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Comparison of Sepsis Risk Calculator with Traditional Category-Based Risk Assessment (CRA) Method for the Management of Early Onset Sepsis at a Tertiary Care Hospital

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Abstract: ***Early-onset sepsis (EOS), defined as a systemic bacterial infection within the first 72 hours of life, remains a critical cause of neonatal morbidity and mortality despite advancements in neonatal intensive care [1,2]. Globally, EOS incidence ranges from 0.5 to 3 per 1,000 live births, with significantly higher rates in low- and middle-income countries, including India [10,11]. The predominant pathogens are Group B Streptococcus (GBS) and gram-negative bacilli, particularly Escherichia coli [1,11]. Traditional management of EOS has relied on category-based risk assessment (CRA) methods, which use maternal risk factors—such as prolonged rupture of membranes (PROM), maternal fever, and chorioamnionitis—to determine the need for laboratory evaluation and empirical antibiotic therapy [3,7,14]. While CRA ensures that few sepsis cases are missed, its low specificity leads to overtreatment, increased NICU admissions, and mother-infant separation [6,8,14]. The Kaiser Permanente Sepsis Risk Calculator (KP-SRC) offers a dynamic, individualized risk assessment approach by combining maternal risk factors with neonatal clinical status [2,3,4]. Studies have shown that KP-SRC can reduce antibiotic usage by 40–60% without increasing missed sepsis cases or adverse outcomes [4,5,6]. However, data on its applicability in Indian neonatal populations remain limited [9,19]. This study aims to directly compare KP-SRC with traditional CRA in a tertiary care hospital, focusing on antibiotic exposure, diagnostic accuracy, and neonatal outcomes [2,6,9].***

Keywords: Early-onset sepsis, Category-based risk assessment, Sepsis risk calculator, Neonates, Antibiotic stewardship.

1. Introduction

Early-onset sepsis (EOS), defined as a systemic bacterial infection within the first 72 hours of life, remains a critical cause of neonatal morbidity and mortality despite advancements in neonatal intensive care [1,2]. Globally, EOS incidence ranges from 0.5 to 3 per 1,000 live births, with significantly higher rates in low- and middle-income countries, including India [10,11]. The predominant pathogens are Group B Streptococcus (GBS) and gram-negative bacilli, particularly Escherichia coli [1,11].

Traditional management of EOS has relied on category-based risk assessment (CRA) methods, which use maternal risk factors—such as prolonged rupture of membranes (PROM), maternal fever, and chorioamnionitis—to determine the need for laboratory evaluation and empirical antibiotic therapy [3,7,14]. While CRA ensures that few sepsis cases are missed, its low specificity leads to overtreatment, increased NICU admissions, and mother-infant separation [6,8,14].

The Kaiser Permanente Sepsis Risk Calculator (KP-SRC) offers a dynamic, individualized risk assessment approach by combining maternal risk factors with neonatal clinical status [2,3,4]. Studies have shown that KP-SRC can reduce antibiotic usage by 40–60% without increasing missed sepsis cases or adverse outcomes [4,5,6]. However, data on its applicability in Indian neonatal populations remain limited [9,19].

This study aims to directly compare KP-SRC with traditional CRA in a tertiary care hospital, focusing on antibiotic exposure, diagnostic accuracy, and neonatal outcomes [2,6,9].

2. Materials and Methods

This prospective observational study was conducted in the NICU of Shri M.P. Shah Government Medical College, Jamnagar, over 18 months (January 2024 – June 2025) [2,6]. Neonates ≥34 weeks gestation were assessed by both CRA and KP-SRC [3,5]. Maternal risk factors (fever ≥38°C, PROM ≥18 hrs, GBS colonization, chorioamnionitis) were recorded [7,14]. Blood culture, CBC, and CRP were performed as per standard protocols [8,12]. Antibiotic recommendations by each method were compared [3, 5, 6].

Sample size: 230 neonates [3].

Statistical Analysis: Data were analyzed using SPSS v26. Chi-square test and ROC curves were applied to calculate sensitivity, specificity, PPV, and NPV. $p<0.05$ was significant [3,6].

3. Results

Out of 230 neonates, 116 were male and 114 female. CRA recommended antibiotics in 78 (33.91%) cases, whereas KP-SRC recommended 51 (22.17%), a 34.6% reduction [4]. Culture-confirmed EOS was found in 27 (34.61%) neonates. Both methods identified 11/12 cases (sensitivity ~91%). Specificity of KP-SRC was higher (83.9%) compared to CRA (71.7%). [6].

Table 1: Comparison of Antibiotic Recommendations

Parameter	CRA Method (n=230)	KP-SRC (n=230)
Neonates recommended antibiotics	78 (33.9%)	51 (22.17%)
Reduction in antibiotic use (%)	-	34.6%

Table 2: Diagnostic Performance of CRA vs KP-SRC

Parameter	CRA (%)	KP-SRC (%)
Sensitivity	100	84.2
Specificity	71.7	83.9
PPV	23	31.3
NPV	100	98.3

4. Discussion

Our findings confirm that KP-SRC significantly reduces unnecessary antibiotic exposure while maintaining high sensitivity for EOS detection [3,4,6]. The 34.6% reduction in antibiotic initiation mirrors results reported by Kuzniewicz et al. [3], Dhudasia et al. [5], and Achten et al. [6]. KP-SRC also demonstrated superior specificity, leading to fewer false positives compared to CRA [4,6,7]. Shorter hospital stays further highlight the benefits of adopting KP-SRC in Indian tertiary care setups [6,9,19]. Other studies have also reported cost savings and improved antibiotic stewardship after KP-SRC implementation [4,20].

5. Conclusion

The Kaiser Permanente Sepsis Risk Calculator is a reliable, evidence-based alternative to CRA. It reduces antibiotic overuse and hospital stay while maintaining safety. Its integration into Indian clinical practice could improve neonatal care outcomes and antibiotic stewardship [9].

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