International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 9, September 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.9.2024.46

ORIGINAL RESEARCH

A retrospective study on antibiotic sensitivity pattern of pathogens isolated from blood culture in cases of late- onset neonatal sepsis at a neonatal intensive care unit in a tertiary care hospital

Dr. Kuna Srivallary[1], Dr. Y. Vishwanath[2], Dr. Jyothi D B[3], Dr. Ajay Rathod[4]

[1,4]Post graduate student, [2]Professor and Head of Department, [3]Assistant Professor, Department of Pharmacology, Ballari Medical College and Research Centre, Ballari, Karnataka, India

Corresponding author
Dr. Jyothi D B
Assistant Professor, Department of Pharmacology, Ballari Medical College and Research Centre, Ballari, Karnataka, India
Email: drjyo6@gmail.com

Received Date: 27 July, 2024 Acceptance Date: 29 August, 2024

ABSTRACT

Background: The occurrence of late-onset neonatal sepsis (LONS) continues to be a major cause of infant morbidity and mortality even with notable advancements in neonatal intensive care. distinct geographical areas have distinct causal organisms and antibiotic susceptibilities, which influences the use of empirical antibiotics in suspected cases of sepsis. **Aims and Objectives:** To determine the drug sensitivity pattern of the commonly isolated pathogens in LONS. **Materials and Methods:** This study was done after obtaining approval from the Institutional Human Ethical Committee of Ballari Medical College and Research center. The blood culture sensitivity data of all neonates admitted and treated as cases of LONS over a period of 3 months (December 2013 to December 2015) at the neonatal intensive care unit of Bapuji Hospital were studied retrospectively. **Results:** A total of 212 neonates admitted were suspected cases of LONS. 45.45% of them were blood culture positive, with 77% of the isolated organisms being Gram-positive and 6(23%) Gram-negative. The most frequently isolated organism was coagulase-negative Staphylococcus aureus (77%) followed by Klebsiellapneumoniae (7%). 71.25% of these organisms showed resistance to ampicillin, and 56.25% showed resistance to gentamicin which is the World Health Organization recommended an empirical choice of antibiotics. **Conclusion:** According to our research, there is a growing trend of resistance to first-line empirical antibiotics that are frequently used, like gentamicin and ampicillin. Therefore, it is crucial to regularly monitor antibiotic susceptibility in order to select the appropriate empirical antibiotic.

INTRODUCTION

One of the most frequent reasons for newborn morbidity and death is sepsis. About 30 to 50 percent of all newborn fatalities in developing nations are caused by it[1]. Approximately 25% of newborn deaths worldwide occur in India, with infections thought to be the cause of more than half (52%) of these deaths[2]. Using vigorous supportive care and sensible antimicrobial medication, newborn death from sepsis can be largely avoided.

Neonatal sepsis is classified as either late ONS (LONS) or early onset neonatal sepsis (EONS) based on the age at which symptoms first appear. In the first 72 hours of life, EONS manifests. The mother's vaginal tract is typically the source of infection. LONS typically manifests itself after age 72 hours. Neonates typically appear with septicemia, pneumonia, or meningitis, and the infection can be nosocomial or community-acquired[3]. The rise in the occurrence of LONs has coincided with the improvement in preterm infant survival, particularly for those with extremely low birth weights. This suggests that hospitalization and life-sustaining medical equipment play a part in the pathophysiology of LONs and neonatal LONs[4,5].The Enterococcus faecium, Staphylococcus aureus, Klebsiellapneumoniae, Acinetobacterbaumannii, Pseudomonas aeruginosa, and Enterobacter are now referred to as "(ESKAPE) pathogens" by the Infection Society of America. The group of bacteria that are

DOI: 10.69605/ijlbpr_13.9.2024.46

composed of ESKAPE species is known by the abbreviation ESKAPE, which includes both Grampositive and Gram-negative species[6,7].These bacteria have the ability to develop drug resistance mechanisms and are frequently the source of serious nosocomial infections[8].

Given the mortality rate and long-term negative consequences linked to LONS, prompt and precise diagnosis is critical. However, because clinical signs and symptoms are frequently mild and vague for a specific illness, diagnosing newborn infections can be difficult. Thus, without waiting for the results, 2 or 3 days of empirical antibiotic therapy should start as soon as cultures are collected in cases with suspected sepsis.

The World Health Organization (WHO) currently recommends ampicillin (or penicillin) and gentamicin as first-line antimicrobials for both EONS and LONS[9]. Antimicrobial drugs should target the most prevalent bacteria without creating selection pressure for antibiotic resistance. This necessitates knowledge of the susceptibility pattern and pattern of causal microorganisms in a given region.

Therefore, the purpose of this study was to ascertain the microbiological traits in suspected LONS cases, including causal organisms and their susceptibility to antibiotics.

MATERIALS AND METHODS

This study was done after obtaining the approval from Institutional Human Ethical Committee of Medical College, BMC and RC Ballari and in collaboration with the Department of Neonatology. The study was conducted retrospectively, where the blood culture sensitivity data of all neonates admitted as suspected cases of LONS over a period of 2 years, i.e., between December 2013 and December 2015 were documented and analyzed. Neonates with major congenital malformations,surgical problems, on antibiotics or those whose mothers have received antibiotics before delivery, were excluded from the present study. Blood culture was done by standard microbiological techniques in all the cases, and the reports were analyzed.

RESULTS

A total of 50 neonates were admitted as suspected cases of LONS. 32 were males and 18 were females.

50 cases of Culture sensitivity reports were included in the study. A total of 26 cases were culture positive. Out of 26 bacterial isolates, 77% (20) were Grampositive and 23% (6) were Gram-negative. The most frequently isolated organism was coagulasenegative S. aureus (77%) followed by K. pneumoniae (7%), Pseudomonas, Acinetobacter, and Enterococci [Figure 1 and Table 1].

All of the isolates had varying degrees of sensitivity to different antibiotics: low for ampicillin, amikacin, and gentamicin, moderate for cefotaxime, ceftriaxone, and ciprofloxacin, and maximal for Linezolid, meropenem, and imipenem[Figures 2-4]

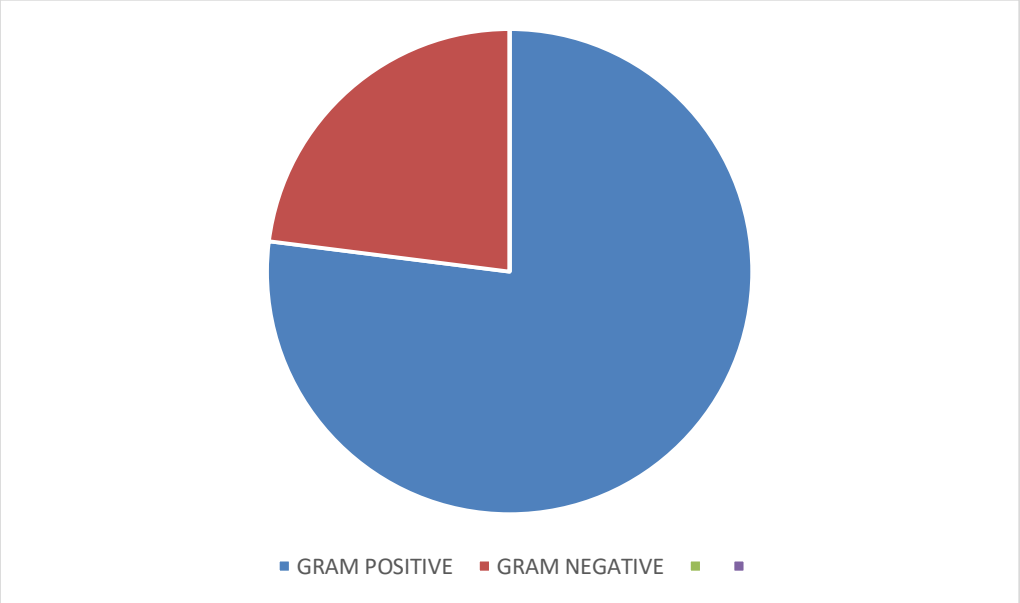

Figure 1: Distribution of organisms

Table 1: Distribution of organisms (ESKAPE group)

BACTERIAL ISOLATE	N (%)
Coagulase-negative Staphylococcus aureus	20(77%)
Klebsiella	2(7%)
Pseudomonas	1(4%)
Acinetobacter	1(4%)

DOI: 10.69605/ijlbpr_13.9.2024.46

Enterococci	1(4%)
Escherichia coli	1(4%)
TOTAL	26(100%)

ESKAPE: Enterococcus faecium, Staphylococcus aureus, Klebsiellapneumoniae, Acinetobacterbaumannii, Pseudomonas aeruginosa, and Enterobacter

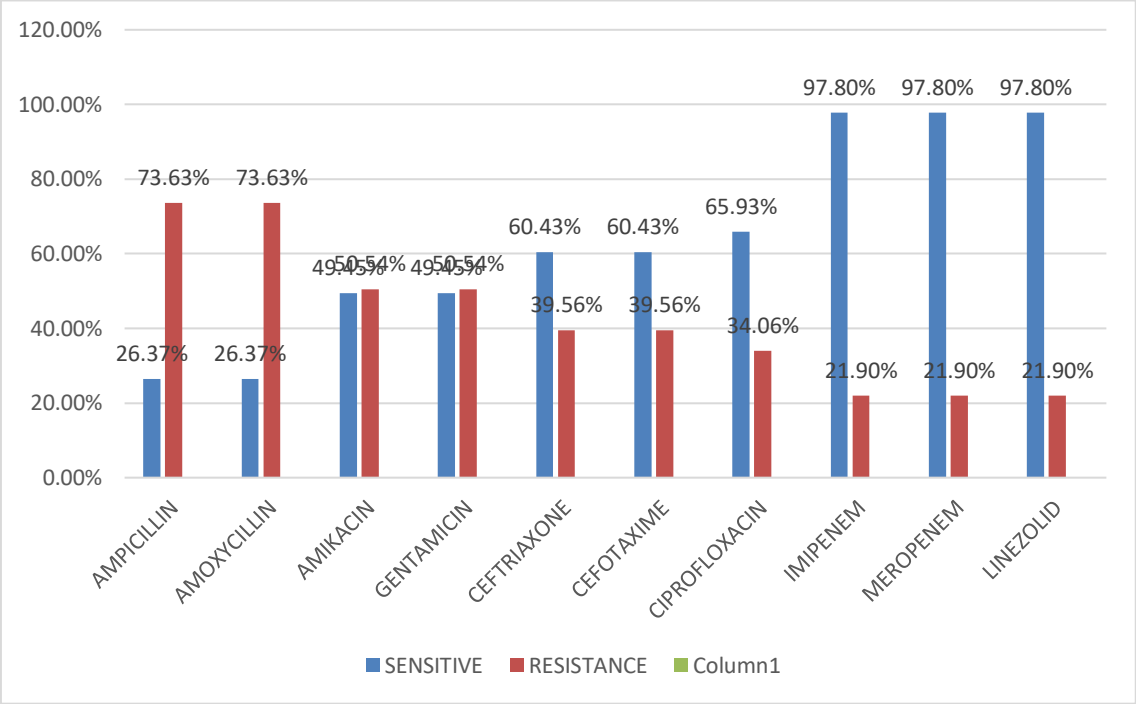

Figure 2: Sensitivity pattern of Enterococcus faecium, Staphylococcus aureus, Klebsiellapneumoniae, Acinetobacterbaumannii, Pseudomonas aeruginosa, and Enterobacter organisms to various drugs

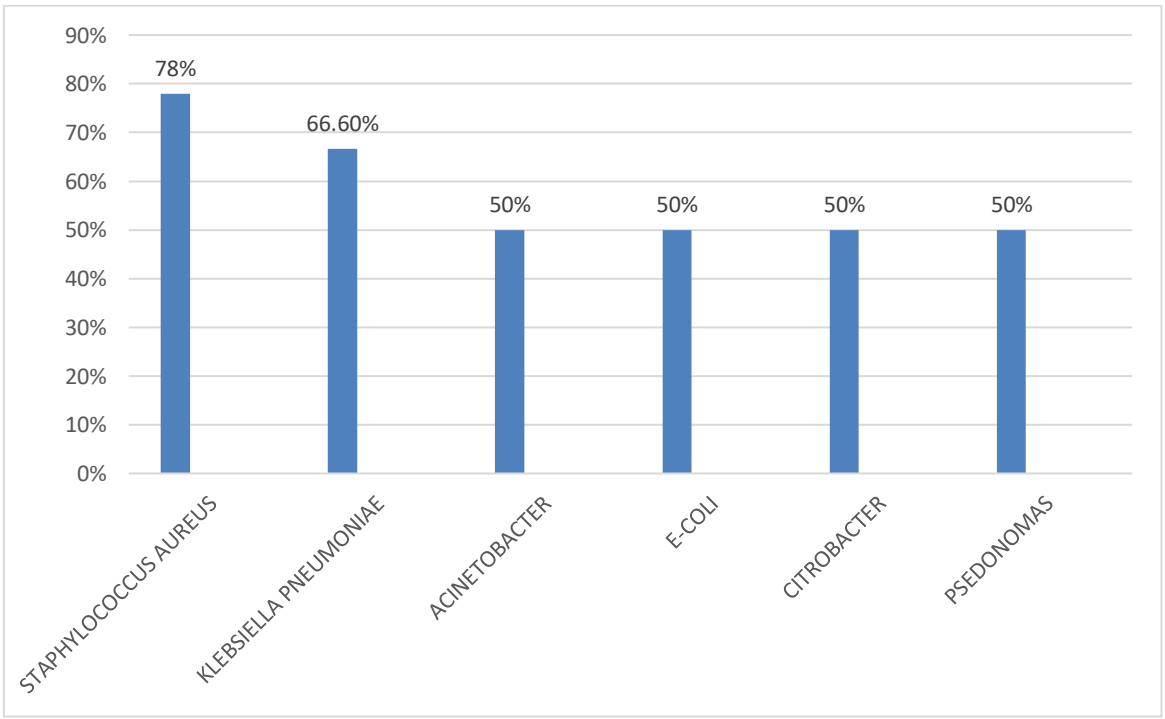

Figure 3: Susceptibility pattern of organisms to ampicillin

DOI: 10.69605/ijlbpr_13.9.2024.46

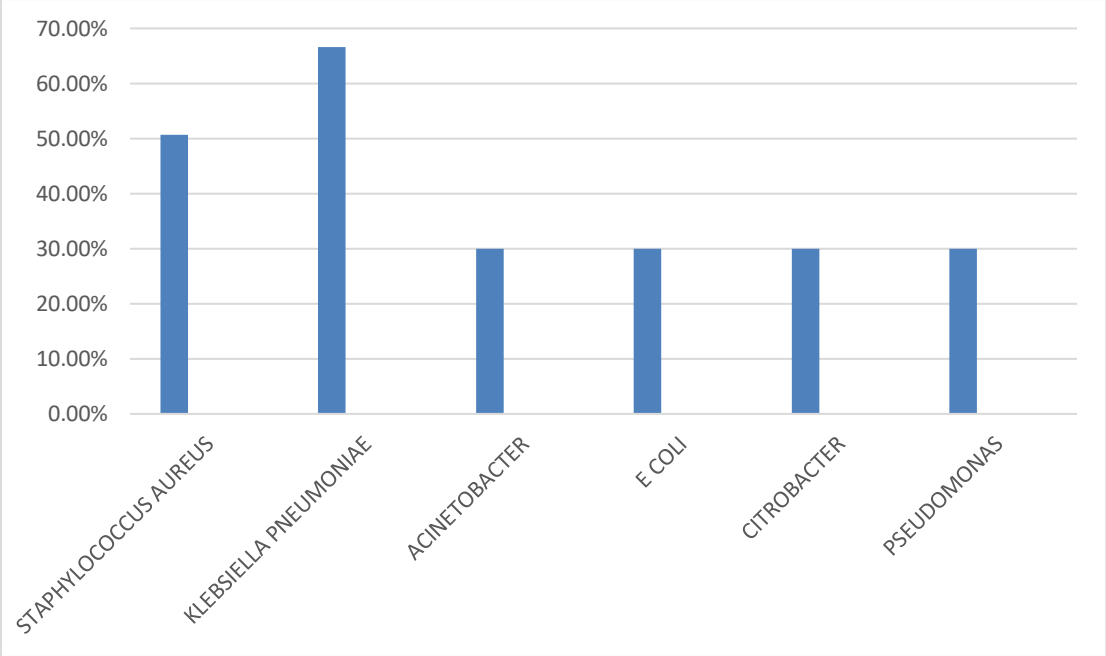

Figure 4: Susceptibility pattern of organisms to gentamicin

DISCUSSION

Findings in Our Study

In the newborn intensive care unit, preventing the morbidity and mortality of neonatal sepsis requires early identification and empirical antibiotic treatment[10]45.45%% was the culture positive rate in our investigation.

Distribution of the organisms responsible for It was shown by LONS that 77% of culture-positive cases were caused by coagulase-negative staphylococci (CoNS), a Gram-positive bacterium. In the study, K. pneumoniae ranked second in frequency after CoNS and was the most prevalent Gram-negative organism with a frequency of 7%. The ESKAPE group of pathogens, which includes Citrobacter, Acinetobacter, and Pseudomonas, was represented by the other isolates. All of the isolates in our investigation had penicillin resistance. The antibiotic with the lowest sensitivity to all bacterial isolates was ampicillin, gentamicin. Third-generation cephalosporins like ceftriaxone and cefotaxime showed moderate sensitivity. Imipenem, linezolid, and meropenem had the highest sensitivity (98% sensitivity).

Findings of Other Similar Studies

Our study's culture positivity rate was 45.45%, compared to 31.75% in studies by Shah et al.[11], 54.64% in studies by Shaw et al. [12], and 32% in studies by Bhattacharjee et al. [13]. The percentages of blood culture positive might vary greatly from location to location due to a multitude of reasons. Interpreting cultures positive for possible pollutants or pathogens—of which CoNS is the most prevalent—is significantly more challenging. It is imperative to properly interpret these findings within the particular clinical setting in which they are observed.[14] In our investigation, CoNS were the most often identified organism, followed by Klebsiella, which is consistent with a study conducted by Gandhi et al.[15]. CoNS have become the most common LOS pathogens, accounting for 53.2–77.9% of LOS in developed nations and 35.5–47.4% in certain developing nations. CoNS infections are typically acquired in hospitals[16]. Spreading via central lines or indwelling catheters. The The pathogenic organisms' distribution patterns differ from one from one area to another and may also evolve over time inside the same hospital as a result of the patients' demographics, colonization of the nosocomial environment by microflora and the antibiotic usage policy[5]. These creatures, via a many different ways, are becoming resistant to the routinely used antibiotics. Gentamicin with ampicillin had the lowest susceptibility to every isolation of bacteria. Which is comparable to The results of a study by Tallur and colleagues.[17]

The highest sensitivity was recorded with meropenem, imipenem and linezolid (98% sensitivity). similar to the findings in the study done by Bilal et al. In adults, ESKAPE organisms isolated from the tracheal tube
showed high susceptibility to imipenem.[18]

Strengths and Limitations of the Study

The goal of the study was to discover the pathogenic organisms responsible for long-term hospital stays (LONS), which are becoming more common despite tertiary centers' aseptic precautions and lengthen hospital stays and morbidity rates. The restrictions on The limited sample size and retrospective nature of this investigation It was challenging to locate all the pertinent clinical information that could have provided more context for other elements that contributed to the emergence of LONS.

DOI: 10.69605/ijlbpr_13.9.2024.46

CONCLUSION

The likelihood of neonates developing LONS is rising as neonatal intensive care advances. Preventive measures should be implemented, with a focus on good hand hygiene and examination of other possible reservoirs as sources of bacterial acquisition and transmission, since LONS is typically acquired in hospitals. To lower infant morbidity and death, empirical antibiotics must be used to treat neonatal sepsis as soon as possible. The WHO currently recommends ampicillin and gentamicin as the first-line empirical antibiotics for the treatment of LONS. The unintentional use of antibiotics is reflected in the rising resistance to the widely used drugs. In order to limit and rationalize the use of antibiotics, it is crucial to regularly update the pattern of prevalent strains and their medication susceptibility in a region.

REFERENCES

1. Stoll BJ. The global impact of neonatal infection. ClinPerinatol1997;24:1-21.
2. United Nations Children's Fund (UNICEF). State of the World's Newborns 2001. Washington, DC: Save the Children Publication; 2002.
3. Report of the National Neonatal Perinatal Database (National Neonatology Forum); 2002-2003.
4. Bizzarro MJ, Raskind C, Baltimore RS, Gallagher PG. Seventy-five years of neonatal sepsis at Yale: 1928-2003. Pediatrics2005;116:595-602.
5. Shim GH, Kim SD, Kim HS, Kim ES, Lee HJ, Lee JA, et al. Trends in epidemiology of neonatal sepsis in a tertiary center in Korea: A 26-year longitudinal analysis, 1980-2005. J Korean Med Sci2011;26:284-9.
6. Rice LB. Federal funding for the study of antimicrobial resistance in nosocomial pathogens: No ESKAPE. J Infect Dis 2008;197:1079-81.
7. Bush K, Jacoby GA. Updated functional classification of betalactamases. Antimicrob Agents Chemother2010;54:969-76.
8. Rice LB. Progress and challenges in implementing the research on ESKAPE pathogens. Infect Control HospEpidemiol 2010;31 Suppl1:S7-10.
9. WHO. Pocket Book of Hospital Care for Children. 2nd ed. Geneva: WHO Press; 2013. Available from: http://www.who. int/maternal_child_adolescent/documents/child_hospital_ care/en. [Last accessed on 2014 Sep 18].
10. Wisplinghoff H, Seifert H, Tallent SM, Bischoff T, Wenzel RP, Edmond MB, et al. Nosocomial bloodstream infections in pediatric patients in united states hospitals: Epidemiology, clinical features and susceptibilities. Pediatr Infect Dis J 2003;22:686-91.
11. Shah AJ, Mulla SA, Revdiwala SB, Neonatal sepsis: High antibiotic resistance of the bacterial pathogens in a neonatal intensive care unit of a tertiary care hospital. J ClinNeonatol2012;1:72-5.
12. Shaw CK, Shaw P, Thapalial A. Neonatal sepsis bacterial isolates and antibiotic susceptibility patterns at a NICU in a tertiary care hospital in western Nepal: A retrospective analysis. Kathmandu Univ Med J 2007;5:153-60.
13. Bhattacharjee A, Sen MR, Prakash P, Gaur A, Anuprabha S. Increased prevalence of extended spectrum β – Lactamase producers in neonatal septicemic cases at tertiary referral hospital. Indian J Med Microbiol2008;26:356-60.
14. Buttery JP. Blood cultures in newborn and children: Optimizing an everyday test. Arch Dis Child Fetal Neonatal Ed 2002;87:F25-7.
15. Gandhi S, Ranjan KP, Ranjan N, Sapre N, Masani M. Incidence of neonatal sepsis in tertiary care hospital: An overview. Int J Med Sci Public Health 2013;2:548-52.
16. Dong Y, Speer CP. Late-onset neonatal sepsis: Recent developments. Arch Dis Child Fetal Neonatal Ed 2015;100:F257-63.
17. Tallur SS, Kasturi AV, Nadgir SD, Krishna BV. Clinicobacteriological study of neonatal septicemia in hubli. Indian J Pediatr2000;67:169-74.
18. Bilal SM, Sanji N, Somashekar HS, Vishwanath G, Dinakar KR, Pavani S. Antibiotic sensitivity of Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumonia, Acinetobacter, Pseudomonas aeruginosa and Enterobacter (ESKAPE) organisms isolated from the endotracheal tube isolates from a pediatric ICU of a tertiary care. Indian J Public Arch 2014;3. Available from: http://www.ijpaonline.info/index.php/ ijpaonline/article/view/109. [Last accessed on 2017 Oct 24].