

# Frequency of Bacteria Causing Neonatal Sepsis in Neonatal Intensive Care Unit

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## ABSTRACT

**Objective:** To determine the frequency of bacteria causing neonatal sepsis in Neonatal Intensive Unit (NICU).

**Study Design:** Cross sectional descriptive study.

**Settings:** Neonatal Intensive Care Unit, Department of Pediatrics Liaquat University of Medical and Health Sciences Hyderabad.

**Period:** Six months from 8<sup>th</sup> July 2018 to 7<sup>th</sup> January 2019.

**Material and Methods:** A total of 141 neonates with neonatal sepsis admitted in neonatal ICU were included in this study. The relevant clinical history and specific physical examination was performed by principal researcher. The blood cultures were obtained at the time of admission. The bacteriological profile was explored in pre-designed proforma.

**Results:** The average age of the neonates were  $18.33 \pm 6.93$  days. There were 73 (51.77%) male and 68 (48.23%) female. *Streptococcus pneumonia* was the most common pathogens responsible for neonatal sepsis found in 33.3%, *Escherichia coli* (*E. coli*) was observed in 11.3%, *Klebsiella* 14.9%, *Staphylococcus aureus* (*S. aureus*) was 9.2%.

**Conclusion:** We conclude that according to local patterns of bacterial pathogens *Streptococcus pneumonia* was the commonest pathogens followed by, *E. coli*, *Klebsiella* and *S. aureus* respectively.

**Key words:** Bacteria, Neonatal Intensive Care Unit, Neonatal Sepsis, *Streptococcus pneumonia*

**HOW TO CITE THIS ARTICLE:** Muhammad Nadeem Chohan, Bushra Ilyas, Salma Shaikh, Mushtaque Ali shah, Hafiz Wajid Ali Buriro, Dilawar Khan, Frequency of Bacteria Causing Neonatal Sepsis in Neonatal Intensive Care Unit, J Res Med Dent Sci, 2022, 10(5): 146-150.

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**Received:** 21-Feb-2022, Manuscript No. JRMDS-22-47175;

**Editor assigned:** 23-Feb-2022, Pre QC No. JRMDS-22-47175 (PQ);

**Reviewed:** 9-Mar-2022, QC No. JRMDS-22-47175;

**Revised:** 22-Apr-2022, Manuscript No. JRMDS-22-47175 (R);

**Published:** 6-May-2022

## INTRODUCTION

Early onset neonatal sepsis occurs within 0-3 days of life while late onset sepsis occurs after 4<sup>th</sup> day of life. The common clinical features identified in babies with sepsis are fever (59%), respiratory distress (60%), seizures (14%), lethargy (68%), apnoea (18%), poor feeding (70%), vomiting (39%), irritability (47%), abdominal distension (41%) and abnormal bleeding (15%). In a study from Pakistan 11.5% neonatal deaths in a tertiary care hospital were due to infections and sepsis [1-3].

Different studies from different parts of the world have shown variable bacteriological pathologies. In studies from different parts of the subcontinent, gram negative rods have been noted as the more common organisms, while some other studies have shown gram positive cocci like *Staphylococcus aureus* to be the most common

pathogen in 80% of the case [4]. While in another study bacteriological profile *Escherichia coli* (*E. coli*) (15.6%), *Klebsiella* (37.5%) and *Staphylococcus aureus*, *S. aureus* (25%) and *Streptococcus pneumonia* (40.5%) were the common pathogens responsible for neonatal sepsis [5]. Therefore knowledge of local common organisms causing neonatal sepsis is essential in to choose appropriate antimicrobial treatment. In addition, geographical variability is seen in patterns of micro-organisms which often changes with time.

This study was planned to document the bacteria's causing neonatal sepsis as it can help in management of neonatal sepsis according to local patterns of bacterial pathogens. Further the complication of antibiotic decreases, organism common in our population will be identified. Moreover the results of present study will evaluate the existence of any difference and deviation for proportion of pathogens reported by international studies.

The objective of this study is to determine the frequency of bacteria causing neonatal sepsis in Neonatal Intensive Unit (NICU), LUMHS Hyderabad.

**MATERIALS AND METHODS**

**RESULT**

A total of 141 neonate with neonatal sepsis admitted in neonatal ICU were included in this study. The average age of the neonate was 18.33 ± 6.93 day's similarly average gestation age at birth and age at onset of symptoms (Table 1). There were 73 (51.77%) male and 68 (48.23%) female as shown in Table 1. The common clinical features identified in babies with sepsis are fever (97.2%), respiratory distress (58.2%), as tabulated in Table 1. Frequency of bacteriological profile of neonatal sepsis is presented in Table 2. *Streptococcus pneumonia* was the common pathogens responsible for neonatal sepsis found in 33.3%, *Escherichia coli* (*E. coli*) was observed in 11.3%, Klebsiella 14.9%, *Staphylococcus aureus*-*S. aureus* was 9.2%. Regarding mode of delivery, rate of caesarean section was 65.25%, SVD 22.7% and instrument delivery was 12.05% as shown Table 2.

Rate of *E. coli*, *Klebsiella*, *S. Aureus* and *streptococcus pneumonia* was not statistically significant among different age groups of neonate. Similarly it was also not significant between groups (Table 2). Stratification analysis was performed according to presenting symptoms as shown in table I. Rate of *E. coli*, *Klebsiella*, *S. Aureus* and *streptococcus pneumonia* was not statistically significant with fever while Rate of *E. coli*, *Klebsiella* and *S. Aureus* was statistically high with those cases who had respiratory distress. It was not statistically significant with symptom seizure and apnoea. Stratification analysis was also performed with respect to gestational age at delivery, mode of delivery, age at onset of symptoms, residence neonatal anemia and hyperbilirubinemia as shown in Table 1.

**Table 1: Descriptive characteristics and presenting complaints of the patients (n=141).**

| Profile                     | <i>Streptococcus pneumonia</i> | <i>E. coli</i> | <i>Klebsiella</i> | <i>S. Aureus</i> |
|-----------------------------|--------------------------------|----------------|-------------------|------------------|
| <b>Age (days)</b>           |                                |                |                   |                  |
| <10 (n=29)                  | 10 (34.5%)                     | 2 (6.9%)       | 1 (3.4%)          | 4 (13.8%)        |
| 11-20 (n=50)                | 17 (34%)                       | 7 (14%)        | 8 (16%)           | 3 (6%)           |
| 21-25 (n=43)                | 12 (27.9%)                     | 6 (14%)        | 8 (18.6%)         | 5 (11.6%)        |
| 26-28 (n=19)                | 8 (42.1%)                      | 1 (5.3%)       | 4 (21.1%)         | 1 (5.3%)         |
|                             | P value=0.740                  | P value=0.591  | P value=0.253     | P value=0.573    |
| Male (n=73)                 | 21 (28.8%)                     | 9 (12.3%)      | 11 (15.1%)        | 9 (12.3%)        |
| Female (n=68)               | 26 (38.2%)                     | 7 (10.3%)      | 10 (14.7%)        | 4 (5.9%)         |
|                             | P value=0.233                  | P value=0.703  | P value=0.952     | P value=0.186    |
| <b>Fever</b>                |                                |                |                   |                  |
| Yes (n=137)                 | 45 (32.8%)                     | 16 (11.7%)     | 20 (14.6%)        | 12 (8.8%)        |
| No (n=04)                   | 2 (50%)                        | 0 (0%)         | 1 (25%)           | 1 (25%)          |
|                             | P value=0.473                  | P value=0.468  | P value=0.565     | P value=0.268    |
| <b>Respiratory Distress</b> |                                |                |                   |                  |
| Yes (n=82)                  | 38 (46.3%)                     | 14 (17.1%)     | 16 (19.5%)        | 10 (12.2%)       |
| No (n=59)                   | 9 (15.3%)                      | 2 (3.4%)       | 5 (8.5%)          | 3 (5.1%)         |
|                             | P value=0.811                  | P value=0.0005 | P value=0.003     | P value=0.268    |
| <b>Seizures</b>             |                                |                |                   |                  |
| Yes (n=62)                  | 20(32.3%)                      | 7(11.3%)       | 11(17.7%)         | 6(9.7%)          |
| No (n=79)                   | 27(34.2%)                      | 9(11.4%)       | 10(12.7%)         | 7(8.9%)          |
|                             | P value=0.810                  | P value=0.985  | P value=0.40      | P value=0.868    |
| <b>Apnea</b>                |                                |                |                   |                  |
| Yes (n=39)                  | 8 (20.5%)                      | 7 (17.9%)      | 6 (15.4%)         | 3 (7.7%)         |
| No (n=102)                  | 39 (38.2%)                     | 9 (8.8%)       | 15 (14.7%)        | 10 (9.8%)        |
|                             | P value=0.054                  | P value=0.126  | P value=0.919     | P value=0.698    |
| <b>Poor Feeding</b>         |                                |                |                   |                  |
| Yes (n=56)                  | 20 (35.7%)                     | 5 (8.9%)       | 3 (5.4%)          | 9 (16.1%)        |

|                             |               |               |               |               |
|-----------------------------|---------------|---------------|---------------|---------------|
| No (n=85)                   | 27 (31.8%)    | 11 (12.9%)    | 18 (21.2%)    | 4 (4.7%)      |
|                             | P value=0.626 | P value=0.462 | P value=0.010 | P value=0.022 |
| <b>Vomiting</b>             |               |               |               |               |
| Yes (n=49)                  | 17 (34.7%)    | 6 (12.2%)     | 10 (20.4%)    | 6 (12.2%)     |
| No (n=92)                   | 30 (32.6%)    | 10 (10.9%)    | 11 (12%)      | 7 (7.6%)      |
|                             | P value=0.803 | P value=0.806 | P value=0.180 | P value=0.365 |
| <b>Irritability</b>         |               |               |               |               |
| Yes (n=65)                  | 22 (33.8%)    | 6 (9.2%)      | 10 (15.4%)    | 6 (9.2%)      |
| No (n=76)                   | 25 (32.9%)    | 10 (13.2%)    | 11 (14.5%)    | 7 (9.2%)      |
|                             | P value=0.905 | P value=0.464 | P value=0.880 | P value=0.997 |
| <b>Abdominal Bleeding</b>   |               |               |               |               |
| Yes (n=86)                  | 29 (33.7%)    | 6 (7%)        | 16 (18.6%)    | 5 (5.8%)      |
| No (n=55)                   | 18 (32.7%)    | 10 (18.2%)    | 5 (9.1%)      | 8 (14.5%)     |
|                             | P value=0.903 | P value=0.056 | P value=0.122 | P value=0.133 |
| <b>Abdominal Distention</b> |               |               |               |               |
| Yes (n=45)                  | 15 (33.3%)    | 5 (11.1%)     | 9 (20%)       | 3 (6.7%)      |
| No (n=96)                   | 32 (33.3%)    | 11 (11.5%)    | 12 (12.5%)    | 10 (10.4%)    |
|                             | P value=0.999 | P value=0.952 | P value=0.244 | P value=0.473 |

**Table 2: Characteristics of participants (n=141).**

| Profile                            | <i>streptococcus pneumonia</i> | <i>E. coli</i> | <i>Klebsiella</i> | <i>S. Aureus</i> |
|------------------------------------|--------------------------------|----------------|-------------------|------------------|
| <b>Gestational Age At Delivery</b> |                                |                |                   |                  |
| ≤ 36 Weeks (n=88)                  | 31 (35.2%)                     | 8 (9.1%)       | 9 (10.2%)         | 11(12.5%)        |
| 37 to 40 Weeks (n=53)              | 16 (30.2%)                     | 8 (15.1%)      | 12 (22.6%)        | 2 (3.8%)         |
|                                    | P value=0.539                  | P value=0.276  | P value=0.045     | P value=0.083    |
| <b>Mode Of Delivery</b>            |                                |                |                   |                  |
| SVD (n=32)                         | 20 (62.5%)                     | 1 (11.1%)      | 0 (0%)            | 26 (28.3%)       |
| Forceps (n=9)                      | 10 (31.3%)                     | 5 (55.6%)      | 0 (0%)            | 1 (1.1%)         |
| Vacuum (n=8)                       | 0 (0%)                         | 1 (11.1%)      | 5 (62.5%)         | 15 (16.3%)       |
| C/S (n=92)                         | 2 (6.3%)                       | 0 (0%)         | 0 (0%)            | 11 (12%)         |
|                                    | P value=0.005                  | P value=0.0005 | P value=0.0005    | P value=0.409    |
| <b>Age at symptoms onset</b>       |                                |                |                   |                  |
| ≤ 10 days (n=79)                   | 27 (34.2%)                     | 9 (11.4%)      | 9 (11.4%)         | 7 (8.9%)         |
| >10 days (n=62)                    | 20 (32.3%)                     | 7 (11.3%)      | 12 (19.4%)        | 6 (9.7%)         |
|                                    | P value=0.810                  | P value=0.985  | P value=0.187     | P value=0.868    |
| <b>Residence</b>                   |                                |                |                   |                  |
| Urban (n=60)                       | 14 (23.3%)                     | 9 (15%)        | 18 (30%)          | 6 (10%)          |
| Rural (n=81)                       | 33 (40.7%)                     | 7 (8.6%)       | 3 (3.7%)          | 7 (8.6%)         |
|                                    | P value=0.030                  | P value=0.239  | P value=0.0005    | P value=0.792    |

**DISCUSSION**

Neonatal septicemia has been defined as bacteremia producing a clinical syndrome caused by circulating

microorganism/toxic products, within first month of life. To determine the frequency of bacteriological profile of neonatal sepsis in patients a total of 141 neonate of either gender with neonatal sepsis admitted at neonatal

ICU were included in this study. In our study the average age of the neonate was  $18.33 \pm 6.93$  days. The prevalence of neonatal sepsis in females (48.23%) was not significantly different from that in males (51.77%).

Regarding frequency of bacteriological profile of neonatal sepsis in our study, *Streptococcus pneumoniae* was the common pathogens responsible for neonatal sepsis found in 33.3%, *Escherichia coli* (*E. coli*) was observed in 11.3%, *Klebsiella* 14.9%, *Staphylococcus aureus* (*S. aureus*) was 9.2%. In a study from Nepal most common bacterial isolates was *Klebsiella* species (n=23, 33.3%) [7]. In a study from Ghana gram positive organisms were more common 18 (69%) than gram negative organisms (31%). *Staphylococcus epidermidis* was the most common 14 (53.8%) organism identified [8]. In a local study from Islamabad blood Culture was positive in 7.2% samples. Gram negative organisms (*E. coli*) were predominant (6.67%) and only 1 were gram positive [9]. A Ethiopian study showed that Gram positive bacteria were commonly isolated 81 (67.5%). The *S. aureus* was 49 (40.8%) followed by coagulase negative *Staphylococci* 26 (21.6%) [10]. In an Iranian study most common cause of early and late onset sepsis was Coagulase-Negative *Staphylococci* [11]. Above mentioned international, regional and local studies revealed different organism than our study emphasizing the different pathogens causing the neonatal sepsis in different locations.

In our study out of 141 neonates, 42.5% were residing in urban area while 57.4% were from rural area. C-Section does not increase the risk of neonatal sepsis. About 83.5% neonates were born with normal vaginal delivery while 16.5% via caesarean section, neonates born via NVD is 2.29 times more risk of developing NNS as compared to caesarean section ( $p < 0.05$ ). A study from Rawalpindi had incidence of suspected neonatal sepsis of 29.5%. Majority of the babies (70.3%) were preterm 11. In a study from United Arab Emirates prevalence of neonatal sepsis was 80 (2.9%) had a blood culture-proven sepsis with a Gram-negative pathogen. Vaginal delivery was present in 38 (47%) and Cesarean section in 42 (53%) [12].

In our study, the most common clinical feature in babies with sepsis were fever (97.2%), followed by respiratory distress (58.2%), seizures (44%), apnoea (27.7%), poor feeding (39.7%), vomiting (34.8%), irritability (46.1%), abdominal distension (61%) and abnormal bleeding (31.9%). In an international the most common clinical feature at presentation in neonatal sepsis was respiratory distress [13]. In another study neonatal jaundice (70.19%) was most common in early onset neonatal sepsis while feeding intolerance (49.44%) was most common complaint in late onset sepsis [14].

### CONCLUSION

We conclude that according to local patterns of bacterial pathogens *Streptococcus pneumoniae* was the commonest pathogens followed by, *E. coli*, *Klebsiella* and *S. aureus* respectively. The epidemiology of neonatal sepsis,

causative risk factors may be used to develop guidelines for management of neonatal sepsis.

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