

Original Research Article

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## Bacteriological Profile and Anti Microbial Susceptibility Pattern of Neonatal Sepsis in a Tertiary Care Hospital

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### ABSTRACT

Neonatal sepsis refers to systemic and generalized infection of the newborn which is documented by a positive blood culture in the first four weeks of life. It is one of the four leading causes of neonatal mortality in India, to isolate bacterial pathogens in neonates with clinical suspicion of sepsis from blood samples and to study their antimicrobial susceptibility pattern. Blood samples collected from 1072 neonates with suspected sepsis were processed. Out of 1072 neonates 231(21.54%) were culture positive. 122(52.81%) of bacterial pathogens were isolated in early onset sepsis and 109(47.18%) in late onset sepsis. Among the isolated bacteria 126 (54.55%) were Gram negative and 105 (45.45%) were Gram positive. *Klebsiella* species and *Staphylococcus aureus* were the predominantly isolated organisms. Anti microbial susceptibility pattern revealed that Piperacillin-Tazobactam and Imepenem were the two most effective antibiotics against Gram negative bacteria and Vancomycin and linezolid still remains the most effective drug for *Staphylococcus aureus*. In neonatal sepsis knowledge of the commonly isolated organism and their anti- microbial susceptibility pattern in our geographical area, aids in the selection of appropriate antimicrobials for therapy.

#### Keywords

Early onset sepsis,  
Late onset sepsis,  
Pathogens.

#### Article Info

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### Introduction

Neonatal sepsis refers to systemic and generalized infection of the newborn which is documented by a positive blood culture in the first four weeks of life. It is one of the four leading causes of neonatal mortality in India (Agnihotri *et al.*, 2004). It is characterized by variable systemic physiologic changes triggered by infection, which continues to provide an extraordinary challenge to clinicians who manage critically ill neonates and children (Wynn *et al.*, 2010). It is estimated that up to 20% of neonates develop sepsis and approximately 1% die of sepsis related causes (Stoll, 1997). Current neonatal

mortality rate in India is 27/1000 live births (UNICEF, 2012). Neonatal sepsis has been classified as early onset sepsis (EOS) and late onset sepsis (LOS). Early onset sepsis presents within 72 hours of life. The source of infection is vertical transmission during labour or nosocomial. The neonate usually presents with respiratory distress, and pneumonia. The presence of the following risk factors like low birth weight babies, meconium stained liquor, premature rupture of membrane, prolonged labour has been associated with an increased risk of EOS (Aggarwal *et al.*, 2001; Belady *et al.*, 1997;

Kaftan *et al.*, 1998). Late Onset Sepsis (LOS) usually presents after 72 hrs of birth. The source of infection is either nosocomial or community acquired and neonates usually present with septicemia, pneumonia or meningitis (Baltimore, 1998; Wolach, 1997).

In most developing countries, Gram negative bacteria remain the major cause of neonatal sepsis (Anwer *et al.*, 2000). These organisms have developed increased drug resistance over the last two decades, since the spectrum of organisms that causes neonatal sepsis changes over time and varies from region to region, it is necessary to conduct periodic surveillance to access the changing pattern of organisms causing neonatal sepsis. The gold standard for diagnosis of septicemia is the isolation of pathogen from blood culture (Nwadioha *et al.*, 2010).

Hence the present study was undertaken to study the bacteriological profile of neonatal septicemia cases and their antibiotic susceptibility pattern for planning strategy for the management of these cases.

### **Materials and Methods**

Neonates with a clinical diagnosis of sepsis admitted in pediatric ward in a Tertiary care hospital attached to Medical College, during the period of June 2016–May 2017 were included in this retrospective study. About 1072 blood samples collected were processed by standard microbiological method. Antibiotic sensitivity testing was performed by Kirby- Bauer disc diffusion method as per CLSI guidelines.

### **Results and Discussion**

Out of 1072 cases 231 (21.54%) were culture positive and 841 (78.45%) were culture negative. 132 (22.56%) of males and 99 (20.32%) of females were culture positive.

Among the culture positive cases 122 (52.81%) were early onset sepsis (EOS) and 109 (47.18%) were late onset sepsis. 99(42.86%) of term babies and 132 (57.14%) of pre-term babies were culture positive. 102 (44.15%) of culture proven septic neonates had birth weight of more than 2500 gms which is appropriate for gestational age (AGA), and 129 (55.84%) were low-birth weight (LBW) less than 2500 gms (Tables 1–3).

Among the culture positive cases 126 (54.55%) were Gram negative bacteria and 105 (45.45) were Gram positive bacteria. Predominant Gram negative bacteria were *Klebsiella* species followed by *Escherichia coli*. *Staphylococcus aureus* was the predominant gram positive bacteria. Anti-microbial susceptibility pattern showed 27.43% of *Klebsiella* species, 12.5% of *Escherichia coli*, and 20% of *P. aeruginosa* were multi drug resistant. About 16.22% of *Staphylococcus aureus* were MRSA (Table 4).

In our study, positive blood cultures were found in 231(21.54%) of clinically suspected neonatal sepsis cases, similar to the results of previous studies by Hura Kanwaljeet Singh *et al.*, (2016); Khan *et al.*, (2012) and Kenneth Iregbu *et al.*, (2006).

Among the culture positive cases 132 (22.56%) of males and 99 (20.32%) of females were culture positive. This male predominance might be because of the importance given to the male infants and also because of more number of male infants born compared to female infants born (Jyothi *et al.*, 2013).

Among the culture positive cases 122 (52.81%) were early onset sepsis (EOS) and 109(47.18%) were late onset sepsis (LOS) which was almost similar to the findings of

Jyothi *et al.*, (2013). Most of the cases were detected by blood culture occurred in the first week of life, calls for close monitoring of the newborns especially those in high risk categories as soon as they born. 99(42.86%) of term babies and 132(57.14%) of preterm babies were culture positive. 102(44.15%) of culture proven septic neonates had birth weight of more than 2500 gms, and 129 (55.84%) neonates had low birth weight

(LBW) of less than 2500 gms. Most of the cases hospitalized were low birth weight babies and the preterm babies which were found similar to the study showed by Rania Mohammed Kishk *et al.*, (2014). In the present study Gram negative bacteria with 126 (54.55) isolates constituted major group of pathogens causing neonatal sepsis which correlates with the findings of Kumhar *et al.*, (2002); Hura Kanwaljeet Singh *et al.*, (2016).

**Table.1** Samples showing culture positivity and gender distribution

Blood culture	Male	Female	Total
positive	132 (22.56%)	99 (20.32%)	231 (21.54%)
negative	453(77.43%)	388 (79.67%)	841(78.45%)
Total	585 (100%)	487 (100%)	1072(100%)

**Table.2** Cases according to age of onset and culture positivity

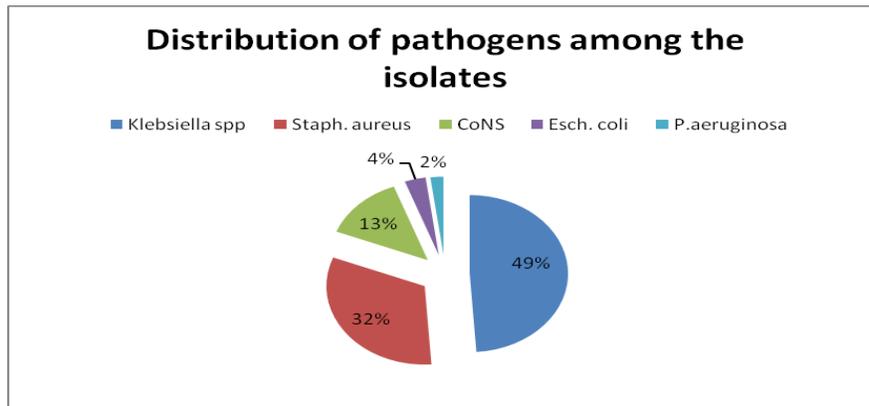
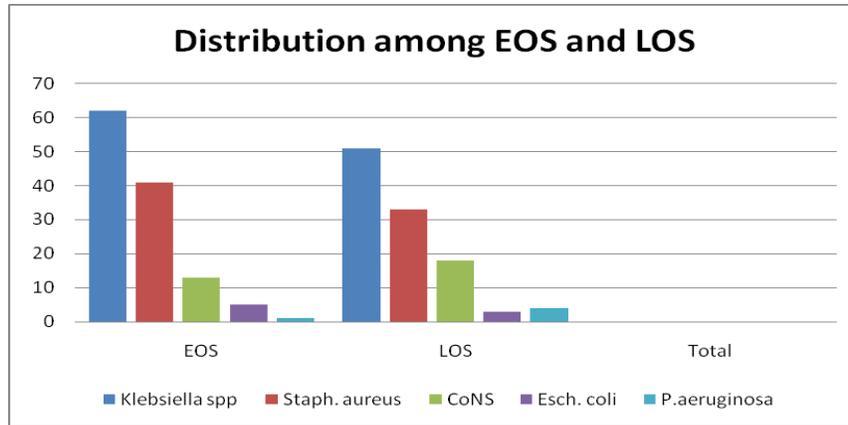
Age of onset	Positive	Negative
EOS	122(52.81%)	453(53.86%)
LOS	109(47.19%)	388(46.14%)
Total	231(100%)	841(100%)

**Table.3** Culture proven septic neonates as per gestational age (GA) and birth weight

Culture Positive cases n=231 (100%)	
Term	99 (42.86%)
Preterm	132 (57.14%)
Weight AGA > 2500g	102 (44.15%)
LBW <2500g	129 (55.84%)

**Table.4** Bacterial isolates in blood culture

Organism	EOS	LOS	Total
<i>Klebsiella</i> spp	62	51	113(48.92%)
<i>S. aureus</i>	41	33	74(32.03%)
CoNS	13	18	31(13.42%)
<i>E. coli</i>	5	3	8(3.46%)
<i>P. aeruginosa</i>	1	4	5(2.17%)
Total	122	109	231(100%)



**Table.5** Antibiotic sensitivity pattern of Gram positive isolates

Antibiotics	Staph (74)	CoNS (31)
Penicillin	32 (43.24%)	28(90.32%)
Gentamicin	37 (50%)	26(83.87%)
Cefoxitin	62 (83.78%)	30 (96.77%)
Vancomycin (E-Test)	74 (100%)	31 (100%)
Linezolid	74 (100%)	31 (100%)

**Table.6** Antibiotic sensitivity pattern for Gram negative bacterial isolates

Antibiotics	Klebsiella spp (113)	Esch. Coli (8)	P. aeruginosa (5)
Ampicillin	-	1 (12.5%)	-
Amikacin	76 (67.25%)	7 (87.5%)	3 (60%)
Cefotaxime	55 (48.67%)	5 (62.5%)	-
Ceftazidime	-	-	4 (80%)
Piperacillin/Tazobactam(PIT)	82 (72.57%)	6 (75%)	3 (60%)
Imipenem	113 (100%)	8 (100%)	5 (100%)
Meropenem	113(100%)	8 (100%)	5 (100%)

**Table.7** Multi-drug resistance among Gram negative bacteria

	Klebsiella spp. (n=113)	Escherichia coli (n=8)	P. aeruginosa (n=5)
No. of MDR isolates	31 (27.43%)	1 (12.5%)	1 (20%)
Antibiotic categories	1.Aminoglycosides 2.Extended spectrum cephalosporins 3.Anti-pseudomonal penicillin + beta lactamase inhibitor	1.Penicillins 2.Aminoglycosides 3.Extended spectrum cephalosporins 4.Anti-pseudomonal penicillin + beta lactamase inhibitor	1.Aminoglycosides 2.Anti-pseudomonal cephalosporins 3.Anti-pseudomonal penicillin + beta lactamase inhibitor

Among them, with 113 (48.92%) isolates *Klebsiella* species has been found to be the predominant pathogen which correlates with the findings of Madhu Sharma *et al.*, (2002) 105 (45.45%) of Gram positive organisms observed in our study coincides with I Roy *et al.*, (2002). Among the Gram positive organisms with 74 isolates (32.03%) *Staphylococcus aureus* was the dominant pathogen.

Results of the antimicrobial susceptibility pattern revealed that 33(26.19%) of the Gram negative organisms were multi-drug resistant. It has been shown that PIT, Imepenem and meropenem are the two most effective antibiotics against Gram negative organisms. Among the Gram positive bacteria, 12(16.22 %) of the *Staphylococcus aureus* were MRSA, and Vancomycin still remains the most sensitive drug for *S. aureus*, which correlates with findings of Roy *et al.*, (2002) (Tables 5–7):

In conclusion, the present study showed that Gram negative bacteria were the most common cause of septicaemia in neonates, with *Klebsiella* species as the predominant pathogen. Most of the Gram negative bacteria were multi-drug resistant and. Early detection of these strains is crucial to establish an appropriate anti-microbial therapy, thereby reducing the morbidity and mortality associated with these infections and also to prevent hospital acquired infections in neonates.

Formulating antibiotic policy and judicious use of higher antibiotics, strict aseptic precautions are the measures that can be taken to combat serious therapeutic challenge faced with emerging multi-drug resistant bacterial pathogen.

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