# Spectrum of Bacterial Infection and Antimicrobial Sensitivity Pattern in Neonatal Septicemia in a Peripheral Tertiary Care Hospital in West Bengal

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## ABSTRACT

**Introduction**: Neonatal sepsis is the single most important cause of neonatal deaths in the community. It is a major clinical problem in neonatology with significant morbidity and mortality, particularly in developing countries. Neonatal Septicemia, its high incidence and its grave prognosis, in spite of all modern antibiotics, have been a challenge for all times. Objectives: To determine the bacteriological profile and antimicrobial sensitivity pattern of organisms from clinically suspected neonates for appropriate selection of antibiotics**.**

**Material and methods**: This descriptive study was done from February 2015 to June 2015. Blood samples from 208 clinically suspected NS cases were subjected to aerobic culture and their antimicrobial susceptibility pattern was determined by Kirby-Bauer disc diffusion method on Muller Hinton agar as per CLSI recommendations.

**Results**: Among the culture positive cases, Gram negative isolates were 73.07 %, Gram positive 26.92%. Klebsiella pneumonia and Escherichia coli were the commonest isolates in 42.30% and 38.46% of cases, respectively.

**Conclusions**: Blood culture is the gold standard for diagnosis of Neonatal Sepsis. Knowledge of prevalent bacterial spectrum and their antimicrobial susceptibility pattern in Neonatal ICU'S will help the clinician to select appropriate antibiotics for treatment of suspected Neonatal sepsis cases.


**Keywords:** Neonatal sepsis, bacterial isolates, Antibiotic susceptibility, Drug resistance, gram-positive, gram-negative.

## INTRODUCTION

Systemic bacterial infections are well known by the common term 'neonatal sepsis' which includes pneumonia, septicemia, and meningitis. When pathogenic organisms access into the blood-stream, they can cause an overwhelming infection which leads to develop septicemia. When these organisms predominantly localized to the lung or the meninges they may cause pneumonia and meningitis, respectively.[1]

Neonatal sepsis can be divided into two sub-types depending upon whether the onset of symptoms is before 72 hours of life [*early onset sepsis (EOS)*] or later [*late onset sepsis (LOS)*]. Early-onset infections are caused by organisms prevalent in the maternal genital tract or in the delivery area. Late- onset septicemia is caused by the organisms thriving in the external environments of the home or the hospital.

There is a difference in the causative organisms for neonatal sepsis between the developed and developing countries.[2] In the developing world, *Escherichia coli, Staphylococcus aureus and Klebsiella sp.* are the most common pathogens of early-onset sepsis, whereas *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Streptococcus pnemoniae* are the most commonly reported organisms in late-onset sepsis.

Study aimed to find out the bacteriological profile of clinically suspected septicemia cases of neonates from blood sample and to determine the sensitivity pattern and selection of appropriate antibiotics of the same.

## MATERIAL AND METHODS

This study was done from February 2015 to June 2015 in the department Microbiology, Burdwan Medical College, West Bengal. A total of 208 neonates who presented with sepsis or developed sepsis during hospital stay and their blood or CSF culture were found to be positive were included in the study. Inform consent was obtained from the parents. History taking and detailed physical examinations were done in all patients presenting with clinical features of sepsis. Blood samples were collected under aseptic measures. 4–5 ml blood samples were taken in 5 cc disposable syringe. The blood samples were added into blood culture bottles. After incubation of 24–48 hours, bacterial growth was obtained using automated blood culture technique (BACTEC). The antibiotic sensitivity and resistance pattern of various antibiotics against the isolated pathogens were noted and then the percentage of sensitivity and resistance was calculated. Relevant hematological, biochemical and radiological investigations were also performed. Second blood culture was also performed in a few cases which were not improving after initial treatment.

The study proposal along with other relevant documents was submitted to the 'Institutional Ethics Committee' for review and approval. The study was commenced only after approval is obtained from appropriate authority.

## STATISTICAL ANALYSIS

Data were coded and entered into MS-Excel sheet. Statistical analysis were done using software SPSS 20 version. Descriptive and inferential statistics were used. Data were presented in percentages and simple bar diagram.

## RESULTS

A total of 208 patients of neonatal sepsis were included in

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| Causative organisms | Penicillins | | 3 rd generation cephalosporins | | | Aminoglycosides | | Cipro | Imipenem |
|---|---|---|---|---|---|---|---|---|---|
| | Ampicillin | Amox ycillin | Cefotaxime | Ceftriaxone | Ceftazidime | Amikacin | Gentamicin | | |
| *E.coli* | 68.44 | 71.01 | 32.76 | 45.05 | 55.15 | 11.01 | 61 | 51.04 | 18 |
| *S.aureus* | 79.03 | 84.21 | 56.43 | 55.1 | 47.45 | - | - | 58.8 | 22.13 |
| *K.pneumoniae* | 92.12 | 98.67 | 14.6 | 15.4 | 0 | 26.6 | 48.54 | 26.37 | 8.10 |
| *S.epidermidis* | 78.9 | 83.12 | 62.1 | 66.65 | 53.23 | - | - | 48.54 | 65.11 |
| *Acinetobacter* | 89.11 | 90 | 81 | 79.25 | 70.5 | 46.6 | 66.6 | 74.3 | 48.9 |
| *Pseudo* | 98.53 | 85.4 | 55.7 | 46.6 | 16.44 | 8.55 | 11.22 | 7.12 | 4 |
| *B.cepacia* | 97.11 | 96.43 | 82.1 | 96 | 73.4 | 51 | 48 | 77.54 | **43.29** |

**Table-2:** Resistance of various causative bacteria to antibiotics (%)

the study. Age of the patients ranged from 2 to 28 days. These patients were positive for sepsis on blood culture. Male patients were 122 (58.65%) while female patients were 86 (41.34%).All the patients' age ranged from 2 days to 28 days. Gram-negative bacteria were more frequent than gram-positive bacteria, i.e., gram negative bacteria were found in 152 (73.07 %) cases, while 56 (26.92%) cases were caused by gram-positive bacteria. Late onset sepsis (LOS) was found in 131 (62.98%) cases, while early onset sepsis (EOS) was found in 77 (37.01%) cases. Frequency of various causative bacteria and antibiotic resistance pattern is shown in Table-1, Figure-1, and Table-2

## DISCUSSION

Compare to adults, infants are having much higher tendencies to develop infections.[3] This is attributed by several factors including an in-properly developed immunological system making sepsis a risk to the newborn, particularly under poor hygienic conditions. In pre antibiotic era, mortality from neonatal sepsis exceeded 90% but now with availability of antibiotics, the mortality rate has been reduced to between 10 and 50% as describe in Rubin et al[4] and Yalaz et al.[5] In advance centers, blood culture is positive in 80% of genuine sepsis.[6]

Shaw et al[7], Moreno et al[8], Lim et al[9] have described that late onset sepsis (LOS) is more common as compare to early onset sepsis (EOS) which is consistent with our study.

Gram positive and gram-negative organisms were isolated in different cases. But gram negative bacteria (73.07%) were more common than gram positive bacteria (26.92%), which is consistent with other studies.[10] In a study, gram positive bacteria were the main contributors to neonatal sepsis[11], this may be due to geographical distribution of microorganisms.

In our study, Klebsiella pneumoniae was found to be the most commonly isolated pathogen. Klebsiella pneumoniae was found in both EOS and LOS, but mainly were found in LOS compare to EOS which is consistent with WHO reports.[12]

The second most common bacteria were E. coli. This is consistent with other studies; in some studies E. coli was the most common

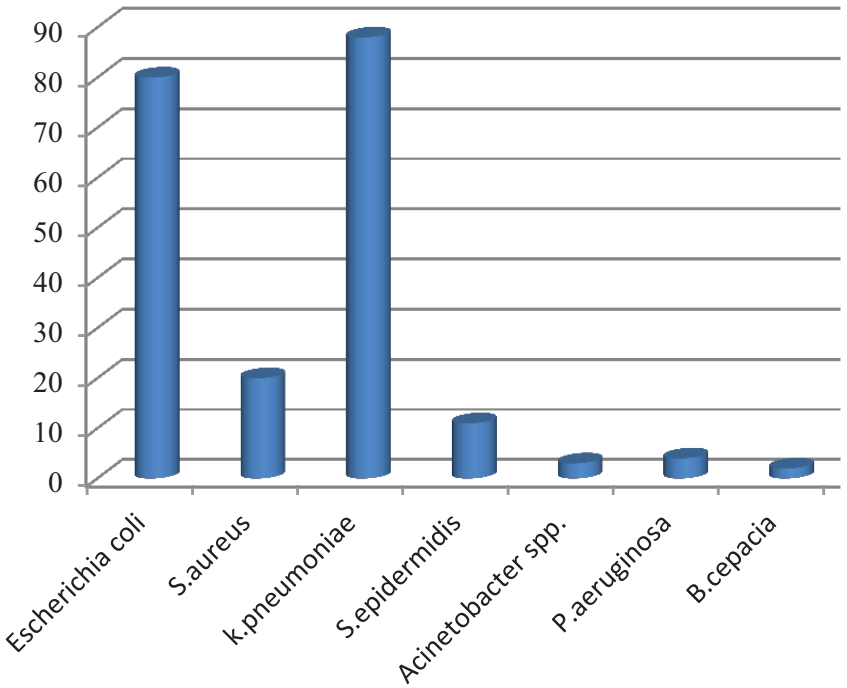


**Figure-1:** Pathogens isolated from blood culture

| Isolated organisms | Total | EOS | LOS |
|---|---|---|---|
| Escherichia coli | 80 (38.46) | 22 (10.57) | 58 (27.88) |
| Staphylococcus aureus | 20 (9.61) | 08 (3.84) | 12 (5.76) |
| Klebsiella pneumoniae | 88 (42.30) | 38 (18.26) | 50 (24.03) |
| Staphylococcus epidermidis | 11 (5.28) | 06 (2.88) | 05 (2.40) |
| Acinetobacter spp. | 03 (1.44) | 01 (0.48) | 02 (0.96) |
| Pseudomonas aeruginosa | 04 (1.92) | 02 (0.96) | 02 (0.96) |
| Burkholderia cepacia | 02 (0.96) | 00 (0.00) | 02 (0.96) |

**Table-1:** Distribution of various isolates causing neonatal sepsis [n (%)]

bacteria isolated, while in most studies it is second most common bacteria causing neonatal sepsis.[13,14]

Staphylococcus epidermidis was found in 5.28% of cases in our study contributing to both early onset sepsis (EOS) in 2.88% of cases and late onset sepsis (LOS) in 2.44% of cases. Waseem et al[15] described Staph epidermidis in 10.51% contributing 7.8% cases to EOS, and 2.77% cases to LOS.

In the present situation antibiotic resistance has become a serious problem. Higher prevalence of resistant pathogens indicates injudicious overuse of different antibiotics. So it is very important to use all the antibiotics according to epidemiological studies with their rational indications of usage. Although positive blood culture is the gold standard in the diagnosis of neonatal sepsis, but in the absence of proof of sepsis many neonatologists felt obliged to continue antibiotics treatment for a full of 10 day course. There is also emergence of resistant pathogens. If this continues there will be lack of effective antibiotics. A meticulous hand-washing, judicious use of antibiotics is the main solution to this serious problem. It is important to continue proper surveillance of neonatal sepsis in order to follow closely changes in trends and risk factors, and take necessary steps as earliest to prevent outbreaks.

## CONCLUSION

*Escherichia coli* and *Klebsiella pneumonia* are the most common organisms causing neonatal sepsis. Both gram-positive and gram-negative bacteria have developed resistance against commonly used antibiotics like ampicillin, amoxicillin, cefotaxime, ceftriaxone. Less commonly used antibiotics like amikacin and ceftazidime are relatively more effective in the treatment modalities.

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