Trend of Isolation and Serotypes of Group B Streptococci in Korea

Yunsop Chong, Kyungwon Lee, Oh Hun Kwon, Chung Hyun Nahm
Teiko Murai and Yoshiko Inazumi

Group B streptococci (GBS) neonatal infection, a prevalent disease in western countries, is considered rare in Korea. GBS neonatal infection is known to be often due to serotype III organisms, but the serotypes in Korea have not been reported. In this study, GBS were frequently isolated from specimens of genitalia, urine and various pus. Among the 186 isolates 14 (7.5%) were from neonates, two with concomitant bacteremia and meningitis and one with pneumonia. Frequently isolated GBS serotypes were 1b (9.2%), 1b/c (26.6%) and III/R (23.9%). Change of frequently isolated serotypes during the study was noted, but JM9 which became increasingly isolated in Japan was not found. It is concluded that less prevalence of severe neonatal GBS infection in Korea is not due to the absence of serotype III, but possibly due to low genital carriage rate of GBS by pregnant women.

Key Words: Group B streptococci, neonatal infection, serotype

It is now well recognized that Streptococcus agalactiae (group B Streptococcus, GBS) can cause serious infections in neonates (Wenger et al. 1990). To prevent the high morbidity and mortality, preventive measures such as antibiotic treatment of colonized or high risk pregnant women (Tuppurainen and Hallman, 1989; Wanger, 1992) and immunoprophylaxis of pregnant women with deficient anti-GBS capsular antibody (Baker et al. 1988), have been considered in America.

Increased GBS infections in adults with underlying diseases were reported (Eykyn, 1991). Such a tendency was also noted in Korea, but neonatal infection was reported to remain very rare (Nahm, 1992). One of the risk factors for early onset neonatal infection is the GBS carriage of pregnant women (Dillon et al. 1987). Serotyping has been used as an epidemiological tool to explain GBS infections (Wilkinson, 1978). It was reported that neonatal meningitis or bacteremia were more often caused by serotype III. Not only the carriage rates of the pregnant women, but also the regional differences of prevalent serotypes were reported. The prevalent serotype may also change in time (Murai et al. 1990). In Korea, we do not know the maternal carriage rate nor the serotypes distribution of GBS.

In this study, the recent trend of GBS isolation was analyzed and the serotypes were tested as these may reveal part of the reasons for the rarity of the GBS neonatal infections in Korea.

MATERIALS AND METHODS

GBS were isolated from various clinical...
materials of patients at the Severance Hospital, Seoul. Species of the isolates were identified by the conventional method. Catalase negative gram-positive cocci with characteristic hemolysis, no growth in SF broth (Difco) and on bile esculin azide agar (Difco), and positive coagglutination test with Phadebact group B Streptococcus reagent (Karo Biodiagnostics AB, Huddinge, Sweden) were identified as GBS. The trend of GBS isolation during the years 1986 to 1990 was analyzed retrospectively by reviewing laboratory records.

Part of the strains which were isolated during 1979 to 1992 and kept frozen at -35°C in skim milk were tested for the serotype. Serotyping was carried out at the Toho University School of Medicine, Tokyo, Japan. The antisera against reference strains were prepared by the Jelinkova's method (1976) using reference strains provided by the WHO Collaborating Center for Reference and Research on Streptococcus, Prague, Czechoslovakia. The typing sera use in this study were Ia, Ib, II, III, IV, V, type cand. NT6, type cand. 72T1, JM9, c, R and X. Extracts of the isolates were prepared by the modified Lancefield’s method (Sugiyama et al. 1990), using 0.2 N hydrochloric acid and incubating the suspension at 52°C for 2 hours. Capillary precipitation method was used for the typing (Lancefield, 1934).

RESULTS

During the 1986 to 1990 period, 799 isolates of β-hemolytic Streptococcus were identified as group A, B, C or G (Table 1). Among the β-hemolytic streptococcal isolates, 326 (41%) were from respiratory specimens, 249 (31%) from various pus, 164 (21%) from genitourinary specimens, 42 (5%) from blood and 18 (2%) from other body fluid. The genitourinary specimens were mostly from female patients. Among the isolates, 45% were group A, 23% B, 10% C and 22% G. Over 50% of the β-hemolytic streptococci isolated from specimens of respiratory, blood, and pus were group A. However, over 60% of the isolates from specimens of genitalia and urine were group B. From body fluids such as spinal and pleural fluid, GBS were more frequently isolated than A, C or G group streptococci, and 4 of the 8 GBS isolates were from spinal fluid. Among the 17 isolates of group B, C and G streptococci, from patients less than one month of age, 14 (82%) were GBS.

The serotype of 109 isolates of GBS were determined (Table 2). Among them, 26 were strains isolated in 1979~1986 (period 1) and the remaining 83 in 1991~1992 (period 2). More frequently encountered serotypes were: 29 isolates of Ib/c, 26 of III/R, 9 each of Ia, II/c, and III, and 7 of Ia/c. Serotype JM9 was not found. Serotype Ib and Ib/c did not exist in the first period, but became isolated during the second period and the latter was the most prevalently isolated one.

Serotype II/c, which was the predominant type in the first period, was not isolated in the second period. The proportion of serotype III/R markedly increased during the second

<table>
<thead>
<tr>
<th>Specimen</th>
<th>No. (%) of isolates with</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Respiratory</td>
<td>169 (52)</td>
<td>21 (6)</td>
</tr>
<tr>
<td>Pus</td>
<td>140 (56)</td>
<td>29 (12)</td>
</tr>
<tr>
<td>Genitalia</td>
<td>12 (13)</td>
<td>60 (67)</td>
</tr>
<tr>
<td>Urine</td>
<td>7 (9)</td>
<td>56 (75)</td>
</tr>
<tr>
<td>Blood</td>
<td>25 (60)</td>
<td>12 (29)</td>
</tr>
<tr>
<td>Body fluid</td>
<td>6 (33)</td>
<td>8 (44%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>359 (45)</td>
<td>186 (23)</td>
</tr>
</tbody>
</table>

* All except 2 were from female patients.

† 4 from spinal fluid, 3 pleural fluid and 1 peritoneal fluid.
Table 2. Serotypes of group B *Streptococcus* by source of isolation

<table>
<thead>
<tr>
<th>Source</th>
<th>No. of isolates with serotype</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ia</td>
<td>Ia/c</td>
</tr>
<tr>
<td>Blood</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Spinal fluid</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ear</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Throat</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Sputum</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Urine</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cervix</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Others*</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>All</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

* Isolate from inguinal area.  
* Umbilical, peritoneal and wound specimens.

Table 3. Comparison of serotypes of group B *Streptococcus* isolated in Korea and in other countries

<table>
<thead>
<tr>
<th>Country and source</th>
<th>% of isolates with serotype</th>
<th>Total (No.)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea All sources (1979–86)</td>
<td>27</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>Korea All sources (1991–92)</td>
<td>58</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>Japan All sources</td>
<td>40</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>Japan All sources</td>
<td>46</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>USA Meningitis (≥ 10 d)</td>
<td>9</td>
<td>1</td>
<td>91</td>
</tr>
<tr>
<td>USA Meningitis (&lt; 10 d)</td>
<td>18</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td>USA Bacteremia, adult</td>
<td>35</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>USA Pregnant women</td>
<td>25</td>
<td>38</td>
<td>35</td>
</tr>
<tr>
<td>USA Hospital personnel</td>
<td>20</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>USA GU-GI sites</td>
<td>27</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Italy Mothers and neonates</td>
<td>44</td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td>Israel Mothers and neonates</td>
<td>64</td>
<td>0</td>
<td>27</td>
</tr>
</tbody>
</table>

* NT, nontypable.  
* One isolate (9%) was type IV.
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period (Table 3).

DISCUSSION

In America, neonatal meningitis and septi-
cemia due to GBS are so prevalent that pro-
phylactic chemotherapy or immunization is
being considered (Baker, 1988; Tuppurainen
and Hallman, 1989; Wang, 1992). GBS was
the 5th most frequently isolated etiologic
agent of bacterial meningitis in 1986 and was
the most frequent in the age group of less
than one month (Wenger et al. 1990). The
rates of early onset disease per 1000 live
births were 1.09 in a cohort study in Atlanta
and even 1.9—5.4 in hospital series (Schuchat
et al. 1990). The National Institute of Allergy
and Infectious Disease reported rates of 2—3/
1000 live births (1983).

In Korea, an accurate rate of GBS neonatal
infection is not known, but laboratory data
(Nahm, 1992) suggest much lesser prevalence.
A much lower incidence of neonatal infec-
tions was reported in Israel (Weintraub et al.
1983), United Kingdom (Mayon-White, 1985),
Italy (Visconti et al. 1985) and Sweden (Sjoe-
berg et al. 1990). In Japan, the rate was also
reported to be low (Iimura, 1979). Takazawa
and Tomizawa (1991) reported that only 5 of
the 238 GBS strains were isolated from blood

GBS carried by pregnant women has been
proven to be the source of infection of early
onset neonatal disease (Ferrieri et al. 1977;
Dillon et al. 1987). The carriage rates of
American women were reported from 18% to
41% depending on races (Anthony et al. 1978).
In Sweden, an increased annual incidence
from 0.1 to around 0.5/1000 live births and
increased colonization, from 16% in the late
1970s to 30% in the later period, were report-
ed (Sjoeberg et al. 1990). In this study, an
increase of proportion of GBS among the
hemolytic streptococci was noted compared
to the previous one (Choi et al. 1981). It is
more difficult to detect GBS than other β-
hemolytic streptococci, because of its charac-
teristic incomplete hemolysis. But the recent
increase can not be explained by the im-
proved detection alone. For example, GBS be-
came more often isolated from blood cultures
at this hospital. Although the increased isola-
tion from blood was mostly from adult pa-
tients with various underlying diseases, some
were from neonates.

In Israel, neonatal sepsis was estimated at
1 in 12,500 newborns during the period of
1977 to 1982 (Weintraub et al. 1983). The moth-
er to infant transmission rate of 66% and
nosocomial infection rate of 6.6% were simi-
lar to those in western countries. Therefore,
the low incidence of GBS neonatal sepsis in
Israel was explained by the low vaginal colo-
nization rate of 2.8% compared with 4.6% to
36% in western countries. We consider the
GBS carriage rate of pregnant Korean wo-
men to be very low (unpublished data) and
this may partly explain the rarity of neo-
natal GBS infections. Other factor(s) may also
influence the incidence of neonatal infection.
The carriage rate of Chinese women in Hong
Kong was 19.0% and the neonatal coloniza-
tion rate was 19.6%, but the neonatal infec-
tion was rare, 0.58/1000 live births (Liang et
al. 1986). Greater prevalence of GBS neonatal
infection among infants born from black
young mothers was considered to be due to
socioeconomic factors, as could be seen in
Haemophilus influenzae type b infection (Sc-
uchat et al. 1990). Interestingly, H. influenzae
neonatal infection is also less prevalent in
Korea.

It was reported that 70% of strains isolated
from blood and spinal fluid were serotype III,
whereas overall proportion of this type was
32% (Wilkinson, 1973). Infants born from
mothers carrying type III became carriers
more often than those born from mothers
carrying other types (Ancona et al. 1980). In
our study, although a definite conclusion
could not be drawn as the number of GBS
isolates was not large, it was apparent that
the proportion of type III was not signifi-
cantly different from those of pregnant
women and hospital personnel in America
(Table 3). Therefore, the rarity of neonatal
infection can not be due to the rarity of type
III. In Japan, Murai et al. (1990) and
Sugiyama et al. (1990) reported a gradual in-
crease of serotype JM9 (M9) isolates, but this
serotype was not found among our isolates,
possibly indicating a regional difference of
the distribution.

GBS may spread nosocomially (Paredes et
al. 1977; Liang et al. 1986), and some of the late onset neonatal infection may be due to nosocomially acquired strains (Schuchat et al. 1990). GBS also causes various infections in adults. GBS is a significant urinary pathogen in nonpregnant women and it was reported that its presence signals a need for screening for urinary tract abnormalities (Munoz et al. 1992). It also causes meningitis and other infections (Aharoni et al. 1990; Bernatchez and Tourangeau, 1992). In our study, GBS were most often isolated from genital and urine specimens of women, but it was also isolated from other infections. Most of the patients had various underlying diseases. It is unclear whether the infections were caused by GBS carried by the patients or transmitted from other sources. The appearance of a large number of type Ib/c and the disappearance of II/c, during the second period of our study is statistically significant and may suggest a nosocomial spread of GBS. GBS were reported more resistant to antimicrobial agents than other β-hemolytic streptococci (Berkowitz et al. 1990; Buu-Hoi et al. 1990). This factor may play some role for the nosocomial spread of the organism.

In conclusion, less prevalence of the early onset neonatal GBS infection in Korea is not due to the rarity of more virulent serotype III, but is probably due to the low carriage rate of GBS by the pregnant women. The recent increase of GBS isolation from various clinical materials may suggest a possible increase of neonatal infection in the future.

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