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CLINICAL COURSE AND SURGICAL TREATMENT OF PARAURETHRAL CYSTS IN WOMEN

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The results of surgical treatment of 59 women (average age 31.9 ± 1.3 years) who underwent laser ablation of paraurethral cysts using the Lakhta-Milon laser apparatus (Russia) (diode laser with a wavelength of 0.97 μm) are presented. The postoperative period in all patients proceeded without serious complications. The average hospital stay was 1.7 ± 1.5 days. 4 weeks after surgery, all 59 patients noted improvement such as lack of dysuria, only 10 (16.9%) had minor discharge from the genital tract. 6 weeks after surgery all 59 operated patients had wound epithelization. Conclusion: The treatment of paraurethral cysts should be surgical and as radical as possible. The operation of choice is laser ablation of paraurethral formations.

Keywords: paraurethral cysts; laser ablation; Skene's glands.

КЛИНИЧЕСКОЕ ТЕЧЕНИЕ И ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ ПАРАУРЕТРАЛЬНЫХ КИСТОЗНЫХ ОБРАЗОВАНИЙ У ЖЕНЩИН

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Представлены результаты хирургического лечения 59 женщин (средний возраст 31,9 ± 1,3 года), которым выполняли лазерную абляцию парауретральных кист с использованием лазерного аппарата «Лахта-Милон» (Россия) (диодный лазер с длиной волны 0,97 мкм). Послеоперационный период у всех больных протекал без серьезных осложнений. Средняя длительность госпитализации составила 1,7 ± 1,5 дней. Через 4 недели после операции все 59 больных отмечали улучшение состояния — отсутствие дизурии, только у 10 (16,9 %) сохранялись незначительные выделения из половых путей. Через 6 недель после операции у всех 59 оперированных пациенток отмечалась эпителизация раны. Лечение парауретральных кист должно быть хирургическим и максимально радикальным. Операцией выбора является лазерная абляция парауретральных образований.

Ключевые слова: парауретральная киста; лазерная аблация; скиниевы железы.

INTRODUCTION

Paraurethral cyst is a benign lesion originating from glands located around the urinary tract. Female urethra measures 3–4 cm in length and 7–8 mm in diameter. The urethra, along its almost entire length, is adjacent to the anterior wall of the vagina. The proximal part of urethra is separated from the vagina by loose connective tissue, whose volume gradually decreases, and the urethra becomes embedded in the vaginal wall. At this part, the urethra could be easily palpated. Female urethra is surrounded by numerous paraurethral glands. The number of glands may be over 30. Paraurethral glands develop from the urogenital sinus and open predominantly into the distal part of the urethra [1]. Skene's glands are the largest paraurethral glands. These paraurethral glands

are named after Alexander Skene. Skene's glands were first described in 1672 by Dutch anatomist Regnier de Graaf. He was also the first to indicate the substantial similarity of these glands with the male prostate. Two centuries later, in 1880, American gynecologist Alexander Skene described paraurethral glands in detail and supposed its definite secretory function [2]. In 1947, a 3D model of paraurethral glands was created and used to determine the dimensions, number, and types of paraurethral ducts; the model also revealed paraurethral glands as a complex system of tubuloalveolar glands located predominately near external and internal urethral orifices and not regularly along the entire urethra [3].

Skene's glands are relatively large botryoidal plexuses which are homologous with the prostate gland. During sexual activity, these glands secrete a fluid containing prostate-specific antigen, prostate-specific acid phosphotase, zinc, and fructose [4, 5]. The role of paraurethral glands in women have been long considered as negligible. Currently, the supposed functions of Skene's glands is as a protective barrier for urethra during sexual intercourse due to its antimicrobial activity, providing local protection from microbial invasion [6]. Skene's glands undergo substantial changes in different periods of woman's life: hypertrophy during pregnancy, involution in postpartum period, and atrophy in menopause [7].

The incidence of paraurethral cystic lesions in women aged 20–60 years accounts for 1% to 6% [8]. Paraurethral cysts may commonly be confused with other diseases, predominantly with lower urinary tract infections.

The leading cause of paraurethral cysts is an obturation of one or several ducts of paraurethral glands [8]. In this case, a gland increases in size, and infection develops with abscess formation and subsequent drainage of abscess into the urethral lumen. The common causes of paraurethral cysts include inflammation and surgical interventions on the urethra. Urethral lesions may be secondary to delivery trauma or caused by surgical trauma during episiotomy or urinary tract surgical intervention [9].

Paraurethral cysts are commonly asymptomatic and found accidentally during gynecological examination. Symptoms develop in the setting of cyst infection and in large lesions. Clinical manifestation of infected paraurethral cyst has two stages. First, dysuria and urethral discharge appear. Then, with the development of chronic inflammation around the cyst, pelvic pain with dyspareunia may occur. For this stage of cyst evolution, the most common clinical signs include urine mixed with pus, foreign body sensation in urethra, induration, and pain in paraurethral area [9]. Acute urinary retention may develop in women with large paraurethral cysts.

Although several publications reported the successful non-surgical management of paraurethral cysts [10], surgery remains the main treatment modality [9]. Marsupialization, partial surgical resection, and transvaginal cyst dissection are suggested; however, most authors recommend complete excision [9, 11, 12]. Recurrence and post-operative complications, such as urethrovaginal and vesicovaginal fistulae, urethral stricture, urethral pain syndrome, urinary incontinence, recurrent urinary tract infection, and bleeding with hematoma, may develop.

This study aimed to investigate the efficacy and long-term outcomes of laser ablation of paraurethral cysts. This technique showed good results in treatment of other urinary tract diseases in women [13].

MATERIAL AND METHODS

A total of 59 females with paraurethral cystic lesions were examined and treated in an urology clinic in I.P. Pavlov First St. Petersburg State Medical University. The mean age was 31.9 ± 1.3 years, and the majority (51 (86.4%)) of patients were aged 20–50 years. The duration of disease varied from 6 months to 36 months (mean time, 9.44 ± 6.7 months). The cysts were in dimension of 10 mm to 30 mm (mean, 13.9 ± 5.2 mm). All patients with paraurethral lesions underwent the following studies: urethrocystoscopy, and transvaginal ultrasonography. During suspicion of a connection between the cyst and the urethra a voiding cystourethrography and contrast-enhanced magnetic resonance imaging of the pelvis were performed. No connection between the cyst and the urethra was confirmed. Gynecological examination revealed dimensions and location of paraurethral cysts. Physical examination commonly showed masses on anterior vaginal wall, and purulent discharge from the urethra was observed during palpation. Paraurethral cysts located in the distal third of the urethra in 45 (76.3%) patients, in the medial third in 9 (15.2%), and in the proximal third in 5 (8.5%) patients.

The differential diagnosis included vaginal cyst, urethral diverticulum, urethrocele, and urethral neo-

plasia for small and medium-size paraurethral cysts and cystocele for large paraurethral cysts. During gynecological examination, a metal bougie was inserted into a bladder, and in the presence of prolapsed anterior vaginal wall one could feel it by finger. During cystoscopy, a cystocele was associated with transillumination through the anterior vaginal wall, and cystic lesions were not.

All 59 women underwent a laser ablation of paraurethral cysts using the Lakhta-Milon laser apparatus (Russia) (diode laser with a wavelength of 0.97 μm). All surgeries were performed under a local infiltration anesthesia and total intravenous anesthesia.

The following surgical technique was used. The cyst was transected through the vaginal wall by contact insertion of laser waveguide, a cystic material was drained, and dropping cyst walls were excised (power of 4–6 W; continuous mode). Then, a laser ablation of the internal capsule with lower power in pulsed mode (3 W) was performed. Paraurethral cystic lesions in the medial and proximal thirds of the urethra were dissected on a metal bougie. Adherence to technical specifics allowed the decrease in the extent of thermal necrosis, which was particularly significant for manipulations with vaginal tissues and paraurethral area. The contact approach with tapered optic fiber tip is preferable to improve surgical precision and to decrease injury during ablation using continuous laser and diode laser. Movement of the tip on tissue should be performed with uniform speed. If the movement is stopped, the power supply should be disrupted to avoid a local enlargement of necrotic zone. For ablation with pulse laser, short powered pulses with low frequency are preferable to reduce thermal necrosis. Whereupon, a decline in heat distribution occurs deep in the tissue. For any laser (ablative and subablative modes) used for hemostasis, an irradiation time should be limited. If a bleeding continues for longer than 2–3 s from the onset of irradiation, power supply should be broken off and hemostasis should be achieved by conventional methods. The operative field is reasonable to be cooled with saline if necessary.

For area of laser ablation >4 cm^2, continuous or interrupted stich with slowly absorbable thread was applied on the cystic bed. Vaginal mucosa layer was closed with interrupted Donati stitch. An urethral Foley catheter was inserted for 24–48 h only in women with cystic lesions at the medial and proximal thirds of the urethra (14 patients).

The follow-up period after laser ablation was no less than 12 months.

RESULTS AND DISCUSSION

The analysis of patient history showed lower urinary tract infections to be the leading factor for the development of paraurethral cysts in the majority of patients (n = 47; 79.7%). The observed patients with paraurethral cysts had following complaints: palpable paraurethral mass (n = 42; 71.9%), painful (n = 49; 83.1%) and frequent (n = 22; 37.2%) urination, pelvic pain (n = 17; 28.8%), urethral discharge (n = 9; 15.2%), and dyspareunia (n = 12; 20.3%). Paraurethral mass caused an acute urinary retention in four (6.8%) patients.

No urethral injury was observed during the surgery. In the early post-operative period, a moderate dysuria represented by cutting pain during urination and scanty discharge from the genital tract was observed. No serious post-operative complications were noted. Antibacterial therapy (nitrofurans) was administered only in 14 patients, who had a permanent urinary catheter in the bladder. After the removal of the urinary catheter, natural urination was restored in all patients. The mean duration of hospital stay was 1.7 ± 1.5 days. Four weeks after surgery, no dysuria occurred in all 59 women, and minor genital discharge was observed in 10 (16.9%) patients. Cysts were over 20 mm in size in this group of patients. Six weeks after surgery, wound epithelization was observed in all 59 patients. No serious complications, including urethral injury and urethrovaginal and vesicovaginal fistulae, were observed.

Figures 1 and 2 show a paraurethral cyst before and on day 3 after laser ablation, respectively.

Twelve weeks after surgery, no complaints were received from 58 (98.3%) patients. One patient had a chronic urethritis; she received a treatment course with satisfactory outcome. For 12 months of follow-up, no recurrences of paraurethral cysts were noted.

Notably, wound after laser ablation of paraurethral cysts heals slowly for up to 4–6 weeks. A complete rejection of the gland capsule with its content and adhesion of surrounding tissues were observed as the main reason for the absence of recurrence. Laser wounds come with definite specifics. The mechanism of tissue laser cutting is a transformation of the light energy of infra-red quanta in the site of contact with first layers of cells into thermal energy with emerging of

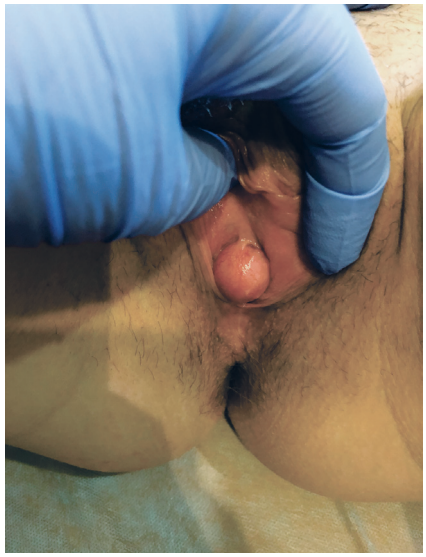

Fig. 1. Patient M., 46 years. Paraurethral cyst before surgery
Рис. 1. Больная М., 46 лет. Парауретральная киста до проведения операции

Fig. 2. Patient M., 46 years. 3rd day after laser ablation of the paraurethral cyst. Postoperative laser wound of the anterior vaginal wall
Рис. 2. Больная М., 46 лет. 3-и сут. после лазерной аблации парауретральной кисты. Послеоперационная лазерная рана передней стенки влагалища

extremely high temperature (300–600 °C). As the result, immediate evaporation of inter- and intracellular fluid with coagulative (dry) thermal necrosis with complete hemostasis and wound sterilization occur. A laser cut is sterile, providing another type of inflammatory response in reparative process, including aseptic proliferative inflammation with reduced exudation, and active early proliferation of mononuclear phagocyte and macrophage cell system programming the reparative process. At 24–36 h after laser irradiation, macrophages become activated. A functional role of macrophages is programming of a course of regeneration of laser wounds. Macrophages produce IgG and IgM, interleukin-1, prostaglandins, inducing the proliferation of fibroblasts and collagen synthesis, and stimulate neoangiogenesis. These factors provide aseptic proliferative inflammation [14]. The absence of leucocytic infiltration, stimulation of angio- and fibrillogenesis, and early development of granulations with following differentiation into fibrous tissue do not cause rough scar deformity in the post-operative period, which plays an important role for urethral surgery.

When using surgical lasers, two main principles occur: 1) high-intensity laser irradiation acts as scalpel, multi-type surgical device; 2) physical factor, possessing wide spectrum of biological effect. Main technical parameters of laser device include a wavelength, mode, and power of irradiation. The depth of impact on biological tissue depends on a wavelength. The more the power of irradiation is used, the more the thermal effect occurs [15]. The main physical factor of laser with a wavelength of 0.8–1.06 μm is a heat energy which emerges in the settings of interaction between laser irradiation and biological tissue. Diode laser irradiation is absorbed by chromophores, such as melanin, hemoglobin, and water. Corresponding with local absorption maximums of water and whole blood, the diode laser irradiation with wavelength of 0.97 μm reaches the depth of 0.5–2 mm in biological tissue, thereby properly combining cutting and hemostatic properties. For optimal laser irradiation, the correct proportion of its parameters – power, duration, and pulse frequency – is necessary in accordance with the basic concept of laser irradiation: high power provides the depth and speed of cutting and ablation; long pulse provides high heat input of light energy in tissue. The correlation of above-mentioned parameters results in integral effect: successful surgical resection with minimal thermal changes in tissues adjacent to the resection line (or surface) [16]. Continuous laser irradiation with wavelength of 0.97 μm and power of 4 W provides a scalpel effect with creation of incision, and pulse laser with power of 2 W results in predominantly ablative effect representing in superficial necrosis of epithelial layer [16].

CONCLUSION

The treatment of paraurethral cysts should be surgical and as radical as possible. Surgical treatment of these lesions in women should be performed in the period of minimal clinical signs. The surgery of choice

is laser ablation of paraurethral formations. Compliance with the laser surgery technique and appropriate post-operative management allow avoiding complications and recurrence.

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