ORIGINAL ARTICLE

NEONATAL SEPSIS: A STUDY OF CAUSATIVE PATHOGENS AND THEIR ANTIMICROBIAL SENSITIVITY PATTERN AT TERTIARY HOSPITAL

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ABSTRACT

Background: Neonatal sepsis is a clinical syndrome of bacterial infection characterized by signs and symptoms of systemic involvement during first month of life. It is a common cause of morbidity and mortality in full term and preterm neonates. The microorganisms and their sensitivity pattern vary from region to region and time to time. The current study was conducted to know the pattern of bacterial organisms at a tertiary level hospital and their response to commonly used antibiotics.

Material & Methods: This descriptive study was conducted at Special Care Baby Unit, Department of Child Health and Microbiology Section Department of Pathology, Hayatabad Medical Complex, Peshawar, from February 2010 to January 2011. Blood was taken from 456 consecutive neonates admitted to Special Care Baby Unit fulfilling criteria for neonatal sepsis. The clinical and laboratory data was recorded.

Result: A total of 456 blood cultures were taken, out of these 88(19.3%) were positive. Escherichia coli was the most common organism found in 36(40.91%) cases, followed by *Klebsiella spp.* in 17(19.32%), *Staphylococcus aureus* 14(15.91%), *Pseudomonas aeruginosa* 12(13.63%) and *Staphylococcus epidermidis* in 9(10.23%). All isolates showed low sensitivity to ampicillin, good sensitivity to cefotaxime & ceftazidime, and maximum sensitivity to amikacin, cefepime, ciprofloxacin, meropenem and vancomycin.

Conclusion: Neonatal sepsis is a leading cause of neonatal admissions, morbidity and mortality in developing countries. Drug resistance is one of the emerging issues especially for routinely used antibiotics as found in our study.

Key Words: Neonatal sepsis, Bacterial isolates, Blood culture.

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INTRODUCTION

Neonatal sepsis is a clinical syndrome of bacterial infection characterized by signs and symptoms of systemic involvement during the first month of life.[1] Neonatal sepsis is an important and common cause of morbidity and mortality in full term as well as preterm neonates and is the result of interaction between the products of microorganisms and host factors including cytokines and other mediators.[2,3] Perinatal mortality rate is 50-60/1000 and neonatal mortality rate is 50/1000.[4] The incidence of neonatal sepsis in the developed countries is 1-10/1000 live births, where as it is roughly three times more in developing countries. Sepsis occurring in the first week of life is called as early onset sepsis (EOS) and one occurring in the rest three weeks of life is late onset sepsis (LOS).[5]

Neonatal sepsis is associated with significant morbidity and mortality throughout the world.[6] Though sepsis is a cause of neonatal deaths in the developed countries the scenario is more serious in developing countries, where neonatal sepsis is responsible for 30-50% of neonatal mortality.[7] Pathogens responsible for EOS are mostly from vertical transmission while late onset neonatal sepsis is caused by horizontal transmission. The microorganisms change from one to other region and with the passage of time. The incidence is mainly due to poor antenatal care and lack of trained staff to conduct deliveries. There is a strong association between maternal urinary tract infection, pyrexia, vaginal discharge & unclean vaginal examination during labour and early onset neonatal sepsis.[8]

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In 1960, in Western world, gram negative organisms were the most common isolates of neonatal sepsis; however, it changed to group B Streptococci in 1970. In next couple of decades coagulase negative Staphylococci emerged as the commonest pathogen. The aetiological agents for neonatal sepsis in the developing countries are gram negative bacilli.[9,10] Gram negative bacteria are steadily increasing cause of neonatal sepsis in Asian countries.[11]

Bacterial resistance is an important issue throughout the world and especially in this part. Multidrug resistance has increased in the last two decades. There are multiple explanations including; over the counter sale and irrational use of antibiotics, and poorly controlled infections in maternity centers.[12,13]

Timely diagnosis of neonatal sepsis is extremely important. Though various diagnostic modalities are present for neonatal sepsis including c-reactive protein, complete blood count, platelet count, erythrocyte sedimentation rate, yet blood culture is the gold standard.[14]

Table 1: Bacterial isolates causing neonatal sepsis at tertiary hospital (n=88)

S. No.	Bacterial Isolates	Number	Percentage
1.	Escherichia coli	36	40.91%
2.	Klebsiella spp.	17	19.32%
3.	Staphylococcus aureus	14	15.91%
4.	Pseudomonas aeruginosa	12	13.63%
5.	Staphylococcus epidermidis	9	10.23%

A great diversity is present on pattern of causative organisms in various studies conducted from time to time.[15]

The current study was conducted in order to know the pattern of bacterial organisms at tertiary level hospital and their response to various commonly used antibiotics in the special care baby unit.

MATERIAL AND METHODS

This descriptive study was conducted at Special Care Baby Unit, Department of Pediatrics, Hayatabad Medical Complex Peshawar. Neonates with clinical features of sepsis were included in the study with age 0 to 28 days. Dysmorphic babies, neonates with kernicterus, grade III birth asphyxia, neonates on antibiotics or those cases where mothers have received antibiotics before delivery were excluded from the study.

Detailed history including obstetric history, maternal risk factors, and physical examination (signs and symptoms) were recorded on proforma. Investigations including full blood count, blood glucose, blood urea and blood cultures were sent in all cases. Cerebrospinal fluid and urine examination and cultures were sent in selected cases.

Blood sample of 2.5 ml was taken in 30 ml closed circuit blood culture bottle from all neonates with features of neonatal sepsis. Cultures were processed by aseptic techniques and sent to Microbiology Section, Department of Pathology Hayatabad Medical Complex (HMC) Peshawar. Antibiotics on empirical grounds were started after taking blood for culture sensitivity and then modified accordingly. The sensitivity was checked for commonly used antibiotics ampicillin, cefotaxime, ceftazidime, cefepime, amikacin, ciprofloxacin, meropenem and vancomycin.

RESULTS

A total of 456 blood cultures were taken, out of these 88 (19.3%) were positive. *Escherichia coli*

Table 2: Antibiotics sensitivity pattern of blood cultures in neonates presenting with sepsis

S. No.	Organism	Number	Amp	Cefot	Ceftz	Cefpm	Amikacin	Cipro	Mero	Van
1.	E. coli	36	5(13.88%)	19(5.77%)	22(61.11%)	26(72.22%)	29(80.55%)	28(77.77%)	35(97.22%)	33(91.66%)
2.	Klebsiella	17	3(17.65%)	10 (58.82%)	11 (64.70%)	14 (82.35%)	12(70.59%)	15(88.23%)	16(94.12%)	15(88.23%)
3.	Staph aur	14	1(7.14%)	6(42.86%)	7(50.00%)	10(71.43%)	9 (64.28%)	8(57.14%)	13(92.85%)	14(100.0%)
4.	P. aerug	12	2 (16.67%)	5 (41.67%)	10 (83.33%)	9 (75.00%)	8 (66.67%)	10 (83.33%)	11 (91.67%)	10 (83.33%)
5.	Staph epi	9	2(22.22%)	6(66.67%)	6(66.67%)	7(77.78%)	7(77.78%)	5 (55.56%)	8 (88.89%)	8 (88.89%)

Amp: Ampicillin, E. coli: Escherichia coli, Cefot: Cefotaxime, Staph aur: Staphylococcus aureus, Ceftz: Ceftazidime, Staph epi: Staphylococcus epidermidis, Cefpm: Cefepime, P. aerug: Pseudomonas aeruginosa, Cipro: Ciprofloxacin, Mero: Meropenem, Van: Vancomycin.

was the most common pathogen isolated in 36 (40.91%) cases followed by *Klebsiella spp.* 17 (19.32%), *Staphylococcus aureus* 14 (15.91%), *Pseudomonas aeruginosa* 12 (13.63%) and *Staphylococcus epidermidis* 9 (10.23%). (Table 1)

All isolates showed low sensitivity to ampicillin, good sensitivity to cefotaxime and ceftazidime, and maximum sensitivity to amikacin, cefepime, ciprofloxacin, meropenem and vancomycin. (Table 2)

DISCUSSION

Neonatal sepsis is responsible for 1.5 to 2.0 million deaths per year in the developing countries. Gram negative organisms were responsible for about more than 60% of total isolates. This predominance of gram negative organisms is consistent with most of the local date.

E. coli constituted 40.91% Klebsiella 19.32%, Staphylococcus aureus 15.91%, Pseudomonas aeruginosa 13.63% and Staphylococcus epidermidis 10.23%. Almost same results were found by Ahmad A et al with E. coli as the most common isolates followed by Klebsiella, Pseudomonas aeruginosa, Staphylococcus aureus and epidermidis.[16] Butt et al found Escherichia coli as the commonest pathogen constituting 31.67% .[17] Aurangzeb B et al also detected E coli as the common pathogen in their study.[18] In other local studies gram negative organisms were common but Klebsiella and Enterobacter were the most frequently occurring organisms.[19,20]

In the developed countries gram positive cocci are the most common bacterial isolates. Group B Streptococci was reported as the most common pathogens in term infants in United States by National Institute of Child Health and Development.[21] In a study conducted at the United Kingdom showed Group B Streptococci as the most common bacterial isolates in term infants followed by coagulase-negative Staphylococcus, non-pyogenic streptococci and E. coli.[22] Isaac et al also reported gram positive cocci as the commonly etiological agents for neonatal sepsis causing sepsis in more than 60%.[23]

In our study ampicillin had lowest sensitivity to all bacterial isolates. There was no sensitivity to Staphylococcus aureus and 12% sensitivity to Staphylococcus epidermidis. Highest sensitivity was recorded to meropenem and vancomycin followed by amikacin, cefepime and ciprofloxacin. Vancomycin showed a sensitivity of 88-100% and meropenem showed 88-97%. As far as cephalosporins are concerned moderate sensitivity was observed for third generation ones i.e. cefotaxime and ceftazidime, while higher sensitivity was documented for fourth generation cephalosporins i.e. cefepime.

Waheed et al found cefotaxime as the most efficacious drug with 80% sensitivity to Klebsiella, 70% to staphylococcus aureus and 65% to Escherichia coli .[24] Ceftazidime has almost the same results. Sensitivity of amikacin was high against Klebsiella i.e. 80% but low against other organisms. Ciprofloxacin also did not show encouraging results. Anwer et al found amikacin as the most effective antibacterial with efficacy of about 90-100%, cefotaxime sensitivity of 84-89% and least sensitivity to Ampicillin i.e. less than 20%.[25]

Mokuolu et al found 94% of the organisms were sensitive to azithromycin followed by streptomycin 77.8%, gentamycin 73.3% and ampicillin-salbactam 69.2%. The common pathogen in this study was staphylococcus aureus, coagulase negative staphylococcus albus and Klebsiella sp and unclassified Choliforms.[26] Ellabib et al found Enterobacteriaceae most common (Serratia, Klebsiella and Enterobacter spp.) followed by coagulase negative and positive staphylococci. The low resistance was found to imipenem, ciprofloxacin and piperacillin/tazobactam while all staphylococci were sensitive to vancomycin.[27] Shresta et al found highest resistance to ampicillin (91.94%) and least to chloramphenicol (94.84%). None of the isolates in this study were resistant to vancomycin and teicoplanin.[28] In our special care baby unit we use combination therapy of ampicillin and amikacin. We found that response was good in most of the cases as later culture sensitivity proved amikacin as to be highly efficient drug.

CONCLUSION

Neonatal sepsis is a leading cause of neonatal admissions, morbidity and mortality in developing countries. Drug resistance is one of the emerging issues especially for routinely used antibiotics as found in our study.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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None declared.