

Bacteriological Profile of Neonatal Septicemia and Antibigram of Isolates

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Abstract

Background: Septicemia in neonates refers to generalized bacterial infection documented by positive blood culture in first four weeks of life. It is the leading cause of neonatal mortality and morbidity in India.

Aim: To isolate and identify the bacteriologic etiologic agents responsible for neonatal sepsis and to determine the susceptibility pattern of isolates at Kurnool Medical College and Govt General Hospital, Kurnool.

Materials and Methods: Two hundred and fifty two samples were collected from neonates for a period of ten months and processed in accordance with standard protocols. Antibiotic susceptibility of the isolates was done by Kirby-Bauer disc diffusion method as recommended in the National Committee for Clinical Laboratory Standards (NCCLS) guidelines.

Results: Blood culture reports were positive in 54.7% cases. Among the culture positive cases, Gram positive isolates were 12.6% and Gram negative isolates were 42.1%. *Staphylococcus aureus* was the predominant Gram positive organism isolated and *Klebsiella* spp. was the predominant Gram negative organism isolated. Best overall sensitivity among Gram-negative isolates was to Imipenem (95.2%) followed by Tigecycline (92.8%). Gram positive isolates had sensitivity of 96.4% to Linezolid, 82% sensitivity to Vancomycin.

Conclusion: Gram negative organisms are the leading cause of neonatal sepsis in this study and most of them are multi drug resistant. Therefore this study highlights the emergence of multi drug resistant strains at tertiary care centre.

Key words: Antimicrobial resistance, multidrug resistance, neonatal septicaemia.

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I. Introduction

Septicaemia in neonates refers to generalized bacterial infection documented by positive blood culture in the first four weeks of life. Neonatal sepsis is a clinical condition characterized by systemic signs and symptoms due to bacteremia in the first month of the life¹ It is a global problem and despite the development of highly effective antibiotics and implementation of the hygiene practices in the healthcare settings, neonatal sepsis has established itself as a major cause of morbidity and mortality with high level of impact in low resource countries²

The incidence of neonatal sepsis may vary not only from developed countries to developing countries but also from hospital to hospital even in the same country. Twenty percent of all neonates get neonatal sepsis and is the cause of 30-50% of total neonatal deaths.³

According to World Health Organization every year an estimated 1.6 million neonatal deaths occur globally with 40% of all neonatal deaths occurring in developing countries. The risk factors those may be associated with neonatal sepsis are premature rupture of membrane, prolonged rupture, prematurity, urinary tract infection, poor maternal nutrition, low birth weight, birth asphyxia and congenital anomalies. Neonatal sepsis may be divided into two types: early onset and late onset. The infection acquired within 72 hrs of age is known as early onset neonatal sepsis and the common bacteria associated with it are group B *Streptococcus*, *Escherichia coli*, coagulase negative *Staphylococcus* spp., *Hemophilus influenzae* and *Listeria monocytogens*. Similarly, the infection acquired after 72 hrs of age is known as late onset neonatal sepsis and the most common causative agents are coagulase negative *Staphylococcus* spp., *S. aureus*, *Klebsiella pneumoniae*, *E. coli*, *Enterobacter* spp., *Pseudomonas aeruginosa* and *Acinetobacter* spp.⁴

Neonatal sepsis can be life threatening if proper treatment is not given in time⁶. Blood culture for the isolation of the causative agent is gold standard for identification of the cases of neonatal sepsis and the antibiotic susceptibility pattern of the bacteria isolated is necessary for giving proper treatment. In AP, different

studies have reported the high rates of neonatal sepsis with the bacteria showing different rates of resistance to commonly used antibiotics. The microbiological pattern and antimicrobial susceptibility patterns of the causative agents of neonatal sepsis may vary from hospital to hospital and their knowledge may be helpful in timely proper management of neonatal sepsis. So, in this study we determined the rate of neonatal sepsis, bacteriological profile of neonatal sepsis and antimicrobial susceptibility patterns of the causative agents in Kurnool Medical College, Kurnool. Further, we also determined the association between the neonatal sepsis and the different characteristics of the neonates.^{5,6}

II. Materials And Methods

A hospital based cross-sectional study was conducted among a total of 252 neonates suspected of suffering from sepsis (children with fever, breathing problem, low blood sugar, reduced sucking, low or high heart rate) at Kurnool Medical College And Govt General Hospital, Kurnool, from January 2018 to October 2018.

The hospital has well-equipped neonatal intensive care unit. One ml of venous blood was collected using standard procedures and was inoculated into 5 ml of brain heart infusion broth (HiMedia, India). The blood culture bottles were immediately sent to the microbiology laboratory of the govt general hospital. All the blood culture bottles were incubated at 37°C for 24 hrs and subcultured on MacConkey agar, blood agar and chocolate agar (HiMedia, India) daily for 7 days. The inoculated MacConkey agar plates were incubated aerobically for 24-48 hours. Blood culture bottles showing no growth on subculture done after incubation of 7 days were reported as negative. The colonies grown were identified on the basis of colony morphology, Gram's stain and biochemical tests. The necessary patient's informations were obtained from the neonatal ward, which were entered in excel. The antimicrobial susceptibility testing was performed by Kirby Bauer disc diffusion method following standard guidelines and interpretive criteria of the Clinical and Laboratory Standards Institute¹⁰. For quality control of biochemical tests, purity plate was used. Similarly, for quality control of antimicrobial susceptibility testing, *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 were used.

Data were analyzed using statistical package for social sciences version 16.0. Chi-square test was used and p-value<0.05 was considered as statistically significant.

III. Results

During the study period of 10 months, a total of two hundred and fifty two newborns with clinical sepsis were admitted. Blood culture reports were positive in 138 cases(54.7%).

Detailed etiology of the 138 isolates is provided in Table 1. These included Gram negative bacilli (83/138, 60.15%) and Gram positive cocci (55/138,39.85%). *Klebsiella spp.* And *Staphylococcus aureus* were the most common Gram negative and Gram positive organisms.

Table 1: DISTRIBUTION OF ISOLATED ORGANISMS

Organisms	Frequency of isolation (%)
<i>Klebsiella</i>	53(38.4)
<i>Staphylococcus aureus</i>	36(26)
<i>Escherichia coli</i>	23(16.6)
<i>Coagulase negative staphylococcus</i>	14(10.14)
<i>Pseudomonas</i>	07(5.07)
<i>Enterococcus</i>	05(3.6)
Total	138

Tables 2 and 3 show the antibiotic susceptibility pattern in Gram negative and Gram positive isolates. Best overall among Gram negative isolates was to Imipenem(95.2%), followed by Tigecycline(92.8%). Gram positive isolates had sensitivity of 96.4% to Linezolid followed by 82% to Vancomycin.

Table 2 : ANTIBIOTIC SUSCEPTIBILITY OF GRAM NEGATIVE ORGANISMS

Antibiotics	Resistant(%)
Amoxiclav	44(53)
Amikacin	32(38.5)
Ciprofloxacin	36(43.3)

Co-trimoxazole	40(48.1)
Imipenem	04(4.8)
Gentamycin	30(36.1)
Piperacillin-tazobactam	22(26.5)
Tigecycline	06(7.2)

Table 3: ANTIBIOTIC SUSCEPTIBILITY OF GRAM POSITIVE ORGANISMS

Antibiotics	Resistant(%)
Amoxiclav	44(80)
Amikacin	32(58.1)
Linezolid	02(3.6)
Cefaperazone	36(65.4)
Erythromycin	38(69)
Gentamycin	30(54.5)
Piperacillin-tazobactam	22(40)
vancomycin	10(18.1)

IV. Discussion

We found the statistically significant association between the gestational age and rate of neonatal sepsis with prematurely delivered neonates being at higher risk of sepsis. Similarly, Premalatha et al. found the low birth weight and prematurity to be the risk factors for neonatal sepsis. But in our study, though highest rate of neonatal sepsis was found in the neonates with low birth weight, statistically there was no significant correlation. This may be due to the small sample size taken in our study. Premature babies have low immunity and are more prone to infection. The risk factors associated with neonatal sepsis are premature rupture of membranes, prolonged rupture, prematurity, urinary tract infections, poor maternal nutrition, low birth weight, birth asphyxia and congenital anomalies.^{6,7}

As we have reported, Kumaravel and Rameshbabu showed the highest rates of susceptibility of Gram negative and Gram positive bacteria toward amikacin and vancomycin respectively¹⁷. In addition, as in our study Gyawali and Sanjana found the third generation cephalosporins and aminoglycosides to be more satisfactory for Gram negative bacteria in comparison to Gram positive bacteria.⁸ Further, Muley et al. Reported the maximum susceptibility of both Gram negative and Gram positive bacteria to ciprofloxacin and amikacin.⁹ And suggested to use these antibiotics in empirical therapy of neonatal sepsis.¹⁰ The difference in patterns of antibiotic usage in different hospitals is the main reason for the difference in antibiotic susceptibility reported by different authors. We did not try to find out the source of infection in neonates, which is a major limitation of our study.¹¹

V. Conclusion

Staphylococcus aureus followed by *Klebsiella spp* were the most common causes of the neonatal sepsis. Prematurely delivered neonates are more prone to suffer from neonatal sepsis. Vancomycin and Linezolid can be used as the drugs of choice for preliminary treatment of neonatal sepsis in our settings. Further, Imipenem, Tigecycline may be good options for treatment of neonatal sepsis caused by Gram negative bacteria.

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