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ORIGINAL ARTICLE

INTRAPARTUM GROUP B STREPTOCOCCI COLONIZATION AND SEROTYPE DISTRIBUTION AMONG MOTHER NEWBORN DYADS AT TIKUR ANBESA SPECIALIZED HOSPITAL, ETHIOPIA

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ABSTRACT

Introduction: Group B streptococcus was identified as the leading cause of neonatal disease in developed countries. There is scarce data from developing countries. The surrogate for early-onset neonatal disease caused by Group B streptococcus is the rectovaginal colonization of pregnant women before delivery.

Objective: to determine the Group B streptococcus colonization rate among pregnant women and their newborns, vertical transmission rate and serotype distribution at Tikur Anbessa Specialized Hospital.

Method: A hospital based cross-sectional study was conducted at Tikur Anbessa Specialized Hospital from March 2015 to August 2015. Two hundred eighty pregnant women and their newborns were screened for Group B streptococcus. Isolated Group B streptococcus were serotyped by using serotype-specific antisera. A structured questionnaire was used to collect socio-demographic and obstetric data. Logistic regression was used to compare the Group B streptococcus colonization rate with different factors. A P value less than 0.05 was taken as a test of significance.

Result: Group B streptococci colonization rate among pregnant women, newborns and vertical transmission rate in this study were 65(23.2%), 95% CI [18.6-28.9], 32(11.3%), 95% CI [7.8-14.8] and 32/65(49.2%) respectively. Type Ia Serotype was the most commonly identified GBS isolated in the present study.

Conclusion: Group B streptococci colonization rate detected in this study was high. Serotype Ia was the predominant serotype followed by serotype II. In the future, we recommend studies to determine the burden of early-onset diseased that could be caused by GBS in the study area.

Keywords: Group B streptococcus, Vertical transmission, Colonization rate, Serotype, Ethiopia

INTRODUCTION

Group B Streptococcus (GBS) remains a major cause of morbidity and mortality among newborns in many countries (1). Rectovaginal colonization of pregnant women during and before delivery is a prerequisite for the development of early-onset disease (EOD) (2). Factors such as prolonged rupture of membrane, prematurity, chorioamnionitis, low level of anti-GBS capsular antibody and previous newborn with EOD can increase the risk of EOD (3).

Intrapartum antibiotic prophylaxis (IAP) can prevent vertical transmission of GBS from colonized pregnant women to their newborns, and there are two main way to select pregnant women for IAP: screening and risk factor-based approaches (4). The Centers for Disease Control and Prevention (4) recommends that all pregnant women between the 35 and 37 gestational weeks should be screened for GBS colonization, and for those with positive cultures antibiotic should be administered.

In some countries, IAP is administered based on the presence of clinical risk factors such as preterm labor, premature or prolonged rupture of membranes, GBS bacteriuria, and previous infant with GBS disease (5).

Penicillin G is the drug of choice for prophylaxis with ampicillin as the alternative medication (6). For pregnant women who are allergic to penicillin but without a history of anaphylaxis, cefazolin is the preferred antibiotic. Vancomycin is recommended for those with a history of anaphylaxis, and if GBS is resistant to erythromycin and clindamycin. If GBS is susceptible to erythromycin or clindamycin, either of them is recommended for IAP (7).

As a result of IAP, the burden of EOD caused by GBS has declined dramatically over the past 15 years in the USA and other developed countries (7, 8). IAP is not commonly used in most developing countries including Ethiopia.

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Even though IAP has substantially reduced the incidence of disease, it has its own limitation. The strategy does not eliminate all cases of the disease; it does not affect late-onset disease caused by GBS and there is a concern of the selection of antimicrobial resistant bacteria.

Above all, it is not feasible for developing countries including Ethiopia, where resource is limited for laboratory diagnosis. As an alternative, a capsular based vaccine is being developed; currently, vaccine formulation containing Ia, Ib, and III is in a clinical trial and it was reported to be cost-effective (9). However, as GBS serotypes vary from place to place and from time to time the current vaccine formulation on trial may not work for all countries. As a result, comprehensive data on GBS serotypes is required.

The contribution of GBS in neonatal mortality and morbidity in Ethiopia was not well addressed and there is also scarce information regarding maternal and neonatal GBS colonization, vertical transmission rate, and serotype distribution. In the study substantial, colonization and vertical transmission was reported (10). Therefore, this study was done with the objective of providing data about Group B streptococci colonization rate among mothers and newborns and vertical transmission rate including its serotypes distribution.

PATIENTS AND METHODS

Study design, Period and Area

A hospital-based cross-sectional study was conducted from March 2015 to August 2015 at Tikur Anbesa Specialized Hospital (TASH). TASH is in Addis Ababa which is the capital city of Ethiopia; the hospital is located at the center of the country, with a total population of 3,384,569 (11). TASH is a tertiary referral, teaching governmental hospital and the largest of all public hospitals in Ethiopia. The hospital has a total of 800 beds, 80 of which are currently being used in obstetrics and gynecology ward. About 3000 deliveries are attended each year and 60% of these are operative deliveries.

Study population and sample size calculation

The sample size was calculated by using a single proportion formula, margin of error = 0.05, Confidence interval = 95%, prevalence of 20.86% from the previous study conducted in Ethiopia (12). Based on the calculation the sample size was 280; convenient sampling technique was used to recruit study participants. Two-hundred eighty pregnant women who were in labor at TASH and their newborns were screened for GBS.

Newborns were followed through telephone for 7 days to check about their health status.

Inclusion and exclusion criteria

We included pregnant women with vaginal delivery and who were willing to participate in the study along with their newborns. Pregnant women who were on antibiotics and with planned cesarean section were excluded.

Variables of the study

Dependent variable: GBS colonization rate

Independent variables: Factors that could be associated with maternal and newborn GBS colonization rate.

Sample collection, handling, and transport

Swabs from the lower vagina and the rectal region of women in labor and external ear, nasal area, throat and umbilical area of the newborn were collected by trained attending midwifery. All sample collection was done according to the recommendation of the Center of Disease Control and prevention (4). All swabs were placed on Stuart's transport media (BD Diagnostics, USA) and were delivered to the Microbiology Laboratory within 4 hours.

Culture and identification of GBS

Rectovaginal swabs from pregnant women and swabs from the external ear, nasal, throat and umbilical area of newborn was placed into Lim broth (BD Diagnostics, USA) supplemented with colistin (10µg/ml) and nalidixic acid (15µg/ml). The purpose of an antibiotic is to prevent the overgrowth of commensals. The inoculated selective medium was incubated for 18–24 hours, at 37°C in 5% CO₂ enriched atmosphere and then sub-cultured onto sheep blood agar and incubated in 5% CO₂ enriched atmosphere at 37°C for 18–24 hours. If GBS was not identified after the incubation of 18–24 hours, blood agar plate was re-incubated and examined at 48 hours to identify suspected organisms.

All suspected GBS colonies (beta-hemolytic, or non-hemolytic, Gram positive cocci, catalase-negative) were sub-cultured and isolated for confirmatory testing. A CAMP (Christite, Atkins, Munch, Petersen) test was considered presumptive identification of a positive GBS culture. Ambiguous CAMP test culture results were re-tested using a Strp B Grouping Latex (Remel, USA). GBS isolate was serotyped by using-type specific antisera (Statens Serum Institute).

Statistical analysis

Data entry and analysis was done using SPSS version 20 software. Prevalence figures were calculated for the total study population and separately by age group and risk factors. Logistic regression was used to compare the results obtained from pregnant women and their newborns with different age groups and risk factors. A P value of less than 0.05 was considered statistically significant.

Ethical approval and consent to participate

The study was approved by the Institutional Review Board of the College of Health Sciences, Addis Ababa University (Ref No: 069/13/DMIP) and the National Ethics and Research Committee (Ref No: 3.10/795/06).

Written informed consent was obtained from all study participants. The parents also consented for permission to collect samples from their newborns.

RESULTS**Socio-demographic characteristics**

A total of 280 pregnant women along with their 283 newborns participated in the present study. Majority of the participants were from Addis Ababa city and most of the participants were housewives and were in the age group of 25-29 (Table 1). Mean age was 26.6 with Standard deviation of ± 4.5 .

Table 1: Socio-demographic characteristics of pregnant women attending Tikur Anbessa Specialized Hospital, Addis Ababa, March 2015 - August 2015 (n=280)

Variables	Description	Frequency	Percent
Address	Addis Ababa	220	88.6
	Outside Addis Ababa	60	21.4
Occupation	Housewives	190	67.9
	Private work	60	21.4
	Government employee	23	8.2
	Student	7	2.5
Age	15-19	23	8.2
	20-24	103	36.8
	25-29	115	41.1
	30-34	27	9.5
	35-39	11	3.9
	40-44	1	0.4
Sex of newborn	Male	158	55.8
	Female	125	44.2

Gestational characteristics of pregnant women and newborn**Pregnant women**

Among 280 pregnant women participated in the present study, 223(79.6%) delivered at gestational age of 37-42, 147(52.5%) were multigravida; 32(11.4%) had history of newborn with EOD; 129(46.1%) had history of spontaneous vaginal delivery (SVD); most of them had a duration of rupture of the membrane of 0-5 hours; 14(5%) had a premature rupture of membrane (PROM) (Table 2). All mothers recruited in this study were alive, mode of delivery was vaginal, no complication associated with GBS colonization was observed.

Newborns

From a total of 283 newborns participated in this study, those who were alive during birth were 270 (95.4%); most were in the weight range of 2500-4000g; the majority of them had APGAR score at 5 minutes >7 ; 257(90%) newborns had APGAR score at 10 minutes >7 ; 18(6.4%) newborns had other abnormalities (Table 3).

Table 2: Gestational characteristics of 280 pregnant women attending Tikur Anbessa Specialized Hospital, Addis Ababa, March 2015 - August 2015 (n=280).

Characteristics		Frequency	Percent
Gestational age in weeks	<37	37	13.2
	37-42	223	79.6
	>42	20	7.1
Gravida	Primigravida	133	47.5
	Multigravida	147	52.5
History of EOD	Yes	32	11.4
	No	115	41.1
	NA	133	47.5
Previous mode of delivery	Vaginal	129	46.1
	CS	18	6.4
	NA	133	47.5
Duration of rupture of membrane (In the index pregnancy)	0-5 hours	179	63.9
	6-10 hours	66	23.6
	11-15 hours	35	12.5
PROM	Yes	14	5
	No	266	95
Chorioamnionitis	Yes	1	0.4
	No	279	99.6
Meconium stained amniotic fluid	Yes	9	3.2
	No	271	96.8
Other illness*	Yes	35	12.5
	No	245	87.5

EOD: early onset disease, NA: not applicable, SVD: spontaneous vaginal delivery, CS: Cesarean section,
 PROM: Premature rupture of membrane

*HIV/AIDS, Patent ductus Arteriosus, Epilepsy, Thrombocytosis, Cord prolapse, Diabetes mellitus

Table 3: Clinical characteristics of newborn delivered at Tikur Anbessa Specialized Hospital, Addis Ababa, March 2015 - August 2015 (n=283).

Characteristics		Frequency	Percent
Newborn status during birth & immediate after birth	Alive	270	95.4
	Dead	13	4.6
Weight	<1500 gram	16	5.7
	1500-2499 gram	31	11.1
	2500-4000 gram	236	83.4
APGAR score at 5 minutes	<7	83	29.3
	>7	200	70.7
APGAR score at 10 minutes	<7	26	9.2
	>7	257	90.8
Developed EOD	Yes	6	2.1
	No	277	97.9
Other abnormality*	Yes	18	6.4
	No	265	93.6

APGAR: Appearance, Pulse, Grimace, Activity, Respiration EOD: early onset disease

*Clift lip and palate, Hydrocephaly, Down syndrome, Spina befida.

GBS colonization rate among mothers and newborns

Group B streptococcus colonization rate among pregnant women was 65(23.2%), 95% CI [18.6-28.9]; GBS colonization among newborns was 32 (11.3%), 95% CI [7.8-14.8]. Among GBS colonized newborns none of them developed sign and symptoms of early onset disease but one of them was stillbirth.

GBS serotype distribution and vertical transmission rate

Vertical transmission rate of GBS from pregnant women to their newborns in the present study was 32/65(49.2%); overall serotype distribution of GBS was: Ia 22(22.7%), Ib 16(16.5%), II 29(29.9%), III 7(7.2%), V 18(18.6%), none-typeable 5(5.2%) (Table 4).

Table 4: Serotypes distribution of GBS isolated from pregnant women and their newborn and vertical transmission rate at Tikur Anbessa Specialized Hospital, Addis Ababa, March 2015-August 2015

Serotype	Pregnant women	Newborn	Pregnant women & newborn	VTR
Ia	14/65(21.5%)	8/32(25%)	22/97(22.7%)	8/14 (57.1%)
Ib	10/65(15.4%)	6/32(18.8%)	16/97(16.5%)	6/10 (60%)
II	19/65(29.2%)	10/32(31.3%)	29/97(29.9%)	10/19 (52.6%)
III	4/65(6.2%)	3/32(9.4%)	7/97(7.2%)	3/4 (75%)
V	15/65(23.1%)	3/32(9.4%)	18/97(18.6%)	3/15 (20%)
NT	3/65(4.6%)	2/32(6.3%)	5/97(5.2%)	2/3 (66.7%)
Total	65	32	97	32/65(49.2)

Risk factors associated with GBS colonization rate

Group B streptococci colonization rate among mothers and newborns in the current study was not significantly associated with any of the risk factors measured.

DISCUSSION

Prevalence of GBS colonization among pregnant women is not consistent across different regions (1,2). GBS colonization rates vary during pregnancy; colonization late in pregnancy is a good predictor of GBS transmission from mother to newborn and that could lead to EOD (1,4). In the present study, maternal and neonatal GBS colonization rate and vertical transmission rate were 23.2%, 11.3%, and 49.2% respectively.

Comparison of GBS colonization rate among different studies was usually biased by methodological differences (4). Maternal GBS colonization rate in this study was higher compared to some African countries, such as Nigeria (13), Mozambique (14) but it is similar to colonization rate reported from Ghana (15), Congo (16) and Malawi (17).

In contrast to our study, higher colonization rates have been reported previously from Europe (14) and 47% from Zimbabwe (18).

Like many other studies, maternal GBS colonization rate found in this study was in the range of 10-30% (19,21) and it was high compared to the colonization rate reported from Brazil 14.6% (22), Germany 16% (23); it is comparable to the colonization rate reported from Sweden, 25.4% (24), and Malawi, 21.7% (25). There are several reasons for the differences observed in colonization rate such as; laboratory methods used, site and time of sample collection.

Newborn GBS colonization rate (11.3%) and vertical transmission rate of GBS from mother to newborn (49.2%) found in this study was comparable with earlier studies conducted in United States (2). In this study, 1 out of 32 GBS colonized newborn was stillbirth. Recently some studies reported that colonization with GBS may lead to stillbirth (26), this area may need further investigation in Ethiopia setting. In this study, a significant association was not found between maternal and newborn GBS colonization rate and the risk factors ($P>0.05$).

Group B Streptococcus (GBS) serotype distribution vary from one region to the other (27) and it will also change over time (28, 29) however, serotype III, Ia, Ib, II, and V are the common GBS serotypes reported from developed countries (29,30). In this study, serotype II (29.9%) was predominant followed by Ia (22.7%), V (18.6%), Ib 16.5%, and III 7.2%. Our finding was comparable with GBS serotypes reported from other countries (31); however type III was less prevalent but highly transmissible in this study compared to report from other countries (1,7,9,31). Like our study low serotype III prevalence was reported from Brazil (2) and Japan (28).

Other studies also reported that serotype III to be the most common (48.9%) among different geographic areas, followed by serotypes Ia, Ib, II, and V (31). These five serotypes account for more than 94% of neonatal diseases caused by GBS worldwide (30). The reason we did not find newborn with early onset disease can be due to small sample size, the nature of GBS strains in the study area, and antibody in maternal antibody.

Limitations

Since we have used a convenience sampling technique, it may cause a selection bias.

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Mothers who were asked about the health status of their newborn may not provide correct information.

Conclusions

In this study, we found a high GBS colonization rate among pregnant women and their newborns at TASH. This indicates the existence of primary risk factors for EOD in the study area. The prevalent GBS serotypes we identified in this study were serotype II, Ia, V, Ib, III. Therefore, we recommend further study to identify the burden of neonatal disease due to GBS in the study area.

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Competing interests

The authors declare that this manuscript was approved by all authors in its current form and that no competing interest exists.

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