Original Article

Group B Streptococcal Infection in Jeddah, Saudi Arabia: Maternal Colonization and Neonatal Infection

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Abstract

The existence of Group B Streptococcus (GBS) in the rectovaginal area during pregnancy and labor is linked to disease and even death in neonates. However, the extent of GBS colonization in pregnant women in Saudi Arabia has not been fully established. The goal of this study was to ascertain the prevalence of Group B Streptococcus (GBS) colonization in pregnant women in Saudi Arabia, where GBS screening is not routinely conducted. This retrospective study involved 1201 Saudi women at ≥28 weeks of gestation admitted in labor to King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia. Vaginal and rectal swabs were taken from these patients between January 2019 and December 2020. Neonatal outcomes were also documented. Out of the 1201 women participating in this study, 534 (44.5%) tested positive for GBS in either the vaginal or rectal sample or both. GBS was also identified as the most common microorganism present in the subjects' cultures. Eleven instances of neonatal sepsis were recorded, three of which were early-onset cases induced by GBS. There were no demographic distinctions between patients who were GBS-positive and those who were GBS-negative. Similarly, no differences in GBS status were found between women with preterm birth and ruptured membranes and those without. The presence of bacterial colonization in women during labor is one of the most problematic and common in the Western province of Saudi Arabia. This study observed an elevated rate of GBS colonization in Saudi women admitted to KAUH while in labor.

Keywords: Colonization, Group B streptococcus, Labor, Prevalence, Saudi women, Vaginal swab

Introduction

Group B Streptococcus (GBS) is a gram-positive bacterium implicated in infections of the fetus, neonate, and/or mother. It is also linked to adverse pregnancy outcomes such as preterm delivery and stillbirth and is one of the main causes of sepsis in newborns in both early-onset cases (< 7 days old) and late-onset cases (7–89 days old) [1]. Unless steps are taken to prevent GBS in pregnant women, early-onset GBS infection is found in 2% of newborns whose mothers were colonized with GBS [1, 2].

An example of how prevention is effective can be seen in the US, where the rate of early-onset GBS disease in newborns fell significantly when guidelines were issued for routine testing for GBS in women at 35–37 weeks of gestation, with antibiotics given prophylactically four hours before delivery to GBS-positive patients [3], although this did not alter the incidence of late-onset GBS. However, elsewhere around the world, these screening and treating measures have not been widely used, with the lack of robust data on the incidence of women and newborns affected by GBS in many regions impending healthcare policy decisions [4].

GBS colonization rates vary to a great extent geographically [1, 2]. The rates of GBS colonization reported in pregnant women in the Middle East range from 3.3% to 33.5% [5-7]. More specifically, the variable rates of GBS colonization reported in pregnant women in various regions of Saudi Arabia have shown great variation [8-12]; however, some of these studies were limited by a small sample size. Research has also indicated that pregnant women in Saudi Arabia lack awareness of GBS [13].

It is important to determine the present status of GBS colonization in the country before further studies to explore new diagnostic measures and initiate vaccines. As with other parts of Saudi Arabia, the western province lacks sufficient data on GBS colonization. This is especially true in Jeddah. To address this paucity of robust data from the region, and to more fully understand differences in the recorded incidence of GBS colonization to develop appropriate guidelines for

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screening, this study seeks to ascertain the rate of rectovaginal colonization with GBS among Saudi women in labor admitted at a tertiary care hospital in Jeddah, in the western province of Saudi Arabia, where GBS testing is not routinely conducted.

Materials and Methods

Study Design and Participants

A two-year retrospective study was carried out to determine the extent of GBS colonization in Saudi women presented to the obstetric unit of King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia, while in labor. Detailed participant data was extracted from the obstetric database and clinical management system used by KAUH and evaluated. Included in the evaluation were maternal demographics (e.g., age, gravidity, and parity), delivery mode, gestational age at delivery, birth weight, gender of the newborn, and neonatal and maternal complications. Exposure variables were identified during laboratory tests that were carried out to detect recto-genital infections.

Several inclusion criteria were applied to choose participants: ≥28 weeks of pregnancy, singleton pregnancy, intact or ruptured membranes, GBS status not known, and no history of prior GBS infection in children. Women were excluded if they had a positive GBS rectovaginal culture previously identified during their current pregnancy, GBS bacteriuria was found at any point during the current pregnancy, they had already had children infected with GBS, or had an arranged delivery via cesarean section, whether it was elective or for an emergency and irrespective of the membrane status (ruptured or intact).

Sample Collection and Identification of Group B Streptococcus

Vaginal and rectal swab samples from participating women were obtained by the attending physician following universal standard procedures and precautions. Incubation of swabs was first carried out in colistin–nalidixic acid agar or 5% sheep blood agar plate (BAP) with enrichment media at a temperature of 37°C for 24 hours [2]. Gram-positive cocci and bacilli can both be cultured in this way. Subsequently, gram-positive Streptococci were differentiated from gram-positive Staphylococci using a catalase reaction test. The MicroScan WalkAway 40 Si Microbiology Analyzer (Siemens AG, Inc., Munich, Germany) was used for isolate identification. Confirmation of the organisms as GBS was made through a rapid latex slide agglutination test, employing a MASTASTREP kit (Mast House, Merseyside, UK).

Intrapartum GBS prophylaxis was given to women whose samples were GBS positive, following recommendations by the American College of Obstetricians and Gynecologists and the US Centers for Disease Control and Prevention [2].

Data Analysis

Data from the investigation was recorded and analyzed using SPSS version 20.0. Descriptive statistical analyses were carried out using averages with standard deviations; medians with ranges; and frequencies with corresponding percentages. Continuous variables were compared using the t-test, while comparisons of discrete variables were carried out using the Chi-square test. A P-value of <0.05 was used to determine statistical significance.

Results and Discussion

The 1201 women enrolled in this study were between 18 and 43 years of age (mean 28.43 ± 5.62 years), and advanced maternal age (defined as being ≥35) was documented in 216 (18%) women. A total of 570 (47.5%) participants were in their first pregnancy, and 631 (52.5%) had been pregnant before. The Gravidity of the participating women ranged from 1 to 12, parity from 0 to 9, and abortion from 0 to 11. Gestational age was recorded as 28–42 weeks, with a mean of 37.93 ± 3.21 weeks. 937 (78.1%) of the women delivered vaginally, while 263 (21.9%) underwent cesarean sections. Only 87 (7.2%) of the 1201 mothers had a fever on admission, while others were healthy. Obstetric complications noted in the current pregnancy were gestational hypertension (2.3%) and gestational diabetes (3.7%).

Figure 1 illustrates the types of microorganisms recovered from the 1201 pregnant women in labor at KAUH. GBS-positive cultures were collected from swabs of the vagina, rectum, or both sites in 534 women, with a maternal colonization rate of 44.5%. The vagina was the most common site of colonization (*n* = 243; 45.5%), but some patients were colonized in the rectum alone (*n* = 118; 22.1%) or at both sites (*n* = 173; 32.3%). Other organisms isolated included Candida albicans (34.3%), Coagulase-negative staphylococci (CoNS) (2.2%), Klebsiella pneumoniae (1.5%), and Haemophilus Influenzae (1.2%) **(Figure 1)**.

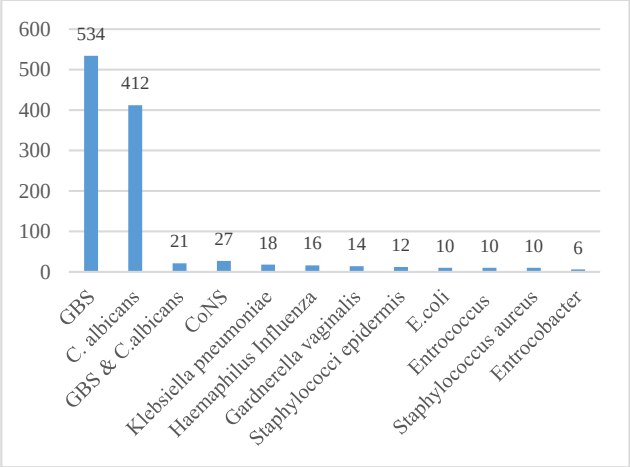

Figure 1. Microorganism colonization in the studied women

The majority of the 1201 infants born to the participants were ≥37 weeks of gestation (*n* = 967; 80.6%) and ≥2.5 kg

(*n* = 955; 79.5%). Half of the newborns were male (*n* = 606; 50.5%), and 112 (9.3%) were GBS-positive. Sepsis was observed in 52 of the infants (4.3%), of which three were GBS-positive, three were CoNS-positive, and three tested positive for Klebsiella pneumoniae; the other newborns had negative cultures.

Distribution of GBS Colonization According to Maternal Age

The distribution of GBS status in the participants according to their age groups is shown in **Table 1**. No significant age-related variations in the percentage of participants colonized by GBS were observed.

Table 1. GBS colonization in relation to age in the studied women

Age (years)	Cases (total)	GBS cases	%	OR	P
18-23	246	112	45.53	1.011	0.94
24-29	472	210	44.49	1.08	0.529
30-35	325	134	41.23	0.812	0.13
≥35	157	77	49.04	1.195	0.323

OR-odds ratio

Distribution of GBS Colonization According to Parity

The distribution of GBS colonization according to parity is shown in **Table 2**. Parity did not affect GBS status in the participants, with similarly high rates observed in all parity groups.

Table 2. Prevalence of GBS colonization vis-à-vis parity in the studied women

Parity	Cases (total)	GBS cases	%	OR	P
<2	817	357	43.7	0.945	0.663
2-4	332	152	45.8	1.035	0.80
≥5	52	25	48.1	1.14	0.66

OR-odds ratio

Distribution of GBS Colonization According to Abortion

The distribution of GBS found in the participants according to abortion is shown in **Table 3**. History of previous loss of pregnancy did not affect GBS status. Women with prior pregnancy loss had a colonization rate of 44.9% (P=0.7).

Table 3. Prevalence of GBS colonization vis-à-vis abortion in the studied women

Abortion	Cases (total)	GBS cases	%	OR	P
0	903	400	44.30	1.043	0.765
1	194	86	44.33	0.958	0.794
2	69	30	43.48	0.874	0.601
≥3	35	18	51.43	1.205	0.60

OR-odds ratio

Distribution of GBS Colonization According to Maternal Condition

Furthermore, there was no link between a gestational age of less than 37 weeks and an increased incidence of colonization, with a GBS colonization rate of 48.9% observed in these early cases (P = 0.15). Additionally, no significant change in rate was observed in women with prelabor rupture of membranes, gestational diabetes, or hypertension **(Table 4)** [14].

Table 4. GBS colonization in relation to prelabor rupture of membranes and preterm birth

Maternal condition	Cases (total)	GBS cases	%	OR	P
PROM	233	101	43.5	0.80	0.15
Gestational diabetes	44	11	25	1.31	0.44
Hypertension	28	9	32	1.70	0.19

OR-odds ratio; PROM-prelabor rupture of membranes

Maternal rectovaginal colonization with GBS raises the risk of invasive infections in newborns [2]. Variations in the GBS colonization rates occur globally, with reported values of 6.5–36% in Europe, 10–30% in the United States, 7.1–16% in Asia, 11.9 – 31.6% in Africa, and 9.1 – 25.3% in the Middle East [7, 15, 16]. The rate we found (44.5%) is higher than the 17.9% prevalence rate found in a meta-analysis of rates from 37 countries in the developing world [17], and it is also above even the high end of the range seen in other Middle Eastern nations.

In Saudi Arabia specifically, wide geographic variations (15–27.6%) in the level of maternal GBS positivity have been reported in Makkah, Dammam, Taif, and Riyadh [8-11]. Our findings are somewhat higher than those previously reported in the same hospital in Jeddah, where 31.6% of pregnant women were found to be GBS positive [12]. With both studies having been carried out at KAUH, these outcomes suggest that GBS colonization is an increasing problem among expectant women in Jeddah.

In pregnancy, the prevalence of vaginal micro-organisms doubles. This rise in colonization is linked to higher concentrations of estrogen in circulation and vaginal deposits of glycogen and other substrates [18]. In the current study, GBS was the most common pathogen isolated from women in labor (44.5% of cases). This differs dramatically from the results of a study in Abha, in the southern part of Saudi Arabia, where CoNS was the most prevalent pathogen found in 24.2% of 7713 pregnant women reviewed [19].

GBS was, however, reported as the most common organism found in other studies conducted in Saudi Arabia. In a study

done in Riyadh, researchers found a GBS colonization rate of 27.6% of women in their third trimester [11]. Likewise, a study in Alkhobar, reported a 19% GBS-positive rate in women admitted to the hospital while in labor [9]. In this Saudi context, the GBS colonization rate in women in their third trimester documented in the current study is higher than that found in other investigations, especially the Abha study, where just one case was isolated from 7,713 cases examined [19]. However, these disparities are unsurprising since maternal GBS colonization is known to vary geographically [20]. Although no recent studies have been conducted in Jeddah, the location of the present study**,** a 2011 study at the same hospital isolated GBS in 31.6% of women in their third trimester [12]. It is impossible to know if the elevated GBS prevalence found in the present study stems from an actual rise in GBS colonization.

The link between colonization with GBS and the age of the mother has been considered. In the current study, GBS was found more often in cultures of women above 35 (49.04%) than in younger women, but these differences were not statistically significant. Other studies found different age groups to be most likely to be GBS positive, but none of the differences reached statistical significance [21, 22]. While the reasons for disparities in the age in relation to GBS are unclear, they point to a myriad of factors that may affect GBS.

The impact of parity on GBS status in pregnant women also varies. Some research suggests no link between parity and GBS [23, 24]. However, some research does suggest a possible link between increasing age or parity and a higher risk of GBS colonization [22]. In a Tanzanian study, researchers found greater GBS colonization rates (50%) in women who delivered at least four times compared to those with fewer deliveries, especially those with only one delivery (19.8%), though the difference did not reach statistical significance. In a study in the Netherlands, researchers found higher GBS colonization rates in women who had given birth fewer times than in women who had given birth more often [21]. This is inconsistent with our findings, where women who delivered five times had higher colonization rates (48.08%) than women who delivered less than two times (43.7%), although this difference was not statistically significant. Why such varying rates of GBS colonization exist is unclear and warrants further investigation.

The timing of screening in studies on GBS colonization is key, as taking samples at 35–37 weeks of gestation could result in a lower colonization rate than if samples are taken later. This was underscored in a systemic review on when gestational GBS screening is carried out, which determined that 6% of GBS colonization was not found during prenatal screening [25]. Although in the current study, there was no significant change in the percentage of GBS at different gestational ages of women with prelabor rupture of membranes (28–36 weeks), we believe that testing during labor is the optimal time to preempt neonatal complications. One obstacle, however, is that the use of the test which allows for rapid GBS screening—the polymerase chain reaction test— is not widespread.

The current study did not find a greater prevalence of GBS colonization in women with pregnancy-related conditions like prelabor rupture of the membrane, gestational diabetes, or hypertension. Although one study in Iran reported higher rectal GBS colonization in pregnant women with diabetes than in those without diabetes, researchers did not find a diabetes-related difference in vaginal GBS colonization, in line with our findings [26].

Bacteria make up the majority of microorganisms reported in women during pregnancy. In the US, the rate of maternal colonization with GBS has dropped progressively to its current range of 20–25%. This may be attributable to the country's universal culture-based screening program, but different guidelines concerning the use of intrapartum antibiotics exist in different countries [2]. Notably, Saudi Arabia has no national standard policy or program for GBS screening of pregnant women, and awareness of GBS among pregnant women in the region is lacking [13]. The high prevalence of GBS found in this study underscores how important it is to implement culture-based testing for maternal GBS colonization at all prenatal clinics. GBS-positive women would then be given antibiotics prophylactically upon admittance for delivery. These measures would stop the maternal-neonate GBS transfer, avoiding the subsequent onset of sepsis and meningitis [27].

Certain limitations of the current study must be noted. It was carried out at just one institution, a tertiary government hospital, which may limit its generalizability to other settings in Saudi Arabia. Another limitation is the absence of data concerning the serotype distribution of GBS in the study participants. Nevertheless, the GBS colonization rate is comparable to those reported for other areas in the Middle East. Furthermore, our use of one microbiology laboratory may strengthen our results. With the lack of robust data about GBS in Saudi Arabia and the broader Middle East region, our findings go some way in filling that gap and suggest that the rate of GBS colonization in pregnant women here is quite high.

Conclusion

There is an elevated rate of GBS colonization in Saudi women admitted to hospitals while in labor in the Western region of Saudi Arabia. This high rate indicates the importance of maternal GBS screening at prenatal clinics so that intrapartum antibiotics can be given prophylactically to those found positive for GBS, subsequently preventing transmission to newborns. Comparable studies on GBS prevalence should be carried out in other areas of Saudi Arabia to give policymakers sufficient data on which to base decisions concerning universal GBS screening for pregnant women in Saudi Arabia.

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CONFLICT OF INTEREST: None

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ETHICS STATEMENT: Ethical approval for this study was obtained from the Biomedical Ethics Committee at King Abdulaziz University, Jeddah, Saudi Arabia (Reference No. 597-20, November 19, 2020). The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. General informed consent was obtained from all patients admitted to KAUH to use their data anonymously for educational and research purposes.

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