

## Evaluation of Bacteriological Etiology of Neonatal Sepsis

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### Abstract

**Background:** Sepsis is one of the common causes of neonatal mortality and morbidity worldwide. Etiology of neonatal sepsis varies according to geographical area and neonatal period.

**Objectives:** The objective of this study was to evaluate the bacteriological etiology of neonatal sepsis.

**Methods:** This cross-sectional, observational study was conducted at inpatient department of Pediatrics, Rangpur Medical college Hospital from 1st January, 2017 to 30<sup>th</sup> June, 2017. Total 52 of both term and preterm newborns who had clinical features of sepsis were enrolled into this study. 1 ml of venous blood was collected aseptically and sent for blood culture in the department of Microbiology, Rangpur Medical College using Blood and MacConkey Agar media. Data analysis was done using SPSS version 21.0.

**Results:** Results of the study revealed that out of 52 newborns, preterm, 35 (67.31%) outnumbered term neonates, 17 (32.69%) (p=0.000). Early onset neonatal sepsis was observed in 30 (57.69%) cases (p=0.000) and late onset sepsis was evident in 22 (42.31%) newborns (p=0.000). Blood culture yielded positive growth in 19 (36.5%) cases and negative in 33 (63.5%) neonates. Among the identified isolates from blood culture, Gram negative organism, Escherichia coli (E.coli) was the predominant, the etiologic agent in 10 (52.63%) cases (p=0.032) followed by Klebsiella pneumoniae in 6 (31.58%) and Staphylococcus aureus in 3 (15.79%) neonates.

**Conclusion:** It was concluded from the study that E.coli accounted for the majority cases of neonatal sepsis. Klebsiella pneumoniae and Staphylococcus aureus were the other organisms identified in blood culture. Sepsis was more prevalent among preterm newborns. Cases of early onset neonatal sepsis outnumbered late onset sepsis.

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**Key words:** Neonate, Sepsis, Bacteria, Blood culture

### Introduction

Neonatal sepsis is a clinical syndrome characterized by systemic signs of circulatory compromise caused by invasion of the blood stream by bacteria in the first four weeks of life.<sup>1</sup> It is one of the three most common illnesses among newborns and second most common cause of neonatal mortality especially

among preterm and low birth weight babies. World Health Organization report reveals that approximately 5 million neonatal deaths occur each year, of which sepsis is estimated to cause 1.6 million deaths annually.<sup>2</sup> It is responsible for 30% to 50% of neonatal deaths each year in developing countries. In Bangladesh, it contributes to 36% of total deaths of neonates.<sup>1</sup>

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In addition to mortality, it also contributes to prolonged hospital stay, increased health care costs and adverse neurodevelopment outcome, particularly in infants with a very low birth weight.<sup>3</sup> Neonatal sepsis is categorized according to infant's postnatal age at onset of disease. Most clinicians define early onset neonatal sepsis (EOS) as that occurring during the first 72 hours of life and late onset sepsis (LOS) occurring after 72 hours.<sup>4</sup> Early onset sepsis is generally acquired from pathogens in the maternal genital tract, whereas late onset sepsis occurs from its origin either in the community or in the healthcare environment.<sup>5</sup> However, the diversity of organisms causing neonatal sepsis vary significantly across different regions and changes over time, even in the same place. This variation may affect the success of empirical management.<sup>6</sup> In developed countries, the most common causes of neonatal sepsis are Group B streptococci (GBS), *Escherichia coli* (*E. Coli*) and *Listeria monocytogenes*, while Gram negative bacteria and coagulase-negative staphylococci are the most common in developing countries, the prevalence rate is 3–10 fold higher in preterm than in full term neonates.<sup>6</sup> In addition, the incidence is higher in low birth weight (LBW) than normal weight neonates and in males than females.<sup>7,8,9,10</sup> Neonatal sepsis is a life threatening emergency, and delay in prompt diagnosis and early initiation of appropriate antibiotics may have devastating complications.<sup>11,12</sup> A definitive diagnosis requires the isolation of pathogen from a normally sterile body site, including blood, cerebrospinal fluid and urine.<sup>13</sup> Polymerase chain reaction (PCR) has proved to be a valuable adjunct for detection of neonatal viral infections. However, use of PCR to detect bacteremia and fungemia is more challenging and thus is still under investigation. Therefore, the gold standard for diagnosing neonatal sepsis remains the blood culture.<sup>14</sup>

## Methods

This was a cross-sectional, observational study, done in the department of Pediatrics of Rangpur Medical College Hospital from 1<sup>st</sup> January, 2017 to 30<sup>th</sup> June, 2017. Total 52 of both term and preterm newborns, who had clinical features of neonatal sepsis, were enrolled into this study. Inclusion criteria was set as presence of one or more clinical sign/symptoms consistent with possible severe bacterial infection, such as stopped feeding well, fast breathing (60 or more breaths per minutes), severe chest indrawing, grunting, hypothermia (temp. less than 35.5<sup>o</sup>/36.5<sup>o</sup>C), fever (temp. 38<sup>o</sup>C or more), movement only when stimulated or no movement at all, convulsion, umbilicus red or draining pus and skin pustules. Exclusion criteria were patients with respiratory distress syndrome (RDS), gross congenital anomalies and previous antibiotic therapy. After taking informed written consent from parents or caregiver, history was taken, physical examination was done and data were collected in a preformed questionnaire. 1ml of venous blood was collected aseptically for blood culture. The collected blood was incubated directly into 20 ml of broth at bedside. This was incubated at 35<sup>o</sup>C in air for seven days at department of Microbiology, Rangpur Medical College for culture prior to starting of antibiotics. The blood culture bottles were examined daily for evidence of growth. Any specimen showing signs of growth was examined for Gram staining and sub culture was done. Routine subculture was done at 18-24 hours after blood collection into Blood and MacConkey Agar media. Data analysis was done using SPSS version 21.0.

## Results

During 6 months of study period, out of 52 cases of neonatal sepsis, blood culture yielded positive growth of bacteria in 19 (36.5%) and negative in 33(63.5%) cases. Organisms identified from blood culture were E.coli in 10 (52.63%) (p=0.032), Klebsiella pneumoniae, in 6 (31.58%) and Staphylococcus aureus, in 3 (15.79%) cases (Table I). Number of patients with early onset neonatal sepsis was 30 (57.69%) (p=0.000) and late onset neonatal sepsis was 22 (42.31%) (p=0.000) (table II). Neonatal sepsis was more common in preterm babies, 35 (67.31%) (p=0.000) than term, 17(32.69%) neonates (Table III).

Table I: Distribution of bacterial isolates from blood culture (n= 19)

Organisms	Frequency of bacterial isolates (%)	p
E. coli	10 (52.63%)	0.023
Klebsiella	6 (31.58%)	0.141
Staph.aureus	3 (15.79%)	1.000

Table I demonstrates E. coli was the predominant organism isolated from blood culture.

Table II: Age wise distribution of type of neonatal sepsis (n=52)

Age	Number of Patients	Percentage	p
0-3 days	30	57.69%	0.000
4-28 days	22	42.31%	0.000

Table II shows cases of early onset neonatal sepsis outnumbered late onset sepsis.

Table III: Distribution of neonates according to gestational age (n=52)

Gestational age	Number of neonates	%
Preterm	35	67.3
Term	17	32.6

Table III reveals majority of neonates with sepsis were preterm.

## Discussion

The study evaluated the bacteriological etiology in neonatal sepsis. Out of 52 patients, neonatal sepsis was more common in preterm, 35 (67.31%) than term neonates, 17 (32.69%), (p=0.000), (Table III). Number of patients with early onset neonatal sepsis were, 30 (57.69%) (p=0.000) and late onset sepsis, 22 (42.31%) (p=0.000) (Table II). Out of 52 blood samples only 19 (36.5%) yielded the growth of bacterial pathogens in this study. Sharma CM et al and Bhattacharjee et al found positive blood culture results in 37.63% and 32% cases respectively.<sup>15,16</sup> Pius S et al also showed culture positive result in 42.0% cases and Madavi et al found positive culture in 107 (36.64%) out of 292 cases in another studies.<sup>7,17</sup> These were similar with the results of current study. On the contrary, Raha BK et al reported low yield of organisms in 8.9% of cases only.<sup>1</sup> This was possibly due to use of different culture media in identifying the etiologic bacteria.

The findings from the current study revealed that E.coli was the most common bacteria from blood culture isolates. Klebsiella pneumoniae and Staphylococcus aureus were the other organisms among positive isolates from blood culture. Frequency of organisms identified from blood culture were E. coli in 10 (52.63%) (p=0.032), Klebsiella pneumoniae, in 6 (31.58%) and Staphylococcus aureus, in 3 (15.79%) cases (Table I). E.coli was the cause of majority cases of neonatal sepsis in this study. Different studies from Bangladesh, Nepal and Pakistan showed that E.coli was the leading cause of neonatal sepsis.<sup>18,19</sup> But Pius S found that E.coli was positive in 39.1% cases only.<sup>7</sup> In another study, Madhavan et al also showed that E.coli was positive in 27.5% cases.<sup>20</sup> On the other hand, Onyedibe KI et al found E.coli positive in 10.1% and Jajoo M et

al in 14% cases in New Delhi, India.<sup>21</sup> The probable explanation of this difference might be due to regional variation and use of different culture media.

In current study, *Klebsiella pneumoniae* was present in 31.58% isolates. Raha BK et al found in a study in BIRDEM, Bangladesh that *Klebsiella pneumoniae* was positive in 37.5% isolates<sup>1</sup>. *Klebsiella pneumoniae* was also found positive in 31.6%, 27.01%, 30.4% and 36.5% cases and the studies were done by Arowosegbe AO et al, Sharma CM et al, Onyedibe KI et al and Shobowale EO et al respectively.<sup>5,6,14,15</sup> These were consistent with finding of current study.

However, report of Garg D et al unveiled positive growth of *Klebsiella* in 7.14% cases.<sup>22</sup> *Staphylococcus aureus* was positive in 3 (15.79%) isolates in current study. This corroborates with similar studies done by Shobowale EO et al and Arowosegbe AO et al in 15.8% and 18.8% of neonatal sepsis respectively.<sup>5,6</sup>

### Conclusion

In conclusion, it was found from the study that *E.coli* accounted for the majority cases of neonatal sepsis. *Klebsiella Pneumoniae* and *Staphylococcus aureus* were the other organisms identified in blood culture. Sepsis was more prevalent among preterm newborns. Cases of early onset neonatal sepsis outnumbered late onset sepsis.

### Recommendation

Regional variation of causative organisms of neonatal sepsis buttresses the need for continuous review of bacterial profile. Attention should be paid to preterm babies, in particular during first 72 hours of life. It would be prudent and pragmatic if a database of bacteriological etiology of neonatal sepsis is created for further and future reference in Bangladesh.

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