

# Determine the Etiology and Antimicrobial Patterns of Neonatal Sepsis

AYESHA MASOOD<sup>1</sup>, HASSAN RAZA HERAL<sup>2</sup>, SHAMIA ZEESHAN<sup>3</sup>, NIMRA JAVAID SANDHU<sup>4</sup>, ZUHAIB FAROOQ<sup>5</sup>, BILAL ALI ANJUM<sup>6</sup>

<sup>1</sup>Assistant Professor Department of Pathology UCM, The University of Lahore

<sup>2</sup>Consultant Pathologist Mayo Hospital Lahore

<sup>3</sup>Consultant Pathologist Mayo Hospital Lahore

<sup>4</sup>Demonstrator Pathology University of Lahore

<sup>5</sup>Demonstrator University College of Medicine and Dentistry, The University of Lahore

<sup>6</sup>Specialist Registrar, FCPS Paeds Medicine, PIMS Islamabad

Correspondence to: Dr. Shamia Zeeshan, Email: Shamiazeeshan@hotmail.com, Phone No: +923018403996

## ABSTRACT

**Objective:** To determine the etiology and antimicrobial patterns of neonatal sepsis.

**Study Design:** Cross-Sectional

**Place & Duration:** Department of Pathology UCM, The University of Lahore for the duration of two years i.e from 1<sup>st</sup> April 2018 to 31<sup>st</sup> March 2020.

**Methods:** Total 500 blood samples of both genders were extracted in this study. Patients demographics were recorded after written consent. All the patients were worked up with complete history, clinical examination and investigations to rule out confounders and bias in the study results. All the follow ups were done by the researcher himself. Antimicrobial susceptibility testing was carried out by Modified Kirby Bauer disk diffusion method on Mueller Hinton agar using CLSI protocols.

**Results:** In this study, 125(25%) were culture positive extracted from 500 blood samples. Out of 125 positive blood cultures, 72(57.6%) were observed gram negative organisms and gram positive organisms were 48(38.4%) and the rest were positive for Candida spp 5(4%). Pseudomonas spp 22(30.5%) was the most common isolated in gram negative organisms while in gram positive organisms Coagulase Negative Staphylococci (CoNS) 33(68.5%) was the most frequent isolated organism. Variable pattern of resistance was seen among other members of enterobacteriaceae, non-fermenters and Gram positive organisms.

**Conclusion:** It is concluded that the frequency of isolated gram positive organisms were lower in number than that of negative gram organisms due to isolation of Coagulase negative Staphylococci (CoNS) in gram positive and Pseudomonas spp in gram negative.

**Keywords:** Neonatal sepsis, Bacteriological profile, Antibiotic susceptibility, Neonates

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## INTRODUCTION

Neonatal sepsis is a clinical condition caused by the pathophysiological effects of local or systemic infection (sepsis neonatorum). It affects babies under 1 month of age and covers systemic infections such as meningitis, pneumonia, arthritis, osteomyelitis, and infections of the urinary tract<sup>[1,2]</sup>. Neonates are immune-compromised and are weakly effective against bacterial infections. Group B Streptococci, Escherichia coli, Listeria monocytogenes, coagulase-negative Staphylococci (CoNS), Staphylococcus aureus, Enterococci, Klebsiella spp., Enterobacter spp., Pseudomonas spp., Salmonella spp., H. are bacterial agents associated with neonatal sepsis Neisseria meningitidis, influenzae, and Streptococcus pneumoniae<sup>[3-5]</sup>.

Early onset neonatal sepsis (EONS) refers to the occurrence in patients younger than 72 hours of life of a reported infection in the blood or cerebrospinal fluid (CSF) and late onset neonatal sepsis (LONS) refers to the onset of such infection between the ages of 72 hours and 90 days.<sup>2,4</sup> Etiologic agent information is heterogeneous. Though Group B Streptococcus is the most common cause of EONS in developed countries, Enterobacteriaceae is the main cause in developing countries.<sup>[6-14]</sup>

In neonatal septicemic patients, immediate onset of the antimicrobial regimen is mandatory and conclusions need to be drawn on the extensive history of species and their antimicrobial patterns in neonatal intensive care units. In order to determine the pattern of micro-organisms

prevalent in that field, it is very important to conduct such types of studies in every hospital on a regular basis. So, we will develop an antibiogram policy that will assist our patients in offering empirical care choices. The emerging tragedy of neonatal sepsis in combination with antimicrobial resistance to widely used antibiotics is the greatest threat today.<sup>[15]</sup>

## MATERIAL AND METHODS

This study was conducted at Department of Pathology UCM, The University of Lahore for the duration of two years i.e from 1<sup>st</sup> April 2018 to 31<sup>st</sup> March 2020.

In this analysis, a total of 500 blood samples from both sexes were extracted. Detailed demographics of patients, including age, sex, residence and body mass index, were reported after written consent was received. Samples were obtained from patients admitted to University of Lahore Teaching Hospital, Paediatric Ward. In the paediatric emergency of the hospital, paediatric tryptic soya broth blood culture bottles were given to the medical house employees to obtain blood samples. The house staff were given detailed instructions on the technique of aseptic blood collection for culture. Before any antimicrobial medicines started in the hospital, all the samples were obtained. One blood sample was taken, i.e. 0.5-1ml, and then inoculated into 9 ml of tryptic soy broth.

According to Clinical and Laboratory Standards Institute (CLSI) guidelines, antibiotic susceptibility testing of isolates was carried out using the updated Kirby-bauer disc

diffusion process. Gram staining, catalase test, oxidase test and motility by hanging drop method were based on preliminary identification. To recognize cells, biochemical tests have been placed in place. Triple sugar iron, citrate utilisation, urease, indole, motility, methyl red, and voges proskaur tests have been subjected to both catalase positive and oxidase negative rods.

Development on Mannitol salt agar, Coagulase test (slide and tube method), and Deoxyribonuclease tests were classified as catalase positive Gram positive cocci. By Streptococcal grouping latex kit UK, gramme positive cocci with catalase test negative were further categorised. The complete data was analysed using version 24.0 of SPSS.

## RESULTS

Total 500 samples were included in this study. Out of these 125(25%) were extracted culture positive. Out of 125 positive blood cultures, 72(57.6%) were observed gram negative organisms and gram positive organisms were 48(38.4%) and the rest were positive for Candida spp 5(4%). (Table 1)

Table 1: Baseline frequency of blood cultures

Blood cultures	Frequency	%age
Gram Negative	72	57.6
Gram Positive	48	38.4
Candida spp	5	4
Total	125	100

*Pseudomonas* spp 22(30.5 percent) was the most common isolate among Gram negative organisms(n=72), followed by *Escherichia coli* 18(25 percent), *Klebsiella pneumoniae* 11 (15.27 percent), *Acinetobacter* spp 10(13.9 percent), *Enterobacter* spp 7 (9.72 percent) and *Citrobacter* spp 4 (5.6 percent) and Coagulase Negative Staphylococci (CoNS) was the most prevalent among Gram positive organisms (n=48).Table 2

Table 2: Frequency of positive/negative isolated organisms

Isolated Organisms	Frequency	%age
Gram negative	(n= 72)	-
<i>Pseudomonas</i> spp	22	30.5
<i>Escherichia coli</i>	18	25
<i>Klebsiella pneumoniae</i>	11	15.27
<i>Acinetobacter</i> spp	10	13.9
<i>Enterobacter</i> spp	7	9.72
<i>Citrobacter</i> spp	4	5.6
Gram positive	(n=48)	
Coagulase Negative Staphylococci (CoNS)	33	68.75
<i>Staphylococcus aureus</i>	12	25
Group D Streptococci	3	6.25

In this study, 100 percent resistance of ceftazidime, ceftriaxone, cefotaxime and aztreonam to various antibiotics among enterobacteriaceae was observed in *Escherichia coli* and *Klebsiella pneumoniae* in neonatal septicemic patients. In *Enterobacter* spp, 100% resistance to cefipime and gentamicin was observed and *Citrobacter* spp showed 100% resistance to aztreonam and ciprofloxacin, whereas the level of resistance of non-fermenters to various antibiotics, i.e. *Acinetobacter* spp demonstrated 98% resistance to ceftazidime, ceftriaxone

and cefotaxime, while gentamicin showed the highest resistance to *Pseudomonas* spp (70.4%).

The frequency of resistance among Gram positive organisms to various antibiotics. In our study , 80 percent resistance to trimethoprim-sulfamethoxazole followed by 72.8 percent to penicillin and ciprofloxacin was demonstrated by Coagulase Negative Staphylococci (CoNS). *Staphylococcus aureus* demonstrated 88 percent penicillin resistance. In Group D Streptococcus, penicillin was found to have 99 percent resistance. None of the Gram-positive isolates have been LZD-resistant.

## DISCUSSION

A significant cause of mortality in developing countries is neonatal bacterial sepsis. Inappropriate antimicrobial intake and insecure living conditions worsen the proliferation and spread of antibiotic-resistant bacteria. The most prevalent species associated with neonatal sepsis differ in geographical location and time of infection<sup>[16]</sup>. Therefore, to combat neonatal morbidity and mortality issues, information on the bacteriological profile of neonatal sepsis and effective antimicrobial agents for its treatment is essential. In our country, neonatal sepsis is a major contributor to the cause of neonatal mortality and morbidity<sup>[17]</sup>.

In this analysis, a total of 500 blood samples from both sexes were extracted. From patients. 125(25 percent) were culture-positive extracted from 500 blood samples in this study. Of 125 healthy blood cultures, 72 (57.6 percent) were gram-negative species observed and 48 (38.4 percent) were gram-positive species and the rest were healthy for *Candida* spp 5 (4 percent), these findings showed similarities to previous studies performed by Qadeer S and Javed I et al.<sup>[18]</sup> Other studies also indicate a much higher rate of culture positivity.<sup>[19-20]</sup>

We found that the most common isolate was *Pseudomonas* spp 22(30.5 percent), followed by *Escherichia coli* 18(25 percent) in gram-negative species. Similar trends were also recorded in India<sup>[21]</sup>. Another research in Quetta was performed in which *Pseudomonas* spp (21.4 percent) and *Klebsiella pneumoniae* (21.4 percent) were the most common species<sup>[22]</sup>. The frequency of resistance among Gram positive organisms to various antibiotics. In our study , 80 percent resistance to trimethoprim-sulfamethoxazole followed by 72.8 percent to penicillin and ciprofloxacin was demonstrated by Coagulase Negative Staphylococci (CoNS). *Staphylococcus aureus* demonstrated 88 percent penicillin resistance. In Group D Streptococcus, penicillin was found to have 99 percent resistance. None of the Gram-positive isolates have been LZD-resistant.

In this study, 100 percent resistance of ceftazidime, ceftriaxone, cefotaxime and aztreonam to various antibiotics among enterobacteriaceae was observed in *Escherichia coli* and *Klebsiella pneumoniae* in neonatal septicemic patients. In *Enterobacter* spp, 100% resistance to cefipime and gentamicin was observed and *Citrobacter* spp showed 100% resistance to aztreonam and ciprofloxacin, whereas the level of resistance of non-fermenters to various antibiotics, i.e. *Acinetobacter* spp demonstrated 98% resistance to ceftazidime, ceftriaxone and cefotaxime, while *Pseudomonas* spp showed the

highest resistance to gentamicin (70.4%) in previous studies of 23. Gandhi S et al.<sup>[23]</sup>

## CONCLUSION

It is concluded that the occurrence of gram-positive isolated species was lower in number than that of gram-negative organisms due to the isolation of gram-positive coagulase-negative staphylococci (CoNS) and gram-negative *Pseudomonas* spp.

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