ORIGINAL RESEARCH PAPER

Volume-9 | Issue-2 | February-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY OF SOCIO-DEMOGRAPHIC AND MICROBIOLOGICAL PROFILE OF NEONATAL SEPSIS AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF ISOLATES ADMITTED IN A TERTIARY HOSPITAL IN CENTRAL INDIA.

Paediatrics

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ABSTRACT

Objective: As Neonatal sepsis is a major cause of morbidity and mortality of newborns (< 1 month of age) we have done this study to study the sociodemographic and microbiological profile of neonatal sepsis and antibiotic susceptibility pattern of the isolates from neonates admitted in a tertiary hospital in central India.

Results: We studied a total of 200 suspected cases of neonatal sepsis, out of which 30 (15%) cases showed positive blood culture. The prevalent of positive blood culture with different neonatal risk factors (sex, age, birth weight, gestational age, and delivery mode) showed highest positive bacterial growth in male (60%); 3 or above 3 days age (70%); low birth weight (67%); preterm gestational age (37%); and caesarean delivery mode (63%). Among positive cases, the bacteriological profile was found highest for *Staphylococcus aureus* (40%) followed by *Klebsiella pneumoniae* (16%).

KEYWORDS

Neonatal sepsis

INTRODUCTION

Sepsis neonatorum or Neonatal sepsis is a clinical syndrome which results from the pathophysiologic effects of local or systemic infection affecting newborns below 1 month of age and encompasses systemic infections including meningitis, pneumonia, arthritis, osteomyelitis and urinary tract infections [1, 2]. The bacterial agents associated with neonatal sepsis are Group B Streptococci, *Escherichia coli, Listeria monocytogenes,* coagulase-negative Staphylococci (CoNS), *Staphylococcus aureus,* Enterococci, *Klebsiella* spp., *Enterobacter* spp., *Pseudomonas* spp., *Salmonella* spp., *H. influenzae*, *Neisseria meningitidis*, and *Streptococcus pneumoniae* [3–5].

The rampant unsafe birthing practices in developing countries like India have critical role to cause neonatal infections. Globally, the neonatal morbidity and mortality cases have been estimated to 2.5–3 million, annually [6]. Currently, emergence of multidrug resistant bacteria imposes challenges in treatment of neonatal sepsis [7, 8]. This study aims to determine sociodemographic and microbiological profile of neonatal sepsis and antibiotic susceptibility pattern of the isolates from neonates admitted in a tertiary hospital in central India

METHODOLOGY:

This was a hospital based cross-sectional study conducted from January 2019 to June 2019. Sample size was determined based on prevalence rate of previous study [8]. A total of 200 suspected cases of neonatal sepsis were included in this study. The diagnosis of neonatal sepsis was based on clinical profile, septic screening, and blood culture.

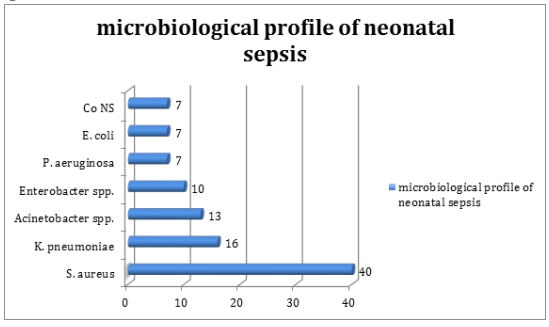
Antibiotic susceptibility test of isolates was performed by modified Kirby-bauer disk diffusion method according to guidelines of Clinical and Laboratory Standards Institute (CLSI) [10]. The antibiotics used in this study were ampicillin (10 µg), amoxycillin (30 µg), piperacillin (100 µg), amikacin (30 µg), gentamicin (10 µg), azithromycin (30 µg), cefotaxime (30 µg), ceftazidime (30 µg), ciprofloxacin (5 µg), ofloxacin (5 µg), cotrimoxazole (25 µg), erythromycin (15 µg), meropenem (10 µg), and imipenem (10 µg).

The data analysis was done in SPSS software version (16.0) and *Chi* square test was performed. *P* value was calculated and considered significant only when it was less than or equal to 0.05.

RESULTS

Out of a total of 200 blood samples studied, 30 samples showed growth of organism and 170 samples did not show any microbial growth. The incidence of neonatal sepsis was 15% among 200 blood samples enrolled in this study. The highest bacterial strains isolated were *S. aureus* (40%) followed by *K. pneumonia*e (16%), *Acinetobacter* spp. (13%), *Enterobacter* spp. (10%), CoNS (7%), *P. aeruginosa* (7%), *E. coli* (7%)

Figure 1 showing microbiological profile of neonatal sepsis from suspected neonates



The highest prevalence (60%) of positive blood culture was found in the male neonates. There was no significant association between gender and blood culture positivity (P > 0.05). In relation to different neonatal risk factors, positive blood culture showed the highest prevalence of bacterial growth in neonatal cases with 3 or above 3 days age (70%); low birth weight (67%); preterm gestational age (37%); and caesarean mode of delivery (63%). Statistical analysis showed that there was significant association between neonatal risk and culture positivity among suspected cases ($P < 0.05$)

Table 1 showing sociodemographic profile of patients with positive blood culture

Neonatal risk factors	Culture positive (%)	Culture negative (%)	P value
Sex 1. male 2. female	 18 (60) 12 (40)	 90 (53) 80 (47)	 >0.05
Age: 1. below 3 days 2. 3 days or above 3 days	 9 (30) 21 (70)	 15 (9) 175 (91)	 <0.05
Birth weight: 1. very low birth weight 2. low birth weight 3. good birth weight	 1 (3) 20 (67) 9 (30)	 1 (0.5) 25 (15) 174 (84.5)	 <0.05
Gestational age: 1. preterm 2. term	 11 (37) 19 (63)	 24 (14) 146 (86)	 <0.05
Mode of delivery: 1. normal 2. LSCS	 11 (37) 19 (63)	 148 (87) 22 (13)	 <0.05

Amoxicillin showed total resistance against enterobacter spp, P. aeruginosa and E. coli while gentamycin showed 100% sensitive towards K. Pneumoniae, enterobacter spp, P. aeruginosa. E. coli and Co NS.

Table 2: Antimicrobial susceptibility patterns of bacterial strains isolated from suspected cases of neonatal sepsis

Antibiotics	K. pneumonia N=5 (%)	Acinetobacter sp N=4 (%)	Enterobacter sp N=3 (%)	P aeruginosa N=2 (%)	E coli N=2 (%)	Staph aureus N=12 (%)	Co NS N=2
amoxycillin	3 (60)	1 (25)	0	0	0	5 (42)	1 (50)
amikacin	5 (100)	3 (75)	3 (100)	2 (100)	2 (100)	10 (83)	2 (100)
gentamycin	5 (100)	3 (75)	3 (100)	2 (100)	2 (100)	11 (92)	2 (100)
cefotaxim	0	2 (50)	1 (33)	2 (100)	1 (50)	8 (67)	1 (50)
ciprofloxacin	2 (40)	1 (25)	1 (33)	1 (50)	1 (50)	7 (58)	1 (50)
ofloxacin	4 (80)	2 (50)	2 (66)	1 (50)	2 (100)	8 (67)	1 (50)
cotrimoxazole	2 (40)	3 (75)	2 (66)	0	0	6 (50)	1 (50)
ceftazidime	0	1 (25)	1 (33)	1 (50)	1 (50)	5 (42)	1 (50)
meropenem	5 (100)	NT	3 (100)	NT	NT	NT	NT
imipenem	5 (100)	NT	3 (100)	NT	NT	NT	NT

DISCUSSION

Even with all the modern advancements in the fields of medicine, neonatal bacterial sepsis is a major cause of death in developing countries. The most common organisms associated with neonatal sepsis vary with time of infections and geographical location [8]. Therefore, information on bacteriological profile of neonatal sepsis and effective antimicrobials for its treatment are important to combat with neonatal morbidity and mortality issues.

This study found 15% of neonates had microbiologically confirmed sepsis. The incidence rate of this study is quite lower compared to previous studies which have reported the incidence rate above 40% [8, 11]. The low incidence rate is due to the fact that this study was conducted in tertiary care hospital where most of the cases were referred from other hospital and clinics. The higher rate of growth positivity was observed in male compared to female neonates. These finding is in agreement with previous studies [12–14]. Most of the previous studies have shown similar pattern of high prevalence of neonatal sepsis in late onset of sepsis [9, 15]. Prolonged use of invasive ventilator and catheter, failure of early breast feeding, longer use of parenteral nutrition, hospitalization, surgery, cardiovascular diseases, and respiratory infections lead to late onset of sepsis among neonates [16, 17]. Positive blood culture was observed high (67%) in low birth weight neonates. The low birth weight is strong neonatal risk factor that leads to cause neonatal sepsis [14]. Preterm neonates have 3 to tenfold higher incidence of infections than full term normal birth weight infants [6]. The neonates delivered by caesarean section showed the highest positive blood culture compared to normal delivery. Studies have revealed increased risk of neonatal death delivered by caesarean compared to vaginal delivery [18].

Bacterial profile revealed the highest prevalence of *S. aureus* followed by *K. pneumoniae Acinetobacter* spp., *Enterobacter* spp., CoNS, *P. aeruginosa*, *E. coli*, *Citrobacter* spp., and *S. typhi* (Fig. 1). These bacterial strains are predominant causative agents which have been identified by several studies [8, 9, 11, 13]. Among the Gram-positive isolates, *S. aureus* is predominant hospital acquired organism. Furthermore, *S. aureus* has greater chance of transmission from health care workers and relatives to neonates [19].

The antibiotic susceptibility pattern of bacterial isolates from blood culture showed the maximum susceptibility towards amikacin, gentamicin, ciprofloxacin, and ofloxacin. However, the isolates showed the higher resistivity pattern towards amoxycillin.

CONCLUSIONS

This study showed the high prevalence of *S. aureus* as Gram-positive bacteria and *K. pneumoniae* as Gram-negative bacteria among suspected neonatal cases. Overall isolates showed maximum sensitivity towards aminoglycosides and quinolones whereas minimum sensitivity towards penicillin.

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