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Clinical Profile and Outcomes of Neonatal Sepsis in Tertiary Care Hospital.

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Abstract: ***Background:*** Neonatal sepsis is one of the leading cause of infant mortality all over the world. In tertiary care hospital, the increasing multidrug resistance and insidious clinical manifestations require renewed surveillance in order to enhance survival. ***Objectives:*** To estimate the clinical manifestation, microbiological trends, and prognosis of neonatal sepsis in 100 cases in a tertiary care hospital. ***Methodology:*** This prospective study conducted at Department Of Pediatrics Medicine Saidu Medical College Saidu Sharif Swat from jan 2025 to june 2025.involved 100 suspected neonates who were suspected of having sepsis. The maternal risk factors, gestational age, and clinical signs data were noted. Diagnostics were blood counts, C-reactive protein (CRP), and automated blood cultures. The SPSS (Chi-square and t-tests) were used in statistical analysis. ***Results:*** The cohort was 62% male and 38% preterm, with a mean age of 4.2 days (SD ± 2.1). Dominant symptoms were respiratory distress (65%) and poor feeding (58%). Culture positivity was 38%, with Gram-negative bacteria like Klebsiella pneumoniae (42%) and E. coli (24%) prevailing; 55% of isolates were resistant to third-generation cephalosporins. Statistical analysis revealed that low birth weight ($p=0.032$) and elevated CRP ($p<0.001$) were significant predictors of severity. The overall mortality rate was 18%, significantly higher in Early-Onset Sepsis (EOS) cases ($p=0.045$). Shock and DIC occurred in 12% of patients, primarily those with multidrug-resistant infections. ***Conclusion:*** Multidrug-resistant Gram-negative pathogens are increasingly prevalent causes of neonatal sepsis in tertiary setting. CRP and low birth weight are very important markers of prognosis. The optimal way to improve survival is through strict infection control and rational antibiotic stewardship directed at the local resistance pattern.

Keywords: Neonatal Sepsis, Mortality, Klebsiella, Antibiotic Resistance.

INTRODUCTION

Neonatal sepsis, which is a syndrome of systemic inflammatory response manifested during the first 28 days of life as a result of the alleged or even confirmed infection, is a thorny issue in the practice of pediatrics throughout the world. Although medical progress has achieved a lot in the 21 st century, it remains one of the most common causes of mortality in the neonatal unit especially in Tertiary Care Hospitals of low- and middle-income countries. Such environments are characterized by the high-risk nature of neonatal care, preterm deliveries, and the rise in the number of multidrug-resistant (MDR) organisms [1,2]. Neonatal sepsis has a pathophysiology that is unique because of the immature immunity of the neonate. On the contrary, neonates have a small pool of neutrophils and lower chemotaxis and intracellular killing potential [3]. This physiologic susceptibility will ensure that localised infection can develop into systemic inflammatory response syndrome (SIRS), dysfunction of multiple organs, and death within hours. The past classification of sepsis was mostly based on the timing of occurrence. Early-Onset Sepsis (EOS): This is an infection that happens between the first and 72 hours of life, and it is normally attributed to vertical infection by the maternal genital tract. Common culprits include the Group B Streptococcus and Escherichia coli pathogens. Late-Onset Sepsis (LOS) after 72 hours is frequently healthcare-associated, which is associated with invasive measures, extended hospitalisation, and environmental horizontal transmission [4,5]. The clinical profile is changing in tertiary care units. We are also witnessing a tremendous increase in Gram-negative bacteria, including Klebsiella pneumoniae and Acinetobacter baumannii, which tend to be resistant to the first and even second-line antibiotics [6]. This is an effect of such a high use of broad-spectrum antibiotics, resulting in the selection of highly resistant strains, causing such an effect as this antibiotic shadow. In addition, the clinical manifestation of sepsis among neonates is infamously unobtrusive and imprecise [7]. A newborn baby can simply have nothing more than not doing well, poor feeding, or minor temperature fluctuations. When such classic signs as respiratory distress, jaundice, or sclera manifest, the time to act might be running out [8].The effects of neonatal sepsis are not restricted to immediate survival. Neurodevelopmental effects on survivors are usually long-term in nature, such as cerebral palsy, hearing impairment, and cognitive development. The healthcare system and the economic cost to the family are high, including a lengthy NICU stay and costly antimicrobial treatment. Thus, to optimise the existing clinical profile, i.e. the particular signs of the disease, local microbial flora, and mortality predictors, it is crucial to comprehend the existing clinical profile. The proposed study will address the void in the local data through the analysis of 100 cases, which will present a modern picture of the challenges experienced in tertiary neonatal units. By determining the relationship between lab values such as CRP and patient outcome, we may proceed to even more accurate, timely, and effective care of the neonates [9,10].

Study Objectives

The aim of the study is to examine the clinical manifestations, determine causative microbiological agents, and determine survival outcomes and prognostic factors of 100 neonates with a diagnosis of sepsis in the tertiary care unit.

MATERIALS AND METHODS

Study Design & Setting

The study was a prospective study conducted at This prospective study conducted at Department Of Pediatrics Medicine Saidu Medical College Saidu Sharif Swat from jan 2025 to june 2025.that lasted 6 months in the Neonatal Intensive Care Unit (NICU) of saidu group of teaching hospitals/saidu medical college, which is a high-risk neonatal referral center.

Participants

There were 100 neonates (0,28 days old) who were admitted with clinical suspicions of sepsis in the study. Participants were recruited in sequence, depending on the availability of two or more clinical features of the infection (SE: respiratory distress, lethargy or poor feeding) and maternal risk factors that included PROM or maternal fever. All parents had given informed consent.

Sample Size Calculation

The 100 neonates were used because it was calculated using a margin of error of 5 per cent and a confidence level of 95 per cent, and the prevalence of neonatal sepsis was estimated at 15 per cent in tertiary care units in the region. This sample size will be adequate for discovering meaningful associations between clinical variables and outcomes.

Inclusion Criteria

- Newborns (0-28 days old) admitted to the NICU.
- Integrated Management of Neonatal and Childhood Illness (IMNCI) clinical suspicion of sepsis.
- Neonates having at least one of maternal risk factor(e.g. PROM >18 hours).

Exclusion Criteria

- Neonates having significant congenital malformation or chromosomal abnormalities.

- Neonates who were discharged or died due to incompleteness of investigations within 12 hours of their admission.
- The instances of the absence of parental consent.

Diagnostic and Management Strategy.
Diagnosis was based on the clinical findings, C-reactive protein (CRP), and automated blood cultures. They were handled according to common NICU guidelines, such as empirical intravenous antibiotics (Ampicillin/Gentamicin), respiratory support, and intravenous fluid resuscitation, which were later adjusted to the particular culture sensitivity findings and clinical development.

Statistical Analysis
SPSS Version 26.0 was used to analyze the data. Mean plus SD was used to show the quantitative variables, such as age. Chi-square tests were the methods used to analyze qualitative variables. The p-value of less than 0.05 was taken to be statistically significant, in terms of characterizing predictors of mortality and the effectiveness of diagnostic markers.

RESULTS

Of the 100 neonates studied, 62% were male and 38% were female. The population had a mean age of 4.2 days with a standard deviation (SD) of 2.1 days. Preterm neonates accounted for 58% of the cases. The most frequent clinical presentations were respiratory distress (65%), poor feeding (58%), and lethargy (42%). Blood culture positivity was recorded in 38 cases. Gram-negative organisms predominated (68% of isolates), with Klebsiella pneumoniae being the most common (42%). Resistance to third-generation cephalosporins was alarmingly high at 55%. Statistical analysis demonstrated that low birth weight (<2500g) was a significant predictor of mortality ($p=0.032$). Additionally, an elevated CRP (>10 mg/L) showed a strong association with culture-proven sepsis ($p<0.001$). The overall mortality rate was 18%. Early-onset sepsis was associated with higher mortality compared to late-onset sepsis ($p=0.045$). These results suggest that prematurity and high CRP are critical indicators of poor prognosis.

Intervention Outcome
The survival of the neonates was greatly higher (82) in cases where the antibiotic therapy was administered within the first hour of clinical suspicion. On the other hand, those neonates that were infected with multidrug-resistant Gram-negative strains had a 40 per cent probability of developing complications such as shock or DIC, which illustrates the importance of a strong antimicrobial stewardship and early intervention.

Table 1: Demographic and Clinical Characteristics of the Study Population (N=100)

Variable	**Frequency (n=100)**	**Percentage (%)**
Gender (Male/Female)	62 / 38	62% / 38%
Gestational Age (Preterm/Term)	58 / 42	58% / 42%
Mean Age (Days)	4.2	SD ± 2.1
Birth Weight (<2500g)	64	64%
Clinical Signs:		
- Respiratory Distress	65	65%
- Poor Feeding	58	58%
- Lethargy	42	42%
- Fever / Hypothermia	35	35%

This table outlines the baseline demographic data and the most frequent clinical presentations observed upon admission

Table 2: Microbiological Profile and Culture Positivity (n=38)

Organism Type	**Isolate Name**	**Frequency (n=38)**	**Percentage (%)**
Gram-Negative (68%)	Klebsiella pneumoniae	16	42.1%
	Escherichia coli	9	23.7%
	Pseudomonas aeruginosa	1	2.6%
Gram-Positive (32%)	Staphylococcus aureus	7	18.4%
	Cons	5	13.2%
Total		38	100%

Distribution of causative organisms isolated from blood cultures, highlighting the predominance of Gram-negative bacteria in the tertiary care setting.

Table 3: Correlation of Laboratory and Clinical Risk Factors with Mortality

Risk Factor	Survived (n=82)	Expired (n=18)	p-value
Birth Weight <2500g	48	16	**0.032***
Preterm Gestation	45	13	0.061
CRP >10 mg/L	30	17	**<0.001***
Sepsis Onset (EOS)	40	14	**0.045***
Mechanical Ventilation	10	9	**0.012***

Statistical analysis of predictors for poor outcomes. P-values < 0.05 indicate statistical significance using Chi-square and T-tests.

Table 4: Sensitivity Pattern of Major Gram-Negative Isolates

Antibiotic Group	Antibiotic Name	Sensitivity (%)	Resistance (%)
Cephalosporins	Ceftriaxone	45%	55%
Aminoglycosides	Amikacin	72%	28%
Carbapenems	Imipenem	88%	12%
Fluoroquinolones	Ciprofloxacin	60%	40%
Penicillin's	Ampicillin	20%	80%

Antimicrobial resistance profile of the most common pathogens (Klebsiella and E. coli), demonstrating high resistance to standard third-generation cephalosporin's.

DISCUSSION

The findings of the study allow for an exhaustive picture of the clinical and microbiological picture of neonatal sepsis in a tertiary care environment, as the neonatal infection landscape is changing [11]. The fact that we have obtained a 62 per cent male preponderance is in line with the available literature, most of which has proposed that biological factors and X-linked immunomodulatory genes could give a minor survival benefit to the female neonates against systemic infections. This age of 4.2 days (SD ± 2.1) and the high incidence of preterm births (58%) help highlight the susceptibility of the physiological systems at an early life that is also reflected in recent surveillance statistics over the past five years [12]. In our cohort, clinical manifestations were largely non-specific, and the most common clinical manifestations were respiratory distress (65) and poor feeding (58). This is equivalent to findings in, who had stated that the respiratory signs were common before the occurrence of hemodynamic instability in neonatal sepsis [13]. Nevertheless, the diagnostic issue is acute; according to, these symptoms are too similar to other non-infectious disorders, such as transient tachypnea of the newborn or respiratory distress syndrome, so it is vital that effective biomarkers can be used [14]. The high correlation between the CRP >10 mg/L and the culture-proved sepsis ($p < 0.001$) in our study supports the usefulness of CRP as a screening method, which observed in their investigation of the tertiary care diagnostic protocol. In the microbiological aspects of our study, we found a culture-positivity rate of 38% between the 30 to 45 per cent range of a similar tertiary setting in the past five years [15]. The Gram-negative preponderance (68 per cent) and, more so, Klebsiella pneumoniae (42 per cent) are notable changes to the previous literature, where Gram-positive cocci such as Group B Streptococcus prevailed [16]. This Gram-negative movement in hospital-acquired and late-onset sepsis is supported by and, who attribute the same to the higher use of invasive procedures and colonization of the environment in NICUs [17]. the most alarming outcomes was the prevalence of antimicrobial resistance, whereby 55% of the isolates were resistant to third-generation cephalosporins [18]. This indicates an increasing international neonatal sepsis epidemic of multidrug resistance (MDR). Recent reports by described analogous resistance patterns in LMIC tertiary centers and indicated there is no longer evidence that the empirical regimen of ampicillin and gentamicin could be satisfactory enough in most areas [19]. The inference made by that carbapenem resistance is one of the major independent precursors of newborn death is justified by the result of our investigation, which found that mortality among infected neonates was more significant in the case of MDR strains [20]. Moreover, the high rate of mortality (18% in our study) is not out of place with modern-day statistics in high-acuity referral centers. Low birth weight (4.637E-02) and Early-Onset Sepsis (EOS) (4.637E -02) are statistically significant predictors of neonatal mortality, which is also consistent with the results of who underscored that the compensatory mechanisms of prematurity and early bacterial insult tend to be overwhelmed by the joint effect [21]. Altogether, Gram-negative MDR pathogens are becoming increasingly characteristic of the clinical manifestation of neonatal sepsis. The

comparison with the study conducted over the past five years indicates that there is a severe necessity to revise the antimicrobial stewardship and enhance the level of infection control. The most successful approach to the prevention of mortality among such high-risk patients is early identification with the help of biomarkers such as CRP, along with a high index of clinical suspicion related to respiratory distress [22].

Limitations

This study lacks a multi-Centre study and a very small sample size of 100 neonates, which might not represent microbiological differences in the region. As well, the low rate (38 per cent) of blood culture positivity indicates that the cases of clinical sepsis were either not detected or pre-treated with antibiotics by mothers.

CONCLUSION

Multidrug-resistant Gram-negative bacteria, and especially Klebsiella pneumoniae, are becoming the driving force of neonatal sepsis in the tertiary care setting. The critically important predictors of mortality are high levels of CRP and low birth weight. To overcome resistance and increase survival rates in neonatal intensive care, it is necessary to implement the most effective infection control and local antimicrobial stewardship.

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Authors Contributions

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