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Original Research Paper

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SPECTRUM AND ANTIBIOTIC SENSITIVITY PATTERN OF BLOODSTREAM BACTERIAL ISOLATES FROM SEPTICEMIC NEONATES IN A TERTIARY CARE CENTRE IN EASTERN INDIA

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ABSTRACT

OBJECTIVE: To determine the antibiotic sensitivity pattern of bacterial isolates from septic neonates so as to identify the most suitable policy for use of empirical antibiotics . Design: Retrospective cross sectional study. PARTICIPANTS: 252 infants admitted between 1st September 2019 and 30th August 2020 for treatment of suspected sepsis.

METHOD: Reports of blood culture done by BactT/Alert system and other relevant data pertaining to suspected cases of neonatal sepsis were collected from case records and retrospectively analyzed.

RESULTS AND OUTCOME MEASURES: Commonest organism was E.Coli resistance to ampicillin, gentamycin, and cefotaxime was significant. Overall 73% of all organisms were susceptible to either carbapenems or glycopeptides while 63% were susceptible to either piperacillin/tazobactam or an aminoglycoside (preferably netilmicin.

CONCLUSION: Carbapenems and glycopeptides rotated with Piperacillin/tazobactam and an Aminoglycoside(preferably netilmicin) may have to be empirically used in units with similar flora and sensitivity patterns.

KEYWORDS : Newborn, Sepsis, Anti-Bacterial agents, Microbial sensitivity tests.

INTRODUCTION

Septicemia has been the second most frequent cause of death in newborns after perinatal asphyxia in as recent a time as 2002-03 in India, when an incidence rate of about 16% among hospital born neonates was estimated [1]. It is still one of the three most important causes of neonatal mortality in this country, the others being prematurity/low birth weight and birth asphyxia [2]. The pattern of organisms causing neonatal sepsis and that of their antibiotic sensitivity in developed countries [3,4], differ substantially from those in the developing ones [5,8].

Regional variations are also seen within the geographical limits of developing nations. Having said that, it cannot be overemphasized that empirical antibiotic therapy is an essential and life saving part of management of neonatal sepsis and any attempt at formalization of policy streamlining such practice requires a thorough knowledge of the regional spectrum of causative organisms as well as their antibiotic sensitivity patterns. This study was conceived with the above intention.

OBJECTIVE

To determine the antibiotic sensitivity pattern of bacterial isolates from septic neonates so as to identify the most suitable policy for use of empirical antibiotics.

METHODS

A retrospective cross sectional study was conducted including 126 infants admitted between 1st September 2019 and 30th August 2020, for treatment of suspected sepsis to the NICU of Ramakrishna Mission Seva Pratisthan and Vivekananda Institute of Medical Sciences, a tertiary care hospital, providing level II neonatal intensive care services. Blood samples were collected for culture from all neonates either showing clinical signs of sepsis as described by Young Infants Clinical Signs Study Group [9] or born to mothers with risk factors for infection including prolonged rupture of membrane for more than 12 hours, fever, UTI, foul smelling and/or meconium stained amniotic fluid. Newborns with gross congential anomalies and ongoing exposure to antibiotics for probable sepsis were excluded from the study. Aseptically collected samples of blood were cultured in a BacT/Alert®3D system and were sub-cultured if indicated, onto specific media for isolation of causative organisms. Isolated organisms were identified by colony characteristics, Gram staining and biochemical methods. Antimicrobial sensitivity tests were carried out following Kirby-Bauer's disc diffusion method modified as required according to current CLSI guidelines [10].Demographic characteristics of the subjects as well as the blood culture and sensitivity results were collected from hospital records. Organization, descriptive representations and analysis of data were done using STATA® version 12SE for Windows® statistical software package. Categorical variables and blood culture results were tested for mutual independence using Pearson's X^2 test.

RESULTS AND OUTCOME MEASURES

During the study period there were 15% culture positive cases among the 252 infants included in the study.

Table 1

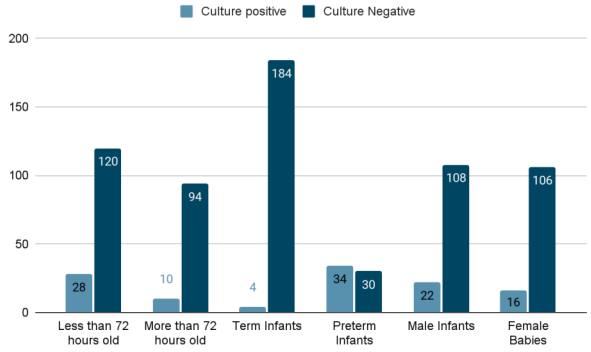
Culture results with respect to patient characteristics:

Characteristics	Culture positive	Culture negative	p-value*
Less than 72 hours old	28	120	0.151
More than 72 hours old	10	94	
Term infants	4	184	0.000
Preterm infants	34	30	
Male infants	22	108	0.551
Female infants	16	106	

*Derived from Pearson's X^2 test, where a p-value<0.05 was considered as statistically significant.

Figure 1

Culture results with respect to patient characteristics:



Among the 38 pathogenic bacteria isolated, about 74% were Gram negative organisms. Predominant among those were E.Coli (42%), Klebsiella so (22%), Staph aureus (11%) and Staph epidermidis(16%) were the Gram positive isolates. As regards antibiotic sensitivity of the flora, Gram negative bacteria were highl;y 85%, resistant to cefotaxime. Ampicillin susceptibility was found to be 29%. Only 50% of the entire Gram negative group were susceptible to Aminoglycosides as well as Piperacillin/tazobactum although the figure was slightly better (75%) for E. Coli alone. Best overall susceptibility of the gram negative flora were to Chloramphenicol (79%) followed by Carbapenems (64%). As for the Gram positive organisms, half of the S.aureus and all of the S. epidermidis were resistant to ampicillin. 50% of Staph aureus and all of Staph .epidermidiswere methicillin resistant but were uniformly susceptible to Vancomycin, teicoplanin and linezoid. Azithromycin and clindamycin susceptibility stood at 60%. Overall 100% were susceptible to netilmicin, glycopeptides and linezoid. Gentamicin resistance was 50% among S.aureus and 100% among S.epidermidis.

Table 2 *Percent isolates susceptible to various antibiotics:*

	CPM	FLQ	CMB	PCL	PLXN	GLCN	AMG	CPHN3
E.Coli	88	50	75	88	75*	88	75	25
K.pneumoniae	100	50	50	100	100	100	50	None
K.oxytoca	None	None	None	100	100	None	None	None
A. baumanni	None	None	None	None	100	100	None	None
S.epidermidis	None[#]	None	None	100	Not Tested	Not Tested	100 [$£]	None
S.aureus	50	Not Tested	50	100	Not Tested	Not Tested	50	50

***= This includes 25% E.coli which were resistant to colistin but susceptible to plymyxin-B.**

 # = Only 33% was sensitive to Imipenem; [$];

$ = all were resistant to gentamicin

£ = all were sensitive to netilmicin.

CPM= Carbapenems (Meropenem, Imipenem & Doripenem)

FLQ= Fluoroquinolones (Ciprofloxacin, Ofloxacin)

CMB= Combinations (Piperacillin/Tazobactam, Ampicillin/ Sulbactam)

PCL= Phenicols(Chloramphenicol)

PLXN= Polymyxins (Colistin, Polymyxin-B)

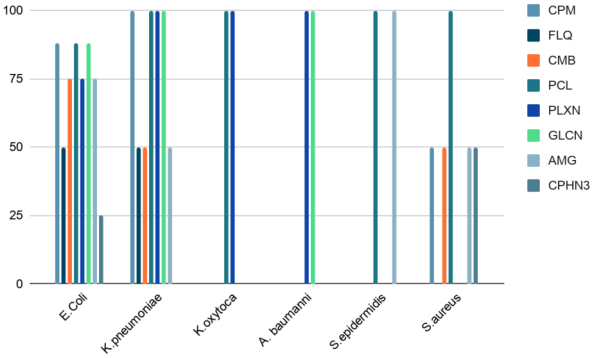
GLCN= Glycylcyclines(Tigecycline

AMG=Aminoglycosides(Gentamicin, Amikacin, Netilmicin)

CPHN3=3rd generation cephalospororins(Cefotaxime, Ceftiaxone)

Figure 2

Percent isolates susceptible to various antibiotics:



DISCUSSION

Our analysis showed a blood culture yield of 15.1% and an overall incidence rate for sepsis of 31.7 per 1000 live births. In this study, early onset sepsis was encountered more often than late onset sepsis, male preponderance prevailed among afflicted (male:female=1.4:1) and prematurity was associated with culture positivity in a statistically significant manner. The causative organisms were mostly gram negative and E.Coli was the commonest one. Among Gram positive flora, S.epidermidis was most commonly isolated followed by S.aureus. With regard to antibiogram of the isolates, very steep resistance to ampicillin and third generation cephalosporins and significant resistance to aminoglycosides were noted among Gram negative organisms. As for the Gram positive flora, susceptibility to penicillins, macrolides as well as cephalosporins were found to be dwindling.

This was a purely retrospective analysis done with controls. Hence, although prematurity has been linked with increased vulnerability to sepsis, there might have been a selection bias involved.Similar incidence rates for neonatal sepsis and associations of culture positivity were reported in recent Indian Studies[6,11-13]. Contrary to our findings, many workers reported Klebsiella sp. as the commonest isolate[1,7,8].

Our overall scenario may reflect a principally nosocomial source but such findings are not uncommon and similar scenarios among hospitals born neonates in the developing world were recently found and analyzed by Zaidi et al [7]. In our study, 73% of all organisms were susceptible to either carbapenems or glycopeptides providing best coverage. The figure for Piperacillin/ Tazobactam and aminoglycosides (preferably netilmicin) was close(63%). Reports from Pakisthan [14] and JIPMER,Pondicherry [15] submit that carapenems and glycopeptides may have to be escalated to the first line of attack in places where significant antibiotic resistance prevails. While we find ourselves in the same boat, our study also indicates that antibiotics with susceptibility patterns almost similar to those with broadest spectrum coverage can usually be found. We have to utilize that opportunity and although not studied here, rotation between such antibiotics can always minimize the selection of resistant strains in the long run.

CONCLUSION

Carbapenams and glucopeptides can sometimes appear to be the only antibiotics with decent coverage of bloodstream isolates from septic neonates thus making them candidates for empirical use in rotation with other antimicrobials with almost similar effectiveness (Pipearacillin/Tazobactam and Netilmicin in our study).

DECLARATIONS

Contributors: Tapabrata Chatterjee – Determination of study design and methodology, analysis of the collected data, literature search and preparation of manuscript.

Aparna Mitra- Conceptualization, collection of data and revision of the manuscript.

Competing and conflict of interests: None

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