

Research Article

Association of Maternal and Neonatal Risk Factors with Early Onset Neonatal Sepsis

Dr. Debabrata Roy^{1*}, Professor Dr. M.A Mannan², Dr. A.S.M Selim³, Dr. Debashish Saha⁴, Dr. Sarbari Saha⁵, Dr. Farhana Afroj⁶

¹Junior Consultant, Department of Pediatrics, Upazila Health Complex, Kaliakoir, Gazipur, Bangladesh

²Professor, Department of Neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

³Assistant Professor Department of Pediatrics, TMSS Medical College Hospital, Bogura, Bangladesh

⁴Consultant, Department of Neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

⁵Medical Officer, Department of Neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

⁶Assistant Professor, Department of Pediatrics, Kumudini Medical College Hospital, Tangail, Bangladesh

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Abstract: Introduction: Sepsis is a leading cause of mortality and morbidity for neonates in developing countries due to different maternal and neonatal risk factors. The aim of the present study is to see the maternal and neonatal risk factor for neonatal sepsis. **Aim of the study:** The aim of the present study is to see the maternal and neonatal risk factors for neonatal sepsis. **Methods:** This cross-sectional study was conducted in the Department of Neonatology of Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka, Bangladesh during the period from January 2011 to June 2011. Statistical analysis was performed by using SPSS for windows version 12.0. 95% confidence limit was taken. Probability value <0.05 was considered as level of significance. **Result:** A total number of 100 patients were enrolled in this study and was categorized into two groups. One group was sepsis group which was taken as case and another one was the non-sepsis group which was taken as control group. In sepsis group male and female were in 51.3% and 48.7% respectively, febrile illness in the mother within 2 weeks prior to delivery was present in 33.3% cases and absent in 66.7% cases (p=0.001). In sepsis group rupture of maternal amniotic membranes >18 hours was present in 70.5% and absent in 29.5% (p=0.001). In sepsis group prolonged labor was found in 28.2% cases and absent in 71.8% cases (p=0.759). In sepsis group single unclean or >3 sterile vaginal examinations during labor was found in 28.2% cases and absent in 71.8% cases (p=0.003). Less than 4 Apgar score was found in 17.9% cases and 4.9% cases in sepsis and non-sepsis groups respectively (p=0.034). In sepsis group less than <1500 grams' body weight neonates were found in 7.7% case. In sepsis group gestational age less than 37 weeks was found in 35.9% cases and more than or equal to 37 weeks in 64.1% cases (p=0.001). In sepsis group positive blood culture was found in 23.1% cases and negative in 76.9% cases (p=0.001). The mean I/T ration was found in 0.27 ± 0.07 and 0.15 ± 0.05 in sepsis and non-sepsis group respectively (p=0.001). The mean C-reactive protein was found in 18.38 ± 10.11 and 2.71 ± 1.68 in sepsis and non-sepsis group respectively (p=0.001). **Conclusion:** It was found that different maternal and neonatal risk factors were responsible for neonatal sepsis of which prematurity, low birth weight, low Apgar score, maternal febrile illness, frequent vaginal examinations and maternal rupture of amniotic membranes >18 hours were significantly associated with neonatal sepsis.

Keywords: Maternal, Neonatal, Neonatal sepsis.

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INTRODUCTION

Neonatal sepsis is the commonest cause of neonatal mortality¹. In the pre-antibiotic era neonatal sepsis was usually fatal. It has been classified as either early onset sepsis (EOS) which is at 0-7 day of age or late onset sepsis (LOS) which is 7-28 days of age [2]. It is responsible for 30-50% of total neonatal deaths each year in developing countries [3]. It is estimated that up to 20% of neonates develop sepsis and approximately 1% die of sepsis related causes [4]. As per National

Neonatal Perinatal Database (NNPD) 2002-2003, the incidence of systemic infection is 3% among intramural babies in tertiary care institutions in India, with septicemia being present in three fourth of the cases and pneumonia in one fourth of neonates [1]. It's most clinical manifestations are meningitis (30-40%), bacteraemia (40%), septic arthritis (5% to 10%) and more rarely omphalitis and osteomyelitis and the reported incidence of neonatal sepsis varies from 7 to 38 per 1000 live births in Asia [5], from 6.5 to 23 per 1000 live births in Africa [6], and from 3.5 to 8.9 per

1000 live births in South America and the Caribbean [7]. By comparison, rates reported in the United States and Australasia range from 6–9 per 1000 live birth [8] and in Europe 0.3-3 per 1000 live births [9]. Infections are one of the commonest causes of neonatal deaths globally. Neonatal sepsis contributes 1/3 neonatal deaths of Bangladesh [10]. Clinical features of sepsis are non-specific in neonates and often overlooked and a high index of suspicion is required for timely diagnosis. It is desirable to administer appropriate therapy as early as possible to the suspected infected infant. In a developing country like Bangladesh, where 80% delivery occurs at home by unskilled birth attendance as well as proper laboratory facilities are not available at upazilla and district level, identification of risk factors and early initiation of antibiotic therapy can improve the mortality and morbidity. This purpose of the present study is to find out the association between maternal and neonatal risk factors with early onset neonatal sepsis.

OBJECTIVES

a) General objective

- To see the maternal and neonatal risk factors for neonatal sepsis.

b) Specific Objectives

- To find out the association of maternal risk factors with neonatal sepsis.
- To find out the association of neonatal risk factors with neonatal sepsis

METHODOLOGY & MATERIALS

It was a cross sectional study. The study was carried out in the Department of Neonatology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. This study was conducted from January 2011 to June 2011 for a period of six (06) months. All the neonate within the age of 72 hours presented with mentioned risk factors in Department of Neonatology at BSMMU were enrolled as study population. The patients were voluntarily included in the study with their consent and they were neither supported nor additionally burdened financially. The sampling technique was consecutive sampling and this purposive sampling technique was used as per inclusions and exclusion criteria. All data were recorded systematically in preformed data collection form (questionnaire) and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using MS-Excel-2016 & SPSS for windows version 12.0. 95%

confidence limit was taken. Probability value <0.05 was considered as level of significance.

RESULT

A total number of 100 patients were enrolled in this study and was categorized into two groups. One was sepsis group which was taken as case and another group was the non-sepsis group which was taken as control. Among 39 patients in sepsis group gestational age less than 37 weeks was found in 14 (35.9%) cases and more than or equal to 37 weeks in 25 (64.1%) cases. Among 61 patients in non-sepsis group gestational age less than 37 weeks was found in 8 (13.1%) cases and more than or equal to 37 weeks in 53 (86.9%) cases. The difference was statistically significant ($p=0.001$) [Table-1]. In sepsis group male and female were in 20 (51.3%) cases and 19 (48.7%) cases respectively. In non-sepsis group male and female were in 42 (68.9%) cases and 19(31.1%) cases respectively. The difference was statistically significant ($p=0.013$) [Table-2]. Less than 4 Apgar score was found in 7 (17.9%) cases and 3 (4.9%) cases in sepsis and non-sepsis groups respectively. More than or equal to 4 Apgar score was found in 32 (82.1%) cases and 58 (95.1%) cases in sepsis and non-sepsis groups respectively. The difference was statistically significant ($p=0.034$) [Table-3]. In sepsis group less than <1500 grams' body weight neonates were found in 3 (7.7%) case, 1500- <2500 grams' body weight neonates were found in 16 (41.0%) and more than or equal to 2500 grams' body weight neonates were found in 20 (51.3%) cases. In non-sepsis group less than <1500 grams' body weight neonates were found in 1 (1.6%) case, 1500 - <2500 grams' body weight neonates were found in 9 (14.8%) and more than or equal to 2500 grams' body weight neonates were found in 51 (83.6%) cases. The difference was statistically significant ($p=0.002$) [Table-4]. Among 39 patients in sepsis group rupture of membranes >18 hours was found in 27 (69.2%) cases and absent in 12 (30.8%) cases. Among 61 patients in non-sepsis group rupture of membranes >18 hours was found in 27 (44.3%) cases and absent in 34 (55.7%) cases. The difference was statistically significant ($p=0.015$) [Table-5]. Among 39 patients in sepsis group single unclean or > 3 sterile vaginal examinations during labor was found in 11 (28.2%) cases and absent in 28 (71.8%) cases. Among 61 patients in non-sepsis group prolonged labor was found in 4 (6.6%) cases and absent in 57 (93.4%) cases. The difference was statistically significant ($p=0.003$) [Table-6]. Among 39 patients in sepsis group positive blood culture was found in 9 (23.1%) cases and negative in 30 (76.9%) cases. Among 61 patients in non-sepsis group positive blood culture was not found and negative all in

61 (100.0%) cases [Table-7]. The difference was statistically significant ($p=0.001$). (Table-1). The mean Total leukocyte count was found in $10.92 \times 10^9 \pm 7.89 \times 10^9$ and $12.88 \times 10^9 \pm 5.88 \times 10^9$ in sepsis and non-sepsis group respectively. The difference was not statistically significant ($p=0.160$). The mean I/T ration was found in 0.27 ± 0.07 and 0.15 ± 0.05 in sepsis and non-sepsis group respectively. The difference was

statistically significant ($p=0.001$). The mean C-reactive protein was found in 18.38 ± 10.11 and 2.71 ± 1.68 in sepsis and non-sepsis group respectively. The difference was statistically significant ($p=0.001$). The mean Absolute neutrophil count was found in 4226.9 ± 2370.7 and 5210.0 ± 1297.6 in sepsis and non-sepsis group respectively. The difference was statistically significant ($p=0.009$) [Table-8].

Table-1: Distribution of patient according to gestational age group (n=100)

Gestational Age	Group		P Value
	Sepsis	Non-sepsis	
<37	14 (35.9)	8 (13.1)	0.001
≥37	25 (64.1)	53 (86.9)	

Table-2: Distribution of neonates according to the sex (n=100)

Sex	Group		P Value
	Sepsis	Non-sepsis	
Male	20 (51.3)	42 (68.9)	0.013
Female	19 (48.7)	19 (31.1)	

Table-3: Distribution of patient according to Apgar score (n=100)

APGAR Score	Group		P Value
	Sepsis	Non-sepsis	
<4	7 (17.9)	3 (4.9)	0.034
≥4	32 (82.1)	58 (95.1)	

Table-4: Distribution of patient according to birth weight group (n=100)

Birth weight (gm)	Group		P Value
	Sepsis	Non-sepsis	
<1500	3 (7.7)	1 (1.6)	0.002
1500 - <2500	16 (41.0)	9 (14.8)	
≥2500	20 (51.3)	51 (83.6)	

Table-5: Distribution of patient according to rupture of membranes > 18 hours

Factor	Group		P Value
	Sepsis	Non-sepsis	
Present	27 (69.2)	12 (30.8)	0.015
Absent	27 (44.3)	34 (55.7)	

Table-6: Distribution of patient according to single unclean or > 3 sterile vaginal examinations during labor

Single unclean	Group		P Value
	Sepsis	Non-sepsis	
Yes	11 (28.2)	4 (6.6)	0.003
No	28 (71.8)	57 (93.4)	

Table-7: Distribution of patient according to blood culture (n=100)

Blood culture	Group		P Value
	Sepsis	Non-sepsis	
Positive	9 (23.1)	0(0.0)	0.001
Negative	30 (76.9)	61 (100.0)	

Table-8: Distribution of findings in different investigations (n=100)

Component	Group		P value
	Sepsis Mean±SD	Non-sepsis Mean±SD	
Total leukocyte count	10.92x10 ⁹ ± 7.89 x10 ⁹	12.88 x10 ⁹ ± 5.88 x10 ⁹	0.16
I/T ration	0.27 ± 0.07	0.15 ± 0.05	0.001
Absolute neutrophil count	4226.9 ± 2370.7	5210.0 ± 1297.6	0.009
C-reactive protein	18.38± 10.11	2.71± 1.68	0.001

DISCUSSION

A total number of 100 patients were enrolled in this study and was categorized into two groups. One was sepsis group which was taken as case and another group was the non-sepsis group which was taken as control. The distribution of neonates according to sex was recorded. Among 39 patients in sepsis group gestational age less than 37 weeks was found in 14 (35.9%) cases and more than or equal to 37 weeks in 25 (64.1%) cases. Among 61 patients in non-sepsis group gestational age less than 37 weeks was found in 8 (13.1%) cases and more than or equal to 37 weeks in 53 (86.9%) cases. The difference was statistically significant (p=0.001). In sepsis group male and female were in 20 (51.3%) cases and 19 (48.7%) cases respectively. In non-sepsis group male and female were in 42 (68.9%) cases and 19 (31.1%) cases respectively. The difference was statistically significant (p=0.013). Less than 4 Apgar score was found in 7 (17.9%) cases and 3 (4.9%) cases in sepsis and non-sepsis groups respectively. More than or equal to 4 Apgar score was found in 32 (82.1%) cases and 58 (95.1%) cases in sepsis and non-sepsis groups respectively. The difference was statistically significant (p=0.034). Similar result was reported by Yancey *et al.* and mentioned that Apgar score was one of the risk factor for neonatal sepsis [11]. Schuchat *et al.* and Thomas *et al.* had reported similar findings [12, 13].

In sepsis group less than <1500 grams' body weight neonates were found in 3 (7.7%) case, 1500-<2500 grams' body weight neonates were found in 16 (41.0%) and more than or equal to 2500 grams' body weight neonates were found in 20 (51.3%) cases. In non-sepsis group less than <1500 grams' body weight neonates were found in 1 (1.6%) case, 1500 - <2500 grams' body weight neonates were found in 9 (14.8%) and more than or equal to 2500 grams' body weight neonates were found in 51 (83.6%) cases. The difference was statistically significant (p=0.002). Similar result was reported by Yancey *et al.* and mentioned that birth weight was association with neonatal sepsis [10]. The reason might be due to the more chance of neonatal infection as because low birth weight neonates had lack of immunity. Adair *et al.* had reported that low birth weight of the neonate was one of

the risk factor for the causation of neonatal sepsis which was consistent with the present study [14].

The distribution of patient according to rupture of membranes >18 hours was recorded. Among 39 patens in sepsis group rupture of membranes >18 hours was found in 69.2% cases and absent in 30.8% cases. Among 61 patients in non-sepsis group rupture of membranes >18 hours was found in 44.3% cases and absent in 55.7% cases. The difference was statistically significant (p=0.015). Similar result was reported by Yancey *et al.* [11] and mentioned that rupture of membranes >18 hours was the risk factor of neonatal sepsis. Adair *et al.* [14] and Thomas *et al.* [13] had reported that rupture of the membrane was one of the risk factor for the causation of neonatal sepsis which was consistent with the present study. Schuchat *et al.* [12] and Seaward *et al.* [17] had also found a similar result. The reason of this might be due to the long time rupture of the membrane allows to enter the organisms in to the neonates during delivery.

Among 39 patients in sepsis group single unclean or > 3 sterile vaginal examinations during labor was found in 11 (28.2%) cases and absent in 28 (71.8%) cases. Among 61 patients in non-sepsis group prolonged labor was found in 4 (6.6%) cases and absent in 57 (93.4%) cases. The difference was statistically significant (p=0.003). The difference was statistically significant (p=0.003). Similar result was reported by Yancey *et al.* (1996) and mentioned that single unclean or unsterile vaginal examination during labour was one of the risk factor for the causation of neonatal sepsis [11]. Thomas *et al.* was also reported the similar result [13]. Bhutta *et al.* had also found an association with frequent vaginal exams with amnionitis, early-onset sepsis, and neonatal infections [15]. Seaward *et al.* had also found a similar result [16]. Oddie and Embleton also reported that the single unclean or unsterile vaginal examination during labour related with maternal risk factors was also responsible for neonatal sepsis which was consistent with the present study [17].

The distribution of findings in different investigations was recorded. The mean Total leukocyte count was found in 10.74x10⁹ ± 8.63 x10⁹ and 12.01

$\times 10^9 \pm 4.58 \times 10^9$ in sepsis and non-sepsis group respectively. The mean I/T ration was found in 0.26 ± 0.06 and 0.15 ± 0.03 in sepsis and non-sepsis group respectively. The mean C-reactive protein was found in 17.57 ± 8.39 and 2.58 ± 1.41 in sepsis and non-sepsis group respectively. The mean Absolute neutrophil count was found in 3661.5 ± 2737.50 and 4955.0 ± 1290.01 in sepsis and non-sepsis group respectively. Similar result was reported by Shitaye and mentioned that these markers are highly sensitive and specific and can be used for routine clinical work-up in community health delivery systems, particularly in developing countries [18]. Various hematological parameters, a complete blood count, WBC count and differential and absolute neutrophil count had been evaluated for their ability to predict neonatal sepsis [19]. An increased I: T ratio of >0.2 had been reported to have moderately increased specificity for sepsis [19]. This result was consistent with the present study.

Limitations of the study

Our study wasn't a blinded study so patient bias was present along with observer bias in subjective recording and the small sample size was taken in this study. It was a non-randomized sampling method. It was a single cantered study and the study and follow up period was short in comparable to other series.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the findings of this study permit to conclude that different maternal and neonatal risk factors are responsible for neonatal sepsis of which prematurity, low birth weight, low apgar score, maternal febrile illness, frequent vaginal examinations and maternal rupture of amniotic membranes >18 hours are significantly associated with neonatal sepsis.

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