Laboratory Detection and Reporting of *Streptococcus agalactiae*

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The presenter states no conflict of interest and has no financial relationship to disclose relevant to the content of this presentation.
I. Importance of prenatal screening strategies

II. Past approaches

III. Current guidelines
   A. General indications for prophylaxis
   B. Laboratory methods and reporting
   C. Adaptations of molecular approaches
   D. Antimicrobial susceptibility testing
Importance of Prenatal Screening
Streptococcus agalactiae

- Colonizes 15-40% of pregnant women
  
  J. Infect. Dis. **143**: 761-766; 1981  
  J. Infect. Dis. **148**: 802-809; 1983  

- Vertical transmission
Streptococcus agalactiae

- Neonatal incidence rate per 1000 live births:
  - Infection: 3.0
  - Septicemia: 2.0
  - Case fatality: 1.0

J. Pediatr. 82: 707-718; 1973

- Group B streptococcal disease
  - Early onset: 0-72 hours; pneumonia ± bacteremia
  - Late onset: 1-3 months; meningitis
803 women screened at 36 weeks gestation

173 (21.5%) positive for *S. agalactiae*

80 received intrapartum ampicillin
93 did not receive antimicrobials
# INTERVENTION

<table>
<thead>
<tr>
<th>Intrapartum Ampicillin Treatment</th>
<th>Number of Colonized Moms</th>
<th>Number (%) of Colonized Babies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>80</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>No</td>
<td>93</td>
<td>43 (46.2)</td>
</tr>
</tbody>
</table>

## INTERVENTION

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Number of Moms</th>
<th>Number of Births</th>
<th>GBS Sepsis/1000 Births</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Incidence</td>
</tr>
<tr>
<td>GBS screen + and <strong>treated</strong>; GBS screen -</td>
<td>710</td>
<td>710</td>
<td>0.00</td>
</tr>
<tr>
<td>GBS screen + and <strong>not treated</strong>; Not screened for GBS</td>
<td>1269</td>
<td>1274</td>
<td>5.49</td>
</tr>
<tr>
<td><strong>Not treated</strong>; Not screened for GBS</td>
<td>3095</td>
<td>3110</td>
<td>2.25</td>
</tr>
</tbody>
</table>
Second trimester assessment
Screening- or risk-based
DISEASE REDUCTION

65% reduction in early-onset disease prevalence from 1993-1998

Figure 1. Incidence of Early- and Late-Onset Invasive Group B Streptococcal Disease in Three Active Surveillance Areas (California, Georgia, and Tennessee), 1990 through 1998, and Activities for the Prevention of Group B Streptococcal Disease.
A POPULATION-BASED COMPARISON OF STRATEGIES TO PREVENT EARLY-ONSET GROUP B STREPTOCOCCAL DISEASE IN NEONATES

Adjusted relative risk for early-onset GBS disease associated with screening approach was 0.48

35- to 37-week assessment

Screening-based
SCREENING-BASED METHODS

Blood agar plate

Blood agar plate

Todd Hewitt (LIM) broth plus subculture

Increases yield 20-35%

# ADDITIONAL (RECTAL) SAMPLING

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients</th>
<th>Carriage Rate (%)</th>
<th>Recovery Only by Rectal Sampling (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badri <em>et al.</em> 1977</td>
<td>789</td>
<td>20.5</td>
<td>50.0</td>
</tr>
<tr>
<td>Dillon <em>et al.</em> 1982</td>
<td>2540</td>
<td>35.0</td>
<td>51.4</td>
</tr>
<tr>
<td>Philipson <em>et al.</em> 1995†</td>
<td>383</td>
<td>20.4</td>
<td>31.1</td>
</tr>
<tr>
<td>Platt <em>et al.</em> 1995*</td>
<td>651</td>
<td>16.9</td>
<td>26.4</td>
</tr>
<tr>
<td>Quinlan <em>et al.</em> 2000</td>
<td>222</td>
<td>24.3</td>
<td>18.5</td>
</tr>
<tr>
<td>Kovavisarach <em>et al.</em> 2007</td>
<td>320</td>
<td>41.9</td>
<td>24.6</td>
</tr>
</tbody>
</table>

*J. Infect. Dis. 135: 308-312; 1977
## WHO’S SAMPLING??

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Location</th>
<th>S. agalactiae Culture Sensitivity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Patient Collection</td>
</tr>
<tr>
<td>Mercer et al. 1995</td>
<td>Tennessee</td>
<td>91.7†</td>
</tr>
<tr>
<td>Molnar et al. 1997</td>
<td>Ontario</td>
<td>97.4</td>
</tr>
<tr>
<td>Price et al. 2006</td>
<td>Ontario</td>
<td>87.5*</td>
</tr>
<tr>
<td>Arya et al. 2008</td>
<td>Ireland</td>
<td>84.3</td>
</tr>
</tbody>
</table>

†P < 0.05

*P = 0.11

Fam. Pract. **14**: 403-406; 1997
SCREENING-BASED METHODS

Blood agar plate + Todd Hewitt (LIM) broth plus subculture = 87.0% sensitivity

Blood agar plate + Carrot broth plus subculture = 96.3% sensitivity

Wheaton Franciscan Laboratory in-house data
CARROT BROTH (observed at 24h)

Negative for
*S. agalactiae*

Positive for
*S. agalactiae*
SCREENING-BASED METHODS

Blood agar plate + Todd Hewitt (LIM) broth plus subculture
38.3% resulted on day 1

Blood agar plate + Carrot broth plus subculture
80.8% resulted on day 1 (P < 0.0002)

Wheaton Franciscan Laboratory in-house data
Is This Working?
Evaluation of Universal Antenatal Screening for Group B Streptococcus

Melissa K. Van Dyke, Ph.D., Christina R. Phares, Ph.D., Ruth Lynfield, M.D.,
Ann R. Thomas, M.D., Kathryn E. Arnold, M.D., Allen S. Craig, M.D.,
Janet Mohle-Boetani, M.D., Ken Gershman, M.D., William Schaffner, M.D.,
Susan Petit, M.P.H., Shelley M. Zansky, Ph.D., Craig A. Morin, M.P.H.,
Nancy L. Spina, M.P.H., Kathryn Wymore, M.P.H., Lee H. Harrison, M.D.,
Kathleen A. Shutt, M.S., Joseph Bareta, M.P.H., Sandra N. Bulens, M.P.H.,
“SUCCESS” IN SCREENING

“SUCCESS” IN PROPHYLAXIS

Estimate

Ten-state surveillance

Early-onset GBS disease per 1000 births


Interval

CDC Guidelines

Revised CDC Guidelines

† Estimate

* Ten-state surveillance

J. Pediatr. **82**: 707-718; 1973

JAMA **299**: 2056-2065; 2008

<table>
<thead>
<tr>
<th>Group B Streptococcus Status</th>
<th>Preterm Delivery † (N = 962)</th>
<th>Term Delivery (N = 6727)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Positive prenatal screening test before delivery‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29.7 (23.9–36.3)</td>
<td>23.9 (22.6–25.2)</td>
</tr>
<tr>
<td>Received intrapartum antibiotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>84.5 (72.9–91.7)</td>
<td>87.0 (84.9–88.9)</td>
</tr>
<tr>
<td>&lt;4 hr between admission and delivery</td>
<td>79.6 (54.8–92.6)</td>
<td>62.7 (56.2–68.8)</td>
</tr>
<tr>
<td>≥4 hr between admission and delivery</td>
<td>85.8 (71.7–93.5)</td>
<td>94.0 (92.2–95.5)</td>
</tr>
</tbody>
</table>

DISAPPOINTMENT???


<table>
<thead>
<tr>
<th>Group B Streptococcus Status</th>
<th>Preterm Delivery† (N=962)</th>
<th>Term Delivery (N=6727)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Unknown colonization status§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>54.2 (49.3–59.0)</td>
<td>0.7 (0.5–1.0)</td>
</tr>
<tr>
<td>Received intrapartum antibiotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>63.4 (57.0–69.4)</td>
<td>78.5 (63.7–88.4)</td>
</tr>
<tr>
<td>&lt;4 hr between admission and delivery</td>
<td>34.0 (24.3–45.3)</td>
<td>38.9 (8.4–81.5)</td>
</tr>
<tr>
<td>≥4 hr between admission and delivery</td>
<td>74.1 (66.7–80.4)</td>
<td>84.3 (69.3–92.7)</td>
</tr>
</tbody>
</table>

### Table 3. Implementation of 2002 Recommendations Regarding Intrapartum Chemoprophylaxis, According to Term Status, 2003–2004.*

<table>
<thead>
<tr>
<th>Group B Streptococcus Status</th>
<th>Preterm Delivery† (N = 962)</th>
<th>Term Delivery (N = 6727)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of group B streptococcus bacteriuria or previous infant with group B streptococcus disease</td>
<td>% (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6.2 (4.3–8.7)</td>
<td>6.7 (6.1–7.5)</td>
</tr>
<tr>
<td>Received intrapartum antibiotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>73.5 (53.9–86.8)</td>
<td>80.7 (76.0–84.7)</td>
</tr>
<tr>
<td>&lt;4 hr between admission and delivery</td>
<td>59.9 (28.7–84.7)</td>
<td>55.6 (44.5–66.1)</td>
</tr>
<tr>
<td>≥4 hr between admission and delivery</td>
<td>74.9 (51.6–89.3)</td>
<td>89.7 (85.0–93.1)</td>
</tr>
</tbody>
</table>
Expected 44 to 86 cases of group B streptococcal disease among term infants

Observed 116 cases


<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mothers Who Delivered at Term and Whose Infants Had Group B Streptococcal Disease (N=189)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no. (%)</td>
</tr>
<tr>
<td>Screened</td>
<td>155 (82.0)</td>
</tr>
<tr>
<td>Positive for group B streptococcus</td>
<td>37 (19.6)</td>
</tr>
<tr>
<td>Negative for group B streptococcus</td>
<td>116 (61.4)</td>
</tr>
<tr>
<td>Unknown colonization status</td>
<td>2 (1.1)</td>
</tr>
</tbody>
</table>

Need improved diagnostics

At same time, demographics may benefit from rapid & accurate diagnostics
BENEFIT FROM A RAPID RESULT

- Increased attack rates and mortality in low birth weight neonates

**Table 1. Number of Cases of Early-Onset Neonatal Invasive Group B Streptococcal Disease and Case Fatality Rates According to Gestational Age in Selected Counties in the United States, 1993 to 1998.**

<table>
<thead>
<tr>
<th>Gestational Age</th>
<th>No. (% of Early-Onset Cases)</th>
<th>Case Fatality Rate (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤33 wk</td>
<td>137 (9)</td>
<td>30</td>
</tr>
<tr>
<td>34–36 wk</td>
<td>116 (7)</td>
<td>10</td>
</tr>
<tr>
<td>≥37 wk</td>
<td>1247 (83)</td>
<td>2</td>
</tr>
</tbody>
</table>


MMWR. 59 (RR-10): 1-32; 2010
BENEFIT FROM A RAPID RESULT

- Increased attack rates and mortality in low birth weight neonates

- Inadequate/no prenatal care
  
  Higher probability in African Americans
  Increased disease in those with inadequate care
  Increased disease in African American neonates

BENEFIT FROM A RAPID RESULT

- Increased attack rates and mortality in low birth weight neonates

- Inadequate/no prenatal care

- Moms who screen negative at 35-37 weeks, but are colonized at parturition (estimated 4-9%)

Pediatrics 115: 1240-1246; 2005
J. Infect. Dis. 148: 802-809; 2005
COMMERCIAL PCR

- Rapid detection of *S. agalactiae* DNA in vaginal/rectal specimens from prepartum or intrapartum women (direct swab)

- 86-94% sensitivity (*LIM broth* reference)

PERFORMANCE INDICES

Carrot broth-enhanced PCR  33.0% detection
LIM broth-enhanced PCR  30.5% detection
Carrot broth culture  29.6% detection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Carrot Broth PCR</th>
<th>LIM Broth PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>100.0</td>
<td>92.5</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>100.0</td>
<td>96.4</td>
</tr>
<tr>
<td>Unresolved rate (%)</td>
<td>0.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Processing time/specimen (min)</td>
<td>5.1</td>
<td>5.1</td>
</tr>
</tbody>
</table>

### Parameter Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Timepoint of Carrot Broth Culture Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overnight Incubation</td>
</tr>
<tr>
<td>Positive culture</td>
<td>34</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>50.7</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>80.5</td>
</tr>
</tbody>
</table>

COMMERCIAL PCR

- Rapid detection of *S. agalactiae* DNA in vaginal/rectal specimens from prepartum or intrapartum women (direct swab)

- 86-94% sensitivity (*LIM broth* reference)
  

- 56-59% sensitivity (*carrot broth* reference)
  
WHY??

WHY??

Wheaton Franciscan Laboratory in-house data
WHY??

% Difference in Sensitivity

- Direct swab PCR
- LIM broth culture
- Carrot broth culture
- Carrot broth-Enhanced PCR

Clinical specimen (vaginal/rectal swab)

Inoculate carrot broth

Carrot broth produces orange pigment

Report as positive for group B *Streptococcus*

No pigment production

Perform PCR on broth aliquot
CAN THIS BECOME MORE RAPID??
IN VITRO EXPERIMENTATION

- Inoculate carrot broth tubes with $10^3$, $10^2$, $10^1$ *S. agalactiae*

- Mock inoculation with $10^9$ flora; simulating…
  - Anaerobic flora
  - Gastrointestinal flora
  - Urogenital flora
  - Pathogenic flora

- Collect 500-μL aliquots at specified intervals for carrot broth-enhanced PCR
### CARROT BROTH-ENHANCED PCR

<table>
<thead>
<tr>
<th>S. agalactiae Inoculum</th>
<th>Percentage Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time of aliquot collection (hours)</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>$10^1$</td>
<td>0.0</td>
</tr>
<tr>
<td>$10^2$</td>
<td>58.3</td>
</tr>
<tr>
<td>$10^3$</td>
<td>100.0</td>
</tr>
</tbody>
</table>

ND; not determined

1. Recover remaining swab from original patient collection for direct swab StrepB PCR
2. Retrieve frozen carrot broth aliquot for StrepB PCR

Carrot broth inoculation

Orange carrot broth pigment after overnight incubation

x hours

Hold remaining swab from original patient collection

Aliquot removed and frozen (-70°C)
1. Recover remaining swab from original patient collection for direct swab StrepB PCR
2. Retrieve frozen carrot broth aliquot for StrepB PCR

30 of the prospective aliquots retrieved for early-aliquot StrepB PCR specificity validation
### CLINICAL EXPERIMENTATION

<table>
<thead>
<tr>
<th>Number of Specimens</th>
<th>Early- aliquot Carrot Broth-enhanced PCR</th>
<th>% Positive from Remnant Direct Swab PCR</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collection Interval (h)</td>
<td>% Positive</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>&lt; 3.00</td>
<td>54.5</td>
<td>66.7</td>
</tr>
<tr>
<td>35</td>
<td>3.00-3.99</td>
<td>40.0</td>
<td>54.3</td>
</tr>
<tr>
<td>35</td>
<td>4.00-4.99</td>
<td>51.4</td>
<td>48.6</td>
</tr>
<tr>
<td>41</td>
<td>5.00-5.99</td>
<td>73.2</td>
<td>65.9</td>
</tr>
<tr>
<td>39</td>
<td>6.00-6.99</td>
<td>82.1</td>
<td>46.2</td>
</tr>
<tr>
<td>44</td>
<td>&gt; 7.00</td>
<td>86.3</td>
<td>56.8</td>
</tr>
<tr>
<td>Total (227)</td>
<td></td>
<td>66.1</td>
<td>56.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Specimens</th>
<th>Early-aliquot Carrot Broth-enhanced PCR</th>
<th>% Positive from Remnant Direct Swab PCR</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collection Interval (h)</td>
<td>% Positive</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>&lt; 3.00</td>
<td>83.3</td>
<td>91.7</td>
</tr>
<tr>
<td>12</td>
<td>3.00-3.99</td>
<td>50.0</td>
<td>75.0</td>
</tr>
<tr>
<td>10</td>
<td>4.00-4.99</td>
<td>80.0</td>
<td>80.0</td>
</tr>
<tr>
<td>19</td>
<td>5.00-5.99</td>
<td>94.7</td>
<td>89.5</td>
</tr>
<tr>
<td>13</td>
<td>6.00-6.99</td>
<td>100.0</td>
<td>69.2</td>
</tr>
<tr>
<td>10</td>
<td>&gt; 7.00</td>
<td>100.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Total (76)</td>
<td></td>
<td>85.5</td>
<td>80.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Specimens</th>
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<th>% Positive from Remnant Direct Swab PCR</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collection Interval (h)</td>
<td>% Positive</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>&lt; 3.00</td>
<td>38.1</td>
<td>52.4</td>
</tr>
<tr>
<td>23</td>
<td>3.00-3.99</td>
<td>34.7</td>
<td>43.5</td>
</tr>
<tr>
<td>25</td>
<td>4.00-4.99</td>
<td>40.0</td>
<td>36.0</td>
</tr>
<tr>
<td>22</td>
<td>5.00-5.99</td>
<td>54.5</td>
<td>45.5</td>
</tr>
<tr>
<td>26</td>
<td>6.00-6.99</td>
<td>73.1</td>
<td>34.6</td>
</tr>
<tr>
<td>34</td>
<td>&gt; 7.00</td>
<td>82.4</td>
<td>52.9</td>
</tr>
<tr>
<td>Total (151)</td>
<td></td>
<td>56.2</td>
<td>44.4</td>
</tr>
</tbody>
</table>

35- to 37-week assessment

Screening-based
INDICATIONS FOR PROPHYLAXIS

- Previous infant with invasive early-onset disease
- *S. agalactiae* bacteriuria during any trimester of current pregnancy
- Positive *S. agalactiae* vaginal/rectal screening culture in late gestation during current pregnancy
- Unknown *S. agalactiae* status at labor PLUS one:
  - Delivery at < 37 weeks’ gestation
  - Amniotic membrane rupture $\geq$ 18 hours
  - Intrapartum temperature $\geq$ 100.4° F
  - Positive intrapartum nucleic acid amplification test

*MMWR. 59 (RR-10): 1-32; 2010*
SPECIMEN COLLECTION/TRANSIT

- Lower vaginal, then rectal collection
  35-37 weeks’ gestation; can be self-collected
  Cervical, perianal, perirectal not acceptable

- Swabs placed into non-nutritive transport medium
  Recovery decreases over 1-4 days (room temp)
  Refrigerate swabs, if feasible

- Clinicians indicate if patient possesses allergy to penicillin or cephem agent

MMWR. 59 (RR-10): 1-32; 2010
SPECIMEN PROCESSING

- Selective broth medium (Todd-Hewitt base)
  - LIM broth
  - Transvag broth

- Alternative selective media can be chromogenic
  - Carrot broth
  - Granada biphasic broth

- 18-24 hours in 35-37°C ambient air or 5% CO₂

- Direct plating may be included
  - Lower sensitivity than broth enrichment
  - Should not be used as sole means of recovery

MMWR. 59 (RR-10): 1-32; 2010
SELECTIVE BROTHS SUBCULTURED TO APPROPRIATE AGAR(S)

- Non-pigmented chromogenic broths subcultured to appropriate agar(s)

- Positive identification may be derived from:
  - Biochemical or probe testing of isolated growth
  - Pigmented broth (β-hemolytic *S. agalactiae*)
  - Probe testing of selective broth
  - Nucleic acid amplification testing of selective broth
  - Latex agglutination of selective broth

**MMWR. 59 (RR-10): 1-32; 2010**
DIRECT MOLECULAR DETECTION?

“Accurate results are more important than rapid turnaround time for antenatal screening.”

MMWR. 59 (RR-10): 1-32; 2010

College of American Pathologists MIC.64817

“A pre-enrichment step using a selective broth enrichment culture is performed for antepartum (35-37 weeks gestation) vaginal/rectal swab screening for Group B streptococci (GBS) colonization by nucleic acid amplification testing (NAAT).”
ANTIMICROBIAL SUSCEPTIBILITY

- Disk diffusion or broth microdilution performed on antenatal *S. agalactiae* isolates from women at risk for anaphylaxis (related to penicillin or cephem)

  - Anaphylaxis
  - Angioedema
  - Respiratory distress
  - Urticaria

- Inducible clindamycin testing on erythromycin-resistant *S. agalactiae*

- CLSI M100 document recommends suppression of erythromycin susceptibility testing data

  **MMWR. 59 (RR-10): 1-32; 2010**
INDUCIBLE CLINDAMYCIN RESISTANCE

- CDC recommends “D-test” on erythromycin-R/clindamycin-S isolates of *S. agalactiae*; allows for performance on other validated AST systems

- 2 μg clindamycin disk
- 15 μg erythromycin disk
- 12 millimeters apart

Mueller-Hinton w/blood
35C; 5% CO₂
20-24 hours

MMWR. 59 (RR-10): 1-32; 2010
S. agalactiae versus erythromycin
$S.\ agalactiae$ versus erythromycin
Percentage Susceptible

S. agalactiae versus erythromycin
S. agalactiae versus clindamycin
Percentage Susceptible

S. agalactiae versus erythromycin
S. agalactiae versus clindamycin
INTRAPARTUM PROPHYLAXIS

Patient allergic to penicillin?

No

Penicillin G, 5 million units IV initial dose, then 2.5–3.0 million units† every 4 hrs until delivery or
Ampicillin, 2 g IV initial dose, then 1 g IV every 4 hrs until delivery

Yes

Patient with a history of any of the following after receiving penicillin or a cephalosporin?§
- Anaphylaxis
- Angioedema
- Respiratory distress
- Urticaria

No

Cefazolin, 2g IV initial dose, then 1 g IV every 8 hrs until delivery

Yes

Isolate susceptible to clindamycin¶ and erythromycin***?

No

Vancomycin, 1 g IV every 12 hrs until delivery

Yes

Clindamycin, 900 mg IV every 8 hrs until delivery

References

MMWR. 59 (RR-10): 1-32; 2010
Fourteen non-invasive *S. agalactiae* isolates between 1995-2005 had alterations in PBP2X

Clinical significance unclear

Antimicrobial. Agents Chemother. **52**: 2890-2897; 2008
...THEY ARE A CHANGIN’

Table 1. MICs (mg/L) of antimicrobial agents for GBS isolated in 2004 and 2007

<table>
<thead>
<tr>
<th></th>
<th>GBS 2004</th>
<th>GBS 2007</th>
<th>CLSI S</th>
<th>CLSI R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin G</td>
<td>0.06</td>
<td>0.25</td>
<td>≤0.12</td>
<td>NA</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>0.12</td>
<td>1</td>
<td>≤0.5</td>
<td>NA</td>
</tr>
<tr>
<td>Oxaclindin</td>
<td>1</td>
<td>4</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>0.12</td>
<td>0.5</td>
<td>≤0.25</td>
<td>NA</td>
</tr>
<tr>
<td>Meropenem</td>
<td>0.03</td>
<td>0.25</td>
<td>≤0.5</td>
<td>NA</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>0.06</td>
<td>0.06</td>
<td>≤0.25</td>
<td>≥1</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>0.06</td>
<td>0.12</td>
<td>≤0.25</td>
<td>≥1</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>32</td>
<td>32</td>
<td>≤2</td>
<td>≥8</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>0.25</td>
<td>0.5</td>
<td>≤3</td>
<td>NA</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>0.5</td>
<td>0.5</td>
<td>≤2</td>
<td>≥8</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>4</td>
<td>4</td>
<td>≤4</td>
<td>≥16</td>
</tr>
</tbody>
</table>

GBS, group B Streptococcus; CLSI S and CLSI R, MIC breakpoints for susceptibility (S) and resistance (R); 1 NA, not available.

1 Microbiologie médicale et infectiologie, Centre hospitalier de l’Université de Montréal (CHUM)-Hôpital Saint-Luc, 1058 rue Saint Denis, Montréal, Québec, Canada, H2X 3J4; 2 Département de microbiologie et immunologie, Université de Montréal, CP 6128 succ. Centre-Ville, Montréal, Québec, Canada, H3C 3J7; 3 Médecine interne, CHUM-Hôpital Saint-Luc, 1058 rue Saint Denis, Montréal, Québec, Canada, H2X 3J4; 4 Laboratoire de santé publique du Québec/Institut national de santé publique du Québec (LSPO/INSPO), 2005 chemin Sainte-Marie, Sainte-Anne-de-Bellevue, Québec, Canada, H9X 3H5. 1 Microbiologie médicale et infectiologie, CHUM-Hôpital Notre-Dame, 1560 rue Sherbrooke Est, Montréal, Québec, Canada, H2L 4M1

**S. agalactiae BACTERIURIURIA**

- Marker for heavy genital tract colonization; risk factor for early-onset GBS disease


- 1996 guidelines no threshold specification
  2002 guidelines report any concentration
  2010 guidelines $10^4$ colony forming units/mL

- Few data available on risk for early-onset GBS in context of low-count bacteriuria

  *MMWR. 45 (RR-7): 1-24; 1996*
  *MMWR. 51 (RR-11): 1-24; 2002*
  *MMWR. 59 (RR-10): 1-32; 2010*
Identification of candidates for intrapartum chemoprophylaxis is essential for prevention of early-onset group B streptococcal disease.

Much of this has fallen into the hands of laboratory.

Situation has improved since the 1970s; more work to be done.

Molecular diagnostics and antimicrobial susceptibility testing, when applied appropriately, play major role.