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ORIGINAL PAPER

Genitourinary syndrome of menopause and intestinal microbiota

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Abstract

Introduction: Genitourinary syndrome of menopause (GSM) is one of the pathological symptoms of menopause, which causes significant physical, psycho-emotional, and sexual discomfort to a woman.

Material and methods: The study describes an examination of 65 middle-aged women, who were divided into 2 groups. Group I included 39 patients with GSM, who, depending on the duration of symptoms (3–5 years, more than 7 years), were divided into subgroups Ia and Ib. Group II included 26 patients who did not have clinical manifestations of GSM. All patients underwent general clinical studies. Bacteriological examination of faeces was used to assess the state of the intestinal microbiota.

Results: It was found that menopause occurred in women with GSM earlier, compared with patients without manifestations of urogenital disorders. Also, the women with GSM were more likely to be diagnosed with type 2 diabetes mellitus, metabolic syndrome, overweight, and iron deficiency anaemia. When analysing the results of a bacteriological study in this group of patients, a statistically significant decrease in the colonization of *Bifidobacterium* and *Lactobacillus*, as well as excessive bacterial growth of such conditionally pathogenic bacteria as *Escherichia coli* with reduced enzymatic activity, and *Klebsiella* and *Streptococcus* was revealed. Conclusions: Conducting a fundamental study on the characteristics of the intestinal microbiota in menopausal disorders will be an important step towards understanding the pathogenetic mechanisms of their formation, and correction of intestinal metabolism can become an important condition for effective prevention and treatment.

Key words: menopause, intestinal microbiota, genitourinary menopausal syndrome.

Introduction

One of the pathological symptoms of menopause is the genitourinary syndrome of menopause (GSM), which, according to statistical studies, appears by the age of 55 years in 49–52% of modern women, and by the age of 70 years this figure reaches 70–74% [1]. Genitourinary syndrome of menopause includes the following clinical symptoms: vaginal dryness, irritation and burning sensation, decreased pelvic floor muscle tone, vaginal prolapse, dysuria, acute and recurrent urinary tract infections, stress urinary incontinence (upon laughter, coughing, any physical activity), pollakiuria (urination more than 8 times a day), nocturia (more than one episode of urination per night), decreased libido, discomfort and pain during intercourse, and postcoital spotting [2]. Dryness of the vaginal mucosa is the earliest precursor of GSM and indicates the approach of other unpleasant symptoms that soon begin to appear one after another.

It should be noted that GSM causes not only significant physical and sexual discomfort in a woman, but also negatively affects her self-perception, motivational behaviour, social adaptation, professional activity, and daily life, reducing the quality of life in general [3].

According to numerous clinical studies, this syndrome tends to progress over time without timely preventive measures and therapeutic correction [4]. The frequency of development of GSM is directly proportional to the duration of the postmenopausal period.

According to the results of a multivariable logistic regression, which was carried out by several large clinical diagnostic centres, many factors influence the time of occurrence and severity of GSM, the most important of which are the initial hormonal background, the number of pregnancies and complicated births, inflammatory diseases of the organs of the lesser pelvis in history, reduced immunity, diet, body mass index, as well as excessive hygiene of the external genital organs or, conversely, its absence [5].

It should be noted that, at this stage of the study, GSM has not yet been clearly formulated, and only the most probable pathogenetic links in the formation of this pathology have been identified [6]. In this regard,

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there is no single consensus on the management and treatment of patients with GSM.

So, according to some clinicians, GSM is associated primarily with age-related changes in the body, namely with the progressive extinction of ovarian activity, which invariably leads to cascade neuroendocrine, metabolic, and, as a result, metabolic and trophic disorders [7]. According to this concept, hypoestrogenism as the leading aetiological factor of GSM causes ischaemic damage to the structures of the urogenital tract, thinning of the epithelium (the cells of the surface and intermediate layers disappear, only a thin layer of basal and parabasal cells, poor in glycogen), shifting of the pH of the vaginal secretion toward alkaline, and colonization of the urogenital tract by opportunistic and pathogenic bacteria, which contributes to the maintenance of a recurrent inflammatory process, and impaired proliferation of both the vaginal epithelium and the urothelium [8]. Consequently, pathogenetically appropriate methods of GSM correction according to this group of specialists are long-term local oestriol replacement therapy in monotherapy mode or personalized systemic menopausal hormone therapy [9].

According to another concept, the leading pathogenetic mechanism of GSM is not a progressive deficiency of sex steroids, but their sharp fluctuation, leading to oxidative stress, a permanent imbalance between the antioxidant defence system and free radical oxidation, destabilization of the vascular wall, endothelial damage, microcirculation disorders, ischaemia and, as a result, the development of degenerative processes in the tissues of the urinary tract [10].

Also, according to this group of researchers, age-related rhythmological discoordination of the hypothalamic-diencephalic structures and the limbic-reticular complex of the brain is a significant aetiopathogenetic factor of menopausal disorders [11]. The combined effect of these factors causes a stable dysfunction of endocrine-metabolic and trophic processes, as well as a progressive decrease in the reparative potential of tissues [12]. Recommendations for GSM treatment, according to this concept, include the use of local oestriol replacement therapy in monotherapy mode in combination with drugs focused on the normalization of rhythmological activity in the central nervous system [13].

There are also many studies in which genitourinary dysfunction during menopause is considered not from the point of view of hormonal imbalance, but in certain changes in receptor mechanisms that cause inflammation and tissue atrophy [14]. The studies focus on the fact that oestrogen therapy does not significantly affect the level of ERβreceptors, which prejudices the appropriateness of hormone replacement therapy.

To date, some scientists also do not exclude the aetiopathogenetic involvement of the intestinal microbiota in the pathophysiology of menopausal disorders [15]. A turning point for large-scale scientific studies of the intestinal microflora was the rapid development of such molecular genetic technologies as metagenomic and metatranscriptome sequencing, metaproteomics, and metabolomics [16]. These advanced research methods make it possible to identify the detailed taxonomic (phylogenetic) composition of the intestinal ecosystem, obtain a detailed analysis of the genetic material (metagenome) of microbial communities in the aggregate, which provides a unique opportunity to analyse their cause-and-effect changes more purposefully and thoroughly, study and refine the mechanisms of their functioning, activity, and metabolic connections, and, first and foremost, interaction with the macroorganism [17].

At this stage of the development of science, it is known that the intestinal microbiota is a unique and unusually complex ecosystem for each individual, which is a multicomponent community of bacteria, archaea, viruses, fungi, and protists, which dynamically changes depending on age, nutrition, hereditary factors, and influences of the internal and external environment [18]. It is important to note that the macroorganism and microflora, subject to their physiological functioning, are in a state of "ecological balance".

It should be emphasized that the microorganisms of the gastrointestinal tract have fundamentally similar needs for energy and nutrition sources; therefore, fiercely competing with each other, they are forced to constantly adapt to the changing conditions of coexistence, acquiring special mediator and metabolic properties. Thanks to this constant kaleidoscope of variable biochemical transformations, multi-vector enzyme cascades, which are ordered by multilevel regulatory systems, a fundamental and accentuated role of the intestinal microbiota in maintaining the vital activity of the body is formed [19].

At present, the scientific community is also actively discussing and studying such a concept as the gut-brain axis (GBA), which is a bidirectional neurohumoral system that regulates metabolic homeostasis by converting sensory information into neuronal, hormonal, and immunological reactions at the molecular, cellular, and organ levels [20]. According to researchers, this communication is carried out through intracellular (phagocytosis, endocytosis, etc.) processes, as well as remote and contact interactions of low molecular weight compounds, signalling molecules, and structural components of symbiotic bacteria with sensitive nerve endings located in loose fibrous connective tissue of lamina propria of the mucous membrane of the gastrointestinal tract. Thus, according to the results of clinical and experimental studies, intestinal bacteria promote secretion, and some independently secrete such paramount neurotransmitters as serotonin, melatonin, gamma-aminobutyric acid, norepinephrine, dopamine, histamine, and acetylcholine in the process

of metabolism. Gases synthesized by the intestinal flora (CO, NO, H_2S), as well as polyamines (spermine, spermidine, putrescine, cadaverine), which are products of its metabolism, are able to modulate brain functions, affecting cognitive functions, the hypothalamic-pituitary response to stressful situations, mood, and behavioural responses [21]. The microbiota also performs the enzymatic transformation of complex steroid compounds and nitrogen derivatives, which belong to the class of prohormones. And this is only a small descriptive fragment of the metabolic processes carried out by intestinal microorganisms within the framework of the functioning of GBA.

In addition, evidence has been accumulated indicating that a change in the composition of the intestinal flora initiates the formation of a syndrome of increased intestinal permeability (leaky gut syndrome) with activation of the inflammation system, coagulation factors, accumulation of active oxygen radicals, and impaired permeability of the mucosa of the gastrointestinal tract, and increased translocation of bacteria and lipopolysaccharides from the intestine, which determines the most important role of the microbiota in the pathophysiology of many diseases in connection with so-called "endotoxin aggression" [22].

Thus, at present, there is no doubt about the participation of the intestinal microbiota in the aetiopathogenesis of many pathological conditions in the body. According to generally accepted conceptual views, GSM is a chronic degenerative-dystrophic process in the vulva, perineum, vagina, urethra, and bladder of a woman, caused by a progressive oestrogen deficiency. However, many researchers still do not agree with such an unambiguous position and state the multicomponent nature of the aetiopathogenetic mechanisms of GSM. In particular, the study of the role of the intestinal microbiota in the initiation and development of menopausal disorders is an interesting and promising trend; therefore, it is attracting the attention of modern researchers.

Material and methods

A total of 65 middle-aged women (45–59 years old) took part in the present study. It was of interest for us to examine this particular age group of patients because during this period most women are socially in demand, having the opportunity to realize their professional experience in full and realize their creative potential, and they are also sexually active.

The patients were divided into 2 groups. Group I included 39 patients who were diagnosed with GSM on the basis of complaints of dryness, irritation and burning sensation in the vagina, episodes of stress urinary incontinence, nocturia, decreased libido, discomfort during sexual intercourse, as well as the results of a gynaecological examination (decrease in the tone of the muscles of the pelvic bottom, prolapse of the vaginal walls, etc.).

Depending on GSM duration, this group was divided into 2 subgroups:

- Ia (n = 22) – duration of manifestations of GSM for 3–5 years,
- Ib (n = 17) – duration of manifestations of GSM for more than 7 years.

Group II (control group) included 26 patients who did not have clinical manifestations of GSM.

All patients underwent general clinical studies according to the recommendations of modern clinical protocols (complete blood count, a comprehensive metabolic panel, coagulation tests, ECG, etc.).

To help diagnose iron-deficiency anaemia, complete blood count, haemoglobin concentration, red blood cells (RBC) mean corpuscular volume, RBC mean corpuscular haemoglobin, blood iron levels, and ferritin levels were used [23, 24].

The menopause rating scale (MRS) was used to determine the severity of menopause symptoms [8]. To assess the state of changes in the urogenital tract, the scale of the vaginal health index of Gloria Bachmann was used [25].

The state of the intestinal microbiota was assessed by bacteriological examination of faeces. The content of the main representatives of the obligate microflora was determined, namely *Bifidobacterium*, *Lactobacillus*, *Escherichia coli* with normal enzymatic activity, *Streptococcus viridans*, *Bacteroides*, etc. and facultative (conditionally pathogenic) microorganisms – pathogenic strains of *Escherichia coli*, representatives of the genera *Proteus*, *Klebsiella*, *Enterobacter*, *Citrobacter*, *Clostridium*, *Staphylococcus epidermidis*, *Candida albicans*, etc. All examined patients followed a certain diet for 3 days before sampling, excluding food products that promote fermentation processes in the intestines, as well as alcohol and drugs (antibiotics). At least 10 hours passed from the moment of the last meal to the taking of the material. Samples for the study were placed in sterile glassware and delivered to the laboratory no more than 2 hours later. The interval between taking the biomaterial and the start of inoculation did not exceed 3–4 hours. A portion of faeces (0.5–1.0 g) was added to a sterile pre-weighed test tube, and after repeated weighing, the weight of the sample was determined. After a series of successive dilutions, inoculations were made on various nutrient media. Quantitative accounting of the grown microorganisms was carried out by calculating 1 g of faeces, taking into account the dose of the inoculated material and the degree of its dilution.

To process the results of the study, the method of variation statistics and nonparametric methods were used using Excel-2000 and Statistica for Windows v.6.0 software.

Table 1. Features of somatic and gynaecological history in patients suffering from genitourinary syndrome of menopause (subgroup Ia, Ib) and control group (group II)

Features of somatic and gynaecological history	I group, *n* = 39				II group, *n* = 26	
	Ia subgroup, *n* = 22		Ib subgroup, *n* = 17			
	Abs.	%	Abs.	%	Abs.	%
Age of the patients						
45–50 years old	**8**	36.4	**3**	17.6	**8**	30.8
51–55 years old	**5**	22.7	**4**	23.5	**7**	26.9
56–59 years old	9	40.9	10	58.9	11	42.3
Quantity of female patients in menopause	15	68.2	12	70.6	12	46.2
Average age of menopause beginning	50.3 ±2.0		50.9 ±1.9		56.5 ±1.7	
Inflammatory diseases of the pelvic organs	8	36.4	11	64.7	5	19.2
Precancerous lesions of cervix	3	13.6	2	11.8	2	7.7
Premenstrual syndrome	9	40.9	9	52.9	2	7.7
Uterine leiomyoma	4	18.2	3	17.6	–	–
Benign ovarian tumours	3	13.6	4	23.5	–	–
Polycystic ovary syndrome	–	–	1	5.9	–	–
Abnormal uterine bleeding	3	13.6	5	29.4	1	3.8
Total number of gynaecological operations	9	40.9	13	70.6	3	11.5
Childhood infections	19	86.4	16	94.1	21	80.8
Diseases of the respiratory organs (chronic tonsillitis, chronic bronchitis, etc.)	5	22.7	3	17.6	3	11.5
Cardiovascular diseases (arterial hypertension, ischaemic heart disease, varicose disease)	5	22.7	5	29.4	3	11.5
Diseases of the digestive system (chronic pancreatitis, chronic cholecystitis, chronic hepatitis, chronic colitis)	4	18.2	3	17.6	2	7.7
Blood diseases (iron deficiency anaemia)	8	36.4	10	58.8	5	19.2
Diseases of the urinary system (chronic cystitis, chronic pyelonephritis, urolithiasis)	4	18.2	4	23.5	3	11.5
Endocrine diseases (diabetes mellitus type 2, metabolic syndrome, obesity)	5	22.7	5	29.4	–	–

Results

The first step of our investigation was the study of somatic and gynaecological history of the patients (Table 1).

The average age of women in subgroup Ia was 52.7 ±4.8 years, subgroup Ib 54.6 ±4.1 years, and group II 53.1 ±4.3 years. At the time of the study, 15 (68.2%) patients in subgroup Ia were in the menopause period, subgroup Ib 12 (70.6%), and group II 12 (46.2%). An interesting observation was the fact that the average age of menopause in patients who did not suffer from symptoms of GSM was 56.5 ±1.7 years, i.e. it was significantly higher. In patients from subgroup Ia, this index was 50.3 ±2.0 years, and in subgroup Ib it was 50.9 ±1.9 years (pIa-II = 0.027, pIb-II = 0.039, pIaIb > 0.05).

The women with GSM (Ia and Ib subgroups) also had a burdened gynaecological history and, as a result, the total number of gynaecological operations in patients of subgroup Ia was 3.6 times higher compared to the control group, and in subgroup Ib it was 6.1 times higher.

The analysis of somatic pathology revealed the following features: iron deficiency anaemia was diagnosed 1.9 and 3.1 times more often in patients of subgroups Ia and Ib, respectively, as well as such endocrine and chronic metabolic diseases as type 2 diabetes mellitus, metabolic syndrome, and obesity.

The next step of the study was to assess the severity of menopausal symptoms and determine the degree of age-related changes in the urogenital tract in the patients under examination. Thus, menopausal women were asked to fill in a MRS. According to the results of the calculation, the symptoms of menopause were most pronounced in women of subgroup Ib (15.7 ±1.9 points), whereas in patients of subgroup Ia this indicator was 11.4 ±1.7 points and did not differ significantly (pIaIb = 0.100). In the control group, menopausal

symptoms were assessed as mild, on average 3.3 ±1.0 points (pIb-II < 0.01, pIa-II < 0.01).

Also, all patients underwent a determination of their vaginal health index according to Gloria Bachmann. Most of the women from subgroup Ib showed signs of severe urogenital atrophy (1.3 ±0.5 points). In the women of subgroup Ia, this indicator was statistically significantly higher (2.8 ±0.4 points, pIaIb = 0.025), which led to the conclusion that the manifestations of urogenital atrophy worsened with an increase in the duration of GSM (more than 7 years). In the group II patients, the vaginal health index was 3.9 ±0.3 points (pIb-II < 0.01, pIa-II = 0.033).

The main stage of the investigation was the study of the characteristics of the intestinal microbiota in patients of the examined groups (Table 2).

It was found that in patients suffering from GSM, there was an imbalance in the intestinal microbiota compared with the control group. Thus, there was a significant decrease in such representatives of the obligate microflora as *Bifidobacterium* and *Lactobacillus*. In patients from group II, the content of *Bifidobacterium* was within (54.25 ±7.31) × 10^8, and for *Lactobacillus* – (18.67 ±4.56) × 10^6. In women suffering from GSM for no more than 7 years, the data indices were within (17.69 ±5.15) × 10^8 (pIa-II < 0.01) and (6.47 ±1.92) × 10^6 (pIa-II = 0.018), in patients with a duration of GSM manifestations of more than 7 years they were (15.76 ±4.33) × 10^8 (pIb-II < 0.01) and (4.29 ±1.21) × 10^6 (pIb-II = 0.004), respectively. In addition, there was a significant increase in the number of strains of opportunistic microorganisms such as *Streptococcus viridans*, *Klebsiella*, as well as *Escherichia coli* with reduced enzymatic activity. In patients of the control group, the content of *Streptococcus viridans* was within (0.35 ±0.11) × 10^6, *Klebsiella* – (0.30 ±0.04) × 10^5, and *Escherichia coli* with reduced enzymatic activity – (12.45 ±3.26) × 10^6. In women of subgroup Ia, the content of these opportunistic microorganisms was significantly higher – (0.71 ±0.12) × 10^6 (pIa-II = 0.032), (1.39 ±0.19) × 10^5 (pIa-II < 0.001), and (29.04 ±6.54) × 10^6 (pIa-II = 0.028), respectively. Similar results were obtained when analysing the intestinal microbiota in patients of subgroup Ib- (0.83 ±0.10) × 10^6 (pIb-II = 0.002), (2.01 ±0.34) × 10^5 (pIb-II < 0.001), and (27.60 ±5.21) × 10^6 (pIb-II = 0.018).

Thus, the result of our study was the identification of certain disorders of the intestinal microbiota in patients suffering from symptoms of GSM. It is possible to suggest that reduced colonization of *Bifidobacterium* and *Lactobacillus*, as well as overgrowth of opportunistic bacteria such as *Escherichia coli* with reduced enzymatic activity, and *Klebsiella* and *Streptococcus* may affect the highly selective semi-permeable intestinal barrier with the formation of leaky gut syndrome. According to modern scientific concepts, the development of this syndrome slows the metabolism, causes a lack of vitamins, minerals, and amino acids, causes immune dyscrasia, and initiates the processes of chronic systemic inflammation, which, interfering in interactions in the gut-brain axis, can be one of the leading biological markers of body aging and an important pathogenetic factor of age-related diseases.

Discussion

The effectiveness of the treatment of any disease or pathological condition depends primarily on the aetiopathogenetic orientation of therapy.

In the early 2000s, several studies were conducted to evaluate the effectiveness of oestrogen monotherapy in women with GSM. At that time, the pathogenetic rationale for the use of oestriol for the correction of urogenital atrophy did not raise doubts, because the scientific community was dominated by the concept according to which GSM was considered to be the result of a progressive depletion of the ovarian follicular reserve with the formation of an oestrogen-deficient state [26]. However, accumulated clinical experience and analysis of retrospective studies have shown that when hormonal therapy is discontinued, the symptoms of GSM not only recur, but also intensify [27, 28]. In this regard, the assertion that local oestrogens are the "gold standard" for the treatment of GSM began to be reasonably questioned [29].

Currently, more and more researchers consider GSM to be a consequence of age-related polyhormonal insufficiency, namely, a staged and sequential decrease in secretion, first of progesterone, then of androgens and oestrogens [30]. According to this concept, progesterone deficiency plays an important trigger role, triggering a cascade of sequential reactions in the processes of cellular and systemic aging, which opens new opportunities for optimizing GSM pharmacotherapy.

It should also be emphasized that the rapid development of nanotechnologies in biology and medicine has contributed to a certain change in the ideas of scientists about the dynamics of life processes. According to modern views, the human body is a symbiotic community of numerous eukaryotic cells and various microorganisms, the optimal number, ratio, functioning, and interaction of which in specific environmental conditions determine its health [31].

The results of our study showed that in the women with GSM there was a significant inhibition of the growth of "beneficial" microflora, accompanied by excessive reproduction of various types of opportunistic microorganisms. It is quite possible that a more in-depth study of the intestinal microbiota in this pathology will become an important step towards understanding the pathogenetic mechanisms of the formation of GSM, and the impact on the intestinal microbiota may become a significant condition for the effective prevention and treatment of this pathological condition.

Table 2. The content of intestinal microorganisms in 1 g of faeces in patients with genitourinary menopausal syndrome (subgroup Ia, Ib) and in women of the control group (group II)

Microorganisms	Group I, *N* = 39		Group II, *n* = 26
	Subgroup Ia, *n* = 22	Subgroup Ib, *n* = 17	
Bifidobacterium ($\times 10^8$)	17.69 ±5.15 (pIa-Ib = 0.776) (pIa-II < 0.01)	15.76 ±4.33 (pIb-II < 0.01)	54.25 ±7.31
Lactobacillus ($\times 10^6$)	6.47 ±1.92 (pIa-Ib = 0.343) (pIa-II = 0.018)	4.29 ±1.21 (pIb-II = 0.004)	18.67 ±4.56
Escherichia coli with reduced enzymatic activity ($\times 10^6$)	29.04 ±6.54 (pIa-Ib = 0.864) (pIa-II = 0.028)	27.60 ±5.21 (pIb-II = 0.018)	12.45 ±3.26
Bacteroides ($\times 10^8$)	18.29 ±3.79 (pIa-Ib = 0.667) (pIa-II = 0.556)	15.88 ±4.07 (pIb-II = 0.400)	23.63 ±8.16
Streptococcus viridans ($\times 10^6$)	0.71 ±0.12 (pIa-Ib = 0.447) (pIa-II = 0.032)	0.83 ±0.10 (pIb-II = 0.002)	0.35 ±0.11
Enterococcus faecium ($\times 10^6$)	34.28 ±7.53 (pIa-Ib = 0.609) (pIa-II = 0.488)	40.01 ±8.18 (pIb-II = 0.839)	42.50 ±9.02
Staphylococcus epidermidis ($\times 10^4$)	0.91 ±0.17 (pIa-Ib = 0.150) (pIa-II = 0.406	0.62 ±0.10 (pIb-II = 0.424)	0.74 ±0.11
Klebsiella ($\times 10^5$)	1.39 ±0.19 (pIa-Ib = 0.120) (pIa-II < 0.001)	2.01 ±0.34 (pIb-II < 0.001)	0.30 ±0.04
Candida albicans ($\times 10^4$)	0.73 ±0.19 (pIa-Ib = 0.364) (pIa-II = 0.835)	1.08 ±0.33 (pIb-II = 0.718)	0.85 ±0.54
Enterobacter ($\times 10^3$)	2.24 ±0.61 (pIa-Ib = 0.490) (pIa-II = 0.678)	1.76 ±0.32 (pIb-II = 0.719	1.94 ±0.38
Citrobacter ($\times 10^3$)	1.54 ±0.32 (pIa-Ib = 0.919) (pIa-II = 0.624)	1.49 ±0.37 (pIb-II = 0.732)	1.33 ±0.28
Clostridioides difficile ($\times 10^5$)	0.22 ±0.07 (pIa-Ib = 0.595) (pIa-II = 0.363)	0.29 ±0.1 1(pIb-II = 0.227)	0.15 ±0.03
Proteus ($\times 10^3$)	1.02 ±0.29 (pIa-Ib = 0.679) (pIa-II = 0.575)	0.86 ±0.25 (pIb-II = 0.842)	0.78 ±0.31

Conclusions

Modern medicine has in its arsenal various options for treating GSM, including surgical treatment, laser technology, and local or systemic hormone replacement therapy [32, 33]. But the problem of effective pathogenetic pharmacotherapy of GSM in women has not been fully resolved. Therefore, according to experts, the need to revise the GSM formation paradigm has become obvious. It is quite possible that not only age-related deficiency of sex steroids, but also altered intestinal homeostasis interfere with the pathogenetic outline. It is known that an indispensable condition for the normal functioning of the body is to maintain the physiological constancy and activity of the intestinal microbiota. Influencing the intestinal metabolism can become a new therapeutic strategy in the prevention and treatment of genitourinary syndrome in order to ensure a high quality of life for women at any age.

Disclosure

The authors report no conflict of interest.

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