Section: Pediatrics

Original Research Article

MICROBIOLOGICAL PROFILE OF NEONATAL SEPSIS IN NICU OF TERTIARY CARE HOSPITAL

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Abstract

Background: Septicaemia is a significant source of morbidity and mortality in neonatal wards, and it is imperative to conduct a periodic evaluation of cases to detect any changing trends in the infecting organisms and their antibiotic susceptibility. The aim is to study the Microbiological profile of neonatal sepsis in NICU. **Materials and Methods:** A total of 40 neonates with suspected sepsis were assessed. Detailed medical history and physical examination was conducted on each neonate. Comprehensive maternal history was obtained. Blood sample for culture was obtained from a peripheral vein or artery, with all antiseptic precautions. Age, gender, weight, mode and place of birth, presenting symptoms, and symptoms indicative of sepsis were all taken into consideration. All isolates were also tested for antibiotic susceptibility on Muller Hinton agar with commercially available discs (Hi media) by utilising the Kirby Bauer disc diffusion method, in accordance with NCCLS guidelines. **Result:** Male predominance was seen with 52.5% and females being 47.5%. The male: female ratio was 1.10:1. In majority of the cases, Klebsiella was found to be predominant pathogen in 47.5%, Acinetobacter in 15% of the cases. Piptaz/Amikacin was sensitive in 25% of the pathogens; Piptaz/Meropenem was sensitive in 15%. **Conclusion:** Regardless of clinical signs of septicaemia, neonatal sepsis screening should be performed if risk factors for sepsis are present. Antibiotic usage that is rational and appropriate reduces the emergence of multidrug resistant bacteria in neonatal facilities.

INTRODUCTION

Neonatal sepsis is a bacteraemia clinical condition defined by systemic infection signs and symptoms in the first month of life.[1] Systemic diseases of the neonates, such as septicaemia, meningitis, and pneumonia, are all encompassed in neonatal sepsis.[2]

Neonatal sepsis is described as a bacteraemia-related clinical condition accompanied by systemic signs and symptoms of infection that occurs within the first four weeks of life. In 2.3 % of intramural live births, septicaemia occurs. The neonatal period accounts for more than 40% of all mortality among children under the age of five globally.[3] Severe infections are estimated to cause more than one million new born mortality globally each year, with one million deaths owing to neonatal sepsis or pneumonia alone, according to the World Health Organization.[4]

The morbidity of new born sepsis varies greatly by region. In developed countries, the rate of neonatal sepsis ranges from 1 to 5 cases per 1,000 live births, but it increases in underdeveloped countries, with rates ranging from 49 to 170 cases per 1,000 live births. In developing nations like India, neonatal mortality is quite high.[5] Neonatal mortality is predicted to affect 5 million babies worldwide, with 3.2 million deaths occurring in the first week of life. According to a global assessment, India faces one-fourth of the global burden of new born mortality, with over 1.2 million neonates dying each year. Sepsis is one of the leading causes of neonatal mortality in India.

Based on the postnatal age of onset, neonatal sepsis may be divided into two types: The first seven days of life are marked by early-onset neonatal sepsis (EOS), whereas the seventh day is marked by late-onset neonatal sepsis (LOS). LOS is caused by organisms acquired after delivery and is classified as nosocomial community-acquired infections. EOS is caused by microorganisms from the maternal genital tract before or at the time of birth, whereas LOS is caused by organisms acquired after delivery and is classified as nosocomial community-acquired infections.[6]

Infectious pathogens can be transmitted in a variety of ways from mother to foetus or new born child. Transplacental haematogenous spread can occur at

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various stages of pregnancy. Vertical transmission of infection can occur in utero, shortly before or during birth. Several variables influence the prevalence and severity of new born infection, emphasising the significance of early detection and treatment.

With the increased complexity of neonatal intensive care, new-borns who are gestationally younger and have a lower birth weight are surviving and surviving in a setting with a high risk of infection for longer periods of time. Subclinical infection, moderate to severe signs of localised or systemic infection, and it may mimic the characteristics of other diseases, causing the diagnosis of infection to be overlooked or delayed until the process has progressed widely are some of the clinical manifestations of neonatal infections. Because of one or more immunologic abnormalities, new-born new-borns are less capable of reacting to infections. Bacteria, viruses, fungi, and protozoa are among the pathogenic agents that infect new-borns. Shigella dysenteries type 1, Streptococcus agalactiae, Serratia marcescens, Streptococcus pyogenes, Proteus mirabilis, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, Salmonella typhi, gram positive organisms like Staphylococcus aureus, Coagulase negative staphylococcus, Streptococcus viridans, Enterococcal species, Citrobacter freundii, Enterobacter aerogenes and Acinetobacter calcoaceticus.

As a result of the changing profile, it was decided to conduct a study to identify the agents causing neonatal septicaemia as well as their antibiotic sensitivity. This will aid in rationalising therapy and evaluating the management.

MATERIALS AND METHODS

Department: Department of Paediatrics, NICU. Princess Esra Hospital.

Sample size: 40

Type of Study:

Random Prospective Observational Study

The following criteria were used to collect blood samples from 40 clinically suspected cases of new born septicaemia:

Inclusion Criteria

- Neonates suspected to have sepsis.
- Temperature > 99 degree Fahrenheit or < 95 degree Fahrenheit Diarrhoea.
- Drowsy or unconscious.
- Respiratory rate more than 60 per minute.
- Seizures.
- Not accepting feed.
- Abnormal cry.
- Septic focus on skin or umbilicus.
- Change in behaviour.

Exclusion Criteria

- Clinically not suspected septic neonates.
- No characteristics indicating probable sepsis.
- Prior antibiotic administration.

Each infant's thorough medical history and physical examination was done. A comprehensive and relevant maternal history was gathered. A blood sample for culture is obtained from a peripheral vein or artery, with all antiseptic precautions done. Age, gender, weight, mode and place of birth, presenting symptoms, and symptoms indicative of sepsis were all taken into consideration.

All isolates were tested for antibiotic susceptibility on Muller Hinton agar using commercially available discs (Hi media) using the Kirby Bauer disc diffusion method, as per NCCLS guidelines.

Statistical Analysis

The data was entered in the excel and SPSS22 software was used for statistical analysis. The data was presented in the form of tables with numbers and percentages.

Ethical Clearance

Ethical Clearance was obtained from the institutional ethics committee prior to the commencement of the study.

RESULTS

A total of 40 neonates with high probability of sepsis were included.

Male predominance was seen with 52.5% and females being 47.5%. The male: female ratio was 1.10:1.

Around 67.5% of the infants were below 2.5kgs and the rest 32.5% of the infants had a birth weight of 2.5 to 3.5 kgs. The mean birth weight was 2.15 $\pm$ 0.57 kgs.

Around 75% were out born and 25% were inborn.

Around 70% of the infants were preterms with gestational age between 28 – 36 weeks, rest 30% are term deliveries with gestational age of 37 to 38 weeks. The mean gestational age was 35.02 $\pm$ 2.43 weeks.

Around 72.5% were AGA, 25% were SGA and 2.5% were LGA.

In 12.5% of the neonates EOS was observed and in 87.5% of the cases it was LOS.

In neonatal risk factors, HMD was reported in 7.5%, birth asphyxia in 5% and HIE stage 3, RDS, IDM, MSL, NEC-1, Hirschsprung's was reported in 2.5% of the cases each.

Majority of the mothers around 65% belonged to the age group of 21 to 30 yrs., 27.5% belonged to >31 yrs. age group and 7.5% belonged to <20 yrs. age group. The mean maternal age was 26.75 $\pm$ 5.02 yrs.

In maternal risk factors was reported in 47.5% of the cases of which, PPROM was reported in 12.5% of the cases, Hypothyroidism in 7.5% of the cases, Oligohydramnios, DM, PIH in 5% of the cases each. Thalassemia trait, Abruptio placentae, AEDF, MSL, TORCH was reported in 2.5% of the cases each.

In majority of the cases, Klebsiella was found to be predominant pathogen in 47.5%, Acinetobacter in 15%, Pseudomonas and Spingobacterium in 7.5% of the cases each, Candida sepsis, MRSA in 5% of the

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cases each, Staph Aureus, Salmonella, Candida, Citrobacter Freundii, Polymicrobion was the pathogen prevalent in 2.5% of the cases each.

Piptaz/Amikacin was sensitive in 25% of the pathogens, Piptaz/Meropenem was sensitive in 15%, Piptaz and Meropenem/vancomycin was sensitive in 10% of the pathogens each. Levofloxacin and Meropenem/Collistin was sensitive in 7.5% of the pathogens each. Meropenem/Levoflox, Cefepime/Meropenem and Fluconazole/amphotericin B was sensitive in 5% of the pathogens each. Meropenem, Colistin/Fluconazole, Liposomal Amphotericin and Mero/Vanco/Piptaz was sensitive in 2.5% of the pathogens each.

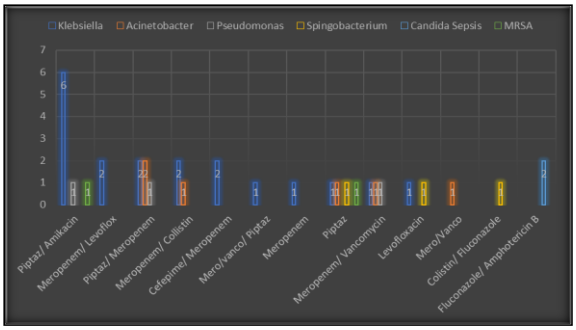

Figure 1: Correlation of Pathogen isolated with antibiotic sensitivity

Klebsiella: Out of 19 Klebsiella isolated, Piptaz/ Amikacin was sensitive in 15% of the cases, Meropenem/ Levoflox, Piptaz/ Meropenem, Meropenem/ Collistin and Cefepime/ Meropenem was sensitive in 5% of the cases each. Mero/vanco/ Piptaz, Meropenem, Piptaz, Meropenem/ Vancomycin and Levofloxacin was sensitive in 2.5% of the cases each.

Acinetobacter: Out of 6 Acinetobacter isolated, Piptaz/ Meropenem was sensitive in 5% of the cases. Meropenem/ Collistin, Piptaz, Meropenem/ Vancomycin and Mero/Vanco was sensitive in 2.5% of the cases each.

Pseudomonas: Out of 3 Pseudomonas isolated Piptaz/ Amikacin, Piptaz/ Meropenem and Meropenem/ Vancomycin was sensitive in 2.5% of the cases each.

Spingobacterium: Out of 3 Spingobacterium isolated, Piptaz, Levofloxacin and Colistin/ Fluconazole was sensitive in 2.5% of the cases each.

Candida Sepsis: Out of 2 Candida Sepsis isolated, Fluconazole/ Amphotericin B was sensitive in 2.5% of the cases each.

MRSA: Out of 2 MRSA isolated, Piptaz and Piptaz/Amikacin was sensitive in 2.5% of the cases each.

Table 1: Distribution based on Gender

Gender	Frequency	Percentage
Male	21	52.5%
Female	19	47.5%
Total	40	100%

Table 2: Distribution based on Neonatal parameters

Birth weight	Frequency	Percentage
<2.5 kgs	27	67.5%
2.5 – 3.5 kgs	13	32.5%
Inborn/Out born		
Inborn	10	25%
Out born	30	75%
Gestational Age		
28 – 36 weeks	28	70%
37 – 38 weeks	12	30%
Gestational Age status		
AGA	29	72.5%
SGA	10	25%
LGA	1	2.5%
Type of Sepsis onset		
EOS	5	12.5%
LOS	35	87.5%
Risk factors		
Hyaline Membrane disease (HMD)	3	7.5%
Birth Asphyxia	2	5%
HIE stage 3	1	2.5%
RDS	1	2.5%
Hirschsprung's	1	2.5%
Infants of diabetic mothers (IDM)	1	2.5%
Meconium stained liquor (MSL)	1	2.5%
Necrotizing enterocolitis (NEC) - 1	1	2.5%

Table 3: Distribution based on maternal parameters

Maternal age	Frequency	Percentage
<20 yrs.	3	7.5%
21 – 30 yrs.	26	65%

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>31 yrs.	11	27.5%
Maternal History		
PRIMI parous	12	30%
Multi Parous	28	70%
Risk factors		
Preterm premature rupture of the membranes (PPROM)	5	12.5%
Hypothyroidism	3	7.5%
Oligohydramnios	2	5%
Diabetes Mellitus	2	5%
PIH	2	5%
Thalassemia trait	1	2.5%
Abruptio placentae	1	2.5%
Absent end-diastolic flow (AEDF)	1	2.5%
Thin meconium stained liquor (MSL)	1	2.5%
TORCH	1	2.5%
Total	19	47.5%

Table 4: Distribution based on Pathogen Blood culture

Blood Culture	Frequency	Percentage
Klebsiella	19	47.5%
Acinetobacter	6	15%
Pseudomonas	3	7.5%
Spingobacterium	3	7.5%
Candida Sepsis	2	5%
MRSA	2	5%
Staph Aureus	1	2.5%
Salmonella	1	2.5%
Candida	1	2.5%
Citrobacter Freundii	1	2.5%
Polymicrobion{ Spingomonas+candida}	1	2.5%

Table 5: Distribution based on Antibiotic sensitivity

Antibiotic Sensitivity	Frequency	Percentage
Piptaz/Amikacin	10	25%
Piptaz/Meropenem	6	15%
Piptaz	4	10%
Meropenem/vancomycin	4	10%
Levofloxacin	3	7.5%
Meropenem/Collistin	3	7.5%
Meropenem/Levoflox	2	5%
Cefepime/Meropenem	2	5%
Fluconazole/amphotericin B	2	5%
Meropenem	1	2.5%
Colistin/Fluconazole	1	2.5%
Liposomal Amphotericin	1	2.5%
Mero/Vanco/Piptaz	1	2.5%
Total	40	100%

Table 6: Correlation of Pathogen isolated with antibiotic sensitivity

Antibiotic Sensitive	Klebsiella (n=19)	Acinetobacter (n=6)	Pseudomonas (n=3)	Spingobacterium (n=3)	Candida Sepsis (n=2)	MRSA (n=2)
Piptaz/ Amikacin	6	0	1	0	0	1
Meropenem/ Levoflox	2	0	0	0	0	0
Piptaz/ Meropenem	2	2	1	0	0	0
Meropenem/ Collistin	2	1	0	0	0	0
Cefepime/ Meropenem	2	0	0	0	0	0
Mero/vanco/ Piptaz	1	0	0	0	0	0
Meropenem	1	0	0	0	0	0
Piptaz	1	1	0	1	0	1
Meropenem/ Vancomycin	1	1	1	0	0	0
Levofloxacin	1	0	0	1	0	0
Mero/Vanco	0	1	0	0	0	0
Colistin/ Fluconazole	0	0	0	1	0	0
Fluconazole/ Amphotericin B	0	0	0	0	2	0

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DISCUSSION

The Microbiological profile of new born sepsis differs depending on location. Gram-positive and Gram-negative bacteria, as well as Candida, cause neonatal sepsis.[7] The variety of organisms that cause sepsis varies by geography and changes with time, even within the same area.[8,9] Group B Streptococcus is the main cause of new born septicaemia in the United States.[10] However, the most prevalent pathogen causing neonatal septicaemia in China, according to a recent national neonatal perinatal database, is Klebsiella pneumoniae, followed by Staphylococcus aureus.[11] In this study Klebsiella was found to be predominant pathogen in 47.5%, Acinetobacter in 15%, Pseudomonas and Spingobacterium in 7.5% of the cases each, Candida sepsis, MRSA in 5% of the cases each, Staph Aureus, Salmonella, Candida, Citrobacter Freundii, Polymicrobion was the pathogen prevalent in 2.5% of the cases each. Two other studies on neonatal septicaemia, published by Muhammad et al,[12] and Agnihotri et al, respectively,[13] contradict these findings. Staphylococcus aureus was the most prevalent isolate in both studies, occurring in 27 percent of patients in the former and 35 percent of cases in the latter. Acinetobacter was the most prevalent isolate among the gram-negative bacteria found in this study. Because of their frequent isolation in recent years, Acinetobacter species are gaining prominence as a possible pathogen in neonatal septicaemia. Acinetobacter was isolated in 15% of the total septicaemia cases in this study, which is comparable with the prevalence of Acinetobacter sepsis reported from China (6.5–31.5%).[14] In new-borns who have intravenous catheterization and artificial ventilation, Acinetobacter septicaemia is prevalent.[15] Prematurity and/or LBW are the most significant neonatal factors that predispose to infection, since they frequently necessitate extended intravenous access, endotracheal intubation, or other invasive procedures that provide a portal of entry for infection.[16] Prematurity and LBW are associated with an increased risk of sepsis in new-borns. Furthermore, in a Brazilian investigation, the use of a central venous catheter and mechanical ventilation were found to be major risk factors for new born Acinetobacter septicaemia.[17]

In this study, the number of risk factors present was correlated to blood culture positivity. It is reasonable to deduce that as the number of risk factors increases, so does the probability of septicaemia in the neonate. In such circumstances, septicaemia screening tests must be performed routinely.

The standard approach is to begin empirical antibiotic therapy of neonates suspected of developing septicaemia as soon as possible. Nonetheless, the quandary of unneeded antibiotic exposure in this vulnerable group persists, fostering an environment for emerging bacterial resistance and the probability of poor prognosis. Survivors of neonatal sepsis, on the other hand, are at risk of both short- and long-term neuro-developmental morbidity.

CONCLUSION

The gold standard for diagnosing neonatal sepsis is by blood culture. Blood culture has a strong association with the risk factors for neonatal sepsis. Regardless of clinical signs of septicaemia, neonatal sepsis screening should be performed if risk factors for sepsis are present. Antibiotic usage that is rational and appropriate reduces the emergence of multidrug resistant bacteria in neonatal facilities.

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