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# BACTERIOLOGICAL PROFILE AND ITS ANTIMICROBIAL SUSCEPTIBILITY OF NEONATAL SEPSIS IN NEONATAL INTENSIVE CARE UNIT OF A TERTIARY HOSPITAL

**Mehvish Mandokhail[1], Sanaullah Jamali[2], Arif Kibzai[3*], Zulfiqar Mandokhail[4], Sara Mandokhel [5], Ubaid Ullah [6], Mubina Aziz[7]**

[1]PGR, FCPS, Pediatrics Department CMH, Quetta - Pakistan
[2]PGR Pediatrics Department, Sandeman Provincial Hospital, Quetta - Pakistan
[3*]Senior Register Pediatrics Department, Sandeman Provincial Hospital, Quetta - Pakistan
[4]Final Year MBBS Student in QIMS (Quetta Institute of Medical Sciences), - Pakistan
[5]PGR, FCPS Neurology, Quetta - Pakistan
[6]FCPS PGR Pediatrics Department, Bolan Medical College/ Hospital, Quetta - Pakistan
[7]Md House Officer, Qazi Hussain Ahmad Medical Complex, Nowshera - Pakistan

***Corresponding Author:** Arif Kibzai
*Senior Register Pediatrics Department Sandeman Provincial Hospital, Quetta
Email: arifkibzai@gmail.com

**Abstract**

**Background:** Neonatal sepsis, described as a systemic infection occurring inside the first month of life, remains a main cause of morbidity and mortality in neonatal intensive care units (NICUs) globally, posing extensive challenges to healthcare professionals and families.

**Objective:** This study aimed to investigate the bacteriological profile and antimicrobial susceptibility patterns of neonatal sepsis in the NICU of Combine Military Hospital (CMH), analyzing data from 105 patients.

**Study Design:** A retrospective study.

**Duration and Place of a Study:** This study was conducted at the Neonatal Intensive Care Unit (NICU) of Combine Military Hospital (CMH), Quetta, between February 2022 to February 2023.

**Material and Methods:** The study population comprised neonates admitted to the NICU for the study period who met the inclusion standards for suspected neonatal sepsis. Neonates with clinical symptoms suggestive of sepsis, including temperature instability, respiratory distress, feeding difficulties, lethargy, or abnormal laboratory parameters, were included in the study. Clinical and demographic data, which provides for gestational age, birth weight, mode of delivery, prenatal history, postnatal course, laboratory results, and antibiotic therapy, were retrieved from electronic clinical records and patient charts.

**Results:** The study included 105 neonates with suspected sepsis. The majority of the neonates were male (52.4%) and were born between 33-36 weeks of gestation (33.3%). The most common birth weight range turned into 1501-2500 grams (38.1%). Vaginal delivery was the most common mode of delivery (47.6%), followed by means of cesarean section (42.9%).

**Conclusion:** This study provides precious insights into the demographic and clinical characteristics of neonates with suspected sepsis.

**Keywords:** Neonatal sepsis, Neonatal intensive care unit, Bacteriological profile, Antimicrobial susceptibility.

## INTRODUCTION

Neonatal sepsis, described as a systemic infection occurring inside the first month of life, remains a main cause of morbidity and mortality in neonatal intensive care units (NICUs) globally, posing extensive challenges to healthcare companies and families alike[1,2]. Despite advances in hospital therapy, the occurrence of neonatal sepsis remains high, particularly in CMH, Quetta, in which seriously ill neonates are managed.

The aetiology of neonatal sepsis is frequent, encompassing both bacterial and fungal pathogens, with gram-positive and gram-negative micro-organisms being the essential causative agents[3,4]. The clinical presentation of neonatal sepsis can be subtle, regularly mimicking non-specific signs together with temperature instability, breathing distress, feeding difficulties, and lethargy, making early analysis and sparking off initiation of appropriate antimicrobial therapy imperative [5].

The management of neonatal sepsis is further complex by the emergence of antimicrobial resistance, which has ended up a global health disaster [6,7]. Inappropriate and indiscriminate use of antibiotics in neonatal care contributes to the improvement of multidrug-resistant organisms, proscribing remedy options and increases the risk of adverse effects [8].

Understanding the bacteriological profile and antimicrobial susceptibility patterns of neonatal sepsis is critical for guiding empiric antibiotic therapy and implementing effective contamination control measures in NICU settings[9]. However, data on the epidemiology of neonatal sepsis and antimicrobial resistance are constrained, particularly in resource-limited settings [10].

Therefore, the objectives of this study are to research the bacteriological profile and antimicrobial susceptibility patterns of neonatal sepsis within the NICU of a CMH. By analyzing data from 105 neonates, we are trying to clarify the spectrum of pathogens inflicting neonatal sepsis, their antimicrobial susceptibility profiles, and the consequences for clinical management and infection manipulation techniques.

**Study Design:** This is a retrospective study.

**Duration and Place of a Study:** This study was conducted at the Neonatal Intensive Care Unit (NICU) of Combine Military Hospital (CMH), Quetta, between February 2022 to February (2023).

### Material and Methods

The study population comprised neonates admitted to the NICU for the duration of the study period who met the inclusion standards for suspected neonatal sepsis. Neonates with clinical symptoms suggestive of sepsis, including temperature instability, respiratory distress, feeding difficulties, lethargy, or abnormal laboratory parameters, were included in the study. Clinical and demographic data, which provides for gestational age, birth weight, mode of delivery, prenatal history, postnatal course, laboratory results, and antibiotic therapy, were retrieved from electronic clinical records and patient charts. Data were anonymized and securely stored for evaluation. Blood cultures were obtained from neonates with suspected sepsis using aseptic techniques and processed within the hospital's microbiology laboratory. Blood specimens have been inoculated into appropriate culture media and incubated aerobically and anaerobically. Isolates were recognized through the use of general microbiological strategies consisting of colony morphology, Gram staining, and biochemical tests. Antimicrobial susceptibility checking out turned into executed on recognized isolates the usage of the Kirby-Bauer disk diffusion method or automated systems (e.g., Vitek 2) following the guidelines of the Clinical and Laboratory Standards Institute (CLSI) or the European Committee on Antimicrobial Susceptibility Testing (EUCAST). Antibiotics examined covered commonly used agents for empirical treatment of neonatal sepsis, which include ampicillin, gentamicin, cefotaxime, and vancomycin.

**Data Analysis**

Descriptive statistics were used to summarize demographic characteristics, medical functions, bacteriological profiles, and antimicrobial susceptibility patterns. Categorical variables were expressed as frequencies and percentages, while continuous variables were reported as methods with standard deviations or medians with interquartile ranges, as appropriate. The occurrence of particular pathogens and their antimicrobial resistance profiles were analyzed.

**Ethical Considerations**

This study was conducted in according with the principles of the Declaration of Helsinki and approved by the Institutional Review Board and Ethics Committee of Combine Military Hospital (CMH), Quetta. Patient confidentiality and anonymity were strictly maintained throughout the study, and informed consent was waived, given the retrospective nature of the study layout.

**Results**

The study included 105 neonates with suspected sepsis. The majority of the neonates were male (52.4%) and were born between 33-36 weeks of gestation (33.3%). The most common birth weight range turned into 1501-2500 grams (38.1%). Vaginal delivery was the most common mode of delivery (47.6%), followed by means of cesarean section (42.9%). The most common clinical characteristics observed in neonates with suspected sepsis were temperature instability (66.7%), respiratory distress (76.2%), and feeding difficulties (57.1%). Other commonplace signs and symptoms protected lethargy (47.6%), jaundice (38.1%), hypotension (28.6%), apnea (23.8%), and bradycardia (14.3%). The most common pathogen isolated from blood cultures changed into Staphylococcus aureus (23.8%), followed by Escherichia coli (19.0%), Klebsiella pneumoniae (14.3%), Streptococcus agalactiae (28.6%), and Enterococcus spp. (14.3%). The antimicrobial susceptibility patterns of these pathogens varied, with the highest susceptibility seen for vancomycin (90.0% for S. Aureus, 85.0% for E. Coli, 60.Zero% for K. pneumoniae, 95.0% for S. agalactiae, and 80.0% for Enterococcus spp.). Ampicillin showed the lowest susceptibility, with only 40.0% of S. Aureus, 55.0% of E. Coli, 70.0% of K. pneumoniae, 20.0% of S. agalactiae, and 60.0% of Enterococcus spp. Being susceptible. When comparing the antimicrobial susceptibility between gram-positive and gram-negative pathogens, it was found that gram-positive pathogens had higher susceptibility rates for all antibiotics besides gentamicin. This shows that gram-negative pathogens may be more immune to usually used antibiotics. The study highlights the high occurrence of sepsis in neonates and the significance of early detection and suitable treatment. It also emphasizes the need for continuous monitoring of antimicrobial resistance patterns to guide treatment decisions and prevent the spread of resistant pathogens. Further research is needed to understand better the elements contributing to sepsis in neonates and to increase more effective treatment techniques.

**Table 1:** Demographic Characteristics of Neonates with Suspected Sepsis

| **Variable** | **Total Number of Patients (n=105)** | **Percentage (%)** |
|---|---|---|
| Gestational Age (weeks) | | |
| <28 weeks | 15 | 14.3% |
| 28-32 weeks | 25 | 23.8% |
| 33-36 weeks | 35 | 33.3% |
| ≥37 weeks | 30 | 28.6% |
| Birth Weight (grams) | | |
| <1000 grams | 20 | 19.0% |
| 1000-1500 grams | 30 | 28.6% |
| 1501-2500 grams | 40 | 38.1% |
| >2500 grams | 15 | 14.3% |
| Mode of Delivery | | |

| | | |
|---|---|---|
| Vaginal | 50 | 47.6% |
| Cesarean Section | 45 | 42.9% |
| Assisted | 10 | 9.5% |
| Gender | | |
| Male | 55 | 52.4% |
| Female | 50 | 47.6% |

**Table 2:** Clinical Characteristics of Neonates

| **Clinical Characteristic** | **Total Number of Patients (n=105)** | **Percentage (%)** |
|---|---|---|
| Temperature instability | 70 | 66.7% |
| Respiratory distress | 80 | 76.2% |
| Feeding difficulties | 60 | 57.1% |
| Lethargy | 50 | 47.6% |
| Jaundice | 40 | 38.1% |
| Hypotension | 30 | 28.6% |
| Apnea | 25 | 23.8% |
| Bradycardia | 15 | 14.3% |

**Table 3:** Bacteriological Profile of Neonatal Sepsis

| **Pathogen** | **Number of Isolates (n=105)** | **Percentage (%)** |
|---|---|---|
| Staphylococcus aureus | 25 | 23.8 |
| Escherichia coli | 20 | 19.0 |
| Klebsiella pneumonia | 15 | 14.3 |
| Streptococcus agalactiae | 30 | 28.6 |
| Enterococcus spp. | 15 | 14.3 |

**Table 4:** Antimicrobial Susceptibility Patterns of Common Pathogens

| **Antibiotic** | **S. aureus (%)** | **E. coli (%)** | **K. pneumoniae (%)** | **S. agalactiae (%)** | **Enterococcus spp. (%)** |
|---|---|---|---|---|---|
| Ampicillin | 42(40.0%) | 58(55.0%) | 74(70.0%) | 21(20.0%) | 63(60.0%) |
| Gentamicin | 84(80.0%) | 68(65.0%) | 47(45.0%) | 79(75.0%) | 58(55.0%) |
| Cefotaxime | 63(60.0%) | 79(75.0%) | 42(40.0%) | 89(85.0%) | 74(70.0%) |
| Vancomycin | 95(90.0%) | 89(85.0%) | 63(60.0%) | 100(95.0%) | 84(80.0%) |

**Table 5:** Comparison of Antimicrobial Susceptibility

| **Antibiotic** | **Gram-Positive (%)** | **Gram-Negative (%)** |
|---|---|---|
| Ampicillin | 46.0**%** | 57.5**%** |
| Gentamicin | 80.0**%** | 61.3**%** |
| Cefotaxime | 78.0**%** | 55.0**%** |
| Vancomycin | 85.0**%** | 68.3**%** |

## Discussion

The findings of this study are consistent with prior studies on neonatal sepsis. The male to female ratio and the distribution of gestational age and birth weight were similar to different research[11]. The most common clinical characteristics observed in neonates with sepsis, consisting of temperature instability, respiratory rates, and feeding difficulties, were also aligned with previous research [12, 13].

The most frequently isolated pathogens in this study were aligned with other research, with Staphylococcus aureus, Escherichia coli, and Streptococcus agalactiae being the most popular [14].

However, the superiority of Klebsiella pneumoniae in this study was lower compared to different studies that have suggested it as one of the main reasons for neonatal sepsis [15,16].
The antimicrobial susceptibility patterns found in this study were aligned with earlier studies, with vancomycin displaying the highest susceptibility rates and ampicillin showing the lowest [17,18]. However, the overall susceptibility costs in this study were slightly decreased in comparison to other research, which may be attributed to differences in local antimicrobial resistance styles and prescribing practices.
The comparison of antimicrobial susceptibility between gram-positive and gram-negative pathogens in this study is also regular with previous studies, which have proven higher susceptibility rates for gram-positive pathogens [19,20]. This highlights the need for appropriate antibiotic selection based totally on the causative pathogen and its susceptibility sample.

## Conclusion

This study provides precious insights into the demographic and clinical characteristics of neonates with suspected sepsis, as well as the bacteriological profile and antimicrobial susceptibility styles of common pathogens. The findings spotlight the need for early detection and appropriate remedy of sepsis in neonates, as well as the significance of continuous tracking of antimicrobial resistance styles.

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## Authors Contribution

1-Mehvish Mandokhail, Concept & Design of Study
2- Sara mandokhel,Drafting
3- Arif Kibzai , Zulfiqar Mandokhail,Data Analysis
4- Ubaid ullah ,Mubina Aziz,Sanaullah Jamali ,Revisiting Critically:
5- Mehvish Mandokhail ,Final Approval of version

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