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BACTERIAL PROFILES AND THEIR ANTIBIOTIC SUSCEPTIBILITY PATTERNS IN NEONATAL SEPSIS AT TERTIARY CARE HOSPITAL TAMILNADU:A RETROSPECTIVE STUDY

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Abstract:

Background:Neonatal septicemia remains a leading cause of mortality and morbidity in developing countries such as India, representing a significant and ongoing global public health challenge.This study aimed to investigate the bacteriological profile and antibiotic resistance patterns of microorganisms isolated in cases of neonatal sepsis.

Methodology: This retrospective study was conducted in the NICU of a tertiary care hospital in Tamil Nadu, from August 2024 to October 2024. Neonates presenting with clinical signs of sepsis and confirmed by positive blood cultures were included.Blood cultures were collected using aseptic techniques, and antibiotic susceptibility was tested. Empiric treatment was started with ciprofloxacin and gentamycin, upgraded if necessary. Data were analyzed using SPSS, with Fisher's exact test for categorical variables.

Results: Among 170 neonates (54% males, 46% females), 63.5% were born at <37 weeks of gestation, and 44.1% weighed 1.5–2.5 kg. The primary reasons for admission were respiratory support (26.5%), IUGR (18.8%), prematurity (14.7%), PROM (13.5%), and meconium-stained liquor (10.6%).

The most common gram-negative organisms were NFGNB (22.9%), *Klebsiella* species (21.8%), and *E. coli* (12.4%). Gram-positive pathogens included *Staphylococcus aureus* (18.2%) and Coagulase-negative *Staphylococcus* (17.6%).**Antibiotic Sensitivity**:Gram-positive bacteria (*S. aureus*, Coagulase-negative *Staphylococcus*): high sensitivity to vancomycin, linezolid, and cefoxitin.Gram-negative bacteria: *Klebsiella* (doxycycline 97.3%, piperacillin-tazobactam 86.5%, imipenem 56.8%), *Non-Fermentative Gram-Negative Bacilli* (NFGNB) exhibited good sensitivity to Doxycycline (92.3%) and Piperacillin-Tazobactam (76.9%), with moderate sensitivity to Gentamycin (66.7%) and Ceftazidime (56.4%). *E. coli* (imipenem 90.5%).**Antibiotic Resistance**:Gram-positive: Coagulase-negative *Staphylococcus* (penicillin 76.7%, erythromycin 80%), *S. aureus* (penicillin 19.4%).Gram-negative: *Klebsiella* (amoxicillin 64.9%), *E. coli* (amoxicillin 76.2%, ciprofloxacin 50%), NFGNB (ceftazidime 38.5%).

These findings emphasize the need for tailored antimicrobial use based on resistance patterns.

Conclusion:.

The study highlights a high prevalence of neonatal infections caused by Non Fermentative Gram Negative Bacilli(NFGNB) *Klebsiella* species, *Staphylococcus aureus*, Coagulase-negative

Staphylococcus, and *E. coli*. Gram-positive organisms showed high sensitivity to vancomycin and linezolid, while gram-negative organisms like NFGNB exhibited good sensitivity to Doxycycline and Piperacillin-Tazobactam , with moderate sensitivity to Gentamycin and Ceftazidime ., *Klebsiella* and *E. coli* were most sensitive to piperacillin-tazobactam and imipenem,gentamycin,doxycyclin. Significant resistance was noted to penicillin and erythromycin in gram-positive bacteria, and to amoxicillin and ciprofloxacin in gram-negative bacteria. These findings emphasize the need for targeted antimicrobial therapy based on local resistance patterns and regular surveillance to optimize neonatal sepsis management.

Keywords: Neonatal septicemia, Bacteriological profile, Antibiotic resistance, Neonatal intensive care unit, Antimicrobial resistance.

INTRODUCTION:

Neonatal sepsis accounts for a significant proportion of neonatal deaths globally (1). India has higher rates of neonatal infections than other low and middle-income countries (LMICs), with a recent review indicating a case fatality rate of 50% for culture-positive sepsis.The challenge of treating neonatal sepsis is made even more difficult by the issue of antimicrobial resistance (AMR). Increased antibiotic use and the frequent administration of broad-spectrum antibiotics have contributed to the growing issue of AMR (4).

Neonatal sepsis is a life-threatening condition that occurs when an infection spreads into the bloodstream of a newborn, typically within the first 28 days of life.It continues to be a significant cause of death and illness among newborns, especially in developing countries.It continues to be a significant cause of death and illness among newborns, especially in developing countries. Despite advancements in neonatal care, the incidence of sepsis remains high, contributing significantly to infant mortality, especially in low-resource settings. The condition can manifest rapidly, with symptoms often nonspecific, making early diagnosis and treatment challenging. Neonatal sepsis is generally categorized into early-onset sepsis (EOS), which occurs within the first 72 hours of life, and late-onset sepsis (LOS), which occurs after 72 hours. The causative organisms of neonatal sepsis vary by geographic region. They may include both Gram-positive and Gram-negative bacteria, with Escherichia coli, Staphylococcus aureus, and Coagulase-negative staphylococci being the most commonly identified pathogens in many areas. The infection can lead to severe complications, including multi-organ failure, cerebral palsy, and hearing impairment, with survivors often facing long-term health challenges. (5) The diagnosis of neonatal sepsis is complex and often delayed due to the subtle and nonspecific clinical presentation, such as lethargy, feeding difficulties, and respiratory distress(6). As a result, prompt initiation of empiric antibiotic therapy is crucial to reduce mortality and morbidity. (7) The treatment is typically guided by local pathogen profiles and antimicrobial susceptibility patterns, though global treatment guidelines provide a foundation for management. Despite the availability of treatment protocols and resources like the World Health Organization's guidelines for managing infections in neonates, challenges such as limited access to healthcare, inadequate diagnostic facilities, and the high burden of infectious diseases continue to hinder progress in reducing the impact of neonatal sepsis in resource-limited settings(8). Understanding the microbiological causes and resistance patterns of pathogens responsible for neonatal sepsis is essential for improving diagnosis, treatment, and outcomes. This highlights the importance of continued surveillance and research to guide clinical practices and improve neonatal health worldwide. This study aimed to examine the bacteriological profile and antibiotic resistance patterns of microorganisms isolated from cases of neonatal sepsis in tertiary care hospitals, in Tamilnadu.

Methodology

This retrospective cross-sectional study was conducted in the Neonatal Intensive Care Unit (NICU) of a tertiary-level teaching hospital in Tamil Nadu, which has a capacity of 120 NICU beds and

cares for an average of 400 critically ill neonates monthly. The study included neonates admitted to the NICU between August 2024 and October 2024, for a period of three months, who presented with clinical signs of sepsis and had a positive blood culture.

Blood cultures were obtained from neonates with either a clinical suspicion of sepsis or known risk factors. Sepsis was suspected in the presence of symptoms such as temperature instability, lethargy, feeding intolerance, respiratory distress, hemodynamic instability, convulsions, hypotonia, irritability, or bleeding diathesis. Risk factors for neonatal sepsis included prematurity (< 37 weeks of gestation), low birth weight (< 2500 g), history of resuscitation at birth, prolonged rupture of membranes (PROM > 18 hours), antepartum fever, foul-smelling amniotic fluid, and repeated unclean per vaginal examinations (≥ 3 times).

The microbiological techniques followed at the hospital included disinfecting the neonate's skin with 10% Povidone-iodine solution for 2 minutes, followed by 0.5% Chlorhexidine solution for 1 minute before blood collection. Aseptic collection of 1–3 milliliters of blood from a peripheral vein was injected into conventional culture medium(Monophasic medium of 50-100ml of brain heart infusion(BHI) broth). Blood culture bottles were transported to the lab at room temperature within 2hrs of collection.Subculture and organism identification and Antibiotic susceptibility testing as per the Clinical and Laboratory Standards Institute (CLSI) guidelines (2019) (9).

Empiric treatment with intravenous ciprofloxacin and gentamycin (first-line therapy) was started immediately after blood collection. If there was no clinical improvement after 48–72 hours, therapy was upgraded to intravenous pipercillin plus tazobactum and amikacin (second-line), or Meropenem and Colistin (third-line). Antibiotics were further modified based on the blood culture results and antibiotic susceptibility patterns..

Early-onset sepsis (EOS) was defined as sepsis occurring within the first 72 hours of life, while late-onset sepsis (LOS) was defined as sepsis occurring after 72 hours (5). Multidrug-resistant (MDR) strains were identified as those exhibiting non-susceptibility to ≥1 agent in ≥3 antimicrobial categories, as per international standards for acquired resistance (10).

Data for the study were collected by reviewing the microbiology laboratory blood culture registers and identifying all neonates with positive blood cultures. The records of these neonates were then evaluated for clinical evidence of sepsis and included in the study. Information on age at admission, gestational age at birth, birth weight, maternal risk factors, laboratory parameters, blood culture isolates, susceptibility patterns, and clinical outcomes were gathered. Data entry was conducted using EpiInfo™ for Mobile, while statistical analysis was performed with SPSS version 21. Descriptive statistics were presented as percentages for categorical variables and as means with standard deviations for continuous variables.Fisher's exact test was used to assess differences between categorical variables, with a p-value of less than 0.05 considered statistically significant.

Table 1: Gender wise distribution of neonates

Gender	No. of neonates (170)	percentage
MALE	92	54%
FEMALE	78	46%

Table 1 shows:Out of the 170 neonates, 92 (54%) were male, while 78 (46%) were female

Table 2: Gestational age wise distribution of neonates

	No. of neonates	Percentage
<37 weeks	108	63.5%
>37 weeks	62	36.5%

Table 2 shows:Out of the 170 neonates, 62 (36.5%) were born at > 37 weeks of gestation, while 108 (63.5%) were born at <37 weeks of gestation.

Table 3: Birth Weight Wise Distribution of neonates

Birth Weight (kg)	Number of Neonates	Percentage (%)
<1 kg	20	11.8
1-1.5 kg	35	20.6
1.5-2.5 kg	75	44.1
>2.5 kg	40	23.5

Table 3 shows that among the 170 neonates, 20 (11.8%) weighed less than 1 kg, 35 (20.6%) weighed between 1 and 1.5 kg, 75 (44.1%) weighed between 1.5 and 2.5 kg, and 40 (23.5%) weighed more than 2.5 kg.

Table 4: Diagnosis at admission

S.no	Cause of admission	N=170	PERCENTAGE
1	Any Respiratory Support	45	26.5%
2	Prematurity	25	14.7%
3	Moderate To Severe Birth Asphyxia	15	8.8%
4	PROM(>24 hrs)	23	13.5%
5	IUGR	32	18.8%
6	Meconium Stained Liquor(Mas)	18	10.6%

Table 4 shows:Among the 170 neonates, the diagnoses at admission were Any Respiratory Support (26.5%), Prematurity (14.7%), Moderate to Severe Birth Asphyxia (8.8%), PROM (13.5%), IUGR (18.8%), and Meconium-Stained Liquor (10.6%).

Figure 1:Diagnosis at admission of Neonates

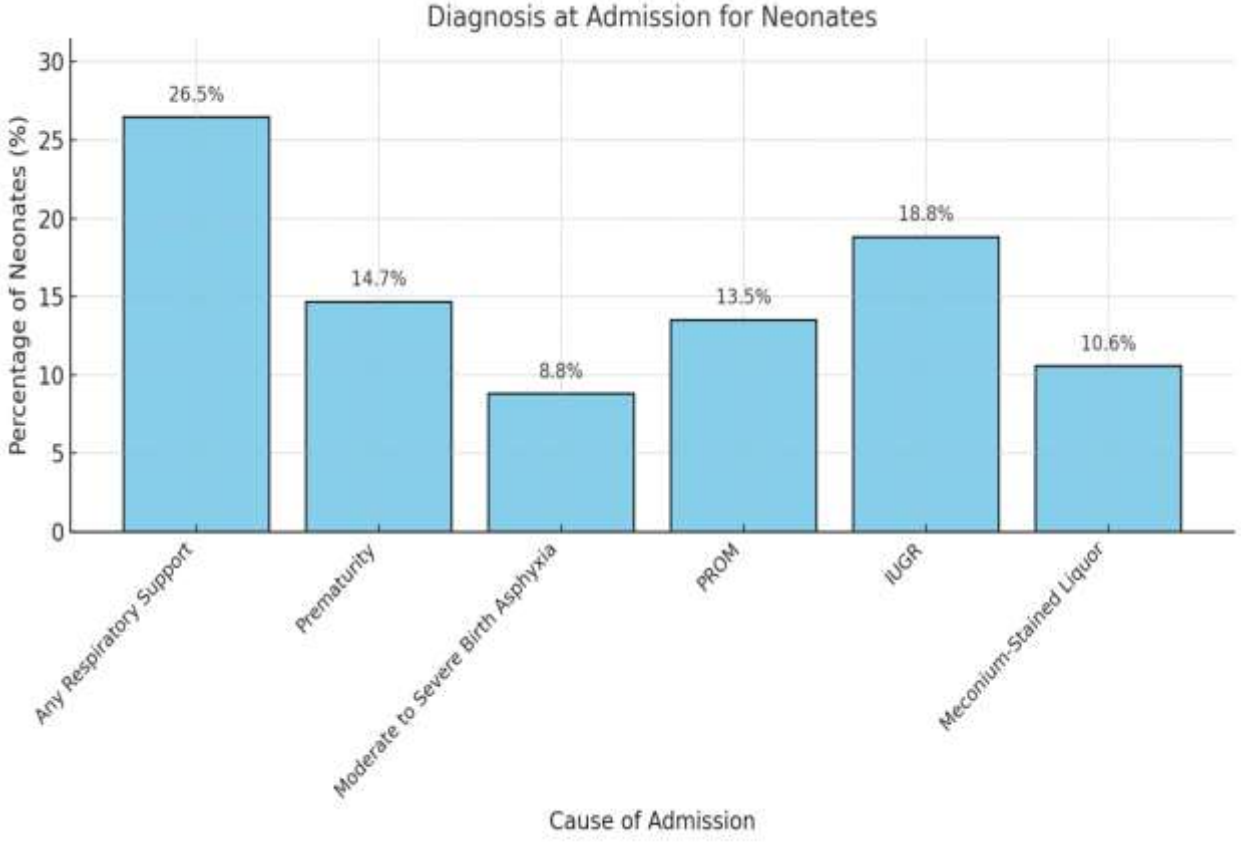

Table 5:Distribution of bacterial isolates with their relative frequency

s.no	Bacterial isolate	Number (170)	Percentage
1	Non Fermentative Gram Negative Bacilli	39	22.9%
2	Klebsiella species	37	21.8%
3	Staphylococcus aureus	31	18.2%
4	Coagulase negative staphylococcus	30	17.6%
5	E.Coli	21	12.4%
6	Enterococcus species	5	2.9%
7	pseudomonas	4	2.4%
8	Citrobactor	2	1.2%
9	Acinetobacter	1	0.6%

Among the 170 neonates, the distribution of bacterial isolates was as follows: Coagulase negative staphylococcus in 30 neonates (17.6%), Staphylococcus aureus in 31 neonates (18.2%), Enterococcus species in 5 neonates (2.9%), E. coli in 21 neonates (12.4%), Klebsiella species in 37 neonates (21.8%), Non-Fermentative Gram Negative Bacilli in 39 neonates (22.9%), Pseudomonas in 4 neonates (2.4%), Citrobacter in 2 neonates (1.2%), and Acinetobacter in 1 neonate (0.6%).

Figure 2:Distribution of bacterial isolates in neonates

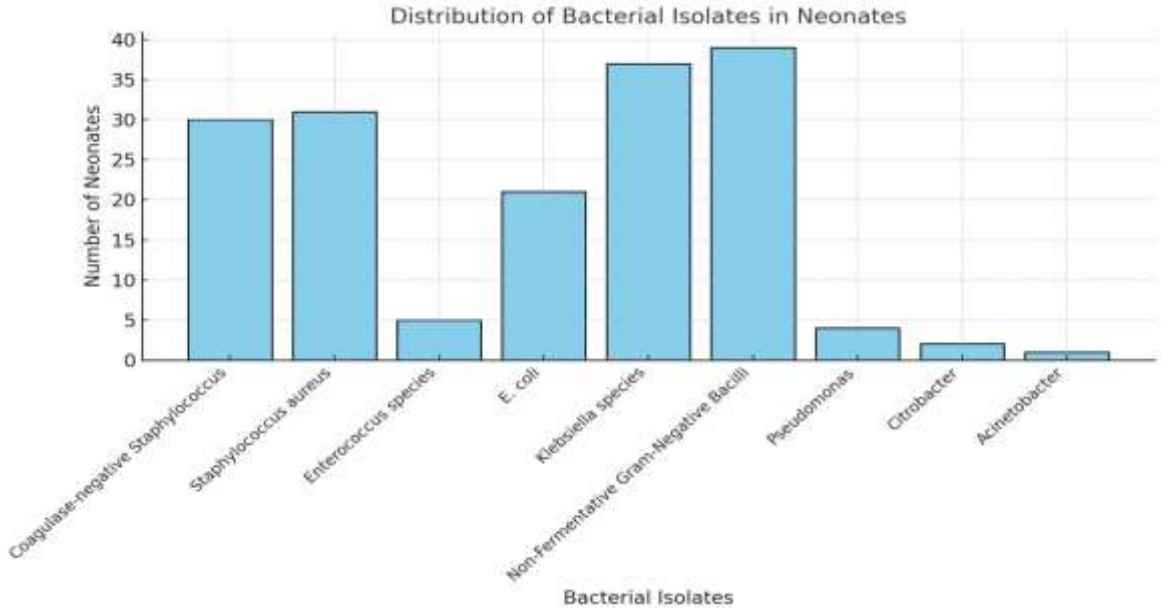

Table 6:Antibiotic sensitivity pattern(gram positive bacteria)including the percentages for each drug:

Antibiotic	**Coagulase Negative Staphylococcus (n=30)**	**Staphylococcus aureus (n=31)**	**Enterococcus species (n=5)**
Vancomycin	29 (96.7%)	26 (83.9%)	5 (100%)
Linezolid	25 (83.3%)	27 (87.1%)	4 (80%)
Cefoxitin	28 (93.3%)	26 (83.9%)	
Gentamycin	17 (56.7%)	16 (51.6%)	5 (100%)
Penicillin	7 (23.3%)	13 (41.9%)	1 (20%)
Erythromycin	5 (16.7%)	16 (51.6%)	
Cotrimoxazole	6 (20%)	12 (38.7%)	
Colistin	4 (13.3%)		
Ceftazidime	4 (13.3%)		
Cefoperazone + Sulbactam	6 (20%)	6 (19.4%)	
Imipenem	1 (3.3%)		

The antibiotic sensitivity pattern for the gram-positive bacteria in the study is as follows:

- **Coagulase negative staphylococcus** showed high sensitivity to Vancomycin (96.7%), Linezolid (83.3%), and Cefoxitin (93.3%).
- **Staphylococcus aureus** was most sensitive to Linezolid (87.1%) and Vancomycin (83.9%).
- **Enterococcus species**was fully sensitive to Vancomycin (100%) and Gentamycin (100%). Other antibiotics like Penicillin, Erythromycin, and Cotrimoxazole showed variable sensitivity across the isolates.

Table 7: Antibiotic resistance pattern of gram positive organisms

Antibiotic	Coagulase Negative Staphylococcus (n=30)	Staphylococcus aureus (n=31)	Enterococcus species (n=5)
Vancomycin	1 (3.3%)		
Penicillin	23 (76.7%)	6 (19.4%)	2 (40%)
Amikacin			
Amoxicillin	2 (6.7%)		
Imipenem	1 (3.3%)	2 (6.5%)	
Clindamycin	12 (40%)	6 (19.4%)	
Linezolid			
Cefoxitin	2 (6.7%)	2 (6.5%)	
Gentamycin	1 (3.3%)	1 (3.2%)	
Erythromycin	24 (80%)	6 (19.4%)	
Cotrimoxazole	1 (3.3%)	1 (3.2%)	
Colistin			
Ampicillin			4 (80%)

Table 7 shows the antibiotic resistance pattern for gram-positive organisms shows that **Coagulase negative staphylococcus** exhibited high resistance to Penicillin (76.7%) and Erythromycin (80%). **Staphylococcus aureus** demonstrated resistance to Penicillin (19.4%) and Clindamycin (19.4%). **Enterococcus species** showed notable resistance to Penicillin (40%) and Ampicillin (80%). Other antibiotics, such as Vancomycin, Amikacin, and Linezolid, showed low or no resistance in these organisms.

Table 8: Sensitivity pattern of gram negativeorganisms

Antibiotic	Klebsiella species (n=37)	NFGNB (n=39)	E. Coli (n=21)	Pseudomonas (n=4)	Acinetobacter (n=2)	Citrobactor (n=2)
Piperacillin Tazobactam	32 (86.5%)	30 (76.9%)	18 (85.7%)	3 (75%)	1 (50%)	
Gentamycin	23 (62.2%)	26 (66.7%)	15 (71.4%)	2 (50%)		1 (50%)
Amikacin	5 (13.5%)	28 (71.8%)	3 (14.3%)	2 (50%)		1 (50%)
Ceftazidime	15 (40.5%)	22 (56.4%)	11 (52.4%)	4 (100%)		
Ciprofloxacin	2 (5.4%)	7 (17.9%)		1 (25%)		1 (50%)
Imipenem	21 (56.8%)	17 (43.6%)	19 (90.5%)	2 (50%)		
Cotrimoxazole	10 (27%)	4 (10.3%)	3 (14.3%)	1 (25%)		
Meropenem	3 (8.1%)			1 (25%)	1 (50%)	1 (50%)
Ceftriaxone	9 (24.3%)	10 (25.6%)	4 (19%)			1 (50%)
Doxycycline	36 (97.3%)	36 (92.3%)	19 (90.5%)	3 (75%)		1 (50%)
Colistin	2 (5.4%)					

Table 8 shows the antibiotic sensitivity pattern for gram-negative organisms among the 170 neonates showed that **Klebsiella species** had the highest sensitivity to Doxycycline (97.3%), followed by Piperacillin Tazobactam (86.5%) and Imipenem (56.8%). *Non-Fermentative Gram-Negative Bacilli* (NFGNB) exhibited good sensitivity to Doxycycline (92.3%) and Piperacillin-Tazobactam (76.9%), with moderate sensitivity to Gentamycin (66.7%) and Ceftazidime (56.4%).

E. Coli showed good sensitivity to Imipenem (90.5%), Piperacillin Tazobactam (85.7%), and Gentamycin (71.4%). **Pseudomonas** and **Acinetobacter** displayed more variable sensitivities, with **Pseudomonas** showing the highest sensitivity to Ceftazidime (100%) and **Acinetobacter** being sensitive to Meropenem (50%).

Table 9:Resistance pattern of gram negative organisms

Antibiotic	**Klebsiella species (n=37)**	**NFGNB (n=39)**	**E. Coli (n=21)**	**Pseudomonas (n=4)**	**Acinetobacter (n=2)**	**Citrobactor (n=2)**
Amoxicillin	24 (64.9%)	4 (10.3%)	16 (76.2%)			
Ceftazidime	18 (48.6%)	15 (38.5%)	8 (38.1%)		1 (50%)	
Ceftriaxone	12 (32.4%)	5 (12.8%)	8 (38.1%)			
Imipenem (IPM)	7 (18.9%)	9 (23.1%)		2 (50%)		
Penicillin		1 (2.6%)	1 (4.8%)			
Ceftriaxone	1 (2.7%)	1 (2.6%)				
Ciprofloxacin	1 (2.7%)	2 (5.1%)		1 (25%)	1 (50%)	
Gentamycin	12 (32.4%)	12 (30.8%)	2 (9.5%)			
Piperacillin Tazobactam (PTZ)	2 (5.4%)					
Meropenem (MRP)	1 (2.7%)					
Ceftazidime (CFS)	1 (2.7%)	2 (5.1%)				
Amikacin	3 (8.1%)	3 (7.7%)		1 (25%)		
Doxycycline	1 (2.7%)	1 (2.6%)				
Cotrimoxazole (COT)	1 (2.7%)	1 (2.6%)				
Ampicillin	2 (5.4%)					

The antibiotic resistance pattern for gram-negative organisms in this cohort shows that Klebsiella species **exhibited significant resistance to Amoxicillin (64.9%) and Gentamycin (32.4%).** NFGNB **showed considerable resistance to** Ceftazidime **(38.5%) and** Gentamycin **(30.8%).** E. Coli **demonstrated high resistance to** Amoxicillin **(76.2%) and** Ciprofloxacin **(50%).** Pseudomonas **showed resistance to** Imipenem **(50%) and** Ciprofloxacin **(25%).** Acinetobacter **displayed resistance to** Ciprofloxacin **(50%). The least resistance was seen with** Piperacillin Tazobactam **(5.4%) and** Meropenem **(2.7%) in theKlebsiella species growth**

Results

A total of 170 neonates were enrolled in the study, with 92 (54%) males and 78 (46%) females. The majority (63.5%) of neonates were born at < 37 weeks of gestation, while 36.5% were preterm (>37 weeks). Regarding birth weight, 44.1% of neonates weighed between 1.5–2.5 kg, 23.5% weighed more than 2.5 kg, 20.6% weighed between 1–1.5 kg, and 11.8% weighed less than 1 kg.

The primary causes for admission included respiratory support (26.5%), prematurity (14.7%), moderate to severe birth asphyxia (8.8%), PROM (13.5%), IUGR (18.8%), and meconium-stained liquor (10.6%).

The distribution of bacterial isolates in the neonates revealed Non-Fermentative Gram Negative Bacilli (NFGNB) (22.9%) , Klebsiella species (21.8%), Staphylococcus aureus (18.2%), Coagulase negative staphylococcus (17.6%), , and E. coli (12.4%) as the most common pathogens. Other less common isolates included Pseudomonas (2.4%), Citrobacter (1.2%), and Acinetobacter (0.6%).

The antibiotic sensitivity pattern showed high susceptibility to Vancomycin, Linezolid, and Cefoxitin in Coagulase negative staphylococcus and Staphylococcus aureus, with varying sensitivities to Gentamycin, Penicillin, and Erythromycin. Enterococcus species exhibited complete sensitivity to Vancomycin (100%) and Gentamycin (100%).

Resistance patterns for gram-positive organisms showed significant resistance to Penicillin (76.7%) and Erythromycin (80%) in Coagulase negative staphylococcus, while Staphylococcus aureus showed resistance to Penicillin (19.4%) and Clindamycin (19.4%). Enterococcus species showed resistance to Penicillin (40%) and Ampicillin (80%).

Among gram-negative bacteria, Klebsiella species exhibited high sensitivity to Doxycycline (97.3%), Piperacillin Tazobactam (86.5%), and Imipenem (56.8%). *Non-Fermentative Gram-Negative Bacilli* (NFGNB) exhibited good sensitivity to Doxycycline (92.3%) and Piperacillin-Tazobactam (76.9%), with moderate sensitivity to Gentamycin (66.7%) and Ceftazidime (56.4%). , while E. coli was highly sensitive to Imipenem (90.5%). Pseudomonas showed the highest sensitivity to Ceftazidime (100%), while Acinetobacter displayed variability in sensitivity patterns, with notable sensitivity to Meropenem (50%).

Resistance patterns for gram-negative organisms included significant resistance to Amoxicillin (64.9%) and Gentamycin (32.4%) in Klebsiella species, with NFGNB exhibiting resistance to Ceftazidime (38.5%) and Gentamycin (30.8%). E. coli showed high resistance to Amoxicillin (76.2%) and Ciprofloxacin (50%). Pseudomonas showed resistance to Imipenem (50%) and Ciprofloxacin (25%).

In summary, the study found high prevalence of infections due to both gram-positive and gram-negative bacteria, with varying antibiotic sensitivities and resistance patterns. The results underscore the importance of timely and appropriate antimicrobial therapy, taking into account the emerging resistance trends in neonates with septicemia.

Discussion

This study highlights key demographic, clinical, and microbiological findings in neonates admitted to the NICU. The predominance of gram-negative pathogens like **Klebsiella species** and **Non-Fermentative Gram-negative Bacilli**, alongside gram-positive bacteria, such as **Staphylococcus aureus**, and **Coagulase-negative staphylococcus** reflects common causative agents of neonatal infections.

Gram-positive organisms showed high sensitivity to Vancomycin and Linezolid, while resistance to Penicillin and Erythromycin was significant. Among gram-negative organisms, Piperacillin-Tazobactam and Meropenem were the most effective antibiotics, with resistance observed in agents like Amoxicillin, Gentamycin, and Ciprofloxacin. Alarmingly, resistance to carbapenems, particularly Imipenem in **Pseudomonas aeruginosa**, signals the need for judicious antibiotic use.

The findings underscore the importance of local antibiograms to guide empiric therapy and highlight the critical need for robust antimicrobial stewardship and infection control strategies in the NICU to mitigate rising resistance trends.

The current study and other cited studies collectively underscore the alarming trends in neonatal sepsis and antimicrobial resistance (AMR). A comparative analysis reveals similarities and differences across different geographic and clinical settings:

Prevalence and Pathogen Distribution

In the current study, **Gram-negative bacteria** (Klebsiella species and Non-Fermentative Gram-Negative Bacilli) were the predominant pathogens, similar to findings from **TeshiwalDeress et al. (2024)**(11)and**Mubashir Hassan Shah et al. (2022)**,(12) where Klebsiella pneumoniae emerged as the leading Gram-negative pathogen. Conversely, **Kwame Opare-Asamoah et al. (2023)(13)** reported a higher prevalence of Gram-positive pathogens, with Coagulase-negative staphylococcus (CoNS) dominating. This regional variation highlights the importance of tailoring antibiotic protocols to local microbiological profiles.

Antimicrobial Resistance Patterns

Resistance trends observed in the current study are consistent with the findings of **Mubashir Hassan Shah et al. (2022)(12)** and **DeNIS collaboration (2016)**,(3) demonstrating significant resistance to aminoglycosides and cephalosporins among Gram-negative bacteria. In the current study, **Klebsiella species** showed resistance to Amoxicillin (64.9%) and Gentamycin (32.4%), aligning with high resistance to similar antibiotics reported by **Bhishma Pokhrel et al. (2018)**(14)and**Zakariya et al. (2023)(15)**. Furthermore, resistance to carbapenems, a critical concern highlighted in the **DeNIScollaboration(3)**, was also observed in Pseudomonas isolates in the current study (50% resistance to Imipenem).

Empirical Therapy Implications

The current study supports the use of Piperacillin-Tazobactam and Meropenem for Gram-negative organisms, consistent with recommendations from **Zakariya et al. (2023)(15)** and **Pokhrel et al. (2018)(14)**. However, the emerging carbapenem resistance calls for cautious use and the consideration of alternative antibiotics, as suggested by **Mubashir Hassan Shah et al. (2022)(12)**, including Colistin for resistant strains.

Risk Factors and Clinical Implications

This study presents the findings of TeshiwalDeress et al. (2024) (11), which identify preterm birth and low birth weight as significant contributors to neonatal sepsis, emphasizing the need for preventive measures in high-risk neonates. The findings of **Kwame Opare-Asamoah et al. (2023)(13)** further highlight the association of early-onset sepsis with preterm delivery and hypothermia, reinforcing the importance of early intervention in vulnerable populations.

Limitations and Future Directions:The study is limited by its single-center design, which may not fully capture the broader regional variability in bacterial profiles and resistance patterns. Longitudinal data on outcomes and the impact of resistance trends would provide deeper insights into optimizing neonatal sepsis management. Future studies should focus on molecular mechanisms underlying resistance and strategies to enhance antibiotic stewardship in NICUs.

Conclusion

The study highlights a high prevalence of neonatal infections caused by, Non Fermentative Gram Negative Bacilli(NFGNB). *Klebsiella* species, *Staphylococcus aureus*, Coagulase-negative *Staphylococcus*, and *E. coli*. Gram-positive organisms showed high sensitivity to vancomycin and linezolid, while gram-negative organisms like NFGNB exhibited good sensitivity to Doxycycline and Piperacillin-Tazobactam , with moderate sensitivity to Gentamycin and Ceftazidime ., *Klebsiella* and *E. coli* were most sensitive to piperacillin-tazobactam and imipenem, gentamycin, doxycyclin. Significant resistance was noted to penicillin and erythromycin in gram-positive bacteria, and to amoxicillin and ciprofloxacin in gram-negative bacteria. These findings emphasize the need for targeted antimicrobial therapy based on local resistance patterns and regular surveillance to optimize neonatal sepsis management.

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Declaration of conflicting interests

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