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Research article

BACTERIOLOGICAL PROFILE OF NEONATAL SEPTICEMIA: A RETROSPECTIVE ANALYSIS FROM A TERTIARY CARE HOSPITAL IN LONI

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ABSTRACT

Background: Septicemia continues to be a major cause of neonatal mortality and morbidity worldwide. Epidemiology and surveillance of neonatal sepsis helps in implementation of rational empirical antibiotic strategy. **Objectives:** To study the bacteriological profile and antibiotic sensitivity pattern and types of neonatal septicemia among the suspected blood & CSF samples coming to Microbiology Department of Pravara Rural Hospital. **Methodology:** All the reports fulfilling the eligibility criteria were studied for Percentage of neonatal sepsis in suspected blood and CSF samples, Percentage of bacteriological sepsis (Gram-positive and Gram-negative sepsis), Bacterialogical profile, Percentage of EOS (Early Onset Sepsis) and LOS (Late Onset Sepsis) in confirmed cases, Antibiotic Sensitivity Tests. **Result:** The study showed a culture positivity of 259 blood culture samples (23.31%) for bacterial growth out of 1111 and 36 (5.99%) positive out of 601 C.S.F culture samples. Early onset sepsis (92.54%) was found to be predominant with Klebsiella the predominant EOS pathogens and Coagulase Negative Staphylococci (CONS) as predominant LOS pathogen. Gram Negative sepsis (59.32%) predominated in this study. In this study the predominant organisms were found to be Klebsiella (28.81%).The antibiotic sensitivity testing showed that gram negative isolates were sensitive to Meropenem and gram positive isolates to Linezolid, Netilmicin and Chloramphenicol . **Conclusion-** The most common bacteria causing neonatal sepsis was found to be Klebsiella and the gram negative samples showed highest sensitivity for Meropenem and Cefazolin was found to be most resistant. The gram positive samples showed highest sensitivity for Linezolid and Penicillin and Ampicillin were found to be most resistant.

Keywords: Neonatal Sepsis, Rural, Antibiotic Sensitivity,Culture ,Bacteriological Profile

INTRODUCTION

Neonatal septicemia refers to a generalized bacterial infection that has been documented by positive blood culture or CSF culture during the first 28 days of life and it is an important cause of morbidity and mortality in neonates[1]. In common clinical usage, neonatal sepsis specifically refers to the presence in a neonate of a bacterial blood stream infection, such as meningitis, pneumonia, pyelonephritis or gastroenteritis in the setting of fever.

According to the World Health Organization (WHO) estimates, there are about 5 million neonatal deaths a year, 98% occurring in developing countries with neonatal infection being one of the major causes, causing about 1.6 million deaths annually [2]. Sepsis and meningitis are responsible for most of these deaths.

Neonatal septicemia is one of the four leading causes of morbidity and mortality among neonates in India

[3].The neonatal period accounts for 38 % of all deaths in children younger than 5 years. The National Neonatal Perinatal Database (NNPD) reported an incidence of 8.5 per 1000 live births for blood culture proven sepsis [4] .The incidence of sepsis in the neonate is greater than at any other period of life and varies from hospital to hospital depending on the rates of Prematurity, Prenatal care, conduct of labour and environmental condition in nurseries.

Neonatal sepsis may be classified according to the time of onset of disease as Early Onset Septicemia (EOS) i.e. from birth to 7 days and Late Onset Septicemia (LOS) i.e. from 7 days to 28 days. The clinical relevance is that the EOS is mainly due to bacteria acquired before or during delivery while LOS is from nosocomial or community sources.

The EOS infections are caused by organisms prevalent in the maternal genital tract or in the delivery area. The predisposing factors include low birth weight (LBW), prolonged rupture of membranes; foul smelling liquor, multiple per vaginum examinations, maternal fever, difficult or prolonged labour and aspiration of meconium.

The LOS infections are caused by the organisms thriving in the external environments of the home or the hospital. The infection is often transmitted through the hands of the care-providers. The predisposing factors include LBW, lack of breastfeeding, poor cord care, superficial infection (pyoderma, umbilical sepsis), aspiration of feeds, and disruption of skin integrity with needle pricks and use of intravenous fluids.

In the literature, however there is little consensus as to what age limits apply, with EOS ranging from 48 hours to 7 days after delivery. This makes it difficult to compare studies where cases are grouped into EOS and LOS without further details.

Neonatal meningitis occurs in 2-4 cases per 10000 live births and contributes significantly to mortality from neonatal sepsis; it is responsible for 4% of all neonatal deaths .Since studies have shown the presence of neonatal meningitis in the absence of bacteremia it becomes significant to also examine the CSF culture to exclude the presence neonatal meningitis [5] .

A wide variety of bacteria may cause neonatal sepsis, to compound the problem, regional and temporal differences in etiological agents exist. The uncertainty surrounding the clinical approach to the treatment of neonatal septicemia can be minimized by periodic epidemiological surveys of etiological agents and their antibiotic sensitivity patterns leading to recognition of the most frequently encountered pathogens in a particular setting.

The epidemiological data from other developing countries shows important differences in the incidence, risk factors, pattern and antimicrobial sensitivities of the pathogens and mortality from that of developed countries. Group B streptococci disease is the most important cause of neonatal sepsis in Europe and North America, but there is a preponderance of gram negative organisms in tropical and developing countries like ours [6].

As neonatal septicemia is a life-threating emergency and delays in diagnosis and treatment with appropriate antibiotics may have devastating consequences, surveillance is needed to identify the common signs and the pathogens of neonatal septicemia in a particular area.

The purpose of this research is to give an overview of the burden of bacterial sepsis and meningitis in the newborn population in a rural setup. The focus will be on the pathogens mostly implicated and their antibiotic susceptibility pattern, as knowledge of the bacteriological profile of the etiologic agents would help to reduce the associated mortality in neonatal septicemia.

This is retrospective study at a rural tertiary hospital to determine the bacteriological profile of neonatal septicemia and the antibiotic sensitivity patterns of the isolated bacteria from the suspected blood and CSF samples. A retrospective analysis of 1111 blood samples and 601 CSF samples showing clinical picture suggestive of neonatal sepsis was done for a period of 2 years.

Aims & Objectives:

1. To find out the percentage of neonatal septicemia among the suspected blood & CSF samples coming to Microbiology Department in a rural tertiary hospital.
2. To determine the percentage of early onset sepsis & late onset sepsis in confirmed cases.
3. To determine the bacteriological profile of neonatal septicemia in a rural tertiary hospital.
4. To determine the antibiotic sensitivity of the isolated bacteria.

METHODOLOGY

Study design: This is a retrospective observational review of the reports of blood cultures & CSF cultures of all suspected cases of neonatal septicemia in a tertiary rural hospital for a period of two years.

Ethical consideration: Approval from Institutional Ethical Committee was dully taken and study was done after ethical clearance. Data collected from Medical records

The reports were obtained from the records of Microbiology department and were subjected to the following eligibility criteria:

Inclusion criteria: All the blood and C.S.F. samples of suspected cases of neonatal septicemia were considered. Sepsis was suspected if the mother showed evidence of chorioamniotis, prolonged rupture of membranes, diarrhea, fever or urinary tract infection and the neonate manifested systemic signs such as lethargy, chest retraction, grunting, abdominal distension, tachycardia, hypothermia etc.

Exclusion criteria: Cases of incomplete reporting were excluded from consideration. Aerobic spore bearers, wherever grown, were regarded as contaminants and excluded.

All the reports fulfilling the above eligibility criteria were studied for

1. Percentage of neonatal sepsis in suspected blood and CSF samples
2. Percentage of bacteriological sepsis (Gram-positive and Gram-negative sepsis), Bacterialogical profile
3. Percentage of EOS (Early Onset Sepsis) and LOS (Late Onset Sepsis) in confirmed cases
4. Antibiotic Sensitivity Tests

Statistical analysis: Data was tabulated by using the Microsoft excel and data was presented as percentage.

RESULTS

(i) Percentage of neonatal sepsis in suspected blood and CSF samples : During the study period of 2 years, 1712 neonates were clinically diagnosed as having sepsis of which 259 (23.31%) out of 1111 were confirmed by blood culture and 36 (5.99%) out of 601 were confirmed by CSF culture.

(ii) Percentage of Gram-positive and Gram-negative sepsis: Of the 295 organisms isolated 175 (59.32%) were gram negative and 120 (40.67%) were gram positive. The predominant gram negative organism isolated were Klebsiella (48.57%) and Pseudomonas (26.85%) followed by Acinetobacter and E.coli (both 10.28%) as shown in Fig.1 The predominant organisms isolated among the gram positive were CONS (44.16%) and Staph.aureus (37.50%) as shown in Fig 2.

(iii) Percentage of EOS (Early Onset Sepsis) and LOS (Late Onset Sepsis) in confirmed cases : Among the positive cases 273 (92.54%) were EOS and 22 (7.45%) were LOS as shown in Fig.3.The predominant organisms in EOS were Klebsiella (29.30 %) followed by CONS (17.21%), Pseudomonas (16.84%) and Staph.aureus (15.38%) as shown in Fig.4.The predominant organisms in LOS were CONS (27.27%),Klebsiella (22.72%) and Staph.aureus (13.63%) as shown in Fig.5.

(iv)Bacteriological profile of neonatal sepsis : In this study the predominant organisms were found to be Klebsiella (28.81%) followed by CONS (17.96%), Pseudomonas (15.93%) and Staph.aureus (15.25%) as shown in Fig. 6.

(v) Antibiotic Sensitivity testing : The antibiotic sensitivity testing showed that most of the gram negative isolates were sensitive to meropenem followed by chloramphenicol, ciprofloxacin , gentamicin and amikacin. They were not sensitive to the commonly used antibiotics like penicillin, ampicillin etc as shown in Fig.7.

The antibiotic sensitivity testing of the gram positive isolates showed that they were maximally sensitive to Linezolid, Netilmicin and Chloramphenicol as shown in Fig.8.

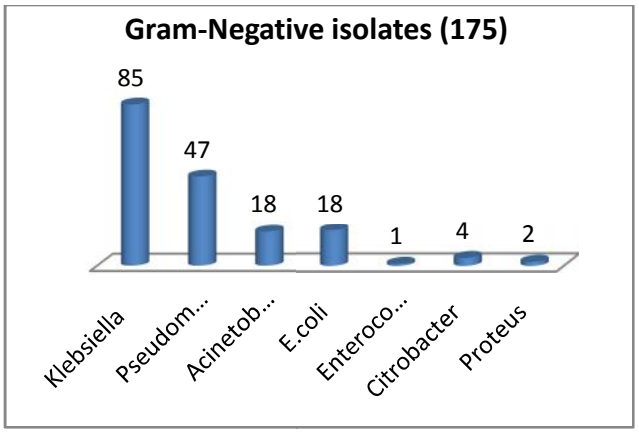

Fig 1: Gram Negative Organisms isolated

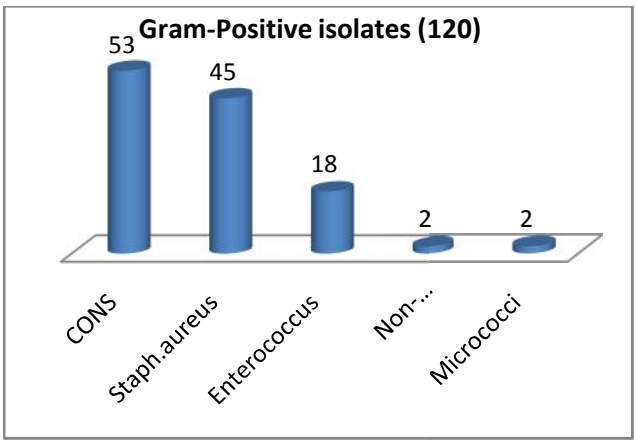

Fig 2: Gram Positive Organisms isolated

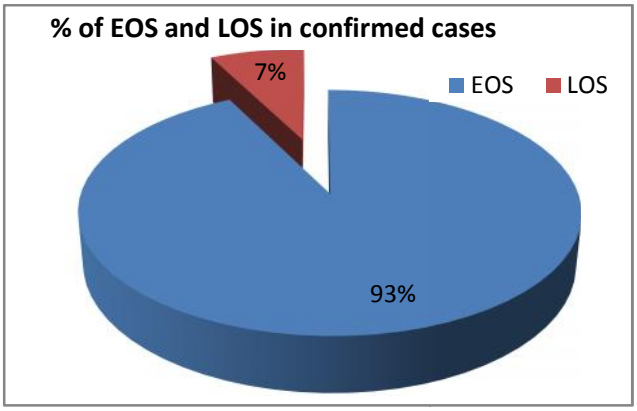

Fig 3: Percentage of EOS (Early Onset Sepsis) and LOS (Late Onset Sepsis) in confirmed cases

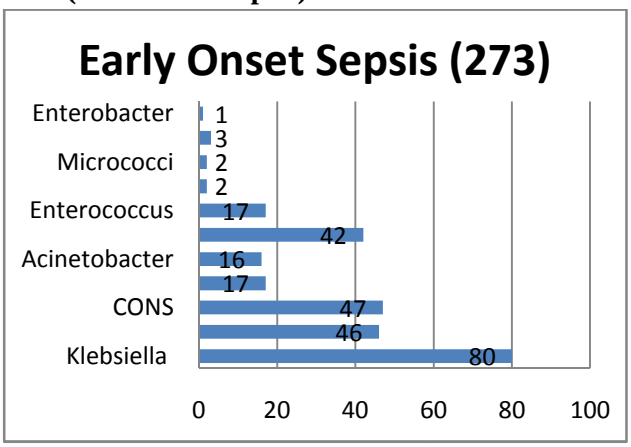

Fig 4: Organisms isolated in Early Onset Sepsis

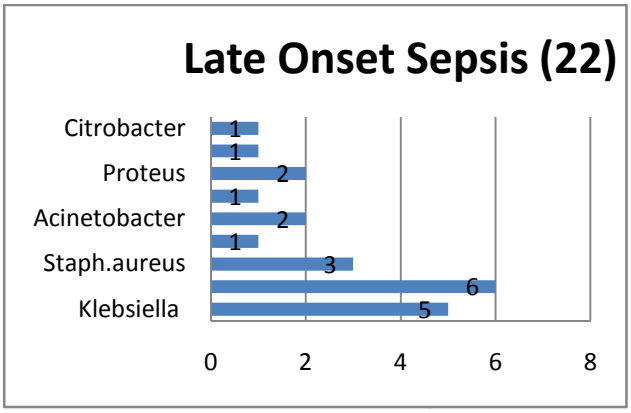

Fig 5: Organisms isolated in Late Onset Sepsis

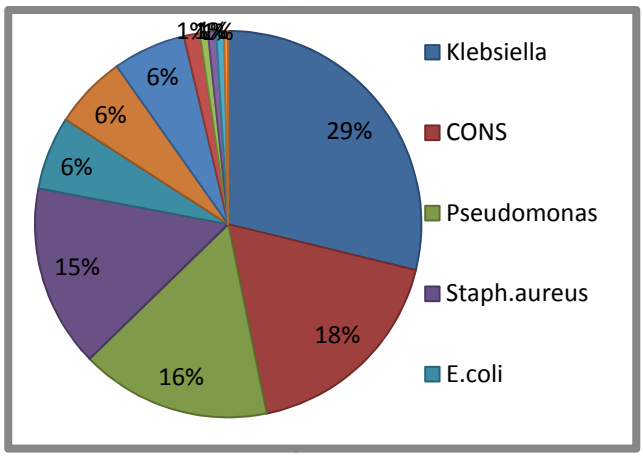

Fig 6: Bacteriological profile of Neonatal Sepsis

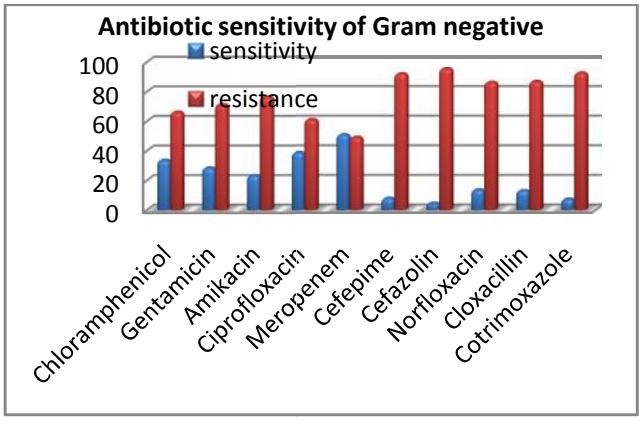

Fig 7: Antibiotic Sensitivity of Gram negative organisms

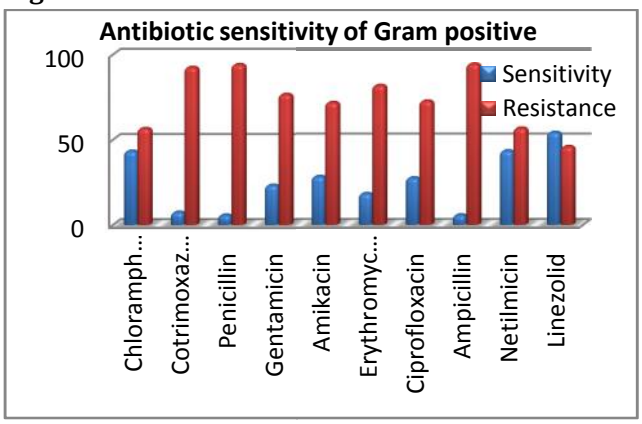

Fig 8: Antibiotic Sensitivity of Gram positive organisms

DISCUSSION

Clinical recognition of neonatal sepsis is not always straight-forward .Appropriate intervention requires an early etiological diagnosis. For effective management of neonatal sepsis cases , study of the bacteriological profile with their antibiotic sensitivity pattern plays an important role .Several studies on neonatal sepsis have documented the diversity of bacteria and their temporal variability. The present study reiterates the earlier findings and emphasizes the importance of

periodic surveys of microbial flora encountered in particular neonatal settings to recognize the trend. The culture positivity of the blood samples were 23.3% and the CSF samples were 5.99% .Similar blood culture positivity of around 24.88% was reported by Mathur et al in their study[7]. But a significantly higher blood culture positivity rate of 42% was reported by Ghanshyam et al in their study in a tertiary care hospital in India [8] and a lower blood culture positivity rate of 13.7% was reported by Kaistha et al in their study [9].The CSF culture positivity rates in the study by Katiyar et al was 2.06% which is lower than the findings in our study [10].

The low culture isolation rate in this study might be due to several reasons like administration of antibiotics before blood or CSF collection either to the mother or to the infant .Also the possibility of infection with anaerobes cannot be ruled out .Negative culture does not exclude sepsis as cases with negative blood culture have been reported with fatal illness and post-mortem evidence of infection .Chow et al reported that 26% of all neonatal septicemia was caused by anaerobes [11].

Early onset sepsis was found in majority of the confirmed cases rather than late onset sepsis .The percentage of EOS in this study was found to be 92.54% with Klebsiella, CONS, Pseudomonas and *Staph. aureus* being the predominant pathogens causing EO. The LOS was reported in 7.45% cases,with CONS, *Klebsiella* and *Staph.aureus* causing the LOS. Higher culture positivity rates in LOS were reported by P. Jyothi et al (25.2%) and Kaistha et al (14.18%) which differs from this study [12].All the other studies reported higher culture positive rates in EOS except in a study by Ahmed et al in Bangladesh which reported the positivity rates of EOS as low as 26%. They reported that the higher mortality rates in early onset cases to be the reason for this discrepancy [13] .

In this study, Gram negative organisms were isolated in about 59.32% of the cases with Klebsiella (48.57%) and Pseudomonas (26.85%) being the predominant ones among the gram negative organisms. Similar findings was reported by Ghanshyam et al with 60% gram negative isolates with Klebsiella as the predominant gram negative isolate [8].Comparatively a higher incidence of gram negative isolates was found in the study of Mathur et al (87.1%) [7].

In this study Gram Positive were isolated in 40.67% cases with CONS and Staph.aureus being the predominant pathogen. In the study by P.Jyothi et al, they also found CONS to the predominant Gram positive organism [12] but majority of the other studies reported Staph. aureus to be the predominant Gram positive organism over CONS [8, 9, 14] .Various studies have shown that in the last two decades, the isolation of Gram positive organisms has increased significantly [9].But nevertheless the predominance of gram negative corroborates with the findings of other studies done in the Indian context. Many studies have shown the preponderance of gram negative organisms in tropical and developing countries also [13, 15].

Klebsiella was found to be the predominant pathogen causing neonatal sepsis which is in accord with many studies like that of Ghanshyam et al (33.8%) , Zakariya et al (66%) , Mathur et al (38.5%) ,Kaistha et al (28.3%) and P.Jyothi et al (31%) which were done in India .Other studies from developing countries also found Klebsiella as the common organism. But studies done by Ahmed et al, Agnihotri et al and Bhat et al showed the predominant pathogen to be E.coli (30%),Staph.aureus (35.3%) and Pseudomonas (33.2%) respectively .

Group B Streptococcus (GBS) was not isolated in this study , unlike western , developed countries where it is the major agent of neonatal septicemia This may be attributed to low prevalence of GBS colonization of pregnant women in this area or possibly , to the presence of strains with low virulence [13].Since a sizeable number of culture specimens were negative by aerobic culture , the possibility of infection by anaerobes must be entertained and anaerobic culture can be performed routinely in cases of neonatal sepsis [8] . However, the feasibility, logistics and cost-effectiveness of routine anaerobic culture for neonatal sepsis need to be explored further.

The antibiotic sensitivity testing showed that most of the gram negative isolates were sensitive to meropenem followed by chloramphenicol ,ciprofloxacin ,gentamicin and amikacin .They were not sensitive to the commonly used antibiotics like penicillin , ampicillin etc .The antibiotic sensitivity testing of the gram positive isolates showed that they were maximally sensitive to linezolid ,netilmicin and cholramphenicol .This is comparable to the study

done by P. Jyothi et al in which maximum sensitivity was observed in imipenem and linezolid [12] .Netilmicin and amikacin was found to be highly sensitive in the study done by Agnihotri et al for Staph.aureus and gram negative isolatesrespectively [1] .While the study by Mathur et al showed Gentamicin to be sensitive in gram negative cases [7].Many studies also reported cefotaxime to have shown maximum sensitivity [7] but it could not be compared as some of the samples from this study had not undergone the sensitivity testing for cefotaxime . Besides the antimicrobial sensitivity patterns differs in different studies as well as at different times in the same hospital.This is because of emergence of resistant strains as a result of indiscriminate use of antibiotics.Thus ,Meropenem and Linezolid were found to the most sensitive drugs for gram negative and gram positive respectively , but these two drugs should not be used indiscriminately and kept as reserve drugs , otherwise resistance to these drugs may develop , thereby threatening the treatment .

Therefore, to conclude, an effective infection control programme which will among others ensure good and effective hand washing, regular antibiotic susceptibility surveillance and evaluation, and the enforcement and periodic review of the antibiotic policy of the hospital as well as the encouragement of rational antibiotic use will reduce the rates of acquiring neonatal infections and development of bacterial resistance.

CONCLUSION

Klebsiella was found to be the most common agent causing the neonatal sepsis followed by CONS, Pseudomonas, Staph.aureus and E.coli .Gram Negative sepsis predominated in this study. Early onset sepsis was found to be the major burden of neonatal sepsis in the rural setting.

Meropenem was found to the most sensitive drug for gram negative and Linezolid for gram positive. In the gram negative samples Cefazolin was found to be most resistant drug and Penicillin and Ampicillin in the gram positive.

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Conflict of interest: None declared

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