Bacteriological Profile of Neonatal Sepsis in a Tertiary Hospital in Bangladesh

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Summary:

Objectives: To evaluate the common pathogens associated with neonatal sepsis in a tertiary care hospital in Bangladesh and their antibiotic susceptibility pattern.

Materials and Method: This prospective study was done at Special Care Baby Unit (SCABU) BIRDEM Hospital from January to December 2008. Neonates whose blood culture yielded growth of bacteria were included in this study.

Results: Sepsis was associated with Low Birth Weight and common organism isolated was Klebsiella and Enterobacter. Ampicillin, Genatamicin and third generation cephalosporin were almost resistance to all organisms.

Conclusion: Bacterial profile is not the same as western countries, Gram-negative bacteria and in particular* Klebsiella and enterobacter *species are the leading causes of neonatal sepsis and resistance to ampicillin, gentamicin and third generation cephalosporin.

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Introduction:

Neonatal Sepsis is the commonest cause of neonatal mortality and it is responsible for 30-50% of the total neonatal deaths in developing countries[1, 2]. It is estimated that 20% of neonates develop sepsis and approximately 1% death related to sepsis[2]. Some of the factors responsible for sepsis in newborns are immaturity of the immune system, which include decreased phagocyte activity of white cells, decreased production of cytokines and weak cellular and humoral immunity. Moreover the natural skin barrier is very thin. Various other maternal, foetal and environmental factors also contribute towards sepsis in the newborns. Some of the maternal factors are premature rupture of membrane, maternal fever within 2 weeks prior to delivery, meconium stained amniotic fluid (MSAF), foul smelling liquor and instrumental delivery. The foetal factors include birth weight, gestational age and APGAR score[3,4]. Neonatal sepsis is a life threatening emergency and delay in diagnosis and treatment with appropriate antibiotics may have devastating consequences. Surveillance is needed to identify the common pathogens of the disease as well as the antibiotic susceptibility profile of the pathogens in a particular area. This study was designed to evaluate the common pathogens associated with neonatal septicemia in our hospital and their antibiotic susceptibility pattern over a one year period.

Methods:

This prospective study was done at Special Care Baby Unit (SCABU) in BIRDEM Hospital from January to December 2008. Neonates whose blood culture yielded growth of bacteria were included in this study. Neonates were categorized in two groups; group-1 included

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preterm and group-2 term neonate. Blood culture samples were aseptically collected by the doctors into the blood culture broth and were sent to the laboratory where they were handled according to the manufacturers specifications. The antibiotic sensitivity tests were carried out by disk diffusion method. All the records of the study population were carefully reviewed and data including sex, age, clinical features consistent with sepsis, results of cultures, antibiotic sensitivity and clinical outcome (death versus survival) of the patients were entered into a data collection sheet. Statistical analyses were calculated by Statistical Package for Social Sciences (SPSS version 12).

Results:

In this Study total 65 neonates were included whose blood culture were positive. Among them 40 (61.54%) babies were preterm (group-1) and 25(38.46%) were term (group-2), and 47(70%) were LBW. Male was 38 (65%) and female was 27 (35%), inborn was about 50% and majority was delivered by C/S (72.31%). Sepsis developed within 7 days (early onset) in 23 (35.4) babies (Table-I). Mean birth weight was 1513.02±423.61g in group-1and 2840 (±640.80) g in group-2.

Majority of neonate presented with feeding intolerance (50.77%), respiratory distress (40.28%), abdominal distension (33.85%), apnoea (24.62%) and bleeding manifestation (23.08%). Apnoea, less activity, hyperglycaemia and feeding intolerance were present equally in both group. Abdominal distension and bleeding manifestation were more in group-1 and respiratory distress and convulsion were more common clinical presentation in group-2 (Table-II).

Table-I

Distribution of neonate according to neonatal characteristics (n=65)

Neonatal characteristics		Total No (%) N=65	Group-1 No (%) n=40	Group-2 No (%) n=25	P value
Sex	Male	38 (65)	22(55)	16(64)	0.245
	Female	27(35)	18(45)	9(36)	
Place of delivery	Inborn	33 (50.77)	22(55)	11(44)	0.202
	Outborn	32 (49.23)	18(45)	14(56)	
Mode of delivery	C/S	47 (72.31)	28(70)	19(76)	0.471
	NVD	18 (27.69)	12(30)	6(24)	
Type of sepsis	Early onset	23 (35.39)	12(30)	11(44)	0.114
	Late onset	42 (64.61)	28(70)	14(56)	
Low birth weight	45(69.23)	39(97.5)	6(24)	0.146	

Table-II

Distribution of neonate according to clinical feature

Clinical feature	No (%)	Group-1 No (%)	Group-2 No (%)	P value
Apnoea	16(24.62)	09(22.5)	07(28)	0.313
Less active	21(32.31)	13(32.5)	08(32)	0.486
Feeding intolerance	33(50.77)	20(50)	13(52)	0.099
Hyperglycemia	03(4.62)	02(5)	01(4)	0.217
Respiratory distress	28(40.28)	18(45)	10(64)	0.073
Sclerema	06(9.23)	04(10)	02(8)	0.411
Bleeding	15(23.08)	11(27.5)	04(16)	0.153
Abdominal distension	22(33.85)	16(40)	06(24)	0.001
Convulsion	13(20.0)	10(25)	03(12)	00.001

In this study 52.3% neonatal sepsis was caused by Klebsiella species. Second most common cause was Enterobacter (20.0%). Other organism were Acinatobacter 10.8%), Pseudomonas (06.2%), Serratia (06.2%), Cytobacter (03.1%). Gram positive organism (Staphylococcus) was found in only one neonate. Sepsis with Klebsiella was found equally in both groups; Acinatobacter, Pseudomonas and Serratia were more common organism in group-2 and Enterobacter was more in group-1 (Table-III).

In this study, both groups were equally sensitive to all antibiotics except chloramphenicol (Table-IV). Ampicillin and Gentamicin were 100% resistance to Klebsiella, third generation cephalosporin was also resistance to klebsiella. Imipenem and meropenem were highly sensitive to all organisms and ceftazidime was also highly sensitive to pseudomonas and Serratia (75%). Amikacin and Netilmycin had good sensitivity against some organism than gentamicin (Table-V). Overall mortality due to sepsis was found 7 (10.8%) in this study and more in group-1(15%) than group-2 (4%) (Table-VI).

Table-III

Organism isolated from blood culture (n=65)

OrganismNo (%)N=65	Group-1 No (%) N=41	Group-2 No (%) N=24	P value
Klebsiella34 (52.3)	21(52.5)	13(52)	0.152
Acinatobacter 07 (10.8)	4(1.0)	3(12.0)	0.160
Pseudomonas 04 (6.20)	2(0.5)	2(8.0)	0.176
Serratia04 (6.20)	2(0.5)	2(8.0)	0.113
Cytobacter 02 (03.1)	2(0.5)	0(0)	0.449
Staphylococcus01 (01.5)	1(0.25)	0(0)	0.113
Enterobacter 13 (20.0)	9(22.5)	4(16.0)	0.400

Table-IV

Distribution of neonate according to sensitivity pattern (n=65)

AntibioticNo (%)	Group-1 No (%)	Group-2 No (%)	P value
Ampicillin	02(5.0)	2(8)	0.327
Gentamycin	5(6.5)	2(8)	0.306
Ceftazidime	6(15)	4(16)	0.453
Ciprifloxcin	9(22.5)	8(32)	0.207
Amikacin	10(25)	5(20)	
0.332			
Imipenem	34(85)	20(80)	0.307
Meropenem	34(85)	21(84)	0.453
Cotrimoxazole	6(15)	1(4)	0.096
Netilmycin	7(17.5)	4(16)	0.447
Chloranphenicol	1(2.5)	3(12)	0.087

Table-V

Pattern of antimicrobial sensitivity of microorga nism isolated from blood cultures of neonates with bacterial sepsis (n=65)

Antibiotics	Klebsie-lla (n=34) N(%)	Entero-bactor (n=13) N(%)	Acinatobactor (n=07) N(%)	Pseudomonas (n=04) N(%)	Serratia (n=04) N(%)	Cytobactor (n=02) N(%)	Staphylo-coccus (n=01) N(%)
Ampicillin	0	02(15.4)	0	02 (50.0)	0	0	0
Gentamicin	0	01(07.7)	04(57.1)	01(25.0)	01(25.0)	0	0
Amikacin	01(02.9)	0 6(42.9)	03(42.9)	01(25.0)	03(75.0)	02(100)	0
Imipenem	30(88.2)	11(84.6)	04(57.1)	03(75.0)	03(75.0)	02(100)	01(100)
Meropenem	31(91.2)	11(84.6)	04(57.1)	03(75.0)	03(75.0)	02(100)	01(100)
Netilmycin	01(02.9)	04(30.8)	04(57.1)	0	0	01(50)	01(100)
Ceftazidim	0	01(07.7)	03 (42.9)	03 (75.0)	03(75.0)	0	0
Cefotaxim	02(05.8)	01(07.7	04(57.1)	01(25.0)	0	0	0
Ciprofloxac	11(32.4)	03(23.1)	02(28.6)	01(25.0)	0	0	0

Table-VI

Distribution of neonate according to outcome (n=65)

Outcome	no(%)	Group-1no(%)	Group-2no(%)	P value
Survived	58 (89.23)	34((85.0)	24(96.0)	0.096
Died	7 (10.77)	6(15)	1(4)	

Discussion:

Sepsis is the commonest cause of neonatal morbidity and mortality. LBW is a strong risk factor contributing to sepsis. In this study birth weight is related to development of sepsis. Among 65 babies who develop neonatal sepsis during the study period 70% were LBW. This is in concordance with other studies where low birth was found to be important risk factor for sepsis [5,6]. LBW babies are mostly also premature and are predisposed to sepsis due to multiple reasons like immune incompetence at various levels of defense, more subjected to invasive interventions etc.

In the present study majority of neonates presented with feeding intolerance (50.77%), respiratory distress (40.28%), abdominal distension (33.85%), apnoea (24.62%) and convulsion (23.08%). In a study done in the tertiary care center in Bangladesh poor feeding, respiratory distress and fever was reported in 22.2%, 27.8% and 44.4% cases respectively [7]. In the same study they documented hypothermia in 11.1%, apnea in 16.7%, cyanosis in 11.1%, convulsions in 11.1% and jaundice in 50%.

In our study the most common etiologic agent was *Klebsiella*. This is in contrast to reports from other parts of the world. In western countries, group B *Streptococci* and *E.coli* were the most common Gram-positive and Gram-negative microorganism respectively [8,9]. In our study *52.3%* of neonatal sepses were caused by *Klebsiella.* All the isolated *Klebsiella* species were resistant to ampicillin and gentamicic. In a study performed on 124 blood culture-positive neonates with sepsis at neonatal ward of Ali Asghar's Children Hospital; the most common pathogens were *Enterobacte* (27%), *Staphyloccocus aureus* (23%) and *Klebsiella* (24%), respectively [10]. In that study almost all Gram negative bacteria were resistant to ampicillin. In another study in Iran on 242 neonates, *Staphylococus aureus* was the leading cause of neonatal sepsis and *Klebsiella*

was found to be the third most common etiologic agent[11]. Missallati et al reviewed 36 cases of blood-culture-proven neonatal septicemia. They found *Klebsiella* as the most common microorganism[12]. In their study, similar to ours, the bacterial isolates were resistant to ampicillin. However, they reported sensitivity of the isolates to cefotaxim but in this study only 4% klebsiella was sensitive to cefotaxim and all were resistant to ceftazidim. *Enterobacter* infections are emerging as significant pathogens among cases of neonatal sepsis. In this study 2nd most common organism responsible for neonatal sepsis was *Enterobacter.* Bhutta in his study found 10% neonate developed sepsis with *Enterobacter*. Approximately half (47%) of *Enterobacter* infections presented within 72 hour of birth and the associated mortality was 21%. Increasing resistance to commonly used first- and second-line antibiotics over the last five years was noted [13].

Acinetobacter can be a cause for concern in neonatal units. It may be associated with severe complications like bleeding diathesis, NEC, meningitis and hyperbilirubinemia with consequent high mortality [14]. In that study 10.8% neonatal sepsis are due to acinatobacter. Misra A found acinatobacter was responsible for neonatal sepsis in 31.0% baby. This high number in their study was due to increase outbreak of Acinatobacter sepsis in that period.

In summary our bacterial profile was not the same as western countries, Gram-negative bacteria and in particular *Klebsiella and enterobacter* species were the leading causes of neonatal sepsis. However the prevalence of resistant *klebsiella* spp. was significant and deserves more consideration. We reviewed the prevalence of various etiologic agents in a one year period. We showed that our bacterial profile was not the same as western countries, Gram-negative bacteria and in particular *Klebsiella and enterobacter* species were the leading causes of neonatal sepsis and almost all were resistance to ampicillin, gentamicin and third generation cephalosporin.

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