A Retrospective Study on the Bacteriological Profile and Antibiotics Sensitivity along with Resistance Pattern in Neonates with Sepsis in a Tertiary Care Hospital of Salem District, Tamil Nadu

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Abstract

Neonatal sepsis is the leading cause of infant mortality and morbidity on a global scale. This was a retrospective study that aimed to assess and to evaluate the bacteriological profile, antibiotic resistance and sensitivity pattern in neonates with sepsis in a tertiary care hospital. The neonatal cases with sepsis were selected by inclusion and exclusion criteria. All neonates with a clinical suspicion of sepsis with a positive blood culture were identified. Patient demographics, clinical details, maternal risk factors and laboratory data including bacteriological profiles. Antimicrobial susceptibilities were analyzed and recorded. Out of 110 neonatal cases, the most predominant bacteria isolated were Gram-negative organisms, they were Klebsiella pneumonia (n=27, 41.5%), Acinetobacter sp (n=14, 21.5%) and the majority of Gram-positive bacterial isolate was Staphylococcus aureus (n=9, 20%).

The antibiotics Amikacin (79.3%), Gentamycin (76.1%), Imipenem (74.6%), Meropenem (71.4%) and Ciprofloxacin (69.8%) were sensitive and Ampicillin (87.3%), Amoxiclav. (71.4%), Cefopodoxime (66.6%) and Cefuroxime (61.9%) were resistant to Gram-negative bacteria. The antibiotics Amikacin (88.8%), Gentamycin (82.2%) and Chloramphenicol (86.6%) were sensitive and the antibiotics Ampicillin (77.7%), Cefixime (73.3%) were resistant to Gram-positive bacteria. The research aids us in concluding that regular antibiotic surveillance is essential at the study site to reduce antibiotic resistance.

Keywords: Neonatal Sepsis, Bacteriological Profile, Antibiotic, Sensitivity, Resistance.

Introduction

Sepsis, also known as septicemia or blood poisoning, is a potentially fatal illness that arises when the body's response to infection causes harm to its tissues and organs. Several types of organisms including bacteria, viruses and fungi, cause sepsis. The infections are typically seen in the lungs, brain, urinary tract, skin and abdominal organs[4]. Neonatal sepsis is a bacterial-related clinical condition that is characterized by systemic signs and symptoms of infection within 28 days of life. Systemic symptoms of neonatal sepsis include arthritis, osteomyelitis and urinary tract infection[1].

Neonatal sepsis can be classified based on the onset of symptoms into 2 main classes: Early Onset Sepsis (EOS) can be interpreted as the occurrence of symptoms before 72 hours and Late Onset Sepsis (LOS) can be defined as the incidence of symptoms after 72 hours[16]. The majority of neonatal sepsis occurs in developing countries. Although risk factors are attributable to neonatal sepsis, its causative organisms and their antimicrobial resistance patterns are well described, such evidence is based predominantly on data from tertiary hospitals[2,7,11,15,17]. The incidence of neonatal septicemia is 1 to 10 per thousand live births [6]. However, the incidence of the latter varies with the geographical area, the socio-economic structure and various customs and practices and the prenatal period[1].

Promotion of institutional deliveries among the rural population of India has helped with the progress achieved over the past two decades. Early diagnosis and appropriate therapy of septicemia are of utmost importance to prevent morbidity and mortality[9]. Distribution of micro-organisms causing neonatal sepsis changes over time and varies from region to region[5,11]. Emergence of multi-drug-resistant bacteria imposes further challenges in its treatment[13]. The current study intended to determine the most common bacteria of newborn sepsis as well as their antibiotic resistance and sensitivity patterns in the tertiary care hospital in Salem, Tamil Nadu, India.

Material and Methods

The retrospective study regarding bacteriological profile, antibiotic sensitivity and resistance pattern of neonates with sepsis was conducted over a 6-month period from January 2022 to June 2022. A total of 250 neonates affected with sepsis from July to December 2021 were admitted as in-patients in the Pediatrics department of a tertiary care hospital located in Salem district, Tamil Nadu. This study included 110 patients who were randomly selected from a group of 250 patients. All neonates with a clinical suspicion of sepsis with a positive blood culture were identified and the details regarding the patient demographics, clinical details, maternal risk factors, pharmacological therapies and laboratory data including bacteriological profiles and

antimicrobial susceptibilities were recorded and analyzed. Patient demographics were obtained including age, gender, gram stain and blood culture.

The exact inclusion and exclusion criteria were followed during data collection. Neonatal patients diagnosed with neonatal sepsis under the age of 28 days met the inclusion criteria and critically unwell newborns who were unable to undertake the required laboratory tests, were excluded from the study. The collected data were investigated with the help of necessary parameters such as clinical specimens, microbiological culture media and bacteriological profiles. The study examined the antibiotic resistance and sensitivity patterns for different organisms. The statistical analysis was completed using Microsoft Excel Office 365 and the results are presented in tabular and diagrammatic format.

Results and Discussion

A retrospective study of the bacteriological profile along with the antibiotic sensitivity and resistance pattern in neonates with sepsis was conducted in a tertiary care hospital, in Salem, Tamil Nadu. The data was collected from 110 neonates and the research was performed during a period of 6 months. The neonates were selected by considering the inclusion and exclusion criteria. The study was based on the patient demographic details, clinical details, maternal risk factors, pharmacological therapies and laboratory data including bacteriological profiles and antimicrobial susceptibilities. The study population included 74 (67.27%) male neonates and 36(32.73%) female neonates. This study correlates with the research done by Jyoti et al[4] which indicated that neonatal sepsis was more likely to develop in male neonates.

The males were commonly affected mainly with *Acinetobacter sp* followed by *Coagulase-negative staphylococcus aureus and Klebsiella pneumonia* while female neonates were commonly affected mainly with *Klebsiella pneumonia* followed by *Acinetobacter sp and Staphylococcus aureus*.

The study was divided into two categories based on the onset of symptoms in neonatal sepsis: early-onset sepsis and late-onset sepsis. Neonates who were affected by early onset sepsis were 20 (18.1%) and late-onset sepsis were 90 (89.9%) in the total study population. Study conducted by Thakur et al[14] does not correlate to the results of this study which showed that late-onset sepsis occurs more commonly than early-onset sepsis in neonates.

The distribution of pathogens was done for the early onset sepsis patients and it demonstrated that the most common organism isolated was *Klebsiella pneumoniae* (20%) followed by *Acinetobacter sp* (10%) and the least common isolated organisms were *Candida sp* (5%) and *Klebsiella sp* (5%). The distribution of pathogens was done for the late-onset sepsis patients and it demonstrated that the most common organism isolated was *Klebsiella pneumoniae* (24.4%) followed by *Acinetobacter sp* (13.9%) and the least common isolated organisms were *Enterococcus sp* (1.1%) and *Staphylococcus sp* (1.1%).

Bacterial microorganisms were classified into groups based on their morphological and biological characteristics. In this research, the organisms causing neonatal sepsis were classified as Gram-positive microorganisms 45(41%) and Gram-negative microorganisms 65(59%). The prevalence of Gram-negative bacteria was higher than Gram-positive bacteria. The distribution of Gram-positive bacilli causing neonatal sepsis was done and it showed that *Staphylococcus aureus* (20%) and *Coagulase-negative Staphylococcus* (13.9%) were the most common Gram-positive bacteria whereas *Beta hemolytic Staphylococcus* (2.2%) and *Listeria monocytogenes* (2.2%) were the least common bacteria. The results of this study correlate with the findings of Serra et al[12] and Raoofi et al[10] who showed that *Staphylococcus aureu*s and *Coagulase-negative Staphylococcus aureus* were found to be the most common sepsis causing gram-positive bacteria.

The distribution of gram-negative bacilli causing neonatal sepsis was done and it showed that *Klebsiella pneumonia* (41.5%) and *Acinetobacter sp* (21.5%) were the most common Gram-negative bacteria whereas the least common bacteria were *Acinetobacter baumani* (1.5%) and *Burkholderia cepacia complex* (1.5%). The findings of this study correlate with the results of Bhattarai et al[3] who showed that the most common sepsis-causing Gram-negative bacteria were *Klebsiella pneumonia* and *Acinetobacter sp.*

The antibiotic sensitivity in Gram-positive organisms was conducted and it portrayed that they were sensitive to antibiotics such as amikacin (88.8%), gentamycin (82.2%) and chloramphenicol (86.6%). The antibiotic sensitivity of Gram-negative organisms was studied and it showed that they were sensitive to antibiotics such as amikacin (79.3%), gentamycin (76.1%), imipenem (74.4%), meropenem (71.4%) and ciprofloxacin (69.8%). The antibiotic resistance in Gram-positive organisms was conducted and it portrayed that they were resistant to antibiotics such as ampicillin (77.7%) and cefixime (73.3%). The antibiotic sensitivity of Gram-negative organisms was conducted and it portrayed that they were resistant to antibiotics such as ampicillin (87.3%), amoxyclav (71.4%), cefopodoxime (66.6%) and cefuroxime (61.9%).

The antibiotic sensitivity and resistance patterns of bacteria such as *Klebsiella pneumonia, Acinetobacter sp and Staphylococcus aureus* were studied. The results regarding *Klebsiella pneumonia* portrayed that it was most sensitive to amikacin, cefoperazone, chloramphenicol, ciprofloxacin, gentamicin, netillin and tobramycin and it was also resistant to amoxicillin and amoxiclavunate, cefotaxime, cefpodoxime and tetracycline.

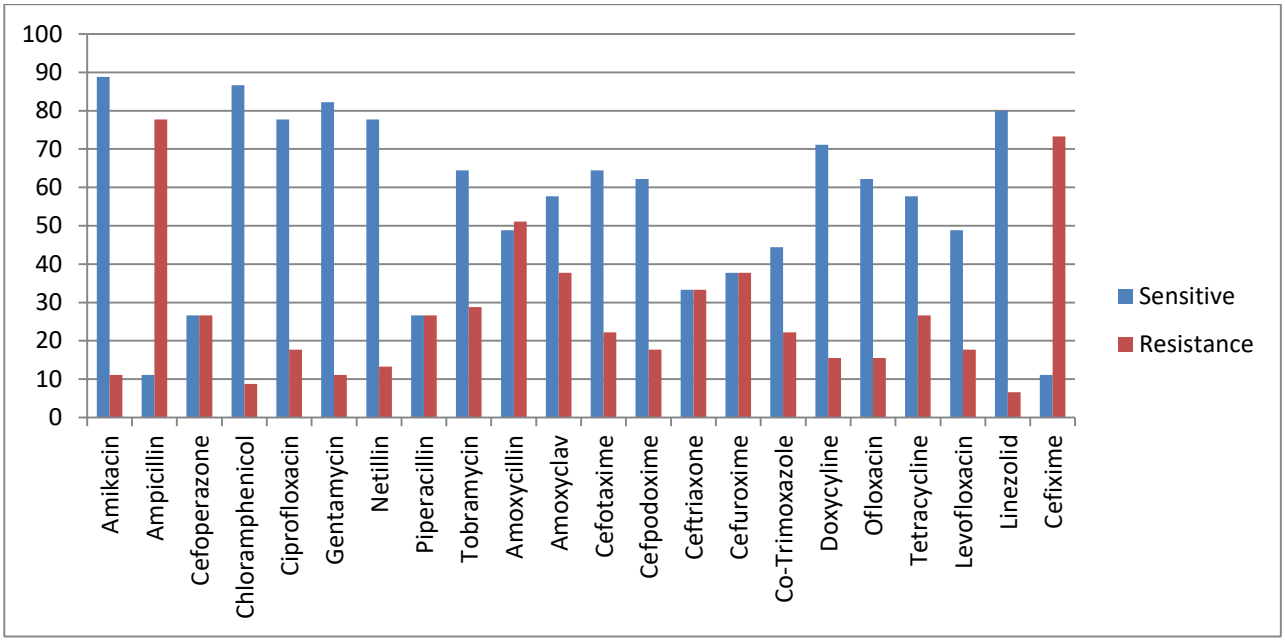

Figure 1: Antibiotic Sensitivity and Resistance Pattern of Gram-Positive Organism

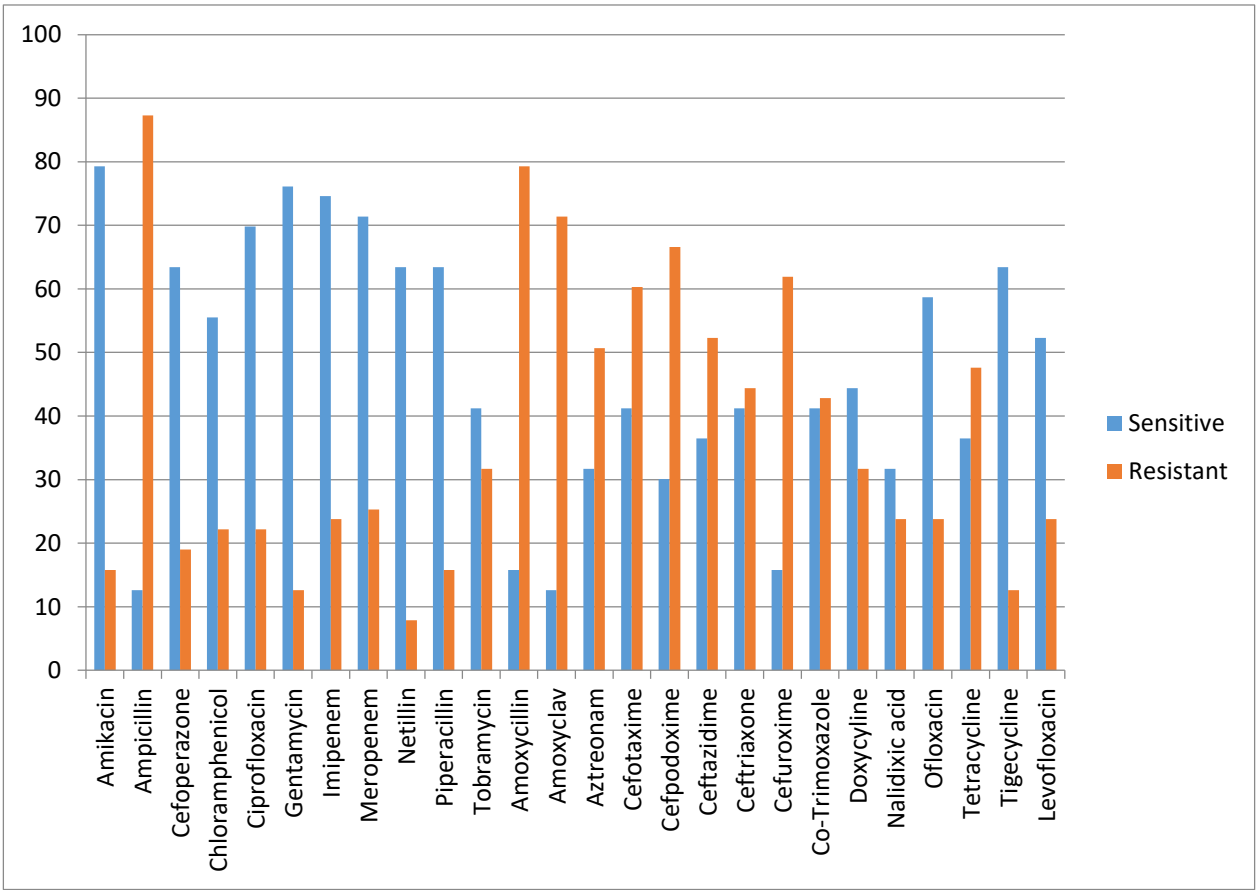

Figure 2: Antibiotic Sensitivity and Resistance Pattern of Gram-Negative Organism

The results regarding *Acinetobacter sp* portrayed that it was most sensitive to cefoperazone, chloramphenicol, gentamicin, levofloxacin, ofloxacin, amikacin, netillin, tobramycin, piperacillin and tetracycline and it was also resistant to amoxicillin, amoxiclavunate, aztreonam, cefixime, ceftriazone, cefotaxime and ceftazamide. The results regarding *Staphylococcus aureus* portrayed that it was most sensitive to amikacin, chloramphenicol, ciprofloxacin, doxycycline, gentamicin and linezolid and it was also resistant to cefixime and ampicillin.

Conclusion

The result of this study helps us to understand that the patients were more frequently impacted by neonatal sepsis.

The Gram-negative bacteria that were commonly isolated during the research, were *Klebsiella pneumoniae and Acinetobacter sp*. They were the predominant organism causing neonatal septicemia in our institution. These organisms were mostly susceptible to antibiotics such as amikacin, gentamicin and chloramphenicol.

The findings of this study encourage us to understand that regular antibiotic surveillance is required at the study site to lower antibiotic resistance. Therefore, for the treatment of neonatal sepsis, routine monitoring of antimicrobials should be employed for the proper selection of antibiotics for empirical therapies.

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