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PATHOLOGICAL CHANGES IN THE VAGINAL MICROBIOTA

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Abstract. Preterm birth (PBB) is a leading cause of perinatal mortality and morbidity, associated with the need for neonatal intensive care, long-term neurological and respiratory complications, and increased healthcare costs.

Although the etiology of MOT is multifactorial, in recent years it has been increasingly confirmed that the infectious-inflammatory pathway, especially the disruption of the microecology of the lower genital tract, is an important link in the pathogenesis of MOT.

Keywords: pregnancy, dysbiosis, bacterial vaginosis, preterm labor, candidiasis

During pregnancy, the vaginal microbiota usually switches to a Lactobacillus-dominant state, creating a low pH and protection against colonization.

However, in some women, dysbiosis, an increase in anaerobes typical of bacterial vaginosis, a decrease in L. crispatus, or a predominance of L. iners-dominant profile persist, and these conditions have been shown to be associated with the risk of spontaneous MOT and PPROM. Therefore, the detection of early changes in the vaginal microbiocenosis is a promising direction for the early assessment of MOT and timely planning of preventive measures. The group of women who are pregnant for the first time (primigravida) is particularly relevant: since they have no previous births in their reproductive history, “classical” clinical prognostic indicators may be limited.

Evidence that parity and gestational age affect the composition of the vaginal microbiota reinforces the need for a separate assessment of microbiota markers in primigravida women. In addition, early identification of infectious risks during the first pregnancy may serve to prevent not only MOT, but also recurrent complications in subsequent pregnancies. Therefore, the topic “Features of the vaginal microbiocenosis in primigravida women and its association with the risk of preterm birth” is of practical importance in terms of prevention, early screening and individual risk stratification.

Data obtained in this area in the local population (regional microbiota characteristics, antibiotic use, social factors) will allow to improve clinical algorithms and scientifically substantiate strategies for the prevention of MOT. Pathogenesis link: dysbiosis → inflammation → cervical/membrane weakening. In conditions of dysbiosis enriched with anaerobes, weakening of the epithelial barrier, activation of TLR/NF-κB signaling and an increase in proinflammatory cytokines such as IL-1β, IL-6, IL-8 can lead to increased prostaglandin synthesis and collagen degradation; this increases the risk of cervical ripening and PPROM/MOT [1,10]. Clinical practice: diagnosis and risk stratification.

The main methods for assessing the vaginal microbiota in practice are: (1) pH and microscopy (Gram/Nugent), (2) NAAT/PCR for STIs, (3) extended microbiota analysis (16S or metagenomics). Recent work has shown that CST classification and machine learning models, when combined with existing clinical markers (cervical length, medical history), increase prognostic accuracy. The vaginal microenvironment is crucial for women’s reproductive health and overall well-being, and it has a multi-layered defense system [4]. At the heart of this defense system is the vaginal microbiota, which is mainly formed by Lactobacillus species [1, 4]. A healthy vaginal microbiota acts as a

barrier against pathogens, while also producing metabolic products that prevent bacterial and viral infections.

However, this delicate balance can be disrupted by various internal and external factors, leading to dysbiosis [1, 4]. Literature review The vaginal microbiota is an important indicator of women's health, and its composition and function have been studied in depth in recent years using modern molecular methods [3]. A healthy vaginal ecosystem is typically characterized by a dominance of Lactobacillus species, in particular L. crispatus, L. gasseri, L. jensenii, and L. iners, in approximately 70% of women [1, 4]. These lactobacilli convert glycogen to lactic acid and maintain a low (acidic) vaginal pH, which limits the growth of pathogenic microorganisms [4, 6]. They also produce hydrogen peroxide and bacteriocins, forming a protective barrier against bacterial and viral pathogens.

Lactobacillus-dominant microbiota is a valuable biomarker of a healthy vaginal ecosystem [1]. The vaginal flora is divided into dynamic Community-State Types (CSTs) [3]. Lactobacillus species, especially L. crispatus-dominant CSTs, are closely associated with vaginal health, while other CSTs are correlated with reproductive health and sexually transmitted diseases [3]. A study of North American women identified five major CSTs: four Lactobacillus-dominant (found in 73% of women) and various CST IVs in the remaining 27% [3]. The dynamics and stability of the vaginal microbiota are influenced by many factors. These include modifiable factors (e.g., sexual behavior, hygiene, diet, probiotics, hormone replacement therapy, smoking, alcohol consumption, psychosocial stress) and non-modifiable factors (e.g., race or ethnicity, age).

Hormonal contraception and personal hygiene have been shown to promote eubiosis [5]. Methodology Various methodological approaches have been used to study the vaginal microbiota. Traditional methods include the Nugent scoring and Amsel criteria, which are based on microscopic analysis [1]. However, these methods have limited ability to determine the complete composition of the microbiota. In recent years, molecular analysis methods, especially culture-independent techniques, have significantly expanded our understanding of the vaginal microbiota [1, 3]. Methods such as real-time quantitative PCR (qPCR) allow us to determine the distribution and abundance of certain Lactobacillus species [2]. The central role of the vaginal microbiota in women's health is undeniable. The dominance of Lactobacillus species ensures eubiosis and provides an effective defense mechanism against many pathogens [1, 4, 6]. The prevalence of dysbiosis and its negative impact on reproductive health increase the relevance of research and clinical interventions in this area [6]. The impact of factors such as lifestyle factors, hormonal status, and ethnicity on the composition of the microbiota serves as an important basis for the development of personalized medicine approaches.

The vaginal microbiota is fundamental to women’s health, and the dominance of Lactobacillus species is a key marker of a healthy ecosystem. Dysbiosis is closely linked to a wide range of common gynecological diseases and reproductive problems. Factors such as lifestyle, hormonal status, and ethnicity significantly influence the composition of the microbiota. Modern molecular methods are helping to understand the complex dynamics of the vaginal microbiota. Vaginal candidiasis infections are a common concern for women worldwide, including millions of Indian women each year. Although highly treatable, the discomfort, discomfort, and misconceptions associated with this condition can make many women anxious or even hesitant to seek help. Understanding vaginal candidiasis infections, their causes, how to recognize them, and when to seek professional advice is essential for women’s comfort, well-being, and overall health.

Vaginal candidiasis, also known as vulvovaginal candidiasis, is caused by an overgrowth of a fungus called candida, usually Candida albicans, in the vaginal area. Although Candida naturally

lives in small amounts in the vagina, various factors can upset this balance, leading to an overgrowth of the fungus and uncomfortable symptoms. Vaginal candidiasis infections are not sexually transmitted diseases, but sexual activity can sometimes trigger symptoms. Most women will experience at least one episode during their lifetime, and some will experience recurrent infections. Candidiasis infections are very common - statistics show that almost 75 percent of women will experience at least one vaginal candidiasis infection during their lifetime, and about 40-50 percent will experience two or more episodes. Recent studies and reports from gynecologists in India suggest that urban lifestyle changes, antibiotic use, and a hot climate have increased the incidence of candidiasis infections among Indian women of all ages.

Causes and risk factors for vaginal candidiasis infection

The most common cause of vaginal candidiasis is an imbalance of bacteria and yeast in the vagina, allowing the Candida fungus to grow. Some of the main causes and risk factors are:

Frequent use of antibiotics (for illnesses such as fever, cough or skin infections) can reduce the "good bacteria" (lactobacilli) that keep candidiasis at bay. Poor genital hygiene Washing the vaginal area with strong soaps or harsh chemical cleaners can disrupt the protective bacterial balance.

Wearing wet or sweaty clothing - common in hot and humid Indian summers or after a long trip - creates a warm environment that encourages candidiasis to grow.

Uncontrolled blood sugar, especially common in urban India, provides food for candidiasis to develop Hormonal changes. Pregnancy, menstruation, or use of hormonal contraceptives (such as birth control pills) can increase sensitivity due to hormonal changes. Postmenopausal women may be more susceptible due to decreased estrogen levels and thinning vaginal tissue. Wearing tight jeans, leggings, or synthetic (non-cotton) underwear can trap moisture.

A weakened immune system (due to stress, illness, certain medications, or untreated HIV infection) may increase the risk.

Symptoms of a vaginal yeast infection: signs to look out for

Symptoms of a vaginal yeast infection can range from mild discomfort to severe irritation, depending on the severity of the infection. Common symptoms include:

Severe itching or burning in or around the vagina and vulva Thick, white, "cottage cheese" discharge, usually odorless Redness, swelling, or pain in the vaginal and vulvar tissues A rash or small red spots on the vulva Burning sensation when urinating, especially when urine comes into contact with inflamed skin Pain or discomfort during sex Watery vaginal discharge (less common, but can occur in some cases) Vaginal discharge with a yeast infection is usually odorless. A strong "fishy" odor usually indicates another infection, such as bacterial vaginosis. Experiencing four or more yeast infections in a year (recurrent infection). Having uncontrolled diabetes. Having a weakened immune system (such as due to HIV infection or certain medications). Symptoms advice Although it may be possible, especially with the first infection or severe symptoms - it is important to consult a gynecologist for a proper diagnosis.

Diagnostic Steps:

Medical History: The doctor will ask about symptoms, recent medications, diabetes status, hygiene habits, and sexual activity. Physical Examination: A visual examination of the vulva and vagina. Laboratory Tests: A sample of vaginal discharge may be examined under a microscope to look for yeast cells and rule out other causes.

Almost all uncomplicated vaginal candidiasis infections can be effectively treated with an over-the-counter or prescription anti-yeast infection medication.

Antifungal Medications for Vaginal Candida Infection

Topical Antifungals: Creams, ointments, and tablets (pessaries) applied to the vagina; examples include clotrimazole and miconazole. Oral Antifungals: Fluconazole tablets, usually as a single dose, but sometimes extended for more severe/recurrent cases. Complete the Full Course

Always finish the recommended course to prevent recurrence, even if symptoms improve quickly. Avoid using any remaining medication without advice.Special Conditions. Pregnant women: Prefer topical treatments over oral antifungals. Recurrent infections: Long-term or intermittent therapy may be required.

Although vaginal candidiasis infections are common, there are many steps you can take to reduce your risk and prevent recurrence.

Summary. Maintain proper hygiene: Wash your external genitals only with a mild, unscented soap. Avoid harsh cleansers or antiseptics. This is especially important during hot, humid summers. Wear breathable fabrics. Choose soft, cotton underwear and avoid tight synthetic clothing that traps heat and moisture. Change sanitary products regularly: Change pads, tampons, and panty liners frequently during menstruation to keep the area clean and dry. Douching, vaginal sprays, and perfumed products disrupt the natural balance of bacteria and candida. If you have diabetes, control your blood sugar levels to reduce your risk. Limit sugar intake: High-sugar diets encourage candida overgrowth. Antibiotics: Should only be used as directed by a doctor. Unnecessary or prolonged use of antibiotics can kill protective bacteria. Laundry and hygiene during infection: Wash clothes, underwear, and towels in hot water; avoid sharing them.

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