

EFFICACY OF EARLY-ONSET SEPSIS CALCULATOR IN THE PREDICTION OF ANTIBIOTICS USAGE AMONG NEONATES: A LOCAL SETTING STUDY

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Abstract: *Early-onset sepsis (EOS) in neonates is a critical condition that requires timely diagnosis and appropriate management to prevent adverse outcomes. However, overuse of antibiotics in neonates can lead to complications, including antimicrobial resistance. The EOS calculator is a clinical tool designed to assess the risk of sepsis in neonates, helping to guide antibiotic use. Its efficacy in predicting antibiotic administration in high-risk neonates needs further evaluation. **Objective:** To evaluate the efficacy of the EOS calculator in predicting the use of antibiotics in neonates admitted to the neonatal intensive care unit (NICU) at a tertiary care hospital. **Methods:** This comparative cross-sectional study was conducted in the Pediatrics Department of Combined Military Hospital, Peshawar, from August 2020 to June 2022. A total of 982 neonates admitted to the NICU due to a high risk of infection were included. Upon admission, the attending clinician applied the EOS calculator to each neonate. However, the results were kept confidential, and routine management, including antibiotic administration, was carried out based on clinical signs and relevant investigations. The use of antibiotics within 72 hours of admission was compared to the recommendations of the EOS calculator. Statistical analysis used chi-square tests to assess the association between antibiotic use and the EOS calculator's recommendations. **Results:** Out of the 982 neonates included, 590 (60.1%) were male, and 392 (39.9%) were female, with a mean age of 1.38 ± 4.53 days. Within 72 hours of admission, 562 (57.2%) neonates did not receive antibiotics according to local protocols. A statistically significant association was observed between the clinical use of antibiotics and the recommendations of the EOS calculator (p -value < 0.001), demonstrating that the calculator could effectively predict antibiotic needs. **Conclusion:** The EOS calculator proved to be an effective tool in predicting the likelihood of sepsis in neonates at high risk of infection. Its use can guide clinicians in making informed decisions about antibiotic administration, reducing unnecessary antibiotic exposure while ensuring timely treatment for those who need it. Incorporating the EOS calculator into neonatal sepsis management protocols can enhance patient outcomes and help prevent the overuse of antibiotics in neonates.*

Keywords: Early Onset Sepsis Calculator; Neonates; Sepsis

Introduction

Neonates are fragile beings and may get prone to a number of health-related conditions if any untoward event takes place during pregnancy, at the time of birth or soon after the birth. Recently, neonatal intensive care units have been equipped with trained professionals and relevant machinery to combat health problems in these little beings (1). Situation may not be very favorable in our country; many neonates become high risk even before birth (2). Multiple factors related to pregnancy, birth or early antenatal period make them at high risk for various problems, including infections (3).

Epidemiological data suggest that a high percentage of neonates get sepsis in the first few days of life in our part of the world (4). Early they are detected and put on antibiotics, favorable remains the prognosis (5). Many clinical and laboratory parameters have been designed to diagnose sepsis in neonates and may be used according to the availability of resources in relevant health care setting (6). Recent studies in different parts of the world have evaluated early onset sepsis (EOS) calculator as a tool to predict necessary clinical actions, including the start of antimicrobial therapy. Cavigoli et al. 2022 concluded that combining universal serial physical examination with the EOS calculator significantly reduced laboratory investigations and antibiotic treatments in neonates

managed at NICU (7). He published a similar study from China intending to look for efficacy and safety of using EOS calculator in neonates suspected of infection. They concluded that the EOS calculator effectively predicted sepsis and disease, and its results correlated with other laboratory investigations and clinical evaluations (8). Utility of Early onset sepsis calculator for neonates born to mothers having Chorioamnionitis was studied by Carola et al. in 2018. They revealed that using this simple tool may reduce the use of empirical antibiotics in high-risk neonates for sepsis (9). Local data remains limited in this regard; most neonatal teams still use conventional approaches to manage babies with suspected or confirmed sepsis. The use of antibiotics in neonates needs a lot of care and caution. These individuals may be more prone towards adverse effects than adult human beings. Moreover, the non-judicious use of antibiotics burdens the health resources of resource-constrained countries like ours. A recent study on the local population showed sepsis and antibiotic use trends in neonates in our set-up (10). Still, the use of an EOS calculator to use antibiotics is not everyday in our part of the world, and clinicians start antibiotics on clinical suspicion. Therefore, we planned this study to look for efficacy of EOS calculator in predicting use of antibiotics in neonates managed at nursing intensive care unit of a tertiary care hospital.

Methodology

This comparative cross-sectional study was conducted at the neonatal intensive care unit of Combined Military Hospital Peshawar from August 2020 to June 2022. WHO Sample Size Calculator calculated sample size using the population prevalence proportion of EOS in neonates as 1.8% (11). Non-probability Consecutive sampling technique was used to gather the sample. All babies who were born at our hospital and required admission to the neonatal intensive care unit for being at high risk for infection were included in the study. The individuals born with severe congenital malformations or metabolic disorders, those who could not survive for seventy-two hours after admission, or those whose parents got discharged against advice before seventy-two hours of admission were excluded from the study. Those neonates with any immuno-compromised condition at birth were also excluded. Approval for study was obtained from ethical committee of CMH Peshawar via letter no. 09287. Parents or primary caregivers gave written consent after complete information from the research team, and only then were neonates recruited. Those neonates who were considered high risk for developing infections due to any birth-related or other reason were included in the study (12). A standard early-onset neonatal calculator was applied to all the babies at the time of admission in NICU by a team member who kept the outcome confidential. Parameters of the calculator include local incidence of EOS, gestational age, highest maternal intrapartum temperature, rupture of membranes, maternal GBS status and type of intrapartum antibiotics used (13). All the babies then underwent routine workups of sepsis and were managed as per local protocols (14). All the study participants were followed up for three weeks on the use of antibiotics, and then actual management was done, particularly the use of antibiotics, and compared with the results of the EOS calculator. The characteristics of neonates participating in the study and the results of the EOS calculator were described with descriptive statistics. A two-by-two table was made, and Pearson chi-square analysis was applied to look for associations and significant differences in the results of the EOS calculator and clinical management by existing local guidelines. Statistics Package for Social Sciences version 24.0 (SPSS-24.0) was used for the above analysis. The p-values less than or equal to 0.05

were considered significant for ascertaining the association or difference between variables used in the study.

Results

A total of 982 neonates admitted to the neonatal intensive care unit were included in the final analysis. Of them, 590 (60.1%) were male, while 392 (39.9%) were females, with a mean age of 1.38±4.53 days. Table I summarises the general characteristics of neonates recruited for this study. Within 72 hours of admission, 562 (57.2%) neonates did not receive antibiotics as per local protocols, while 420 (42.8%) received antibiotic medications.

Table II shows the results of Pearson's chi-square analysis. It was revealed that clinical use of antibiotics within 72 hours of admission was statistically significantly associated with antibiotic recommendations using the EOS risk calculator at the time of admission (p-value<0.001).

Table 1: Characteristics of neonates included in the study

Study parameters	n (%)
Age (years)	
Mean ± SD	1.38±4.53 days
Range (min-max)	1-3 days
Gender of neonates	
Male	590 (60.1%)
Female	392 (39.9%)
Use of antibiotics in 72 hours	
No	562 (57.2%)
Yes	420 (42.8%)
Antibiotics indicated by EOS calculator	
No	549 (55.9%)
Yes	433 (44.1%)
Mode of delivery	
Normal vaginal	560 (57.1%)
Cesarean	298 (30.3%)
Instrumental	124 (12.6%)
Premature rupture of membranes	
No	569 (57.9%)
Yes	413 (42.1%)

Table 2: Association of clinical and EOS calculator findings regarding the use of antibiotics in suspected cases of neonatal sepsis

Antibiotics indication by EOS calculator at the time of presentation	No antibiotics in 72 hours of clinical management	Use of antibiotics in 72 hours of clinical management	p-value
Not indicated	549 (97.6%)	13 (30.8%)	<0.001
Indicated	12 (12.4%)	408 (69.2%)	

Discussion

Neonatal infections and their management have continuously evolved over the last few decades. Usually, more emphasis has been laid on picking the high-risk cases early and starting the antibiotics to reduce mortality and morbidity. On the other hand, the non-judicious use of antibiotics without much evidence of sepsis has also been condemned. Usually, good insight into the existing risk factors, proper clinical evaluation and relevant laboratory

findings may enable the treating team to make the best decision. This may be time-consuming; therefore, different tools have been applied to evaluate the babies and make appropriate clinical decisions. We conducted this study to look for the efficacy of the EOS calculator in predicting the use of antibiotics in neonates managed at the neonatal intensive care unit of Combined Military Hospital Peshawar.

Laccetta et al. 2021 reviewed the effectiveness of the EOS risk calculator and compared the results generated with

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management by local guidelines (15). It was concluded that more patients received antibiotics if the EOS calculator results were used than local protocols. Our results were slightly different from theirs, and the results of the EOS calculator were quite similar to those of standard clinical practices done in neonatal intensive care units. The reason may be the low local threshold of antibiotics, but it can be grounds for further studies on this subject.

A similar study was published by KSA in 2021 to evaluate the role of an EOS risk calculator for term or near-term babies born at a tertiary care hospital. It was revealed that the EOS calculator could be an essential tool to avoid unnecessary investigations, antibiotic use, and length of stay and reduce the burden on the system and parents (16). Our findings supported the results generated in KSA as EOS calculator results were associated with actual clinical happenings in our study participants.

A study published in the US in 2020 compared local guidelines with readings from the EOS risk calculator in reducing antibiotic use in neonates. They concluded that both were comparable, but using a calculator may become tricky if no clear idea is available regarding local EOS incidence (17). Results of our study also showed that clinical decisions based on local practises were almost the same as those generated by putting values in the EOS risk calculator.

Achten et al., 2019, published a systematic review and meta-analysis regarding the association of the use of the EOS risk calculator with a reduction in antibiotic use. They concluded that the use of the EOS calculator was associated with decreased use of empirical antibiotics for neonates with suspected sepsis (18). We also concluded that the use of the EOS calculator may decrease antibiotic use in a resource-constrained country like ours.

Conclusion

The early-onset sepsis calculator turned out to be an effective tool for predicting the possibility of underlying sepsis in neonates admitted to the neonatal intensive care unit who are at high risk for infection. It can be an essential clinical tool for deciding whether to start antibiotics early.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-EMHPSH-1231-20)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

Mashal Habib (Trainee Medical Officer)

Coordination of collaborative efforts.

Study Design, Review of Literature.

Conception of Study, Development of Research protocol and drafting

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