

MEDICAL SCIENCES

FEATURES OF THE VAGINAL MICROBIOTA IN WOMEN WHO HAVE RECOVERED FROM CORONAVIRUS INFECTION CONSIDERING THE CONDITIONS OF MARTIAL LAW IN UKRAINE

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The coronavirus disease 2019 (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has posed a major challenge to healthcare systems worldwide. One of the important directions of current research is the investigation of the impact of SARS-CoV-2 infection on women's reproductive health [1, p. 2; 2, p. 1].

Analysis of the available literature indicates that women who have recovered from COVID-19 may experience disturbances in reproductive system function manifested by menstrual cycle disorders, including abnormal uterine bleeding, oligomenorrhea (23%), and amenorrhea (10%). In addition, an increased incidence of endometritis (18.8%), endometrial hyperplasia (20.0%), and uterine fibroids (23.8%) has been reported [3, 4].

Particular attention should also be given to the psychological condition of women, especially under the conditions of martial law in Ukraine. Significant stress associated with armed conflict may lead to disruption of adaptive mechanisms and negatively affect immune responses as well as endocrine system functioning [5, p. 7; 6, p. 90].

It is known that SARS-CoV-2 can affect not only the respiratory system but also the human microbiota, including the intestinal and genital microbiota. Studies have demonstrated a decrease in microbial diversity, a reduction in symbiotic bacteria, and an increase in opportunistic microorganisms [7, p. 73; 8, p. 5]. Changes in the vaginal microbiota in women after COVID-19 are often associated with active proliferation of facultative anaerobic microorganisms (staphylococci, streptococci, enterobacteria) as well as anaerobic microflora (*Gardnerella vaginalis*,

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Prevotella spp., Fusobacterium spp.) [9, p. 1327; 10, p. 143]. Considering the combined impact of coronavirus infection and chronic stress under conditions of martial law, the aim of this study was to investigate the characteristics of the vaginal microbiota in women who had recovered from COVID-19, taking into account the timing of infection (before and during the military aggression in Ukraine).

Bacteriological studies were conducted to assess the species composition and quantitative characteristics of the vaginal microbiota in 20 women who had recovered from COVID-19 before the onset of military aggression (Group I) and in 20 women who had recovered from COVID-19 during martial law (Group II). The control group consisted of 30 clinically healthy women examined prior to the outbreak of hostilities.

Bacterioscopic and culture-based analyses of vaginal samples were performed using standard culture media for aerobic and anaerobic microorganisms. Microbial identification was carried out using the automated analyzer Vitek 2 Compact 15 (bioMérieux, France). The diagnosis of ureaplasmosis was performed using a culture method by inoculating vaginal secretions into urea–arginine broth LIO-2 (bioMérieux, France).

Statistical analysis was conducted using the Data Analysis package in Microsoft Excel (Windows 2007).

Microscopic examination of women who had recovered from COVID-19 before the introduction of martial law in Ukraine revealed nonspecific vulvovaginitis in 25% of cases, bacterial vaginosis in 35%, and an intermediate smear type in 40% of the examined women. Culture-based analysis demonstrated an increased frequency (20%) of Gram-positive cocci (*Staphylococcus* spp., *Streptococcus* spp.) at concentrations of log 3.8–4.8 CFU/mL. Among enterobacteria, *Escherichia coli* and *Klebsiella* spp. were most frequently detected (log 3.7–4.8 CFU/mL).

Fungi of the genus *Candida* were identified in 30% of cases, predominantly *Candida albicans*. *Lactobacillus* spp. were detected in 85% of women; however, in 45% of cases their levels were reduced (log 3.8 CFU/mL). The detection rate of *Gardnerella vaginalis* was 30%. Mixed microbial associations were observed in 45% of the patients.

Examination of women in Group II revealed that negative changes in the vaginal microbiota were more pronounced: bacterial vaginosis was diagnosed in 55% of women, vaginitis in 35%, and an intermediate smear type in 10%.

An expansion of the spectrum of Gram-positive cocci was observed, including coagulase-negative staphylococci and *Enterococcus* spp. The concentrations of aerobic Gram-positive coccal microflora ranged from log 4.0 to 6.2 CFU/mL. Enterobacteria were detected in 25–30% of cases (log 4.3–5.8 CFU/mL).

Among vaginal fungal isolates of the genus *Candida*, *Candida albicans* predominated (25%), while *Candida non-albicans* species were detected less frequently (20%). However, a greater diversity of species was observed among *Candida non-albicans*, including *Candida glabrata* (5%), *Candida tropicalis* (5%), *Candida parapsilosis* (5%), and *Candida krusei* (5%).

Lactobacillus spp. were detected in 70% of women, predominantly at low concentrations (log 2.8 CFU/mL). The detection rate of *Gardnerella vaginalis* increased to 55% (log 6.7 CFU/mL), indicating pronounced anaerobic dysbiosis.

In 80% of women in Group II, two- to four-component microbial associations were identified, involving opportunistic bacteria, *Candida* spp., as well as sexually transmitted infections.

The obtained results indicate more profound dysbiotic alterations in women who had COVID-19 during the period of martial law. The combination of post-COVID immune dysregulation and chronic stress may contribute to a deficiency of *Lactobacillus* spp., active proliferation of aerobic and anaerobic opportunistic microflora, an increased frequency of bacterial vaginosis, and the formation of complex polymicrobial associations.

Stress hormones, particularly cortisol, can disrupt estrogen-dependent maturation of the vaginal epithelium, thereby creating conditions for reduced colonization resistance. The combination of immune disturbances following SARS-CoV-2 infection and stress-induced hormonal changes significantly increases the risk of vaginal microbiome imbalance.

The obtained data substantiate the need for monitoring the genital tract microbiota in women after COVID-19, taking into account psychoemotional stress and the timely correction of dysbiotic disorders.

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