

NEONATAL SEPTICAEMIA: A HOSPITAL BASED STUDY IN EASTERN NEPAL

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ABSTRACT

Septicaemia is a major cause of neonatal morbidity and mortality. Premature rupture of membrane, premature delivery, low birth weight and hospitalisation of the neonate are some of the predisposing factors, which influence the onset of infection and its outcome. Depending on the time of onset and the causative factors, a wide variety of organisms are implicated in neonatal septicaemia. The blood culture takes a minimum of 48 hrs to arrive at a definitive diagnosis. A prompt management of such cases along with empirical antibiotic therapy remains the mainstay of management. Hence, knowledge about the organisms prevalent in a particular hospital and their antibiotic susceptibility pattern is an important prerequisite. The study was carried out at the B.P. Koirala Institute of Health Sciences, a tertiary care hospital, in Eastern Nepal for a period of 3-years from 1998 to 2001. Blood samples from 1567 neonates with suspected septicaemia were cultured using standard microbiological technique. 540 (35%) samples were culture positive. Gram-positive bacteria (74%) were more common than Gram-negative bacteria (27%). Staph aureus (60%) was the most common bacterial isolate. Resistant to ampicillin was seen but most were susceptible to other antimicrobial including gentamicin, amikacin, cefotaxime, and ciprofloxacin. Positivity rate decreased in the 3rd year to 25% as against first two years of 41% and 47% respectively, which was, attributed to training and implementation of various measures of infection control practices. Candida spp was not observed during the period of study. It was concluded that a continuous surveillance of the causative agents and their antimicrobial susceptibility pattern is required to control the infection in the hospital neonatal unit.

Key Words: Neonatal septicaemia, Organisms, Antimicrobial susceptibility pattern.

INTRODUCTION

Infections remain an important cause of morbidity and mortality in neonates. Neonatal sepsis is the most important of all neonatal infections. Prematurity, immature immune status, inadequate disinfection and sterilization procedures during home delivery are the predisposing factors in neonatal period.¹ A remarkable feature of the clinical manifestation of neonatal septicaemia (NS) is non-specificity of symptoms, which creates difficulty in diagnosis of infection in the early

stage. High degree of suspicion and keen observation can help to save the children.²

Etiological agents implicated in neonatal septicaemia vary from place to place and change with time and antibiotic use. Organisms implicated are dependant on the age of onset of neonatal septicaemia. In early onset (<72Hrs) Group B Streptococcus, Listeria monocytogenes and gram-negative bacilli namely E.coli are commonly involved, whereas coagulase negative Staphylococcus, Enterococcus, Klebsiella

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and *S.aureus* predominate in late onset (>72hrs) septicaemia.

Blood culture remains an important investigation in diagnosing NS. But it has its limitations. In routine practice a minimum of 48 hrs are required to isolate, identify and determine the anti-microbial susceptibility pattern of bacteria. Prompt institution of empirical treatment is a necessity to decrease the mortality in the septicaemic neonates. This can be effectively achieved in a hospital set up where a prior knowledge of the organisms causing infection in neonates and their sensitivity pattern is available to the clinician.

The present study was undertaken with the objectives of finding the incidence of neonatal septicaemia and to identify the bacterial pathogens and their antimicrobial susceptibility pattern.

SUBJECTS AND METHODS

The blood culture samples of 1,567 neonates admitted with suspected septicaemia at B.P. Koirala Institute of Health Sciences, a tertiary care teaching hospital in Eastern Nepal, during August 1998 to July 2001 were included in the study. One millilitre of blood collected under aseptic conditions was inoculated in blood culture bottle containing 9 ml of Brain Heart Infusion broth and incubated at 37°C. Subcultures were made on to sheep blood agar, chocolate agar and MacConkey agar after 24 hrs and 48hrs of aerobic incubation. Plates were incubated overnight at 37°C in 5% CO₂ atmosphere. Thereafter, culture bottles were observed for turbidity for

10days. Final subcultures were done before reporting negative. Growth obtained was identified by standard methods.³ Antimicrobial susceptibility of the bacterial isolates to antibiotics namely amikacin, ampicillin, cefotaxime, ciprofloxacin, methicillin and gentamicin was determined by Kirby Bauer's disc diffusion method. Results were interpreted as per NCCLS guidelines.

RESULTS

Patients: Out of 1,567 blood cultures, 540 (34.5%) were positive for bacterial pathogens. 65% were isolated from early onset and 36% were isolated from late onset septicaemia.

Organisms: Gram-positive cocci were isolated in 394 (73%) and gram-negative bacilli in 146 (26.5%). *Staphylococcus aureus* in 325(60%) was predominant both in early (55%) and late onset (52%) septicaemia. *Enterococcus* in 60(11%), coagulase negative *Staphylococcus* in 55(11%) were the other gram-positive organisms isolated. Among the Gram-negative organisms *Klebsiella pneumoniae* in 36 (6.7%), *Enterobacter* Sp in 30 (5.6%) were the most common. *Acinetobacter* (5%), *Pseudomonas* (4%) and *E.coli* (4%) were the other isolates.

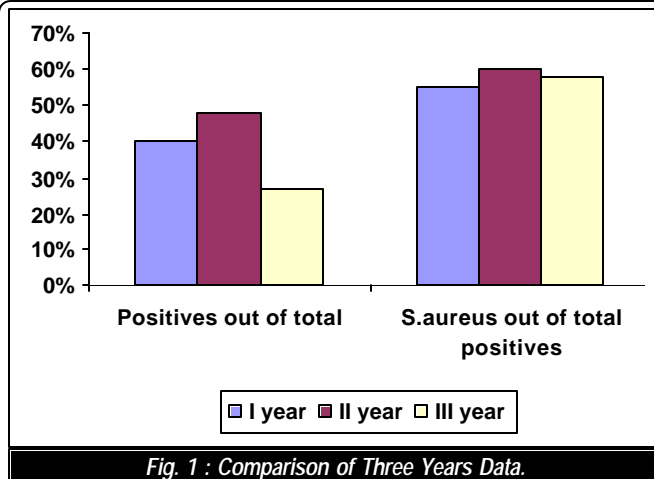
While number of total samples remained almost unchanged during the study period, a decrease in the number of positive cultures from 41% and 47% in first and second year to 25% in the third year was observed (Fig. 1). The isolation of *Staph aureus* remained almost the same during the 3-year period. It was also observed that in 2nd and 3rd year of study *Klebsiella*

Table I : Percentage resistance to antibiotics in bacterial isolates (n = 540)

Organisms	Total No. (%)	Amikacin	Ampicillin	Cefotaxime	Ceftazidime	Chloramphenicol	Ciprofloxacin	Gentamicin	Methicillin
Gram positive	394 (73.0)								
<i>Staph.aureus</i>	325 (60.2)	3	59	8	3	17	28	19	16
<i>Enterococcus fecalis</i>	55 (10.2)	13	12	17	3	17	17	20	-
CNG	10 (1.9)	8	33	8	0	17	17	25	-
<i>Streptococcus</i>	4 (0.7)	0	25	50	0	0	0	0	-
Gram Negative	146 (27.0)								
<i>K. pneumoniae</i>	36 (6.6)	11	58	14	6	22	14	42	-
<i>Enterobacter</i>	30 (5.6)	3	63	13	13	40	10	33	-
<i>Acinetobacter</i>	25 (4.6)	12	68	28	12	44	24	40	-
<i>E.coli</i>	19 (3.5)	5	58	11	16	42	11	32	-
<i>Pseudomonas</i>	19 (3.5)	5	-	16	16	-	26	21	-
<i>Citrobacter</i>	12 (2.2)	0	58	0	0	25	17	25	-
Others	5 (0.9)	0	40	20	20	40	0	0	-

- = Not done

Others = *Proteus* (3), *Salmonella sp.* (1), *Haemophilus* (1)



were seen more frequently (7% & 8%) as against *Enterobacter* (3% & 2%), *Klebsiella* replacing *Enterobacter* in the later 2 years.

Antibiotic Resistance: Resistance to ampicillin (>50%) was observed in both gram positive and negative bacteria. Methicillin resistance was seen in 16% of *Staph aureus* isolates. Resistance to aminoglycosides, gentamicin (20-40%) and amikacin (0-12%) was low. Resistance to 3rd generation cephalosporins and ciprofloxacin ranged from 0-30% (Table I).

DISCUSSION

Neonatal septicaemia is a major cause of morbidity and mortality in neonates. Premature rupture of membrane, multiple vaginal examinations and neonatal factors namely prematurity, low birth weight predisposes a neonate to infections. Type of infection and time of onset of illness determine the microorganisms causing these infections. In early onset septicaemia (EOS) intrauterine factors are responsible with a predominance of gram-negative organisms and group B *Streptococcus*. But the late onset septicaemia is either due to umbilical sepsis or intravenous catheterisation and hospitalisation for other indications. In this group *Klebsiella pneumoniae*, *Enterobacter*, *Pseudomonas* and *Staphylococcus aureus* are predominant.

In a pilot study, carried out in this hospital during 1997-98 in 77 cases of septicaemia, blood culture was found to be positive in 46 (60%) with a predominance of gram-negative bacteria (72%). *E.coli* being most common followed by *Klebsiella*, *Enterobacter*. *Staphylococcus aureus* was most common among the gram-positive organisms.⁴

A shift in the type of isolates was observed in the present study with a predominance of *Staph.aureus* (60%). This trend was also observed by other workers.^{5,6,7} This observation is in contrast to many other studies that reported *Klebsiella* and

other gram-negative organism and *Staph.aureus* as the common isolates.^{8,9,10}

In the present study, majority of patients had EOS showing predominantly *Staph aureus*. Being a tertiary care hospital, complicated pregnancies in labour are referred to BPKIHS. Premature rupture of membrane and repeated vaginal examinations by the midwives were the common factors observed on admissions. *Staph aureus* is not a common organism in the genital tract. Hence it was presumed that possibly due to poor knowledge of disinfection and sterilization in domiciliary practice, or a higher rate of survival of highly susceptible low-birth weight infants, admitted to neonatal intensive care units, acquire this infection from several sources.

Resistance to ampicillin was seen to the tune of 59% in GPC and 68% in GNB, which is in agreement with many other studies. *Staph aureus* showed resistance (16%) to methicillin an observation also made in other studies.^{7,11,12} Resistance to other group of antibiotics was in concurrence with other studies.

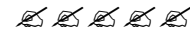
While the total samples per year remained unaltered, a decrease in the positive culture rates over the three-year period was observed. This is attributed to implementation of infection control measures. A combination of ampicillin and gentamicin is the treatment of choice for NS at BPKIHS. It was observed that *Klebsiella* were more resistant to gentamicin (69%) than *Enterobacter* (25%). This could be the possible explanation of relative increase in the incidence of *Klebsiella* in 2nd and 3rd year of the study.

It was concluded that continuous surveillance is needed to understand changing bacterial ecology and the resistance pattern of the antimicrobial agents in a neonatal unit so that an empirical treatment of critically ill or very low birth weight infants could be initiated pending a report of blood culture and sensitivity. Moreover, a decline in infection rate is a great motivation for health care workers for following the infection control practices in the neonatal units.

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