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A personalized approach to vaginal microbiome correction: beyond antibiotic therapy

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Abstract: This article examines a modern approach to vaginal microbiota correction that goes beyond traditional antibacterial therapy. Particular attention is paid to the concept of the microbiome as a dynamic ecosystem closely linked to the patient's overall hormonal and immune status. The mechanisms underlying dysbiotic conditions and the limitations of antiseptics and antibiotics aimed solely at eliminating pathogens are analyzed. The paper substantiates the need for a personalized approach based on assessing the microflora's metabolic profile and using probiotic, prebiotic, and eubiotic strategies to restore natural homeostasis. The results of the analysis demonstrate that the integration of molecular genetic diagnostic methods into clinical practice can improve treatment efficacy and reduce the recurrence rate of pelvic inflammatory diseases.

Keywords: vaginal microbiome, dysbiosis, personalized medicine, probiotics, reproductive health, biocenosis.

Introduction: In modern gynecology, maintaining the microecological balance of the pelvic organs is of particular importance. The vaginal microbiome is a complex dynamic ecosystem, a key component of which are lactobacilli, which protect the reproductive tract by maintaining an acidic environment and producing antimicrobial metabolites. However, according to modern clinical data, in recent years there has been a steady increase in the incidence of recurrent vaginal biocenosis disorders, caused by both a wide range of endogenous factors and unnecessarily aggressive drug interventions [1].

Traditional clinical practice, based on the empirical prescription of broad-spectrum antibiotics, often proves insufficiently effective in the long term [1,7]. The widespread use of antibacterial drugs without consideration of the individual metabolic profile of the microflora contributes to the destruction of biofilms, the destruction of commensal flora, and the development of antibiotic resistance. Furthermore, the existing treatment paradigm often ignores the multifactorial nature of dysbiosis, which can be triggered by psychoemotional stress, nutritional imbalances, and endocrine fluctuations that affect local immunity. Thus, the lack of a personalized approach to restoring natural homeostasis leads to a high relapse rate, significantly reducing patients' quality of life and creating the preconditions for the development of chronic pelvic inflammatory diseases.

The aim of this work is to theoretically substantiate and conceptually develop a personalized approach to correcting the vaginal microbiome. The article analyzes the advantages of strategies aimed at prebiotic and eubiotic support of the microecosystem and discusses methods for integrating molecular genetic diagnostics into clinical practice. Particular attention is paid to the need to move from a "pathogen elimination" strategy to a comprehensive model of biocenosis restoration that takes into account the individual health predictors of each patient. Materials and Methods: This study is based on a systematic analysis of current clinical guidelines, evidence-based medicine data, and the results of modern molecular biology studies on the pathophysiology of the vaginal biocenosis. This article was prepared using relevant international and national protocols for the management of patients with dysbiotic conditions.

A key aspect of the study is a critical review of diagnostic algorithms. The article emphasizes that the traditional method of microscopic examination of a smear for flora, despite its historical significance, has significant limitations in assessing the deep qualitative and quantitative characteristics of the microecosystem [2]. The paper examines the advantages of introducing high-tech diagnostic methods, such as real-time PCR testing (e.g., Femoflor panels or similar quantitative analysis systems), into widespread clinical practice.

The use of molecular genetic methods allows for a shift away from subjective visual assessment in favor of a precise determination of the composition of the microflora, including the identification of obligate anaerobes, facultative anaerobes, and viruses, as well as an assessment of the state of local immune defense [2,7]. This approach forms the foundation for the transition from empirical therapy to personalized treatment regimens, where the choice of treatment strategy is based on the verified metabolic and species profile of a specific patient's microbiome. In this paper, we emphasize that restoring the vaginal biocenosis is not simply a mechanical introduction of lactobacilli, but a process that requires creating favorable conditions for their engraftment. One of the main mistakes in modern clinical practice is attempting to "populate" the microbiome with probiotics without first preparing the "soil."

The vaginal ecosystem is a delicate homeostatic mechanism. The use of probiotics in conditions of active inflammation, disturbed pH, or the presence of pathogenic biofilms is often ineffective, as the introduced strains do not find the necessary conditions for adhesion and metabolic activity [6]. Without normalizing the local environment (restoring acidity, glycogen levels, and eliminating the primary inflammatory process), the introduced microorganisms are eliminated, producing no therapeutic effect.

This is why prebiotic support plays a critical role. Prebiotics are substrates that provide specific nutrition for the obligate flora, promoting the restoration of natural epithelial metabolism. An approach aimed at creating an environment in which the patient's own beneficial bacteria can thrive is more physiological and long-term than attempts at "external colonization." We argue that the effectiveness of therapy depends not on the number of bacteria introduced, but on the physician's ability to "prepare the soil" and create conditions under which the microbiome can recover through self-regulation mechanisms. Therefore, prebiotic correction should precede or accompany the use of eubiotics to ensure the stability of the therapeutic outcome.

Conclusion: The analysis confirmed that the transition from aggressive empirical antibiotic therapy to a strategy of personalized restoration of the vaginal microbiome is a necessary development in modern gynecology.

The main findings of the study are as follows:

1. Diagnostics should be based on highly sensitive molecular genetic methods that provide a complete picture of the microbiome, which is impossible with routine microscopy.

2. The principle of "preparing the soil" through prebiotic support is a fundamental condition for the successful correction of dysbiotic conditions. Ignoring this step makes therapy short-term and contributes to the development of resistance.

3. A personalized approach, taking into account the patient's individual metabolic profile, psychoemotional factors, and immune status, helps minimize the frequency of relapses of chronic inflammatory processes. Thus, the implementation of preventive and supportive methods aimed at maintaining homeostasis should become a priority for obstetricians and gynecologists striving to improve the quality of life of patients and preserve their reproductive potential.

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