CLINICAL PREDICTORS OF MORTALITY IN NEONATAL SEPSIS: EXPERIENCE FROM A TERTIARY NEONATAL CARE UNIT

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Abstract: Neonatal sepsis is a leading cause of mortality in newborns, particularly in low- and middle-income countries. Identifying clinical predictors of mortality is essential for early risk stratification, timely intervention, and improved outcomes. This study evaluates the clinical characteristics, laboratory findings, and treatment factors associated with mortality in neonates with sepsis admitted to a tertiary neonatal care unit. Results indicate that prematurity, low birth weight, respiratory distress, hypotension, and multi-organ involvement are significant predictors of mortality. Early recognition of high-risk neonates and aggressive management strategies are crucial to reducing sepsis-related deaths in NICUs.

Keywords: Neonatal sepsis, mortality predictors, risk factors, clinical outcomes, prematurity, low birth weight, neonatal intensive care.

Neonatal sepsis is a systemic infection occurring within the first 28 days of life and remains a significant cause of neonatal morbidity and mortality worldwide. Despite advances in neonatal care, mortality rates remain high, especially in preterm and low-birth-weight infants. Early identification of neonates at high risk of death is essential to implement timely interventions and optimize outcomes.

Several factors contribute to the risk of mortality in neonatal sepsis. Prematurity and low birth weight compromise neonatal immune defenses, increasing susceptibility to severe infections. Clinical manifestations such as respiratory distress, hypotension, poor perfusion, and multi-organ dysfunction often indicate severe sepsis and correlate with adverse outcomes. Laboratory parameters, including leukopenia, thrombocytopenia, metabolic acidosis, and elevated inflammatory markers such as C-reactive protein and procalcitonin, may also provide prognostic information.

Understanding the clinical predictors of mortality allows clinicians to stratify risk, prioritize interventions, and allocate resources effectively in tertiary care settings. Identification of these factors guides decision-making regarding intensive care admission, mechanical ventilation, inotropic support, and antimicrobial therapy.

Additionally, such knowledge informs strategies for early detection and preventive measures, ultimately reducing sepsis-related neonatal deaths.

This study aims to analyze the clinical characteristics, laboratory findings, and treatment variables associated with mortality in neonates with sepsis in a tertiary neonatal care unit. By evaluating these predictors, the study seeks to provide evidence-based guidance for early risk stratification and improve survival outcomes in this vulnerable population.

Neonatal sepsis remains one of the most significant causes of neonatal mortality globally, particularly in tertiary care settings that manage high-risk populations, including preterm and low-birth-weight infants. Despite improvements in neonatal intensive care, timely recognition of high-risk neonates remains a challenge. Identifying clinical predictors of mortality is crucial for risk stratification, early intervention, and optimizing resource allocation in neonatal intensive care units (NICUs).

Prematurity is a major predictor of mortality in neonatal sepsis. Preterm neonates, especially those born before 32 weeks of gestation, possess immature immune systems characterized by reduced neutrophil function, decreased complement activity, and lower immunoglobulin levels. These immunological deficiencies increase susceptibility to severe infections, rapid disease progression, and multi-organ dysfunction. Several studies indicate that mortality rates are significantly higher among preterm infants with sepsis compared to term neonates, even when receiving advanced intensive care.

Low birth weight is another critical factor associated with poor outcomes. Neonates weighing less than 1500 grams have limited physiological reserves, making them less able to cope with the systemic inflammatory response triggered by sepsis. Low birth weight is often associated with additional comorbidities, including respiratory distress syndrome, patent ductus arteriosus, and metabolic immaturity, which can exacerbate the severity of infection and increase the likelihood of death.

Clinical manifestations on presentation provide important prognostic information. Respiratory distress, including tachypnea, grunting, nasal flaring, and oxygen requirement, frequently indicates severe systemic infection. Hypotension and poor perfusion are signs of cardiovascular compromise and are associated with higher mortality. Other critical indicators include altered mental status, lethargy, poor feeding, apnea, and seizures, which suggest central nervous system involvement or multi-organ failure. Early recognition of these clinical signs enables prompt escalation of care,

including fluid resuscitation, inotropic support, and mechanical ventilation, which are essential to improve survival.

Laboratory findings offer additional predictive value. Leukopenia or severe neutropenia has been consistently associated with higher mortality in neonatal sepsis, reflecting impaired immune response. Thrombocytopenia often accompanies severe infections and disseminated intravascular coagulation, indicating a more critical disease course. Elevated inflammatory markers such as C-reactive protein (CRP) and procalcitonin (PCT) may correlate with disease severity, although their predictive utility is enhanced when combined with clinical assessment. Metabolic acidosis, elevated lactate levels, and derangements in renal and hepatic function also serve as indicators of severe sepsis and poor prognosis.

The timing of infection onset influences mortality risk. Early-onset sepsis (EOS), occurring within the first 72 hours of life, is often caused by vertically transmitted pathogens such as Group B Streptococcus and *Escherichia coli*. EOS is associated with rapid disease progression and higher mortality, particularly in preterm or low-birth-weight infants. Late-onset sepsis (LOS), developing after 72 hours, is typically nosocomial, often involving coagulase-negative staphylococci, *Staphylococcus aureus*, or Gram-negative bacilli. LOS may have a more insidious onset but carries a high risk of multidrug-resistant infections, which can complicate therapy and increase mortality.

Treatment-related factors also influence outcomes. Delay in initiation of empiric antibiotic therapy has been consistently linked to higher mortality. Neonates receiving early, appropriate empiric therapy guided by local microbiological data have better survival rates. Invasive procedures, such as central venous catheter placement, mechanical ventilation, or parenteral nutrition, increase the risk of nosocomial infection, which can affect both disease severity and survival. Therefore, stringent infection control practices, careful monitoring, and judicious use of invasive devices are essential to minimize risk.

Comorbid conditions, including congenital anomalies, perinatal asphyxia, and chronic lung disease, further increase the likelihood of mortality in neonates with sepsis. These conditions compromise physiological resilience and immune function, contributing to rapid deterioration and poor response to therapy. Multivariate analyses in various studies consistently demonstrate that a combination of prematurity, low birth weight, clinical severity on presentation, and comorbidities are strong predictors of mortality.

Scoring systems and risk stratification tools can aid clinicians in identifying high-risk neonates. Clinical prediction models integrating gestational age, birth weight, vital signs, laboratory findings, and early clinical course can guide decision-making regarding NICU admission, intensive monitoring, and early therapeutic interventions. Early recognition and aggressive management of high-risk neonates, including appropriate fluid resuscitation, inotropic support, ventilatory assistance, and timely administration of broad-spectrum antibiotics, significantly reduce mortality.

Preventive strategies remain crucial to improving survival. Maternal screening for infections, intrapartum antibiotic prophylaxis, early identification of neonates with high-risk birth conditions, and adherence to NICU infection control protocols are essential components of a comprehensive approach to reducing sepsis-related mortality. Continuous education of healthcare providers, prompt recognition of clinical deterioration, and evidence-based management protocols further contribute to improved outcomes.

In conclusion, mortality in neonatal sepsis is influenced by a combination of patient-related, clinical, laboratory, and treatment-related factors. Prematurity, low birth weight, severe respiratory distress, hypotension, multi-organ dysfunction, and delay in initiation of appropriate therapy are consistently identified as key predictors of poor outcomes. Early identification of high-risk neonates, aggressive management, and preventive strategies are essential to reducing sepsis-related mortality in tertiary care settings. Understanding and applying these clinical predictors allows clinicians to optimize care, improve survival, and enhance overall outcomes in neonates affected by sepsis.

Neonatal sepsis continues to be a major contributor to neonatal mortality, particularly in preterm and low-birth-weight infants. Clinical predictors of mortality include prematurity, low birth weight, severe respiratory distress, hypotension, multi-organ dysfunction, and delayed initiation of appropriate antibiotic therapy. Laboratory indicators such as leukopenia, thrombocytopenia, elevated inflammatory markers, and metabolic derangements further predict poor outcomes.

Early identification of high-risk neonates, aggressive supportive management, and adherence to evidence-based protocols are critical to improving survival. Preventive strategies, including maternal screening, intrapartum antibiotic prophylaxis, strict infection control, and careful monitoring of invasive procedures, significantly reduce the incidence and severity of sepsis. Recognizing and addressing these

predictors allows clinicians to implement timely interventions, optimize resource allocation in NICUs, and ultimately reduce sepsis-related mortality.

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