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BACTERIOLOGICAL PROFILE OF NEONATAL SEPTICEMIA IN A TERTIARY CARE HOSPITAL IN TELANGANA

Clinical Microbiology

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ABSTRACT

Background and objective: Neonatal septicemia refers to generalized bacterial infection documented by positive blood culture in the first four weeks of life. It is an important cause of morbidity and mortality in neonates. The present study was undertaken to establish the bacteriological profile and antimicrobial susceptibility pattern of the isolates causing neonatal septicemia. **Materials and methods:** The study was conducted at Niloufer hospital over a period of 18 months from January 2021 to June 2022. All clinically suspected cases of neonatal septicemia were included in the study (n=732). Conventional blood cultures were done for all the patients. In the positive blood culture the bacterial isolates were identified and Antimicrobial susceptibility was performed using Kirby-Bauer disc diffusion method according to CLSI guidelines. **Results:** Out of the total 732 cases of septicemia 194(26.3%) were positive for bacterial growth. Among the positive blood cultures Gram negative isolates were 100(51.8%) and Gram positive isolates were 94(48.6%). Among the Gram positive isolates Coagulase negative staphylococci were predominant (30%) followed by Enterococcus species (18.6%). Among Gram negative isolates Klebsiella pneumoniae and Pseudomonas species accounted for 25.3% and 15% of isolates respectively. **Conclusion:** To conclude, the positivity rate of blood cultures in the current study is 26.5% with CONS accounting for majority of 30% of cases. The epidemiology of neonatal sepsis and antibiotic susceptibility pattern helps in formation of antibiotic policy which guides the clinicians to start empirical antibiotic therapy.

KEYWORDS

INTRODUCTION

Septicemia in neonates refers to generalized bacterial infection documented by positive blood culture in the first four weeks of life. It is estimated that up to 20% of neonates develop sepsis and approximately 1% die of sepsis related causes. [1] Neonatal mortality rate is one of the indicators for measuring the health status of a nation. Neonatal sepsis is broadly divided into two types according to age of onset, Early-onset sepsis (<72 hrs) and late-onset sepsis (≥72 hrs-28 days). Early-onset sepsis is acquired during fetal life, delivery, or at the nursery. [2]

The bacterial agents associated with neonatal sepsis are Escherichia coli, Klebsiella spp., Pseudomonas spp., Acinetobacter spp., Coagulase-negative Staphylococci (CoNS), Staphylococcus aureus, Enterococci spp., and Enterobacter spp., [3-5] The present study was undertaken to determine the bacteriological profile and their antimicrobial susceptibility pattern of prevalent pathogens isolated from the blood of septicemic neonates from Neonatal Intensive Care Unit (NICU) at a tertiary care hospital Hyderabad.

MATERIALS AND METHODS

Blood culture was done for all neonates suspected to have septicemia admitted in the Department of Neonatal intensive care unit of Niloufer Hospital for Women and Children from January 2021 to June 2022. 2 ml venous blood was inoculated into blood culture bottle containing 20 ml of sterile trypticase soya broth. The culture bottles were incubated immediately at 37 °C for 7 days and subcultures done at 24hours, 48hours and 96hours of incubation from trypticase soya broth on blood agar (BA) and MacConkey agar (MA). The BA and MA plates were incubated aerobically. The pure isolates obtained from subcultured plates were identifed by standard microbiological techniques. [6,7]

Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion susceptibility method in accordance to Clinical Laboratory Standards Institutes (CLSI) guidelines. [8] The antibiotics used in this study were: Ampicillin (10 µg), Amoxiclav (20/10 µg), Cefuroxime (30µg), Ciprofloxacin (5 µg), Erythromycin (15 µg), Gentamicin (10 µg), Co-trimoxazole (1·25 µg trimethoprim/23·75 µg sulfamethoxazole), Amikacin (30 µg), Imipenem (10 µg), Piperacillin/tazobactam (100/10 µg), Azithromycin (15 µg), and Linezolid (30 µg).. All the antibiotic discs used for susceptibility test were purchased from Himedia, India. For biochemical tests and antibiotics sensitivity tests, following reference strains were used for quality control: Escherichia coli ATCC 25922; Pseudomonas aeruginosa ATCC 27853; Klebsiella pneumoniae ATCC 700603; and Staphylococcus aureus ATCC25923.

All the data were entered on Excel worksheets and results were calculated as frequencies.

RESULTS

Out of 732 samples 199 samples showed the growth of organisms. The incidence of neonatal septicemia was 26.5%. Among culture positive cases there were 82(59%) male babies and 57(41%) were female babies. Out of the199 positive blood cultures 5 of the samples were positive for Candida species. Gram positive bacterial isolates were 100(51.8%) Gram negative bacterial isolates were 94(48.2%).

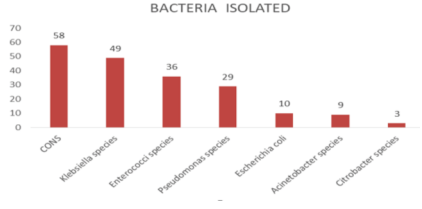

Figure 1: various bacteria isolated

Table-1 Frequency of the different bacteria isolated according to the time of onset.

ORGANISM	FREQUENCY OF ISOLATION	EARLY ONSET	LATE ONSET
Coagulase Negative Staphylococci	58(30%)	6	52
Klebsiella species	49(25.3%)	18	31
Enterococcus species	36(18.6%)	10	26
Pseudomonas species	29(15%)	5	24
Citrobacter species	3(1.5%)	1	2
Escherichia coli	10(18.6%)	3	7
Acinetobacter species	9(4.6%)	0	9
TOTAL	194	43(22.2%)	151(77.8%)

Tables 2 and 3 shows the Antibiotic susceptibility pattern in Gram-negative and Gram-positive isolates. Best overall sensitivity among Gram-negative isolates was to Imipenem (100%), Meropenem (100%) followed by Amikacin (80%).Gram-positive isolates had sensitivity of 100% to Vancomycin, Linezolid.

Table-2 Antibiotic sensitivity pattern of Gram negative bacterial isolates

Antibiotics	Klebsiella spp(n=49)	Pseudomonas spp(n=29)
Ampicillin	0	0
Amikacin	75%	100%
Gentamicin	75%	100%
Ceftriaxone	12%	-
Ceftazidime	-	13.7%
Pipercillin tazobactam	81.3%	95.5%
Imipenem	90.7%	100%
Meropenem	87.5%%	95.5%
Cotrimoxazole	75%	-
Ciprofloxacin	75%	100%

Other Gram negative bacteria included *Escherichia coli, Acinetobacter spp.* and *Citrobacter spp*. which showed maximum sensitivity to Meropenem, Imipenem, Pipericillin-tazobactam and Amikacin.

Table 3 Antibiotic sensitivity of Gram positive bacteria

Organism	CONS (n=58)	Enterococcus sps. (n=36)
Ampicillin	0%	0%
Gentamicin	31.8%	48.3%(High level Gentamicin)
Co-trimoxazole	65%	-
Ciprofloxacin	37.5%	-
Doxycycline	93.8%	84.4%
Clindamycin	88.2%	-
Vancomycin	100%	100%
Linezolid	100%	100%
Cefoxitin	20%	-

DISCUSSION

The total blood culture positivity rate among neonates with sepsis in this study group was 26.5% which was comparable to the study by Awaisu et al. [14] who reported bacteriologically proven sepsis in 25.6% of the cases. The culture positivity might be an underestimation of actual status in our study, as anaerobic organisms were not tested in our institution. In previous studies done in India, it has ranged from 16% to 54%. [4,15-18]. Early diagnosis and therapy are essential for the prevention of morbidity and mortality of neonatal sepsis in the neonatal intensive care unit**.** The pathogens most often implicated in neonatal sepsis in developing countries differ from those seen in developed countries. Gram-negative and Gram-positive septicemia was encountered in 51.2% and 48.2% of the culture-positive cases in this study, which is comparable to a study conducted by Agnihotri et al., [1] which reported that Gram-negative and Gram-positive organisms were responsible for 59% and 41% of the septicemia cases, respectively. [9] Gram-negative organisms are more common and are mainly represented by *Klebsiella spp., Escherichia coli, Pseudomonas spp.* and *Acinetobacter spp.* Of the Gram-positive organisms *CoNS* and *Enterococcus spp.,* were common. *Coagulase negative Staphylococcus species* (CoNS) were(n=58, 30%) followed by *Klebsiella pneumoniae* (n=49,25.3 %) which is similar to study conducted by Arunava Kali et al.,[10] Where *coagulase negative Staphylococcus species* (CoNS) was isolated in 32.8% and was the most common organism followed by were *Klebsiella pneumoniae* 18.7%. Low birth weight, presence of central venous catheters (CVC), indwelling devices, mechanical ventilation and parenteral nutrition are important risk factors associated with CoNS. It typically demonstrate low virulence but is associated with morbidities in the premature infant, including chronic lung disease and adverse neurodevelopmental outcomes. CoNS infections are also associated with prolonged hospital stay and increased hospital costs. [11]

Presentation of sepsis varies depending on severity of the disease process and immune status of the neonate. In this study, respiratory distress was the common presentation which was similar to studies done by Khante SV et al. [12] and Satyamurthi et al. [13] 5 isolate were candida species which was similar to the study done by Gandhi S et al. [18]

The Gram negative isolates showed high resistance to Ampicillin (100%), Ceftriaxone (100%), followed by Co-trimoxazole (25%), and Ciprofloxacin (25%), which is similar to the study done by Pavan Kumar et al from Southern India which reported 100%, 52.9% and 31.2% resistance to ampicillin, gentamicin and third-generation cephalosporin respectively among Gram negative bacilli. [10] Bhat et al from South India and Chandel et al in a multi-centric study reported similar findings. [17, 20] Imipenem, Piperacillin-tazobactam, were effective with lower resistance rates of 9.3% and 19.7% respectively.

In this present study, all the isolates were resistant to Ampicillin, erythromycin and ciprofloxacin resistance was seen in 62.5% of isolates. Cefoxitin resistance was found in 80% isolates of CoNS.

CONCLUSION

In this study the most common organisms causing sepsis were Coagulase negative staphylococci followed by Klebsiella pneumoniae. Gram positive organisms were most sensitive to Vancomycin while Gram negative isolates were most sensitive to Amikacin, Imipenem and Pipericillin-tazobactam. High resistance to commonly used antibiotics like cephalosporins was noted. Emergence of antibiotic resistance among bacterial isolates is a major cause for treatment failure, higher morbidity and mortality. The epidemiology of neonatal sepsis and antibiotic susceptibility pattern helps in formation of antibiotic policy which guides the clinicians to start empirical antibiotic therapy.

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