

Maternal and Neonatal Risk Factors for Developing Early Onset Newborn Sepsis (EONS) in a Tertiary Care Hospital in Bangladesh

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Abstract:

Background: Globally, sepsis is still one of the major causes of morbidity and mortality in neonates, in spite of recent advances in health care units.

Objective: To identify maternal and neonatal risk factors for developing early onset newborn sepsis (EONS) in a tertiary care hospital in Bangladesh.

Methods: This cross-sectional study was carried out in the Neonatology department of Mugda Medical College Hospital (MuMCH) between November 2021 to April 2022 among the neonates who had clinical features of sepsis developed within 72 hours of postnatal age. After taking informed written consent from the parents the clinical profile and risk factors (both maternal and neonatal) were noted in a preformed data collection sheet. Blood for septic screening and C/S were done to confirm the diagnosis.

Results: Majority (90.0%) newborns had maternal risk factors of sepsis whereas 6(10.0%) had not any maternal risk factors of sepsis. Mothers of majority (80.0%) newborns with sepsis had PROM>18 hours. One third had UTI/ lower abdominal pain/ fever within last 2 weeks of delivery. In more than half (56.7%) of the newborn septic cases their mothers had prolonged labour. More than half (58.2%) newborns belonged to gestational age less than 37 completed weeks. About two third (66.7%) newborns belonged to birth weight less than 2500 gm. Almost one third (30.0%) newborns had prelacteal feeding. More than two third (70.0%) newborns were given 7.1% chlorhexidin. Six (10.0%) newborns required resuscitation by bag mask at birth.

Conclusion: For newborn sepsis maternal risk factors PROM>18 hours, prolonged labour, P/ V examination more than 3 times were more common. Neonatal risk factors include prematurity, low birth weight, prelacteal feeding.

Keywords: Maternal and neonatal risk factors, Early onset newborn sepsis

Introduction:

Neonatal sepsis contributes significantly to neonatal morbidity and mortality and is an ongoing major global public health challenge particularly in developing countries where the incidence of neonatal septicemia is 1.6% of all live births¹. Early and late neonatal septicemia is the most common problem in the newborn stage that caused high morbidity and mortality rate. It is responsible for 30-50% of neonatal deaths in developing countries, according to WHO estimates ²Early neonatal septicemia is a clinical

laboratory syndrome caused by the passage of pathogens, their toxins, or their antigens into the blood circulation during the first 72 hours of life ³. The diagnosis is made clinically by non-specific manifestations (low or high temperature of the newborn, lethargy, irritability, tachypnoea or episodes of apnea, rapid or weak pulse, hypotension, low or high blood sugar, metabolic acidosis)⁴.

There are many risk factors for early neonatal sepsis as maternal factors (urinary and genital infections, prenatal fever, prenatal laboratory septicemia, multiple

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pregnancies, frequent vaginal examinations, premature rupture of membranes more than 18 hours), neonatal factors (prematurity, low birth weight, perinatal asphyxia, low Apgar scores, intrauterine infection) and environmental factors (use of resuscitation tools, medical and nursing staff)⁵. White blood cells (WBC), neutrophil count, C-reactive protein (CRP), and platelet count (PLT) are the laboratory criteria for early neonatal sepsis. Blood culture is the gold standard in diagnosis⁶.

In Bangladesh newborn mortality is still high (30/1000 live birth) where newborn sepsis is an important contributing factor as about 21% of all newborn death is caused by newborn sepsis alone. Newborn sepsis may occur in all situations like in normal newborn, asphyxiated newborn and also in preterm newborn. So it is a very common newborn health issue that endanger life in a very short time. There are risk factors (both maternal and neonatal) that contribute newborn sepsis specially early onset newborn to sepsis (EONS) enormously. By determining these risk factors, newborn septic screening as well as preemptive antibiotics therapy can be undertaken that may reduce newborn mortality and morbidity significantly. So, this study was undertaken to observe and determine risk factors (both maternal & newborn) in our community perspective.

Material and Methods:

This cross sectional study included 60 neonates who were admitted with clinical features of newborn sepsis within 72 hours of age during the period of November 2021 to April 2022 at Newborn care unit of Mugda Medical college hospital. On admission, detailed information was recorded on the research form (age, sex, gestational age, birth weight, age at admission, type of delivery, type of pregnancy, use of assistive devices, premature rupture of membranes, maternal age, urinary and genital infections in the mother, laboratory evaluation of the mother, amniotic fluid, need for resuscitation) with a full clinical examination of the patients were included in the study. For diagnosis of septicemia CBC, CRP with a blood culture were done in the laboratory of Mugda Medical College Hospital. Very sick newborns who were referred to another hospital for NICU care, newborn having major congenital anomaly and parents who were not interested to be enrolled in the study were excluded from the study. The current study was approved by the ethical committee of Mugda Medical College Hospital. Informed consent was obtained from the patient's parents.

All data were analyzed using Statistical Package for social sciences (SPSS version 20). Descriptive statistical parameters (mean and standard deviation, frequencies, and percentage) were calculated for each quantitative variable.

Results:

Among the 60 newborns who presented with clinical features of sepsis more than half (51.7%) were male and 29(49.3%) were female. Most of them (80.0%) were inborn and 12(20.0%) out born (Table-I). Majority (90.0%) newborns had maternal risk factors of sepsis whereas 6(10.0%) had no maternal risk factors for sepsis (Figure-1). Mothers of majority (80.0%) of newborns with sepsis had PROM>18 hours, one third had either urinary tract infection (UTI) or lower abdominal pain or fever within last 2 weeks of delivery. In more than half (56.7%) of the newborn septic cases their mothers had prolonged labour (>24 hours for primipara and >18 hours for multipara). Four (6.7%) mothers had foul smelling P/V discharge during pregnancy. In case of one third (33.3%) of newborn sepsis, mothers had meconium stained liquor during delivery. Almost half (43.3%) newborn who developed early onset sepsis, their mother had history of P/V examination >3 times (Figure-2). More than half (58.2%) newborns belonged to gestational age less than 37 completed weeks. About two third (66.7%) newborns belonged to birth weight less than 2500 gm. Almost one third (30.0%) newborns had prelacteal feeding. More than two third (70.0%) newborns were given 7.1% chlorohexidin. Six (10%) newborns required resuscitation by Bag mask at birth (Table-II). It was observed that half (50%) subjects had reluctant to feed followed by respiratory distress (25%), hypothermia (23.3%), lethargic(20.0%), convulsions (6.7%), dyspnea (3.3%), diarrhea (3.3%), fever (3.3%), vomiting (3.3%), bleeding manifestations (3.3%) and Shock (1.7%) (Table-III). It was observed that majority (80.0%) subjects were pink colour followed by (13.3%) icteric and (6.7%) had cyanosis. Almost half (43.3%) subjects had features of respiratory distress. (16.7%) had hyperthermia and (3.3%) had hypothermia. Almost one third (30%) subjects had Capillary Refill Time (CRT) > 3 second. One fourth (24.3%) subjects had distended abdomen. (13.3%) patient had discharge of pus from umbilicus. Two third (66.7%) subjects had diminished primitive reflexes. Half (50.0%) subjects had oliguria. It was observed that two third (66.7%) subjects had normal total count of WBC. Majority (90.0%) subjects had normal Immature to Total neutrophil (I/T) ratio. Almost one fourth (23.3%) subjects had ANC: <1500/mm³. More than three fourth (76.7%) subjects had normal platelet count. Nearly half (40.0%) subjects had CRP positive. Eight (13.3%) subjects had blood culture positive (Table-IV). Figure-4 shows the organisms of culture positive subjects. It was observed that two (33.0%) had found Staphylococcus aureus, 2(33.0%) Enterobacter, 1(17.0%) Klebsiella species and 1(17.0%) had E.coli.

Results:

Table-I

Distribution of the study subjects by sex and place of delivery (n=60)

Sex of newborn		
Male	31	51.7
Female	29	49.3
Place of birth		
Inborn	48	80.0
Out-born	12	20.0

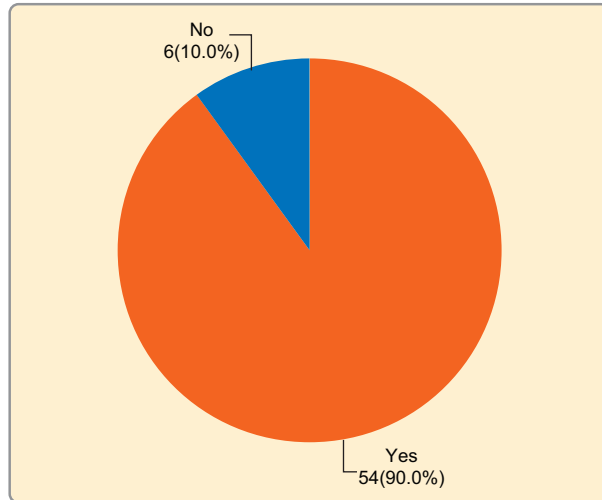


Fig.-1: *Mother's risk factors of sepsis status of study subjects (n=60)*

Table-II

Distribution of the study subjects by neonatal risk factors of sepsis (n=60)

Neonatal risk factors of sepsis	Number of subject	Percentage
Gestational age (weeks)		
≤28	0	0.0
28 - < 34	3	5.0
34 - < 37	35	58.3
37- 42	17	28.2
≥42	5	8.3
Birth weight(gm)		
1000-1499	2	3.3
1500 - 2499	40	66.7
> 2500	18	30
H/O pre-lacteal feeding		
Yes	18	30.0
No	42	70.0
7.1% Chlorhexidin given		
Yes	42	70.0
No	18	30.0
Resuscitation (Bag mask) required at birth		
Yes	6	10.0
No	54	90.0

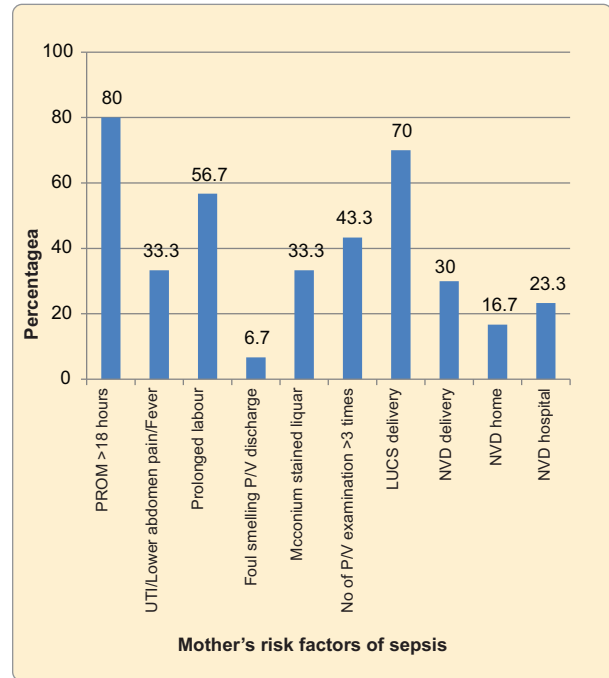


Fig.-2: *The distribution of study subjects mother's risk factors of sepsis (n=60)*

Table-III

Distribution of the study subjects by symptoms (n=60)

Symptoms	Number of subject	Percentage
Reluctant to feed	26	43.3
Respiratory distress	15	25.0
Hypothermia	14	23.3
Lethargic	12	20.0
Convulsions	4	6.7
Diarrhea	2	3.3
Fever	2	3.3
Vomiting	2	3.3
Bleeding manifestations	2	3.3
Shock	1	1.7

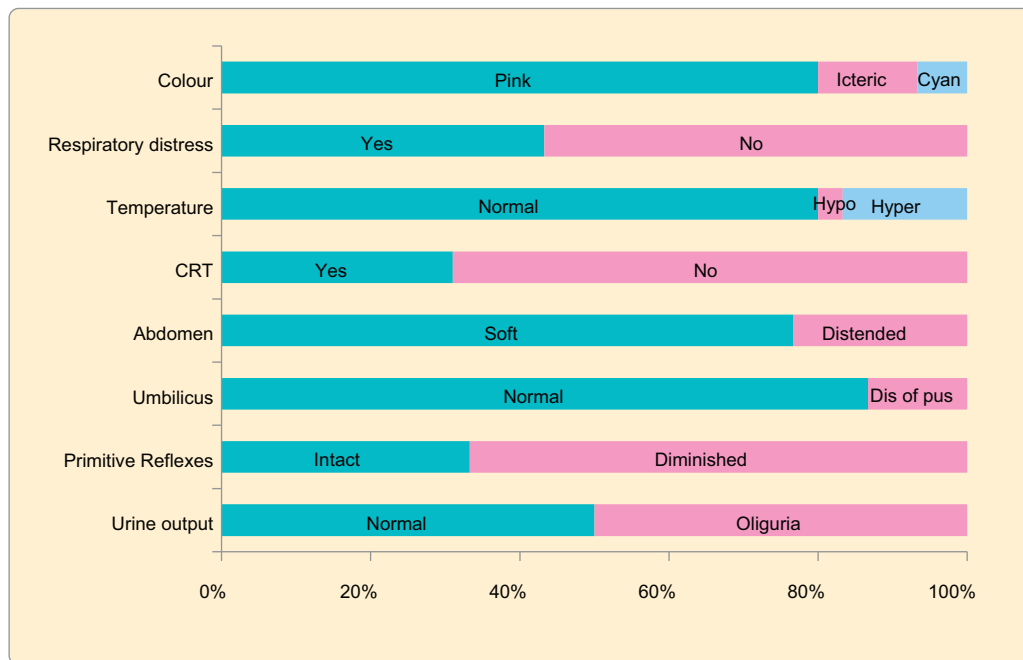


Fig.-3: Bar diagram shows the distribution of the study subjects by physical signs of sepsis(n=60)

Table-IV
Distribution of the study subjects by laboratory findings (n=60)

Laboratory Findings	Number of subject	Percentage
Total count of WBC		
Normal	40	66.7
Leukopenia(< 5000/mm ³)	8	13.3
Leukocytosis(> 25000/mm ³)	12	20.0
I/T ratio		
Normal	54	90.0
Altered	6	10.0
ANC: <1500/mm³		
Yes	14	23.3
No	46	76.7
Platelet count		
Normal	46	76.7
Thrombocytosis	8	13.3
Thrombocytopenia	6	10.0
CRP		
Positive	24	40.0
Negative	36	60.0
Blood culture		
Positive	8	13.3
Negative	52	86.7
Sensitivity of empirical antibiotics to isolated organism		
Sensitive	4	6.7
Not sensitive	2	3.3

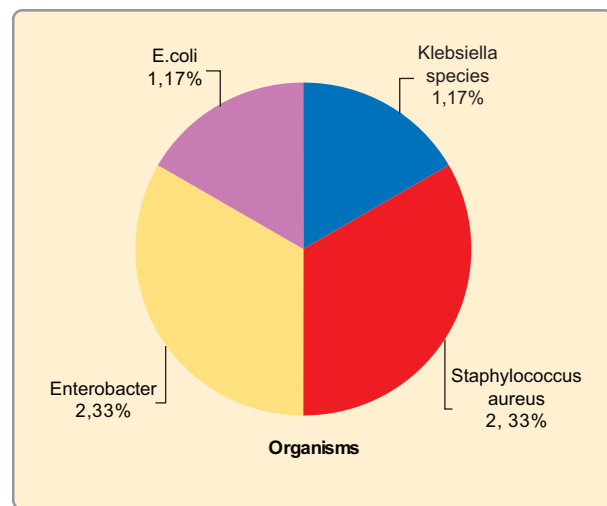


Fig.-4: Pie chart shows the organisms of culture positive subjects (n=6)

Discussion:

In this current study it was observed that 51.7% subjects were male and 49.3% female, which is similar with Nyma et al. study, where they found 58.0% and 42.0% were male and female respectively⁷. Another study also observed that 59.8% were male and 40.2% were female neonates⁸. However, Sohail et al. showed female predominant, where they found 55.0% and 45.0% were female and male neonate respectively⁹. However observations regarding the male predominant

were observed by different studies, Noah et al (2022)^{10,11, 12,13} It is suggested that male neonates were more susceptible to septicemia (sepsis) than females, which can be attributed to gender-specific genes involved in the immune system^{14,,15,16}.

In this present study it was observed that 80.0% subjects were inborn and 20.0% out born. Nyma et al. observed that 16.0% of mothers participated in their study had history of home delivery and 1.16% had history of delivery on the way to hospital and footpath⁷. Some study found that 97.4% were born in the health care facilities and 2.6% born at home¹⁷. Neonates born in an unplanned setting have high rates of respiratory distress, hypoglycemia, and hypothermia, contributing to a considerably greater chance of requiring admission to special care nurseries or intensive care units (ICUs) than do neonates from similar in-hospital births. In comparison with in-hospital deliveries, out born are associated with a higher rate of maternal complications, including extensive lacerations of the birth canal, uterine rupture, and post-partum hemorrhage. Neonatal infection in out born deliveries was 11-fold higher than that in -hospital deliveries. Contaminated places of birth, suboptimal cord cutting and poor perinatal care may be associated with the infection risk of neonates²⁰.

Regarding the symptoms of neonatal sepsis in this study is consistent with Mahallei et al. which shows fever, poor feeding, neonatal icterus, tachypnea, and respiratory distress were common clinical symptoms.

In this present study it was observed that 13.3% subjects had Leucopenia, 20.0% Leucocytosis and 10.0% had altered I/T ratio In the study by Mahallei & Utomo showed 6.2% of neonates suffered from leucopenia with a mean leukocyte count of 11,407cells/mm³. Another study observed that 41.2% had leucocytosis, 15.7% with leucopenia and 54.9% had altered I/T ratio¹⁴. Mahallei et al⁸ study conducted CRP tests for all neonates, with 43.1% positive CRP cases and 56.9% negative, which is consistent with the current study (40% vs 60% respectively).

Blood culture is still the gold standard for definitive diagnosis of neonatal sepsis. This study found that eight (13.3%) subjects had blood culture positive and 6.7% subjects had sensitivity of antibiotics to isolated organism. In a study results from neonatal blood cultures indicated positive cultures in 65.7% neonates, with a number of them exhibiting positive blood

cultures on more than one occasion⁸. In another study culture positivity rate was 37.63% and 31.75%, which also higher than the present study^{21, 22}. Thus culture positivity rate is highly variable from place to place. In a study from India, the culture positivity rate was 13–22.0%²³, which support with the present study.

In this study common pathogens on blood culture were Staphylococcus aureus 33.0%, Enterobacter (33.0%) Klebsiella species 17.0% and 17.0% had E.coli. Haq et al²⁴ and Anwar²⁵ studies found Klebsiella species 25.0%, Escherichia coli 15.0% and Staphylococcus aureus 18.0%.

Maternal and delivery related health issues may cause increased risk for developing early onset newborn sepsis. The human birth canal is colonized with aerobic and anaerobic bacterial organisms that can be transmitted vertically from ascending amniotic fluid infection. In addition, newborns can become infected when exposed to potentially pathogenic bacteria, viruses, or fungi during passage through the birth canal. Maternal infection like UTI, premature rupture of membrane (PROM) for more than 18 hours, maternal fever and leukocytosis within 15days of delivery are known risk factors for developing early onset newborn sepsis. In this study 90.0% subjects had maternal risk factors of sepsis, out of which PROM>18 hours was more frequent (80.0%) and 33.3% had UTI/Lower abdominal pain/Fever within last 2 weeks. In another study Kolhe et al. found that 33.0% had PROM, 25.5% leucocytosis, 7.8% intrapartum fever, 5.9% UTI and 2.0% mother had chorioamnionitis¹⁴. The above mentioned studies findings are comparable with the current study. Study revealed that the majority neonates develop early-onset sepsis since this can occur in utero either transplacental or due to climbing bacteria entering the uterus from the vaginal environment after rupturing of the membranes²⁶.

Other maternal factors like mode of delivery, duration of labour, color of amniotic fluid, number of p/v examination etc. may have impact on causing early onset neonatal sepsis. In this study 70.0% newborns were delivered by LUCS delivery, 56.7% had prolonged labour. Jajoo et.al reported that there are many risk factors for early neonatal sepsis as maternal factors includes urinary and genital infections, prenatal fever, prenatal laboratory septicemia, multiple pregnancies, frequent vaginal examinations, premature rupture of membranes more than 18 hours, environmental factors

like use of resuscitation tools, medical and nursing staff, which support with the present study²⁷

Regarding the neonatal risk factors of sepsis in this current study it was observed that more than half (58.2%) newborns belonged to gestational age less than 37 completed weeks and two third (66.7%) were low birth weight. Premature and low birth weight newborns have compromised immune system that make them more susceptible to newborn sepsis. Gebremedhin et al. mentioned in their study that the majority of neonates include LBW and prematurity which are health risk factors for neonates in industrialized and developing countries²⁸ In another study from Bangladesh showed that infants with LBW can have a significant effect on neonatal sepsis²⁹. The babies born prematurely are susceptible to sepsis due to the immunological immaturity of the neonate which can result in impaired response to infectious agents, especially in premature infants who have a long stay in the hospital and require invasive procedures. Sepsis is associated with preeclampsia, urinary tract infection of mother, low APGAR at 1 and 5 minutes and the occurrence of early death of newborn.³⁰ It is also reported that preterm neonates have three to tenfold higher rate infections than full term normal birth weight infants.^{14,17,31} Many investigators reported that low birth weight is strong neonatal risk factor that leads to cause neonatal sepsis^{14,17,31}

In this current study it was observed that 30.0% subjects had H/O prelacteal feeding, 70.0% had 7.1% chlorohexidin given, 10.0% newborns needed resuscitation with bag mask at birth and 20.0% subjects had poor sanitation at home, which is consistent with others studies^{10,11,21,31}

Conclusion:

Mother's risk factors like PROM > 18 hours, prolonged labour, P/V examination more than 3 times were more common and neonatal risk factors include prematurity, low birth weight, prelacteal feeding were more frequent for developing early onset neonatal sepsis.

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