

## Bacteriological Profile of Suspected Neonatal Septicaemia and Its Relationship with Selected Risk Factors

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### Abstract

**Introduction:** Neonatal septicaemia is one of the major problem in neonatology with a high case fatality rate. Manifestations of neonatal septicaemia are subtle & non-specific. Blood culture is the “gold standard” in the diagnosis of neonatal septicaemia, a high index of suspicion with or without laboratory evidences of infection is the key for early diagnosis. Early diagnosis & introduction of antibiotic may reduce mortality and morbidity. **Objective:** To explore the bacterial organisms among the suspected neonatal septicaemic cases and its relationship with selected risk factors. **Materials and Methods:** A Cross sectional descriptive type of study was carried out on all suspected cases of neonatal septicaemia patients admitted in the paediatric wards of Rajshahi Medical College Hospital during the period of July 2008 to June 2010. Total 60 sixty cases who had non-specific symptoms of septicaemia were enrolled in this study. After a clinical evaluation and management of the patient blood culture was performed on all neonates with risk factors or signs suggestive of sepsis. **Results:** Out of sixty cases of suspected neonatal septicaemic newborns 18.33% were culture positive for bacteria. Both gram negative and gram positive bacteria were responsible for neonatal septicaemia. Majority of the organisms were gram negative (54.5%) and most common organisms was *E.coli* (54.5%). Other gram-positive organisms were streptococcus spp (27.3%) and staph aureus (18.2%) respectively. Among blood culture positive cases 82% were early onset neonatal septicaemia & 18% were late onset septicaemia. Gestational age, Low birth weight, Low socioeconomic status of mother, mode of delivery and birth asphyxia were risk factor for both early onset neonatal sepsis & late onset neonatal sepsis. **Conclusion:** Septicaemia is one of the major causes of death & its manifestations are subtle and non specific. Both gram negative & gram positive bacteria are responsible for neonatal septicaemia. Most isolated bacteria *E.coli*. Risk factors may be the factor for NNS. Although blood culture is the “gold standard” in the diagnosis of NNS, a high index of suspicion with or without laboratory evidences of infection is the key for early diagnosis. If we can avoid risk factors for NNS by antenatal check up of pregnant mother and thereby number of septicaemia could be reduced.

**Keywords:** Bacterial profile, Septicaemia, Risk Factors.

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### Introduction:

Neonatal septicaemia is an important cause of mortality and morbidity among infant. Neonatal septicaemia is best defined as a clinical syndrome characterized by signs of systemic infection and documented by a positive blood culture in the first few weeks of life<sup>1</sup>. Despite considerable progress in hygiene, anti microbial therapy and supportive treatment septicaemia is an important cause of morbidity and mortality in neonatal period<sup>2</sup>. Reduction of neonatal mortality is a special important task of modern pediatrics. Unfortunately morbidity & mortality due to neonatal septicaemia is still continuing. The mortality rate from bacterial sepsis has not changed substantially since the early 1970s<sup>3</sup>. Primary site of invasion is most often the blood stream. Case fatality rate varies from 20 to more than 75 percent and substantial percentage of surviving infants have neurological handicapped<sup>4</sup>. There is variation depending on geographical area and also changes in the same area with time<sup>5</sup>. Comparable figure much higher in Bangladesh. Risk factors for infection may be multiple vaginal examinations, umbilical catheterization for >5 days, mechanical ventilation for >5 days, birth weight <2500 gm, transfer from other hospital, total parenteral nutrition and nasogastric tube. These risk factors are independently associated with neonatal sepsis<sup>6</sup>. Neonatal septicaemia has been

categorized into early onset disease (EOD), occurring during the first week of life, and late onset disease (LOD), between 7 and 28 days of life<sup>7</sup>. There are no definitive criteria for diagnosis of septicaemia in newborn. It is based mainly on consideration of clinical and laboratory parameters, but without positive culture from central body fluid the diagnosis of septicaemia remains unconfirmed. Clinical presentation in neonatal septicaemia is non-specific and common symptoms are lethargy irritability, respiratory distress, fever, hypothermia, apnoeic spell, cyanosis, poor feeding, diarrhea, vomiting, convulsion and abdominal distension<sup>8</sup>. Bacterial organisms causing neonatal sepsis may differ among countries. Group B streptococcus (GBS; streptococcus agalactiae) is the most frequent cause of serious neonatal infection in North America<sup>9</sup>. However, in most developing countries, Gram-negative bacteria remain the major source of infection<sup>10</sup>. The result of epidemiological study from the developed and developing countries may not be same. Furthermore, the epidemiology of neonatal septicaemia within the geographical location may change with time<sup>11</sup>. The incidence of neonatal sepsis in neonatal intensive care unit (NICU) have been ranged from 5.2-to 30.4 per 100 patients<sup>12</sup>. Neonatal septicaemia is still a life threatening emergency and any delay of diagnosis and treatment with appropriate antibiotics may have devastating consequences. It is necessary, therefore, to continue epidemiological surveillance to identify the common pathogens causing neonatal septicaemia and their antibiotic sensitivity in particular area for best choice of empirical antibiotic therapy.

#### Material and Methods:

This cross sectional descriptive study was carried out in the paediatric department of Rajshahi Medical College from July 2008 to June 2010. During the period 60 cases of were diagnose clinically and enrolled in the study. Diagnosis was made on the basis of some clinical manifestations like lethargy, irritability, respiratory distress, jaundice, fever, poor feeding, abdominal distention, apneotic spell, hypothermia, cyanosis, convulsion and diarrhea. Mothers were informed regarding the study, sample collection and its purpose. Perinatal history was taken carefully from mother for the identification of risk factors of neonatal septicaemia. Special emphasis were given on socioeconomic status, gestational age, residence and time of disease, maternal chorioamnionitis, urinary tract infection, unclean vaginal examination and prolonged rupture of membrane, place of delivery, birth weight, and any birth asphyxia along with feeding history. Thorough examinations were done and all findings were recorded in the specific questionnaire. Blood culture is the only investigation done to confirm the diagnosis. Blood culture done at the microbiology department of Rajshahi Medical College. However, diagnosis was based on a combination of high degree of suspicion, clinical feature and positive blood culture. The

feature of NNS were studied and analyzed.

#### Results:

60 cases were enrolled in this study during the period of July 2008 to June 2010. Majority of the cases were male and Male female ratio M:F=2.7:1. Rural patient were predominance than urban patients. Symptoms of septicaemia developed within 1-7 days in 63.3% of the male babies. Most of the babies delivered of in hospital than home and private clinic. Normal delivery was more than cesarean section 76.66%, 23.33% respectively. Early onset of symptoms (<7 days) were 82% and late onset (8-28 days) of symptoms were 18%. 81.67% were culture negative and only 18.33% were culture positive. E.coli was more common in low birth weight, early onset neonatal septicaemic babies than normal weight babies in case of term and preterm there are no difference of E.coli infection, whereas in streptococcus infection low birth weight babies were more affected & in case of Staph Aureus infection normal weight babies were more affected. Babies of low socioeconomic groups of parents (Monthly income 5000taka or less) were more affected than middle or high income group of parents. Among the culture group babies came from rural area were hundred percent culture positive term and preterm, low birth weight and normal weight, asphyxiated and non asphyxiated babies were almost equally affected but statistically not significant.

**Table-I:**

Distribution of suspected neonatal septicaemia cases by sex, time of onset of symptoms, residence & mode of delivery (n=60).

Distribution of the neonates	frequency	Percentage (%)	Total
Male	42	70%	60 (100%)
Female	18	30%	
1-7 days (Early onset)	38	63.3 (%)	60 (100%)
8-28 days (Late onset)	22	36.7 (%)	
Rural	50	83.3 (%)	60 (100%)
Urban	10	16.7 (%)	
NVD	46	76.66 (%)	60 (100%)
LUCS	14	23.33 (%)	

**Table-II:**

Distribution of Organisms detected in culture by birth weight, gestational age & time of appearance of symptoms.

	Organisms detected in culture			Total	Total
	E.coli	Streptococcus spp	Staph Aureus		
Birth wt Less than 2.5kg	4(66.7%)	2(33.3%)	0(0%)	6(54.5%)	11(100%)
Birth wt 2.5kg and above	2(40.0%)	1(20.0%)	2(40.0%)	5(45.5%)	
Preterm	3(27.27%)	1(9.09%)	1(9.09%)	5(45.5%)	11(100%)
Term	3(27.27%)	2(18.18%)	1(9.09%)	6(54.54%)	
EONS	6(54.54%)	2(18.18%)	1(9.09%)	9(81.81%)	11(100%)
LONS	0(00%)	1(9.09%)	1(9.09%)	2(18.18%)	

EONS:Early onset neonatal septicaemia,(EONS): Late onset neonatal septicaemia(LONS)

**Table-III:**

Showed distribution of Organisms detected in culture positive cases according to socioeconomic status of their parents.

Monthly income group	Organisms detected in culture			Total
	Ecoli	Streptococcus spp	Staph Aureus	
5000taka or less	4(57.1%)	2(28.6%)	1(14.3%)	7(63.6%)
5001-10000taka	1(33.3%)	1(33.3%)	1(33.3%)	3(27.3%)
>10,000taka	1(100%)	0(00%)	0(00%)	1(9.1%)
Total	6(54.5%)	3(27.3%)	2(18.2%)	11(100%)

X<sup>2</sup>=1.57,df=4.(p>.05)

**Table-IV:**

Distribution of culture positive & negative cases by their birth weight, gestational age, residence, mode of delivery, presence or absence of birth asphyxia & jaundice.

	Blood culture		Total	p>.05
	positive	negative		
Birth -wt<2.5kg 2.5kg& above	6(28.6%)	15(71.4%)	60(100%)	X <sup>2</sup> =2.26,df=1.(p>.05)
	5(12.8%)	34(87.2%)	60(100%)	X <sup>2</sup> =0.289,df=1.(p>.05)
Term preterm	6(16.2%)	31(83.8%)	60(100%)	X <sup>2</sup> =2.69,df=1.(p>.05)
	5(21.7%)	18(78.3%)	60(100%)	X <sup>2</sup> =1.52,df=1.(p>.05)
Rural Urban	11(22%)	39(78%)	60(100%)	X <sup>2</sup> =1.53,df=1.(p>.05)
	0	10(100%)	60(100%)	X <sup>2</sup> =0.445,df=1.(p>.05)
Normal(NVD) Caesarean section	10(21.7%)	36(78.3%)	60(100%)	
	1(7.1%)	13(92.9%)	60(100%)	
Birth asphyxia Present Birth asphyxia Absent	5(27.8%)	13(72.2%)	60(100%)	
	6(14.3%)	36(85.7%)	60(100%)	
Jaundice Present Jaundice Absent	3(25%)	9(75%)	60(100%)	
	8(16.7%)	40(83.3%)	60(100%)	

**Discussion:**

A total of sixty (60) suspected cases of neonatal septicaemia were enrolled in this study. 18.33% cases (11) were culture positive for bacteria. Similar culture positivity was found in Nigerian study<sup>13</sup> but in contrast to another study the incidence of positive blood culture is 47.5% of neonatal septicaemia<sup>14</sup>. Low culture positivity in early onset septicaemia (EOS) might be due to over diagnosis in this age group because of more nonspecific symptomatology. However negative blood culture does not rule out septicaemia. We have done a single culture utilizing 2 ml blood.

The number of positive cases in early onset septicaemia (EOS) was 9 (81.8%) in comparison to 2(18.2%) in the late onset septicaemia (LOS). In this study, we found that early onset septicaemia (EOS) was more common than late onset septicaemia (LOS), which had the similarity to other studies<sup>15</sup>. Early onset sepsis was indistinguishable from that of perinatal asphyxia and respiratory distress syndrome. Although males have been reported 2-5 fold more likely than females to develop septicaemia<sup>16</sup>. Male female ratio of infant in our study was 2.66:1. The majority of neonates with septicaemia have one or more risk factors. In our study 45.5% (5) cases of neonatal septicaemia were preterm (<37 wks of gestation) and LBW (<2.5k).It was also found in some previous studies<sup>17,18</sup>. Maternal fever during delivery presents in 2 cases (18.2%) and 1(9.1%) of two also had prolonged rupture of membranes for more than 24 hours before delivery. So PROM might be one of the risk factors. It was comparable with the rates reported by others, ranging from 7.8% to 12.0%<sup>19</sup>.

A significant number of study cases were delivered at home, largely in the hand of untrained birth attendants. Home delivery is common in Bangladesh<sup>20</sup>. Repeated examinations increase the chance of introducing bacteria from the external environment into the birth canal<sup>21</sup>. Home deliveries related to birth asphyxia as reported in a dissertation<sup>22</sup>. In our study (45.5%) cases of the culture positive neonatal septicaemia had birth asphyxia. In this study commonly, observed clinical features were poor feeding(68.3%), Fever (48.3%), Lethargy (46.7%), Respiratory distress (38.3%), Convulsion (25%), Jaundice (20.00%), Abdominal distention (13.3%) and Cyanosis (6.7%). These observations showed similarity with findings of other investigator<sup>23</sup>. We found majority of the organisms were gram-negative 54.5%.E. coli was the most common pathogen isolated (54.5%). Similar organisms have been reported in the study in Ngeria<sup>13</sup> and in Nepal<sup>24</sup>. This could be due to most deliveries were conducted in poor standard of hygiene and newborn infants usually lack antibody mediated protection against E. coli. Other common organisms were streptococcus spp. Which was found 27.3% of cases and staph aureus was found in 18.2% of cases. GBS was not found in this study. This might be attributed to low prevalence of GBS in genitalia of pregnant mother in this area<sup>25</sup>. Increasing prevalence of gram-negative septicaemia has been reported from other studies in India, Pakistan and

Bangladesh<sup>16,25,26</sup>. Some studies<sup>25,26</sup> showed that bacteriological profile of neonatal septicaemia differs in EOS and LOS and it also differs in developing and developed countries. In developing countries gram-negative (-ve) organisms were predominant in EOS & LOS but E.coli was predominant in EOS<sup>27,28</sup>. In our study we found that EOS 81.8% (9/11) was more common than LOS and mortality in culture positive cases was 27% (3/11). The mortality rate in the Iranian study was 19.8%<sup>29</sup>.

#### Conclusion:

The present study showed that neonatal septicaemia was one of the major problem in neonatology with a high case fatality rate. Manifestations of neonatal septicaemia are subtle & non-specific. Both gram-negative and gram-positive bacteria were responsible for neonatal septicaemia. Majority of the organism were gram-negative (54.5%). E.coli was the commonest bacteria isolate responsible for septicemia in neonates. Although blood culture is the "gold standard" in the diagnosis of neonatal septicaemia, a high index of suspicion with or without laboratory evidences of infection is the key for early diagnosis. History, clinical examination and laboratory data can minimize the therapy for those neonates who have no infection. Prompt institution of antibiotic therapy and supportive care will save most of the cases of neonatal sepsis. The pattern of antibiotic usage must be reviewed periodically and it must be started as possible in suspected cases and their combination should be changed according to response. If we can avoid risk factors for neonatal septicaemia by antenatal check up of the pregnant mother and thereby the number of neonatal septicaemia can be reduced.

**Conflict of Interest:** None.

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