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Original Research Paper

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BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SENSITIVITY PATTERNS IN NEONATAL SEPSIS: A STUDY FROM EASTERN INDIA

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ABSTRACT

Background: Neonatal sepsis is a leading cause of neonatal mortality and continues to be a formidable problem for neonatologists and pediatricians worldwide.

Objective: The study was carried out to determine the bacteriological flora prevalent in the neonatal care unit of a tertiary care hospital from Eastern India and their antimicrobial sensitivity pattern.

Materials and Methods: The blood culture reports of all neonates with culture positive sepsis during the period from January 2016 to December 2018 were reviewed retrospectively. The data was entered in excel sheets and necessary calculations were done accordingly.

Results and Analysis: Of the 21,113 neonates admitted during this period, 163 had culture positive sepsis, accounting for 7.7 cases of neonatal sepsis per 1000 live births. Gram negative isolates were obtained in 72.39% cases, gram positive in 19.02% cases and 8.6% were mixed isolates. Majority of the cases were late onset sepsis category (68.1%). Acinetobacter baumanii complex was the most frequently isolated organism in both early and late onset sepsis cases. Gram negative isolates were mostly sensitive to Carbapenems and Polymyxin B, whereas gram positive cases had good sensitivity to Vancomycin and Linezolid.

Conclusion: Knowledge of the microbial flora and their susceptibility patterns will help us to decide judicious empirical treatment for neonatal sepsis.

KEYWORDS : neonatal sepsis, bacteriological flora, antimicrobial sensitivity

INTRODUCTION:

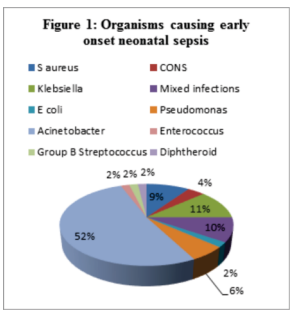
Globally, neonatal sepsis accounts for one of the leading causes of neonatal mortality [1,2], especially in developing countries like India. The challenge of sepsis has greatly magnified in the current era, witnessing the emergence of antimicrobial resistance. As a result, we are left with a limited reserve of antibiotics to tackle the menace of neonatal sepsis. Hence, proper knowledge of the prevailing antimicrobial isolates in the neonatal care units, and their antibiotic susceptibility patterns are crucial for determining appropriate empirical therapy, in turn reducing neonatal morbidity and mortality. This study was undertaken to determine the prevalence of culture-positive sepsis, its bacteriological profile and antibiotic sensitivity patterns in a tertiary care neonatal unit from Eastern India.

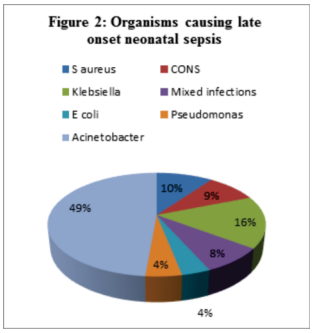
METHODS:

This was a retrospective study carried out in the Neonatal Care Unit of a Tertiary Care Medical College and Hospital, from January 2016 to December 2018. Sepsis screen was done for all neonates suspected of having clinical sepsis. Blood was collected from all the subjects as per standard guidelines. The site was cleansed with 70% alcohol and then with 1% povidone iodine. Next 70% alcohol was used again for cleansing the site. Maintaining strict asepsis, 1 ml of blood was then collected, and inoculated on 10 ml of brain heart infusion broth and incubated at 37°C for 24 hours. Subcultures were also carried out on appropriate culture media. After identification of bacterial isolates, antibiotic susceptibility testing was carried out using Modified Kirbey Bauer disc diffusion method.

RESULTS:

Out of a total of 21,113 neonates admitted during this period, 163 had culture positive sepsis. This resulted in the incidence of neonatal sepsis of 7.7 per 1000 live births. Out of the total cases, 31.9% resulted from early onset sepsis, and 68.1% from late onset sepsis. A total of 9 species of microbes were identified. Of all the microbes isolated, gram negative organisms accounted for 72.39 % of cases, and gram positive organisms in 19.02% of cases, and mixed isolates obtained in 8.6% of the cases. In those cases with early onset sepsis, Acinetobacter sp. was the commonest isolated organism (51.92%), followed by Klebsiella pneumonia (11.54%), Staphylococcus aureus (9.6%) and Pseudomonas aeruginosa (5.77%) (**Figure 1**). Similarly, in cases with late onset sepsis, Acinetobacter sp. was again the highest isolated organism (48.65%), followed Klebsiella pneumonia (16.22%), Staphylococcus aureus (9.99%), and CONS (9.0%) (**Figure 2**). Mixed isolates accounted for 9.6% cases of early onset sepsis, and 8.11% cases of late onset sepsis.





Most of the Acinetobacter sp were sensitive to Polymyxin B (92.6%), with a high percentage of carbapenem resistance (>80%). Highest sensitivity of Klesiella was to Polymyxin B

(91.67%), followed by Meropenem (62.5%) and Imipenem (50%). Staphylococcus aureus isolates showed 100% sensitivity to Linezolid, 93.75% sensitivity to Vancomycin and around 62.5% sensitivity to Clindamycin. CONS isolates were 100% sensitive to Vancomycin, whereas only 91.67% were sensitive to Linezolid. Around two-thirds of the CONS isolates (66.67%) were Clindamycin resistant.

The antibiotic susceptibility pattern is shown in **Table 1**.

Table 1: Antibiotic Sensitivity Patterns of isolated bacteria

				LRT		OP		MICROBES			
ANTIBIOTICS											
	S.aureus	CONS	Enterococcus	E.coli	Klebsiella	Pseudomonas	Acinetobacter	Group B Streptococcus	Diphtheroid	Mixed Infections	
Co-amoxyclav	12.5	8.33	ND	ND	ND	ND	ND	ND	ND		
Piperacillin Tazobactam	ND	ND	ND	20	43.83	75	4.24	ND	ND		
Cefotaxime	6.25	8.33	R	R	R	R	R	ND	ND		
Ceftriaxone	25	R	ND	ND	ND	ND	ND	ND	R		
Cefoperazone + Sulbactam	ND	ND	ND	40	29.17	62.5	3.7	ND	ND		
Imipenem	ND	ND	ND	40	50	62.5	12.96	ND	ND		
Meropenem	ND	ND	ND	60	62.5	75	16.66	ND	ND		
Aztreonam	ND	ND	ND	20	25	50	9.88	ND	ND		
Gentamycin	56.25	41.67	100	40	16.67	12.5	17.28	R	100		
Ciprofloxacin	37.5	16.67	ND	R	R	R	R	ND	100		
Ofloxacin	ND	ND	100	ND	ND	ND	ND	ND	ND		
Amikacin	ND	ND	R	20	43.83	75	6.17	R	ND		
Vancomycin	93.75	100	100	ND	ND	ND	ND	100	100		
Linezolid	100	91.67	100	ND	ND	ND	ND	100	100		
Clindamycin	62.5	33.33	ND	ND	ND	ND	ND	ND	ND		
Polymyxin B	ND	8.33	ND	100	91.67	100	92.6	ND	ND		
Chloramphenicol	ND	ND	ND	40	4.17	R	1.23	ND	ND		
Azithromycin	12.5	R	ND	40	16.67	25	16.05	ND	ND		
Levofloxacin	ND	8.33	ND	60	37.5	75	8.64	ND	ND		
Lomefloxacin	18.75	R	ND	40	20.83	75	3.7	ND	100		
Cefotriaxone	ND	ND	ND	R	R	12.5	4.94	ND	ND		
Fluconzole	ND	ND	ND	R	R	12.5	2.47	ND	ND		

Figures represent percentage of bacteria sensitive to the particular antibiotic.
ND – (Sensitivity) not done; R – Resistant.

DISCUSSION:

Neonatal infection is a major problem and early diagnosis and prompt institution of empirical antimicrobials may be life-saving. The organisms that cause neonatal sepsis varies according to time and region. Periodic surveillance for bacteriological flora and susceptibility pattern can guide judicious empirical antimicrobial therapy.

Incidence of blood culture proven sepsis in our study was comparable to data obtained from other Indian studies. Late onset neonatal sepsis (LONS) constituted majority of culture positive cases (68.1%). The spectrum of pathogens in India and other South-East Asian countries is different from Western data where Group B Streptococcus and Coagulase negative Staphylococcus (CONS) are the predominant pathogens [3].Gram negative bacilli are predominant pathogen in developing countries with K. Pneumoniae being the most common amongst them [4,5].

The recent trends of higher rates of Staphylococcus aureus sepsis in both EONS and LONS and a similar profile of isolated bacteria indicate that the majority of EONS in in-born babies may be hospital-acquired rather than maternally transmitted[5].

Gram negative bacteria (72.39%) were the most common organisms isolated in the present study. Similar observations have been made by others, Bhat et al and Shrestha et al [6,7]. The low incidence of gram positive sepsis in present study can be attributed to low infection rates with CONS which is usually associated with central lines and rarity of Group B Streptococcus in India.

Among the early onset neonatal sepsis (EONS), Acinetobacter baumanii complex (51.92 %) was the commonest organism in our study. Similar result was found in a Jordanian study [8]. Whereas, many studies reported Klebsiella to be the most common organism [7,9,10,11,12]. Some authors have found Staphylococcus aureus as the most common organism [13,14]. Intra partum antibiotic prophylaxis also led to a substantial change in the bacterial flora responsible for EONS. Acinetobacter and Klebsiella (in that order) were the most common organisms (48.65% and 16.22%) attributing to LONS in the present study as compared to other studies which found Klebsiella and Acinetobacter (in that order) as the leading organisms [7,11,13].

Although the Gram negative organisms were the most common in both early as well as late onset sepsis in our study, but the incidence of gram positive sepsis was higher in LONS when compared to EONS . Staphylococcus aureus was the most common Gram positive microbe in both EONS and LONS . A low rate of Enterococci infection in present study is similar to the observations of Bhat et al [7].

Most previous studies failed to document poly microbial sepsis , either because of unawareness of its significance or disregard for the second organism in an already positive culture . Incidence of polymicrobial sepsis was 8.59 % in our study , while it was reported to be 5.2% by Shrestha , 6.8% by Kumhar et al and 3.92% by Viswanathan [7,15,16]. Nepal et al did not find any case of poly microbial sepsis . There is a need to correlate the occurrence of poly microbial sepsis with clinical outcome in neonatal septicemia .

Antibiotic resistance is a widespread problem . In the present study too , a large number of Gram positive and Gram negative bacteria exhibited variable resistance to many of the clinically useful antibiotics . The greater prevalence of resistance to commonly used antibiotics has also been reported in recent studies .

Among Gram negative isolates , Escherichia Coli , Klebsiella Pneumoniae and Pseudomonas show comparable sensitivity to Carbapenem . Highest sensitivity of Aztreonam is against Pseudomonas. Sensitivity to Amikacin is good in case of Klebsiella Pneumoniae and Pseudomonas aeruginosa . >90% Polymyxin B sensitivity is seen in Gram negative bacteria. Acinetobacter shows high level of resistance against almost all of the commonly prescribed antibiotics . For most of the Acinetobacter species , only way is to use high level of antibiotics like Polymyxin B . Sensitivity to Cefoperazone+ Sulbactam , Levofloxacin and Lomefloxacin is good enough against E.Coli and Pseudomonas aeruginosa .None of the organism shows sensitivity to Ciprofloxacin and Cefotaxime and very low sensitivity to Ceftriaxone. Sensitivity to Piperacillin-tazobactam is good among Klebsiella and Pseudomonas. Although studies in the past have shown favourable sensitivity pattern of 3rd generation Cephalosporins, our study revealed higher resistance of gram negative isolates t these drugs. Resistance to 3rd generation cephalosporins is now rampant and has been widely reported in recent studies.

Among gram positive isolates, most were sensitive to Linezolid and Vancomycin. Favourable susceptibility of Vancomycin and Linezolid has been reported in recent studies [6,7,11,15].

Sensitivity to Cotrimoxazole was also quite good. A significant amount of Clindamycin resistance was also seen in our study. However, all gram positive organisms showed very less sensitivity to Co-amoxyclav and Cefotaxime.

Polymyxin B, Carbapenems and Linezolid although revealed maximum sensitivity, these drugs should not be used indiscriminately and be kept as reserve drugs. Development of resistance to these drugs may leave us with no option in life-threatening infections by resistant organisms.

Limitations of our study include its retrospective nature, not taking the clinical picture into account, and not testing the sensitivity of all organisms against similar set of antibiotics.

CONCLUSION:

Our study revealed gram negative isolates as the predominant pathogens in both EONS and LONS groups.

Both gram positive and gram negative isolates showed high resistance to commonly used antibiotics. Such high antibiotic resistance entails high neonatal mortality and morbidity. Continuous surveillance for microbial flora, their antibiotic susceptibility, rational use of antibiotics and the strategy of antibiotic cycling may be of help to curtail emerging antimicrobial resistance.

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