Choosing High-Value Care in the Evaluation and Treatment of Newborns at Risk for Early-Onset Sepsis

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Clinical Scenario

A 38-week gestational age (GA) male infant was born via spontaneous vaginal delivery, with rupture of membranes occurring 10 hours before delivery, to a gravida 1 para 1 (G1P1) mother found to be group B streptococcus (GBS) negative and with negative prenatal serologies. Prior to delivery, the mother of the infant was diagnosed with intra-amniotic infection (previously chorioamnionitis) resulting from maternal fever of 101.5°F, maternal tachycardia, and fetal tachycardia.

The infant’s Apgar score was 8 and 9 at 1 minute and 5 minutes, respectively. The infant was well-appearing and vigorous, and he was placed skin-to-skin with his mother. After a “golden hour,” the infant was transferred to the newborn nursery for further evaluation and care. During this evaluation, the on-call pediatric resident physician performed a physical exam and obtained relevant medical and social history from the mother.

Treatment Options

Option A: The infant is admitted and treated based on the American Academy of Pediatrics (AAP) and the Centers for Disease Control and Prevention (CDC) guidelines for infants born to mothers with intra-amniotic infection (IAI). An intravenous (IV) line is placed while in the nursery, and a complete blood count (CBC) with a blood culture are collected. The infant is then started on empiric antibiotics to prevent early-onset neonatal sepsis, using IV ampicillin and gentamicin. The infant is assessed with vital sign measurements every 4 hours. After 48 hours, his blood culture is negative, and the infant is discharged home.

Option B: The infant is evaluated using the neonatal early-onset sepsis (EOS) calculator based on the Bayesian model for risk stratification of newborns ≥35 weeks GA at risk for EOS. According to the calculator, the risk per 1000 births for EOS in this well-appearing newborn is 0.84. The calculator’s clinical recommendation is to obtain vital signs every 4 hours for 24 hours with no empiric testing or antibiotics unless the infant’s clinical status changes. The infant is managed with routine newborn care and vitals every 4 hours. He is discharged home with his mother after his newborn screening bundle is completed, between 36 hours and 48 hours of life.

Discussion Questions

1. What is the current incidence of neonatal EOS and what are the current recommendations for evaluation and treatment according to 2010 AAP and CDC guidelines?

Answer: Neonatal EOS is defined as blood and/or cerebrospinal fluid culture-proven infection in a newborn less than 7 days old. Current incidence of EOS ranges between 0.5 and 1.2 cases per 1000 live births. Although this incidence represents a threefold to fivefold decrease over the past 20 years, the number of newborns evaluated and empirically treated has remained the same. Based on 2010 guidelines, the percentage of newborns treated with antibiotics is 200-fold higher than the incidence of EOS as all infants born to mothers with IAI are recommended to receive empiric antibiotics.

2. What is the evidence behind the new neonatal EOS calculator?

Answer: In 2013, Escobar et al published results from a 24-year, multi-center retrospective nested case control study (1993–2007). The study examined neonatal sepsis risk at birth based on objective maternal factors, demographics, specific clinical milestones, and vital signs during the first 24 hours of life. Using such data, a risk classification scheme for EOS was developed. The
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The neonatal EOS calculator was then applied retrospectively to 183 infants with culture-proven EOS and 569 population-matched controls.²

The neonatal EOS calculator takes into account the newborn’s clinical presentation, including vital signs, classifying him or her as well-appearing, equivocal, or clinical illness. Risk of EOS changes based on the clinical classification once initial data has been put into the calculator. As the risk of sepsis increases and the number needed to treat decreases, the calculator will recommend additional interventions such as laboratory work and/or empiric antibiotics.⁵

**Costs**

**Option A:** $78 for 1 CBC, 1 blood culture, and antibiotics (4 doses of ampicillin and 2 doses of gentamicin for 48-hour sepsis rule-out)

**Option B:** $0 (no additional charge to routine newborn care)

*Costs were obtained from healthcarebluebook.com.*⁶

These costs are estimates and represent the amount typically charged to the patient for these services.

**Teaching Moment**

Use of the EOS calculator for infants ≥35 weeks GA born at risk for early-onset neonatal sepsis can help decrease unnecessary laboratory evaluation, invasive procedures (IV placement), and empiric antibiotic use during the neonatal period.

**Interventions and Results**

Between July 2016–September 2016, 62 infants were born at our institution (Greenville Health System, or GHS) to mothers with a diagnosis of IAI. From these 62 infants, 77 CBCs were collected. All 62 infants underwent blood cultures and received empiric antibiotics. Before any intervention, we performed a retrospective review and applied the EOS calculator to each newborn. The EOS calculator recommended routine care for 56 of the 62 babies (90%), lab work for 4 babies, and empiric antibiotics for 2 babies. Our review also showed all final blood cultures to be negative.

If the neonatal EOS calculator had been used to guide clinical decision making during these 3 months, a total patient savings of $5136 would have resulted. Extrapolating this figure out to a 1-year period, implementation of the EOS calculator has the potential to save over $20,544 a year. Other benefits of the EOS calculator include less pain from blood draws and IV placement, as well as improved antibiotic stewardship in the neonatal period.

On February 13, 2017, the neonatal EOS calculator was officially implemented at The Family Birthplace located at GHS’ Greenville Memorial Hospital. Newborns with risk factors for EOS are identified and include maternal fever (intrapartum temperature ≥100.4°F), prematurity (GA <37 weeks), prolonged rupture of membranes (≥18 hours), or maternal GBS colonization. Using vital signs and clinical status at 2 hours of age, the EOS calculator is used to determine whether empiric antibiotics and/or laboratory evaluation may be recommended. If indicated, the first dose of antibiotics is administered by 6 hours of life.

Data collection is ongoing. As of June 7, 2017, we have experienced a 93% reduction in the use of empiric antibiotics for healthy newborns and a 70% reduction in the amount of unnecessary lab work obtained in infants at risk for EOS. Of the newborns who received routine care, no readmissions for sepsis have occurred within the first 7 days of life. Since implementation of the EOS calculator, 18 babies were able to stay on their private pediatrician’s service rather than be transferred to the newborn hospitalist service.

We will continue to collect data. However, to date, we believe the EOS calculator to be a helpful tool that has enhanced our ability to provide patients with safe, evidence-based, and cost-conscious care.

**References**


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