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Bacteriological profile and antibiotic susceptibility of neonatal sepsis in a tertiary care hospital

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Abstract
Background: Neonatal septicemia is a significant cause of morbidity and mortality worldwide, especially so in developing countries. The present study was undertaken to determine the bacteriological profile and their antimicrobial susceptibility patterns of prevalent pathogens isolated from the blood of septicemic neonates.
Methods: A retrospective observational study was conducted in the NICU of a tertiary care hospital. The study duration was 24 months, from January 2018 to December 2019. All culture-positive neonatal cases were studied. Blood culture isolates, their susceptibility, and clinical outcomes were collected.
Results: Of the 105 blood samples from neonates with suspected sepsis, septicemia could be confirmed by culture in 31.42% of cases. Of the total cases 45.46%, were of early onset septicemia and 54.54% were of late-onset sepsis. In the present study, gram-negative organisms predominated being responsible for 75.75% of cases of septicemia. *Klebsiella pneumoniae* was found to be the predominant pathogen, followed by Acinetobacter spp. accounting for 33.33% and 18.18% of cases, respectively. Coagulase-negative Staphylococcus 12.12% was a common pathogen in gram-positive isolates. Maximum sensitivity for ciprofloxacin, amikacin, and chloramphinicol was exhibited for *K. pneumoniae* (63.63%, 63.63%, and 81.81%, respectively,). Amikacin and chloramphinicol were sensitive, even in the rest of the gram-negative isolates. Staphylococci aureus strains, including MRSA, methicillin-resistant staphylococci aureus were 100% sensitive to vancomycin in our setup.
Conclusions: This study highlights the predominance of gram-negative organisms in neonatal sepsis and the emergence of multidrug resistance of gram-positive and gram-negative organisms to commonly used antibiotics. To understand and prevent the emergence of resistant organism's, periodic surveillance of organisms and their antibiotic sensitivity patterns are essential.

Keywords: Blood culture, Klebsiella, neonatal sepsis, antibiotic sensitivity

Introduction

Neonatal sepsis is a clinical syndrome with systemic signs of circulatory compromise due to invasion of the bloodstream with bacteria [1]. The incidence of neonatal sepsis is 30 per 1000 live births, according to the National Neonatal Perinatal Database (NNPD, 2002-03) [2]. Systemic infections cause 1.6 million neonatal deaths every year, the majority of developing countries [3].

Neonatal sepsis may be classified as early onset neonatal sepsis (EOS) and late-onset neonatal sepsis (LOS), according to the time of onset of disease [4]. Early onset sepsis (EOS) (less than 72 hours) infections are caused by organisms prevalent in the maternal genital tract or in the delivery area. Late onset sepsis (LOS) (greater than 72 hours) infections are caused by organisms thriving in the external environment of the home or hospital [5].

Neonatal sepsis is an important cause of morbidity and mortality among neonates and is one of the leading causes of neonatal mortality in India [6]. Gram negative organisms (65-85%) were found to be more frequently responsible for septicemia than gram-positive organisms (15%), as evidenced by Indian studies [7]. Bacterial isolates and the antibiotic susceptibility have been constantly changing, depending on several factors.[8] Successful treatment with a favorable outcome of the neonate depends on an ongoing review of the causative organisms and their antibiotic susceptibility patterns [8, 9].

The present study was undertaken to determine the bacteriological profile and their antimicrobial susceptibility patterns of prevalent pathogens isolated from the blood of septicemic neonates.

Methods

This was a retrospective observational study conducted in the NICU of a tertiary care hospital. The study duration was from January 2018 to December 2019. The study included all blood culture-positive cases from babies admitted to the NICU.

Sample collection

Blood samples from these neonates were collected with strict aseptic precautions.

Blood culture: 1-2 mL venous blood was inoculated into a blood culture bottle containing 10-20 mL of sterile tryptose phosphate broth. The samples were processed using a standard bacteriological procedure [10].

Antimicrobial susceptibility testing was performed using the Kirby-Bauer disc diffusion susceptibility method in accordance with Clinical Laboratory Standards Institute (CLSI) guidelines [11].

All culture-positive neonatal cases were studied. Blood culture isolates, susceptibility patterns, and clinical outcomes were collected. Descriptive statistics included the percentage of different categories for categorical variables.

Results

Out of 105 blood samples from neonates with suspected sepsis, septicemia could be confirmed by culture in 31.42% (33 out of 105) of cases. The total NICU admissions during the study duration were 633. Thus, the incidence of culture-positive sepsis was 5.21%.

Of the 33 cases, 15 cases (45.46%) were of early onset septicemia (EOS — septicemia within 72 h of life) and 18 cases (54.54%) were of late-onset septicemia (LOS — septicemia after 72 h of life).

Table 1: Bacteriological profile of neonatal sepsis

Bacterial isolates	Number	Percentage (%)
Gram negative isolates		
Klebsiella pneumoniae	11	33.33
Acinetobacter spp.	6	18.18
Citrobacter freundii	3	9.09
Escherichia coli	2	6.06
Non fermenting gram negative bacilli	2	6.06
Enterobacter cloacae	1	3.03
Gram positive isolates		
Coagulase negative staphylococci	4	12.12
Staphylococcus aureus	2	6.06
Enterococcus faecalis	2	6.06

In the present study, gram-negative organisms predominated being responsible for 75.75% of cases of septicemia. *Klebsiella pneumoniae* was found to be the predominant pathogen, followed by Acinetobacter spp. accounting for 33.33% and 18.18% of cases, respectively. Other gram-negative organisms isolated were *Citrobacter* freundii, *Escherichia coli*, non fermenting gram negative bacilli, and Enterobacter cloacae. Coagulase-negative Staphylococcus 12.12% was found to be a common pathogen in gram-positive isolates. Other gram-positive isolates were Staphylococcus aureus and Enterococcus faecalis, See Table 1.

Table 2: Antimicrobial sensitivity pattern for gram- negative isolates

	Klebsiella pneumonia (n=11) No. (%)	Acinetobacter spp (n=6) No. (%)	Citrobacter freundii (n=3) No. (%)	Escherichia coli (n=2) No. (%)	Non fermenting gram negative bacilli (n=2) No. (%)	Enterobacter cloacae (n=1) No. (%)
Amikacin	63.63	66.67	66.67	50	100	100
Chloramphenicol	81.81	83.33	100	50	100	100
Ampicillin	0	16.67	0	0	50	100
Cefotaxime	0	16.67	0	0	50	100
Ceftriaxone	18.18	50	66.67	0	50	100
Ciprofloxacin	63.63	16.67	33.33	0	50	100
Cotrimoxazole	0	16.67	33.33	0	50	100
Gentamicin	36.36	16.67	33.33	50	50	100
Imipenem	36.36	16.67	33.33	0	50	100
Meropenem	18.18	0	0	0	50	100
Carbicillin	0	0	33.33	0	50	100
Piperacillin	36.36	16.67	33.33	0	50	100
Ofloxacillin	36.36	33.33	0	0	50	100

The maximum sensitivity for ciprofloxacin, amikacin, and chloramphenicol exhibited *K. pneumoniae* (63.63%, 63.63%, and 81.81%, respectively). Amikacin and chloramphinicol were sensitive, even in the rest of the gram-negative isolates. Meropenem, imepenem, piperacillin, and ofloxacin showed low sensitivity in gram-negative isolates of Klebsiella, Acinetobacter, Citrobacter, and E. coli. Resistance ranging from 50% to 73% was observed in gram-negative isolates (Klebsiella, Acinetobacter, Citrobacter, and E.coli) for co-trimoxazole, cefotaxime, ampicillin, and ceftazidime See Table 2.

Table 3: Antimicrobial sensitivity patterns for gram-positive isolates

	Coagulase negative staphylococci (n=4) No. (%)	Staphylococcus aureus (n=2) No. (%)	Enterococcus faecalis (n=2) No. (%)
Amikacin	25	50	0
Cefazoline	0	0	0
Amoxicillin	0	0	0
Ciprofloxacin	0	0	0

Gentamicin	25	50	0
Cotrimoxazole	50	50	50
Penicillin	0	0	0
Vancomycin	100	100	100
Teicoplanin	75	100	0
Cefotaxim	0	50	50

Gram-positive isolates showed resistance ranging from 50% to 100% against co-trimoxazole, cefazoline, amoxicillin, and penicillin. Vancomycin and teicoplanin showed 100% sensitivity for Staphylococcus aureus strains, including MRSA, methicillin resistant staphylococci aureus in our setup. *Enterococcus* is another isolate that showed 100% susceptibility to vancomycin and 50% susceptibility to cotrimaxazole and cefotaxime, see Table 3.

Discussion

Out of 105 blood samples from neonates with suspected sepsis, septicemia could be confirmed by culture in 31.42% (33 out of 105) of cases. Over the years, there has been a wide variation in the growth positivity by blood culture. A higher isolation report was seen by Nazeer S *et al.*, Murty *et al., and R*ajendraprasad *et al. were 57.45%, 52.6 and 47.5%,* respectively [12, 13, 14]. In studies by Muley *et al.* and Monsef A *et al.*, positive cultures obtained were found to be 26.6% and 25.2%, respectively [15, 16].

Of the 33 cases, 15 cases (45.46%) were of early onset septicemia and 18 cases (54.54%) were of late-onset septicemia. Of these, 75.75% of cases occurred within 7 days of life. Clustering of cases in the first week of life reflects immature immunological response (deficit phagocytic migration, sub optimal activation of complement) in the first few days [17, 18]. Study by R S Jaswal *et al.* (74%) and Shrestha P *et al.* (66.9 %) showed a higher proportion of LOS cases [19, 20]. Higher percentage of EOS was seen in the studies done by Tallur *et al.* (83.47%) and Roy *et al.* (71.30%), Movahedian *et al.* have reported 81.5% cases of early onset neonatal septicemia [21, 22, 9].

Gram-negative organisms accounted for 75.75% of all positive blood cultures. According to Nazeer S *et al.* and Muley *et al.* studies, gram-negative organisms accounted for 87.71 and 70.8%, respectively [12, 15].

Klebsiella pneumoniae was found to be the predominant pathogen, followed by *Acinetobacter* spp. accounting for 33.3% and 18.8% of cases, respectively *K pneumoniae* was reported as a predominant pathogen in NNPD Report 2002-2003[2] and Roy *et al.* [9] and Muley *et al.* [15] from India and by Iregbu *et al.* [23] from Nigeria *K. pneumoniae* can survive in the environment for a long time and is widely distributed and therefore has the potential to be transmitted from the environment to the patients through practices that breach infection control measures. Cross-contamination and nosocomial transmission may play a significant role in the etiology of *Klebsiella septicemia* [21]. Predominance of *K pneumoniae* as the causative agent of neonatal sepsis may be due to the selective pressure of antimicrobial agents [24].

Other gram-negative organisms isolated were *Citrobacter* freundii, *Escherichia coli*, Non fermenting gram negative bacilli, and Enterobacter cloacae. *Pseudomonas aeruginosa* was the most common organism by (36%) Movahedian AH *et al.* study and *E. coli* was common organism for Moncef *et al.* study [22, 16].

In this study, *CONS* was the most common gram-positive microorganism isolated. These findings are consistent with Nazeer S *et al.*, Movahedian AH *et al.* studies [12, 22]. A study done by Karthikeyan *et al. S. aureus* is the most common gram-positive organism isolated [25]. The prevalence of different organisms causing neonatal sepsis at various institutes is of great significance and should be notified and can be useful for treating patients.

A high proportion of organisms resistant to commonly used antibiotics is an alarming in our study. Resistance ranging from 50% to 73% was observed in gram-negative isolates (Klebsiella, Acinetobacter, Citrobacter, and E.coli) for co-trimoxazole, cefotaxime, ampicillin, and ceftazidime. Also there is low sensitivity for drugs like meropenem, imepenem, and piperacillin to above organisms. Maximum sensitivity for ciprofloxacin, chloramphenicol, and amikacin was exhibited not only by *K. pneumoniae* but also by the rest of the gram-negative isolates. This has been corroborated by many other studies [14, 15, 25]. The sensitivity pattern in our study suggests that the initial empirical choice of therapy in the form of ampicillin/cefotaxime and gentamicin are show low susceptibility to gram-negative organisms.

Gram-positive isolates showed resistance ranging from 50% to 100% against co-trimoxazole, cefazoline, amoxicillin, and penicillin. Similarly, for gram- positive *CONS*, the low sensitivity to cefotaxime and amikacin is alarming. Higher susceptibility to Vancomycin can justify its use. Vancomycin remains the drug of choice for MRSA strains in our set up.

This study concludes that empiric therapy for suspected neonatal septicemia should cover both gram-negative bacilli and gram-positive cocci, particularly *Klebsiella pneumoniae* and *CONS*. There is an increasing trend in antibiotic resistance to the commonly used first-line drugs. The pattern of sensitivity is changing; hence, continuous surveillance for antibiotic susceptibility is needed to ensure correct empirical therapy before blood culture reports are available.

References

1. Edmond K, Zaidi A. New approaches to preventing, diagnosing and treating neonatal sepsis PLOS Med. 2010; 7(3):e1000213.
2. NNPD Network. National Neonatal-Perinatal Database: Report for 2002-2003, ICMR, New Delhi, 2005.
3. Saving Newborn lives. The state of the world's newborns: A report from saving newborn lives, Washington DC: Save the Children, 2001.
4. Aletayeb SM, Khosravi AD, Dehdashtian M, Kompani F, Mortazavi SM, Aramesh RM. Identification of bacterial agents and antimicrobial susceptibility of neonatal sepsis: A 54-month study in a tertiary hospital, African Journal of Microbiology Research. 2011; 5(5):528-31.
5. Clinical laboratory standards institute. Performance standard for antimicrobial susceptibility testing; seventeenth informational supplement M100-S17; 27(1) Clinical laboratory standards institute Wayne PA USA, 2007.

6. Desai KJ, Malek SS, Parikh A. Neonatal septicemia: bacterial isolates & their antibiotic susceptibility patterns Gujarat Med J. 2011; 66(1):13-5.
7. Gotoff SP, Behrman RE. Neonatal septicaemia J Pediatr. 1970; 76(1):142-53.
8. Mathur NB. Neonatal Sepsis Indian Pediatr. 1996; 33:663-74.
9. Roy I, Jain A, Kumar M. Bacteriology of neonatal septicemia in tertiary care hospital of northern India, Indian J Med Microbiol. 2002; 20(3):156-9.
10. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. Jr 6th ed Philadelphia: Lippincott Williams & Wilkins, Koneman's Color atlas and textbook of diagnostic microbiology, 2006.
11. Pennsylvania. USA: Clinical Laboratory and standards institutes, performance standards for antimicrobial susceptibility testing: twenty first informational supplement M100-S21, 2011.
12. Khan SN, Joseph S. Neonatal sepsis: antibiotic sensitivity and resistance pattern of commonly isolated pathogens in a neonatal intensive care unit of a teritiary care hospital, South India, Int J Pharm Bio Sci. 2012; 3(4):802-9.
13. Murty DS, Gyaneshwari M. Blood cultures in pediatric patients: A study of clinical impact, Indian J Med Microbiol. 2007; 25:220-4.
14. Rajendraprasad BP, Basavaraj KN, Antony B. Bacterial spectrum of neonatal septicemia with their antibiogram with reference to various predisposing factors in a tertiary care hospital in Southern India, Ann trop med public health. 2013; 6:96-9.
15. Muley VA, Ghadage DP, Bhore AV. Bacteriological profile of neonatal septicemia in a tertiary care hospital from Western India, *J Glob Infect Dis*. 2015; 7(2):75-77.
16. Moncef A, Eghbalian F. Antibiotic sensitivity pattern of common bacterial pathogens in NICU and neonatal ward in Hamedan province of Iran Health. 2010; 2(06):625-9.
17. Nelson Essential of Pediatrics. Elsevier publishers & distributor Pvt. Ltd. twenty first edition, 1256.
18. Ghai OP, Paul VK, Bagga A. Essential pediatrics. CBS Publishers & Distributors Pvt. Ltd. Ninth edition, 2018, 136-8.
19. Jaswal RS, Kaushl RK, Goel A. Role of C-reactive protein in deciding duration of antibiotic therapy in neonatal septicemia, Indian Pediatr. 2003; 40:880-3.
20. Shrestha P. Clinical and Bacteriological profile of blood culture positive sepsis in newborns, J Nepal Paediatr Society. 2007; 27(2):64-7.
21. Tallur SS, Kasturi AV, Nadgir SD. Clinico bacterio-logical Study of Neonatal Septicemia in Hubli, Indian J Pediatr. 2000; 67(3):169-74.
22. Movahedian AH, Moniri R, Mosayebi Z. Bacterial culture of neonatal sepsis, Iranian J Pub Health. 2006; 33:84-9.
23. Iregbu KC, Elegba OY, Babaniyi IB. Bacteriological profile of neonatal septicemia in a tertiary hospital in Nigeria, Afr Health Sci. 2006; 6:151-4.
24. Klein JO, Marchy SM. Bacterial sepsis and meningitis. In: Remington JS, Klein JO, editors, Infectious diseases of the fetus and newborn Infants, 4th ed. Philadephia: W.B Saunders, 1995, 36-90.
25. Karthikeyan G, Premkumar K. Neonatal sepsis: Staphylococcus aureus as the predominant Pathogen, Indian J Pediatr. 2000; 68:715-7.