ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://iap-kpj.org

Karnataka Paediatric Journal

Original Article

Study of bacteriological profile and its antibiogram in the newborn care unit of a rural tertiary care centre in India

Thageeru Mahesh Kumar[1], Srihari Alapati[1], Y. C. Beere Gowda[1], B. C. Balasunder[1]

[1]Department of Pediatrics, Sri Narasimha Raja District Hospital, Kolar, Karnataka, India.

***Corresponding author:**
Y. C. Beere Gowda,
Department of Pediatrics,
Sri Narasimha Raja District Hospital, Kolar, Karnataka, India.

beere999@gmail.com

Received: 20 May 2023
Accepted: 22 July 2023
EPub Ahead of Print: 15 September 2023
Published: 18 March 2024

DOI
10.25259/KPJ_35_2023

Quick Response Code:

ABSTRACT

Objectives: Neonatal sepsis is a serious medical condition that affects the newborn babies up to 28 days of postnatal life. Regular monitoring of the prevalent bacterial agents causing sepsis is essential for better patient management. The objective of the study was to determine the bacteriological profile and antibiotic susceptibility pattern of culture-positive neonatal sepsis in the newborn care unit of a rural tertiary care centre in India.

Material and Methods: The venous blood sample collected on the day of admission or on the 3rd day of admission for the neonates suspected to have sepsis with poor clinical improvement after a 2-day trial of empirical antibiotic therapy was subjected to culture and sensitivity pattern. Antibiotic susceptibility test was done using the Kirby-Bauer disc diffusion method. Data regarding the identified organism and its antibiotic sensitivity pattern from the blood samples of neonates were collected from the newborn care unit records.

Results: Out of 387 samples, culture positivity was 10.8%. Among culture positive isolates 57.14% are Gram-negative isolates and *Klebsiella* being the most common Gram-negative organism and 42.85% of Gram-positive isolates with *staphylococcus* predominance.

Conclusion: *Klebsiella* (40.4 %) followed by *Staphylococcus* (35.7%) are the most common bacterial pathogens identified in the rural newborn care centre in India. The routine empirical antibiotics in our unit cefotaxime and ampicillin are 100% resistant and need appropriate changes in the antibiotic policy by making piperacillin or cefoperazone and gentamicin as first-line empirical antibiotics.

Keywords: Antibiogram, *Klebsiella*, Neonatal sepsis, *Staphylococcus*

INTRODUCTION

Sepsis is a dysregulated host response to infection leading to life-threatening organ dysfunction.[1] The infection of the bloodstream in newborn babies younger than 28 days is referred to as neonatal sepsis. In developing and underdeveloped nations, it continues to be a significant factor in neonatal morbidity and mortality.[2] Blood cultures are an essential diagnostic tool for certain illnesses and antibiotic susceptibility patterns support therapeutic rationalisation. Prevalent bacterial agents and their antibiotic responsiveness usually vary with the geographical place and time.[3] Hence, regular monitoring of the prevalence of bacterial pathogens and their trend in antibiotic resistance patterns is essential to maintain the appropriate antibiotic policy and thereby better patient management. Therefore, the goal of the present study is to know the prevalent bacteria and their antibiotic resistance that lead to

neonatal sepsis in our unit which is a low-resourced hospital in a rural area.

MATERIAL AND METHODS

This was a retrospective study conducted in the special newborn care unit (SNCU) of Sri Narasimharaja District Hospital, Kolar, during the period from April 2021 to March 2023.

Aim

The aim of the study was to determine the bacteriological profile and antibiotic susceptibility pattern of culture-positive neonatal sepsis in the newborn care unit of a rural tertiary care centre in India.

Inclusion criteria

1. Neonates admitted with blood samples taken for sepsis with a positive bacterial culture were included in the study.

Exclusion criteria

The following criteria were excluded from the study:
1. Neonates admitted with health issues other than bacterial sepsis
2. Neonates with sterile blood culture.

Method

Neonates were suspected of sepsis based on clinical features such as lethargy, refusal to feed, temperature dysregulation, abdominal distension, convulsions, jaundice, rapid breathing and impaired consciousness. The blood sample was collected for culture along with routine first level investigations at the time of admission or on day 3 of inpatient care from the neonates with poor clinical improvement after a trial of 2 days of empirical antibiotic therapy with cefotaxime or ampicillin and amikacin as per the unit antibiotic policy. 1–2 mL of venous blood was collected in a brain heart infusion culture medium under strict aseptic precautions and the sample was subjected to culture and sensitivity pattern. Antibiotic susceptibility test was done using the Kirby-Bauer disc diffusion method, as per the Clinical and Laboratory Standards Institute guidelines (2014). Data regarding the identified organism and its antibiotic sensitivity pattern from the blood samples of neonates were collected from the newborn care unit records.

RESULTS

This study was conducted in an SNCU of a tertiary care low-resource setting hospital in a rural area. We collected 387 blood samples taken from inborn and outborn neonates admitted in our newborn care unit and those fit into our inclusion criteria, irrespective of gestational age and sex, with clinically suspected sepsis for blood culture and sensitivity and out of them, culture positivity was 10.8% with 42 samples tested positive for bacterial isolates. Out of which 57.14% are Gram-negative isolates and 42.85% of Gram-positive isolates. The most common organism identified was *Klebsiella* species in 17 among 42 samples which contribute to 40.4% followed by *Staphylococcus* species in 15 samples contributing 35.7% and all other prevalent organisms are <5% in the current sample [Table 1].

DISCUSSION

Neonatal sepsis is the second leading cause of infant mortality and India has the greatest frequency of the condition worldwide.[4] The prevalence of microorganisms varies depending on the environment, their ability to develop and how frequently they infect people. The common pathogens isolated from the blood of infants with septicaemic disease, their bacteriological proficiency and antimicrobial susceptibility pattern will give us a better idea of how it can be managed effectively to prevent mortality.

This is a retrospective and cross-sectional study analysis of all neonatal sepsis patients with positive bacterial blood cultures in tertiary care hospitals. This study is the first of its kind to be conducted in the SNCU of the district hospital in Kolar to establish an appropriate antibiotic policy.

It is important to determine the prevalence of the bacteria causing newborn sepsis and its antibiotic susceptibility for effective management. In our study, 57.14% of positive blood cultures were Gram-negative isolates which was similar to the study conducted by Londhe *et al*.[5] and 42.85% of Gram-positive isolates were found in our study in contrast to other similar studies conducted by Gupta *et al*.,[6] Sarangi *et al*.[7] and Parajuli *et al*.[8] Out of 42 samples, 17 were found to be *Klebsiella* species which contributes about 40.4% making it the most common species isolated among Gram-negative organisms in several studies such as in Gupta *et al*.,[6] Londhe *et al*.,[5] Muley *et al*.,[9] Pokhrel *et al*.,[10] Akter *et al*.,[11] Oyekale *et al*.[12] and Kumar *et al*.,[13] followed by *Staphylococcus* species in 15 samples contributing 35.7%which was similar to the study done by Londhe *et al*.,[5] Akter *et al*.,[11] Oyekale *et al*.[12] and Acheampong *et al*.[14] making it the predominant bacteria among Gram-positive isolates and all other prevalent organisms were <5% in the current sample.

The differences in culture positivity rates between studies may be caused by physical circulation, the style of study (retrospective vs. prospective) and whether the patient was on antibiotics before the blood sample being obtained for blood culture.[13] Based on the blood culture results, there is a low

Table 1: Prevalent bacteria in our SNCU.

Bacteria identified	No. of samples tested positive	Percentage
Klebsiella spp.	17	40.4
Staphylococcus spp.	15	35.7
Escherichia coli	2	4.7
Enterococcus	2	4.7
Citrobacter	2	4.7
Enterobacter	1	2.3
Acinetobacter	1	2.3
Streptococcus	1	2.3
Burkholderia	1	2.3

SNCU: Special newborn care unit

prevalence of sepsis positivity among the samples collected may be due to the inability of the laboratory setup to detect very small amounts of bacteria in the culture provided, the time taken between the collection of the sample and analysis of the sample and the medium used for their transport and growth.[14]

In our study, the antibiogram of Gram-negative organisms specifically that of *Klebsiella* was observed to be sensitive to Imipenem (77%), similar finding was seen in the study by Gupta *et al.*[6] and Akter *et al.*[11] followed by Gentamicin (75%) and Cotrimoxazole (75%) where sensitive to the bacteria. *Klebsiella* was found to be highly resistant to Ampicillin (100%), Cefotaxime (100%), Tigecycline (100%) and Cefuroxime (100%) [Table 2]. Similar resistance pattern has be observed in many studies such as in Akter *et al.*,[11] Oyekale *et al.*[12] and Acheampong *et al.*[14]

This shift in antimicrobial sensitivity patterns may be caused by the fact that microbes frequently develop resistance to antibiotics while retaining sensitivity to medicines that are administered infrequently. Antimicrobial sensitivity may also vary between studies and over time. This might result from the promiscuous use of antibiotics for both prophylaxis and the treatment of sick newborns, which has led to the emergence of resistant strains.[11]

Antibiogram of *Staphylococcus* in our study showed 100% of sensitivity to Vancomycin (100%) which was in concordance with the findings of previous studies, Gupta *et al.*,[6] Sarangi *et al.*,[7] Parajuli *et al.*[8] and Acheampong *et al.*[14] followed by Tigecycline (100%) similar to study by Sarangi *et al.*,[7] Teicoplanin (100%). They also show complete resistance to Oxacillin (100%) and Ceftriaxone (100%) [Table 3].

To avoid multidrug resistance, these medications can be used as empirical therapy, although they should be implemented with caution. Neonatal septicaemia's evolving microbial ecology is linked to considerable mortality as well as morbidity and long-term morbidity. Therefore, to guide the selection of empirical antibiotic therapy while awaiting the results of blood culture, regular periodical tracking of the neonatal sepsis-causing organisms and their patterns

Table 2: Antibiotic sensitivity pattern for *Klebsiella* species in our SNCU.

Antibiotic	Samples tested for sensitivity	*Klebsiella* (% s)	*Klebsiella* (% r)
Ciprofloxacin	15	33.3	66.6
Amikacin	14	57.1	42.8
Meropenem	14	64.2	35.7
Imipenem	13	77	23
Piperacillin and tazobactam	13	61.5	38.4
Amoxicillin and clavulanic acid	12	41.6	58.3
Gentamicin	12	75	25
Cotrimoxazole	12	75	25
Ampicillin	12	0	100
Cefepime	10	20	80
Cefotaxime	8	0	100
Ceftriaxone	7	14.2	85.7
Cefoperazone and sulbactam	7	71.4	28.5
Cefoxitin	6	0	100
Ertapenem	6	66.6	33.3
Colistin	4	25	75
Tigecycline	2	0	100
Cefuroxime	2	0	100

SNCU: Special newborn care unit, %s: Percentage of sensitivity, %r: Percentage of resistance

Table 3: Antibiotic sensitivity pattern for *Staphylococcus* species in our SNCU.

Antibiotic	Samples tested for sensitivity	*Staphylococcus* (% s)	*Staphylococcus* (% r)
Ciprofloxacin	15	46.6	53.3
Linezolid	15	93.3	6.6
Cotrimoxazole	15	46.6	53.4
Vancomycin	15	100	0
Erythromycin	14	35.7	64.2
Clindamycin	13	53.8	46.2
Gentamicin	13	92.3	7.6
Teicoplanin	12	100	0
Benzylpenicillin	12	8.3	91.6
Cefoxitin	11	27.3	72.7
Levofloxacin	10	40	60
Tetracycline	10	90	10
Oxacillin	9	0	100
Tigecycline	6	100	0
Ceftriaxone	1	0	100

SNCU: Special newborn care unit, %s: Percentage of sensitivity, %r: Percentage of resistance

of antibiotic susceptibility is required.[6] Our observation demonstrates that the issue of antibiotic resistance is a serious challenge for treating severe bacterial infections in newborns and poses a significant danger of antibiotic resistance. The use of antibiotics should be done wisely and with caution is a highly essential practice.[6,11]

CONCLUSION

In our study, the frequency of blood culture-positive sepsis was found to be 10.8% in which *Klebsiella* (40.4%) followed by *Staphylococcus* (35.7%) are the most common bacterial pathogens identified in the rural newborn care centre in India. The routine empirical antibiotics in our unit cefotaxime and ampicillin are 100% resistant and need appropriate changes in the antibiotic policy by making piperacillin or cefoperazone and gentamicin as first line empirical antibiotics.

Ethical approval

The research/study complied with the Helsinki Declaration of 1964.

Acknowledgment

I would like to thank my family and teachers for their constant support and guidance.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. 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;315:801-10.
2. Seale AC, Blencowe H, Manu AA, Nair H, Bahl R, Qazi SA, *et al*. Estimates of possible severe bacterial infection in neonates in sub-Saharan Africa, south Asia, and Latin America for 2012: A systematic review and meta-analysis. Lancet Infect Dis 2014;14:731-41.
3. Mahmood A, Karamat KA, Butt T. Neonatal sepsis: High antibiotic resistance of the bacterial pathogens in a neonatal intensive care unit in Karachi. J Pak Med Assoc 2002;52:348-50.
4. Murthy S, Godinho MA, Guddattu V, Lewis LE, Nair NS. Risk factors of neonatal sepsis in India: A systematic review and meta-analysis. PLoS One 2019;14:e0215683.
5. Londhe AC, Deshmukh LS, Joshi AK. Bacteriological profile and antibiogram of neonatal sepsis in a tertiary care hospital. Indian J Mater Fetal Neonatal Med 2017;4:38-42.
6. Gupta B, Mohan S, Agarwal A, Dutta R. Bacteriological profile and antibiogram of neonatal septicemia in a tertiary care hospital. Int J Curr Microbiol App Sci 2018;7:3999-4005.
7. Sarangi KK, Pattnaik D, Mishra S, Nayak MK, Jena J. Bacteriological profile and antibiogram of blood culture isolates done by automated culture and sensitivity method in a neonatal intensive care unit in a tertiary care hospital in Odisha, India. Int J Adv Med 2015;2:387-392.
8. Parajuli R, Pant ND, Bhandari R, Giri A, Rai S, Acharya G, *et al*. Bacteriological profile of neonatal sepsis and antibiogram of the isolates. J Nepal Paediatr Soc 2017;37:5.
9. Muley VA, Ghadage DP, Bhore AV. Bacteriological profile of neonatal septicemia in a tertiary care hospital from western India. J Glob Infect Dis 2015;7:75-7.
10. Pokhrel B, Koirala T, Shah G, Joshi S, Baral P. Bacteriological profile and antibiotic susceptibility of neonatal sepsis in neonatal intensive care unit of a tertiary hospital in Nepal. BMC Pediatr 2018;18:208.
11. Akter S, Chaudhury IJ, Jahan MA, Sah S, Mannan A. Pathogens and antibiogram of blood stream isolates in neonatal sepsis: Findings from a tertiary care hospital, Bangladesh. Integr J Med Sci 2022;9:
12. Oyekale OT, Ojo BO, Olajide AT, Oyekale OI. Bacteriological profile and antibiogram of blood culture isolates from bloodstream infections in a rural tertiary hospital in Nigeria. Afr J Lab Med 2022;11:1807.
13. Kumar MU, Sushma T, Vidyasagar M, Rajkumar J. Review on the etiologic profile of bacterial brand-new sepsis in developing countries. J Composit Theory 2022;15:158.
14. Acheampong EN, Tsiase JA, Afriyie DK, Amponsah SK. Neonatal sepsis in a resource-limited setting: Causative microorganisms and antimicrobial susceptibility profile. Interdiscip Perspect Infect Dis 2022;2022:7905727.

How to cite this article: Mahesh Kumar T, Alapati S, Beere Gowda Y, Balasunder B. Study of bacteriological profile and its antibiogram in the newborn care unit of a rural tertiary care centre in India. Karnataka Paediatr J. 2024;39:10-3. doi: 10.25259/KPJ_35_2023