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Neonatal Sepsis Due to Multidrug-Resistant Bacteria: A Prospective Study at aTertiary Care Hospital in Central India

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Abstract

Background: Neonatal sepsis is a significant cause of morbidity and mortality in neonates, particularly in developing countries. The emergence of multidrug-resistant (MDR) bacteria poses a severe challenge to the management and treatment of neonatal sepsis. This prospective study aims to evaluate the prevalence, risk factors, and outcomes of neonatal sepsis caused by MDR bacteria in a tertiary care hospital in Central India.

Methods: A prospective study was conducted at a tertiary care hospital in Central India from March 2023 to February 2024. Neonates diagnosed with sepsis were enrolled, and blood cultures were obtained to identify causative organisms and their antibiotic resistance profiles. Data on demographics, clinical presentation, risk factors, treatment, and outcomes were collected and analyzed.

Results: The study included 200 neonates with sepsis. The prevalence of MDR bacteria was found to be 38%. Risk factors significantly associated with MDR bacterial infections included prolonged hospital stay, prior antibiotic use, and invasive procedures. Mortality rate was higher in neonates with MDR sepsis compared to those with non-MDR sepsis.

Conclusion: MDR bacteria are a significant cause of neonatal sepsis in Central India, associated with higher morbidity and mortality. There is an urgent need for stringent infection control measures, rational antibiotic use, and continuous surveillance to combat the rise of MDR organisms.

Introduction

Neonatal sepsis remains a leading cause of neonatal morbidity and mortality worldwide, with an estimated incidence of 1 to 5 cases per 1000 live births in developed countries and significantly higher rates in developing countries. The emergence of multidrug-resistant (MDR) bacteria has compounded the challenge of managing neonatal sepsis, as these pathogens are resistant to multiple antibiotics, making treatment difficult and often less effective.

The present study aims to assess the prevalence, risk factors, clinical features, and outcomes of neonatal sepsis caused by MDR bacteria in a tertiary care hospital in Central India. This prospective study will provide insights into the epidemiology of MDR neonatal sepsis and inform strategies to improve outcomes.

Methods

Study Design and Setting

This prospective study was conducted in the neonatal intensive care unit (NICU) of a tertiary care hospital in Central India from March 2023 to February 2024.

Study Population

Inclusion criteria:

- Neonates diagnosed with clinical sepsis based on standard criteria.
- Blood culture positive for bacterial pathogens.

Exclusion criteria:

- Neonates with congenital anomalies incompatible with life.
- Parents/guardians not consenting to participate.

Data Collection

Demographic data, clinical presentation, and risk factors (such as prior antibiotic use, duration of hospital stay, and invasive procedures) were recorded. Blood cultures were obtained from all enrolled neonates, and bacterial isolates were identified using standard microbiological techniques. Antibiotic susceptibility testing was performed to determine the resistance profile of the isolates.

Statistical Analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and clinical characteristics. Chi-square and Fisher's exact tests were used to analyze categorical variables. Multivariate logistic regression was employed to identify independent risk factors for MDR bacterial infections. A p-value of <0.05 was considered statistically significant.

Results

Demographic and Clinical Characteristics

Table 1 summarizes the demographic and clinical characteristics of the study population.

Characteristic	MDR Sepsis (n=76)	Non-MDR Sepsis (n=124)	Total (n=200)
Gestational Age (weeks)	35.6 ± 2.1	36.1 ± 1.9	35.9 ± 2.0
Birth Weight (kg)	2.4 ± 0.5	2.6 ± 0.6	2.5 ± 0.6
Gender (Male/Female)	42/34	68/56	110/90
Mode of Delivery (Vaginal/C-Section)	35/41	56/68	91/109
Apgar Score at 5 min	6.8 ± 1.2	7.1 ± 1.3	7.0 ± 1.3
Prior Antibiotic Use	55 (72.4%)	40 (32.3%)	95 (47.5%)
Prolonged Hospital Stay (>7 days)	49 (64.5%)	38 (30.6%)	87 (43.5%)
Invasive Procedures	50 (65.8%)	45 (36.3%)	95 (47.5%)

Prevalence of MDR Bacteria

Table 2 shows the distribution of bacterial isolates and their resistance profiles.

Bacterial Isolate	MDR (n=76)	Non-MDR (n=124)	Total (n=200)
Escherichia coli	20	30	50
Klebsiella pneumoniae	18	40	58
Staphylococcus aureus	12	25	37
Acinetobacter spp.	14	12	26
Pseudomonas aeruginosa	12	17	29

Risk Factors for MDR Infections

Table 3 outlines the risk factors significantly associated with MDR bacterial infections.

Risk Factor	MDR Sepsis (n=76)	Non-MDR Sepsis (n=124)	p-value
Prolonged Hospital Stay (>7 days)	49 (64.5%)	38 (30.6%)	<0.001
Prior Antibiotic Use	55 (72.4%)	40 (32.3%)	<0.001
Invasive Procedures	50 (65.8%)	45 (36.3%)	<0.001

Outcomes

Table 4 presents the outcomes of neonates with MDR and non-MDR sepsis.

Outcome	MDR Sepsis (n=76)	Non-MDR Sepsis (n=124)	Total (n=200)	p-value
Mortality Rate (%)	28 (36.8%)	20 (16.1%)	48 (24.0%)	<0.001
Length of NICU Stay (days)	15.2 ± 3.5	10.5 ± 2.8	12.1 ± 3.7	<0.001
Complications	35 (46.1%)	32 (25.8%)	67 (33.5%)	<0.001

Discussion

Neonatal sepsis due to MDR bacteria is a growing concern in Central India. Our study found a high prevalence (38%) of MDR bacterial infections among neonates with sepsis. This prevalence highlights the significant burden of MDR pathogens in neonatal sepsis within our setting.

Our findings align with other studies conducted in similar settings. For instance, Sharma et al. reported a prevalence of MDR bacteria in neonatal sepsis cases to be approximately 35% in Northern India, which is comparable to our findings. Another study found a 40% prevalence of MDR pathogens in neonatal sepsis in Western India, suggesting regional variations yet consistently high levels of MDR infections.

Our study identified several risk factors significantly associated with MDR bacterial infections, including prolonged hospital stay, prior antibiotic use, and invasive procedures. These findings are consistent with the literature, where prolonged hospitalization and extensive use of antibiotics are known to facilitate the selection and proliferation of resistant bacterial strains.

The association between prior antibiotic use and MDR infections underscores the need for judicious use of antibiotics in neonates. Invasive procedures, which are often necessary in critically ill neonates, also pose a risk for acquiring MDR infections. Therefore, stringent aseptic techniques and infection control measures are imperative to mitigate this risk.

The outcomes for neonates with MDR sepsis were notably worse compared to those with non-MDR sepsis. The mortality rate in the MDR group was 36.8%, significantly higher than the 16.1%

observed in the non-MDR group. This increased mortality is corroborated by a study conducted by Kaur et al., which reported a mortality rate of 38% in neonates with MDR sepsis. The prolonged NICU stay and higher incidence of complications further underscore the severe impact of MDR infections on neonatal health.

The high prevalence of MDR bacteria and the associated poor outcomes highlight the urgent need for robust infection control measures and antibiotic stewardship programs in NICUs. Strategies such as strict adherence to hand hygiene, judicious use of antibiotics, and routine surveillance of bacterial resistance patterns are crucial to curbing the spread of MDR pathogens.

The strengths of this study include its prospective design and comprehensive data collection, which provide a detailed understanding of the epidemiology and impact of MDR neonatal sepsis in a tertiary care setting. However, the study is limited to a single center, which may affect the generalizability of the findings. Future multicentric studies are needed to validate these results and inform regional and national policies on managing neonatal sepsis.

Conclusion

MDR bacteria are a significant cause of neonatal sepsis in Central India, associated with higher morbidity and mortality. There is an urgent need for stringent infection control measures, rational antibiotic use, and continuous surveillance to combat the rise of MDR organisms. Addressing these challenges will require concerted efforts from healthcare providers, policymakers, and researchers to improve outcomes for neonates with sepsis.

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