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The prevalence and risk factors of group B streptococcus colonization in Iranian pregnant women

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Abstract

Background: Group B Streptococcus (GBS) is a leading cause of serious neonatal infections. Although great progress has been made in preventing prenatal GBS, its colonization rate in different regions of Iran remains unknown.

Aim: To determine GBS colonization prevalence and its risk factors among Iranian pregnant women.

Methods: This prospective cross-sectional study was performed on 186 pregnant women, who attended Boo-Ali hospital which is affiliated with Islamic Azad University in Tehran, Iran, from March 2014 to June 2015. The demographic, obstetric and gynecological data were gathered. A recto-vaginal culture was taken from each patient, with a sterile swab, in lithotomy position without using speculum, and vaginal pH was measured. Patients with positive GBS received IV antibiotic therapy during labor (penicillin G 3 gram at first dose then 1.5 gram Q/4h until delivery). Data were analyzed by statistical software SPSS version 21. Statistical tests for differences were performed by Chi-square test. Potential confounding was assessed by logistic regression. Level of significance was set at $p<0.05$.

Results: Twenty-two (11.8%) patients had positive recto-vaginal colonization. No significant differences between colonized and GBS-negative women with regard to age, obstetrics history and socio-economic factor were noticed. In contrast, smoking, history of previous infection with HPV, presence of vulvitis and a vaginal pH>4.5 were associated with GBS colonization ($p\leq0.05$).

Conclusions: With a relatively low prevalence and few significantly correlated factors, it is hardly possible to define a high risk group of pregnant women for GBS colonization. Therefore, thorough measures should be taken in order to prevent infection complications in mothers and neonates in the Iranian population.

Keywords: Group B Streptococcus, Prevalence, Risk Factors, Pregnant Women, Vertical Infection Transmission, Colonization

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1. Introduction

1.1. Background and study logic

Colonization of group B Streptococcus (GBS), a gram positive coccus, in the vagina and perianal regions, is considered as a risk factor for subsequent infections in pregnant women (1). Maternal streptococcal colonization is associated with urinary tract infection, premature rupture of membrane (PROM), preterm labor, intrauterine fetal death and complications such as chorioamnionitis and endometritis (2). Pregnant women who are carriers of GBS have 50-60% potential capacity for vertical transmission of the microorganism, through which 1-2% of their newborns develop invasive GBS infection (1, 3), with 5-20% mortality rate and serious complications, especially among premature neonates (4, 5). Ethnicity, African origin, maternal age, parity, marital status, socio-economic status, education, occupation, geographic location, smoking, presence of sexually transmitted disease, sexual behavior, and high body mass index have been reported to influence the prevalence of colonization (2, 3, 6). The Centers for Disease Control and Prevention (CDC) currently recommend screening of all pregnant women for GBS between 35-37 weeks of gestation (2, 5, 7). Based on recommended guidelines, intra-partum administration of antibiotics in high risk groups like premature deliveries (before 37 weeks), PROM longer than 18 hours, fever higher than 38°c (8), previous history of infant with GBS infection and also in women with positive screening test of GBS, lowers the risk of neonatal GBS infection (1, 8-10). The prevalence of GBS vaginal colonization in pregnant women in alternative studies was as follows: India/Pakistan 12%, America 14%, Asia-Pacific 19%, Sub-Saharan Africa 19%, and Middle-East/North Africa 22% (11). Although there is insufficient evidence regarding the prevalence of GBS colonization among Iranian pregnant women, in Jahromi et al. study in Zeynabieh Hospital, Shiraz, Iran, 9.1% of 1,197 pregnant patients had positive GBS recto-vaginal culture with 60% transmission rate to their neonates (3).

1.2. Objectives

Considering the paucity of data about GBS colonization among Iranian pregnant women, this study was conducted to determine the prevalence of GBS colonization and its risk factors in pregnant women who attended Boo–Ali hospital, a teaching center of Islamic Azad University in Tehran, Capital of Iran.

2. Material and Methods

2.1. Research design

This prospective cross-sectional study was performed on pregnant women, who attended Boo-Ali hospital which is affiliated with Islamic Azad University in Tehran, Iran, from March 2014 to June 2015.

2.2. Selection criteria

Pregnant women, who volunteered, with gestational age between 35-37 weeks, were eligible to enroll in the study. Patients with any symptoms or signs of urinary tract infection during the past 4 weeks, intake of antibiotics during the past 2 weeks, and preexisting medical disorders complicating pregnancy, were excluded from the study.

2.3. Data collection

At the baseline, a gynecologist examined all patients. In addition, demographic, obstetric and gynecological data, as well as information on previous gestations (including history of PROM and early neonatal sepsis) were gathered.

2.4. Sample Size Estimation

Cochran's formula was used to estimate sample size. According to Jahromi et al. (3), the approximate prevalence of GBS colonization in Iran is 9.1%. Using Cochran's sample size formula, with a margin error of 5% and confidence interval of 95%, a sample of 126 patients were required. The formula was as follows: $n=z^2pq/e^2$. Similar sample size was determined using Morgan's table. We interviewed 200 pregnant women, of whom 14 subjects were excluded according to the previously mentioned exclusion criteria. Finally, a total of 186 women participated in this study; higher than estimated sample size.

2.5. GBS Culture

A recto-vaginal culture was taken from each patient, with a sterile swab in lithotomy position without using speculum, and vaginal pH was measured. The swabs were inoculated into Amies transport medium and transported to the microbiology research laboratory. The swabs were then removed from the Amies medium and inoculated in Todd-Hewitt broth, supplemented with gentamicin (8 mg/ml) and nalidixic acid (15 mg/ml). The inoculated samples were incubated for 24 hours at 37 °C. The broth was then subcultured onto a Columbia Agar base with 5% sheep blood, under the same conditions. Colonies suggestive of S. agalactiae (due to presentation of a narrow zone of beta-hemolysis) were subjected to catalase and CAMP tests. Negative blood-agar plates were re-incubated for an

additional 18 to 24 hours. Patients with positive GBS received IV antibiotic therapy during labor (penicillin G 3 gram at first dose then 1.5 gram Q/4h until delivery).

2.6. Statistical analysis

Data were analyzed by statistical software SPSS version 21. Statistical tests for differences were performed by Chi-square test. Potential confounding was assessed by logistic regression. Level of significance was set at $p<0.05$.

2.7. Research ethics

The study was approved by the ethical committee of Islamic Azad University, Tehran Medical Sciences Branch, and written informed consent for participation was obtained.

3. Results

In total, 186 volunteer pregnant women aged 18-35 years, who met the inclusion criteria, were evaluated. Twenty-two (11.8%) patients had positive recto-vaginal colonization. The mean age of participants was 27.91±5.03 years, ranging from 17 to 41 years. The mean ages of GBS-positive and negative women were 28.77±4.4 and 27.79±5.11 years, respectively (p=0.396). Socio-economic characteristics related to GBS colonization is shown in Table 1. No significant difference between colonized and GBS-negative women with regard to socio-economic factor was noticed. Logistic regression analysis showed that smoking (p=0.001, CI: 1.23-83.2), history of previous infection with HPV (p=0.006, CI: 2.08-34.32) and presence of vulvitis (p=0.041, CI: -0.72-27.92) were associated with GBS colonization. In addition, women with a vaginal pH>4.5 were more likely to be colonized than those who had vaginal pH≤4.5 (p=0.488). Indeed, the rate of GBS colonization was 70% higher by each one unit increased pH. However, there was no significant difference in colonization rate in terms of sexual intercourses/week during or pre pregnancy, history of neonate sepsis, history of preterm labor, PROM, PID, previous infection with HSV, vaginal discharge, vaginal candidiasis, rectal coitus, vaginal burning and miscarriages in previous pregnancies (p>0.05). Odd ratios for all variables associated with GBS colonization are shown in Table 2.

Table 1. Gestational and socio-demographic characteristics in GBS-positive and -negative pregnant women

Variables		GBS colonization		p-value
		Positive (n=22)	Negative (n=164)	
Mean maternal age (years) ± SD		28.77 ± 4.4	27.79 ± 5.11	0.396
Educational level	Illiterate	2 (9)	45 (27.4)	0.163
	High school diploma	10 (45.4)	65 (39.6)	
	Academic	10 (45.4)	54 (32.9)	
Employment status	Employed	5 (22.7)	27 (16.4)	
	Unemployed	17 (77.3)	137 (83.6)	
Smoking	Yes	2 (9)	1 (0.6)	<0.001*
	No	20 (91)	163 (99.4)	
Parity	Nulliparity	11 (50)	85 (51.8)	0.421
	1	11 (50)	63 (38.4)	
	2	0 (0)	15 (9.1)	
	≥3	0 (0)	1 (0.7)	
Mean gestational age (week) ± SD		36 ± 0.87	35.81 ± 2.78	0.760

Values are given as number (percentage) in subgroup

* Significant

Table 2. Association between Reproductive history and pregnancy related characteristics of the subjects according to GBS colonization status

Variables		GBS colonization; n(%)		95% CI for % of positive GBS		p-value
		Positive (n=22)	Negative (n=164)			
Previous miscarriages	0	15 (68.2)	134 (81.7)	48.74	87.66	0.096
	1	7 (31.8)	24 (14.6)	12.34	51.26	
	≥2	0 (0)	6 (3.7)	0	0	
PROM[a]	Pos	2 (9.1)	9 (5.5)	-2.92	21.12	0.506
	Neg	20 (90.9)	155 (94.5)	78.88	102.92	
Preterm labor[a]	Pos	1 (4.5)	6 (3.7)	-4.16	13.16	0.838
	Neg	21 (95.5)	158 (96.3)	86.84	104.16	
Rectal coitus	Pos	3 (13.6)	39 (23.8)	-0.72	27.92	0.293
	Neg	19 (86.4)	125 (76.2)	72.08	100.72	
N.I.P.P	More than 1-2 per week	4 (18.2)	42 (25.6)	2.08	34.32	0.772
	1-2 per month	1 (4.5)	13 (7.9)	-4.16	13.16	
	lower than 1-2 per month	1 (4.5)	5 (3)	-4.16	13.16	
	1-2 per week	16 (72.7)	104 (63.4)	54.08	91.32	
N.I.D.P	1-2 per week	9 (40.9)	53 (32.3)	20.36	61.44	0.587
	More than 1-2 per week	2 (9.1)	13 (7.9)	-2.92	21.12	
	1-2 per month	5 (22.7)	62 (37.8)	5.2	40.2	
	Never	6 (27.3)	36 (22)	8.68	45.92	
PID[a]	Pos	2 (9.1)	5 (3)	-2.92	21.12	0.183
	Neg	20 (90.9)	159 (97)	78.88	102.92	
HPV[a]	Pos	4 (18.2)	5 (3)	2.08	34.32	0.006*
	Neg	18 (81.8)	159 (97)	65.68	97.92	
HSV[a]	Pos	2 (9.1)	4 (2.4)	-2.92	21.12	0.123
	Neg	20 (90.9)	160 (97.6)	78.88	102.92	
History of neonate sepsis	Pos	1 (4.5)	9 (5.5)	-4.16	13.16	0.854
	Neg	21 (95.5)	155 (94.5)	86.84	104.16	
Vaginal discharge	Pos	1 (4.5)	4 (2.4)	-4.16	13.16	0.573
	Neg	21 (95.5)	160 (97.6)	86.84	104.16	
Vaginal pruritus	Pos	3 (13.6)	16 (9.8)	-0.72	27.92	0.575
	Neg	19 (86.4)	148 (90.2)	72.08	100.72	
Vaginal Burning	Pos	2 (9.1)	14 (8.5)	-2.92	21.12	0.931
	Neg	20 (90.9)	150 (91.5)	78.88	102.92	
Vulvitis	Pos	3 (13.6)	6 (3.7)	-0.72	27.92	0.041*
	Neg	19 (86.4)	158 (96.3)	72.08	100.72	
Vaginal candidiasis	Pos	5 (22.7)	23 (14)	5.2	40.2	0.289
	Neg	17 (77.3)	141 (86)	59.8	94.8	
Vaginal pH	≤4.5	16 (72.7)	107 (65.2)	54.08	91.32	0.488
	>4.5	6 (27.3)	57 (34.8)	8.68	45.92	

N.I.P.P: Number of intercourse pre pregnancy; N.I.D.P: Number of intercourse during pregnancy; PROM: Premature rupture of membranes; PID: Pelvic inflammatory diseases; Pos: Positive; Neg: Negative; [a] Previous gestation; * Significant

4. Discussion

Even today, vertical transmission of GBS affects neonates as the most frequent infection responsible for sepsis in developing and developed nations (12). Although screening and prophylactic treatments have helped decrease mortality rates to 5%, a clear estimation of disease burden in many developing countries remains unrecognized (13). This cross-sectional study was conducted on Iranian pregnant women with the aim of investigating a wide range of

possible risk factors associated with GBS colonization for the first time. The findings of the present study revealed an 11.8% GBS colonization rate among participants, almost similar to another population based study in Iran, which reported a 9.1% carrier rate (3). Worldwide reports of GBS carriage prevalence estimated a 10% to 30% rate (14). It seems that Iranian women have a relatively low prevalence of GBS colonization. However, the variety in statistics can also be a result of other confining factors such as site and technique of culturing, as well as gestational age. Even though previous history of GBS colonization is a great risk factor (15), it should be noted that the status of colonization might be transient, intermittent or even chronic (16), thus mothers should be evaluated in each pregnancy. Despite the fact that preterm labor and ROM were introduced as remarkable complications of GBS colonization (3), no significant statistical difference was detected in carrier and non-carrier populations of our study. Furthermore, no risk factors correlating the socio-economic status, obstetrics and gynecological history and sexual activity were recognized. In general, our findings indicated that no high risk group can be identified with regards to age, parity or socio-economic variables, which has also had controversial results in different studies. In this regard, our results are in consistence with a study in the Netherlands by Arijaan et al. on 1,702 women from 72 countries (17). Despite various associated factors introduced in previous literature, including bacterial vaginosis, recent vaginal intercourse, vaginal washing (18), colonization in prior pregnancy (19), and body mass index, typical intra-partum risk factors and positive screens are lacking in many infants, who are affected with GBS infection (20). With a relatively low prevalence and few significantly correlated factors, it is hardly possible to define a high risk group of pregnant women for GBS colonization. Therefore, thorough measures should be taken in order to prevent infection complications in mothers and neonates in the Iranian population.

5. Conclusions

The findings of the present study revealed an 11.8% GBS colonization rate among participants, and indicated that vulvitis, smoking, HPV infection and vaginal pH were correlated with risk of GBS colonization. Therefore, it is suggested that women with these associated factors may benefit from prophylactic antibiotic therapy, or when possible, a second culture shortly before delivery. In addition, it can be concluded that screening for HPV or cervical cancer is of greater importance in GBS positive patients. To optimize the prophylactic treatment, it is best to consider local prevalence rate and risk factors, which helps in clinical decision making, based on risk factor approach, when routine recto-vaginal culturing is not cost-effective in clinical settings. Hence, more studies with a larger sample size are suggested.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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