BANGLADESH J CHILD HEALTH 2019; VOL 43 (1) : 35-40

Bacterial Profile of Neonatal Septicemia and Antibiotic Susceptibility Pattern of the Isolates in Tertiary Care Hospital, Dhaka, Bangladesh

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Abstract

Background *: Neonatal septicemia (NS) is the most serious problem in special care neonatal unit (SCANU) and neonatal intensive care unit (NICU), resulting in significant morbidity and mortality. We evaluated the causative pathogens and their drug sensitivity pattern in this study, which will certainly help in the choice of specific antibiotic during treatment of septicemic neonates. The objective of this study is to isolate the causative agents of neonatal septicemia and to analyze antimicrobial susceptibility pattern of the isolates.*

Methodology: *This prospective study was carried out from July 2001 to June 2002 in the Neonatal Unit of Bangabandhu Sheikh Mujib Medical University (BSMMU), and Special Care Baby Unit (SCABU) of Bangladesh Institute of Research and Rehabilitation of Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka. Blood samples from 100 clinically suspected NS cases were collected and processed in the microbiology laboratory of BSMMU and BIRDEM. The growths were identified by standard microbiological protocol and their antimicrobial sensitivity pattern was determined. The results were analyzed maintaining standard procedure with SPSS.*

Results: *Of 100 cases, 31 (31%) showed positive blood culture. Gram-negative isolates were 22 (70.97%) and gram-positive 9 (29.03%). Klebsiella pneumoniae was the most common (41.9%), followed by staphylococcus aureus (29%) and E. coli (19.4%) among the isolates. All the three common isolates showed 100% resistance to ampicillin and very poor sensitivity to gentamicin. Gram-negative isolates were highly sensitive to amikacin and imipenem, where as gram-positive isolates were highly sensitive to amikacin and vancomycin.*

Conclusion: *Neonatal septicemia was found to be 31% in this study, based on blood culture, as the gold standard investigation for diagnosis. A change in microbial spectrum and change in their antimicrobial susceptibility pattern as noticed in this study will certainly help in treating such cases with appropriate antibiotic and thereby help to decrease neonatal morbidity and mortality.*

Keywords: *Changing Bacterial Spectrum, Antimicrobial Susceptibility, Neonatal Septicemia.*

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Received: 28-08-2018 **Accepted:** 16-03-2019

Introduction

Neonatal Septicemia (NS) is a clinical syndrome of systemic illness accompanied by bacteremia in the first 28 days of life.[1] The over all incidence of sepsis is 5-38 per 1000 live birth.[2,3] Till now NS remains the leading cause of neonatal death (30-50% of total neonatal death) despite significant progress in introduction of new antibiotics and latest techniques of early diagnosis and treatment.[4,5] The case fatality rates of NS ranges from 23-57%.[6,7,8]

Spectrum of organisms causing NS changes from region to region, center to center and also with

change of time. Reports of epidemiological data from developing countries show important differences in bacterial pattern from that of developed countries. In Europe & North America, gram positive bacteria, in particular group B streptococcus (GBS) is the predominant cause of NS.[9-12] Where as, gram-negative pathogens are the main cause in developing and under developed countries.[13-15] In the developing and under developed countries klebsiella pneumoniae (k.pneumonae), E. coli and Enterobacter are the predominant gram-negative ; and Staphylococcus aureus and coagulase negtive-staphylococcus (CONS) are the predominant gram-positive pathogens.[16-20]

Microorganisms responsible for NS have developed resistance to antibiotics over the last few decades, and thus making treatment extremely difficult.[21-24] Hence, this study was under taken to determine the bacteriological profile of neonatal septicemia and their antibiotic susceptibility patterns. This will help in formulating the use of antibiotics locally, in order to decide about the best possible use of antibiotics for the treatment of neonatal septicemia.

Materials & Methods

This prospective analytical study was under taken in the Neonatal Unit, Department of Padiatrics, BSMMU & SCABU of BIRDEM; two tertiary level hospitals in Dhaka, Bangladesh from July 2001 to June 2002. A total 100 hospitalized cases of clinically suspected neonatal septicemia were enrolled in this study. Babies younger than 28 days admitted with clinical feature of septicemia irrespective of gestational age & birth weight, in absence of any other serious illness were included in this study. Babies born in the hospital and admission from outside were included. Reluctant to feed, lethargy, temperature instability, abdominal distension, vomiting, diarrhea & jaundice were considered as the main clinical features of NS. Clinical feature appeared in the first 7 days of life was considered as early onset sepsis (EOS) and when the disease appeared during 8-28 days of life was considered as late onset sepsis (LOS).

Ethical clearance was duly taken from the concern authority of the institutes. A thorough physical examination was carried out after taking detailed and careful history of each case. Patient's attendants were interviewed and only those babies were enrolled where the guardians gave permission for collection of samples.

As a sample, 1-2 ml of blood was withdrawn by a sterile disposable syringe with butterfly needle from a peripheral vein after cleaning the site with povidone-iodine and chlorhexidane. The blood culture medium was aseptically inoculated and aerobically incubated at 37ºC (20ml of Trypticase Soya Broth was used). The medium was examined daily for bacterial growth. Sub-cultures were taken on day 1,2,3 and 7 of incubation into blood sugar, chocolate agar and Mac Conkey's media. Where antibiotic was started before drawing of blood, samples were collected in Pedi-Bac T small volume vials and was cultured in FAN (Fast Antibiotic Neutralization) aerobic media with unique antibiotic technology. Cerebrospinal fluid (CSF) was collected by lumber puncture only when meningitis was a suspicion. Chest radiography and swab culture from superficial infection (umbilical sepsis, pyoderma etc.) were carried out in relevant cases. The isolates were identified by studying colonymorphology, gram staining and conventional biochemical methods. Antibiotic sensitivity testing was performed on Muller- Hinton (MHA) plates by Kirby-Bauer disc diffusion method. Most of the investigations were done in the department of Microbiology and Immunology of BSMMU & BIRDEM.

Results

In this prospective study of one year period, among the enrolled 100 clinical septicemia in neonates 68(68%) were EOS and 32(32%) were LOS. Of these 100 clinical sepsis cases 31(31%) were blood culture positive and 69(69%) were culture negative. Thus prevalence of NS in the present study was 31%. Among the clinical EOS (n=68), 18 (26.5%) were blood culture positive, but of LOS (n=32), 13(40.6%) were culture positive (Fig.-1).

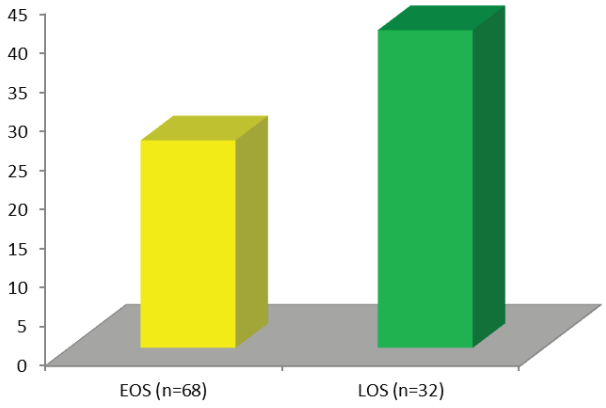

Fig. -1: *Blood culture positivity in early-onset and late-onset sepsis.*

Gram negative organism were predominant with 22 isolates (70.97%) in comparison to gram-positive 9(29.03%) isolates klebsiella pneumoniae was the most common (41.9%) followed by S. aureus (29%) and E.coli (19.4%) among the organism isolated. Other organisms isolated were Acinetobacter sp. (3.2%), Entenobacter (3.2%) and Providentia species (3.2%). In this study, Klabsiella pneumoniae was the commonest organism isolated from both EOS (38.9%) and LOS (46.2%) followed by S. aureus (27.8% & 30.8%) (Table-I). In respect to gestational age Klabsiella pneumoniae was highly prevalent (52.4%) in the preterm culture positive (n = 21) babies, but S. aureus and E. coli were common in term babies (Fig 2). In our study Klabsiella pneumoniae was almost twice as prevalent in low birth weight (LBW) babies (47.8%) than normal birth weight (NBW) babies (25%); where as S. aureus & E.Coli were more prevalent in babies with NBW than LBW (Fig.-3).

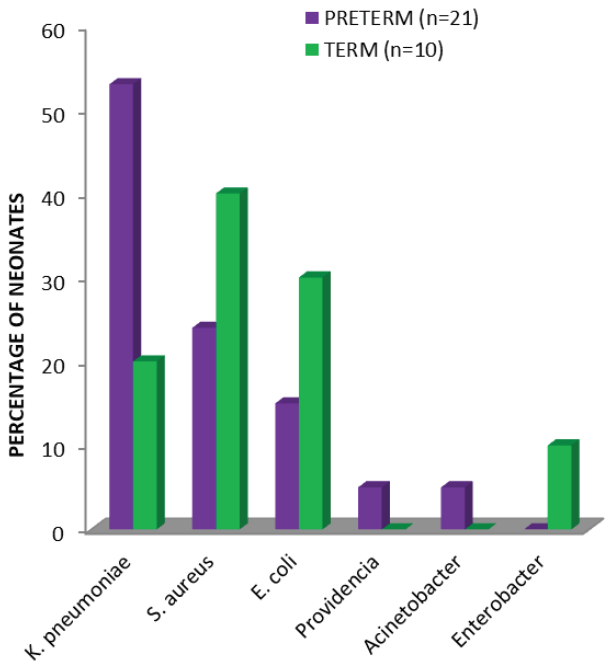

Fig.-2: *Pattern of organisms in relation to gestational age*

The antimicrobial susceptibility pattern of the isolates (Table-II) revealed that ampicillin the commonly used antibiotic in our NICU & SCABU is 100% resistant to K. pneumoniae, S. aureus & E.coli, the main causative pathogen; but 100% sensitive to

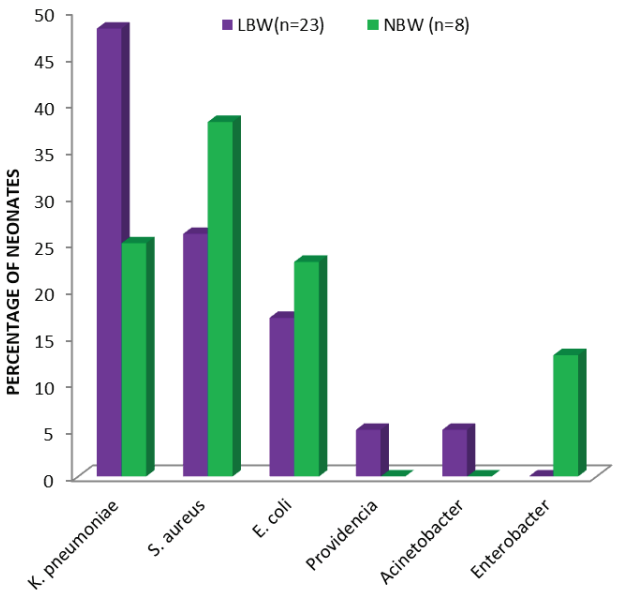

Fig.-3: *Pattern of organism in relation to birth weight of the babies suffering from sepsis*

Acinetobacter & Providencia. Gentamicin was less sensitive to K. pneumoniae (15.4%), S. aureus (44.4%) & E.coli(16.7%). Where as, amikacin was highly sensitive to K. pneumoniae (85.7%) and S. aureus (100%) in our study. In this study, vancomycin showed 83.3% sensitivity to S. aureus but for cloxacillin it was only 25% . The K. pneumoniae isolates here, were 100% sensitive to imipenem. In our study, ciprofloxacin showed 25 to 100% sensitivity to different isolates. During our study, the sensitivity dics for all the antibiotics were not available always.

Table-I

Pattern of organisms isolated from blood cultures (n=31)

Organisms	EOS		LOS		Total	
	No.	(%)	No.	(%)	No.	(%)
K. pneumoniae	7	38.9	6	46.2	13	41.9
S. aureus	5	27.8	4	30.8	9	29
E. coli	3	16.7	3	23	6	19.4
Acinetobacter sp.	1	5.6	0		1	3.2
Enterobacter	1	5.6	0		1	3.2
Providencia sp.	1	5.6	0		1	3.2
Total	18	58.1	13	41.9	31	

Table-II

Sensitivity pattern of organisms isolated on blood culture of septicaemic neonates

Antibiotics	Percentage of cases					
	Klebsiella (n=13)	Staph. aureus (n=9)	E.coli (n=6)	Providencia (n=1)	Enterobacter (n=1)	Acinetobacter (n=1)
Ampicillin	0	0	0	100	0	100
Gentamicin	15.4	44.4	16.7	100	0	100
Chloramphenicol	50	66.7	100	100	100	100
Ceftriaxone	0	0	50	100	0	-
Cefotaxime	0	-	66.7	100	-	0
Amikacin	85.7	100	-	-	-	-
Vancomycin	-	83.3	-	-	-	-
Ciprofloxacin	25	25	50	100	100	100
Ceftaziline	0	0	50	100	-	100
Cloxacillin	-	25	-	-	-	-
Nitilmycin	22.2	66.7	50	100	-	100
Imipenem	100	-	-	-	-	-

Discussion

Neonatal septicemia, one of the leading cause of neonatal death is a life threating emergency[3,5,8,13]. Bacteriological profile of NS changes from region to region, center to center and time to time. Alarming finding is that high proportion of organism are becoming resistant to commonly used antibiotics over the last few years[4,5]. This prospective study was carried out to determine the bacterial profile of NS and antibiotic sensitivity pattern of the isolated pathogens, to select an empirical protocal of antimicrobial therapy before the culture sensitivity report being available. In this study, samples were randomly collected from two tertiary level hospitals of Dhaka city. Both in born and outborn babies from different hospital of dhaka city and also from other district were admitted in these hospitals.

Out of 100 clinical neonatal septicemic case 31% (n=31) had growth on blood culture. This result was within the range of 19-79 percent of blood culture positivity as observed by other investigators[2,4-7,14,15,20]. In our study the predominance of gram-negative 70.97% (n=22) organism in NS is similar to the observation of other investigators from India[2,6,15,17,20], Pakistan[7,16], Bangladesh[18,30], Nepal[19] and Latin America[14]. Klebsiella pneumoniae was the commonest (41.9%) pathogen as isolated in our study. Similar reports have been observed by some other studies[4,5,6,11,16,29,30]. On the other hand, E.coli was found as the commonest bacteria in NS by few others[12,18,19,25]. Among the gram positive isolates S. aureus was the commonest in our study like some other observations[4,17,18,26,30]. In developed countries Group B Streptococci (GBS) and Staphyloccus are still predominant followed by gram-negative pathogens[8,9,10,12,28]. But in our observation, not a single GBS was found among the isolates like many other observers[5,7,15,18,24-26]. However, in some studies of developing countries very few percent of GBS are being isolated now a days[3,6,10,14]. This observation is probably due to difference of life style and climate factors among the two groups of people.

The alarming findings in our study were the development of multi drug resistance pathogens to commonly used antibiotics in our SCABU and NICU, and it is consistent to other studies from developing and developed countries[4-7,11,15,23,30]. In this study, the commonly isolated pathogens K. pneumoniae, S. aureus & E. coli were 100% resistant to ampicillin. Very poor sensitivity of these pathogens to ampicillin was also observed by other observers.[4-7,11] Gentamicin, a commonly used antibiotic in our nurseries was found 15.4%, 16.7% & 44.4% sensitive to K. pneumoniae, E. coli & S. aureus respectively. Very low sensitivity of gentamicin to these pathogens were found in other studies.[4,5,23,26,29,30] However,

higher degree of sensitivity of gram negative pathogen to gentamicin were observed in some reports[6,11,18]. K. pneumoniae, the most commonly isolated gram negative bacteria, was highly sensitive (85 & 100%) to amikacin & imipenem, but was highly resistant to most of the 3rd generation cephalosporin as observed by some others[5,16,20,29]. Ciprofloxacin showed 25-50% sensitivity to the three common isolates in our study. S. aureus isolated in this study was poorly sensitive (25%) to cloxaxillin but showed high degree of sensitivity to vancomycin (83%) and amikacin (100%). Similar high sensitivity was also observed by some other investigators[4,5,15,30] .

Antimicrobial sensitivity pattern differs in different places, in different studies, as well as at different time in the same hospital. Indiscriminate use of antibiotics leads to emergence of resistant strains of pathogens. High resistance observed in this study may be primarily due to excessive and irrational use of these antibiotics at primary health facilities from where neonates are referred to our tertiary centers. We also do not adopt antibiotic regimen timely based on antibiogram in our NICU, SCANU and nurseries.

Conclusion

In this study with 100 hospitalized patients of neonatal septicemia 31% were found culture positive. The main causative organism were Klebsiella pneumoniae, S. aureus and E. coli. Incidence of antimicrobial resistance among various organism from time to time, continuing evaluation at different levels for local pattern of bacterial profile and antibiotic sensitivity of pathogen should be reviewed to develop empirical therapy. There is also a need of both hospital and community based studies with large sample size to find out the source of these organisms in hope of developing a better prevention policy.

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