Keeping Well Newborns Well
Decreasing Unnecessary Antibiotic Administration in Term Neonates

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Financial Disclosures

• No financial disclosures.
Background- Early Onset Neonatal Sepsis

- Two primary causes passed from mother during labor and delivery
  - Group B Strep
  - Chorioamnionitis (Intraamniotic Infection)
Background- What is Chorioamnionitis?

- Chorioamnionitis is a complication of pregnancy and/or labor that is inflammation of the membranes (chorion and amnion) that surround the fetus and the amniotic fluid.
- This can be a serious infection affecting both the mother and infant. Occurring in 1-4% of births.
- In the infant it can cause premature birth, neonatal sepsis, chronic lung disease, brain injury possibly leading to cerebral palsy, other neurodevelopmental disabilities and even death.
Background- Current Practice

• ACOG (American Congress of Obstetricians and Gynecologists) – prophylactic antibiotics given to GBS+ mother while in labor to protect infant.
  – Significantly reduced the incidence of Neonatal EOS

• Currently the CDC recommends that any term infant whose mother is diagnosed with chorioamnionitis during labor and/or delivery be treated with prophylactic antibiotics without taking into account the infant’s clinical exam.
Background – Why a problem?

• Required antibiotic administration separates well newborns from their mother at the crucial time of bonding and breastfeeding after birth.

• Blood draws and IV starts

• Unnecessary antibiotic exposure in these infants has negative long term implications.
  – Potential increase in asthma
  – Change in the newborns gut microbiome
  – IBD and obesity.
We want more of this…

...and less of this!!
Background – Potential Solution

• The Neonatal Early-Onset Sepsis Calculator was created by Kaiser in 2012 to determine which infants should receive antibiotics based on clinical findings and objective risk factors, not just the subjective maternal diagnosis of chorioamnionitis.

• Could we decrease unnecessary antibiotics administration to well newborns without increasing sepsis at SCL Health by using the calculator??
Purpose

• The purpose of this study was to compare the number of infants actually treated with antibiotics per the CDC recommendations versus the number of infants that would have been treated based on the Neonatal Early Onset Sepsis calculator.
Method

• A retrospective analysis of infants >35 weeks gestation born from January 2015 and July 2016 and cared for in the Well Newborn unit, whose mothers were diagnosed with Chorioamnionitis during labor and/or delivery.

• A detailed review of information from the infant and mother’s Electronic Medical Record (EMR) was entered into the Neonatal Early-Onset Sepsis Calculator and calculated the sepsis risk factor of each infant.

• Based on the results of the calculator it was determined which infants should have received antibiotics and/or lab evaluations.

• Finally, we calculated the percentage of infants that would have been treated based on the calculator compared to the total number actually treated.
Neonatal Early-Onset Sepsis Calculator

- https://neonatalsepsiscalculator.kaiserpermanente.org/

Probability of Neonatal Early-Onset Sepsis Based on Maternal Risk Factors and the Infant's Clinical Presentation

The tool below is intended for the use of clinicians trained and experienced in the care of newborn infants. Using this tool, the risk of early-onset sepsis can be calculated in an infant born ≥ 34 weeks gestation. The interactive calculator produces the probability of early onset sepsis per 1000 babies by entering values for the specified maternal risk factors along with the infant's clinical presentation.
**Neonatal Early-Onset Sepsis Calculator**

Please enter details below.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of Early-Onset Sepsis</td>
<td>0.5/1000 live births (CDC national)</td>
</tr>
<tr>
<td>Gestational age</td>
<td>35 weeks, 4 days</td>
</tr>
<tr>
<td>Highest maternal antepartum temperature</td>
<td>98.8 Fahrenheit</td>
</tr>
<tr>
<td>ROM (Hours)</td>
<td>7.8</td>
</tr>
<tr>
<td>Maternal GBS status</td>
<td>Negative, Positive, Unknown</td>
</tr>
<tr>
<td>Type of intrapartum antibiotics</td>
<td>Broad spectrum antibiotics &gt; 4 hrs prior to birth, Broad spectrum antibiotics 2-3.9 hrs prior to birth, GBS specific antibiotics &gt; 2 hrs prior to birth, No antibiotics or any antibiotics &lt; 2 hrs prior to birth</td>
</tr>
</tbody>
</table>

**Risk per 1000/births**

| EOS Risk @ Birth | 0.58 |

**EOS Risk after Clinical Exam**

<table>
<thead>
<tr>
<th>Clinical Illness</th>
<th>Risk per 1000/births</th>
<th>Clinical Recommendation</th>
<th>Vitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Appearing</td>
<td>0.24</td>
<td>No culture, no antibiotics</td>
<td>Routine Vitals</td>
</tr>
<tr>
<td>Equivocal</td>
<td>2.89</td>
<td>Blood culture</td>
<td>Vitals every 4 hours for 24 hours</td>
</tr>
<tr>
<td>Clinical Illness</td>
<td>12.13</td>
<td>Empiric antibiotics</td>
<td>Vitals per NICU</td>
</tr>
</tbody>
</table>

Classification of infant’s Clinical Presentation: Clinical Illness, Equivocal, Well Appearing...
# Neonatal Early-Onset Sepsis Calculator

## Classification of Infant's Clinical Presentation

<table>
<thead>
<tr>
<th>Clinical Exam</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Clinical Illness** | 1. Persistent need for NCPAP / HFNC / mechanical ventilation (outside of the delivery room)
2. Hemodynamic instability requiring vasoactive drugs
3. Neonatal encephalopathy / Pernatal depression
   - Seizure
   - Apgar Score @ 5 minutes < 5
4. Need for supplemental O₂ ≥ 2 hours to maintain oxygen saturations > 90% (outside of the delivery room) |
| **Equivocal** | 1. Persistent physiologic abnormality ≥ 4 hrs
   - Tachycardia (HR ≥ 150)
   - Tachypnea (RR ≥ 60)
   - Temperature instability (≥ 100.4°F or < 97.5°F)
   - Respiratory distress (grunting, flaring, or retracting) not requiring supplemental O₂
2. Two or more physiologic abnormalities lasting for ≥ 2 hrs
   - Tachycardia (HR ≥ 150)
   - Tachypnea (RR ≥ 60)
   - Temperature instability (≥ 100.4°F or < 97.5°F)
   - Respiratory distress (grunting, flaring, or retracting) not requiring supplemental O₂ |
| **Well Appearing** | No persistent physiologic abnormalities |

Note: abnormality can be intermittent
Neonatal Early-Onset Sepsis Calculator

Data Collected

- Gestational Age
- Highest Maternal Antepartum temperature
- ROM (rupture of membranes) in Hours
- Maternal GBS (Group B Strep) Status
- Type of intrapartum antibiotics received
  - Broad spectrum antibiotics >4 hours prior to birth
  - Broad spectrum antibiotics 2-3.9 hours prior to birth
  - GBS specific antibiotics >2 hours prior to birth
  - No antibiotics or any antibiotics <2 hours prior to birth
| Gestational Age (Weeks/days) | Highest Maternal Temp | # of Hours of Rupture of Membranes | Group B Strept status | Culture Results | If positive, what organism identified | Provider | Maternal Allergy to Penicillin | Broad Spectrum Antibiotics > 4 hours prior to birth | Broad Spectrum Antibiotics 2-3.9 hours prior to birth | GBS specific Antibiotic < 2 hours prior to birth | No antibiotic or any antibiotic after 2 hours prior to birth | Early Onset Sepsis Risk at birth | Early Onset Sepsis Risk after exam | Risk per 1000 births | Clinical Recommendation | Antibiotics Yes/No 1/0 | Blood Culture Yes/No 1/0 | Vital Signs Frequency | NICU for part of stay |
|-----------------------------|------------------------|-----------------------------------|----------------------|----------------|--------------------------------------|---------|-----------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------|--------------------------|----------------|------------------------|-----------------|------------------------|
| 30.6                        | 102.4                  | 8                                 | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 3.40           | 1.4                     | B. culture               | 0               | 1                        | 4 hours    | No                     |
| 40.1                        | 100.8                  | 8                                 | Negative             | Negative       | NA                                   | Kaiser  | No                          | No                             | No                                   | Yes                             | NA                                   | 0.30           | 0.13                    | None                    | 0               | 0                        | Routine    | No                     |
| 36.6                        | 98.8                   | 42                                | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 0.57           | 0.23                    | None                    | 0               | 0                        | Routine    | No                     |
| 40.1                        | 103.3                  | 17                                | Negative             | Negative       | NA                                   | Kaiser  | No                          | No                             | No                                   | No                             | Yes                                   | 10.20          | 4.21                    | ABC                     | 1               | 1                        | NICU/YS    | No                     |
| 40.3                        | 99.1                   | 9                                 | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 0.22           | 0.09                    | None                    | 0               | 0                        | Routine    | No                     |
| 40.3                        | 101.1                  | 7                                 | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 1.23           | 0.5                     | None                    | 0               | 0                        | 4 hours     | No                     |
| 38.3                        | 100.0                  | 20                                | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 0.68           | 0.28                    | None                    | 0               | 0                        | Routine    | No                     |
| 39.6                        | 101.5                  | 7                                 | Negative             | do not know    | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 1.48           | 0.61                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 37.2                        | 101.9                  | 9                                 | Positive             | Negative       | NA                                   | Kaiser  | No                          | Yes                            | Yes                                  | Yes                            | No                                   | 1.06           | 0.44                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 39.5                        | 100.6                  | 19                                | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 1.01           | 0.41                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 39.5                        | 101.8                  | 11                                | Negative             | Negative       | NA                                   | Kaiser  | No                          | No                             | No                                   | No                             | Yes                                   | 2.27           | 0.93                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 39.4                        | 100.9                  | 6                                 | Negative             | Negative       | NA                                   | RMY     | Yes                         | No                             | No                                   | No                             | Yes                                   | 0.90           | 0.37                    | None                    | 0               | 0                        | Routine    | No                     |
| 39.1                        | 101.3                  | 18                                | Positive             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | Yes                            | No                                   | 1.14           | 0.47                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 40.3                        | 102.7                  | 10                                | Negative             | Negative       | NA                                   | Kaiser  | No                          | No                             | No                                   | Yes                            | No                                   | 5.10           | 2.1                     | B. culture               | 0               | 1                        | 4 hours     | No                     |
| 40.3                        | 100.9                  | 7                                 | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 0.94           | 0.39                    | None                    | 0               | 0                        | Routine    | No                     |
| 39.2                        | 100.8                  | 12                                | Negative             | Negative       | NA                                   | RMY     | Yes                         | No                             | No                                   | No                             | Yes                                   | 0.99           | 0.41                    | None                    | 0               | 0                        | Routine    | No                     |
| 40.5                        | 101.3                  | 6                                 | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 1.32           | 0.54                    | None                    | 0               | 0                        | 4 hours     | No                     |
| 40.0                        | 99.9                   | 16                                | Negative             | Negative       | NA                                   | Kaiser  | Yes                         | No                             | No                                   | No                             | Yes                                   | 0.52           | 0.21                    | None                    | 0               | 0                        | Routine    | No                     |
| 40.4                        | 101.1                  | 22                                | Negative             | Negative       | NA                                   | Kaiser  | No                          | Yes                            | No                                   | NA                            | Yes                                   | 0.56           | 0.23                    | None                    | 0               | 0                        | Routine    | No                     |
| 40.4                        | 101.1                  | 27                                | Negative             | Negative       | NA                                   | RMY     | No                          | No                             | No                                   | No                             | Yes                                   | 2.00           | 0.62                    | None                    | 0               | 0                        | 4 hours     | No                     |
Results

- Infants cared for in the well newborn nursery from January 2015 to July 2016.
  - 6221
- Infants received antibiotics due to their mother’s diagnosis of Chorioamnionitis.
  - 289
- Infants with a positive blood culture
  - 0
- Calculator recommendation:
  - Blood cultures drawn and receive Antibiotics - 29 infants (10%)
    - 12 of these 29 infants were also transferred to the NICU for further evaluation.
  - Blood cultures drawn only - 37 infants (13%)
  - Observe 48 hours with no interventions - 223 infants (77%)
Results

Neonatal EOS Results (in percent)

- Calculator recommended antibiotics (in NICU): 8
- Calculator recommend blood culture: 13
- Calculator recommend observe: 79
Next Steps

• Created a cross-discipline committee to evaluate our current Infection Risk Policy

• Based on the results of this study the Infection Risk protocol for well newborns was changed.

• Starting July 30, 2017 we are now using the calculator for every newborn > 35 weeks gestation that is cared for in the Well Newborn Unit.

• We are no longer automatically giving antibiotics.
Results  July 30 – May 31, 2018

- Total Number of Deliveries – 3366
- Mothers Diagnosed with Chorioamnionitis – 187 (6%)
- Well Infants Calculator recommended Antibiotics – 1
- Well Infants Calculator recommended Blood Culture – 46
- Well Infants Calculator recommended Observe – 138

- Clinically Ill infants transferred to the NICU - 10
  - 9 for respiratory distress and on CPAP
  - 1 for whole body/brain cooling

- Infants that contracted Early Onset Sepsis - 0
Results July 30, 2017–May 31, 2018

Neonatal EOS Results (in percent)

- Calculator recommended antibiotics (in NICU): 74%
- Calculator recommended blood culture: 25%
- Calculator recommended observe: 6%
Doses per 1000 Patient Days

Implemented Calculator
Good News... Calculator integrated into EMR applications.

- EPIC created a Flowsheet and Report for the calculator.
Questions???????
References


References


