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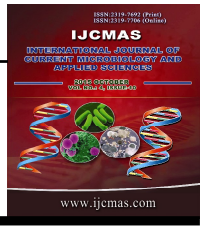

Original Research Article

Bacteriological Profile and their antibiotic sensitivity Pattern in Neonatal Septicemia

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A B S T R A C T

Systemic infection in the newborn is the commonest cause of neonatal mortality. Clinical features of sepsis are non-specific in neonates and a high index of suspicion is required for its timely diagnosis. Blood cultures were done in 1098 cases of clinically suspected neonatal septicemia to determine the bacteriological profile & their antibiotic sensitivity pattern. Blood culture was positive in 36.6% of the cases; of these gram-negative septicemias was seen in 59.7% of cases. *Klebsiella pneumoniae* and *Enterobacter species* were the predominant pathogen amongst gram-negative isolates, whereas *Staphylococcus aureus* was the most common pathogen among gram-positive isolates (74%). Prompt treatment of neonatal sepsis with judicious use of appropriate antibiotics can minimize the mortality and morbidity.

Introduction

Septicemia in neonates refers to systemic and generalized bacterial infection documented by a positive blood culture in the first month of life. It is one of the leading causes of neonatal mortality in India (Kairavi and Saklainhaider, 2010). In pre antibiotic era, the mortality from neonatal septicemia was 90% but it has declined to around 25% after antibiotic came in use (Kaushik *et al.,* 1998). The term neonatal sepsis refers to systemic infection of neonates including septicemia, pneumonia, meningitis, arthritis, osteomyelitis and urinary tract infection (Mane *et al.,* 2010). It is estimated that 20% of all neonates develop sepsis and out of which approximately 1% die due to sepsis related causes (Bang *et al.,* 1999). Sepsis is the commonest cause of neonatal mortality and is probably responsible for 30–50% of the total neonatal death each year in developing countries (Stoll, 1997). However, early diagnosis and proper management of neonatal septicemia with appropriate antimicrobial agents can bring down the mortality and morbidity substantially. Hence, the present study was undertaken to determine bacteriological profile and their

antibiotic sensitivity pattern for planning the better management of these cases.

Materials and Methods

The present study includes 1098 cases of clinically suspected neonatal septicemia admitted in the Neonatal Intensive Care Unit (NICU) of our hospital admitted during the period of March 2014 to August 2015. With all aseptic precautions about 1–2 ml of blood was drawn from each neonate and inoculated into 10 ml of brain heart infusion (BHI) broth. Broth was then sent to the department of microbiology for culture and sensitivity. Blood cultures were processed using standard technique & antibiotic sensitivity was performed using Kirby-Bauer's disc diffusion method. The aerobic isolates were identified up to the species level on the basis of colony characteristics, gram's stain morphology, and biochemical properties. Repeat blood culture was done to rule out contamination.

Results and Discussion

A total of 1098 blood samples from clinically diagnosed cases of neonatal septicemia were processed during the study period. Blood cultures were positive in 402 (36.6%) samples whereas in 696 (63.4%) cases there was no growth. Out of 402 positive samples gram –ve bacilli were seen in 240 (59.7%) samples and gram +ve cocci in 162 (40.3%) (Table 1). Amongst gram-negative bacilli 83.75% (201/240) isolates belongs to family Enterobacteriaceae and rest 16.25% (39/240) were non-fermenters. Amongst family Enterobacteriaceae, *Klebsiella pneumoniae* was the predominant isolates (62.6%) followed by *Enterobacter spp.* (23.8%) and *Escherichia coli* (8.9%). *Pseudomonas aeruginosa* (53.8%) was the most common isolate among non-fermenters followed by *Acinetobacter spp.* (46.2%). *Staphylococcus aureus* was the most common isolate (74%) amongst gram +cocci followed by *Coagulase –ve Staphylococci (CONS)* (18.5%) & *Enterococcus spp.* (7.4%). Regarding the antibiotic sensitivity pattern, Imipenem was found to be the most sensitive (91%) antibiotic for the members of family Enterobacteriaceae, followed by meropenem (71.6%) and cotrimoxazole (70.6%). Amongst non-fermenters colistin was the most sensitive (100%) antibiotic followed by imipenem (84.6%) and piperacillin+tazobactam (66.6%). Linezolid was found to be the most sensitive (100%) antibiotic for gram +ve isolates, followed by vancomycin (95.6%) and teicoplanin (87.6%). ESBL production was seen in 43.6% (55/126) of *Klebsiella pneumoniae* and 22.2 % (4/18) of *Escherichia coli*.

Table.1 Distribution of clinical isolates from total neonatal septicemia positive cases (n=402)

Sr. No.	Organisms	No. of Isolates	Percentage
1.	*Klebsiella pneumoniae*	126	31.34 %
2.	*Staphylococcus aureus*	120	29.85 %
3.	*Enterobacter spp.*	48	11.94 %
4.	Coagulase Negative *Staphylococci (CONS)*	30	7.46 %
5.	*Pseudomonas aeruginosa*	21	5.22 %
6.	*Escherichia coli*	18	4.47 %
7.	*Acinetobacter spp.*	18	4.47 %
8.	*Enterococcus spp.*	12	2.98 %
9.	*Citrobacter spp.*	09	2.23 %
Total		**402**	**100%**

Table.2 Antibiotic sensitivity pattern of gram –ve isolates belongs to family Enterobacteriaceae from neonatal septicemia cases (n=201)

Sr. No	Name of antibiotics	*K. pneumoni* (n=126)	*Enterobacter spp.* (n=48)	*E. coli* (N=18)	*Citrobacter spp.* (n=9)	Total Sensitive (n=201)
1.	Gentamicin	26 (20.6 %)	11(22.9%)	7(38.8%)	4(44.4 %)	48(23.8%)
2.	Amikacin	65 (51.5 %)	30 (62.5%)	16 (88.8 %)	6 (66.6%)	117(58.2%)
3.	Ampicillin	19 (15%)	12 (25 %)	6 (33.3%)	4 (44.4%)	41 (20.3%)
4.	Ampicillin+sulbactam	33 (26.1 %)	13 (27 %)	8 (44.4 %)	5 (55.5%)	59 (29.3%)
5.	Imipenem	112 (88.8 %)	46 (95.8 %)	17(94.4 %)	8 (88.8%)	183 (91 %)
6.	Meropenem	84 (66.6 %)	38 (79.1 %)	15 (83.3 %)	7 (77.7%)	144 (71.6%)
7.	Ertapenem	60 (47.6 %)	26 (54.1%)	10 (55.5 %)	5 (55.5 %)	101 (50.2%)
8.	Tobramycin	55 (43.6 %)	22 (45.8 %)	7 (38.8%)	4 (44.4 %)	88 (43.7 %)
9.	Cotrimoxazole	91 (72.2 %)	32 (66.6 %)	13 (72.2%)	6 (66.6 %)	142 (70.6%)
10.	Cefepime	62(49.2 %)	15 (31.2 %)	9 (50 %)	5 (55.5 %)	91 (45.2%)
11.	Ciprofloxacin	42 (33.3 %)	35 (72.9 %)	8 (44.4%)	4 (44.4%)	89 (44.2%)
12.	Aztreonam	19 (15 %)	15 (31.2%)	4 (22.2 %)	5 (55.5 %)	43 (21.3%)
13.	Ceftriaxone	36 (28.5 %)	13 (27 %)	9 (50 %)	4 (44.4%)	62 (30.8%)
14.	Piperacillin+tazobactam	83 (65.8 %)	29 (60.4 %)	11 (61.1%)	6 (66.6%)	129 (64.1%)

Table.3 Antibiotic sensitivity pattern of gram +ve isolates from neonatal septicemia cases (n=60)

Sr. No.	Name of antibiotics	*S. aureus* (n=120)	*Coagulase negative Staphylococci (CONS)* (n=30)	*Enterococcus spp.* (n=12)	Total Sensitive (n=162)
1.	Erythromycin	72(60%)	19 (63.3 %)	8 (66.6%)	99 (61.1%)
2.	Clindamycin	69 (57.5%)	21(70%)	7 (58.3%)	97 (59.8%)
3.	Azithromycin	92 (76.6%)	22 (73.3%)	8 (66.6%)	122 (75.3%)
4.	Vancomycin	116 (96.6%)	28 (93.3%)	11 (91.6 %)	155 (95.6%)
5.	Linezolid	120 (100%)	30(100%)	12 (100%)	162 (100%)
6.	Teicoplanin	106 (88.3%)	26 (86.6 %)	10 (83.3 %)	142 (87.6%)
7.	Ciprofloxacin	67 (55.8%)	19 (63.3 %)	6 (50 %)	92 (56.7%)
8.	Gentamicin	79 (65.8%)	21(70%)	8 (66.6%)	108 (66.6%)
9.	Levofloxacin	82 (68.3%)	22(73.3%)	7 (58.3%)	111 (68.5%)
10.	Moxifloxacin	79 (65.8%)	21(70%)	8 (66.6%)	108 (66.6%)
11	Penicillin	73 (60.8%)	18 (60%)	8 (66.6%)	99 (61.1%)

Table.4 Antibiotic sensitivity pattern of Non-fermenters from neonatal septicemia cases (n=39)

Sr. No.	Name of antibiotics	*Acinetobacter spp.* (n=18)	*Pseudomonas aeruginosa* (n=21)	Total Sensitive (n=39)
1.	Ciprofloxacin	9 (50 %)	4 (19 %)	13 (33.3 %)
2.	Gentamicin	5 (27.7 %)	8 (38 %)	13 (33.3 %)
3.	Amikacin	6 (33.3 %)	9 (42.8 %)	15 (38.4 %)
4.	Ampicillin+Sulbactam	6 (33.3 %)	8 (38 %)	14 (35.8 %)
5.	Imipenem	17 (94.4 %)	16 (76.1 %)	33 (84.6 %)
6.	Cefepime	12 (66.6 %)	11 (52.3%)	23 (58.9 %)
7.	Ceftazidime	9 (50 %)	11 (52.3%)	20 (51.2 %)
8.	Cefoperazone+Sulbactam	10 (55.5 %)	9 (42.8 %)	19 (48.7 %)
9.	Piperacillin+ Tazobactam	11 (61.1 %)	15 (71.4 %)	26 (66.6 %)
10.	Ticarcillin	13 (72.2 %)	12(57.1 %)	25 (64.1 %)
11.	Colistin	18 (100%)	21 (100 %)	39 (100 %)
12.	Aztreonam	10 (55.5 %)	10 (47.6 %)	20 (51.2 %)
13.	Tobramycin	13 (72.2 %)	12 (57.1 %)	25 (64.1 %)
14.	Ceftriaxone	7 (38.8 %)	3 (14.2 %)	10 (25.6%)
15.	Tetracycline	11 (61.1 %)	4 (19 %)	15 (38.4 %)

Blood culture remains the gold standard method for the diagnosis of septicemia and should be done in all cases of suspected sepsis prior to starting antibiotic therapy. A positive blood culture and antibiotic sensitivity pattern of the isolate is the best guide to antimicrobial therapy (Aggarwal *et al.,* 2001). In the present study, blood culture positivity rate in neonatal septicemia cases was 36.6%, where as in 63.4% cases there was no growth. Though there was a wide variation in blood culture positivity rate over the years but a high blood culture positivity rate (56%) was reported by Sharma *et al.* (1987) and Murty and Gyaneshwari (2007) (52.6%) and a low blood culture positivity rate was reported by Mathur *et al.* (1994) (24.8%). In our study 36.6% isolates were positive in blood culture, which was more or less similar to the study done by Mondal *et al.* (1991) (32%). A low blood culture positivity rate might be due to several reasons – administration of antibiotics prior to blood collection, or possibility of infection with anaerobic bacteria, which cannot be ruled out. Moreover, negative blood cultures do not exclude sepsis as cases with negative blood culture have been reported with fatal illness and post-mortem evidence of infection (Squire *et al.,* 1979). Chow *et al.* (1974) reported that 26% of all neonatal septicemia was caused by anaerobes.

In the present study, 59.7% (240/402) isolates were gram –ve bacteria which was similar to the report done by Kairavi and Saklainhaider (2010) who also found that gram –ve organisms as major pathogen in neonatal septicemia cases. Amongst the gram –ve organisms, *Klebsiella pneumoniae* was the predominant isolate (52.5%) followed by *Enterobacter spp.* (20%) and *Escherichia coli* (7.5%). This finding was also similar to the study done by Kairavi and Saklainhaider (2010) who also found *Klebsiella spp.* as predominant pathogen (47.1%). In our study 40.3% isolates were gram +ve organisms, in which *Staphylococcus aureus* was the most common pathogen (74%) followed by *Coagulase negative Staphylococci (CONS)*

(18.5%) and *Enterococcus spp.* (7.4%). This finding was similar to Mathur *et al.* (1994) where *Staphylococcus aureus* was predominant pathogen among gram +ve isolates.

In our study, *Klebsiella pneumoniae* was highly susceptible to Imipenem (88.8%), followed by cotrimoxazole (72.2%) and Meropenem (66.6%) which was similar to Mane *et al.* (2010) imipenem was 95.8% sensitive to *Enterobacter spp.* and 94.4% sensitive to *E. coli*. Over all for the member of family Enterobacteriaceae Imipenem was the highly sensitive (91%) antibiotic followed by meropenem (71.6%) and cotrimoxazole (70.6%) (Table 2). Amongst gram+ve isolates, *Staphylococcus aureus* was most commonly sensitive to linezolid (100%) followed by vancomycin (96.6%) and teicoplanin (88.3%). Coagulase –ve *Staphylococci* were also highly sensitive to linezolid followed by vancomycin (Table 3). Similarly for non- fermenters colistin was most sensitive (100%) followed by imipenem (84.6%), ticarcillin & piperacillin+tazobactam (66.6% each) (Table 4). Over all the gram +ve isolates were most commonly sensitive to linezolid (100%) followed by vancomycin (95.6%), teicoplanin (87.6%) and azithromycin (75.3%) that was similar to study done by Mane *et al.* (2010).

Incidence of neonatal septicemia is variable and differs from one place to another. It depends on several factors like gestational age, fetal birth weight, maternal nutrition, perinatal care and hygienic conditions, child health care facilities etc. Antimicrobial sensitivity pattern differs in different studies as well as at different times in the same hospital because of different life conditions and emergence of resistant strain due to indiscriminate use of antibiotics (Mustafa and Ahmed, 2014).

In conclusion, Neonatal septicemia is a life threatening emergency and rapid treatment with suitable antimicrobial agent is essential for favorable outcome. For effective management of neonatal septicemia cases, the study of bacteriological profile with their antibiotic sensitivity pattern plays a significant role. Because there is emergence of multidrug resistance organisms, so there should be strategy of antibiotic usages in the hospital, which should be renewed periodically.

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