



A Spectrum of Bacterial Pathogens and its Antibiotic Susceptibility Pattern Isolated from Neonatal Sepsis in an NICU in a Government Pediatric Hospital

Rao Pooja, K N Sowmya, Baliga Shrikala, M Radhakrishna and Bele Keerthiraj

Kasturba Medical College, Mangalore, Manipal University, Karnataka, INDIA

Kasturba Medical College, Light house, Hill Road, Mangalore, Manipal University, 575001, Karnataka, INDIA

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Abstract

Neonatal sepsis being one of the major causes for mortality and morbidity in the NICU. This study will provide a data on the bacterial pathogens causing neonatal sepsis along with their antibiogram. To study the spectrum of significant bacterial isolates causing septicemia in neonates and to determine their antimicrobial sensitivity pattern. A total of 784 blood samples were screened for sepsis in newborns less than 28 days old in this retrospective study. The positive blood cultures were detected by BACTEC blood culture systems and antibiotic susceptibility testing was done by using Kirby-Bauer disk diffusion method. Out of 784 samples, 170 were positive blood cultures. Gram negative and gram positive organisms comprised of 79.94% and 18.17% respectively, out of which Burkholderiacepeca complex (30%), Klebsiellaspp.(15.5%) were the most common pathogens followed by S.aureus (14.7%), Among the gram negative organism's susceptibility for Imipenem, Meropenem and piperacillin/tazobactam was high. All Gram positive bacterial isolates showed 100% sensitivity to Netillin, vancomycin, teicoplanin, rifampacin. Gram negative species has been predominantly seen in neonatal sepsis and Carbapenems is considered one of the best options for empirical antibiotic therapy in our NICU.

Keywords: Neonatal sepsis, NICU.

Introduction

In neonates, sepsis incidence is increasing in the recent years. Neonatal septicemia refers to generalized infection with positive blood culture in the early 28 days of neonates¹. Advances in early diagnosis and treatment have led to better prognosis of newborns in ICUs. It encompasses various diseases of new born including septicemia, meningitis, arthritis, pneumonia, osteomyelitis and urinary tract infection².

According to National Neonatal Prenatal Database 2002-2003, neonatal septicemia in India comprised of 30/1000 live birth³. In rural India, clinical sepsis rates is ranging from 49 to 170/1000 live births⁴.

Neonatal septicemia can be classified into 2 subtypes: Early onset neonatal sepsis (EONS) depending on the onset of symptoms before 72 hours and after 72 hours up to 28 days of life it is considered as late-onset neonatal sepsis (LONS)⁵.

Risk factors for early onset sepsis includes prolonged ruptured membranes (> 18 hours), fetal distress, preterm delivery, history of Group BS streptococcus (GBS) infection in previous infant, GBS bacteriuria in this pregnancy. Late onset sepsis occurs due to prolonged hospitalization. e.g. preterm infant in a NICU, presence of foreign bodies e.g. intravenous catheters, end tracheal tubes, etc., cross infection by staff and parents,

malformations such as urinary tract anomalies (e.g. vesico-ureteral reflux) or neural tube defects^{1,2}.

This retrospective study was undertaken to evaluate major bacterial isolates causing neonatal septicemia and their antibiogram pattern.

Aims and Objectives: To study the spectrum of the significant bacterial isolates from positive blood culture causing septicemia in neonates. To determine the antimicrobial sensitivity pattern of the bacterial isolates obtained from positive blood culture causing septicemia in neonates.

Material and Methods

Study location: Kasturba Medical College Hospital. **Study design:** Retrospective study. **Study Period:** 10 months. February 2014 to November 2014. **Sample size:** All the Blood specimens of neonates of age group 1- 28 days were collected from February 2014 to November 2014.

Blood for bacterial culture was aseptically collected and added to 2ml of blood BD Bactectm Pedsplustm/F culture bottle containing 40ml of processed water, soyabean casein digest broth 2.75% W/V and incubated at 37°C for 48 hours to 7 days in BD BACTEC system. Positive blood culture bottles were sub cultured onto 5% sheep blood agar, chocolate agar and Mac

Conkey's agar and incubated at 37°C for 18 hours. Negative culture bottles were incubated for 7 days. The organism isolated was identified by standard biochemical test and the sensitivity to various antibiotics was assessed using the Modified Kirby - Bauer disk diffusion method on Mueller Hinton agar. Susceptibility testing for *Streptococcus pneumoniae* was performed on Mueller Hinton agar supplemented with 5% sheep blood. Skin colonizers like coagulase negative staphylococcus & micrococcus were excluded from this study. This study will provide adequate rational data on bacterial pathogens causing neonatal sepsis along with their antibiogram and hence in the prompt empirical management of neonatal septicemia.

Results and Discussion

During a period of 10 months, 784 blood samples were collected out of which 170 positive bacterial blood culture samples were studied and *Candida* spp. was isolated from 21 samples. Among the 170 samples, EONS constituted about 44.4% while LONS formed about 53.53%, figure-1.

The gram negative rods were the main cause of septicemia. Neonatal sepsis was predominant in males (64.7%) than females. The gram negative bacteria included *Burkholderia cepacia* complex, *Klebsiella* spp., *Enterobacter* spp., *Acinetobacter* spp., *Pseudomonas* spp. and among the gram positive bacteria *Staphylococcus aureus*, the major cause of gram positive bacterial sepsis. Gram negative and gram positive organisms comprised of 79.94% and 18.17% respectively, out of which *Burkholderia cepacia* complex (30%), *Klebsiella* spp (15.5%) were the most common pathogens followed by *S.aureus* (14.7%), *Enterobacter* spp. *Acinetobacter* spp., *Pseudomonas* spp, and less frequently isolated were other non-

fermentative Gram Negative Bacilli and *Enterococcus* spp, figure-1.

The antimicrobial susceptibility testing revealed that most of the Enterobacteriaceae family members were resistant to ampicillin (90.5%). Enterobacteriaceae family members showed high susceptibility to polymixin B and colistin. Among the gram negative organisms susceptibility for Imipenem, Meropenem, fluoroquinolones and piperacillin/tazobactam were high, figure-2. All Gram positive bacterial isolates showed 100% sensitivity to Netillin, vancomycin, teicoplanin, rifampicin, figure-3. The prevalence of MRSA was found to be 52%. The overall prevalence of ESBL producers among *E.coli* and *Klebsiella* spp was found to be 27.7% and carbapenemase produces were about 26%.

Discussion: Neonatal sepsis is a life threatening emerging infection in the developing countries and it is estimated about 5 million neonatal death occur every year world wide⁶. The invasive procedures in the postnatal period and inadequate hand washing before and after handling babies also contributes to the neonatal sepsis in intensive care units.

In the present study EONS comprised of 44.4% which was almost similar to the study done by Shaw *et al* (49.8%)⁷, while it was 95% in Shah *et al*⁸, 55.3% in Vinod kumar *et al*⁹. In our study Gram negative organisms were the major cause of neonatal sepsis about 79.9% and gram positive organisms about 18.17%. In a study conducted in tertiary care hospital Mangalore, gram positive bacteria (64.4%) were the main cause of sepsis compared to gram negative bacteria (34.56%). About 30% of the isolates were *Burkholderia cepacia* complex, the major isolate in our study. In comparison to other studies conducted in Pakistan and Lucknow, India,

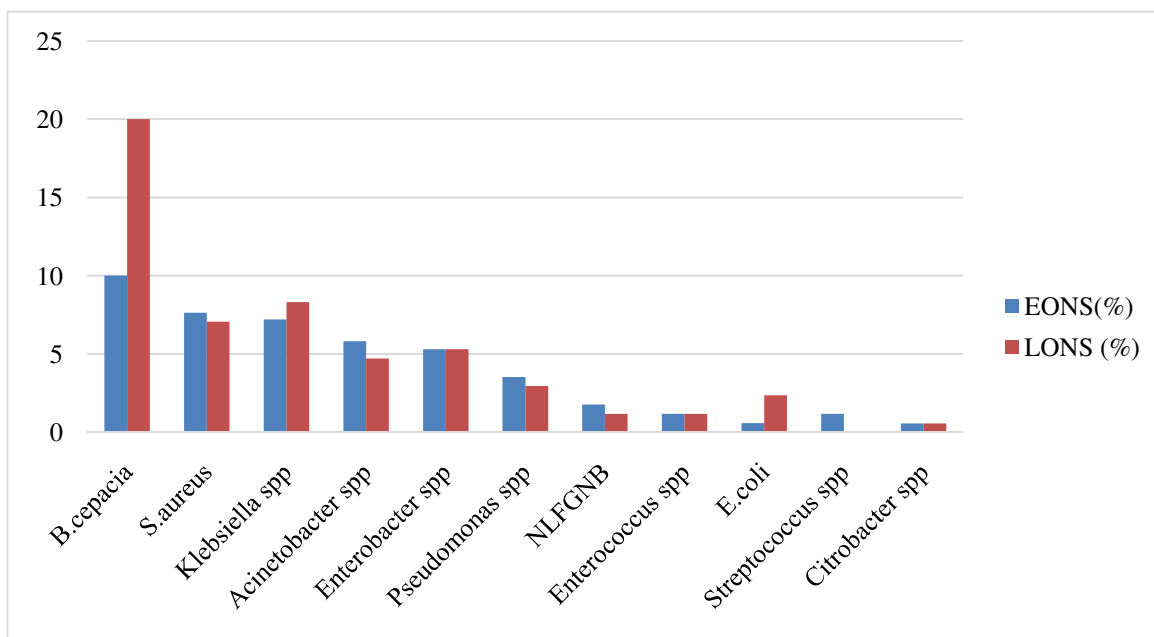


Figure-1
 Distribution of different species of organisms depending on the onset of symptoms

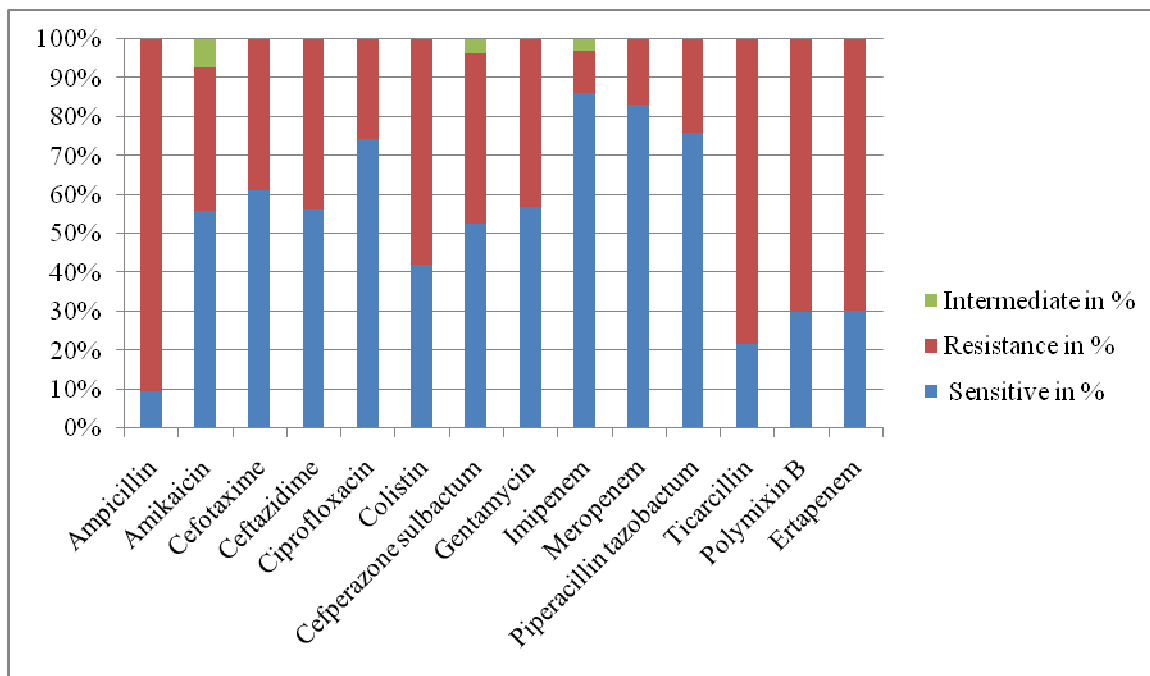


Figure-2
Antibiotic susceptibility pattern of Gram negative Bacteria

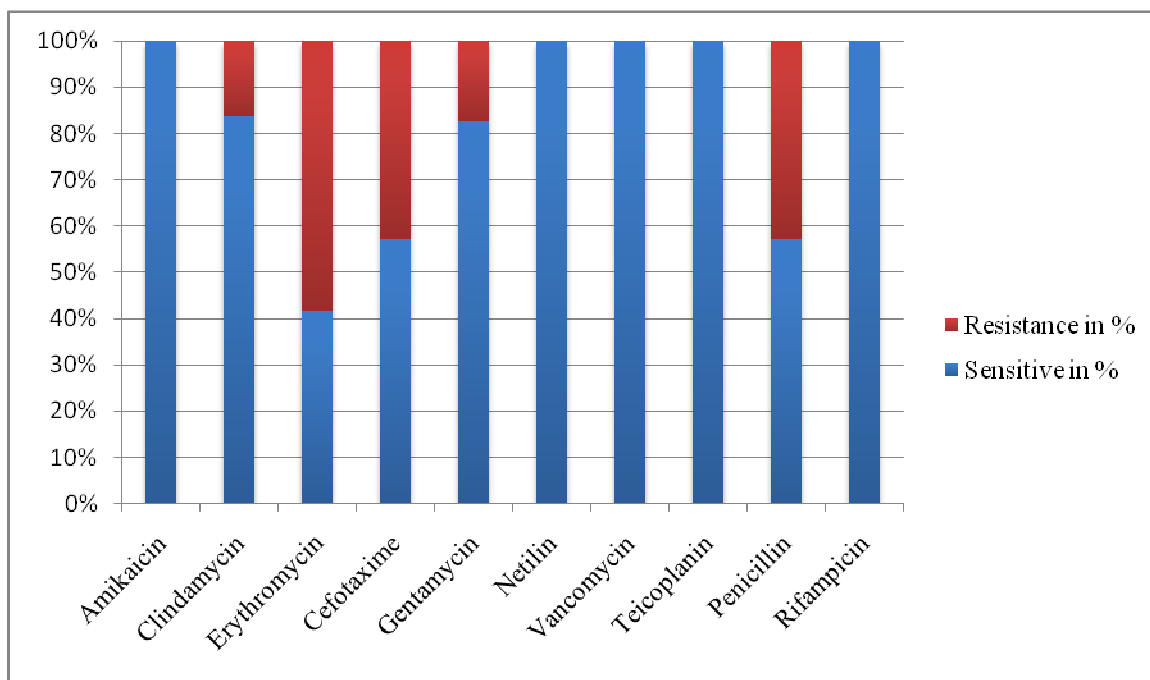


Figure-3
Antibiotic susceptibility pattern in Gram positive cocci

E.coli and *Klebsiella* spp. was found to be the major cause of neonatal sepsis respectively^{10,11}. Non fermentative gram negative bacilli like *Pseudomonas* spp, *Acinetobacter* spp and *Stenotrophomonas maltophilia* are some of the opportunistic pathogens commonly isolated in NICUs with high multidrug resistance. *B. cepacia* can now be included in the list because of

its high rate of transmissibility between in patients, health care staff and multiple drug resistance. In hospitals, *B.cepacia* has been found to contaminate various antiseptics, disinfectants, and nebulizer solution and dextrose solution¹². In our NICU most of the neonates with *B.cepacia* sepsis were under mechanical ventilator support and with risk factors like prematurity and low

birth weight.

Group B Streptococcus which is one of the commonest pathogen to be isolated in western countries was not reported from our study¹³. A possible explanation might be due to the fact that GBS has a tendency to colonize the cervix and sexual partners of infected women can harbor GBS in their urethra and possibly act as reservoirs in certain societies. Therefore, differences in the ethnicity and socioeconomic status may contribute to the varying incidence of GBS infection among neonates in different populations¹⁴.

The other commonly found organisms in our setup were *Klebsiella spp.* (15.5%), *Enterobacter spp.* (10.5%), *Acinetobacter spp.* (10.5%). *S.aureus* (14.5%) and among less frequently isolated organisms were *Enterococcus spp* and other Non-fermentative gram negative bacilli. Male predominance (64.7%) as seen in our study were also found in other studies^{3,14,15}.

Antibiotic resistance is a global problem. The antibiogram pattern differs from country to country depending upon the variability of epidemiology of neonatal sepsis¹⁶. Our study shows high rate of resistance to first line of antibiotics. In our study gram negative bacteria showed high resistance to ampicillin (90.5%) and moderate sensitivity to gentamycin (64.4%) and third generation cephalosporins, ceftazidime (56.3%), cefotaxime (57.63%), figure-2. Our results showed contrast to the study conducted at Hyderabad, India having high resistance to Amikacin (13.6%) and moderate resistance to gentamycin (45%) and third generation cephalosporins like cefotaxime 73%¹⁷. Increase in resistance was also seen in aminoglycosides and third generation cephalosporins which is being used in our setup as empirical therapy. Among the gram negative organisms susceptibility for Imipenem (86.13%), Meropenem (83.22%), piperacillin/tazobactam (76%) and fluroquinolones (74.5%) was high. But quinolones has shown increased side effects. Gram positive bacteria showed moderate sensitivity to Penicillin (57.14%) and high sensitivity to Amikacin (100%). All Gram positive bacterial isolates showed 100% sensitivity to netillin, vancomycin, teicoplanin, rifampicin which was similar to another study¹⁸. Hence, the changing antibiotic susceptibilities need continuous monitoring and re-evaluation for putting forth the guidelines for empirical treatment in NICUs.

Conclusion

Gram negative species are predominantly seen in neonates sepsis and Carbapenems and Beta lactam and Beta lactam inhibitor combinations is considered one of the best options for empirical antibiotic therapy in our NICU. Early identification of organisms causing neonatal sepsis and appropriate use of antibiotics to minimize the morbidity, mortality and emerging resistance in bacteria is essential to control neonatal sepsis in neonatal intensive care units.

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