



A Retrospective National Study on Colonization Rate and Antimicrobial Susceptibility of *Streptococcus agalactiae* in Pregnant Korean Women, 2018–2020

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Purpose: The prevalence of Group B *Streptococcus* (GBS) colonization in pregnant Korean women is increasing; however, nationwide studies are lacking. Therefore, we aimed to analyze regional colonization rates and antimicrobial susceptibility for GBS in pregnant Korean women through a nationwide survey.

Materials and Methods: From January 2018 to December 2020, data from the Seoul Clinical Laboratories on vaginal swab cultures were retrospectively analyzed to detect maternal GBS carriers. Each swab specimen was inoculated onto a 5% blood agar plate and incubated at 35°C–37°C in a 5% CO₂ incubator for 24 h. GBS isolates were identified using a Microflex MALDI Biotyper. Antimicrobial susceptibility tests were performed using the Vitek 2 automated system.

Results: The overall nationwide GBS colonization rate in pregnant Korean women was found to be 10.6% (3578/33721). The maternal GBS colonization rates ranged from 10.5%–10.8% over the 3-year study period. The GBS colonization rates by province, in descending order, were as follows: Jeolla-do, 13.2%; Gangwon-do, 12.0%; Chungcheong-do, 11.8%; Gyeonggi-do, 11.3%; Seoul, 10.2%; and Gyeongsang-do, 9.6%. During the study period, the resistance rates against chloramphenicol, levofloxacin, clindamycin, erythromycin, and tetracycline were 2.6%–2.7%, 18.2%–19.6%, 33.4%–35.7%, 35.6%–36.8%, and 50.5%–53.3%, respectively.

Conclusion: In pregnant Korean women, GBS colonization rates were in the range of 9.6%–13.2%, with Gyeongsang-do being the lowest and Jeolla-do the highest. The resistance rate against clindamycin was high (33.4%–35.7%). GBS colonization rates during pregnancy should be studied nationwide according to the Centers for Disease Control and Prevention-recommended guidelines with periodic antimicrobial resistance monitoring.

Key Words: Group B *Streptococcus*, pregnant women, erythromycin, clindamycin

INTRODUCTION

Group B *Streptococcus* (GBS) is the primary cause of neonatal

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bacterial infections, including sepsis, pneumonia, and meningitis, which can lead to death or long-term effects.^{1,2} GBS infections can present from birth to day 6 [early onset disease (EOD)] or from day 7 to day 89 (late-onset disease). The primary risk factor for neonatal GBS EOD is the colonization of maternal genitourinary and gastrointestinal tracts. Approximately 50% of women who are colonized with GBS can transmit the bacteria to their newborns.³ Vertical transmission usually occurs during labor or after membrane rupture. Implementation of the United States national guidelines for intrapartum antibiotic prophylaxis has resulted in a reduction of >80% in the incidence of GBS EOD, from 1.8 newborns per 1000 live births in the 1990s to 0.23 newborns per 1000 live births in 2015.⁴ In

the absence of intrapartum antibiotic prophylaxis, 1%–2% of the newborns can develop GBS EOD.³

The key obstetric measures necessary for effective prevention of GBS EOD include universal prenatal screening using vaginal–rectal culture, correct specimen collection and processing, appropriate implementation of intrapartum antibiotic prophylaxis, and coordination with pediatric care providers.³ Other factors that influence the incidence rate of GBS EOD are strain virulence, inoculum size, premature or prolonged membrane rupture, preterm delivery, maternal bacteriuria, and serum concentrations of immunoglobulin G antibodies specific for the colonizing capsular polysaccharide type.⁵

The GBS colonization rate in pregnant women varies not only by country and race but also by the study period. In the past, the GBS colonization rate in pregnant Korean women was known to be lower than that in pregnant women from Western countries; however, its prevalence has been increasing recently.^{6,7} According to a single medical institution's longitudinal studies, the colonization rates of GBS in pregnant Korean women were 3.9% in 1993,⁸ 5.9% in 1995,⁹ 11.5% in 2008–2009,¹⁰ and 19.8% in 2017–2019.⁷ Moreover, an abundance of serotype III and V GBS isolates with multi-drug resistance to clindamycin, erythromycin, and tetracycline has been rapidly increasing in Korea, thus narrowing the choice of therapeutic agents available against infections caused by these serotypes.^{7,11,12} However, there has been no nationwide survey on the colonization rate of GBS in pregnant Korean women or antimicrobial susceptibility testing of GBS isolated from pregnant Korean women. Therefore, this study retrospectively analyzed the regional colonization rate and antimicrobial susceptibility results of GBS in pregnant Korean women using data obtained from national network hospitals of Seoul Clinical Laboratories.

MATERIALS AND METHODS

Data collection

From January 2018 to December 2020, 33721 vaginal swab samples collected at obstetrics and gynecology specialized hospitals and obstetrics and gynecology clinics in general hospitals across South Korea were referred to Seoul Clinical Laboratories for GBS culture. All swabs were immediately placed in Stuart transport medium (Becton Dickinson, Sparks, MD, USA). Of the 33721 women attending a hospital for antenatal care, including GBS screening, 90% of the pregnant women were 25–38 years old (mean: 32.0 years; range: 14–48 years). Sample size determination is an important factor when attempting to compare and confirm the colonization rate in retrospective studies, wherein the tested number of populations may be different. If the study population is small, there is a possibility that the colonization rate is incorrectly evaluated as very low or high. The minimum sample size is determined us-

ing Slovin's formula as follows:

$$n = N / (1 + N(e)^2)^{13}$$

where n is the sample size, N is the population size, and e is the margin of error. Adequate sample size calculation in prevalence studies can be determined using the formula $n = Z^2 P (1 - P) / d^2$ (n =sample size, Z =the statistic corresponding to level of confidence, P =expected prevalence, and d =precision).¹⁴ However, it is difficult to ascertain the population size of pregnant women at 35–37 gestational weeks by region in a retrospective survey.

Statistical analysis

The statistical significance of differences in colonization rate by year, and region was analyzed using chi-square tests. All probability values were two-sided, and p values less than 0.05 were considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics v. 25.0 (IBM Corp., Armonk, NY, USA).

Culture and identification methods for GBS

Each swab specimen was inoculated on a 5% blood agar plate (Synergy Innovation, Seongnam, Korea) and incubated at 35°C–37°C in a 5% CO₂ incubator for 24 h. For GBS detection, suspicious colonies showing large, gray, and translucent colonies with a narrow zone of beta-hemolysis or non-beta-hemolysis on blood agar plates were identified using a Microflex MALDI Biotyper (Bruker Daltonik GmbH, Bremen, Germany). A total of 3512 GBS isolates was tested for antimicrobial susceptibility to ampicillin, penicillin, cefotaxime, ceftriaxone, cefepime, meropenem, levofloxacin, erythromycin, clindamycin, tetracycline, chloramphenicol, and vancomycin using the Vitek 2 automated system (bioMérieux, Marcy l'Etoile, France).¹⁵

Ethical approval

Seoul Clinical Laboratories (approval no. IRB-21-057-01) approved this study and stated that a written informed consent was not required.

RESULTS

Colonization rate

The overall GBS colonization rate in pregnant Korean women was 10.6% (3578/33721). There was no difference in the maternal GBS colonization rates by year, with rates of 10.8%, 10.5%, and 10.5% in 2018, 2019, and 2020, respectively.

The maternal colonization rates of GBS by region, in descending order, were 13.2%, 12.0%, 11.8%, 11.3%, 10.2%, and 9.6% in Jeolla-do, Gangwon-do, Chungcheong-do, Gyeonggi-do, Seoul, and Gyeongsang-do, respectively (Table 1). The differences in colonization rates by year in Seoul ($p=0.114$), Gyeong-

gi-do ($p=0.632$), Gangwon-do ($p=0.117$), Chungcheong-do ($p=0.358$), Gyeongsang-do ($p=0.665$), and Jeolla-do ($p=0.383$) were not significantly different. The differences in colonization rates by region were as follows: Gangwon-do and Jeolla-do had high positivity rates in 2018 ($p<0.01$), Seoul and Gyeongsang-do had low positivity rates in 2019 ($p<0.01$), and there was no statistically significant difference in 2020 ($p>0.05$). Fig. 1 shows the rate of maternal colonization in regional cities, obtained with more than 30 culture samples.

Antimicrobial susceptibility

All GBS isolates were susceptible to ampicillin, penicillin, vancomycin, ceftriaxone, cefotaxime, cefepime, and meropenem. The minimal inhibitory concentrations (MICs) of penicillin against GBS isolates were ≤ 0.06 $\mu\text{g/mL}$ and 0.12 $\mu\text{g/mL}$ in 71.3% and 28.78% of the isolates, respectively, and the MICs of ampicillin were ≤ 0.25 $\mu\text{g/mL}$. Among the 1672 strains for which

the chloramphenicol antimicrobial susceptibility test was performed, the proportion of multidrug-resistant GBS isolates with resistance to three or more antibiotic agents of different classes was 32.2% (Table 2).

The resistance rates against non-beta-lactam agents were as follows: chloramphenicol (2.6%–2.7%), levofloxacin (18.2%–19.6%), clindamycin (33.4%–35.7%), erythromycin (35.6%–36.8%), and tetracycline (50.0%–53.3%). There were no statistically significant differences in resistance rates by year (p value; chloramphenicol 0.753, levofloxacin 0.659, clindamycin 0.593, erythromycin 0.876, tetracycline 0.301). The regions with consistently higher resistance rates against non-beta-lactam agents than the national average resistance rate over the 3-year study period were as follows: tetracycline, Chungcheong-do, Gyeonggi-do, and Gangwon-do; erythromycin, Seoul, Gangwon-do, and Chungcheong-do; clindamycin, Gyeonggi-do, Gangwon-do, and Chungcheong-do; and levofloxacin, Seoul, Gyeonggi-

Table 1. Colonization Rate of Group B *Streptococcus* Isolates in Pregnant Women according to a Korean Nationwide Survey during 2018–2020

Province	City	Number (%) of isolates/Number of cultured samples, year			
		2018	2019	2020	Total
Seoul		143 (11.4)/1255	72 (8.6)/839	68 (10.1)/672	283 (10.2)/2766
Gyeonggi-do	Paju			56 (13.6)/413	56 (13.6)/413
	Ilsan	92 (13.3)/693	111 (13.9)/799	97 (11.8)/824	300 (13.0)/2316
	Gimpo	22 (6.6)/331	21 (6.2)/340	23 (6.4)/359	66 (6.4)/1030
	Incheon	54 (13.4)/403	14 (18.4)/76	0 (0.0)/2	68 (14.1)/481
	Bucheon	4 (8.0)/50	0 (0.0)/12	38 (10.9)/348	42 (10.2)/410
	Seongnam	111 (10.2)/1085	116 (12.0)/966	105 (11.0)/953	332 (11.1)/3004
	Suwon	192 (11.7)/1646	200 (11.3)/1776	177 (10.9)/1618	569 (11.3)/5040
	Subtotal	475 (11.3)/4208	462 (11.6)/3969	496 (11.0)/4517	1433 (11.3)/12694
Gangwon-do	Chuncheon			8 (6.6)/121	8 (6.6)/121
	Gangneung	16 (17.2)/93	7 (10.8)/65	7 (10.4)/67	30 (13.3)/225
	Wonju	12 (15.8)/76	49 (12.0)/407	45 (12.0)/374	106 (12.4)/857
	Subtotal	28 (16.6)/169	56 (11.9)/472	60 (10.7)/562	144 (12.0)/1203
Chungcheong-do	Cheonan	15 (10.4)/144	101 (12.6)/799	80 (12.0)/665	196 (12.2)/1608
	Sejong	9 (7.8)/115	24 (11.8)/204	9 (10.7)/84	42 (10.4)/403
	Daejeon	2 (6.5)/31			2 (6.5)/31
	Subtotal	26 (9.0)/290	125 (12.5)/1003	89 (11.9)/749	240 (11.8)/2042
Gyeongsang-do	Sangju		0 (0.0)/11	0 (0.0)/7	0 (0.0)/18
	Gimcheon			0 (0.0)/11	0 (0.0)/11
	Gumi		0 (0.0)/1	22 (9.6)/230	22 (9.5)/231
	Daegu	0 (0.0)/14	0 (0.0)/9	4 (10.5)/38	4 (6.6)/61
	Pohang	100 (12.9)/774	59 (8.8)/672	79 (11.2)/708	238 (11.0)/2154
	Gyeongju	5 (14.7)/34	3 (25.0)/12		8 (17.4)/46
	Gimhae	84 (14.2)/593	78 (11.6)/670	66 (9.7)/682	228 (11.7)/1945
	Busan	264 (8.2)/3228	284 (8.9)/3202	290 (9.5)/3060	838 (8.8)/9490
	Jinju	0 (0.0)/1		0 (0.0)/1	0 (0.0)/2
	Subtotal	453 (9.8)/4644	424 (9.3)/4577	461 (9.7)/4737	1338 (9.6)/13958
Jeolla-do	Jeonju	53 (16.0)/332	39 (12.5)/311	37 (13.3)/278	129 (14.0)/921
	Gwangju	5 (10.6)/47	3 (8.1)/37	2 (5.1)/39	10 (8.1)/123
	Jeongeup	1 (9.1)/11	0 (0.0)/3		1 (7.1)/14
	Subtotal	59 (15.1)/390	42 (12.0)/351	39 (12.3)/317	140 (13.2)/1058
Sum		1184 (10.8)/10956	1181 (10.5)/11211	1213 (10.5)/11554	3578 (10.6)/33721

do, and Chungcheong-do (Table 3).

DISCUSSION

The GBS colonization rates among pregnant Korean women ranged from 1.96%–19.8%, and the colonization rate varied depending on the culture medium used, the site of sample collection, and the number of participants.^{6,7,16} The US Centers for Disease Control and Prevention (CDC) recommends the use of Todd Hewitt Broth with gentamicin and nalidixic acid (or Lim Broth) to maximize the likelihood of recovering group B streptococci upon plating on sheep blood agar.¹⁷ Swabbing

both the lower vagina and rectum (through the anal sphincter) increases the culture yield substantially compared with that obtained by sampling the cervix or the vagina without swabbing the rectum.¹⁷ When direct agar plating is used instead of selective enrichment broth, as many as 50% of women who are GBS carriers show false-negative culture results.¹⁷ Accordingly, the colonization rate in the current study would be lower than that obtained when the CDC recommended protocol¹⁷ is applied, because the vaginal samples were directly inoculated on sheep blood agar without preincubation with the GBS selective enrichment broth.

Recently, it has been reported that non-beta-hemolytic GBS (NH-GBS) are present in approximately 3.5%–8% of all GBS strains from humans.^{7,18} In this study, the proportion of NH-GBS could not be accurately evaluated because colonies suspected of GBS were selected based only on the characteristics of colonies in blood agar. In previous Korean studies, the proportion of NH-GBS was reported to be 4.7%¹⁹ and 8.0%.⁷ Although NH-GBS strains were reported to be approximately four times more frequently associated with noninvasive diseases or colonization than with invasive infections, 71% of the NH-GBS strains from adult invasive infections were from bacteremia.¹⁸ Both animals and humans constitute natural reservoirs for GBS, but knowledge regarding the host specificity of this bacterium is sparse.²⁰ A striking biochemical difference between the isolates obtained from humans and cattle is their ability to ferment lactose.²¹ Duarte, et al.²² reported that 47.1% (n=85) of bovine GBS isolates showed non-beta-hemolysis with 100% lactose fermentation. NH-GBS isolates do not show an orange pigment in Granada medium, owing to the direct genetic linkage between orange pigment production and hemolysin production in GBS.⁷ Therefore, if a laboratorian identifies only beta-hemolytic colonies on blood agar media or yellow colonies on Granada media when detecting GBS carriers,

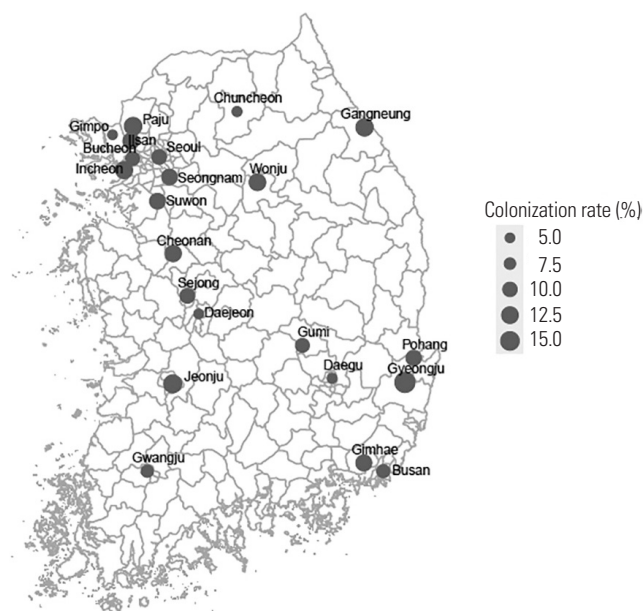


Fig. 1. Rate of maternal colonization in regional cities in which more than 30 culture samples were obtained.

Table 2. Resistance Patterns of 538 Multi-Drug Resistant Group B *Streptococcus* Isolates among 1672 GBS Isolates

Susceptibility to antimicrobial agents					n
Chloramphenicol	Levofloxacin	Clindamycin	Erythromycin	Tetracycline	
S	S	R	R	R	364
S	R	R	R	R	110
S	R	R	R	S	14
S	R	S	R	R	7
S	R	I	R	R	1
S	R	R	R	S	1
S	I	R	R	R	2
R	R	R	R	R	23
R	R	R	R	S	1
R	R	S	R	R	2
R	S	R	R	R	7
R	S	R	R	S	2
R	S	S	R	R	2
R	I	R	R	R	2

S, susceptible; R, resistant; I, intermediate.

Table 3. Antimicrobial Susceptibility of Group B *Streptococcus* in Pregnant Women according to a Korean Nationwide Survey during 2018–2020

Province	City	Antimicrobial resistance rate by years, %*														
		Chloramphenicol			Levofloxacin			Clindamycin			Erythromycin			Tetracycline		
		2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
Seoul		-	3.2	1.5	21.0 ⁴³	20.8 ⁷²	20.6 ⁸⁸	42.7	41.7	32.4	45.5	40.3	38.2	56.6	51.4	52.9
Gyeonggi-do	Paju	-	ND	5.4	ND	ND	21.4 ⁵⁶	ND	ND	35.7	ND	ND	37.5	ND	ND	66.1
	Ilisan	-	2.6	3.1	17.4 ³²	18.0 ¹¹¹	21.6 ⁵⁷	39.1	35.1	39.2	39.1	35.1	40.2	52.2	59.5	54.6
	Gimpo	-	0.0	0.0	22.7 ⁷²	38.1 ²¹	21.7 ²³	27.3	47.6	43.5	31.8	57.1	39.1	59.1	52.4	56.5
	Incheon	-	0.0	ND	22.2 ⁵⁴	14.3 ¹⁴	ND	38.9	28.6	ND	42.6	28.6	ND	70.4	64.3	ND
	Bucheon	-	ND	0.0	0.0 ⁴	ND	23.7 ³⁸	25.0	ND	23.7	23.7	50.0	ND	21.1	ND	39.5
	Seongnam	-	7.1	1.0	15.3 ¹¹¹	24.1 ¹¹⁶	19.0 ¹⁰⁵	39.6	33.6	35.2	42.3	38.8	34.3	61.3	53.4	59.0
	Suwon	-	4.3	3.4	22.4 ⁵²	22.5 ²⁰⁰	18.1 ¹⁷⁷	37.5	39.5	37.9	37.5	42.0	36.7	50.0	57.0	56.5
Subtotal	-	4.2	2.6	19.6 ⁴⁷⁵	22.3 ⁴⁶²	20.0 ⁴⁸⁶	37.9	37.0	36.5	39.4	39.8	35.9	55.6	56.7	56.5	
Gangwon-do	Chuncheon	-	ND	12.5 ⁸	ND	ND	37.5 ⁸	ND	ND	50.0	ND	ND	50.0	ND	ND	50.0
	Gangneung	-	0.0	0.0 ⁷	25.0 ¹⁶	14.3 ⁷	0.0 ⁷	50.0	42.9	14.3	43.8	42.9	14.3	62.5	42.9	42.9
	Wonju	-	0.0	2.2 ⁴⁵	33.3 ¹²	14.3 ⁴⁹	11.1 ⁴⁵	33.3	46.9	48.9	33.3	44.9	48.9	41.7	63.3	60.0
	Subtotal	-	0.0	3.3 ⁶⁰	28.6 ²⁸	14.3 ⁵⁶	13.3 ⁶⁰	42.9	46.4	45.0	39.3	44.6	45.0	53.6	60.7	56.7
Chungcheong-do	Cheonan	-	3.1	5.0	20.0 ¹⁵	25.7 ¹⁰¹	25.0 ⁸⁰	40.0	33.7	42.5	46.7	37.6	42.5	73.3	51.5	62.5
	Sejong	-	0.0	0.0	11.1 ⁹	20.8 ²⁴	22.2 ⁹	33.3	41.7	33.3	33.3	37.5	44.4	55.6	70.8	55.6
	Daejeon	-	ND	ND	50.0 ²	ND	ND	100.0	ND	ND	ND	50.0	ND	50.0	ND	ND
	Subtotal	-	2.6	4.5	19.2 ²⁶	24.8 ²⁵	24.7 ⁸⁹	42.3	35.2	41.6	42.3	42.3	37.6	65.4	55.2	61.8
	Gumi	-	ND	4.5	ND	18.2 ²²	ND	ND	ND	36.4	36.4	ND	ND	ND	ND	54.5
	Daegu	-	ND	0.0	ND	ND	25.0 ⁴	ND	ND	50.0	50.0	ND	ND	ND	ND	75.0
Gyeongsang-do	Pohang	-	4.2	0.0	16.0 ¹⁰⁰	13.6 ⁵⁹	17.7 ⁷⁹	31.0	28.8	39.2	36.0	32.2	40.5	52.0	40.7	50.6
	Gyeongju	-	0.0	ND	20.0 ⁵	33.3 ³	ND	20.0	100.0	ND	20.0	66.7	ND	40.0	100.0	ND
	Gimhae	-	2.9	6.1	15.5 ⁸⁴	12.8 ⁷⁸	22.7 ⁵⁶	25.0	24.4	36.4	28.6	21.8	40.9	45.2	38.5	56.1
	Busan	-	2.9	2.4	15.9 ⁴⁸⁴	13.0 ²⁸⁴	18.6 ²⁹⁰	26.9	26.4	31.7	30.3	31.3	33.1	39.0	41.2	44.5
	Subtotal	-	3.1	2.6	15.9 ⁴⁵³	13.2 ⁴²⁴	19.1 ⁴⁶¹	27.4	26.9	34.1	31.1	30.0	36.0	43.0	41.0	47.9
Jeolla-do	Jeonju	-	0.0	0.0	15.1 ⁵³	15.4 ³⁹	18.9 ³⁷	32.1	17.9	21.6	30.2	20.5	27.0	43.4	35.9	51.4
	Gwangju	-	0.0	0.0	0.0 ⁵	0.0 ³	0.0 ²	20.0	66.7	50.0	20.0	33.3	50.0	40.0	33.3	100.0
	Jeongeup	-	ND	ND	0.0 ¹	ND	ND	0.0	ND	ND	100.0	ND	ND	0.0	ND	ND
	Subtotal	-	0.0	0.0	13.6 ⁵⁹	14.3 ⁴²	17.9 ³⁹	30.5	21.4	23.1	30.5	21.4	28.2	42.4	35.7	53.8
Sum	-	2.7	2.6	18.2 ¹¹⁸⁴	18.5 ¹¹⁸¹	19.6 ¹²¹³	34.3	33.4	35.7	36.6	35.6	36.8	50.4	50.0	53.3	

ND, not done.

*Number of isolates tested.

the GBS colonization rate obtained may be lower than the actual value.

Considering that there was no change in the colonization rate in the recent 3 years in this nationwide survey, we suspect that a certain level of colonization has been reached and maintained in pregnant Korean woman. Moreover, the birth rate in Korea has continued to decline, suggesting a need for urgent action against the increasing rate of GBS infections in pregnant women. Accordingly, it is necessary to include GBS microbiological screening at 35–37 weeks of pregnancy in prenatal screening guidelines in Korea.

Although GBS isolates with reduced penicillin susceptibility have been reported in Korea, Japan, and the United States^{23,24} and penicillin non-susceptible GBS isolates have been reported in Ethiopia (11.1%),²⁵ intravenous penicillin remains the agent of choice for intrapartum antibiotic prophylaxis, with intravenous ampicillin as an acceptable alternative. First-generation cephalosporins (i.e., cefazolin) are recommended for women whose reported penicillin allergy poses a low anaphylaxis risk or is of uncertain severity.³ In the current study, penicillin and ampicillin MIC levels were not reduced in all GBS isolates; however, periodic monitoring of the emergence of non-susceptible strains is required. For women with high penicillin anaphylaxis risk, clindamycin is the recommended alternative to penicillin, but only if the GBS isolate is susceptible to clindamycin.³ In the current study, the clindamycin resistance rate ranged from 33.4%–35.7%, which was higher than the 16.0% reported by Choi, et al.⁷ but lower than the 44.4% reported by Uh, et al.¹⁰ The clindamycin resistance rate of GBS has primarily been determined on the basis of the distribution of macrolide-lincosamide-streptogramin B (MLS_B)-resistant phenotypes. GBS isolates with *erm* (TR)-mediated inducible MLS_B resistance showed resistance to erythromycin and susceptibility to clindamycin; however, GBS isolates with inducible clindamycin resistance detected via disk diffusion using the D-zone test or broth microdilution should be reported as clindamycin resistant.¹³ Therefore, inducible clindamycin resistance detection should be performed in women with high beta-lactam antibiotic anaphylaxis risk. The multidrug-resistant GBS ratio of 32.2% obtained in this study was higher than the 18.9% reported by Safari, et al.²⁶ and lower than the 35.2% reported by Leykun, et al.²⁵ Most of the clindamycin-resistant GBS strains were also resistant to erythromycin and tetracycline. Accordingly, documentation on the detection of clindamycin resistance, including inducible resistance, should be included in the Korean guidelines for the prevention of perinatal GBS infection.

In conclusion, it is necessary to study the nationwide GBS colonization rate during pregnancy according to the recommended CDC guidelines.

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