Med Pregl 2025; LXXVIII (3-4): 81-88. Novi Sad: mart-april.

INFECTIONS CAUSED BY GROUP B STREPTOCOCCUS AND HERPES SIMPLEX VIRUS – THE IMPORTANCE OF PREVENTION AND APPROPRIATE MANAGEMENT DURING PREGNANCY AND LABOR

INFEKCIJE IZAZVANE BAKTERIJOM STREPTOCOCCUS GRUPE B I VIRUSOM HERPES SIMPLEX – ZNAČAJ PREVENCIJE I PRAVILNOG POSTUPANJA U TRUDNOĆI I PORODAJU

David ČUKANOVIĆ[1], Aleksandra VEJNOVIĆ[1,2], Sara ŠEKEROVIĆ[1], Đorđe PETROVIĆ[1,2] and Tihomir VEJNOVIĆ[1,2]

ORCID NUMBER
David Čukanović – 0009-0004-2503-1038
Aleksandra Vejnović – 0000-0001-7697-3261
Sara Šekerović – 0009-0005-7557-2614
Đorđe Petrović – 0000-0002-1148-7032
Tihomir Vejnović – 0009-0001-8942-4365

University of Novi Sad, Faculty of Medicine, Novi Sad[1]
University Clinical Center of Vojvodina, Novi Sad
Clinic of Gynecology and Obstetrics[2]

Original study
Originalni naučni rad
UDK 616.98:579.862]-055.26
UDK 616.98:578.825]-055.26
https://doi.org/10.2298/MPNS2504081C

Abstract

Introduction. Group B *Streptococcus* remains one of the most significant pathogens responsible for infections during pregnancy, being closely associated with chorioamnionitis, intraamniotic infection, maternal sepsis, and neonatal morbidity. Similarly, *Herpes Simplex Virus* represents an important viral agent due to its potential to cause severe neonatal complications. The study aimed to assess postpartum women's knowledge regarding infections caused by *Streptococcus agalactiae* and *Herpes Simplex Virus*, as well as to evaluate the scope and implementation of preventive measures during pregnancy and childbirth. **Material and Methods.** This unicentric study collected data from 204 postpartum women using a structured questionnaire and medical record review. **Results**. *Group B Streptococcus* was isolated from vaginal swabs of 5.6% of participants and from urine cultures in 6.3%. In 73.33% of *Streptococcus*-positive patients, appropriate intrapartum antibiotic prophylaxis was not administered. Five women (2.45%) reported symptoms of genital herpes simplex infection during the current pregnancy, yet none underwent microbiological testing. A history of genital herpes was noted in 2.94% of participants, with only one receiving acyclovir prophylaxis to prevent symptomatic reactivation during delivery. **Conclusion**. The findings indicate a need to raise awareness among pregnant women regarding *Streptococcus agalactiae* and *herpes simplex* virus infections, and to establish a national protocol as current diagnostic and preventive practices do not align with international guidelines.

Key words: Streptococcus; Streptococcus agalactiae; Simplexvirus; Pregnancy; Delivery, Obstetric; Surveys and Questionnaires; Health Knowledge, Attitudes, Practice; Genital Diseases, Female

Sažetak

Uvod. Jedan od najznačajnijih uzročnika infekcija u trudnoći jeste bakterija *Streptococcus* grupe B koja može dovesti do horioamnionitisa, intraamnionske infekcije, sepse kod majke, kao i infekcije novorođenčeta. Bitnu ulogu u nastanku komplikacija u trudnoći imaju i virusi, od kojih infekcije izazvane virusom *Herpes simplex* tip 1 i 2 mogu ostaviti teške posledice na život ploda. Ciljevi istraživanja su bili da se utvrdi nivo znanja porodilja o infekcijama izazvanim bakterijom *Streptococcus agalactiae* virusom *Herpes simplex*, kao i da se ispita obim primene i vrsta preventivnih mera usmerenih ka navedenim infekcijama tokom trudnoće i porođaja. **Mateijal i metode.** Istraživanje je sprovedeno kao unicentrična studija. Podaci su prikupljani iz dva izvora: iz anketnog upitnika, kao i prikupljanjem podataka iz medicinske dokumentacije. **Rezultati.** U uzorku od 204 porodilje, kod 5,6% ispitanica utvrđeno je prisustvo bakterije *Streptococcus* grupe B u vaginalnom brisu, dok je kod 6,3% porodilja urinokultura bila pozitivna. Kod 73,33% pacijentkinja pozitivnih na streptokok, nije primenjena odgovarajuća intrapartalna antibiotska profilaksa. Pet (2,45%) ispitanica je primetilo simptome i znakove herpes simpleks genitalne infekcije tokom aktuelne trudnoće, međutim bris promene nije uzet ni u jednom slučaju. Od 204 porodilje, 2,94% je imalo pozitivnu istoriju obolevanja od genitalnog herpesa, a samo jedna pacijentkinja je primenjivala lek aciklovir u cilju prevencije manifestne infekcije pri porođaju. **Zaključak.** Postoji potreba za unapređenjem nivoa znanja trudnica o infekcijama izazvanim bakterijom *Streptococcus agalactiae* virusom *Herpes simplex*. Dijagnostika i prevencija pomenutih infekcija se ne sprovodi po važećim međunarodnim smernicama, zbog čega je potrebno definisati nacionalni protokol.

Ključne reči: Streptokok; Streptokokus agalaktije; simpleksvirusi; trudnoća; porođaj; ankete i upitnici; znanje o zdravlju, stavovi, praksa; polne bolesti kod žena

Introduction

Pregnancy represents a unique physiological state characterized by profound systemic adaptations designed to meet the metabolic demands of the mother and ensure proper fetal growth and development. These changes affect nearly all organ systems, including the immune system, where complex regulatory modifications occur [1,2]. To prevent maternal immune reactions against fetal alloantigens, a degree of immunological suppression is induced. However, this necessary immunosuppression simultaneously in-

✉ Corresponding author: Aleksandra Vejnović, E-mail: aleksandra.vejnovic@mf.uns.ac.rs

Abbreviations

GBS – Group B Streptococcus
IAP – intrapartum antibiotic prophylaxis
HSV – Herpes Simplex Virus
KIS – Clinical Information System
CDC – Centers for Disease Control and Prevention
RCOG – The Royal College of Obstetricians and Gynaecologists
BASHH – British Association for Sexual Health and HIV

creases maternal susceptibility to infections during pregnancy [3]. Globally, the prevalence of lower genital tract infections among pregnant women is estimated at 40–54% [4,5]. Such infections are major contributors to preterm birth – a complication responsible for approximately 500,000 neonatal deaths annually. *Group B Streptococcus* (GBS) alone accounts for up to 10% of all microbial causes of preterm birth [6,7].

Streptococcus agalactiae, a Gram-positive bacterium and the principle representative of GBS, remains a leading cause of neonatal morbidity and mortality worldwide [8]. This pathogen is isolated from rectovaginal swabs in approximately 10–30% of pregnant women [9]. *GBS infections* can result in a wide spectrum of complications affecting both the mother and the fetus [10]. Given its high prevalence and severe consequences, several preventive measures have been established to reduce pregnancy-related complications and neonatal infection. Intrapartum antibiotic prophylaxis, guided by antenatal screening, continues to be the cornerstone of GBS prevention and transmission control [11].

In addition to bacterial pathogens, viral infections also play a major role in prenatal morbidity [12]. Among these, Herpes Simplex Virus (HSV) is particularly significant. Although neonatal HSV infection is relatively rare – occurring in approximately 1 in 3,200 live births – it can present as localized (skin, eyes, mouth), central nervous system involvement, or disseminated infection [13]. Early identification and timely intervention are crucial to prevent vertical transmission. The consistent implementation of preventive measures against viral infections has gained increasing importance, especially in the context of global health such as pandemics, which pose additional risk to maternal and fetal well-being [12].

The aim of this study was to assess the level of knowledge among postpartum women regarding infections caused by *Streptococcus agalactiae* and *Herpes Simplex Virus*, to evaluate the extent of preventive measures undertaken during pregnancy and childbirth, and to analyze the implementation of prophylactic protocols at the Clinic of Gynecology and Obstetrics, University Clinical Centre of Vojvodina.

Material and Methods

This cross-sectional study was conducted at the Clinic of Gynecology and Obstetrics, University Clinical Centre of Vojvodina, between 4 January and 13 February 2025. The study population comprised postpartum women who delivered at term (between 37+0 and 42+6 weeks of gestation), either by vaginal delivery or cesarean section. Participation involved completing a structured questionnaire designed to assess participants' knowledge regarding infections caused by *Streptococcus agalactiae* and *Herpes Simplex Virus*. Data were obtained from two sources: (1) the questionnaire specifically developed for the purposes of this study, and (2) relevant information extracted from medical records within the Clinical Information System (KIS). Data analysis was performed using Microsoft Excel 365. Numerical variables were expressed as mean values with corresponding measures of variability, while categorical variables were presented as frequencies and percentages. Differences in the distribution of categorical variables were assessed using the chi-squared (χ^2) test. A p-value of less than 0.05 was considered statistically significant. Results are presented in tabular and graphical form. The study protocol was approved by the Ethics committee of the University Clinical Centre of Vojvodina (approval number: 00-473).

Results

A total of 204 completed questionnaires were analyzed. The chi-square test identified a statistically significant difference between primiparous and multiparous women in responses to statement 10, which addressed the efficacy of antibiotics in the treatment of *Group B Streptococcus* (GBS) infections. Participants residing in urban areas demonstrated a higher proportion of correct responses compared with those from rural settings. Statistically significant differences were also observed for statements 2, 5, 6, 13, and 20 (**Table 1).** Participants with higher education levels showed a greater proportion of correct responses across most statements. However, for statements 15, 17, and 18 – related to genital HSV infections – a higher percentage of correct responses was observed among participants with primary and secondary education. The proportion of correct responses between employed and unemployed women was comparable for most questions. A statistically significant difference was noted for statement 7, where a higher proportion of employed women (60%) correctly identified that GBS can be isolated from vaginal swabs. For statement 17, concerning neonatal HSV transmission, unemployed participants demonstrat-

Table 1. Results of the knowledge assessment regarding infections caused by *Streptococcus agalactiae* and Herpes Simplex Virus, and the importance of their prevention during pregnancy and childbirth

Parameter	True n (%)	False n (%)	Do not know n (%)
1. Infections during pregnancy may pose a risk to both the mother and the fetus.	178 (87.25)	2 (0.98)	24 (11.76)
2. Transmission of microorganisms from mother to fetus may occur throughout the entirety of gestation, as well as during labor and delivery.	148 (72.55)	8 (3.92)	48 (23.53)
3. Avoidance of direct contact with infected individuals and the use of barrier protection during sexual intercourse can prevent the transmission of viral and bacterial infections.	162 (79.41)	10 (4.90)	32 (15.69)
4. The most prevalent infections in pregnancy are bacterial infections.	130 (63.73)	10 (4.90)	64 (31.37)
5. Increased volume of vaginal discharge with a characteristic odor and discoloration, accompanied by pruritus and dyspareunia, may indicate a gynecological bacterial infection.	175 (85.78)	1 (0.49)	28 (13.73)
6. Infection with *Streptococcus agalactiae* (Group B Streptococcus) exerts a significant influence on pregnancy outcomes.	74 (36.27)	7 (3.43)	123 (60.29)
7. The presence of *Streptococcus agalactiae* (Group B Streptococcus) may be identified through microbiological analysis of a vaginal swab.	116 (56.86)	3 (1.47)	85 (41.67)
8. In neonates, *Streptococcus agalactiae* infection can result in meningitis, pneumonia, and neonatal sepsis.	50 (24.51)	4 (1.96)	150 (73.53)
9. Intrapartum administration of antibiotics significantly reduces the risk of *Streptococcus agalactiae* transmission to the neonate.	74 (36.27)	11 (5.39)	119 (58.33)
10. Antibiotic therapy is effective in the treatment of infections caused by *Streptococcus agalactiae* (Group B Streptococcus).	88 (43.14)	3 (1.47)	113 (55.39)
11. Infection with the Herpes Simplex Virus is not transmitted transplacentally from mother to fetus.	53 (25.98)	31 (15.20)	120 (58.82)
12. Herpes Simplex Virus type 2 is most commonly transmitted through sexual contact.	72 (35.29)	11 (5.39)	121 (59.31)
13. The presence of antibodies against Herpes simplex virus may be detected via the TORCH screening panel, utilized in prenatal diagnostics.	80 (39.22)	4 (1.96)	120 (58.82)
14. Genital herpes is characterized by the appearance of small vesicular lesions in the genital area, associated with pruritus, pain, and a burning sensation.	101 (49.51)	3 (1.47)	100 (49.02)
15. If a primary outbreak of genital herpes occurs within six weeks prior to delivery, the cesarean section is the recommended mode of delivery.	31 (15.20)	8 (3.92)	165 (80.88)
16. Use of acyclovir, valacyclovir, and famcyclovir has not been associated with teratogenic or harmful effects during pregnancy.	13 (6.37)	6 (2.94)	185 (90.69)
17. If a primary genital herpes infection occurs during pregnancy and active lesions are present at the time of labor, the risk of neonatal herpes infection is approximately 40%.	23 (11.27)	3 (1.47)	178 (87.25)
18. If active genital herpes lesions are present at delivery in a woman with a known history of genital herpes, the risk of vertical transmission to the fetus ranges between 0% and 3%.	15 (7.35)	8 (3.92)	181 (88.73)
19. A woman with a prior history of genital herpes before pregnancy, or the one experiencing an episode during the first or second trimester, should receive prophylactic antiviral therapy from the 36th week of gestation until delivery, in order to prevent recurrence at the time of birth.	35 (17.16)	4 (1.96)	165 (80.88)
20. If genital herpes is diagnosed in a timely manner and appropriate preventive measures are undertaken, vertical transmission from mother to neonate can be prevented in the vast majority of cases.	102 (50.00)	4 (1.96)	98 (48.04)

ed a greater proportion of correct answers (20.59%) compared with employed women (9.41%).

Overall, the assessment of knowledge regarding infections caused by *Streptococcus agalactiae* and HSV types 1 and 2, as well as their prevention, revealed that most postpartum women were inadequately informed. Among all participants, 30.88% correctly answered more than 50% of the statements, whereas 10.29% correctly answered over 70% **(Table 1)**.

Table 2 presents the proportion of participants who underwent diagnostic procedures for GBS and HSV infections. Of the 93.62% who underwent urinary analysis, 6.28% (n=12) had a positive GBS urine culture. Vaginal swabs were obtained during pregnancy in 88.2% of participants, with 5.55% (n=10) testing

Table 2. Participants' responses regarding diagnostic procedures during pregnancy

Parameter	Number (n)	%
Urine culture performed during pregnancy	191	93.62
Urine culture positive for *Streptococcus agalactiae*	12	6.28
Vaginal swab performed during pregnancy	180	88.24
Vaginal swab performed within one month prior to delivery	154	75.49
Vaginal swab positive for *Streptococcus agalactiae*	10	5.55
Vaginal swab positive for other bacteria	31	17.22
Swab taken from lesion suspected of genital herpes	0	0
TORCH test performed (IgM and IgG for HSV*)	86	42.16
Medical history taken regarding genital herpes	36	17.65

*HSV- Herpes Simplex Virus

positive for GBS and 17.22% showing other bacterial growth. Overall, 75.49% reported swab collection within one month before delivery. Notably, 36.36% of women with a positive GBS urine culture had a negative vaginal swab within four weeks prior to delivery. Five participants reported vesicular genital lesions with associated pain and burning during pregnancy; however, none underwent HSV swab testing. Serological testing for HSV antibodies was performed in 42.16% of cases, while a gynecological history regarding prior genital HSV infection was obtained in 17.65%.

Preventive measures against GBS and HSV infections implemented during pregnancy are presented in **Table 3**. All ten women with confirmed GBS colonization received treatment: five with vaginal suppositories, one with antibiotics, one with antibiotics and probiotics, and three with all three therapies. Among all participants, 40.69% reported probiotic use during pregnancy, while 41.18% used vaginal suppositories within four weeks prior to delivery. Of the 2.94% (n=6) with a history of genital herpes, only one woman (0.49%) received prophylactic acyclovir during pregnancy.

Two participants (0.98%) reported experiencing clinical manifestations of genital HSV infection for the first time during the current pregnancy. Both pregnancies were regularly monitored – one in a public healthcare facility and the other in a private institution. Both patients underwent serological testing for HSV antibodies (TORCH screening), but lesion swabs were not obtained. In one case, the gynecologist obtained a medical history regarding HSV infection.

Six patients (2.94%) reported a previous history of genital herpes before pregnancy. Among these, three experienced symptomatic infection during the current pregnancy, and two reported symptoms within six weeks before delivery. Only one patient received prophylactic acyclovir after the 36th gestational week to prevent symptomatic recurrence. A medical history concerning genital herpes was documented in two cases; however, neither received prophylactic therapy. All six women reported regular antenatal care – half in public healthcare facilities and half in private practices.

Based on the collected data, appropriate diagnostic procedures (medical history regarding HSV infection and TORCH serological) were not conducted in two of the six patients with a positive history of genital herpes **(Table 4).** Furthermore, 83.33% of those with prior HSV infection did not receive acyclovir prophylaxis before delivery. One patient, who exhibited active infection signs within six weeks before labor, did not receive antiviral treatment, thereby presenting a potential risk of vertical HSV transmission during vaginal delivery.

Analysis of clinical practices related to GBS prevention revealed the following **(Table 5)**. All 15 women with a positive vaginal or urine GBS culture received antenatal care. One-third (33.33%) were monitored exclusively in public healthcare institutions. Probiotic use during pregnancy was reported by 66.66% of GBS-

Table 3. Participants' responses regarding preventive measures during pregnancy

Parameter	Number (n)	%
Therapy was recommended in cases of positive GBS* swab	10	100
Therapy was recommended in cases of a positive swab for other pathogens	28	90.32
Probiotics were used during pregnancy	83	40.69
Vaginal suppositories were used within four weeks before delivery	84	41.18
Acyclovir was administered after 36 weeks of gestation as prophylaxis against symptomatic infection	1	0.49

*GBS - Group B Streptococcus

Table 4. Overview of missed opportunities for the diagnosis and prevention of HSV infection at the level of primary and tertiary healthcare

	Level of healthcare	Number (n)	Percentage (%)
Missed diagnosis	Primary	2/6	33.33
Missed opportunity for prophylaxis of symptomatic infection prior to delivery	Primary	5/6	83.33
Potential transmission to the neonate	Tertiary	1/6	16.67

Table 5. Summary of clinical management practices implemented in patients with confirmed *Streptococcus agalactiae* colonization

Antenatal Care	Regular	Irregular	Private healthcare	Public healthcare
Number (n)	15	0	10	5
Urine culture taken during pregnancy	Yes	No		
Number (n)	15	0		
Vaginal swab taken within one month before delivery	Yes	No		
Number (n)	13	2		
Indication for treatment	Positive urine culture	Positive vaginal swab	Both tests positive	
Number (n)	12	10	7	
Therapy recommended in case of a positive GBS* swab	Yes	No	Systemic antibiotic prior to delivery	Vaginal suppositories
Number (n)	15	0	2	5
Probiotics used during pregnancy	Yes	No		
Number (n)	10	5		
Antibiotic administered upon admission to the clinic	Yes	No		
Number (n)	4	11		

*GBS - Group B Streptococcus

Table 6. Number of patients in whom adequate preventive measures against GBS infection were not implemented

	Number (n)	Percentage (%)
Screening not performed	2	13.33
Intrapartum antibiotic prophylaxis not administered in GBS-positive patients	11	73.33
Intrapartum Antibiotic prophylaxis not administered in patients with unknown GBS status	42	84

*GBS - Group B Streptococcus

positive women. Vaginal swab within one month prior to delivery were collected in 86.66% of these cases. All patients positive for *Streptococcus agalactiae* were advised to receive specific treatment before labor onset; however, only four (26.67%) received intrapartum antibiotic prophylaxis after hospital admission, all of whom delivered by caesarean section.

A notable finding was that 13.33% of patients with urine culture positive for *Streptococcus agalactiae* had not undergone GBS screening within one month before delivery. Additionally, 73.33% of GBS-positive women, as well as 84% of those with unknown GBS status, did not receive appropriate intrapartum antibiotic prophylaxis **(Table 6).**

Discussion

Among the 204 surveyed parturients, 55% were primiparous. Overall, the proportion of correct responses was similar between primiparous and multiparous participants, except for a statistically significant difference in knowledge regarding the effectiveness of antibiotics in treating GBS infections, where multiparous women performed better. This finding may reflect knowledge gained from prior pregnancies, consistent with evidence that women colonized with GBS during their first pregnancy have a 2.2-fold higher risk of recurrence in subsequent pregnancies [14].

In the present study, postpartum women with primary and secondary education levels more frequently provided correct answers to statements related to HSV infection during pregnancy. A statistically significant difference was observed in responses concerning the transmission of genital HSV infection from mother to neonate, with unemployed participants answering correctly twice as often as employed women. Interestingly, postpartum women with lower education levels and those residing in rural areas demonstrated better knowledge regarding HSV infection, which may be attributed to greater exposure to the disease. This aligns with previous research showing a higher prevalence of infection among women of lower socioeconomic status and limited educational attainment [13,15].

Increasing awareness of the severity of these infections and the importance of preventive measures could improve adherence to prophylactic protocols and reduce disease incidence [16]. Our findings revealed that most postpartum women lacked adequate knowledge about GBS and HSV infections, which is consistent with previous studies [17,18]. Notably, 73.53% of participants were unaware that GBS can cause neonatal meningitis, pneumonia, or sepsis, while 58.33% did not know that intrapartum antibiotic prophylaxis reduces the risk of neonatal GBS infection. These results align with a larger study conducted in Saudi Arabia [17]. Additionally, only 15.2% of participants recognized the risk of vertical HSV transmission, which is considerably lower than the 27% reported by Marioka et al. [18].

A positive urine culture or vaginal swab for *Streptococcus agalactiae* during pregnancy represents a significant risk factor for neonatal infection [19]. Effective screening enables early diagnosis and timely intervention to prevent complications and vertical transmission [20,21]. The Centers for Disease Control and Prevention (CDC) recommends routine vaginal and rectal swab screening for GBS colonization between 36+0 and 37+6 weeks of gestation [22]. In our study, 75.49% of participants underwent vaginal swab testing during the final month of pregnancy; however, the exact gestational age at sampling was not recorded, which represents a methodological limitation. GBS screening coverage in our cohort was lower than that reported in France (89–96%) but comparable to Australia, where 76% of pregnant women are screened within the recommended timeframe [23,24].

Vaginal swabs were obtained from 88.2% of participants, with *Streptococcus agalactiae* was detected in 5.55%. This prevalence is markedly lower than the global average of 17.9% and the European range of 16.1–22%, as reported in a meta-analysis of 221 studies [25]. It is also lower than the 15.6% prevalence observed in a large Serbian study involving more than 5,000 pregnant women [26]. The lower rate in our sample may be attributed to the limited sample size and reliance on self-reported data rather than laboratory-confirmed results. *GBS* was identified in 6.28% of urine cultures among the 93.62% of participants who underwent testing – higher than rates reported by Petersen et al. [27]. Of note, 36.36% of women with positive urine cultures had negative vaginal swabs within four weeks of delivery. Since the presence of GBS in urine warrants intrapartum antibiotic prophylaxis regardless of swab results, microbiological urine analysis should be considered a valuable complementary diagnostic tool. Although not currently part of standard prevention protocols, these findings suggest that guideline revision may be warranted [21,22].

Genital herpes remains a prevalent sexually transmitted infection, and vertical transmission poses a serious risk of severe neonatal diseases. Therefore, timely and accurate diagnosis is crucial for prevention [13,15]. Đorđević et al. reported HSV type 2 IgG seropositivity in 12.5% of pregnant women tested in 2005 at the University Clinical Center of Vojvodina [28]. In our study, 2.45% of participants reported symptoms suggestive of genital HSV infection during pregnancy; however, no lesion swabs were obtained, contrary to current recommendations by the Joint British Association for Sexual Health and HIV (BASHH) and the Royal College of Obstetricians and Gynaecologists (RCOG). These guidelines emphasize that all suspected cases should undergo lesion sampling and receive appropriate treatment upon diagnosis [29].

Among respondents with a history of genital herpes (2.94%), only one received prophylactic acyclovir. According to current guidelines, all pregnant women with prior genital herpes should receive antiviral prophylaxis, regardless of symptom presence. Initiating acyclovir after 32 weeks' gestation significantly reduces the risk of peripartum viral reactivation, thereby lowering the likelihood of clinical manifestation and vertical transmission [29].

An analysis of the incidence of genital herpes infection among postpartum women revealed that 2.45% of participants reported symptoms suggestive of HSV infection during the current pregnancy, a rate consistent with previous published data [15]. However, none of these women underwent lesion sampling for microbiological confirmation of the diagnosis, and only one received prophylactic acyclovir therapy. This practice is inconsistent with the current recommendations of the BASHH and RCOG, which emphasize the importance of timely diagnosis through lesion swabbing and the administration of appropriate antiviral

treatment upon confirmation [29]. The observed management reflects insufficient implementation of existing diagnostic and therapeutic protocols and underscores the need to enhance both healthcare professionals' awareness and patient education regarding the importance of early identification and management of herpes simplex virus infections during pregnancy.

Evaluation of intrapartum antibiotic prophylaxis – an essential measure in preventing vertical transmission of GBS infection – revealed several concerning findings. This therapy was omitted in 73.33% of women with a positive vaginal swab or urine culture results. Particularly noteworthy is that only one-third of women with a positive urine culture for GBS received appropriate antibiotic prophylaxis during labor, despite this being a clear and absolute indication for treatment [22]. Furthermore, 84% of postpartum women with unknown GBS status did not receive intrapartum prophylaxis, despite recommendations to administer antibiotics in cases where risk factors for early neonatal infection are present. It should be noted, however, that in this study, individual risk factors among parturients with unknown GBS status were not identified, which represents a methodological limitation.

Currently, the Republic of Serbia lacks national guidelines for the prevention and management of infections caused by *Streptococcus agalactiae* and Herpes Simplex Virus. Screening and risk-based strategies are only partially implemented, and there is no active national surveillance of invasive GBS or HSV neonatal infections. The findings of this study highlight the urgent need to establish national recommendations for prevention, screening, and clinical management, as well as continuous surveillance systems. Additionally, targeted educational programs for healthcare professionals and the general population are essential to enhance perinatal care and reduce neonatal morbidity and mortality [26].

Conclusion

Based on the conducted research and the obtained findings, it can be concluded that there is a clear need to improve pregnant women's knowledge regarding infections caused by *Streptococcus agalactiae* and Herpes Simplex Virus. Approximately 25% of pregnant women are not included in Group B Streptococcus screening. Intrapartum antibiotic prophylaxis for Group B Streptococcus infection is not administered in accordance with current recommendations and clinical protocols. Similarly, the diagnosis and management of herpes simplex virus infection during pregnancy are not aligned with existing guideline standards. It is therefore imperative to establish national protocols, strengthen the motivation of healthcare professionals, and educate public awareness of the importance of preventing infections caused by Group B Streptococcus and Herpes Simplex Virus, with the ultimate goal of ensuring optimal health protection for both mother and neonate.

References

1. Kazma JM, van den Anker J, Allegaert K, Dallmann A, Ahmadzia HK. Anatomical and physiological alterations of pregnancy. J Pharmacokinet Pharmacodyn. 2020;47(4):271-85.

2. Narayan B, Nelson-Piercy C. Physiological changes of the immune system during pregnancy. In: Einav S, Weiniger CF, Landau R, editors. Principles and practice of maternal critical care. Cham: Springer; 2020. p. 201-13.

3. Nuriel-Ohayon M, Neuman H, Koren O. Microbial changes during pregnancy, birth, and infancy. Front Microbiol. 2016;7: 1031.

4. Nagdev N, Shah MC, Dodiya D. Lower genital tract infections between 18 and 24 weeks of pregnancy and its association with adverse pregnancy outcome. Indian J Sex Transm Dis AIDS. 2023;44(2):158-60.

5. Diadhiou M, Ba Diallo A, Barry MS, Alavo SC, Mall I, Gassama O, et al. Prevalence and risk factors of lower reproductive tract infections in symptomatic women in Dakar, Senegal. Infect Dis (Auckl). 2019;12:1178633719851825.

6. Romero R, Dey SK, Fisher SJ. Preterm labor: one syndrome, many causes. Science. 2014;345(6198):760-5.

7. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet. 2015;385(9966):430-40.

8. Dutra VG, Alves VM, Olendzki AN, Dias CA, de Bastos AF, Santos GO, et al. Streptococcus agalactiae in Brazil: serotype distribution, virulence determinants and antimicrobial susceptibility. BMC Infect Dis. 2014;14:323.

9. Brimil N, Barthell E, Heindrichs U, Kuhn M, Lütticken R, Spellerberg B. Epidemiology of Streptococcus agalactiae colonization in Germany. Int J Med Microbiol. 2006;296(1):39-44.

10. Yusef D, Shalakhti T, Awad S, Algharaibeh H, Khasawneh W. Clinical characteristics and epidemiology of sepsis in the neonatal intensive care unit in the era of multi-drug resistant organisms: a retrospective review. Pediatr Neonatol. 2018;59(1):35-41.

11. Dhudasia MB, Flannery DD, Pfeifer MR, Puopolo KM. Updated guidance: prevention and management of perinatal group B Streptococcus infection. Neoreviews. 2021;22(3):177-88.

12. Gervasi MT, Romero R, Bracalente G, Chaiworapongsa T, Erez O, Dong Z, et al. Viral invasion of the amniotic cavity (VIAC) in the midtrimester of pregnancy. J Matern Fetal Neonatal Med. 2012;25(10):2002-13.

13. Silasi M, Cardenas I, Kwon JY, Racicot K, Aldo P, Mor G. Viral infections during pregnancy. Am J Reprod Immunol. 2015;73(3):199-213.

14. Page-Ramsey SM, Johnstone SK, Kim D, Ramsey PS. Prevalence of group B Streptococcus colonization in subsequent pregnancies of group B Streptococcus-colonized versus non-colonized women. Am J Perinatol. 2013;30(5):383-8.

15. Hammad WAB, Konje JC. Herpes simplex virus infection in pregnancy - an update. Eur J Obstet Gynecol Reprod Biol. 2021;259:38-45.

16. Giles ML, Buttery J, Davey MA, Wallace E. Pregnant women's knowledge and attitude to maternal vaccination including group B streptococcus and respiratory syncytial virus vaccines. Vaccine. 2019;37(44):6743-9.

17. Alshengeti A, Alharbi A, Alraddadi S, Alawfi A, Aljohani B. Knowledge, attitude and current practices of pregnant women towards group B streptococcus screening: cross-sectional study, Al-Madinah, Saudi Arabia. BMJ Open. 2020;10(2):e032487.

18. Morioka I, Sonoyama A, Tairaku S, Ebina Y, Nagamata S, Morizane M, et al. Awareness of and knowledge about mother-to-child infections in Japanese pregnant women. Congenit Anom (Kyoto). 2014;54(1):35-40.

19. Kimberlin DW. Herpes simplex. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, editors. Red book: 2015 Report of the Comittee on Infectious Diseases. 30th ed. Itasca, IL: American Academy of Pediatrics; 2015. p. 826-34.

20. Rac H, Gould AP, Eiland LS, Griffin B, McLaughlin M, Stover KR, et al. Common bacterial and viral infections: review of management in the pregnant patient. Ann Pharmacother. 2019;53(6):639-51.

21. Poojari VG, Vasudeva A, Dawson S, Kaipa G, Eshwara V, Tellapragada C, et al. Diagnosis of lower genital tract infection in pregnancy: routine midtrimester high vaginal swab followed by gram staining seems to be the best strategy. Curr Womens Health Rev. 2019;15(4):277-83.

22. American College of Obstetricians and Gynecologists. Prevention of Group B Streptococcal early-onset disease in newborns [homepage on the internet]. Washington, DC: ACOG; 2020 [cited 2025 May 5]. Available from: https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2020/02/prevention-of-group-b-streptococcal-early-onset-disease-in-newborns

23. Iadeluca L, Farrington E, McLean T, Rousseau B, Agosti Y, Absalon J, et al. Maternal screening and treatment for Group B Streptococcus (GBS) are associated with non-adherence to guidelines, false-negative results and high management costs in the United Kingdom, Italy, France, Spain and Germany. Value Health. 2017;20(9):A797-8.

24. Braye K, Foureur M, de Waal K, Jones M, Putt E, Ferguson J. Group B streptococcal screening, intrapartum antibiotic prophylaxis, and neonatal early-onset infection rates in an Australian local health district: 2006-2016. PLoS One. 2019;14(4)-:e0214295.

25. Kwatra G, Cunnington MC, Merrall E, Adrian PV, Ip M, Klugman KP, et al. Prevalence of maternal colonisation with group B streptococcus: a systematic review and meta-analysis. Lancet Infect Dis. 2016;16(9):1076-84.

26. Kekić D, Gajić I, Opavski N, Kojić M, Vukotić G, Smitran A, et al. Trends in molecular characteristics and antimicrobial resistance of group B streptococci: a multicenter study in Serbia, 2015–2020. Sci Rep. 2021;11(1):540.

27. Petersen KB, Johansen HK, Rosthøj S, Krebs L, Pinborg A, Hedegaard M. Increasing prevalence of group B streptococcal infection among pregnant women. Dan Med J. 2014;61(9):A4908.

28. Dordević H. Serological response to herpes simplex virus type 1 and 2 infection among women of reproductive age. Med Pregl. 2006;59(11-12):591-7.

29. Clarke E, Patel R, Dickins D, Fidler K, Jackson A, Kingston M, et al. Joint British Association for Sexual Health and HIV and Royal College of Obstetricians and Gynaecologists national UK guideline for the management of herpes simplex virus (HSV) in pregnancy and the neonate (2024 update). Int J STD AIDS. 2025;36(1):4-23.

Rad je primljen 1. VIII 2025.
Recenziran 24. X 2025.
Prihvaćen za štampu 24. X 2025.
BIBLID.0025-8105:(2025):LXXVIII:3-4:81-88.