Implementation of an antibiotic stewardship quality improvement initiative in a community hospital for infants born at ≥ 35 weeks

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ABSTRACT

We present our experience in the implementation of an antibiotic stewardship quality improvement initiative directed toward infants born at ≥ 35 weeks using as a primary tool the Kaiser Permanente early onset sepsis calculator (KP-EOS-C) at the Baylor Scott & White Medical Center – Frisco. After the approval and support of the medical staff and administration, we proceeded to launch an extensive educational program for all women's services nursing staff on how to utilize this calculator to communicate results to the pediatricians on staff. After implementation, we saw a 54% reduction in the number of infants undergoing sepsis workup evaluations and a 51% reduction in the number of infants receiving antibiotics ($P < 0.001$). We conclude that the implementation of this type of initiative may be feasible and worthwhile in other similar community hospitals, provided there is buy-in by physicians and administration as well as an extensive educational program to the hospital medical and nursing staff.

KEYWORDS Antibiotics; Kaiser Permanente early onset sepsis calculator; neonatal intensive care unit; newborn nursery; quality improvement; sepsis workup

Pediatricians in community hospitals frequently encounter situations in which well-appearing newborns are born to mothers who may have some known risk factor for early onset sepsis (EOS).¹

Until recently, the American Academy of Pediatrics (AAP) recommended a sepsis workup and administration of antibiotics in well-appearing infants with a maternal history of chorioamnionitis.² Even though EOS is life threatening, its incidence has been decreasing for a few years.³ It is also well established that the use of antibiotics in the newborn is associated with undesirable conditions from obesity to asthma, not counting the effect it may have on antibiotic resistance.⁴ Since its appearance in April 2017, the Kaiser Permanente EOS calculator (KP-EOS-C) has received much attention in the literature and brought awareness to practicing pediatricians.^{5–7} Its unique management of newborns with known risk factors for EOS and the quantification of that risk has brought a powerful and pragmatic tool for practicing pediatricians and neonatologists in the US. For that reason the AAP has recently suggested using it as an approach to dealing with infants at risk for EOS.⁸ Reviewing our hospital data,

we realized we were not exempt from having our infants exposed to an increased number of sepsis workups and administration of antibiotics. Therefore, we implemented an antibiotic stewardship quality improvement initiative in the newborn nursery and neonatal intensive care unit (NICU) at Baylor Scott & White Medical Center in Frisco, Texas, utilizing the KP-EOS-C to reduce the number of infants undergoing sepsis workups and receiving antibiotics. Our specific goal was to reduce, in the first 6 months, the percentage of sepsis workups in infants born ≥ 35 weeks by 40% and the exposure of antibiotics in the same group of infants by 30%.

METHODS

Baylor Scott & White Medical Center – Frisco is a community hospital located in a suburban area in North Dallas with 67 licensed beds and approximately 2200 deliveries per year. Its NICU has eight licensed beds with approximately 200 admissions per year. Before project implementation, pediatricians on the medical staff were using AAP

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Figure 1. Key drivers for a successful antibiotic stewardship project. EOS indicates early onset sepsis.

Figure 2. Compliance rate with the early onset sepsis calculator for (a) nurses and (b) physicians.

recommendations to order sepsis workups and antibiotics, which were based on universal maternal group B streptococcus screening combined with a categorical risk-based approach for EOS.² In January 2018, we assembled a core team consisting of the hospital NICU/newborn nursery manager, NICU/newborn nursery educator, and the medical director of newborn services.

A month later, we started gathering baseline data and identified key drivers for successful project implementation (Figure 1). We sought support and advice about this project from the hospital chief medical officer soon after. We opted to utilize the KP-EOS-C as the primary tool to drive our specific goals.⁵ To gather support from the medical staff, we delivered a presentation on background, hospital-specific data, and stated goals to the women's services committee and later to the pediatricians in the medical staff in May 2018.

After their feedback and approval, we developed an educational program for nursing staff in women's services but specifically the newborn nursery and NICU. Our primary objective was to have the nursing staff input all specific elements necessary to calculate the EOS risk for an infant and present it to the pediatrician for his or her decision. The educational program included information on the elements in the calculator, as well as mock situations so participants could practice. A specific table for documentation was provided, which included the web link for the KP-EOS-C.

A compliance tool was developed to ensure no infants with EOS risk factors were missed. Pediatricians were not required to follow the EOS calculator's suggested management, but their actions were monitored for a future educational opportunity if necessary. All symptomatic infants were admitted to the NICU. On the rare occasion in which the EOS calculator recommended taking vital signs of an asymptomatic infant every 4 hours, our nursing leadership agreed to do so in the nursery. The nursing staff education occurred from late May to June 2018, and the official project starting date was July 1, 2018.

We gathered monthly data on number of deliveries, blood cultures, and number of infants ≥ 35 weeks gestation receiving gentamicin. Blood cultures were a surrogate indicator for infants undergoing EOS evaluation; gentamicin use was a surrogate indicator of patients receiving antibiotics, since the usual EOS regimen in the hospital was ampicillin and gentamicin; and monthly deliveries was used as the denominator to calculate the percentages of infants undergoing EOS workups and receiving antibiotics. A *t* test was used to test differences in the mean before the initiative (January 2017 to June 2018) and after the initiative (July 1 to September 31, 2019).

RESULTS

During project implementation, nursing compliance with the proper use of the KP-EOS-C was above 98%, and physician compliance with the EOS calculator recommendation was above 94% (Figure 2). The percentage of EOS evaluations decreased 54% from a preproject mean of 11.9%

Figure 3. Infants ≥ 35 weeks (a) with sepsis workup and (b) on antibiotics.

(standard deviation [SD] 2.40) to postproject mean of 5.2% (SD 1.52) ($P < 0.001$, *Figure 3a*). The percentage of patients receiving antibiotics decreased 51% from a preproject mean of 6.38% (SD 2.0) to a postproject mean of 3.1% (SD 1.2) ($P < 0.001$, *Figure 3b*). Before the implementation, there were two positive blood cultures. Both infants were admitted to the NICU, and analysis of the clinical data determined there were contaminants (*Staphylococcus epidermidis*). There were three positive blood cultures during the implementation period. One was positive to *Staphylococcus coagulase-negative* and considered a contaminant. Two pathogens were isolated in different infants (*Enterococcus faecalis* and *Escherichia coli*). Both patients were symptomatic in the first 24 hours, and the EOS calculator properly indicated antibiotics. We were not aware of any infant coming back to our facility with symptoms of EOS.

DISCUSSION

After comprehensive implementation of an antibiotic stewardship quality improvement initiative, we were able to achieve significant reductions in the number of infants having sepsis workups and receiving antibiotics (decreases of 54% and 51%, respectively; $P < 0.001$). This experience is somewhat similar to the original paper by Kuzniewicz et al.⁵ We had a lower baseline of infants having sepsis evaluations (11.4% vs. 14.9%), but the magnitude of reduction was not as dramatic (54% vs. 64%). Our baseline use of antibiotics was similar (6.38% vs. 5%), as well as our magnitude of reduction (51% vs. 48.5%). A factor that may have helped in decreasing the use of antibiotics toward the end of our

study was the new AAP recommendation published in December 2018, which provided the use of KP-EOS-C as an alternative for the management of newborns at risk for EOS. One limitation of our initiative was that we did not have the means to monitor potential readmission of infants after the implementation of the quality improvement project. However, the vast majority of infants who are having EOS will be symptomatic in the first 48 hours after delivery,⁵ and we were also not aware of any infant being readmitted to any other local hospital due to EOS.

In conclusion, the comprehensive antibiotic stewardship quality improvement initiative in our hospital was successful in reducing the number of sepsis workups and reducing inappropriate antibiotic usage in infants born at ≥ 35 weeks gestation. Our experience may be reproduced in other community hospitals, provided there is physician and administrative buy-in and extensive educational and monitoring compliance programs to the hospital medical and nursing staff.

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