



PREVALENCE OF NEONATAL SEPTICEMIA AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN IN TERTIARY CARE HOSPITAL

Microbiology

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ABSTRACT

Background- Neonatal sepsis is defined as clinical syndrome in an infant of 28 days life or younger, manifested by systemic signs of infection and isolation of bacterial pathogen from blood stream. Neonatal septicemia has serious consequences such as shock, multi-organ failure, disseminated intravascular coagulation (DIC) & death. Most common etiological agent of neonatal sepsis are *S.aureus*, *E. coli*, *P. aeruginosa*, *K. pneumoniae*, *Acinetobacter baumannii*. This study was conducted to know the prevalence of neonatal septicemia. **Method-** This observational cross sectional study was conducted in the department of Microbiology from the period March 2022 to May 2022. Total 150 clinically suspected neonatal septicemia cases were enrolled and blood culture was performed using Bactec 340 FX system. Isolates were identified by standard techniques & antibiotic susceptibility was performed as per the CLSI guidelines. **Result-** Out of total 150 suspected cases of neonatal septicemia, 50(33%) were culture proven. In culture proven septicemia, 39 (78%) were early onset septicemia and 11(22%) were late onset septicemia. Gram positive isolates (74%) were more compared to gram negative isolates (26%). All gram positive isolates were sensitive to Vancomycin and Linezolid. Gram negative isolates were sensitive to carbapenem and polymyxin B. **Conclusion-** Development of sepsis in neonate is a medical emergency. If local microbiological database is available with the information regarding commonly isolated organisms and their drug resistant patterns, it can help the clinician in empirical therapy.

KEYWORDS

Neonatal sepsis, blood culture, Vancomycin, Polymyxin B, Antimicrobial database

INTRODUCTION

Neonatal sepsis is defined as a clinical syndrome in an infant of 28 days life or younger, manifested by systemic signs of infection the blood stream & isolation of bacterial pathogen from the blood stream.⁽¹⁾ The clinical presentation of neonatal sepsis includes fever, respiratory distress and refusal to feed, jaundice and temp. dysregulation.⁽²⁾ Sepsis occurring in the first 72 hrs. of life is defined as early onset sepsis(EOS) and that occurring beyond 72 hrs as late onset sepsis (LOS).⁽³⁾

Maternal risk factors like premature rupture of membranes, chorioamnionitis, Multiple gestation and caesarian sections are associated with increased risk of EOS. LOS occurs as result of postnatal nosocomial infections or community acquired infections.⁽⁴⁾ Neonatal sepsis is caused by various gram positive and gram negative organisms and candida.⁽⁵⁾

The Prevalence of neonatal septicemia in India is estimated to be 36-55%.⁽⁶⁾ Neonatal sepsis claims over 1.5 million infants life each year, the majority in Saharan Africa & southeast Asia.⁽⁷⁾ In developing countries, Gram negative bacteria remains the major source of infection however, in developed countries gram positive organisms have been implicated as major sources.⁽⁵⁾

The spectrum of organisms that causes neonatal sepsis changes over time and varies from region to region. This is due to the changing pattern of antibiotic use and changes in lifestyle.⁽⁸⁾ Further management of these infections is complicated by emergence of multi-drug resistant organisms reported from intensive care unit.⁽⁹⁾ Microbial invasion of blood stream can have serious consequences such as shock, multi-organ failure, disseminated intravascular coagulation (DIC) & death.⁽¹⁰⁾ Hence this study was conducted to know the prevalence of neonatal septicemia.

Objectives-

To estimate prevalence of neonatal septicemia and antimicrobial susceptibility pattern in tertiary care hospital

Material and method-

This was observational cross sectional study conducted in DVVPF' medical college and hospital for period of 3 months from Mar 2022 to May 2022 after obtaining approval from institutional ethical committee.

Inclusion criteria-

Neonate less than 28 days of life, presented with clinical sign and symptoms of sepsis in DVVPF' medical college and hospital during this study period.

Exclusion criteria-

infants more than 28 days of life 2 ml of blood collected under aseptic precaution and inoculated in Bactec Dickinson ped plus aerobic bottles and incubation performed in the bactec 340 FX system.

All positive bottles were subjected to Gram stain, subculture on blood agar and MacConkey agar. The plates were incubated at 37° c for 24 hrs. Growth was identified by colony morphology, Gram stain, and standard biochemical test. Antimicrobial susceptibility was performed using Kirby Bauer disc diffusion method as per CLSI guidelines. The antibiotic discs procured from Hi Media and were as follows- penicillin 10 U, Cefoxitin 30 µg, ceftriaxone 30 µg, Gentamicin 10/120 µg, cotrimoxazole 1.25/23.75 µg, Ciprofloxacin 5 µg, amoxicillin clavulanic acid 20/10 µg, Vancomycin 30 µg, linezolid 30 µg, Piperacillin Tazobactam (100/10 µg), Imipenem 10 µg, Polymyxin B 300 U. Statistical analysis was performed by using SSPS software.

RESULT-

During this study period, out of total 150 suspected cases of neonatal septicemia, 50(33%) were culture proven. In culture proven septicemia 39 (78%) were early onset septicemia and 11(22%) were late onset septicemia.

Table 1 . Pathogens (n=50) isolated from blood samples

Name of the isolate	Total no.	%age
<i>S. aureus</i>	21	42
<i>S. epidermidis</i>	16	32
<i>E.coli</i>	4	8
<i>Acinetobacter baumannii</i>	3	6
<i>P. aeruginosa</i>	6	12
Total	50	100

Gram positive isolates (74%) were more as compared to gram negative isolates (26%). Antibigram of gram positive isolates revealed that, among *S. aureus*, 11 isolates were susceptible to penicillin, Cefoxitin, Gentamicin and 7 were susceptible to cotrimoxazole. All isolates of *S. aureus* susceptible to Vancomycin and Linezolid. Among *S. epidermidis*, 16 were susceptible to Vancomycin, 13 to Gentamicin, 6 to penicillin and Cefoxitin, least susceptibility to cotrimoxazole.

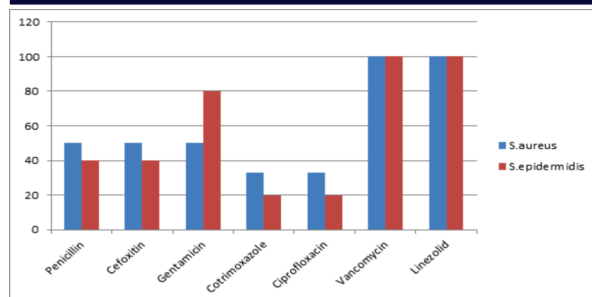


Figure 1. Antimicrobial susceptibility profile of gram positive isolates (n=37)

S. aureus was the predominant isolate. All gram positive isolates were susceptible to Vancomycin & linezolid.

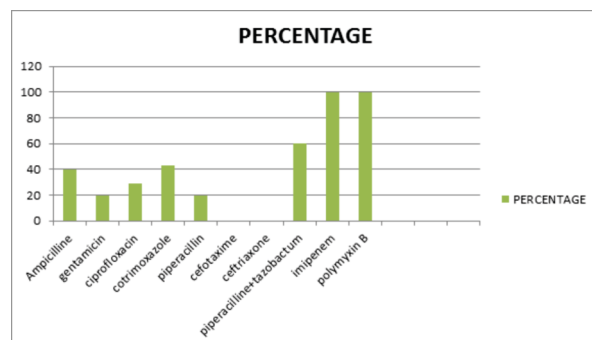


Figure 2. Antimicrobial susceptibility profile of gram negative isolates (n=13)

All gram negative isolates were susceptible to Imipenem and Polymyxin B (100%) followed by Piperacillin –tazobactam (60%). All gram negative isolates were not susceptible to third and fourth generation cephalosporin. Least susceptibility was reported for Gentamicin and Piperacillin.

DISCUSSION-

Early diagnosis and therapy are essential for prevention of morbidity and mortality of neonatal sepsis in the neonatal intensive care unit. In our study among 150 blood samples processed from clinically suspected neonatal septicemia cases, 50 (33%) samples showed culture positivity. Similar culture positivity rate has been reported by Mondal et al.⁽¹¹⁾ Higher positivity rate of 48% and 62% were reported by Bhattacharjee et al.⁽¹²⁾ and Rehman S. et al.⁽¹³⁾

A lower culture positivity rate of 4.1% reported by Altayeb et al.⁽¹⁴⁾ A low blood culture isolation rate could be due to administration of antibiotics before blood collection, blood culture techniques⁽¹⁵⁾ or sepsis due to anaerobic, viral or fungal pathogens.⁽¹⁶⁾

Blood culture positivity was higher in (EOS) early onset sepsis (78%) as compared to (LOS) late onset sepsis (22%). This was similar to the study done in Iran where EOS and LOS was 64% and 30 % respectively.⁽¹⁴⁾

Gram positive organisms (74%) were predominant as compared with gram negative organisms (26%).

S. aureus was the predominant isolate which was in contrast to the study⁽¹⁴⁾ where *K. pneumoniae* was the most common pathogen. Similar to our finding of *S. aureus* as predominant isolate of neonatal septicemia, Ahmed S.⁽¹⁷⁾ in Bangladesh reported the same. CONS were found in 33 % cases in our study. In a study in Santiago⁽¹⁸⁾, highest incidence of sepsis due to *S. epidermidis* was observed in neonates.

Gram negative organisms were isolated in 26% cases which was comparable to Galhotra et al.⁽¹⁹⁾ study. *Pseudomonas aeruginosa* was the predominant gram negative isolate whereas in study done by Ghotasalou R.⁽²⁰⁾ and Sundaram V.⁽²¹⁾ *Klebsiella* was the predominant gram negative isolate.

In our study 50 % *S. aureus* resistant to penicillin. Kumar⁽²²⁾ and Iregbu⁽²³⁾ reported high level of resistance to penicillin.

Staphylococcal isolates were 100 % sensitive to Vancomycin which was similar to Ghotasalou⁽²⁰⁾ study. Most of gram negative isolates were resistant to third generation cephalosporin but susceptibility to them reported by Ahmed et al.⁽¹⁷⁾ All gram negative isolates susceptible to carbapenem similar to study done in Iran.⁽²⁴⁾ To conclude, in our study, gram positive organisms were predominant. *S. aureus* was the most common isolate and the prevalence of early onset septicemia (EOS) was higher.

CONCLUSION

The prevalence of neonatal septicemia noted in this study was 33%. Development of sepsis in neonate is a medical emergency and generally clinicians do not wait for microbiological reports and start treatment empirically. If local microbiological databases are available with information regarding commonly isolated organisms and their drug resistant patterns, it can help clinicians in empirical therapy. We recommend to rationalize the use of antibiotics and implement policies to slow down this rapid rise in multidrug resistant organisms. This requires the studies on spectrum of pathogens and their antimicrobial sensitivities to be carried out regularly and frequently in neonatal ICUs.

Conflict of interest

This study has no conflict of interest to be declared by any author.

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REFERENCES

- Edwards MS, Baker CJ. Sepsis in newborn, in Krugman's Infectious disease of children. Gershon AA, Hostet PJ, Katz SL, USA, ,Eds. Mosby, Philadelphia Pa, 2004;545
- B.J.S.A.Stoll, "Infections of the neonatal infant," in Nelson textbook of paediatrics, Elsevier, Philadelphia, 20 th edition, 2015 ,pp909-925
- Stoll BJ, Hansen NI, Sanchez PJ, Faix RG, Poindexter BB, Van Meurs KP, et al. Early Onset Neonatal sepsis: the burden of group B streptococcal and E.coli disease continues. Pediatrics. 2011; 127(5):817-26
- M. H.Tsai, J. F. Hsu, S.M. Chu et al. Incidence, clinical characteristics and risk factors for adverse outcome in neonates with late onset sepsis, The paediatric infectious disease journal, 2014; vol 33 (1):pp7-pp13
- Jumah DS, Hassan MK. Predictor of mortality outcome in neonatal sepsis. Medical J Basrah university. 2007;25:11-8
- Jain A, Roy I, Gupta MK, Kumar M, Agarwal SK. Prevalence of expected spectrum beta lactamases producing gram negative bacteria in septicemic neonates in a tertiary care hospital. J Med Microbiology 2003;52(5):421-5
- S. Vergano, M. sharland, P. Kazembe, C. Mwansambo and P. Heath, Neonatal sepsis: an international perspective. Archives of disease in childhood, Fetal and neonatal edition, 2005, vol 90(3): pp F220-F224
- Shreshtha P, Das BK, Bhatta NK, Jha DK, Das B, Setia A et al. Clinical & bacteriological profile of blood culture positive sepsis in new borns. J Nepal Paedr Soc. 2008;27:64-70
- Kartikayan G, Premkumar K. Neonatal sepsis: *Staphylococcus* as the predominant pathogen. Indian J of Paediatr. 2001;68:715-717
- Gotoff SP. Neonatal sepsis and meningitis, In: Nelson Textbook of Paediatrics. Phila 18th edition, Behrman RE, Kleigmen RM. Arbin AM Eds Philadelphia. WB Saunders company. 1996;528-37
- Mondal GP, Raghawan M, Bhat BV. Neonatal septicemia among inborn and outborn babies in a referral hospital. Indian J of Paediatrics. 1991;58:529-33
- Bhattacharjee A, Sen MR, Prakash P, Gaur A, Anuprba S. Increased prevalence of extended spectrum betalactamases producers in neonatal septicemic cases at a tertiary referral hospital. Indian J of Medical Microbiology. 2008;26:356-60
- Rahman S., Hameed A, Roghani MT, Ullah Z. Multidrug resistant neonatal sepsis in Peshawar, Pakistan. Arch Dis Child Fetal Neonatal Ed 2002;87:p52-4
- Alatayeb SM, Khosarvi AD, Dehdasthian M, Kompani F, Mortazavi SM, Aramesh MR. Identification of bacterial agents and antimicrobial susceptibility of neonatal sepsis: A 54 month study in a tertiary care hospital. African J Microbiol Res. 2011;5:528-31
- Bansal S, Jain A, Agarwal J, Malik GK. Significance of coagulase negative staphylococci in neonates with late onset septicemia. Indian J of pathology Microbiology. 2004;47:586-8
- Agnihotri N, Kaistha N, Gupta V. Antimicrobial susceptibility of isolates from neonatal septicemia. Jpn J Infect Dis. 2004;57:273-5
- Ahmed AS, Chowdhury MA, Hoque M, Dramstadt GL. Clinical and bacteriological profile of neonatal septicemia in a tertiary level pediatric hospital in Bangladesh, Indian Pediatr 2002;103:4-9
- Rodriguez Cervilla J, Fraga JM, Gracia Riestra C, Fernandez Lorenzo JR, Martinez Soto I. Neonatal sepsis: Epidemiologic indicator and relation to birth weight and length of hospitalizing time. An Esp Pediatr 1998;48:401-8
- Galhotra S, Gupta V, Bains HS, Chhina D. Clinico-bacteriological profile of neonatal septicemia in a tertiary care hospital. J Mahatma Gandhi Inst Med Sci 2015;20:148-52
- Ghotasalou R, Ghorashi Z, Nahaei MR. *Klebsiella pneumoniae* in neonatal sepsis: A 3 year study in the pediatric hospital of Tabriz, Iran. Jpn J Infect Dis 2007;60:126-8
- Sundaram V, Kumar P, Dutta S, Mukhopadhyay K, Ray P, Gautam V, et al. Blood culture confirmed bacterial sepsis in neonates in North Indian tertiary care center: changes over the last decade. Jpn J Infect Dis 2009;62:46-50
- Kumhar GD., Ranchandran VG, Gupta P. Bacteriological analysis of blood culture isolates from neonates in a tertiary care hospital in India. J Health Popul Nutr 2002;20:343-7
- Iregbu KC, Elegba OY, Babaniyi IB. Bacteriological profile of neonatal septicemia in a tertiary care hospital in Nigeria Afr Health Sci 2006;6:151-4
- Lyytikäinen O, Nuroti JP, Halmesmaki E, Carlson P, Uotila J, Vuento R, et al. Invasive Group B streptococcal infections in Finland: A population based study. Emerg Infect Dis 2003;9:469-73