



Plagiarism Checker X - Report

Originality Assessment

0%

Overall Similarity

Date: Apr 13, 2026 (12:23 PM)

Matches: 0 / 1345 words

Sources: 0

Remarks: No similarity found,
your document looks healthy.

Verify Report:

Scan this QR Code



PROFILE OF BACTERIAL PATHOGENS AND THEIR ANTIBIOTIC SENSITIVITY PATTERN IN NEONATAL SEPSIS.

ABSTRACT

Background: Neonatal sepsis in India has the highest incidence worldwide, ranging from 14.3% to 23% and is the second leading cause of mortality among newborns. This study was conducted to isolate the microorganisms causing neonatal sepsis and to determine their antibiotic sensitivity patterns.

Materials and Methods: A prospective study was conducted for a period of 3 months from 24th February 2025 to 25th May 2025. 100 blood cultures samples were collected from newborns admitted to Neonatal Intensive Care Unit (NICU) with signs and symptoms suggestive of neonatal sepsis. Blood collected was loaded into BacT/ALERT 3D culture system. From bottles flagged positive, gram stain was performed and sub-cultures were made onto Blood agar and MacConkey agar. Bacterial colonies were identified by gram stain and biochemical tests and the organism confirmed by VITEK2 Compact ID cards. Antibiotic sensitivity of the organisms was analyzed by VITEK 2 Compact AST cards.

Results: Out of the 100 samples processed, 10 (10%) were culture positive, 80% (n=8) of them were Gram-negative bacteria and 20% (n=2) were Gram-positive bacteria. The most common organisms isolated were *Klebsiella pneumoniae* (n=2, 20%), *Escherichia coli* (n=2, 20%) and *Acinetobacter baumannii* (n=2, 20%). Gram-negative isolates were most susceptible to Amikacin, Meropenem and Piperacillin/Tazobactam combination, whereas, Gram-positive pathogens were susceptible to Vancomycin, Teicoplanin and Linezolid.

Conclusion: The study reaffirms that *Klebsiella pneumoniae*, *Escherichia coli*, *Acinetobacter baumannii* and Coagulase Negative Staphylococcus are the predominant pathogens in neonatal sepsis. It highlights the continued effectiveness of broad-spectrum agents such as Piperacillin/Tazobactam, Meropenem and aminoglycosides against Gram-negative pathogens and Vancomycin, Teicoplanin and Linezolid against Gram-Positive organisms.

Keywords: Neonatal sepsis, Bacterial pathogens, Antibiotic sensitivity

Introduction

Neonatal sepsis is defined as a life-threatening, dysregulated inflammatory response to bloodstream infection in infants under 28 days [1,2] and is a leading cause of morbidity and mortality. In India, neonatal sepsis is the second major cause of mortality, with an incidence ranging from 14.3% to 23%. [3] Globally, of the three million annual neonatal sepsis cases, India has the highest incidence of clinical sepsis (17,000/ 1,00,000 live births). [4]

The predominant organisms isolated across various studies include, *Klebsiella pneumoniae*, *Acinetobacter* species, Coagulase-Negative Staphylococci and *Staphylococcus aureus*.

[5,7]

The emergence of Multi-Drug Resistance (MDR) organisms has become a serious public health concern. Antimicrobial resistance in neonatal sepsis is on the rise due to the use of reserve antibiotics as first and second-line drugs. High rates of multi-drug resistance are observed in *Acinetobacter* (82%), *Klebsiella* (54%) and *Escherichia coli* (38%) isolates. [6]

Materials and Methods

A prospective study was conducted for a period of 3 months from 24th February 2025 to 25th May 2025. Newborns admitted to NICU with clinical signs and symptoms suggestive of neonatal sepsis were included in the study. 100 blood culture samples were collected and processed aseptically in the Department of Microbiology, Apollo Institute of Medical Sciences and Research, Hyderabad, India.

Bacterial Isolation

Under aseptic precautions, 4ml of blood was collected and injected into the PF Plus blood culture bottle and loaded into BacT/ALERT 3D culture system and incubated at 37°C for a maximum of 5 days. When the bottles were flagged positive, gram stain was performed and sub-cultures were made on Blood agar and MacConkey agar and incubated at 37°C for 18-24 hours. The sample was reported sterile if no growth was observed for 5 days.

Identification and AST of bacterial isolates

The bacteria grown was identified by colony morphology, gram stain and bio-chemical tests and

confirmed by VITEK 2 Compact ID cards. Antibiotic sensitivity of the organism was analyzed by VITEK 2 Compact AST cards. AST cards N405 and N406 were used to determine the antibiotic susceptibility of Gram-negative fermenter bacteria and Gram-negative non-fermenter bacteria respectively, while P628 AST cards were utilized for Gram-positive bacteria.

The identified organism and its antibiotic sensitivity pattern were immediately shared with the primary team and all cases were followed till discharge.

Results/Discussion

In the present study, 100 samples were received with the clinical suspicion of neonatal sepsis, of which 10 (10%) were culture positive. Other studies had a higher percentage of positive blood cultures, 19.2% culture positivity by Jyothi Pet al. [5] and 15.3% culture positivity by Siddiqui Tetal. [7] This could be due to the differences in geographical location and hospital setting. Both studies were done in North India and included a larger sample size over a longer study period.

In our study, 80% (n=8) of organisms isolated were Gram-negative bacteria and 20% (n=2) were Gram-positive bacteria. The most common organisms isolated were *Klebsiella pneumoniae* (n=2, 20%), *Escherichia coli* (n=2, 20%) and *Acinetobacter baumani* (n=2, 20%). Other Gram-negative bacteria isolated were *Achromobacter xylosoxidans* (n=1, 10%) and *Enterobacter cloacae* (n=1, 10%).

Gram-positive organisms isolated were Coagulase Negative *Staphylococcus* (n=2, 20%) (*Staphylococcus hemolyticus* and *Staphylococcus hominis*) (Figure 1).

Figure 1: Type and percentage of bacterial isolates

Several other studies have also reported Gram-negative bacteria as the most frequently isolated pathogen in neonatal septicemia. [5,7,8,9] In a study of Zakariya BP et al., *Klebsiella pneumoniae* (66%) was the most common organism isolated followed by Coagulase Negative *Staphylococcus* (12%). [8] Another study by Jyothi P et al, concluded that *Klebsiella*, *Acinetobacter*, Coagulase Negative *Staphylococcus* and *Staphylococcus*

aureus as the leading cause of neonatal sepsis [5], whereas, Lamba Metal.'s study revealed that Coagulase Negative Staphylococcus (17.43%) was the predominant isolate followed by Klebsiella species (16.11%). [10]

Therefore, Klebsiella pneumoniae is the most common Gram-negative bacteria, while Coagulase-Negative Staphylococci is the most common Gram-positive organism isolated in neonatal septicemia.

Treatment with antibiotics is the mainstay treatment for neonatal sepsis. Maximum sensitivity of Klebsiella pneumoniae isolates to Amikacin, Meropenem and Piperacillin/Tazobactam combination was observed in our study. Susceptibility to Ceftriaxone, Ciprofloxacin, Cefoperazone/Sulbactam, Imipenem, Aztreonam was 50%. Zakariya BP et al. also reported

susceptibility of Klebsiella pneumoniae isolate to Amikacin and Meropenem, while showing resistance to other antibiotics. [8]

Both isolates of Escherichia coli were sensitive to Amikacin and only one of them was sensitive to Ceftazidime, Ceftriaxone, Ciprofloxacin, Cefoperazone/Sulbactam, Meropenem, Imipenem, Aztreonam and Piperacillin/Tazobactam.

Acinetobacter baumannii showed resistance to all drugs, as also observed in another study. [6]

Antibiotic susceptibility of other isolates is mentioned in Table 1.

Antibiotic

Sensitivity pattern [n, %]

Klebsiella pneumoniae (n=2)

Escherichia

coli (n=2)

Acinetobacter baumannii (n=2)

Achromobacter xylosoxidans

(n=1)

Enterobacter cloacae (n=1)

Amikacin

2 (100%)

2 (100%)

0

0

1 (100%)

Ceftazidime

1 (50%)

1 (50%)

0

1 (100%)

1 (100%)

Ceftriaxone

1 (50%)

1 (50%)

0

0

1 (100%)

Ciprofloxacin

1 (50%)

1 (50%)

0

0

1 (100%)

Cefoperazone/Sulbactam

1 (50%)

1 (50%)

0

1 (100%)

1 (100%)

Meropenem

2 (100%)

1 (50%)

0

1 (100%)

1 (100%)

Imipenem

1 (50%)

1 (50%)

0

0

1 (100%)

Aztreonam

1 (50%)

1 (50%)

0

0

1 (100%)

Piperacillin/Tazobactam

2 (100%)

1 (50%)

0

1 (100%)

1 (100%)

Colistin

Intermediate

Intermediate

Intermediate

Intermediate

Intermediate

Table 1: Antibiotic sensitivity pattern of the Gram-negative bacterial isolates

Overall, Gram-negative isolates were most susceptible to Amikacin (n=5, 62.5%), Meropenem (n=5, 62.5%) and Piperacillin/Tazobactam combination (n=5, 62.5%). Jyothi P et al. also reported a similar pattern of susceptibility among Gram-negative bacteria, with highest sensitivity to Imipenem (93%), Amikacin (52%) and Netilmicin (41%). [5] Saima Inam et al., noted 80% susceptibility of isolates to Carbapenems like Meropenem and Imipenem.[11] This suggests that Amikacin and Meropenem can be considered for empirical therapy in neonatal sepsis due to Gram-negative bacteria.

All Gram-positive organisms isolated were susceptible to Vancomycin, Teicoplanin and Linezolid (Table 2). A study conducted by Li J et al. reported similar findings of Gram-positive bacteria exhibiting high susceptibility to Vancomycin, Tigecycline and Linezolid, [12] suggesting that Vancomycin, Teicoplanin and Linezolid can be considered for Gram-positive bacteria. Staphylococcus hominis further showed susceptibility to Clindamycin and Gentamicin. Panigrahi P et al., also observed extremely low resistance to Gentamicin and Amikacin.[9] Hence, Aminoglycosides can be considered for the treatment of Staphylococcus hominis in neonatal septicemia.

Antibiotic

Sensitivity pattern [n, %]

Staphylococcus hemolyticus (n=1)

Staphylococcus hominis (n=1)

Amikacin

0

0

Clindamycin

0

1 (100%)

Erythromycin

0

0

Ampicillin

0

0

Doxycycline

0

0

Levofloxacin

0

0

Vancomycin

1 (100%)

1 (100%)

Teicoplanin

1 (100%)

1 (100%)

Gentamicin

0

1 (100%)

Linezolid

1 (100%)

1 (100%)

Minocycline

0

0

Table 2: Antibiotic sensitivity pattern of the Gram-positive bacterial isolates

Conclusion

The present study highlights the profile of bacterial pathogens responsible for neonatal sepsis and their antibiotic sensitivity patterns. *Klebsiella pneumoniae*, *Escherichia coli* and *Acinetobacter baumannii* were the predominant Gram-negative pathogens and Coagulase-Negative Staphylococci was the predominant Gram-positive pathogen isolated in the study. Increased susceptibility to Piperacillin/Tazobactam, Meropenem and Aminoglycosides against Gram-negative bacteria and Vancomycin, Teicoplanin and Linezolid against Gram-positive bacteria was observed. Therefore, we recommend the use of these agents as first-line drugs for the treatment of neonatal sepsis. The results of the study underscore the importance of ongoing surveillance of local antimicrobial resistance patterns to guide in optimal empirical therapy in cases of neonatal sepsis.

References

1. Singh M, Alsaleem M, Gray CP. Neonatal sepsis.
2. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M et al. The third international consensus definitions for sepsis and septic shock (Sepsis-3). *JAMA*. 2016 Feb 23;315(8):801-10.
3. GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015 Jan 10;385(9963):117-71.
4. Fleischmann-Struzek C, Goldfarb DM, Schlattmann P, Schlapbach LJ, Reinhart K, Kissoon N. The global burden of paediatric and neonatal sepsis: a systematic review. *Lancet Respir Med*. 2018 Mar;6(3):223-230.
5. Jyothi P, Basavaraj MC, Basavaraj PV. Bacteriological profile of neonatal septicemia and

antibiotic susceptibility pattern of the isolates. *Journal of natural science, biology, and medicine*.2013 Jul;4(2):306.

6. Chaurasia S, Sankar MJ, Agarwal R, Yadav CP, Arya S. InvestigatorsoftheDelhiNeonatal Infection Study (DeNIS) collaboration. Characterization and antimicrobial resistance of sepsis pathogens in neonates born in tertiary care centres in Delhi, India: a cohort study. *LancetGlobHealth*.2016;4(10):e752-60.

7. Siddiqui T, Dubey A, Kar M, Patel SS, Sahu C, Ghoshal U. Bacteriological profiles and antibioticsusceptibilityofneonatalsepsisinauniversityhospitalofNorthernIndia. *Journal of Family Medicine and Primary Care*. 2023 Mar 1;12(3):493-8.

8. Zakariya BP, Bhat V, Harish BN, Arun Babu T, Joseph NM. Neonatalsepsisinatertiarycare hospital in South India: bacteriological profile and antibiotic sensitivity pattern. *The Indian Journal of Pediatrics*. 2011 Apr;78:413-7.

9. Panigrahi P, Chandel DS, Hansen NI, Sharma N, Kandfer S, Parida S, et al. Neonatal sepsis in rural India: timing, microbiology and antibiotic resistance in a population-based prospectivestudyinthecommunitysetting. *JournalofPerinatology*.2017Aug;37(8):911-21.

10. Lamba M, Sharma R, Sharma D, Choudhary M, Maheshwari RK. Bacteriological spectrum and antimicrobial susceptibility pattern of neonatal septicaemia in a tertiary care hospital of NorthIndia. *TheJournalofMaternal-Fetal&NeonatalMedicine*.2016Dec16;29(24):3993- 8.

11. Inam S, Ikram S, Saeed MT, Munir S, Raza A, Inam A, et al. Spectrumandantibiotic susceptibility of Gram negative organisms associated with neonatal sepsis. *Journal of Population Therapeutics and Clinical Pharmacology*. 2024 Jan 20;31(1):1152-9.

12. Li J, Xia S, Liu Y, Zhang S, Jin Z. Bacteriologicalprofileandantibioticsusceptibilitypattern ofneonatalsepticemiaandassociatedfactorsofICUhospitalizationdays. *Infectionanddrug resistance*. 2022 Jan 1:427-38.

EXCLUDE CUSTOM MATCHES	ON
EXCLUDE QUOTES	OFF
EXCLUDE BIBLIOGRAPHY	OFF