

Original Research Article

Neonatal sepsis-blood culture, antibiotic stewardship and clinico-bacteriological study

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ABSTRACT

Background: Neonatal sepsis refers to an infection involving bloodstream in newborn infants less than 28 days old. It continues to remain a leading cause of morbidity and mortality among infants, especially in middle and lower-income countries. Neonatal sepsis is divided into 2 groups based on the time of presentation after birth: early-onset sepsis and late-onset sepsis.

Methods: This study was done in the neonatal intensive care unit of tertiary hospital, Surendranagar. Study design being observational, data collected from clinical examination and records of the neonates admitted with positive septic screen, neonates admitted with suspected clinical sepsis (temperature >99°F or <95°F, respiratory rate more than 60 per minute, change in behavior, abnormal cry, not accepting feed, drowsy or unconscious, septic focus on skin or umbilicus, diarrhea and seizures) and neonates admitted with culture positive sepsis.

Results: As per this research, neonatal sepsis has more male preponderance, with more commonly occurring in low birth weights and preterm. *Klebsiella*, *Staphylococcus aureus* and *Pseudomonas* being the most isolated organisms. Their resistance pattern, antibiotic profile and newer trends also came across.

Conclusions: Neonatal sepsis comes as one of the major causes of mortality and morbidity of the newborns admitted. By this research, analyzing the sex, age, gestational weeks, organism isolated and the antibiotic profile, emerging new resistance and newer useful antibiotics can thus be studied and can be taken as a base for further study as well as evaluation of the same, along with also guiding to manage and treat neonatal sepsis better.

Keywords: Neonatal sepsis, Newborn, Preterm, Antibiotic, Blood culture

INTRODUCTION

Sepsis is one of important cause of mortality among neonates.^{1,2} The clinical manifestations range from subclinical to severe infection.

The source of the pathogen might be attributed to an in-utero infection, acquisition from maternal flora, or postnatal acquisition from the hospital or community. The time of exposure, pathogen, immune status of the infant, and virulence influence the clinical expression of neonatal sepsis.¹⁻³

Neonatal sepsis includes septicemia, pneumonia, meningitis, osteomyelitis, arthritis and urinary tract infections.^{3,4}

A research in the same is of need with better neonatal intensive care, gestationally younger and lower birth weight newborn are surviving and remains for a longer time in an environment with a high risk of infection.

The clinical manifestations of newborn infections vary, are non-specific, so that the diagnosis of infection is

missed (or) delayed until the process has become widespread.^{1,3,4}

The neonates are less capable of responding to infections because of one or more immunologic deficiencies.

The investigations available for diagnosis do not provide rapid result needed for early and quick recovery.

The emergence of antibiotic resistance among pathogens that infect newborns is of great concern. Early treatment is of critical importance. Failure to appreciate the symptoms, delay in starting the treatment (or) withholding antibiotics may make the difference between survival, death and permanent disability.

Thereby, our research might help to identify the bacterial agents causing neonatal septicemia along with their antibiotic sensitivity, which may help to rationalize therapy and evaluate common programme of the management.

METHODS

Our study was a hospital based observational study, done in newborn intensive care unit of tertiary care hospital, Surendranagar, Gujarat. The study included newborns admitted in NICU between January 2019 and December 2019.

The study included neonates admitted with positive septic screen, neonates admitted with suspected clinical sepsis, neonates admitted with culture positive sepsis.

All high-risk newborns, as given in inclusion criteria screened and culture for the same sent.

Blood collection procedure

Under strict aseptic precaution the local area was cleansed with 70% isopropyl alcohol rubbing vigorously. Then 2% iodine or povidone iodine was applied and again cleaned with 70% isopropyl alcohol and left on the skin for at least one minute. One to two ml of venous blood was drawn by venipuncture. The needle was withdrawn and the area of puncture was cleansed with 70% alcohol. About 1 ml of blood was inoculated immediately into brain heart infusion broth aseptically with utmost care. Another 1 ml of blood was allowed to clot in a dry test tube, serum separated and used for other investigations.^{6,7}

Sample processing

The inoculated bottles were incubated at 37⁰ C in humid atmosphere and examined after 24 hours for any turbidity, discoloration or clotting.

Subcultures examined and colonial morphology done.

Antimicrobial susceptibility testing

After isolating and identifying the organism their antimicrobial susceptibility testing was performed using Kirby-Bauer disc diffusion technique.

This helped to identify the organisms causing neonatal sepsis, rate of isolation, susceptibility pattern of these organisms and emerging pattern of resistance in these organisms (MRSA/ESBL).

Statistical methods

The study was conducted in Neonatal intensive care unit (NICU) of tertiary healthcare centre, CUSMC, Surendranagar. Target population being newborns admitted in our NICU fulfilling the above-mentioned inclusion criteria. Data thereby collected was analyzed using mean, standard deviation and percentage analysis.

Ethical approval

The study was approved by the institutional ethics committee.

RESULTS

In this study, males were more affected.

Table 1: Gender distribution of cases.

Sex	N	Percentage
Male	27	54
Female	23	46
Total	50	100

In this study, pre-terms were more affected.

Table 2: Age distribution of cases.

Term pregnancy	N	Percentage
Preterm	22	44
Term	28	56
Total	50	100

In this study, early onset sepsis was more common.

Table 3: Age of cases.

Age (day)	Number of cases	Percentage
0-7	31	62
8-28	19	38

In this study, low birth weight babies were more affected with sepsis.

In this study, sepsis was more commonly seen in newborns delivered outside the institute.

Table 4: Weight of the cases.

Weight (kg)	Number of cases	Percentage
<1	4	8
1-1.5	16	32
1.5-2.5	19	38
>2.5	11	22

Table 5: Place of delivery.

Place	Number of cases	Percentage
Outborn	38	76
Inborn (institutional)	12	24

In this study, refusal to feed, temperature changes, respiratory symptoms were some of the commonly seen clinical features.

Table 6: Clinical profile.

Clinical features	Percentage
Refusal to feed/lethargy	72
Temperature changes	68
Respiratory distress	56
Heart rate changes/fluctuations	34
Abdominal distension	28
Hypoglycemia	26
Vomiting	14
Jaundice	14
Diarrhea/decreased bowel movement	12
Convulsion	6

In this study, *Klebsiella* followed by *Staphylococcus* and *Pseudomonas* were the commonly isolated organisms.

Table 7: Organism isolated.

Organism	Number of cases	Percentage
<i>Klebsiella</i>	13	26
<i>Staphylococcus aureus</i>	10	20
<i>Pseudomonas</i>	9	18
<i>Escherichia coli</i>	6	12
Coagulase negative <i>Staphylococcus</i>	5	10
<i>Acinetobacter</i>	4	8
<i>Enterococci</i>	2	4
<i>Burkholderia</i>	1	2

Changing trends seen, as *Klebsiella* isolated was seen to be sensitive to newer drugs.

S. aureus was seen to be resistant to previously sensitive and commonly used antibiotics.

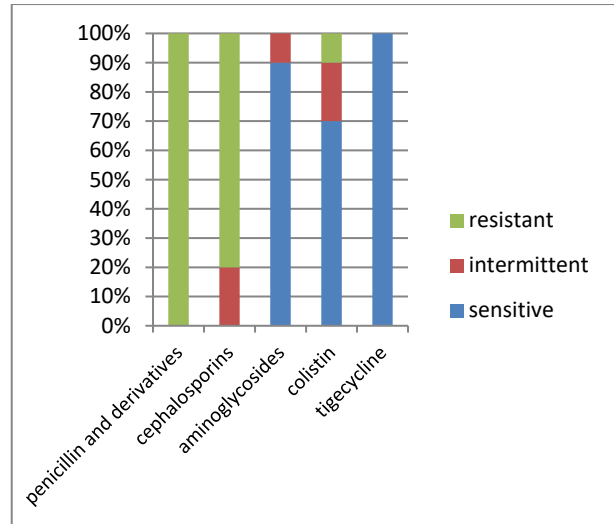


Figure 1: Sensitivity pattern for *Klebsiella*.

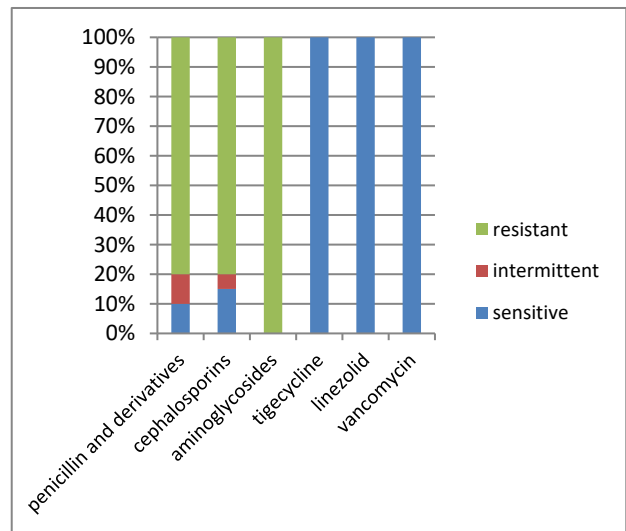


Figure 2: Sensitivity pattern for *S. aureus*.

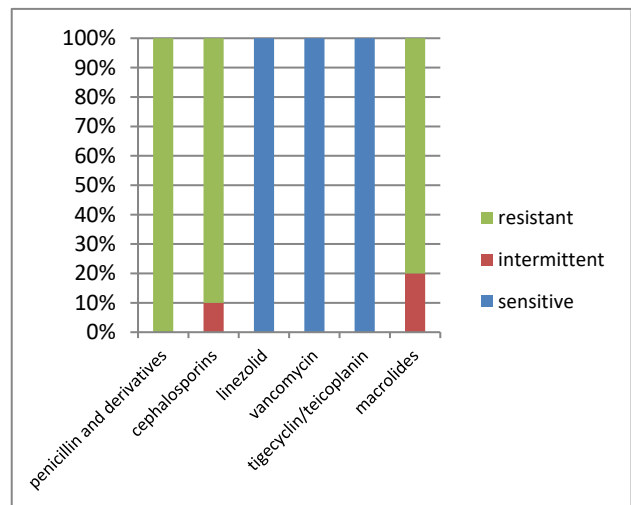


Figure 3: Sensitivity pattern for coagulase negative *Staphylococcus*.

More or less, not much of a change in trend seen with coagulase negative *Staphylococcus*.

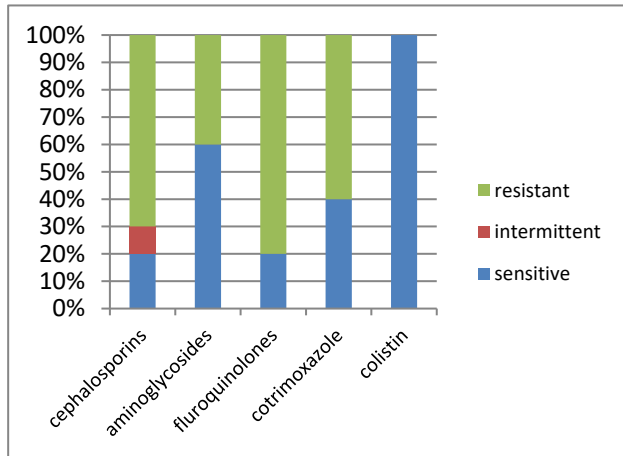


Figure 4: Sensitivity pattern for *E. coli*.

Even though, sensitivity was retained for commonly used antibiotics, *E. coli* showed resistance to colistin, for which further study required.

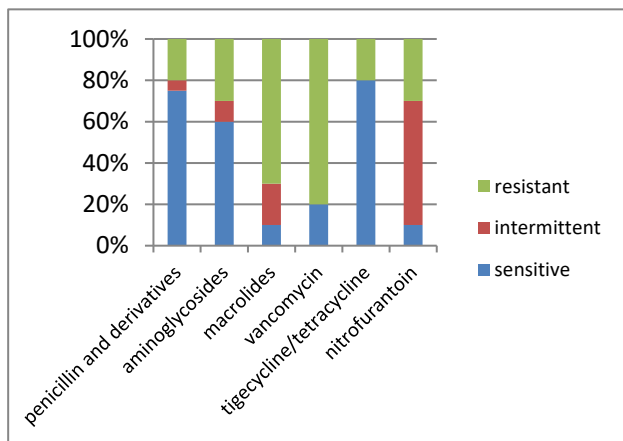


Figure 5: Sensitivity pattern for *Enterococcus*.

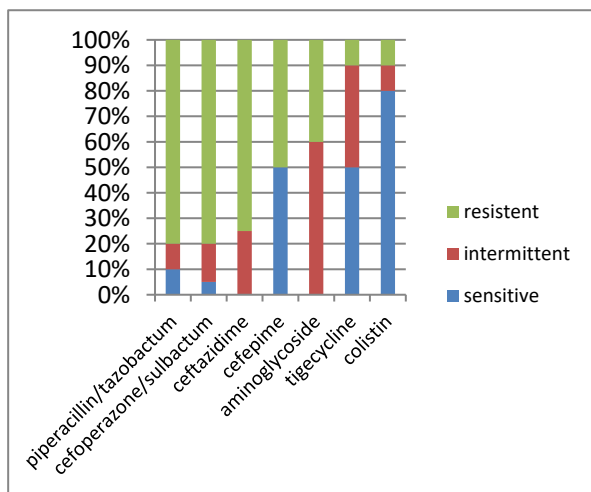


Figure 6: Sensitivity pattern for *Pseudomonas*.

Again, increasing trend of resistance for commonly used antibiotics.

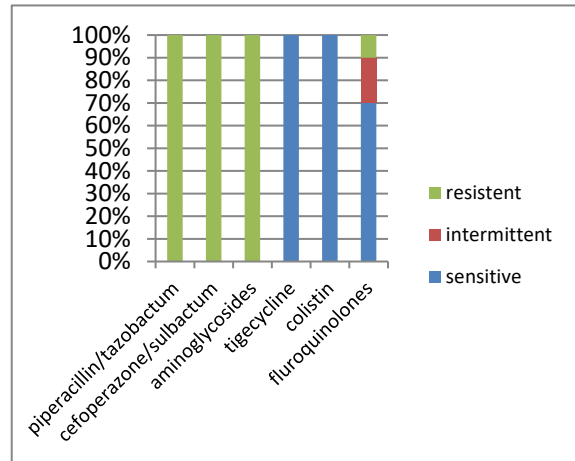


Figure 7: Sensitivity pattern for *Acinetobacter*.

Same trend observed here. From above it is clear, organisms are getting resistant to commonly used drugs, and sensitive to newer antimicrobials.

Table 8: Clinical outcome/mortality.

Clinical outcome	Number of cases	Percentage
Successfully discharged	44	88
Death	6	12

Table 9: Correlation of mortality with type of organism.

Organism	Number of cases	Percentage
<i>Klebsiella</i>	3	60
<i>Pseudomonas</i>	2	40
<i>S. aureus</i>	1	20

In this study, mortality was more commonly observed with *Klebsiella* and *Pseudomonas*.

DISCUSSION

In present study, 50 newborns with culture positive sepsis are taken in account. The results obtained were comparable to various studies and text.⁸⁻¹⁰ In the study undertaken, 54% are males and 46% are females.

Khatua et al reported that culture positivity is more common in males ranging from 59-82%. The male infants in his study constituted 70.7%.¹⁸ Gupta and Sharma et al reported a male predominance of 64.7 and 74% respectively.¹¹

The factors regulating the synthesis of gamma globulins are probably situated on the X chromosome. Presence of one X chromosome in the male infant thus confers less immunological protection compared to the female counterpart.^{19,20}

In this study, neonatal septicemia was observed more in low birth weight neonates, especially lesser than 2.5 kg.

Khatua et al reported a higher incidence of septicemia in low birth weight infants. Higher incidence and mortality of low birth weight infants were also observed by other workers.¹⁸

In the study, refusal to feed, lethargy, respiratory distress, temperature changes were commonly observed.

Khatua et al observed that refusal of feeds, lethargy, diarrhea, hypothermia, abdominal distension, jaundice and vomiting were the most common presenting feature.¹⁸

Thus, symptomatology given by various authors are generalized and does not pertain to a particular system. The frequently observed symptoms are refusal of feeds, poor cry, lethargy and respiratory distress.^{12,13} In essence symptomatology of septicemia is non-specific and multi systemic and hence high index of suspicion in appropriate situations is the only means of early diagnosis.

Also, in this study, we observe that sepsis is more common in out born neonates compared to inborn. Thus, shifting focus towards a complex of factors working for the same.

Long distance travelled with neonate and presentation with hypothermia, cyanosis, convulsions and prolonged capillary refill time were the independent risk factors for mortality in neonatal sepsis among out born.

In this study, *Klebsiella* was the most common organism isolated followed by *S. aureus* and *Pseudomonas*.

According to Karthikeyan et al *Staphylococcus aureus* resistance was seen as a predominant pathogen in sepsis.¹⁴

The frequency of infection by various organisms varies from one institution to another and even from year to year in the same institution and also depending upon whether it is an early onset or late onset sepsis.¹⁵

Banerjee et al reported an outbreak of neonatal septicemia with multi drug resistant *Klebsiella pneumoniae*.¹⁶

According to another study, *Acinetobacter* was seen as an emerging pathogen.¹⁷ Same can be seen in our study.

Changing antibiotic trends, susceptibility and resistance was seen in our study. Similarly, various studies are

reporting the changing trends as per the area, the organism and the antibiotics used.^{19,20}

CONCLUSION

Neonatal sepsis comes as one of the major causes of mortality and morbidity of the newborns admitted. After undertaking the above-mentioned study and going through various characteristics, features and associated factors of neonatal sepsis, the objectives mentioned above hand are fulfilled. A change in antibiotic sensitivity pattern noted. Major antibiotics which were previously sensitive are now emerging resistant. Tigecycline and colistin seem to be the new drugs of focus, hence used with all precautions to prevent their resistance. These might help the clinician to act promptly, keeping in mind the changing trends.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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