GROUP B STREPTOCOCCAL COLONIZATION IN A DEVELOPING COUNTRY: ITS ASSOCIATION WITH SEXUALLY TRANSMITTED DISEASE AND SOCIOECONOMIC FACTORS

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Abstract. Group B Streptococcus (GBS) is an important infectious organism in pregnant women and their neonates. Although excellent data are available from the developing world, little epidemiologic information is available from Latin America. To evaluate the prevalence of GBS colonization in a developing country, a prospective study was performed in Lima, Peru. We found a relatively low prevalence of GBS colonization of 6.0% in parturient women and 10.6% in nonpregnant women. No association of GBS colonization was made with previously identified risk factors such as age, parity, or birth control practices. We did find a positive association between GBS colonization and chlamydial carriage ($P < 0.05$). We also report an even distribution of GBS serotypes: Ia/c = 35%, IIc = 18%, III = 29%, and V = 18%. Our study provides evidence for a low prevalence of GBS maternal carriage in this urban Latin American population.

Group B Streptococcus (GBS) is a cause of significant morbidity and mortality in certain populations of pregnant women and their neonates throughout the world. The attack rate for neonatal invasive disease, both early and late onset, is between 1.7 and 3.3 per 1,000 live births in the United States, and 0.2–0.6 per 1,000 live births in Europe, Canada, and Israel. Case-fatality rates for the early-onset disease in the United States that range from 5% to 20% illustrate the seriousness of the infection. A recent large multicenter study, the Vaginal Infections and Prematurity Study, detailed the association between heavy group B Streptococcal colonization and the delivery of a preterm, low-birth weight infant. The infants born to the heavily colonized women were also at substantially increased risk of neonatal sepsis. Although excellent data are available from the developed world, there is little information on GBS invasive disease in the developing world. To our knowledge, only three maternal carriage studies have been performed in Latin America. As the treatment of GBS by both chemoprophylaxis and vaccine becomes more refined, more GBS data is critical for effective public health planning. We performed a prospective study in Lima, Peru to evaluate the prevalence of GBS colonization in a developing country and its association with sexually transmitted disease.

PATIENTS, MATERIALS, AND METHODS

Study design. This prospective study took place in Lima, Peru from August through October 1991. A parturient group of 151 women was chosen sequentially at La Maternidad de Lima, a large inner-city maternity hospital. Nonpregnant women were sampled sequentially in two clinical settings: 1) 60 women presenting to the family planning clinic at Loayza Hospital for a routine annual examination and birth control; and 2) 63 prostitutes presenting for their monthly clinic visit. Although the latter group was chosen for its high-risk sexual practices, these women are examined monthly, screened, and treated for sexually transmitted disease.

Informed consent was obtained from all participants and human ethical committee approval was obtained at each institution. Data were collected regarding age, marital status, social demographics, obstetrical history, and in the case of the nonpregnant women, current birth control practices, and the date of their last menstrual period.

Collection of samples. A peripheral blood sample was collected from each woman in the study. Using a sterile cotton swab, specimens for GBS culture were obtained from the vagina and rectum and placed in a tube containing Cary Blair Transport Medium (BBL Microbiology Systems, Cockeysville, MD). Transport time from time of collection to the Microbiology Department at the Universidad Peruano Cayetano Heredia was less than 8 hr.

In the gynecologic population, chlamydial specimens were obtained from the cervix with a commercial kit (MicroTrak; Syva Company, Palo Alto, CA). After wiping the mucus from the exocervix, the cytology brush was rotated one full turn within the endocervical canal. The slide was then prepared according to the manufacturer’s instructions to ensure adequate coverage within the slide’s well. After allowing the specimen to fully air-dry, the slide was fixed with methanol for transport to the laboratory. To screen for gonococcal infection, a separate vaginal smear was made for gram-staining.

Streptococcal culture. Upon receipt in the laboratory, one swab from each site, was inoculated into Todd-Hewitt broth (Gibco Diagnostic, Madison, WI) prepared with nalidixic acid (15 µg/ml), polymyxin (1 µg/ml), and crystal violet (0.1 µg/ml) (Sigma, St. Louis, MO). The broth was incubated overnight at 37°C and inoculated onto a sheep blood agar plate.

Group B streptococci were identified on the basis of typical colony morphology, hemolysis on blood agar, and positive Christie, Atkins, and Munch-Petersen (CAMP) and decapitated test results. All positive cultures were confirmed with the Phadebact latex agglutination test (BBL Strep Grouping Kit; BBL Microbiology Systems) and stored for serotyping at the Centers for Disease Control and Prevention (CDC, Atlanta, GA).

Detection of Chlamydia trachomatis. The slides were stained with the Syva (Palo Alto, Ca) fluorescein-labeled monoclonal antibody reagent. A positive result required the
visualization of at least 10 elementary bodies within the 8-
mm well (sensitivity/specificity of 96.3%/99.5%).

All slides were stored at –20°C and positive results were con-
firmed at Johns Hopkins Hospital Department of Microbi-
ology.

**Syphilis serology.** The peripheral blood sample was al-
lowed to clot at room temperature, the serum was separated
and stored at –70°C. A VeneraI Disease Research Labora-
Ratory (VDRL) assay (Trust Assay; New Horizons Diagnos-
tic Corporation, Columbia, MD) was performed (sensitivity/
specificity of 100%/98.9%).

**Culture of Trichomonas vaginalis.** The Cary Blair trans-
port medium from the vaginal and rectal swabs was analyzed
upon receipt to the laboratory microscopically, and cultured
in Locke-egg-serum medium prepared as previously de-
scribed (Cell Culture Lab, Cleveland, OH).

**Vaginal smear.** Vaginal smears obtained were gran-
stained and read for gram-negative intracellular diplococci
(sensitivity = 60%).

**Statistical analysis.** Dichotomous variables and categor-
dical data were analyzed using the Fisher’s exact test. Means
of subgroups were analyzed using a Student’s *t*-test. Two-
tailed *P* values are given.

**RESULTS**

**Demographics.** The three groups of women differed by
age, marital status, and living conditions (Table 1). The
women in the prostitute group were older, less often married,
and had better living conditions than the other two groups.
The parturient women were the youngest group and least
likely to have electricity and plumbing in their homes.

**Group B Streptococcus.** The overall prevalence rate was
8.0% (Table 2). Group B *Streptococcus* was isolated more
frequently from the vagina (21 positive cultures) than the
rectum (eight positive cultures) (*P* < 0.05).

No statistically significant associations were found based
on previously established risk factors such as age less
than 20 years (odds ratio = 1.41), married versus single
(odds ratio = 1.17), women with three pregnancies or less
(odds ratio = 1.75), use of intrauterine device (odds ratio =
1.34), or recent antibiotic use (odds ratio = 2.40). Group B
*Streptococcus* was isolated more frequently from women
who were *Chlamydia*-positive (4 of 15) than *Chlamydia*-neg-
ative women (9 of 108) (odds ratio = 4.0, *P* < 0.05). There
was no statistically significant association of GBS coloni-
zation with *T. vaginalis* (odds ratio 1.17) or syphilis.

**Serotypes of GBS.** Seventeen of the isolates were avail-
able for serotyping by the CDC with the following results:
six were from group Ia/c (35%), three from group II/c
(18%), five from group III (29%), and three from group V
(18%).

**Prevalence rates of sexually transmitted disease.** The
prevalence rates for *C. trachomatis*, *T. vaginalis*, and syph-
ilis are shown in Table 2. The rates of these sexually trans-
mitted infections were similar between the groups. A posi-
tive VDRL test result was found in 1.1% of the total pop-
ulation.

**DISCUSSION**

In this population of lower income Peruvian women, we
found a prevalence of GBS colonization of 6.0% in partu-
rent women and 10.6% in nonpregnant women. Although
no association of GBS colonization was made with previ-
ously identified risk factors such as age, parity, or birth con-
tral practices, colonization was positively associated with
chlamydial carriage. We have also provided GBS serotyping
data including the presence of the recently described sero-
type, type V, in 18% of the isolates.

Rates of GBS colonization vary widely throughout the
world. Culture methods, including the number and type of
sites cultured and type of medium used, have accounted for
some of this variation. Despite these differences in tech-
nique, real regional variation exists. For example, GBS col-
onization is prevalent in the United States (15–25%),
Jordan (30%), Trinidad (31%), and Gambia (22%). The preva-
lence rate of 6.0% in our pregnant population compares
with the 4% seen by DeLourdes Collado and others in Mex-
ico City. Low prevalence rates have also been reported in
Italy (6.6%), Turkey (8.7%), and Ethiopia (9%).

In addition to regional differences, some investigators
have reported racial differences in GBS colonization rates.

**Table 1**

Socioeconomic characteristics of the three subpopulations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Obstetric group (n = 151)</th>
<th>Family planning group (n = 60)</th>
<th>Prostitute group (n = 63)</th>
<th>Comparison of obstetric and prostitute groups <em>P</em> value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>24.4 (6.0)</td>
<td>31.2 (7.2)</td>
<td>36.3 (9.7)</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Range</td>
<td>14–43</td>
<td>18–47</td>
<td>17–61</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>13.2%</td>
<td>8.3%</td>
<td>69.8%</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Married*</td>
<td>79.5%</td>
<td>91.7%</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>Percentage of women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with concrete home</td>
<td>57.6%</td>
<td>85.0%</td>
<td>88.9%</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Running water</td>
<td>66.2%</td>
<td>81.7%</td>
<td>81.0%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Sewage drainage</td>
<td>61.6%</td>
<td>78.3%</td>
<td>81.0%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Electricity</td>
<td>72.2%</td>
<td>83.3%</td>
<td>90.5%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Number of pregnancies</td>
<td>2.6 (1.9)</td>
<td>2.5 (1.5)</td>
<td>3.1 (1.7)</td>
<td>0.12*</td>
</tr>
</tbody>
</table>

* By Student’s *t*-test.
† Officially married or in stable living arrangement customary in Peru.
compares with the 4% found in a similar population in Mexico City, but differs significantly from Brazil (25.6%). Due to the relatively low population size in each study, it is difficult to determine if these differences are due to selection differences between the study groups or if they may reflect genetic differences between the populations. For instance, Rio de Janeiro has a higher proportion of women with African ancestry than Lima or Mexico City. In the United States, Anthony and others found a lower prevalence of carriage in Mexican-Americans (18.4%) than in whites (40.9%) or blacks (31.3%). The multicenter Vaginal Infections and Prematurity Study Group found the prevalence of GBS colonization to be higher in blacks (21.2%) compared with whites (13.7%). In addition, Hispanics from New York, largely of Caribbean descent, had significantly higher rates of colonization compared with Hispanics of Mexican-American descent. To answer this question in Latin America, a prospective study in an ethnically diverse country, such as Brazil, would be helpful.

An important epidemiologic issue is the regional differences of GBS serotypes. The individual serotypes have differences in their clinical course. Suara and others reported a high frequency of serotype V and believed that this may have a role in the low incidence of GBS invasive disease seen in their populations. In contrast, our serotyping data show a more even distribution. Pediatricians in Peru (Zegarra J, Madariege V, unpublished data) believe that there is a low incidence of GBS invasive disease in Peru. Previous studies have also reported a low incidence of low birth weight in Peru. The true prevalence of GBS invasive disease and its effects on preterm labor and low birth weight can only be determined with further epidemiologic work. In the only report of neonatal GBS disease in Latin America, Solorzano-Santos and others reported an incidence of early-onset disease of 0.7 cases/1,000 live births. This is comparable to rates seen in Europe, Canada, and Israel.

The relationship of GBS colonization to sexual activity is not clear. We report a positive association between GBS colonization and chlamydial infection. After controlling for presence of other organisms, Regan and others did not find an association of GBS colonization with C. trachomatis infections. In that same study, GBS colonization was more prevalent in women who reported multiple partners and frequent intercourse. In contrast, colonization was not associated with the total number of partners or number of partners during the current pregnancy. Similarly, although Baker and others found higher prevalence rates in sexually experienced women as compared to virgin women, no association was seen with increased numbers of sexual partners.

Confirming the results of an earlier study in Peru, the prevalence of syphilis was very low in our population. In contrast, the prevalence rate of chlamydial infection in our family planning clinic population (11.7%) was similar to rates found in family planning clinics in San Antonio, Texas (10.5%), South Carolina (16.6%), and Seattle, Washington (9.3%). Interestingly, the rate of chlamydial infection was not significantly higher in our prostitute group as compared to the family planning group. Although the former group have higher risk sexual practices, they are closely screened and treated for sexually transmitted disease.

In conclusion, GBS colonization is low in Lima, Peru. Six percent of parturient women were colonized at the time of delivery. Given the low rate of GBS carriage and the relatively high prevalence of other pathogens, it is likely that GBS invasive disease, including sepsis and meningitis, represents only a small proportion of neonatal infant mortality in Peru. More epidemiologic data on the prevalence of GBS invasive disease and its association with preterm labor and low birth weight are necessary to confirm this in this population.

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