access.

In addition to the anastomotic reconstruction, substitution urethroplasty is used. The method involves replacing part of the urethra with autologous, allogenic, xenogenic or tissue-engineering grafts. This method is one of the most effective in the reconstruction of another part of the urethra, but in the BMP its effectiveness is inferior to anastomotic methods [2].

INDICATIONS, ALGORITHMS OF TREATMENT

Based on the established diagnosis, indications for treatment are determined. Clearly formulated relative indications for surgical intervention for strictures of various parts of the urethra at the present time does not exist. Nevertheless, given the long period of subcompensation, patients are shown to perform dynamic observation and, possibly, treatment for any detected urethral stricture, even under normal urodynamic parameters (maximum urinary flow rate is more than 15 ml/sec, residual urine is absent). It is possible to conduct conservative therapy with fibrinolytics, dilatation and physiotherapy in the early stages of the disease (maximum urine flow rate is 12–15 ml/sec, residual urine volume is less than 100 ml), and in severe inoperable cases.

At present, consensus is reached in the Russian and world practice (EAU Guidelines, 2017, AUAGuidelines,

2016) on the algorithm for helping patients with stricture of the posterior (including the BMP) urethra.

The algorithm for examining and treating lesions of the posterior urethra is based on the causes of stricture. If there is a suspicion of iatrogenic damage to the urethra (for example, catheterization with urethrorrhagia), urethrography is indicated. In case of detection of acute damage, the urethra is drained by a catheter for a period up to the healing of the urethral walls. When revealing stricture of the urethra less than 10 mm in length – DVIU is performed. With strictures of greater length, an anastomotic reconstruction of the urethra is recommended.

If the stenosis of the vesicoureteral anastomosis after radical prostatectomy is revealed, it is possible to dilate the urethra or endoscopic dissection of the stenotic ring. If these methods are ineffective, patients are offered re-anastomosing or permanent drainage of the bladder with a cystostomy.

At a blunt trauma of a urethra endoscopic recanalization or a drainage of a bladder by a cystostoma is carried out for the term up to three months. In the future, if a stricture of the urethra recurs, it is possible to perform a DVIU or an anastomotic reconstruction.

In the presented clinical recommendations, conservative treatment of urethral strictures (recanalization, dilatation, stenting) or performing DVIU is allowed. If they are ineffective, the second stage is used for urethroplastic reconstruction. In the clinical recommendations of the American Urological Association of 2016, the possible negative impact of DVIU and conservative treatment methods on the prognosis of the course of urethral strictures is indicated. Replacement methods of urethroplasty are absent in the presented algorithms because of their low efficiency and lack of advantages over anastomotic methods.

ENDUROLOGICAL METHODS

Performing blind dilatation of strictures of the BMP of the urethra is not recommended because of the high risk of forming a false stroke. The method does not lead to a cure, allowing to maintain an independent urination for several weeks. Recurrence after dilatation is an indication for choosing a different method of treatment. Indication for repeated dilatation is the inability to perform urethral reconstruction [6, 27]Khyber Medical Centre and Khyber Teaching Hospital Peshawar from July 2004 to June 2008. RESULTS: A total of 146 male patients were included in the study. They were divided into two groups of 73 each on alternate basis. Group A was control group and group B with clean intermitting self dilatation and were followed upto 8 months. Study results showed a high rate of recurrence in control group A i.e. 42 patients (57.53%. After performing the DVIU, such patients are recommended to dilate the urethra by self-catheterization with an interval of several days to several weeks with a total duration of more than four months. This procedure is accompanied by painful sensations during the procedure [23, 43]. Constant dilatation of the urethra significantly decreases the quality of life [35]frequency, difficulty and pain associated with intermitting self-dilatation as well as interference of intermitting self-dilatation with daily activity. The primary outcome was patient perceived quality of life. Multivariate analysis was performed to assess factors that affected this

outcome. RESULTS Included in the study were 85 patients with a median age of 68 years, a median of 3.0 years on intermittent self-dilation and a median frequency of 1 dilation per day. On a 1 to 10 scale the median intermittent self-dilation difficulty was 5.0 ± 2.7 , the median pain score was 3.0 ± 2.7 and median interference with daily life was 2.0 ± 1.3 . Overall quality of life in patients with stricture was poor (median score 7.0 ± 2.6 with poor quality of life defined as 7 or greater).

The urethral stents for the first time began to be applied since 1988. There are no stents to restore the permeability of the BMP of the urethra. The use of urethral stents with post-traumatic strictures or a pronounced fibrous process is contraindicated because of the high risk of scarring into the lumen of the stent [5, 26, 46]. For uncoated metallic stents, the expected obstruction by a neoplastic or granulation tissue in the first six months reaches 51.2 %. Polymer coatings (teflon, polyurethane and silicone) reduce the risk of obstruction approximately twice. Currently, there are special modifications of stents to correct stenosis of anastomoses and treatment of patients with severe concomitant pathology, which cannot perform surgical reconstruction [9, 21] 4%-9% of men after brachytherapy and 1%-13% after external beam radiotherapy will develop stenosis. The rate will be greater after combination therapy and can exceed 40% after salvage radical prostatectomy. Although postradical prostatectomy stenoses mostly develop within 2 years, postradiotherapy stenoses take longer to appear. Many result in storage and voiding symptoms and can be associated with incontinence. The evaluation consists of a workup similar to that for lower urinary tract symptoms, with additional testing to rule out recurrent or persistent prostate cancer. Treatment is usually initiated with an endoscopic approach commonly involving dilation, visual urethrotomy with or without laser treatment, and, possibly, UroLume stent placement. Open surgical urethroplasty has been reported, as well as urinary diversion for recalcitrant stenosis. A proposed algorithm illustrating a graded approach has been provided.,"author":{"dropping-particle":"","family":"Herschorn","given":"Sender","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Elliott","given":"Sean","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Coburn","given":"Michael","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Wessells","given":"Hunter","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Zinman","given":"Leonard","non-dropping-particle":"","parse-names":false,"suffix":""},"container-title":"Urology","id":"ITEM-1","issue":"3 Suppl","issued":{"date-parts":["2014","3"]},"page":"S59-70","title":"SIU/ICUD Consultation on Urethral Strictures: Posterior urethral stenosis after treatment of prostate cancer.,"type":"article-journal","volume":"83"},"uris":["http://www.mendeley.com/documents/?uuid=9bf8ed20-9fca-3bbd-85df-0b166f8703e5"],{"id":"ITEM-2"},"itemData":{"ISSN":"0004-0614","PMID":"27725336","abstract":"Urethral stents were first introduced in 1988, and since then, they have undergone significant improvements. However, they did not gain a wide popularity and their use is limited to a small number of centers

around the world. Urethral stents can be used in the entire urethra and for various and diverse indications. In the anterior urethra, it can be used to treat urethral strictures. In the prostatic urethra, they can be used for the treatment of prostatic obstruction, including benign, malignant and iatrogenic prostatic obstruction. Moreover, although not widely used, it can be also applied for the treatment of posterior urethral stricture and bladder neck contracture, usually resulting in urinary incontinence and the need for subsequent procedures. Our main experience are with Allium urethral stents, and as such, we provide the latest updates in urethral stents with special emphasis on the various types of Allium urethral stents: bulbar, prostatic and bladder neck stents.,"-author":{"dropping-particle":"","family":"Bahouth","given":"Z","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Meyer","given":"G","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Yildiz","given":"G","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Nativ","given":"O","non-dropping-particle":"","parse-names":false,"suffix":""},"dropping-particle":"","family":"Moskovitz","given":"B","non-dropping-particle":"","parse-names":false,"suffix":""},"container-title":"Archivos espanoles de urologia","id":"ITEM-2","issue":"8","issued":{"date-parts":["2016","10"]},"page":"601-606","title":"Update in urethral stents.,"type":"article-journal","volume":"69"},"uris":["http://www.mendeley.com/documents/?uuid=22420580-e18d-320a-aa9d-387df9f4c458"]},"mendeley":{"formattedCitation":"[9, 21]","plainTextFormattedCitation":"[9, 21]","previouslyFormattedCitation":"[47; 52]"},"properties":{"noteIndex":0},"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"}. Complication of the urethral stent, in addition to the germination of scar tissue, is a dislocation into the bladder and ischemia of the urethra.

Recanalization is a method of restoring the urethra on a catheter, performed in the bladder with a fibrourethrocystoscope. When the urethra is recanalized in a patient with a distraction defect, drainage of the urethra by the catheter should be stopped only when the re-epithelization of the affected area is completed [15]. At week 9, it is achieved in 83 % of patients, the remaining 13 % – by the 12th week of drainage. This technique does not guarantee a cure, and the process of re-epithelialization should be controlled by the method of periodic flexible ureteroscopy. The overall efficiency of recanalization is low. The subsequent formation of strictures is revealed in 14–79 % of cases, urinary incontinence is < 5 %, impotence is 10–55 % [33, 38] post-void residual and cystoscopic evaluation. Failure of early endoscopic realignment was defined as patients requiring urethral dilation, direct vision internal urethrotomy, posterior urethroplasty or self-catheterization after initial urethral catheter removal. RESULTS A total of 19 consecutive patients (mean age 38 years.

DVIU is the development of the blind uretrotomy technique, allowing to improve the effectiveness and reduce the incidence of complications. It is performed by a cold knife or laser. Strictly contraindicated is holding

power tools. In the case of subtotal lesion or complete obliteration of the urethral lumen, DVIU can be used in the direction of bougie, or by the method of "counter light".

The overall effectiveness of the DVIU in the treatment of strictures of the proximal part of the bulbar urethra is from 20 to 75 % according to different data [32, 33, 39] compared with 24 of 29 patients with shorter strictures ($p = 0.001$, and depends on the cause of the formation and extent of urethral stricture. The effectiveness of this procedure for lesion of the posterior urethra is doubtful, and with complete obliteration of the lumen – critically low [34] morbidity, and outcomes of open versus endoscopic treatment of posttraumatic posterior urethral strictures. We compared two groups of men with strictures of the posterior urethra after pelvic fracture: Group I ($n = 6$).

It is allowed to perform DVIU in the development of unextended stenosis of urethral anastomosis [12] San Francisco experience with delayed anastomotic posterior urethroplasty for management of these injuries. MATERIALS AND METHODS Since 1979 all patients undergoing posterior urethroplasty by a single surgeon at University of California, San Francisco and its affiliated hospitals have been entered prospectively into a patient registry. For this cohort descriptive statistics were calculated and recurrence was analyzed with the Kaplan-Meier method. Success was defined as no recurrence (by symptoms and/or retrograde urethrogram, or with strictures less than 10 mm in length [20, 30, 57] including age, etiology, length and site of the strictures, and catheter duration. Only patients with a minimum followup of 2 years were included. Regular self-catheterization was not used by any child. RESULTS A total of 31 patients (mean age 11.2 years, range 2 to 18. Repeated DVIU do not bring healing [4] and complicate the subsequent treatment [1], worsening the course of the disease [22, 24, 34] thus excluding those with hypospadias, lichen sclerosus, pelvic radiation, prior urethroplasty, incomplete data, or pure penile or posterior urethral stenosis. Cases were divided into 2 groups based on the history of transurethral treatment for urethral stricture before urethroplasty, including group 1-0 or 1 and group 2-2 or greater treatments. RESULTS Of 101 patients with bulbar urethral stricture and all data available 50 and 51 underwent 0 to 1 and 2 or greater previous transurethral treatments, respectively. Repeat transurethral manipulation was strongly associated with longer strictures and the need for complex reconstruction. Repeat transurethral manipulation of bulbar urethral strictures was also associated with an eightfold increase in disease duration between stricture diagnosis and curative urethroplasty. CONCLUSIONS Repeat transurethral manipulation of bulbar strictures is associated with increased stricture complexity and a marked delay to curative urethroplasty." author: [{"dropping-particle": "", "family": "Hudak", "given": "Steven"}, {"dropping-particle": "", "family": "Atkinson", "given": "Timothy H"}, {"dropping-particle": "", "family": "Morey", "given": "Allen F"}], "container-title": "The Journal of urology", "id": "ITEM-1", "issue": "5", "issued": {"date-parts": [{"2012", "5"}]}, "page": "1691-5", "title": "Repeat

transurethral manipulation of bulbar urethral strictures is associated with increased stricture complexity and prolonged disease duration." type: "article-journal", volume: "187", uris: [{"http://www.mendeley.com/documents/?uuid=b4763632-561f-3f1e-a85f-083522465819"}], {"id": "ITEM-2", item-data: {"DOI": "10.1016/j.juro.2013.01.014", "ISSN": "1527-3792", "PMID": "23313208", "abstract": "PURPOSE The long-term success rate of dilation and/or internal urethrotomy is low in cases of recurrent urethral stricture. We investigated the ability of the Memokath™ 044TW stent to maintain urethral patency after dilation or internal urethrotomy for recurrent urethral stricture. MATERIALS AND METHODS A total of 92 patients with recurrent bulbar urethral strictures (mean length 2.7 cm, therefore, in case of relapse, another method of treatment should be chosen. DVIU can provoke the defeat of the sphincter mechanism, and, consequently, urinary incontinence.

With distraction defects of the urethra, it is not recommended to perform a delayed DVIU, but to perform the plastic reconstruction. In such a situation, any excessive urethral interventions should be avoided, as they can delay or worsen treatment outcomes [12] San Francisco experience with delayed anastomotic posterior urethroplasty for management of these injuries. MATERIALS AND METHODS Since 1979 all patients undergoing posterior urethroplasty by a single surgeon at University of California, San Francisco and its affiliated hospitals have been entered prospectively into a patient registry. For this cohort descriptive statistics were calculated and recurrence was analyzed with the Kaplan-Meier method. Success was defined as no recurrence (by symptoms and/or retrograde urethrogram. With incomplete separation of the posterior urethra and partial preservation of the urethral lumen, it is possible to perform DVIU with the first stage followed by self-catabolization in certain groups of patients.

In cases of neurogenic disorders of urination due to spinal trauma, when intermittent catheterization is required, the patient may be required to perform periodic DVIU in order to maintain urethral patency.

ANASTOMOTIC URETHROPLASTICS

With stricture of the posterior urethra, delayed anastomosing urethroplasty is the recommended method of care for most patients. Its use after traumatic injury of the urethra is possible after 2–3 months, for other etiologic reasons – the term is determined individually. Emergency, urgent or delayed urethroplasty is contraindicated, as it is accompanied by a very high risk of complications (impotence – 56 %, incontinence – 21 %).

Anastomotic operations are performed through perineal access in a modified lithotomy position. The need for additional suprapubic access is rare, usually with the correction of the neck of the bladder. Most surgeons consider perineal access to be sufficient for visualization of the entire membranous urethra, and transpubic access – not having significant advantages for greater complexity of execution and high traumatism.

Classical anastomosing method (by Turner-Warwick) involves matching the ends of the urethra after excision of the affected area. When revealing extensive strictures of

the BMP to compensate for a decrease in its length after excision, in some cases, dissection of the intercavernosum septum, resection of the lower branch of the pubic bone, or movement of the urethra (rerouting) over the cavernous body foot (Webster's method) are needed. This set of techniques is technically difficult, it requires a lot of time and involves a high risk of operational injury. Nevertheless, the efficiency of such anastomotic reconstruction reaches 85–90 % [13, 18, 41, 52] 1-stage delayed repairs of complete posterior urethral ruptures in 60 men with at least 1-year followup were reviewed. Two ruptures were due to gunshot wounds and 58 were secondary to a pelvic fracture. There were 58 repairs done by the perineal approach and 5 required an abdominal perineal approach. RESULTS Surgical complications included 2 (3%.

The implementation of anastomotic reconstruction is accompanied by damage to various anatomical structures of the perineum, which can lead to a number of complications. Urinary incontinence often develops due to the surgical trauma of any of the elements of the distal urinary sphincter. In case of its occurrence, expensive implantation of an artificial urinary sphincter will be required, however, not guaranteeing disposal of incontinence [41]. Violation of erectile function is a consequence of the destruction of cavernous vessels and nerves. The risk of severe erectile dysfunction after anastomotic urethroplasty is more than 5 %, and the risk of impairment of erectile function reaches 36–38 % [36, 54] suggesting a neurogenic aetiology in the majority. Bilateral pubic rami fracture was also associated with a high incidence of impotence. CONCLUSION Disruption of the cavernosal nerves lateral to the prostatomembranous urethra behind the symphysis pubis is the most likely cause of impotence in this injury. author: [{"dropping-particle": "", "family": "Mark", "given": "S D", "non-dropping-particle": "", "parse-names": false, "suffix": ""}, {"dropping-particle": "", "family": "Keane", "given": "T E", "non-dropping-particle": "", "parse-names": false, "suffix": ""}, {"dropping-particle": "", "family": "Vandemark", "given": "R M", "non-dropping-particle": "", "parse-names": false, "suffix": ""}, {"dropping-particle": "", "family": "Webster", "given": "G D", "non-dropping-particle": "", "parse-names": false, "suffix": ""}], container-title: "British journal of urology", id: "ITEM-1", issue: "1", issued: {"date-parts": [{"1995", "1"}]}, page: "62-4", title: "Impotence following pelvic fracture urethral injury: incidence, aetiology and management.", type: "article-journal", volume: "75", uris: [{"http://www.mendeley.com/documents/?uuid=e7699bda-da92-30a9-acc6-5dda-f43a5837"}], {"id": "ITEM-2", "itemData": {"DOI": "10.1097/01.ju.0000067660.51231.05", "ISSN": "0022-5347", "PMID": "12771742", "abstract": "PURPOSE Erectile dysfunction is a common sequel of pelvic fractures, particularly those associated with posterior urethral injury when it can be neurogenic or arteriogenic due to damage to the cavernous nerves or branches of the pudendal arteries. We studied erectile function of patients with posterior urethral injuries due to pelvic fractures. MATERIALS AND METHODS Patients referred for posterior urethral reconstruction and strictures due to pelvic fractures were evaluated before reconstruction. All patients underwent nocturnal penile tumescence

testing, and if those results were abnormal, penile duplex ultrasound with intracavernous injection was performed. Patients with normal vascular function on duplex ultrasound were diagnosed with neurogenic erectile dysfunction. Those patients with abnormal arterial function on duplex ultrasound underwent arteriography to further define the extent and location of arterial damage. RESULTS The study included 25 consecutive patients with posterior urethral strictures and a mean age of 28.6 years. Of the patients 18 (72%.

There are several variants of vessel-sparing anastomotic operations (Jordan's method [25]) 10 patients underwent vessel sparing urethral reconstruction including 3 after radical prostatectomy, 6 following straddle trauma and 1 potentially with a congenital stricture. A plane was developed between the urethra and the proximal blood supply at the bulbospongiosum, allowing for division of the urethra without dividing the spongy tissue of the corpus spongiosum or the arteries to the bulb. Only 7 patients are presented for data analysis because the other 3 have not had sufficient followup to date. RESULTS Patient age range was 15 to 72 years (mean 47, alternative intraurethral anastomosis of Andrich – Mundy [7] and others) that prevent violations of the normal blood supply of the corpus spongiosum and successfully perform the reconstruction of the distal strictures of the urethra. These methods for their technical characteristics are limitedly applicable for lesions longer than 2–3 cm.

The presence of strictures of the distal urethra limits the use of anastomotic reconstruction. The effectiveness of one-stage or subsequent reconstruction is reduced due to a violation of the blood supply to the corpus spongiosum [28]. Particular attention is required to patients with congenital hypospadias due to more severe ischemic disorders of the blood supply of the bulbar urethra during its devascularization.

SUBSTITUTING URETHROPLASTICS

In addition to the anastomotic reconstruction, substitution urethroplasty is used. In cases where it is impossible to perform an anastomosing operation (with an extensive distraction defect, urethral strictures longer than 7 cm, or with ineffectiveness of the preceding anastomotic urethroplasty), it is recommended to do the flap or graft reconstruction [42].

The membrane of the urethra is not surrounded by feeding structures. It passes in the thickness of the muscles of the pelvic floor and consists of a gentle transitional epithelium. It is believed that the anastomotic reconstruction of the membranous urethra is preferable to graft replacement due to poor survival of the flaps on the muscular base [11] 22 urethral reconstructions were completed using a graft of buccal mucosa. Eighteen of 22 patients had previously failed hypospadias repairs, while three had bulbar urethral stricture and one had penile carcinoma. Grafts were taken from either the inner cheek or the lower lip, and seven were used as a combined graft. Onlay grafts were used in 6 cases and tubularized grafts in 16 cases. RESULTS Two patients developed complications at the donor site. Nine of 22 patients had complications of the urethroplasty-two had meatal stenosis, four developed a urethral fistula, and

three developed urethral stricture. All complications have been managed successfully to date. CONCLUSIONS Buccal mucosa is an excellent source of graft material for urethral replacement in complex urethroplasties. It is readily available, in abundant supply, and has physical properties beneficial to free graft survival.”; author: [“dropping-particle”: “”; family: “Caldamone”; given: “A A”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Edstrom”; given: “L E”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Koyle”; given: “M A”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Rabinowitz”; given: “R”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Hulbert”; given: “W C”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; container-title: “Urology”; id: “ITEM-1”; issue: “5A Suppl”; issued: [“date-parts”: [“1998”; “5”]]; page: “15-9”; title: “Buccal mucosal grafts for urethral reconstruction.”; type: “article-journal”; volume: “51”; uris: [“http://www.mendeley.com/documents/?uuiid=e46c743a-f8ab-32b8-91b7-d53dca63798”]]; mendeley: [“formattedCitation”: “[11]”; plainTextFormattedCitation”: “[11]”; previouslyFormattedCitation”: “[9]”; properties: [“noteIndex”: 0]; schema: “https://github.com/citation-style-language/schema/raw/master/csl-citation.json”].

The experimental work performed on animals can be considered as an evidence against the hypothesis of poor engraftment of grafts on a muscular basis. The study established [3] that the survival rate of the buccal graft on the gallbladder of the penis is 93.4 %, on the muscle – 90.7 %, on fat – 81 %. Thus, the reason for the ineffectiveness of the replacement urethroplasty of the membranous part of the urethra is not the muscular basis for transplantation, but the disruption of normal blood supply in the surgery area and the use of tubularized grafts.

The creation of a urethral tube from a revascularized radial flap is technically complex and time-consuming [14, 48] particularly in patients who have had previous amputation for penile tumour or who have undergone gender reassignment. Many reconstructive techniques currently in use recreate the urethra but are prone to recurrent stricture formation and fail to achieve micturition with a good stream when standing. The authors propose using the radial forearm fasciocutaneous free flap as a single-stage technique of male urethral reconstruction. METHODS During 1999-2004, nine patients underwent microsurgical reconstruction of the male urethra using the radial forearm fasciocutaneous free flap. Three patients underwent urethral reconstruction following previous subcutaneous penectomy for penile cancer. Another six patients had urethral reconstruction performed after failure of primary urethra construction as part of their gender reassignment surgery. RESULTS The average age at the time of surgery was 35.1 yr (range: 22-55 yr. Indication for such an operation is the impossibility of repeated anastomosing or too long defect of the urethra for anastomosing [44]. This method is also widely used in the formation of a penoid.

Urethroplasty with a tubularized flap is performed from crotch access. The transplant is sewn circularly

on the urethral catheter with the proximal end fixed with a 3-0 thread. Then the transplant is cut along the length of the defect and anastomosed with the distal end of the urethra, beginning with the dorsal semicircle. This one-step approach leads to a high risk of relapse (about 50 %) [47] pedicled flap, free graft and complex urethral reconstruction are reported. New trends such as dorsal urethroplasty and the use of buccal mucosa are reviewed. SUMMARY Most urethral strictures can be managed successfully by urethral surgery. A wide spectrum of effective procedures is available. To obtain optimal results, adequate knowledge and experience of the most common techniques are required.”; author: [“dropping-particle”: “”; family: “Pansadoro”; given: “Vito”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Emiliozzi”; given: “Paolo”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; container-title: “Current opinion in urology”; id: “ITEM-1”; issue: “3”; issued: [“date-parts”: [“2002”; “5”]]; page: “223-7”; title: “Which urethroplasty for which results?”; type: “article-journal”; volume: “12”; uris: [“http://www.mendeley.com/documents/?uuiid=fa620485-5aa7-3428-862d-0a698b904277”]]; mendeley: [“formattedCitation”: “[47]”; plainTextFormattedCitation”: “[47]”; previouslyFormattedCitation”: “[37]”; properties: [“noteIndex”: 0]; schema: “https://github.com/citation-style-language/schema/raw/master/csl-citation.json”].

Alternative methods of substitution urethroplasty: combined tissue transfer (for example, dorsal transbulbar transplantation in combination with a ventral flap in one stage), combined dorsal and ventral transplants (Asopa [8] and an elliptical raw area was created over the tunica on which a free full-thickness graft of preputial or buccal mucosa was secured. The urethra was retubularized in one stage. RESULTS After a follow-up of 8 to 40 months, one recurrence developed and required dilation. CONCLUSIONS The ventral sagittal urethrotomy approach for dorsal free graft urethroplasty is not only feasible and successful, but is easy to perform.”; author: [“dropping-particle”: “”; family: “Asopa”; given: “H S”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Garg”; given: “M”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Singhal”; given: “G G”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Singh”; given: “L”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Asopa”; given: “J”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; [“dropping-particle”: “”; family: “Nischal”; given: “A”; non-dropping-particle”: “”; parse-names”: false; suffix”: “”]; container-title: “Urology”; id: “ITEM-1”; issue: “5”; issued: [“date-parts”: [“2001”; “11”]]; page: “657-9”; title: “Dorsal free graft urethroplasty for urethral stricture by ventral sagittal urethrotomy approach.”; type: “article-journal”; volume: “58”; uris: [“http://www.mendeley.com/documents/?uuiid=24e61b2a-a140-39c9-911f-68ac37d33afe”]]; mendeley: [“formattedCitation”: “[8]”; plainTextFormattedCitation”: “[8]”; previouslyFormattedCitation”: “[14]”; properties: [“noteIndex”: 0]; schema: “https://github.com/citation-style-language/schema/raw/master/csl-citation.json”].

com/citation-style-language/schema/raw/master/csl-citation.json"}, Barbagli, Kulkarni methods). The effectiveness of similar methods of replacement of the BMP plasticity varies greatly, reaching 92.9 % ($n = 14$) [19] [ISSN:"1699-7980"; PMID:"24948356"; abstract:"INTRODUCTION Urethroplasty with oral mucosa grafting is the most popular technique for treating nontraumatic bulbar urethral strictures; however, cases involving the membranous portion are usually treated using progressive perineal anastomotic urethroplasty. We assessed the feasibility of performing dorsal (or ventral. The limitation is the dissection of vessels and nerves, analogous to anastomotic methods, which can (30 % chance) lead to impaired erectile function or urinary incontinence [10].

Intraurethral replacement plastic [56]21 ANTA, described in 2012, is one of the most complex of substitute urethroplasty methods. This technique is performed with strictures of the proximal part of the bulbar urethra. In the BMP of the urethra this method is not applicable.

Rarer techniques such as endoscopic urethroplasty with a skin or mucosal flap with different fixation mechanisms have the advantage of being less invasive, but not sufficiently studied to talk about their success. Preliminary data are contradictory – the effectiveness was from 54.5 to 80 % [17, 31] endoscopic antegrade urethroplasty was performed in 11 patients with recurrent vesicourethral anastomotic strictures that developed after retropubic radical prostatectomy (RRP).

The most promising new method for the reconstruction of the posterior urethra is tissue-engineering surgery [16, 53] re-epithelialization, and remodeling that are limited by the size of the defect. Scar formation occurs because of an inability of native cells to regenerate over the defect before fibrosis takes place. We investigated the maximum potential distance of normal native tissue regeneration over a range of distances using acellular matrices for tubular grafts as an experimental model. MATERIALS AND METHODS Tubularized urethroplasties were performed in 12 male rabbits using acellular matrices of bladder submucosa at varying lengths (0.5, 1, 2, and 3 cm. In a pilot study [49] published in 2011, the results of the replacement of the BMP of the urethra in 10–14 year old boys with the use of tissue-engineered tubular flaps were analyzed. With a median follow-up of 71 months, the efficacy was 100 %. Similar results claim a new “gold standard” of assistance after a multicenter study [55].

CONCLUSION

Based on the review of currently used methods for treating of strictures of the BMP of the urethra, it is possible to draw a number of conclusions. First, DVIU is ineffective and dangerous operation, which can worsen the results of subsequent treatment and make the disease more difficult. Secondly, there is a significant group of patients for whom the performance of anastomotic reconstruction can lead to negative consequences due to damage to anatomical perineal structures (perineal muscles, urethral sphincter, vessels and nerves of the urethra and penis). Third, the methods of traditional substitution urethroplasty are inferior in effectiveness to anastomotic reconstructions, or are not available in

everyday urological practice for technical reasons (tissue-engineering surgery).

In summary, the stricture of the BMP of the urethra is a rare, but extremely urgent and dangerous pathology. The given conclusion is caused by technical complexity, low efficiency and heavy consequences of existing methods of treatment.

Thus, there is a need to develop a different, more effective method of helping patients with strictures of BMP of the urethra, the proximal part of the bulbar urethra or stenoses of anastomoses in the posterior urethra.

Conflict of interest

The authors declare no conflict of interest.

Transparency of the research

The study had no sponsorship. Researchers are fully responsible for providing the final version of the manuscript for publication.

Declaration on financial and other interactions

All authors participated in the development of the concept and design of the study and in the writing of the manuscript. The final version of the manuscript was approved by all authors. The authors did not receive a fee for the study.

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