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The Impact of Asymptomatic Bacteriuria on Pregnancy Outcome

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Abstract The terms inflammation and cystitis, i.e., patient complaints, cover a wide range of conditions—from asymptomatic bacteriuria on the one hand, to acute pyelonephritis and septicemia on the other—all combined based on a common feature: a positive urine culture. Currently, inflammatory diseases of the genitals are a leading gynecological pathology and the most common cause of reproductive health problems in women. Vaginal infections are the most common infectious and inflammatory diseases of the female genital tract. The presence of opportunistic pathogens from the facultative anaerobic group in the urogenital tract and the increased number of anaerobic bacteria dramatically increase the risk of ascending infection of the endocervix, endometrium, and fallopian tube mucosa. Long-term and often asymptomatic persistence of infectious agents in the endometrium during pregnancy leads to significant changes in its structure. Persistent endometritis interferes with normal embryo implantation, can disrupt embryogenesis, and ultimately leads to numerous complications of pregnancy and childbirth.

Keywords Urogenital tract inflammation, Asymptomatic bacteriuria, Pregnancy

1. Introduction

Among reproductive disorders in women, pathologies of the male reproductive system are of particular medical and social significance. Demographic indicators in Uzbekistan, as elsewhere in the world, indicate an increase in the incidence of infertility in both men and women, reaching an average of 30-50% [4]. Inflammatory diseases of the male reproductive system are currently one of the most common causes of decreased reproductive potential. Bacteriuria and bacteriospermia are a frequent and often the only manifestation of genital inflammation. The presence of bacteria in urine and ejaculate is associated with an increased risk of pregnancy loss and infectious complications before and after delivery.

2. Study Materials

Data analysis confirms that the leading pathogens causing inflammatory bowel disease in the study groups are gram-negative microorganisms such as Escherichia coli, Enterococcus spp., and Enterobacter spp. However, these bacteria are not the only cause for concern. Of considerable interest is Staphylococcus aureus, a gram-positive bacterium, due to its ability to cause serious complications during pregnancy, childbirth, and the postpartum period, threatening the health of both mother and child. All microorganisms associated with BBU have the ability to adhere to epithelial cells, attaching to the epithelial surfaces of the urinary tract, including the bladder and urethra, where they form characteristic biofilms inherent in this disease [20]. To comprehensively assess the vaginal microbiome, as well as to identify age-related differences, an analysis was performed using the Femoflor 16 test. This test is a molecular biological study that allows for the identification and quantitative assessment of the composition of the vaginal microbiota, determining the balance between beneficial and pathogenic microorganisms. The examination of men included microscopy of a urethral smear and bacteriological culture of ejaculate. A prerequisite for semen analysis was 5 days of sexual abstinence. Bacterial flora in the ejaculate was determined using the WHO method. Bacterial sperm counts of 10^3 CFU/ml or more were considered diagnostically significant.

3. Discussion of the Results

According to the results of extended colposcopy, smear microscopy and bacteriological culture of cervical mucus, cervicitis was detected in 74 (63.6%) women in the couples. In Group 1, this figure was 31 (41.8%) and in Group 2, 45 (93.8%) women. The level of contamination with various types of opportunistic microorganisms ranged from 10^3 to 10^8 CFU/ml. The most frequently encountered were Enterococcus faecalis, Escherichia coli, hemolytic Staphylococcus epidermidis, Candida albicans, Streptococcus

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mitis, Staphylococcus cohnii, Staphylococcus warneri and Gemella haemolysans, with the combined growth of several species often being recorded. Microbial contamination levels of various opportunistic pathogens, ranging from 10 ³to 10 8 CFU/ml, were measured. The most frequently encountered were St. epidermidis, E. coli, E. faecalis, St. cohnii, St. pyogenes, Str. mitis, and G. haemolysans, as well as combined growth of certain species. It should be noted that barrier methods of contraception were not used regularly in all couples. A match between the species isolated in cervical mucus and ejaculate was observed in 62.8% of cases. In 74 couples in which the women suffered from cervicitis, all men were found to have bacteriospermia.

According to the results of histological analysis of endometrial biopsy specimens performed in 78 women (74 with cervicitis, 4 with only bacteriospermia in the husband), chronic endometritis was diagnosed in 32 of them (82.1%). Moreover, in Group 1 - in 9 women (24.3%), in Group 2 - in 23 (100%). When comparing the results obtained in the observation groups, the following was revealed. Among married couples in Group 1 (n=37), 40.5% of women were diagnosed with cervicitis, 24.3% - chronic endometritis, and 45.9% of men - bacteriospermia. In Group 2 (n=23), cervicitis occurred in 95.7% of patients, chronic endometritis - in 100%, and bacteriospermia was detected in 95.7% of men. The study found that, when examining married couples planning pregnancy, men were found to have bacteriospermia in more than half of the cases (65%). Furthermore, the sexual partners of men with bacteriospermia were found to have inflammatory diseases of the cervix and endometrium in 100% of cases, both in couples with a history of pregnancy and in those planning their first pregnancy. Therefore, bacteriospermia should be considered a risk factor for endocervical and endometrium infection and, consequently, reproductive problems.

Asymptomatic bacteriuria of pregnancy is a microbiological diagnosis based on the analysis of urine collected under strict sterile conditions. A characteristic feature of ABP is the complete absence of clinical signs of urinary tract disease (dysuria, intoxication, etc.). Asymptomatic bacteriuria is observed 10 times more often in women than in men, and occurs in 2-10% of pregnant women. Most women develop bacteriuria before pregnancy. Acute pyelonephritis develops during pregnancy in 20-40% of women.

Because the female urethra is significantly shorter and wider than the male urethra (3 to 5 cm in length and approximately 1 cm in width), women are more likely to develop acute and chronic inflammatory diseases of the bladder and upper urinary tract. The external urethral opening is located in the vaginal vestibule, where microbial flora is present, facilitating the entry of bacteria from the vagina. Turbulent urodynamics in the bladder and urethra during urination contribute to frequent bladder infections and the development of cystitis. Back pressure, which occurs when urine passes from the wider initial part of the urethra to the narrower terminal part, leads to the return of the first portions of urine into the bladder, thereby infecting it with bacterial flora from the urethra. The process then becomes progressive, with vesicoureteral reflux playing a significant role.

The development of vesicoureteral reflux can be interpreted to some extent by a woman's social status. In developing countries, UTIs are most common among pregnant women from the lower social classes (6.5%), and significantly less common among the middle class—2.5%. This view is based on the results of bacteriological examination of urine in pregnant women with UTIs, according to which E. coli and its associations with other microorganisms are most frequently detected among socially maladjusted groups of the population [6].

Sexual activity is a prerequisite for the ascending spread of microorganisms [3]. Asymptomatic bacteriospermia in the husband is of great importance in the infection of the female urinary tract. Numerous bacteria are isolated from the semen of sexual partners suffering from a urogenital tract infection. This explains the Saturday or Sunday morning cystitis that occurs in women a week after intercourse with a partner suffering from asymptomatic bacteriospermia. Treatment of the sexual partner and the use of a condom reduce the recurrence of urogenital tract infections in women [14]. Urinary tract infections can also arise from inflammatory processes in the female genital organs and surrounding pelvic tissue, where bacteria can remain dormant for long periods. In vulvitis and bacterial vaginitis, ascending spread of microorganisms is particularly common during pregnancy [8].

At the same time, the Urology Society, the Interregional Association for Clinical Microbiology and Antimicrobial Chemotherapy, and national guidelines recognize that anaerobic bacteria extremely rarely cause renal infections. Chlamydia and ureaplasma are not pathogens that cause pyelonephritis. Conditions such as atrophic vaginitis, sexually transmitted diseases (caused by chlamydia, gonococci, and herpes virus infection), as well as candidal and trichomonas vaginitis, which also involve frequent urination, are not considered urinary tract infections [2]. The incidence of bacteriuria increases during pregnancy, reaching 0.9% in the first trimester, 1.8% in the second, and 5.6% in the third. Bacteriuria is more common in repeat pregnancies (6.0%), compared to 3.2% in primiparous women [9]. The persistence of bacteriuria is also facilitated by the changes occurring in a woman's body during pregnancy: defects in local defense mechanisms (insufficient production of neutralizing antibodies) and glucosuria, which promotes accelerated bacterial growth. The properties of microorganisms with a certain virulence (adhesins, hemolysin, etc.) should also be considered.

During pregnancy, the anatomical and functional state of the urinary tract changes, manifested by dilation of the renal pelvis and calyceal system and insufficiency of the sphincter mechanism of the bladder. The development of bacteriuria is facilitated by factors arising from the effect of progesterone on the muscle tone of the ureters and their mechanical obstruction by the growing uterus. These include: a slowdown

in the rate of urine passage due to a decrease in the tone and peristalsis of the ureters, dilation of the renal pelvis and upper ureters with the formation of physiological hydronephrosis of pregnancy, a decrease in the tone of the bladder, an increase in the amount of residual urine, contributing to vesicoureteral reflux and ascending migration of bacteria into the upper urinary tract. [7]. Existing hypotension and dilation of the renal pelvis are detected by ultrasound examination and excretory urography [12]. Hormonal changes during pregnancy promote physiological relaxation of the uterus and pathological relaxation of all parts of the urinary system [10].

Estrogens cause a hypertonic or hyperkinetic state of the urinary tract, while progesterone leads to hypotension and hypokinesia. Elevated serum hormone levels in pregnant women coincide with the onset of urodynamic disturbances in the upper urinary tract and the development of pyelonephritis. Dilation of the upper urinary tract in healthy women is rare before 20 weeks of pregnancy. A decrease in serum levels at 21-22 weeks of pregnancy, combined with hormonal imbalance and urodynamic disturbances, contributes to the increased incidence of urodynamic disturbances and pyelonephritis in pregnant women during this period [12].

In the third trimester of pregnancy, the placenta begins to secrete large amounts of estrogens, progesterone, and glucocorticoids. Estrogens promote the growth of bacteria pathogenic to the urinary tract, which is caused, in part, by decreased lymphocyte function [7].

As pregnancy progresses, dilation of the renal pelvis and ureters occurs relatively rapidly, persisting for up to 40 weeks. This is explained by the growth of the pregnant uterus and its pressure on the ureters above the level of the pelvic ring [3,13]. Additional factors contributing to mechanical pressure from the uterus on the ureters of a pregnant woman include polyhydramnios, multiple pregnancy, a narrow pelvis, and a large fetus.

Other causes predisposing to urodynamic disturbances of the upper urinary tract during pregnancy include congenital malformations (6-18%) of the kidneys and urinary tract, kidney and ureteral stones (6.1%), vesicoureteral reflux in cystitis and cystocele, nephroptosis, and structural features of the genitourinary tract [1,4]. Previous infections play a significant role in the pathogenesis of UTIs [6,13]. Immunosuppression during normal pregnancy is caused by increased hormonal levels and metabolic shifts, accompanied by a decrease in T-lymphocytes and an increase in B-lymphocytes, which leads to a decrease in local vaginal immunity.

Fatigue, vitamin deficiencies (especially folic acid deficiency), and infectious diseases contribute to the disruption of the normal regulation of the mother's defense mechanisms. Extragenital diseases are also a premorbid background, especially chronic tonsillitis and diabetes mellitus.

In 70-95% of cases, the primary pathogen in UTIs is E. coli; other representatives of the Enterobacteriaceae, such as Proteus spp., Klebsiella spp., etc., are less commonly identified. In nosocomial infections, the spectrum of isolated microorganisms is wider and, along with the above-mentioned enterobacteria, a decrease in the frequency of detection of E. Coli is noted with an increase in the frequency of detection of Serratia spp., Morganella spp., Citrobacter spp., Pseudomonas aeruginosa, Staphyloccoccus aureus, and enterococci [15].

Based on their uropathogenicity, microorganisms are divided into the following groups:

- Primary pathogens - species that cause UTIs in individuals without pathology. This group also includes rarely detected bacterial species (Salmonella);
- Secondary pathogens - species that rarely cause primary infection in individuals without urinary tract pathology but are associated with nosocomial UTIs: Klebsiella spp., Enterobacter spp., Proteus vulgaris, Morganella, S. aureus, Enterococcus spp., and Candida albicans.

The main causative agent of UTIs in outpatient settings is Escherichia coli, which occurs in 80% of cases. Less common are Staphylococcus saprophytics (7%), Enterococcus faecalis (5%), Proteus mirabilis (5%), and Other Gram-negative bacteria (3%). In hospital settings, Escherichia coli is found in only 40% of women examined. Other Gram-negative bacteria were detected in 25% of cases, Enterococcus faecalis in 12%, and Proteus mirabilis in 10%. Less common are Pseudomonas aeruginosa (5%), Candida albicans (5%), and Staphylococcus epidermidis (3%) [4,7].

The role of Proteus mirabilis and Enterococcus faecalis as possible risk factors for recurrent UTIs during pregnancy is noted. There is evidence that certain pathogens, particularly ß-hemolytic streptococci and Staphylococcus saprophyticus, can cause UTIs even with low urine counts of uropathogens (less than 105 per 1 ml). According to the literature, the types of pathogens isolated in UTIs in pregnant and non-pregnant women do not differ significantly. The spectrum of microorganisms in pregnant women with asymptomatic UTIs and those with pronounced clinical manifestations is also virtually identical [10].

UTI pathogens can also include anaerobic bacteria, fungi, mycoplasmas and ureaplasmas, viruses, trichomonas, and L-form bacteria, when urine cultures are ineffective after a temporary abatement of the inflammatory process [8]. It is generally recognized that the main route of infection is ascending (from the urethra to the bladder, ureters, and renal pelvis). It is possible that hematogenous infection of the renal parenchyma is also possible against the background of bacteremia; however, this route is extremely rare [3].

It should be acknowledged that the issue of the informativeness and prognostic value of various diagnostic methods for pathological processes of the urinary tract has not been sufficiently addressed. Many authors recommend using the following criteria for UTI [8]: 1) isolation of the same bacterial species in quantities of > 105 CFU/ml in 2 consecutive urine cultures with an interval of 3-7 days, obtained from women without signs of UTI; 2) isolation of the same bacterial species in quantities of > 105 CFU/ml on a single occasion in a urine culture in men; 3) a single isolation

of bacteria in quantities of > 105 CFU/ml in a urine culture obtained during bladder catheterization. There are no specific criteria for diagnosing bacteriuria in pregnant women. These criteria are so strict because a single urine culture of voided urine can result in external contamination with microorganisms from the perineum in 40% of cases, and a diagnosis of bacteriuria is not confirmed by repeat urine culture. Double urine culture with detection of bacteriuria is intended to protect a significant number of women, including pregnant women, from unnecessary antibacterial therapy.

Hormonal balance plays a key role in maintaining the health of the genitourinary system, and any fluctuations can contribute to the development of infections, including bacteriuria. Furthermore, adolescent lifestyle, both during and outside of pregnancy, can also impact immunity and contribute to the development of urogenital infections. Increased stress, lack of sleep, frequent changes in sexual partners, high levels of physical activity, or, conversely, physical inactivity can weaken the immune system.

Stress and fatigue reduce the body's overall resistance to infections, making young women more vulnerable to bacterial pathogens. Maintaining a healthy lifestyle, including a balanced diet, regular exercise, and adequate sleep, is an important factor in preventing UTIs and other urogenital infections. Educating young women about urogenital hygiene and early detection of infection symptoms is also important, as this can facilitate prompt medical attention and prevent complications. Introducing educational programs in schools and communities aimed at raising awareness of urogenital health can be an effective means of preventing UTIs and other related conditions among young women. This will help them lead healthier lifestyles and emphasize the importance of regular medical checkups.

4. Conclusions

The study demonstrated that BBU plays a significant role in the development of pregnancy pathologies, labor, and pediatric complications. This underscores the need for regular screening of pregnant women for BBU as an integral part of obstetric care, especially for young women. Preventing obstetric complications associated with BBU requires not only timely diagnosis but also the administration of effective and safe therapy, which is becoming a fundamental principle for specialists providing care to pregnant women in challenging logistical conditions.

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