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Original Research Article

Know Your Bugs Better for Handling Neonatal Septicemia: Indian Study with Special Reference to Blood Culture Positivity and Antimicrobial Susceptibility of These Bugs

Jagdeepak Gill[1], Ankita Gupta[2], Sonal Jindal[3], Geeta Gupta[4], Ashutosh Rawat[5]

[1]Postgraduate Student, Department of Microbiology, Santosh Medical College and Hospitals
[2]Assistant Professor, Department of Microbiology, Santosh Medical College and Hospitals
[3]Professor, Department of Microbiology, Rama Medical College, Kanpur, UP
[4]Professor, Department of Microbiology, Santosh Medical College and Hospitals,
[5]Professor and Head, Department of Microbiology, Santosh Medical College and Hospitals

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Corresponding Author: Dr. Sonal Jindal
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Abstract:

Background: Neonatal sepsis is a significant cause of neonatal mortality in developed as well as developing countries. The etiologic agents and risk factors are diverse resulting in variable rates in any geographical area. Timely blood culture reports can reduce mortality and morbidity.

Aim and Objectives: Detection of microbial agents causing neonatal septicemia and to know their antimicrobial susceptibility pattern.

Material and Methods: Blood culture samples were collected from around 456 neonates suspected of neonatal septicaemia over a period of one year and incubated in BacT/Alert. Positive flagged bottles were subcultured on Blood agar and MacConkey agar. Culture positive isolates were identified by routine microbiological procedures and antimicrobial susceptibility testing was performed on Vitek 2 compact.

Results: Amongst the 456 blood samples taken from suspected cases, 95(20.8%) were culture positive. The major risk factors were difficult delivery, premature and prolonged rupture of membranes and the commonest symptoms were lethargy and poor feeding. About 58(61.1%) were early onset and presented symptoms before 24 hours, whereas 37(38.9%) were late onset septicaemia. Amongst the isolates Klebsiella pneumoniae 22(23.1%) was the predominant bacterial pathogen followed by Escherichia Coli 16(16.8%), Staphylococcus Aureus 14(14.7%) and CoNS 14(14.7%). Pseudomonas spp and Enterococcus species were 8(8.4%) each, Acinetobacter spp. were 5(5.2%)and Streptococcus spp. were 3(3.1%).The isolates were multi drug resistant and mostly resistant to first line drugs like cephalosporins and penicillin group. The case fatality rate was 12.6 % among culture positives.

Conclusion: Neonatal sepsis rates vary enormously across countries. Stringent infection control measures, early diagnosis and prompt management is the key to better patient outcome.

Keywords: Neonatal Septicimia, Blood Culture, Antimicrobial Resistance.

Introduction

Neonatal sepsis is a type of invasive disease of blood causing significant morbidity and mortality especially in the low- and middle-income countries. Globally, neonatal sepsis contributes to 2.5 million neonatal deaths annually [1]

In India it accounts for an incidence of 17000 per 100000 live births and 25% to 65% of case fatality rate [2]. Neonatal septicemia is categorized into early onset if diagnosed within 72 hours of birth. It may be due vertical transmission in utero, through blood or amniotic fluid and during birth. Late onset sepsis is when symptoms manifest after 72 hours of birth and may be acquired due to long term intervention in the hospital [3]. The major risk factors include pre mature rupture of membranes, spontaneous preterm labour, chorioamnionitis, prolonged labour and perinatal asphyxia [4]. Neonatal sepsis may result in various neurodevelopment complications like seizures, hydrocephalus, encephalopathy and delays in cognitive development [5].

Newer culture techniques, antibiotic stewardship and care bundles to prevent the nosocomial infections help in reducing the rate of late sepsis cases. In addition to this the biomarkers and hematological indices help in timely diagnosing and monitoring of sepsis hence reducing the mortality and morbidity.[6] The present study reports microbiological profile and their antimicrobial susceptibility pattern

from confirmed neonatal sepsis cases which would help in formulating a neonatal sepsis policy at our setup and thus reduce the burden of neonatal mortality due to sepsis.

Material and Methods

The study was conducted in the Department of Microbiology of tertiary care Hospital of western Uttar Pradesh in India for a period of one year from Jan 2023 to Dec 2023. A total of 456 blood samples were collected from neonates born in our hospital admitted at the NICU who were suspected of sepsis. All the neonates were <28 days postnatal age, admitted at NICU suspected of having septicemia. The demographic data was collected from medical records of all patients.

Under strict aseptic precautions, 1-2 ml of blood was collected from each neonate and was inoculated in paediatric BacT/Alert bottles and inserted in BacT/Alert. The bottles were kept for 5 days in the instrument and removed if there was no growth. The flagged culture bottles that had growth were removed and direct Gram staining was performed from all the flagged blood culture bottles. Simultaneously the blood sample was inoculated on 5% sheep blood agar, chocolate agar and Mac Conkey agar and incubated aerobically at 37ºC. Identification of isolates and AST pattern was done by VITEK compact 2 which was in accordance to recent clinical laboratories standards institutes (CLSI) guidelines.[7,8].

Result

Amongst the 456 blood samples taken from suspected cases, 95 (20.8%) were culture positive. There were several risk factors like difficult delivery, premature and prolonged rupture of membranes, previous history of still births and chorioamnitis. The commonest symptoms were lethargy, poor feeding, fever, abdominal upset and seizures. Among the culture positive, 46(48.4%) were males and 49(51.6%) were female neonates.

About 58(61.1%) were early onset and presented symptoms before 24 hours, whereas 37(38.9%) were late onset septicaemia .Out of the total 95 positive samples, 71(74.7%) were normal vaginal deliveries and 24(25.2%) were LSCS. It was observed that among the confirmed cases, 67(70.5%) had normal birth weight and 28(29.4%) were low birth weight.

Table 1: Demographic data of the confirmed neonatal sepsis cases.(n=95)

S.No	Characteristic	Data	Value In Culture Positive(N=95)	Value In Culture Negative(N=361)	P Value
1.	Duration	Early onset sepsis	58(61.1%)	198(54.8%)	>0.05
		Late onset sepsis	37(38.9%)	163(45.1%)	
2.	Gender	Male	46(48.4%)	176(48.7%)	>0.05
		Female	49(51.6%)	185(51.3%)	
3.	Mode of Delivery	Normal vaginal delivery	71(74.7%)	219(60.7%)	<0.05
		LSCS	24(25.2%)	142(39.3%)	
4.	Birth weight	Normal birth weight	67(70.5%)	258(71.4%)	>0.05
		Low birth weight	28(29.4%)	103(28.5%)	
5.	Place of Delivery	In born	69(72.6%)	267(73.9%)	>0.05
		Out born	26(27.3%)	92(25.5%)	
5.	Mortality	Mortality rate	12(12.6%)	21(5.8%)	

On characterisation of the micro-organisms isolated it was noted that 39(41%) were Gram positive cocci, 51(53.7%) were Gram negative bacteria and 5(5.3%) samples were cases of candidemia. Amongst the isolates Klebsiella pneumoniae 22(23.1%) was the predominant bacterial pathogen followed by Escherichia Coli 16(16.8%), Staphylococcus Aureus 14(14.7%) and CoNS 14(14.7%).

Pseudomonas spp and Enterococcus species were 8(8.4%) each, Acinetobacter spp. were 5(5.2%) and Streptococcus spp. were 3(3.1%) (Figure 1)

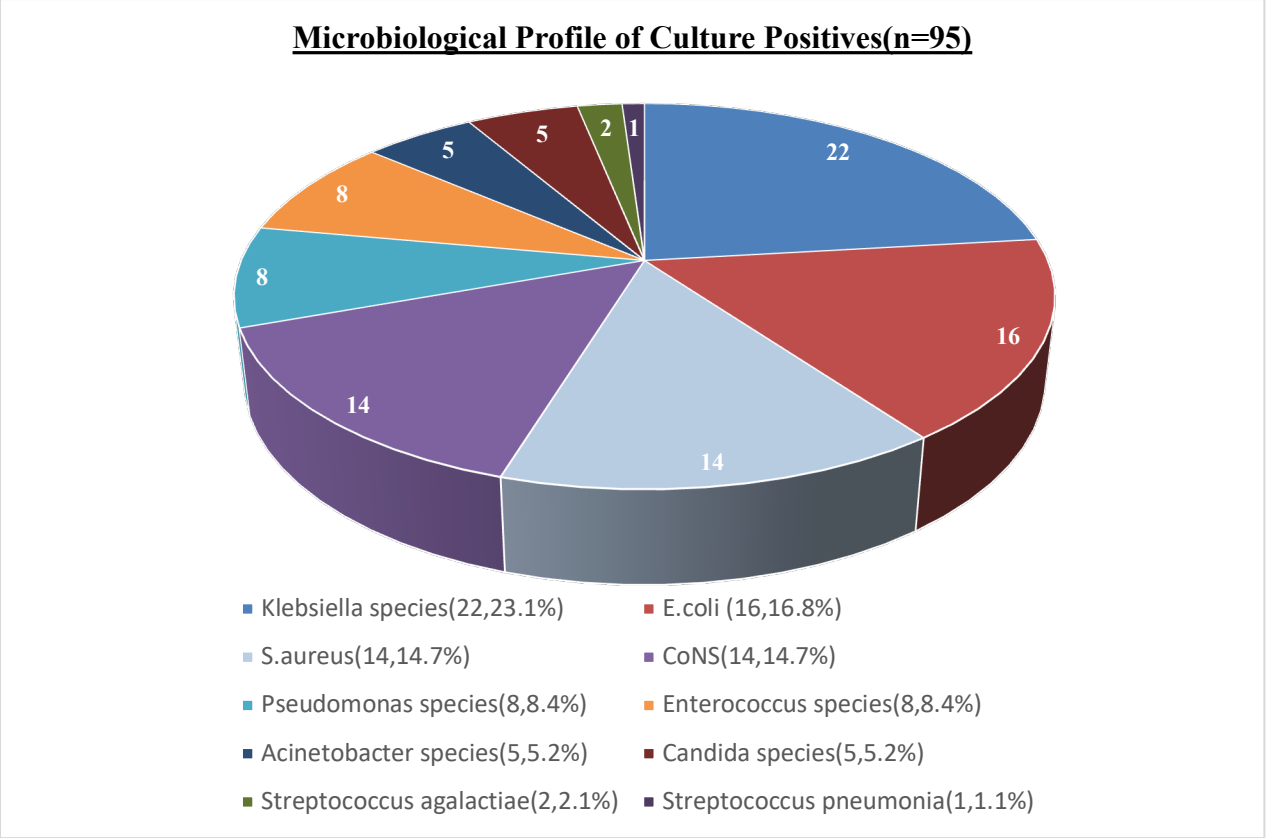

Figure 1: Microbiological profile of culture positive cases

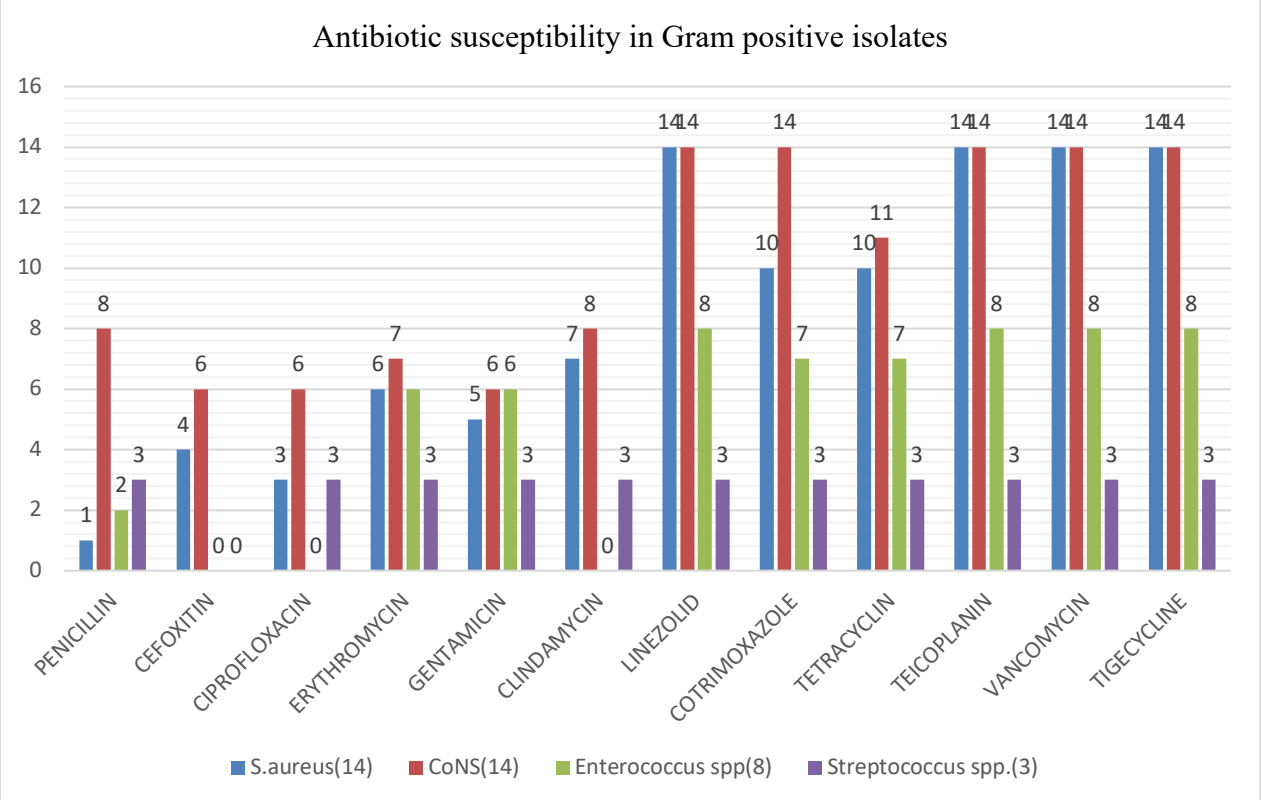

Figure 2: Antibiotic susceptibility pattern in Gram positive isolates

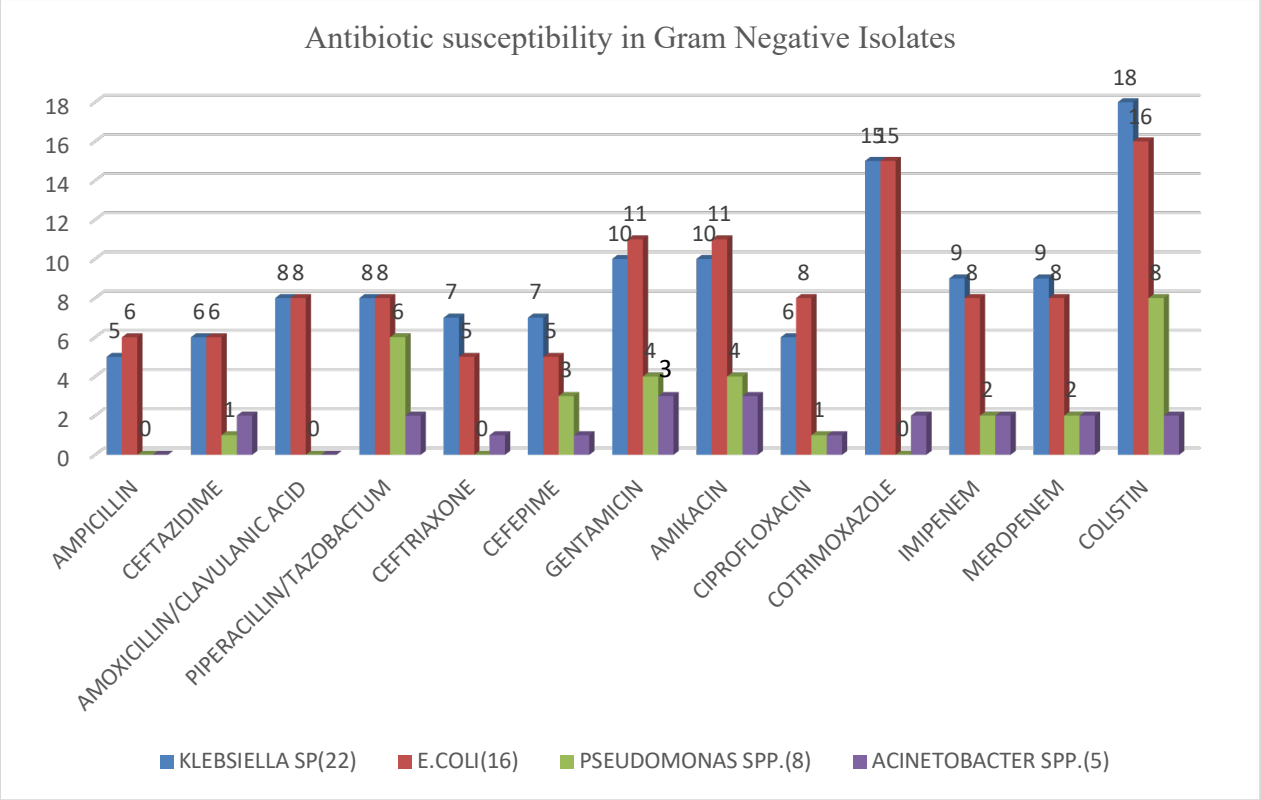

Figure 3: Antimicrobial susceptibility pattern in Gram negative isolates

Among Gram positive organisms 14(35.9%) were sensitive to penicillin, 12 (30.7%) to ciprofloxacin, 22(56.4%) to Erythromycin, 20(51.3%) to gentamicin, 18(46.1%) to clindamycin, 34(87.1%) to cotrimoxazole, 31(79.4%) to Tetracycline and all 39(100%) were sensitive to Linezolid, Teicoplanin, Vancomycin and Tigecycline. Among Staphylococcus species 10(71.4%) were Methicillin resistant Staphylococcus aureus and 8(57.14%) were Methicillin Resistant Coagulase Negative Staphylococcus species.

Among the Gram negative organisms 11(21.56%) were sensitive to Ampicillin, 13(25.4%), 15(29.4%) and 16(31.3%) were sensitive to Ceftriaxone, Ceftazidime and Cefepime respectively. Around 16(31.3%) isolates were sensitive to Amoxicillin/Clavulanic acid and 24(47%) to Piperacillin/Tazobactum.28 (54.9%) isolates were sensitive to aminoglycosides. Only 16(31.3%) isolates were sensitive to Ciprofloxacin and 33(64.7%) were sensitive to Cotrimoxazole. Klebsiella species were multidrug resistant, 16(72.7%, n=22) isolates were ESBL producers and 13(59%,n=22) were carbapenamase producers and 4(18.1%,n=22) were resistant to Colistin. Among E.coli 8(50%,n=16) were carbapenamase producers, but 100 % were Colistin sensitive. 4(50%, n=8) Pseudomonas isolates were sensitive to aminoglycosides and 6(75%,n=8)Pseudomonas species were resistant to carbapenems. Three isolates (60%, n=5) of Acinetobacter species were resistant to carbapenems and colistin. All Candida isolates including Candida albicans in 2 neonates and Candida tropicalis in 3 neonates were susceptible to Flucanozole, Voriconazole, Caspofungins, Amphotericin B and Flucytosine.

Sepsis was the underlying cause of death in nearly one fifth of neonates with suspected sepsis. The case fatality rate was 33(7.2%, n=456) among suspected cases of sepsis and 12(12.6%, n=95) among culture positive cases.

Discussion

Neonatal septicaemia is a significant cause of morbidity and mortality. Early diagnosis and prompt treatment helps reduce the mortality rate. The correct and timely identification of infectious agent and its antibiotic susceptibility pattern guides clinician in both empirical and definitive treatment modalities. In this cross-sectional study done in our hospital a rate of 20.8% culture positive septicemia was observed among neonates. Pahuja et al have reported a culture positivity rate of 32.24%[9] and Thakur et al[10] have reported 41.7% positive blood culture septicaemia while Jatsho et al from Bhutan have reported a rate of 14%[11]. The variability in rates may be due to collection methods, processing methods, geographical locations, intraparum antibiotic usage etc. The clinical profile of the neonates showed respiratory distress and fever as the predominant factor, similar to studies like by Arowosegbeet al[12],while some studies like by Chaudhari et al[13]have reported lethargy and re-

fusal to feed as the commonest symptom. Major risk factors found was prematurity, low birth weight as well difficult delivery which was found to contribute to sepsis which was in concordance to study by Siddiqui et al [14]Most of the neonates developed early onset neonatal sepsis i.e 58(61.1%) and 37(38.9%) had late onset neonatal sepsis with symptoms of sepsis after 3 days of birth. This was similar to studies conducted by Sethi et al [15]and Pokhralet al [16].In our study Gram negative bacteria were predominant which was in compliance with several studies including Rajesh pol et al[17] and Nayak et al[18]. The increased incidence of Gram negatives can be due to their virulence factors and easy spread ability, prolonged existence due to multi drug resistance. In contrast Galhotra et al [19] have stated Gram positive as the commonest.

The isolates were multi drug resistant posing a global problem .In our study Gram negative and Positive organisms were mostly resistant to drugs mainly cephalosporins, aminoglycosides and fluoroquinolones. Our antibiogram were similar to studies by [17-19].However there was no resistance to Linezolid and Vancomycin among Gram positives. The emergence of antibiotic resistance is an alarming situation and irrational use of antibiotics is one of the major risk factors. The Antimicrobial Stewardship team plays a very important role in formulating antibiotic policy which in turn guides clinician for rational use of antibiotics.

Conclusion

To conclude a 19.3% culture positive sepsis rate was observed in our study. Most of these isolates grew in 24 hours of birth. Both maternal risk factors and neonatal risk factors play a rolein causing sepsis among neonates. Multi drug resistance was found among both the Gram positives and Gram negative bacteria for cephalosporins, penicillin group of antibiotics. Inadequate infection control procedures, breach in daily cleaning protocols and excessive antibiotic use may increase the incidence .Extensive surveillance, formulation of antibiotic policies and preventive actions are required. An early diagnosis and prompt treatment, is the need of the hour to save naïve lives. Knowing these bugs better by early detection is the key for prompt treatment of neonatal septicemia.

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