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Research Article

Epidemiology and Antibiotic Sensitivity Patterns of Neonatal Sepsis in Neonatal Intensive Care Units.

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Abstract: Particularly in underdeveloped nations, neonatal sepsis still poses a significant threat of morbidity and mortality worldwide. Effective treatment and antimicrobial stewardship depend on an awareness of the antibiotic susceptibility and epidemiology of the etiological agents. Objective: To assess the antibiotic sensitivity patterns, microbial profile, and epidemiological traits of neonatal sepsis in Neonatal Intensive Care Units (NICUs). ***Methods***: Twelve months saw an observational cross-sectional study run in the NICU of a tertiary care hospital. Inclusion was neonates under clinical suspicion of sepsis. Standard microbiological methods of processing blood cultures were used. Under CLSI standards, isolated bacteria were tested for antibiotic sensitivity using the Kirby-Bauer disc diffusion approach. ***Results***: Among 250 suspected sepsis newborns, 95 (38%) had culture-proven sepsis. Early-onset sepsis was responsible for 54% of instances; late-onset sepsis for 46%. Of the total, gram-negative numbers (63%) prevailed. Among the most regularly isolated organisms were Klebsiella pneumoniae (28%), Escherichia coli (19%), and Staphylococcus aureus (17%). Highly observed sensitivities were 92% for meropenem, 81% for amikacin, and 78% for piperacillin-tazobactam. Resistance was strongly noted against ampicillin (72%) and ceftriaxone (65%). Conclusion: With rising resistance to frequently utilized antibiotics, gram-negative bacteria continue to be the most prevalent cause of neonatal sepsis in NICUs. Empirical treatment and lowering neonatal death depend on constant monitoring of antimicrobial susceptibility patterns.

Keywords: Neonatal, sepsis, NICU, Antibiotic resistance Blood culture, Epidemiology.

INTRODUCTION

Neonatal sepsis represents a fulminant illness that affects newborns within their first 28 days of birth and persists as one of several leading causes of infant disability as well as death internationally. Presence of bacteremia together with clinical indications and signs of infection like fever unsteadiness, respiratory suffering, tiredness, reduced nourishing and hemodynamic unsteadiness define it. Newborns especially preterm and small birth mass childes are especially susceptible to insidious infections because of their immature immune systems. Neonatal sepsis still significantly causes neonatal fatalities, especially in poor countries where healthcare facilities are poor and infection control measures might not be enough despite advancements in neonatal intensive care and antimicrobial treatment. [1, 2]

With the load being disproportionately greater in low- and middle-income countries, neonatal sepsis accounts for a sizable share of neonatal fatalities globally. In Neonatal Severe Care Departments (NICUs), overcrowded healthcare facilities, restricted access to trained healthcare staff, bad hygiene practices, extended hospital stays, and aggressive medical treatments all raise infection risk. Moreover, managing neonatal infections becomes more difficult as a result of socioeconomic issues, late diagnosis, and unsuitable or experimental antibiotic use. Initial detection and accurate antibiotic cure are emphasized by these difficulties to lower the morbidity and death connected to infant sepsis. [3]

Initial onset sepsis (EOS) as well as delayed onset sepsis (LOS) are two broad categories of neonatal sepsis

depending on the timing of inception. Preliminary onset sepsis normally manifests itself within the initial seventy-two hours of delivery and is most frequently acquired from maternal genital tract bacteria during delivery or pregnancy. Common pathogens linked with EOS include Group B Streptococcus, Escherichia coli, and other gram-negative bacilli. Late beginning sepsis by dissimilarity, hits after 72 hours of living and is mainly normally attached with nosocomial or sanatorium acquired infections, especially into NICU situations. Common pathogens causing LOS, contain coagulate negative staphylococci, Staphylococcus aureus, Klebsiella species, Pseudomonas species, as well as other opportunistic fungi. Invasive operations like mechanical ventilation, intravenous catheterization, and long hospitalization are frequently connected with these infections. [4–6]

The rise of multidrug resistant (MDR) bacteria in recent years presents a big obstacle in the treatment of neonatal sepsis. The widespread, and sometimes illogical, use of broad-spectrum antibiotics has helped hospital environments to develop resistant bacterial strains. Multidrug-resistant bacteria not only make treatment plans more difficult but also raise the risk of treatment failure, extended hospital stays, and more expensive medical charges. Therefore, the existence of antimicrobial resistance in NICUs has become a major worry for neonatologists and healthcare planners all around [7,8].

Effective empirical antibiotic treatment is guided by an awareness of the local epidemiology and antimicrobial susceptibility profile of bacterial isolates. Because the spectrum of pathogens and their resistance profiles differ across several hospitals and geographical areas, regular surveillance studies are needed to follow shifting patterns. Before culture results become known, such data assist doctors in choosing suitable initial antibiotic regimens and help to improve neonatal clinical results in cases of suspected sepsis.[9]

Effective infection management strategies and antimicrobial stewardship programs depend on ongoing monitoring of microbial profiles and antibiotic sensitivity patterns in NICU environments. With the goal of giving evidence-based guidance for best empirical treatment and better newborn results, the present study was carried out in this setting to assess the epidemiology, microbial spectrum, and antibiotic sensitivity profiles of neonatal sepsis in Neonatal Intensive Care Units. [10]

MATERIALS AND METHODS

The most recent study was conducted as hospital-based cross-sectional observational research to evaluate the epidemiology, microbial sketch, and antibiotic sensitivity trends of infant sepsis among newborns admitted to the Neonatal Intensive Care Unit. [1,2] The distribution of bacterial pathogens and their antimicrobial susceptibility patterns among neonates displaying clinical symptoms suggestive of sepsis during the study period [3,4] were to be methodologically evaluated via a cross-sectional design. Simultaneously gathering clinical, demographic, and microbiologic data, this architecture gave a picture of the present burden and resistance profiles of neonatal sepsis in the study context. [4]

The study was conducted in a tertiary care teaching hospital's Neonatal Intensive Care Unit, where a large number of high-risk neonates are admitted for specialized care and management. Advanced neonatal treatment including mechanical ventilation, invasive monitoring, and control of preterm and severely ill newborn is offered in the NICU [3]. These elements make such units the best places to observe antimicrobial resistance trends and neonatal infections. [7, 8]

From August 2024 to August 2025, the study period was twelve months. Doing the research over a whole year guaranteed a more representative sample of neonatal sepsis patients [2] and enabled the scientists to include neonates admitted in various seasons. Before data gathering began, the institutional ethical review committee granted ethical approval for the study; all processes were carried out in line with ethical norms for biomedical research. [5]

All babies admitted to the NICU with clinical suspicion of sepsis throughout the study period made up the study population. The attending neonatologist's assessment of clinical indications and symptoms pointing to systemic infection guided suspicion of neonatal sepsis. Temperature instability, respiratory difficulty, lethargy, inadequate feeding, irritability, apnea, and other systemic indications of infection were among these indicators. [2, 7]

Inclusion criteria. were neonates 0–28 days, admitted to the NICU with clinical signs including fever, hypothermia, respiratory distress, lethargy, or poor feeding suggestive of sepsis. To guarantee correct microbiological analysis [6], the study also included only those neonates in who's blood culture samples were obtained prior to antibiotic treatment.

Exclusion criteria. Comprised cases in which blood culture samples were insufficient or contaminated, which could call into question the validity of microbiological results, and newborns who had already received antibiotic treatment before admission, as this could affect blood culture results. [3, 6]

The research covered a total sample of 250 newborns with possible neonatal sepsis. Enrollment was continuous

of all qualified newborns admitted to the NICU during the study period that fulfilled the inclusion criteria until the target sample size was reached. This strategy ensured that all eligible cases during the study period were included and helped to reduce selection bias. [4, 9]

Data collection was performed using a structured and predesigned proforma developed specifically for the study. Every newborn had demographic and clinical data noted. The characteristics acquired were age, gender, newborn weight, gestational age, as well as labor technique. Furthermore, precise clinical data on presenting symptoms and indicators pointing toward sepsis was recorded. Findings from the laboratory, including blood culture results and antibiotic sensitivity profiles of the isolated microorganisms were also written. [1, 2] Direct clinical evaluation, laboratory reports, and patient medical records all gathered all data [3].

Blood samples for microbiological examination were obtained under rigorous sterile conditions prior to the start of antibiotic treatment. For culture and identification of bacterial pathogens, the collected blood samples were quickly transported to the microbiology facility. Standard microbiological methods were used to analyze blood cultures. Through traditional biochemical tests, which enabled discrimination of gram-positive and gram-negative bacteria and exact detection of the causative agents, identification of bacterial isolates was done. [6, 9]

After separation of the bacterial entities, antibiotic susceptibility testing was done utilizing the Kirby–Bauer disc diffusion approach on Mueller–Hinton agar plates. The results were analyzed in line with the Clinical and Laboratory Standards Institute (CLSI) guidelines, which provide consistent criteria for assessing bacterial sensitivity or resistance to antibacterial medications. This method enabled the determination of the susceptibility patterns of isolated organisms to commonly used antibiotics in the NICU. [6]

All collected data were carefully entered into a database and analyzed using SPSS version 25**.** The data were summarized using descriptive statistical techniques. Categorical variables included gender, mode of delivery, kind of bacterial isolates, and antibiotic resistance patterns were used to compute frequencies and percentages. Appropriate descriptive statistics were used to summarize continuous variables such as age, birth weight, and gestational age. To give a clear grasp of the epidemiological characteristics and antimicrobial susceptibility patterns related with neonatal sepsis in the study population, the examined data were shown in tables and graphs. [1, 2, 7, 8]

RESULTS

The study included 250 new born babies with clinical doubt of sepsis enrolled to the Infant Serious Care Department [1, 2]. Demographic characteristic analysis revealed that 145 (58%) were male neonates while 105 (42%) were females [1]. Regarding gestational age, 110 (44%) newborns were born prematurely while 140 (56%) were born at term. [2, 3] Regarding birth weight distribution, 120 (48%) neonates had low birth weight, whereas 130 (52%) had normal birth weight [3, 4] (Table 1). Among the neonates with confirmed sepsis, cases were further categorized according to the time of onset of infection. While early-onset sepsis (EOS) accounted for 51 (54%) instances, late-onset sepsis (LOS) was seen in 44 (46%) newborns [2, 5] (Table 2).

Analysis of blood cultures showed that 95 newborns had culture-positive sepsis and various bacterial diseases were isolated. Most frequently discovered pathogen among the isolates was Klebsiella pneumoniae: 27 (28%). Next, eighteen (19%) occurrences of Escherichia coli came; Staphylococcus aureus appeared in sixteen (17%) cases. Eleven (12%) cases contained Acinetobacter species; eleven (11%) cases saw coagulase-negative Staphylococci (CONS) [1, 3, 6] (Table 3). Among culture-positive samples [4, 6], Klebsiella pneumoniae was clearly predominant, then E. coli and Staphylococcus aureus in the graphical distribution of bacterial isolates.

Meropenem had the most sensitivity (92%), Amikacin (81%), and Piperacillin– Tazobact 78% according to analysis of the antibiotic sensitivity profiles of the isolated organisms. Gentamicin (64%) showed moderate sensitivity; Ceftriaxone (35%) and Ampicillin (28%) [6, 7] had somewhat lesser degrees of response. These results suggest that aminoglycosides and carbapenems are more effective against the isolated infections than against more often used first-line antibiotics. [6, 8]

Table 1. Demographic Characteristics of Neonates (n = 250)

Variable	Frequency (n)	Percentage (%)
Sex		
Male	145	58.0
Female	105	42.0

Gestational Age		
Preterm	110	44.0
Term	140	56.0
Birth Weight		
Low Birth Weight	120	48.0
Normal Birth Weight	130	52.0

Table 2. Distribution of Early- vs. Late-Onset Sepsis

Type of Sepsis	**Cases (n)**	**Percentage (%)**
Early-Onset Sepsis	51	54.0
Late-Onset Sepsis	44	46.0
Total	**95**	**100.0**

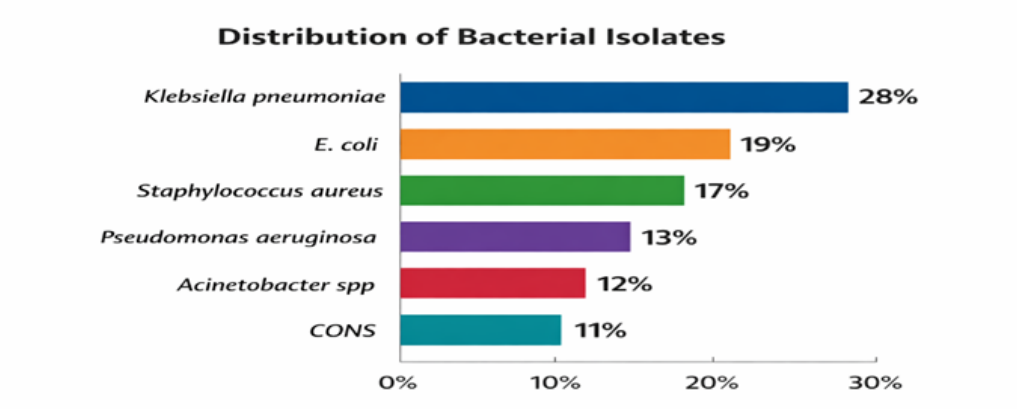
Table 3. Microbial Profile of Culture-Positive Sepsis (n = 95)

Organism	**Frequency (n)**	**Percentage (%)**
Klebsiella pneumoniae	27	28.0
Escherichia coli	18	19.0
Staphylococcus aureus	16	17.0
Pseudomonas aeruginosa	12	13.0
Acinetobacter spp.	11	12.0
Coagulase-negative *Staphylococci*	11	11.0
Total	**95**	**100.0**

Table 4. Antibiotic Sensitivity Pattern Among Culture-Positive Isolates

Antibiotic	**Sensitivity (%)**
Meropenem	92.0
Amikacin	81.0
Piperacillin–Tazobactam	78.0
Gentamicin	64.0
Ceftriaxone	35.0
Ampicillin	28.0

Note: Percentages represent the proportion of culture-positive isolates sensitive to each antibiotic



DISCUSSION

Particularly in underdeveloped nations where healthcare reserves are few and infection administer procedures may be insufficient [1,3], neonatal sepsis still accounts for a significant amount of neonatal morbidity and mortality worldwide. Among infants admitted to the Neonatal Intensive Care Unit (NICU), the current study assessed the epidemiology, Pathogenic sketch, and antibiotic efficacy trends of new born sepsis. [1, 2] Culture positivity within 38 percent of inferred cases in our research suggests a significant load of laboratory validated new born sepsis. [1,4]. These results match others from around the world and locally, where traditions positivity tempos between newborns with alleged sepsis vary between 30% and 45%. [3, 7] Differences in

research groups, laboratory methods, previous antibiotic disclosure, and occasions of blood civilization sampling may all help to explain variations in culture positivity. [2, 6]

Male neonates made up a greater share (58%) of cases in the current study than female ones (42%). [1] Several earlier research have noted this male predominance in neonatal sepsis; it may be linked to genetic, hormonal, and immunological variations that raise male infants' vulnerability to infection. [2,8] Furthermore stressing their increased sensitivity to systemic infections is the fact that preterm newborns and low birth weight babies made a significant portion of the research population caused underdeveloped immune systems, inadequate physical barriers, and frequent exposure to invasive procedures in the NICU. [3, 7]

Early-onset sepsis (54%) was somewhat more prevalent than late-onset sepsis (46%) as shown by the distribution of sepsis according to the time of onset in our study [2, 5]. Whereas late-onset infections are more often connected with nosocomial or hospital-acquired pathogens [2, 7], early-onset infections are usually connected with vertical transmission of germs from the maternal genital tract. Maternal risk factors, intrapartum infections, or insufficient screening for maternal colonization may help to explain the greater prevalence of early-onset sepsis in our research. [5]

Concerning the microbial profile, our research showed an obvious preponderance of Gram-negative species, which accounted for most of culture-positive instances. [1, 3, 7] Among the few pathogens, Klebsiella pneumoniae (28%) was the most often found organism, followed by Escherichia coli (19%) and Staphylococcus aureus (17%). Among other isolates were coagulase-negative Staphylococci (CONS) [1, 6], Acinetobacter species, and Pseudomonas aeruginosa. These results agree with those of numerous studies done in NICUs in underdeveloped nations, where Gram-negative bacteria, especially Klebsiella species, are often reported as the main cause of neonatal sepsis. [3, 4, 7] Often linked to hospital-acquired infections, contaminated equipment, extended hospital stays, and invasive operations carried out in neonatal intensive care units, these organisms predomancy. [3, 8]

According to the antibiotic sensitivity pattern seen in this investigation, Meropenem had the highest sensitivity (92%), followed by Amikacin (81%) and Piperacillin–Tazobactam (78%). [6, 8] These findings suggest that several of the bacterial isolates found in the NICU still show great sensitivity to carbapenems and aminoglycosides. Commonly used first-line antibiotics include Ampicillin (28%) and Ceftriaxone (35%), which have somewhat low sensitivity and hence reveal noteworthy resistance amongst the bacterial isolates. [6, 7] Other studies have found similar resistance patterns, indicating that broad-spectrum antibiotics are misused or overused helps to explain the development of multidrug-resistant organisms in neonatal units. [8]
A major worry in the treatment of neonatal sepsis is the growing resistance to routinely prescribed antibiotics, as it might cause delayed treatment response, extended hospitalization, and increased mortality. [6, 8] These results underline the need of regular checking of local bacterial profiles and antimicrobial susceptibility patterns to inform proper empirical antibiotic treatment. [1, 2] Strict infection control practices and antimicrobial stewardship strategies can reduce the spread of resistant organisms and enhance treatment results in neonatal intensive care units. [5, 7]

The findings of this research underline into NICU environments the necessity of regular microbiological observation, sensible antibiotic usage, and enhanced infection anticipation measures. [1, 3, 5] Premature identification, suitable antimicrobial rehabilitation, and devotion to firm aseptic methods during invasive processes are necessary strategies to decrease the occurrence of new born sepsis and enhance neonatal survival tempos. [2, 4, 6]

Limitations

Although the current study offers valuable information upon the antimicrobial struggle trends and epidemiology of infant sepsis, it has certain restraints. [1, 2] Initial, the research was carried out within a solitary Referral hospital, which may confine the applicability of the results to further healthcare surroundings. [3] Next, while an appropriate descriptive analysis could be performed with a sample of 250 newborns, more representative information upon the microbial trends of ifant sepsis [2, 4] would result from larger multicenter studies. Third, the research primarily concentrated on traditions affirmative cases; some babies with quantifiable sepsis yet negative cultures could have been missed because of restrictions of traditional diagnostic methods. [5] Furthermore, molecular diagnostic techniques were not employed for pathogen finding, which would have presumably aided in the recognition of fastidious species. [6] To better comprehend the evolving trends of infant sepsis and antibiotic resistance in NICU environments, future studies with bigger populations, sophisticated diagnostic methods, and extended follow-up periods is advised. [1,7]

CONCLUSION

Especially in developing nations where medical resources and infection control procedures may be few, neonatal sepsis still accounts for a major amount of disability and death between newborns entered to Neonatal Severe Care Departments (NICUs). [1,2] The current research revealed a substantial fraction of traditions positive sepsis among new born with inferred infection, indicating the continuing trouble of newborn sepsis into hospital surroundings. [3] The great part these germs play in neonatal bloodstream infections under intensive care

settings is underscored by their predominance, especially Klebsiella pneumonia [6].

Whereas greater sensitivity was noted with antibiotics like meropenem and amikacin, the study also found much resistance to often used antibiotics such as ampicillin and ceftriaxone. [1] These findings draw attention on the growing challenge of antimicrobial combat in NICUs and underline the importance of selecting empirical antibiotic treatment guided by limited susceptibility.[8]

Important strategies to lower the incidence of newborn sepsis and improve newborn health are continuous monitoring of microbial specimens, strong dedication to infection prevention and mitigation strategies, and prudent antibiotic use. [7] Early diagnosis and quick treatment will help to significantly lower neonatal problems and fatalities related to sepsis, therefore strengthening antimicrobial stewardship initiatives will help to achieve this. [5] To better grasp the changing epidemiology and fight trends of neonatal germs and to help with the creation of successful healing recommendations, more large scale, multi center studies are advised. [1]

REFERENCES

1. Shane, A. L., Sánchez, P. J., & Stoll, B. J. (2017). Neonatal sepsis. The Lancet, 390(10104), 1770–1780. http://doi.org/10.1016/S0140-6736(17)31002-4
2. Simonsen, K. A., Anderson-Berry, A. L., Delair, S. F., & Davies, H. D. (2014). Early-onset neonatal sepsis. Clinical Microbiology Reviews, 27(1), 21–47. http://doi.org/10.1128/CMR.00031-13
3. Zaidi, A. K. M., Huskins, W. C., Thaver, D., Bhutta, Z. A., Abbas, Z., & Goldmann, D. A. (2005). Hospital-acquired neonatal infections in developing countries. The Lancet, 365(9465), 1175–1188. http://doi.org/10.1016/S0140-6736(05)71881-X
4. Fleischman, C., Reichert, F., Cassini, A., Horner, R., Harder, T., Markwart, R., … Eckmanns, T. (2021). Global incidence and mortality of neonatal sepsis: A systematic review and meta-analysis. The Lancet Infectious Diseases, 21(12), e108–e118. http://doi.org/10.1016/S1473-3099(20)30484-3
5. World Health Organization. (2015). Managing possible serious bacterial infection in young infants when referral is not feasible: WHO guideline. World Health Organization.
6. Clinical and Laboratory Standards Institute. (2023). Performance standards for antimicrobial susceptibility testing (33rd ed., CLSI Supplement M100). Clinical and Laboratory Standards Institute.
7. Dong, Y., & Speer, C. P. (2015). Late-onset neonatal sepsis: Recent developments. Archives of Disease in Childhood - Fetal and Neonatal Edition, 100(3), F257–F263. https://doi.org/10.1136/archdischild-2014-306213
8. Zafer, M. M., El Mahallawy, H. A., Aly, M. M., Gharieb, R., Alkaff, D., & Amin, M. A. (2019). Epidemiology and risk factors associated with multidrug-resistant bloodstream infection in neonatal intensive care units: A multicenter study. Journal of Perinatology, 39(1), 96–104. http://doi.org/10.1038/s41372-018-0244-5
9. Cohen-Wolkowiez, M., Moran, C., Benjamin, D. K., Cotten. C. M., Clark, R. H., Benjamin, D. K., & Smith, P. B. (2016). Early and late onset sepsis in late preterm infants. Pediatrics, 138(2), e20160803. https://doi.org/10.1542/peds.2016-0803
10. Hornik, C. P., Fort, P., Clark, R. H., Watt, K., Benjamin, D. K., Smith, P. B., & Manzoni, P. (2012). Early and late onset sepsis in very low birth weight infants from a large group of neonatal intensive care units. Early Human Development, 88(Suppl 2), S69–S74. http://doi.org/10.1016/S0378-3782(12)70019-1