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Bacterial spectrum and antimicrobial susceptibility pattern of neonatal septicaemia in a intensive care hospitals (ICU) of Akola (M.S.)

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Abstract

Neonatal sepsis refers to a clinical syndrome that is marked by signs and symptoms of infection in the first 28 days of life, with or without isolation of a pathogen. A retrospective study of bacterial isolates from suspected cases of neonatal septicemia was carried out over a period from Jan 2014 to Jan 2017 at the intensive care unit (ICU) of different hospitals in Akola city, Maharashtra, India. The study was carried out to determine the bacterial profile of the isolates in accordance with standard techniques and the antimicrobial susceptibility of the isolates was done by Kirby Bauer disc diffusion method. A total of 1000 blood samples for blood culture were obtained, out of which 738 were positive for bacterial isolates. Among the total 11 different types of bacterial isolates. Gram positive organisms (*Staphylococcus epidermidis*, *Staphylococcus aureus* (CONS), *Streptococcus agalacticus*, *Aerococcus* spp.) and Gram negative organisms (*Klebsiella Pneumoniae*, *E. coli*, *Proteus vulgaris*, *Pseudomonas* spp., *Acinetobacter* spp., *Enterobacter* spp. and *Salmonella* spp.) were the leading cause of neonatal sepsis in this study. In present investigation, gram positive isolates exhibited high sensitivity against Imipenem and Meropenem followed by Amikacin, Gentamicin and Vancomycin where as high resistance was observed against commonly used antibiotics: Penicillin, Ampicillin, Norfloxacin and Amoxycillin. Gram negative organisms had good sensitivity to Imipenem and Meropenem followed by Amikacin and Gentamicin. High resistance was noted against Penicillin, Ampicillin and Norfloxacin. It is concluded that all bacterial pathogens have emerged as the predominant pathogens responsible for neonatal sepsis which were resistant to commonly used antibiotics and multi drug resistant (MR).

Keywords: Neonatal Septicemia, gram positive, gram negative, Antibiotic sensitivity

1. Introduction

Neonatal sepsis (NS) is a significant cause of mortality and morbidity in the newborn [2]. Neonatal sepsis refers to a clinical syndrome that is marked by signs and symptoms of infection in the first 28 days of life, with or without isolation of a pathogen [14]. Incidence of neonatal septicemia in developed countries varies from 1-10/1000 live birth, whereas it is 3 times more common in India [13]. At birth, the newborn is exposed to the microbial environment. NS can be categorized as early onset sepsis (EOS) and late onset sepsis (LOS). EOS is defined as onset of signs and symptoms of infection within 72 h of life and may be associated with pathogen isolation or not. In the LOS, signs and symptoms present after 72 h of life [12]. Early onset sepsis is acquired during fetal life, delivery, or at the nursery [11]. Neonatal sepsis is caused by a variety of Gram positive as well as Gram negative bacteria, and sometimes yeasts. Neonatal septicemia is one of the leading causes of neonatal mortality and morbidity worldwide. Therefore, the present study was undertaken to determine the bacterial profile of the isolates commonly causing neonatal sepsis and antimicrobial susceptibility at a neonatal care units (ICU) in Akola city (M.S.).

2. Materials and Methods

During this retrospective study over a period from Jan 2014 to Jan 2017, a total of 1000 blood samples for culture were obtained from neonates having a clinical picture suggestive of neonatal septicemia. All the blood samples for culture were collected before instituting antibiotic therapy.

Prospective analysis was carried out on 738 blood samples from neonates admitted to neonatal intensive care unit (ICU) at different hospitals of Akola city, Maharashtra.

The processing of blood samples for culture and isolate identification was done by standard methods [4].

After the identification of bacteria, antimicrobial susceptibility testing of all blood culture isolates was done by Kirby- Bauer disc diffusion method on Muller Hinton agar as per Clinical and Laboratory Standards Institute (CLSI) guidelines [3]. Antibiotic susceptibility patterns of isolates were determined against Chloramphenicol, Ampicillin, Cefotaxime, Penicillin, Ceftazidime, Ceftizoxime, Ciprofloxacin, Erythromycin, Carbapenem, Norfloxacin, Imipenem, Gentamicin, Meropenem, Nalidixic acid, Tetracycline, Amoxycillin, Vancomycin, Amikacin, Furazolidone, Azithromycin.

3. Results and Discussion

The present study was conducted in nine different hospitals of Akola city of Maharashtra in which neonates admitted in NICU with signs and symptoms of sepsis were enrolled for study. Out of 1000 suspected blood samples collected from different hospitals, 736 (73.6%) were positive for bacterial isolates. Among gram positive isolates, there were 207 (76.2%) isolates from early onset sepsis (EOS) while only 65 were from late onset sepsis (LOS) illness. In present study, gram negative bacilli were more frequently (62.7%) involved in causing neonatal septicemia than gram positive cocci (37.3%) which was consistent with the studies done by [1, 7]. In present investigation, total four types of gram positive and seven types of gram negative organisms were identified. Details of these isolates are provided in Table 1 and Table 2.

Table 1: Frequency Distribution of Gram Positive Bacterial Isolates.

Gm +ve Organisms	Frequency (n)	Percent
<i>Staphylococcus epidermidis</i> (CONS)	104	14.1%
<i>Staphylococcus aureus</i>	97	13.1%
<i>Streptococcus agalacticus</i> (GBS)	56	7.6%
<i>Aerococcus</i> spp.	15	2.0%
Total	272	36.9%

Table 2: Frequency Distribution of Gram Negative Bacterial Isolates.

Gm -ve Organisms	Frequency (n)	Percent
<i>Klebsiella Pneumoniae</i>	119	16.1%
<i>Proteus vulgaris</i>	82	11.1%
<i>Escherichia coli</i>	113	15.3%
<i>Pseudomonas</i> spp.	74	10%
<i>Salmonella</i> spp.	3	0.40%
<i>Enterobacter</i> spp.	31	4.2%
<i>Acinetobacter</i> spp.	42	5.7%
Total	464	63.1%

Findings from this study corresponds to a study done in a Neonatal Intensive Care Unit (NICU) in Bangladesh, where they identified gram negative organisms (78%) to be the most common pathogen of neonatal sepsis [10].

For effectual management of septicemia cases, study of bacteriological profile along with the antimicrobial sensitivity pattern plays a noteworthy role [6, 16]. Therefore, Simultaneously, antibiotic susceptibility patterns of positive blood culture isolates against 20 different types of antibiotics, viz Chloramphenicol, Ampicillin, Cefotaxime, Penicillin, Ceftazidime, Ceftizoxime, Ciprofloxacin, Erythromycin, Carbapenem, Norfloxacin, Imipenem,

Gentamicin, Meropenem, Nalidixic acid, Tetracycline, Amoxycillin, Vancomycin, Amikacin, Furazolidone were determined, using the Kirby Bauer disc diffusion method according to the Clinical and Laboratory Standard Institute [3]. Table 3, Graph 1 and Table 4 and Graph 2 show the antibiotic susceptibility patterns in Gram positive and Gram negative isolates. The analysis of drug resistance pattern showed that among gram positive isolates, high sensitivity was observed against Imipenem and Meropenem followed by Amikacin, Gentamicin and Vancomycin. On the other hand, high resistance was observed against commonly used antibiotics such as Penicillin, Ampicillin, Norfloxacin and Amoxycillin. The greater prevalence of resistance to commonly used antibiotics has also been reported by other studies [15, 8].

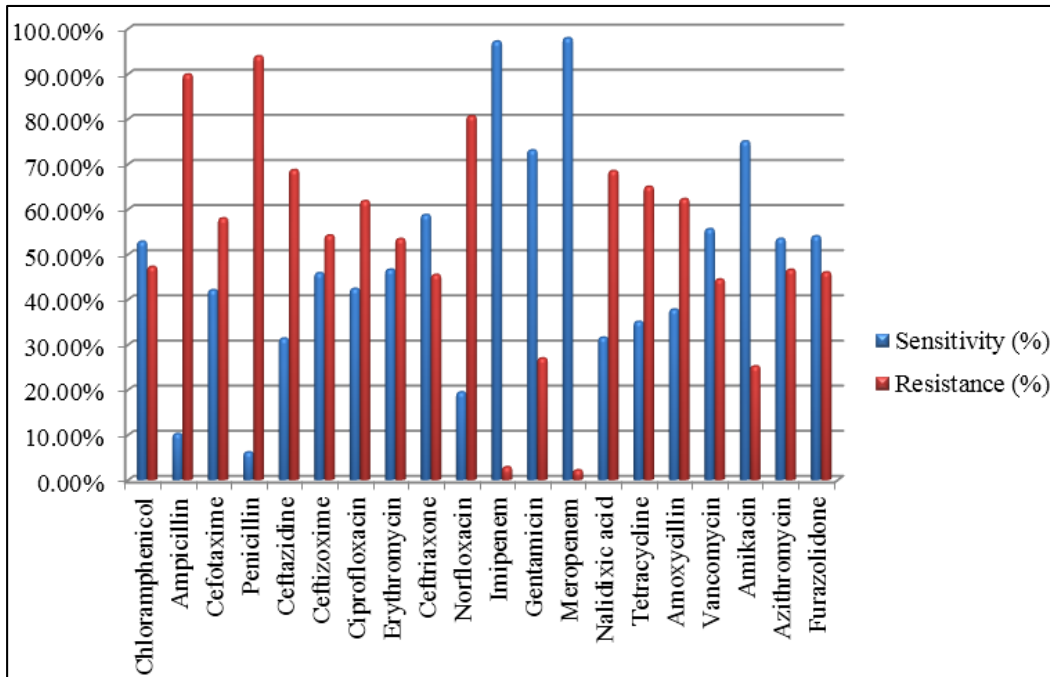
Gram negative organisms showed good sensitivity to Imipenem and Meropenem followed by Amikacin and Gentamicin. High resistance was noted against Penicillin, Ampicillin and Norfloxacin.

Table 3: Antibiogram of Gram Positive Isolates

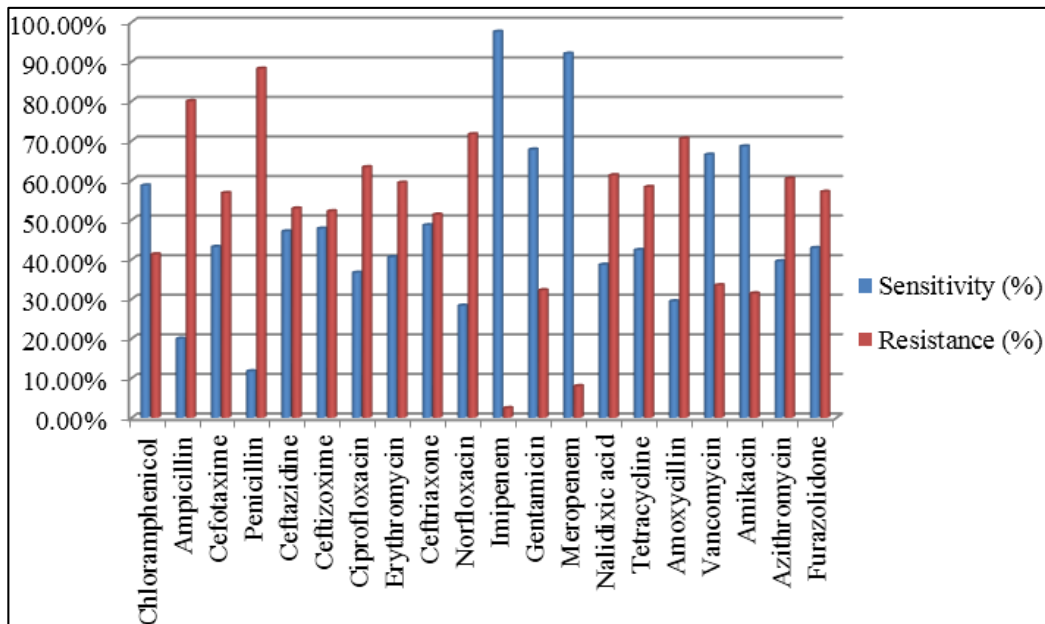
Antibiotics	Sensitivity (%)	Resistance (%)
Chloramphenicol	58.70%	41.30%
Ampicillin	19.98%	80.03%
Cefotaxime	43.20%	56.80%
Penicillin	11.75%	88.23%
Ceftazidime	47.10%	52.90%
Ceftizoxime	47.80%	52.20%
Ciprofloxacin	36.65%	63.35%
Erythromycin	40.60%	59.40%
Ceftriaxone	48.65%	51.35%
Norfloxacin	28.33%	71.65%
Imipenem	97.55%	2.45%
Gentamicin	67.78%	32.23%
Meropenem	92.00%	8.00%
Nalidixic acid	38.68%	61.30%
Tetracycline	42.40%	58.33%
Amoxycillin	29.43%	70.55%
Vancomycin	66.50%	33.50%
Amikacin	68.58%	31.43%
Azithromycin	39.55%	60.45%
Furazolidone	42.90%	57.10%

Table 4: Antibiogram of Gram Negative isolates

Antibiotics	Sensitivity (%)	Resistance (%)
Chloramphenicol	52.79%	47.21%
Ampicillin	10.17%	89.83%
Cefotaxime	42.04%	57.96%
Penicillin	6.11%	93.87%
Ceftazidime	31.33%	68.66%
Ceftizoxime	45.81%	54.17%
Ciprofloxacin	42.34%	61.79%
Erythromycin	46.60%	53.39%
Ceftriaxone	58.69%	45.44%
Norfloxacin	19.41%	80.59%
Imipenem	97.14%	2.84%
Gentamicin	73.03%	26.94%
Meropenem	97.87%	2.14%
Nalidixic acid	31.54%	68.44%
Tetracycline	35.03%	64.94%
Amoxycillin	37.74%	62.23%
Vancomycin	55.57%	44.41%
Amikacin	75.00%	25.17%
Azithromycin	53.41%	46.57%
Furazolidone	53.99%	46.00%



Graph 1: Antibigram of Gram Positive Isolates



Graph 2: Antibigram of Gram Negative isolates

4. Conclusion

Gram positive organisms (*Staphylococcus epidermidis*, *Staphylococcus aureus* (CONS), *Streptococcus agalacticus*, *Aerococcus* spp.) and Gram negative organisms (*Klebsiella Pneumoniae*, *E. coli*, *Protius vulgaris*, *Pseudomonas* spp., *Acinetobacter* spp., *Enterobacter* spp. and *Salmonella* spp.) are the leading cause of neonatal sepsis in this study and It is concluded that most of them are resistant to commonly used antibiotics, multi drug resistant(MR) and these have emerged as the predominant pathogens responsible for neonatal sepsis. Results of this study suggest resistance pattern of microorganisms responsible for neonatal infections and are helpful to design a specific empirical antibiotic regimen.

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