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Bacteriological and Antibiogram profile of sepsis in new-born in a tertiary referral hospital: A retrospective study

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ABSTRACT

Introduction: Neonatal infection could be a major reason for death and illness in new borns, significantly in growing countries. To minimize neonatal sepsis-related morbidity and mortality, paediatricians must thoroughly understand the bacterial flora present and their pattern of susceptibility to antibiotics. This study focused to investigate the etiological profile of culture-positive sepsis and antibiotics sensitivity pattern.
Material and Methods: All neonates hospitalized in the critical care unit of the government general hospital in Srikakulam were included in this prospective study, which was done over the course of a year from January 2021 to December 2021. All infants with a positive blood culture and a medical diagnosis of sepsis were identified. All neonate demographics, clinical information, parental risk factors, bacterial profiles, and patterns of antibiotic sensitivity were noted and analysed.
Results: A total of 556 newborns admission to the NICU during the study period out of these 282 cases were diagnosed as neonatal sepsis out of these 282 neonatal sepsis cases 52 cases were culture-positive sepsis. Most bacterial isolates from culture-positive sepsis were gram-negative, predominantly *Escherichia coli* ad *Klebsiella pneumonia* and they are having good susceptibility to meropenem, cefotaxime and amikacin. cultures with gram-positive species staphylococci were the most common microorganisms and it was good susceptibility to piperacillin-tazobactam and linezolid.
Conclusion: in the present study *K. pneumonia*, *E. coli* and were the more frequently isolated microorganisms, these organisms are very well susceptible to meropenem, cefotaxime and amikacin. So we recommend cefotaxime and amikacin as the first line of treatment in our institution and meropenem and piperacillin-tazobactam as the second line of empirical therapy in our institution.

1. Introduction

The current new-born death rate in India is twenty per thousand live births according to SRS (Sample Registration System) 2020.[1] The second-ranking factors in new-born fatalities in India are neonatal sepsis (33%) such as pneumonia, septicemia, and umbilical card infections.[2] According to the NNPD data, In India, there were 8.5 cases of blood culture-proven sepsis per 1000 live babies in 2002-2003.[3] Detecting neonatal sepsis early and administering the right medications can avoid the majority of infant deaths caused by it.

Sepsis may be categorised into early sepsis that develops within the first 72 hours of life and late sepsis, which typically develops after that time.[4] The early detection of sepsis might benefit from knowledge of the relevant risk factors.

The bacteriological characteristic that causes newborn septicemia differs between nations and might occasionally alter from one region to another within a same nation.[5] in developed countries like the USA and Europe,

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the predominantly isolated organism was Group B streptococci (GBS) and *E. coli*, in developing countries the predominant organism was Staphylococci and Gram-negative bacilli(*Klebsiella pneumoniae*).[6]

Even in the developing world, there are regional differences in the prevalence of bacterial pathogens that cause neonatal sepsis.[7]

In every institution Knowledge about the most common causative organism causing neonatal sepsis is most important to reduce neonatal mortality. Hence it is most important to understand the trend of micro-organisms causing new-born sepsis and antibiotic sensitivity of the micro-organism in that particular area.

Hence, in our tertiary care facility in India, this analysis was conducted to know the most frequent microorganisms triggering neonatal sepsis and their antiobiogram of AST.

2. Material and Methods

In the neonatal critical care unit at the Government General Hospital in Srikakulam, Andhra Pradesh, India, This prospective cohort research was completed. The research comprised neonates with clinical manifestations of sepsis who were hospitalized to the NICU between January 2021 and December 2021 and whose blood culture came up positive. The existence of both an isolated organism in a blood culture and the clinical signs and symptoms of sepsis were considered to be evidence of proven sepsis. Sepsis that develops within the first three days of life is referred to as early-onset neonatal sepsis, whereas sepsis that develops more than three days after birth is referred to as late-onset sepsis.[8] For all probable cases of neonatal sepsis, blood cultures were performed. Before commencing antibiotics, blood was drawn in our facility using aseptic techniques, and 2 ml of plasma was introduced to each of the two bottles carrying 20 ml of bile broth. These had spent the previous seven days growing at 37°C in an aerobic environment. On Nutrient agar and MacConkey agar plates, the first subculture was performed after one day of culture, the second subculture on the third day, and the final one on the seventh day. The antimicrobial susceptibility pattern for all neonatal cases with positive blood cultures was examined using the cup method as per the standards of the CLSI.

Blood culture registrations from microbiology laboratories have been examined for record-keeping purposes, and all infants with positive blood cultures have been identified. Following an evaluation of their data, the study was enrolled. Data were gathered on the patient's age at admission, gestational age at the start of the pregnancy, birth weight, parental risk factors, laboratory results, blood culture isolates, susceptibility pattern, and treatment outcomes.

3. Results

A total of 556 new-borns admission to the NICU during the study period out of these 282 cases were diagnosed as neonatal sepsis out of these 282 neonatal sepsis cases 52 cases were culture-positive sepsis. The culture-positive rate in our study was 18.4%. Among these 52 culture-positive sepsis cases 12 cases were preterm and 40 cases were term new-born babies, out of these males were 32 babies and females were 20 babies. Among these 26(50%) babies were delivered through spontaneous vaginal delivery and 22 (42.3%) babies through caesarean section 4 (7.7%) through instrumental delivery. All these parameters are shown in Table 1.

Table 1: Demographic details of the 52 neonates with culture-positive sepsis

Demographic details	Values
No. of Preterm neonates (%)	12(23.1%)
No. of Term neonates (%)	40(76.9%)
Sex	
Male	32
Female	20
Birth weight (kg), mean ± SD	2.45 ± 0.5 kgs
Mean age of presentation ± SD	5.35 ± 5.5
Type of delivery	
Caesarean section (%)	22 (42.3%)
Normal delivery (%)	26 (50%)
Instrumental delivery (%)	4 (7.7%)
Maternal data	
No. of Meconium aspiration cases (%)	12 (23.1%)
No. of premature membrane rapture cases > 24 h (%)	10 (19.23%)
Maternal fever	5 (9.6%)

Of the 52 culture-positive neonatal sepsis cases 21(40.4%) cases were early onset of sepsis and 31 (59.6%) cases were late onset of sepsis. In the early onset of culture-positive neonatal sepsis cases most common isolated organism was *Klebsiella pneumoniae*, and in the late onset of culture-positive neonatal sepsis cases most common isolated organism was *Escherichia coli*.

In our study, Of the 52 sepsis cases with positive cultures, 43 (82.7%) included gram-negative germs. In our investigation, the most frequent etiological agents of neonatal sepsis were *K. pneumoniae* (26.9%) and *E. coli* (26.9%). The most prevalent gram-positive agent was a type of *Staphylococcus* (11.5%). Table 2 lists the etiological factors for both early-onset and late-onset neonatal sepsis.

Observations on antibiotic sensitive profile among gram-negative *Escherichia coli* and *Klebsiella pneumoniae* high sensitive to meropenem (100%) accompanied by amikacin, cefotaxime and piperacillin-tazobactam. And other gram-negative organisms like Pseudomonas aeruginosa, Nonfermenting Gram-Negative Bacilli, and Proteus also show maximum susceptibility to meropenem

Table 2: Type of bacteria isolated in Culture positive Sepsis

Microorganism	Total (%)	Deaths (%)	Type of sepsis		Gestational age at birth	
			Early onset (%)	Late-onset (%)	Pre-term	Term
Escherichia coli	14 (26.9%)	1	5	9	4	10
Klebsiella pneumoniae	14 (26.9%)	1	8	6	2	12
Pseudomonas aeruginosa	9 (17.3%)		2	7	3	6
Staphylococcus species	6 (11.5%)	1	1	5		6
Proteus	4(7.7%)		3	1	1	3
Enterococci	3(5.77%)		2	1	1	2
Nonfermenting Gram-Negative Bacilli	2(3.85%)		0	2	1	1
Total	52	3 (5.77%)	21(40.4%)	31(59.6%)	12(23.1%)	40(76.9%)

Table 3: Antibiotic sensitivity pattern of culture-positive sepsis

Microorganism	Antibiotics								
	Amikacin	Cefotaxim	Ciprofloxacin	Levofloxacin	Ofloxacin	Meropenem	Piperacillin tazobactam	Linezolid	Cefixime
Escherichia coli N: 14	14(100%)	14(100%)	8 (57.1%)	10(71.4%)	10(71.4%)	14(100%)	10 (71.4%)		8(57.1%)
Klebsiella pneumoniae N:14	8 (57.1%)	12(85.7%)	4(28.6%)	6(42.9%)	6(42.9%)	14(100%)	8(57.1%)		6(42.9%)
Pseudomonas aeruginosa N:9	8(88.9%)	8(88.9%)	4(44.4%)	5(55.5%)	5(55.5%)	9(100%)	6(66.75)		4(44.4%)
Staphylococcus species N:6	2(33.3%)	3(50%)				4(66.7%)	6(100%)	6(100%)	
Proteus N:4	4(100%)	4(100%)	4(100%)	4(100%)	4(100%)	4(100%)			3(75%)
Enterococci N:3						2(66.7%)	3(100%)	3(100%)	
Nonfermenting Gram-Negative Bacilli N:2	2(100%)	1(50%)		2(100%)	2(100%)	2(100%)			1(50%)

(100%) followed by amikacin and cefotaxime.

Staphylococcus species were the very frequent gram-positive organisms linked with neonantal infection in our analysis and they show maximum susceptibility to linezolid and piperacillin-tazobactam. The antibiogram pattern in culture-positive infection is shown in Table 3.

4. Discussion

To lower infant illness and mortality from neonatal sepsis in the NICU, early identification and effective treatment are crucial. This necessitates that we must identify the most prevalent isolated bacterium causing neonatal sepsis and the pattern of antibiotic sensitivity. The culture-positive rate in our study was 18.4% which was comparably high in studies done by Samaga, et al[9] (14.2%), Martin et al[10] (9.5%), and Aletayeb et al[11] (4.1%). Higher culture positivity rates were seen in studies done by A. Awaisu et al[12] (25.6%), Jain NK et al[13] 28.3%, and Bhattacharjee et al[14] (48%).

In our study most common isolated organisms were Gram-negative organisms (82.7%) in culture-positive infection which was similar to the studies done by Samaga, et al[9] (72%), Shrestha S et al[15] (60.64%) and Rajendraprasad BP et al[16] (70.5%). In contrast, studies were done by Galhotra S et al,[17] show Gram-positive isolates (60%) were more in relative to Gram-negative isolates (37%).

In our study, the most common isolated Gram-negative organisms were *Escherichia coli* (26.9%) and *Klebsiella pneumonia* (26.9%) and the frequent gram-positive organisms were *Staphylococcus* species (11.5%). In the early onset of culture-positive neonatal sepsis cases most common isolated organism was *K. pneumoniae*, and in the late onset of culture-positive neonatal infection cases very frequent isolated organism was *Escherichia coli*. In this analysis, in the early onset of culture-positive neonatal infection cases commonly isolated organism was *K. pneumoniae*, and in the late onset of culture-positive neonatal infection cases commony isolated organism was *Escherichia coli*. Additionally, research by Samaga, et al.[9] indicates that *Escherichia coli* (9.8%), S. aureus (19.5%), *K. pneumoniae* (36.6%) and Citrobacter (12.1%), were among the other common isolates in EOS. *Escherichia coli* (44.4%), *Staphylococcus* aureus (33.3%), and *Klebsiella pneumoniae* (22.2%) were the three most common isolates in LOS. In their investigation, Zakariya et al.[18] identified *Klebsiella pneumoniae* as the most prevalent isolate in EOS (74.4%) and CONS as the second most prevalent isolate. Gram-negative bacilli, most frequently *E. coli* and *Klebsiella*, were identified from the majority (70%) of the cultures, according to studies by Ahmed A. S. et al.[19] Meropenem (100%) had the highest antibiotic susceptibility in our investigation among gram-negative *Escherichia coli* and *Klebsiella pneumoniae*, followed by amikacin, cefotaxime, and piperacillin-tazobactam. An antibiotic susceptibility pattern identical to the examination done by Shrestha S et al[15] shows gram-positive and gram-negative organisms showed high susceptibility to Carbapenems, similar to our study. Linezolid and piperacillin-tazobactam have high sensitivity against gram-positive isolated micro-organisms, similar to the studies done by Mullah SA et al.[20]

Neonatal sepsis remains a significant and difficult problem, though with cutting-edge medication and contemporary diagnostics. Every neonatal intensive care unit must generate a regular bacteriological characteristic and antibiogram pattern to reduce significant new-born mortality rates because of neonatal sepsis. Identification of bacteriological and antibiotic sensitivity profile was most important to enable diagnosis and empirical treatment.

5. Conclusion

In our study blood, the culture positivity rate was 18.4%. In our study most common isolated organisms were *Escherichia coli* (26.9%) and *Klebsiella pneumoniae* (26.9%), these organisms are very well susceptible to meropenem, cefotaxime and amikacin. According to the antimicrobial sensitivity pattern we recommend cefotaxime and amikacin as the first line of treatment in our institution and meropenem and piperacillin-tazobactam as the second line of empirical therapy in our institution. In every neonatal intensive care unit, culture-positive organisms and antimicrobial patterns are different according to their location so every neonatal intensive care unit must generate a regular bacteriological profile and antibiotic susceptibility pattern to reduce significant neonatal mortality rate because of neonatal sepsis. In our institution every year we revived culture-positive microorganisms and antimicrobial sensitivity patterns and change the empirical treatment according to the antimicrobial sensitivity pattern.

6. Source of Funding

None.

7. Conflict of Interest

None.

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