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Neonatal Sepsis and Its Associated Risk Factors : A Case Control Study in Tertiary Care Hospital in Chattogram

Shanta Dutta[1*] Feroza Akter[2] Bibi Fatema Zidney[1] Wazir Ahmed[3]

Abstract

Background: Neonatal sepsis is a clinical syndrome resulting from the pathophysiologic effects of local or systemic infection. It is one of the major cause of morbidity and mortality of neonate and is an enduring major global public health challenge predominantly in developing countries. The objective of this study is to evaluate the risk factors association with neonatal sepsis in tertiary care hospital of Chattagram Maa Shishu O General Hospital (CMSOGH), Chattogram.

Materials and methods: The study was a prospective type of case control study, conducted from October to December 2023, in the tertiary care hospital of Chattogram. A total sample 150 were selected, among them 50 cases, were proven sepsis through clinical and laboratory criteria of IMNCI (Integrated Management of Neonatal and Childhood Illness were incorporated as cases in this study. Those were neither suspected nor diagnosed sepsis but admitted to the Neonatal Ward of CMSOGH due to other indications such as low birth weight, neonatal jaundice, diarrhea etc. throughout the study period were included as controls.The chi square test was used to test the association between dependent and independent variables associated with risk factors to neonatal sepsis.

Results: Late onset neonatal sepsis was common among neonatal sepsis and maternal age<20 years and mode of delivery, who were delivered by vaginalyhad significant association of sepsis. Maternal history of UTI (Urinary Tract Infection) in 3rd trimester and mode of delivery were significant ($p<0.05$) as a risk factors of sepsis. APGAR score <7 and prematurity both p-value <0.05, that's indicate significant association with neonatal sepsis. The common presenting symptoms among the neonates were jaundice and refusal to feed. The organisms isolated were Acinetobacter (30%) Pseudomonas (30%) Klebsiella (20%) Coagulate negative staphylococcus aureus (15%).

Conclusion: The study concludes that maternal age, UTI in 3rd trimester, mode of deliveryand low APGAR score were high risk factors for neonatal sepsis. Ensuring proper antenatal care employment would help early recognize the risk factors of neonatal sepsis and applicable intrusions for achievement of SDG (Sustainable Development Goals) where neonatal mortality is a burning issueto resolve as part of sustainable development in medical science of a country.

Key words: Bacterial organisms; Neonatal sepsis; Risk factors; Sustainable Development Goal (SDG).

1. Assistant Professor of Neonatology
Chattagram Maa-O-Shishu Hospital Medical College, Chattogram.
2. Associate Professor of Neonatology
Chattagram Maa-O-Shishu Hospital Medical College, Chattogram.
3. Professor of Neonatology
Chattagram Maa-O-Shishu Hospital Medical College, Chattogram.

***Correspondence: Dr. Shanta Dutta**
Cell : 01818 67 49 88
E-mail: shanta.dutta16@gmail.com

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Introduction

Neonatal mortality rate is considered as powerful predictor of nation's development as well as health and health service accessibility by the people in a developing country. Neonata lsepsis is a clinical syndrome of systemic illness accompanied by bacteremia in infants < 28 days of life and is an essential cause of neonatal morbidity and mortality. It is an enduring major global public health challenge.[1] According to the World Health Organization (WHO) globally each year over 4 million neonates died within 28 days of birth.[2] Neonatal sepsis is one of the core cause of neonatal deaths (35%) followed by deaths resulted from preterm births (28%), intrapartum related complications (24%) and asphyxia (23%). Globally 7% of mortality in children under5 years and 15% in neonates were related to sepsis and meningitis in 2016.[3] In developing countries sepsis is probably liable for 30–50% of the total neonatal deaths each year.[4] In Bangladesh the current neonatal mortality rate is around 30 per 1000 live birth and accounts for 67% of all under 5 deaths. Of the different causes, perinatal asphyxia (22.9%) preterm and low birth weight (29.7%), and neonatal sepsis contribute to around 19.9% of all neonatal deaths.[5]

Neonatal sepsis remains the main important causes of neonatal morbidity and mortality. A baby may acquire infections while in utero, during birth process or after birth. Considering the time of acquisition of organisms, neonatal infection is broadly classified into two classes: (i) Early-Onset

Neonatal Sepsis (EONS) define as onset of symptoms within the 72 hours of birth and (ii) Late-Onset Neonatal Sepsis (LONS) define as onset of symptoms after the 72 hours of birth. In EONS infection acquired when the baby in utero or ascending infection from maternal genital tract andduring delivery while organisms acquired from the environment (Nosocomial or community sources) are responsible for LONS.[6]

Some studies have observed there are some risk factors are responsible for developing sepsis.[7] Premature Rupture Of Membranes (PROM) especially more than 18 hours, infection and fever of the mother during labor, foul smell of amniotic fluid, turbidity and meconium stained amniotic fluid and multiple gestations are maternal risk factorsand Prematurity, low birth weight, asphyxia, resuscitation during delivery, invasive procedure, congenital anomaly, parenteral nutrition and long hospital stay in neonatal intensivecare unit are the neonatal conditions. Clinically, neonatal sepsismay present as lethargy, hypothermia, fever, poor feeding, abnormal cry, vomiting diarrhea, respiratory distress, bleeding tendencies, seizures, pallor, shock etc. But the gold standard for confirming sepsis is the isolation of causative organism from blood.[8]

Among of the neonatal deaths, globally 15% are caused by neonatal sepsis and predominantly it is a major apprehension in the LMICs. Moreover, it is not only increasing the economic burden butalso surviving infant have significant long-term neuro developmental sequels. Neonates are in imitably susceptible to invasive disease because of their immature immune system, which also responsible for minimal or nonspecific clinical manifestations and effective treatment requires responsiveness to elusive signs of infection.

In Bangladesh, not many studies have described on the prevalence of neonatal sepsis in different areas of the country.Like other South Asia countries, in Bangladesh neonatal sepsis and its complications is a burden.To achieve third Sustainable Development Goal for child health aims to end preventable deaths of newborns and children under five years of age by 2030, expansion of clinical care for babies and mothers.[8] Neonatal sepsis donates suggestively to neonatal mortality. Bangladesh like developing country showed differences in the incidence, risk factors of sepsis and also has some difference pattern and antimicrobial sensitivities from that of developed countries. Our hospital is tertiary hospital in Chattogram, deals both inborn and outborn neonates, so we conducted this study to evaluate the risk factors of neonatal sepsis in Chattagram Maa Shishu O General Hospital, Chattogram.

Materials and methods

The study was an unmatched case control study carried out in the Neonatal Ward of Chattagram Maa Shishu O General Hospital (CMSOGH) from October to December, 2023. It is an 800 bedded General Hospital, where there was a 50 bedded neonatal ward with a 25 bedded Neonatal Intensive Care Unit (NICU).

The Neonate aged between 0 to 28 days who were admitted in the Neonatal Ward of CMSOGH during the study period was the target population. Considering purposive sampling technique, the study was proposed to assemble a subset of the target population to get desired sample.

Neonate (0-28) days of age admitted in this study period with history, clinical features and laboratory parameter/ culture suggestive of sepsis were included as case and those were admitted other than sepsis such as Low Birth Weight (LBW) Prematurity, neonatal jaundice, diarrhea etc. during the study period included as control. Congenital Malformations, surgical complications and parents/caregivers left against medical advice were excluded from the study.

Informed written consent was taken every sample, after that a face to face interview was taken from mother or other caregiver of both case and control group and medical records were reviewed to identify risk factors. Neonatal sepsis is defined accordingly to the international pediatric sepsis consensus conference, by the presence of the hematological criteria along with the established IMNCI (Integrated Management of Neonatal and Childhood Illness) clinical features either of fever (37.5°C) or hypothermia (35.5°C) fast breathing (60 breath per minute) severe chest indrawing, not feeding well, movement only when stimulated, convulsion, lethargic or unconscious] and evidence of positive blood culture results. Controls were not matched for age with cases. The blood sample was collected for all samples both

case and controls and also done septic screening by trained pediatrics nurses and send to microbiology lab of CMSOGH. 1 ml of blood was collected from each patient and directly inoculated into a pediatric FAN blood culture bottle. Collected samples were incubated in the BACT/Alert machine for up to 5 days.[9] For identification of organisms, positive culture samples were directly inoculated into Mac Conkey (MC) agar, chocolate agar, and blood agar (5% sheep blood) plates.

After taking history about patient's epidemiological factors, presenting complains maternal and neonatal risk factors as well as laboratory parameters and blood culture who meet the inclusion criteria of case and controls were recorded on the data collection form.

All data were documented systemically in data collection form. The data were analyzed by using SPSS (IBM version 20.0). The data were presented in tubular or diagrammatic form. Quantitative data were expressed as mean± standard deviation and categorical data were presented as frequency. To determine the relations between independent variable and outcome variables, Pearson's chi-squared test were used also determine the risk of neonatal sepsis, binary logistic regression analysis was employed. The magnitude of association was measured by using an odds ratio at a 95% confidence interval. Statistical significance was declared at $p < 0.05$. Necessary permission was taken before start the study.

Results

The present study comprised of 50 cases, who had sepsis with their mothers and fulfilled the criteria of sepsis according to international pediatric sepsis consensus conference of neonatal sepsis and 100 control neonates who had no sepsis.This study was accessible that during the study period about 50% neonates had sepsis, among them 17(34%) was EONS and 66% was LONS. Almost half of the neonates of both groups were male 97 (65%) with male to female ratio 1.8:1.

Among the participants total 60.66% (n=91) maternal age >20 yrs, in case and control this were 21(42%) and 70(70%) respectively. In frequency table of maternal and neonatal factors data represented UTI during antenatal period was higher in the cases 41% than controls 16%. Similarly, the proportion of mothers who gave birth after 18 hours of Rupture of the Membrane (PROM) was advanced in the cases 41 (82%) than controls 13 (13%). Around 69% of the total samples, 28(56%) cases and 53% controls were normal vaginal delivery, 23% of mothers had prolonged labour (24% cases and 11% controls). More than half of neonates were admitted before 72 hours, which was 83(55.33%) in total samples. Majority 36(72%) of the neonates had normal birth weight 2.5kg and above. Referring to APGAR score about 103(68.60%) had APGAR scores >7. The proportion of neonates who had APGAR scores <7 at 5 minutes was higher in the cases than controls.

Table I showing the risk factors associated with sepsis that maternal age, maternal UTI during 3rd trimester, premature rupture of membrane, mode of delivery, term baby, male and Apgar score at 5 minutes were significantly associated with neonatal sepsis. After applying bivariate logistic regression, Maternal age was significantly associated with neonatal sepsis, neonate from the mother whose age <20yrs were 1.03 times more than whose age >20yrs [$p< 0.05$). Genitourinary infection was the highly significant risk factor (41% vs 9%, $p<0.01$). Caesarian section and term baby which gestational age more than 37 weeks were at 2 time higher risk for getting sepsis than neonates delivered in time ($p<0.05$ OR = 2.00, 95% CI: 0.41–0.76). Neonates having a lower APGAR score (<7) at 5minutes were more significant to get sepsis than neonates with APGAR score of 7 and above [$p<0.05$, 95% CI (0.25- 3.21).

Table II showed that the risk factors of early onset neonatal sepsis. Binary logistics regression showed that among maternal factors, maternal age, prolong labour, PROM, mode of delivery and neonatal factors, Gestational age >37weeks, APGAR score <7 were highly significant of developing EONS.

Table III had showed that the risk factors of LONS. In this table we found after binary logistics regression, APGAR score and maternal UTI were significant for LONS ($p<0.05$). In LONS, whose APGAR score <7 were 3.53 times more prone to develop LONS.

In Figure 1 the graphical presentation of causative

organisms, we found most of organisms were gram-negative, whereAcinatobactum and Pseudomonas were the largest (30%) after that Klebsiella pneumonia (20%).

Figure 2 depicted the clinical features by bar diagram, where showed that jaundice and refusal to feed was the most common findings. In cases, refusal to feed (50%), respiratory distress (38%) followed by seizures. From this diagram we know that sepsis also presented with the features of abdominal distention hypothermia and lethargic.

Table 1 Distribution of maternal and neonatal risk factors

Variables	Cases n=50(33.33%)	Controls n=100(66.66%)	Total n=150(100%)
PL>18hrs			
Yes	12(24%)	11(11%)	23(15.33%)
No	38(76%)	89(89%)	127(84.66%)
PROM			
Yes	41(82%)	13(13%)	25(16.66%)
No	9(18%)	87(87%)	125(83.33%)
Multiple Pregnancy			
Yes	4(8%)	13(13%)	54(36%)
No	46(92%)	87(87%)	96(64%)
Foul Smelling			
Yes	8(16%)	2(2%)	10(6.66%)
No	42(84%)	98(98%)	140(93.33%)
Mode of Delivery			
NVD	22(44%)	47(47%)	54 (36%)
C/S	28(56%)	53(47%)	96(64%)
Place of Delivery			
Home	9(18%)	16(16%)	25(16.66%)
Hospital	41(82%)	84(84%)	125(83.33%)
MSAF			
Yes	13(26%)	8(8%)	21(14%)
No	37(74%)	92(92%)	129(86%)
Maternal UTI			
YES	41(41%)	16(16%)	57(38%)
NO	9(9%)	84(84%)	93(62%)
Gestational Age			
<37 Weeks	14(28%)	32(32%)	46(30.66%)
>37 Weeks	36(72%)	68(68%)	104(69.33%)
Sex			
Male	30(60%)	67(67%)	97(64.66%)
Female	20(40%)	33(33%)	53(35.33%)
Age			
<72 hrs	33(66%)	50(50%)	83(55.33%)
>72 hrs	17(34%)	50(50%)	67(44.66%)
Weight			
<2.5 Kg	14(28%)	36(36%)	50(33.33%)
>2.5 Kg	36(72%)	64(64%)	100(66.66%)
Apgar Score			
<7	24(48%)	23(23%)	47(31.33%)
>7	26(52%)	77(77%)	103(68.66%)

Table II Bivariate logistic regression analysis the risk factors of neonatal sepsis

Variables	Cases n=50 (33.33%)	Controls n=100 (66.66%)	Total n=150 (100%)	Chi Square Value	p Value	Odd Ratio and CI
Maternal Age						
<20 Years	29(58%)	30(30%)	59(39.33%)	46.03	0.000	1.03
>20 Years	21(42%)	70(70%)	91(60.66%)			(0.01-0.24)
ES						
High	16(32%)	47(47%)	63(42%)	1.03	0.308	0.533
Below	34(68%)	53(53%)	87(58%)			(0.16-1.79)
Gravida						
Primi	18(36%)	40(40%)	58(38.66%)	0.07	0.793	1.169
Multi	32(64%)	60(60%)	92(61.33%)			(0.36-3.75)
PL>18hrs						
Yes	12(24%)	11(11%)	23(15.33%)	0.05	0.825	0.773
No	38(76%)	89(89%)	127(84.66%)			(0.078- 7.66)
PROM						
Yes	41(82%)	13(13%)	54(36%)	3.85	0.050	1.68
No	9(18%)	87(87%)	96(64%)			(0.55-0.84)
Multiple Pregnancy						
Yes	4(8%)	7(7%)	11(7.33%)	0.278	0.594	1.07
No	46(92%)	93(93%)	137(92.66%)			(0.99-1.15)
Mode of Delivery						
NVD	22(44%)	47(47%)	69(46%)	2.50	0.04	1.12
C/S	28(56%)	53(53%)	81(54%)			(0.40-0.69)
Place of Delivery						
Home	9(18%)	16(16%)	25(16.66%)	3.40	0.07	4.62
Hospital	41(82%)	84(84%)	125(83.33%)			(0.82-26.02)
MS						
Yes	13(26%)	8(8%)	21(14%)	0.624	0.430	3.00
No	37(74%)	92(92%)	129(86%)			(0.17-51.74)
Maternal UTI						
YES	41(41%)	16(16%)	57(38%)	5.99	0.01	0.165
NO	9(9%)	84(84%)	93(62%)			(0.03-0.77)
Gestational Age						
<37 Weeks	14(28%)	32(32%)	46(30.66%)	10.9	0.001	2.00
>37 Weeks	36(72%)	68(68%)	104(69.33%)			(0.41-0.76)
Sex						
Male	30(60%)	67(67%)	97(64.66%)	10.9	0.001	2.00
Female	20(40%)	33(33%)	53(35.33%)			(0.41-0.76)
Age						
<72hrs	33(66%)	50(50%)	83(55.33%)	2.22	0.136	2.48
>72hrs	17(34%)	50(50%)	67(44.66%)			(0.74-8.35)
Weight						
<2.5Kg	14(28%)	36(36%)	50(33.33%)	2.38	0.123	2.66
>2.5Kg	36(72%)	64(64%)	100(66.66%)			(0.753-9.45)
Apgar Score						
<7	24(48%)	23(23%)	47(31.33%)	0.024	0.03	0.905
>7	26(52%)	77(77%)	103(68.66%)			(0.25-3.21)

Table 3 Bivariate logistic regression for risk factors of early-onset neonatal sepsis

Variables	Cases n=33 (40%)	Controls n=50 (60%)	Total n=83 (100%)	Chi Square Value	p Value	Odd Ratio and CI
Maternal Age						
<20 Years	8(24%)	7(14%)	15(18%)	27.76	0.000	0.125
>20 Years	25(76%)	43(86%)	68(82%)			(0.02-0.78)
PL>18 hrs						
Yes	10(30%)	7(14%)	17(20%)	20.43	0.000	0.300
No	23(70%)	43(86%)	66(80%)			(0.11-0.77)
PROM						
Yes	10(30%)	6(13%)	16(19%)	16.86	0.000	0.400
No	23(70%)	44(87%)	67(81%)			(0.18-0.85)
Mode of Delivery						
NVD	18(55%)	26(52%)	44(53%)	10.66	0.001	1.87
C/S	15(45%)	24(48%)	39(47%)			(1.16-3.01)
Weight						
<2.5Kg	13(40%)	25(50%)	38(46%)	6.86	0.009	1.66
>2.5Kg	20(60%)	25(50%)	45(54%)			(1.16-2.38)
Gestational Age						
<37 Weeks	13(40%)	25(50%)	38(46%)	6.86	0.009	1.66
>37 Weeks	20(60%)	25(50%)	45(54%)			(1.16-2.38)
Apgar Score						
<7	20(61%)	19(38%)	39(47%)	29.11	0.000	0.050
>7	13(39%)	31(62%)	44(53%)			(0.00-0.33)
UTI						
YES	28(85%)	8(16%)	36(44%)	1.88	0.170	0.714
NO	5(15%)	42(84%)	47(56%)			(0.56-0.90)

Table IV Bivariate logistic regression for risk factors of Late-onset neonatal sepsis

Variables	Cases n=17 (26%)	Controls n=50 (74%)	Total n=67 (100%)	Chi Square Value	p Value	Odd Ratio and CI
Maternal Age						
<20 Years	1(6%)	10(20%)	11(17%)	0.74	0.38	1.77
>20 Years	16(94%)	40(80%)	56(83%)			(1.15-2.73)
PL>18hrs						
Yes	2(12%)	6(12%)	8(12%)	3.46	0.06	3.2
No	15(88%)	44(88%)	59(88%)			(1.43-7.34)
PROM						
Yes	2(12%)	7(14%)	9(14%)	3.23	0.07	3.00
No	15(88%)	43(86%)	58(86%)			(1.46-6.13)
Weight						
<2.5Kg	1(6%)	11(22%)	12(18%)	0.58	0.44	1.66
>2.5Kg	16(94%)	39(78%)	55(82%)			(1.09-2.33)
Gestational Age						
<37 Weeks	1(6%)	7(14%)	8(12%)	1.51	0.218	2.66
>37 Weeks	16(94%)	43(86%)	59(88%)			(1.41-5.02)
Apgar Score						
<7	4(24%)	4(8%)	8(12%)	17	0.000	3.53
>7	13(76%)	46(92%)	59(88%)			(1.55-4.98)
UTI						
YES	13(77%)	8(16%)	21(32%)	4.65	0.03	0.385
NO	4(23%)	42(84%)	46(68%)			(0.19-0.76)

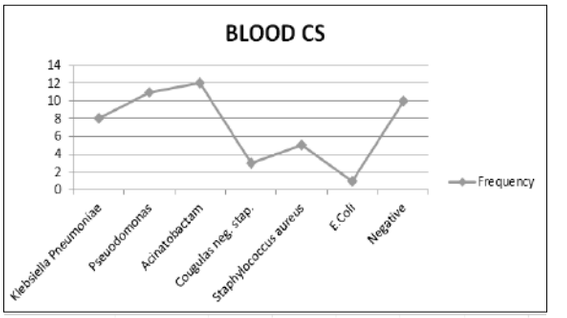

Figure 1 Graphical presentation of causative organisms of sepsis

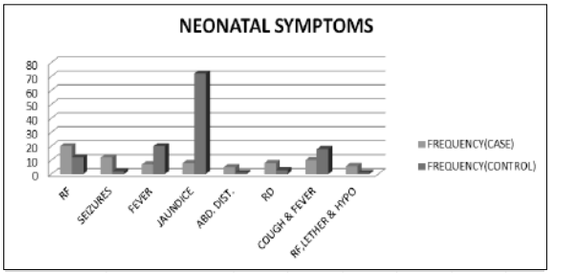

Figure 2 Bar diagram of presenting symptoms among total neonates

Discussion

Neonatal septicemia is one of the major contributors of neonatal morbidity and mortality in Bangladesh. The present study was aimed to evaluate maternal and neonatal risk factors of neonatal sepsisa,also the pattern of organism responsible for sepsis which helps to faces the challenges of neonatal mortality.

In this study the overall proportion of neonatal sepsis was 50%, among them two third of the cases (62%) had EONS and 38% were diagnosed as LONS. These findings were less comparable with the studied conducted in Dhaka, Bangladesh (35%).[10] Thesimilar findings were found in different study on neonatal sepsis in different countries like India (67%) Nepal (78%) Ethiopia (77%) and Ghana (82%).[11-14]

Maternal age was also significantly associated with neonatal sepsis, in our study showed that neonates those maternal age <20 yrs were suggestively associate to developing sepsis than the mother who aged more than 20years (p=0.05). The same results also found in the studied from Bangladesh 67% and Tanzania may be due to Bangladesh like developing countries has high number of mothers less than 20 years of age.[15,16]

The another risk factors of the study was prolonged rupture of membrane >18 hours, 1.68 times higher than control who was delivered uneventful. Similar risk factor was found in several studies.[17-18] Early and prolonged rupture of amiontic membrane is the main route of entrance of microorganisms from the birth canal into the amniotic sac.[18-19]

With regards of risk factors of sepsis in this study, cesarean section was statically significant p value <0.05, which was compatible with Peter et al. in Ghana.[20] Althoughcesarean section was not exposed to vaginal and fecal bacteria but prolong hospital stay and delay initiation of breast feeding are common.[21,22] Delay initiations of breast feeding after c/s can cause delay protect mechanism of colostrum against different pathogenic microbes and also provide immunity for the neonate.[23,24]

In agreement with present study, different meta-analysis over the world reported that lab confirmed maternal urinary tract infection significantly increases the riskof neonatal sepsis both EONS and LONS.[24] Around half of the cases (41%) were e born to mothers who had a history of UTI during the index pregnancy with significantly higher of developing sepsis compared to neonates born to mothers who did not have a UTI diagnosis (p=0.05) in this study. Other maternal risk factors, prolonged labor and meconium stained liquor were responsible for ascending infection were found to momentous risk of neonatal sepsis in different studies though these factors were not associated with increased risk of sepsis in our study.[25,26]

Among the neonatal factors, which play a serious role for developing neonatal sepsis, this study established that premature and low birth baby, Apgar score at 5th minute (p-<0.05) were bring to being association with EONS. The different studies piloted in India (1997) Saudi Arabia (1997) Bangladesh (2011) and Washington (1985) also indicated that APGAR score at 5th minute had a strong effect on risk of neonatal sepsis.[18,19] Perinatal asphyxia is believed to cause immuno-logical insult and subsequently interventions for resuscitation frequently render the newborns prone to infection. Preterm birth and low birth weight were declined asrisk factors of neonatal sepsis in numerous previous studies.[18,27,28] Conversely, some studies establishno association between neonatal sepsis and preterm birth or low birth weight.[12,29]

Regarding pattern of microorganism for neonatal sepsis, our study set-up gram-negative organisms were more commonly isolated than gram-positive organisms. Acinatobactum and pseudomonas were the major gram-negative bacteria followed by Klebsiella pneumoniae although Staphylococcus aureus was the leading gram-positive organism. A previous study in Bangladesh, regarding causative micro organisms of sepsis described the same organism as our study but another study from Bangladesh reported Klebsiella pneumoniae as the most frequently isolated organism.[18-30]

Limitations

- The study was carried out by collecting data from only one tertiary level Private Hospital Chattogram city but there are so many hospitals in this area so the data might not be representative for the whole city.Mainly the data was collected by the interview from the parents or caregivers. So, all history may not be had given accordingly.
- Financial and time constraints were also limitations for which larger samples over a wider area with adequate time was not possible.

Conclusion

Evaluation of risk factors of neonatal sepsis from this study we found maternal age < 20 years, prolong rupture of membrane > 18hrs, caesarian section and UTI crucially related with emerging neonatal sepsis. On other hand prematurity and APGAR score <7 were considered as statically significant neonatal risk factors for developing neonatal sepsis. Early onset neonatal sepsis was the more common type of sepsis in our study. Acinatobacter and pseudomonas were common responsible organisms. To reduce the burden the neonatal sepsis and also achieving our health related Sustainable Development Goal-3 we should emphasis to diminish neonatal sepsis, which is one of the big contributor of NMR. Therefore, we should encouraging the proper implementation of antenatal services which helps to identify the high risk mothers, perinatal care of newborn and immediate interventions to minimize the risk factors of adverse birth outcomes including neonatal sepsis.

Recommendation

To reduce the neonatal mortality and mortality Government already take different measures and should also take measures about antenatal and perinatal care to consider the results of this study. More efforts should be given a people living in the rural area. They should provide proper antenatal care, safe and clean delivery and proper postnatal management.

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Contribution of authors

SD-Conception, acquisition of data, data analysis, drafting & final approval.

FA-Acquisition of data, interpretation of data, drafting & final approval.

BFZ-Acquisition of data, data analysis, critical revision & final approval.

WA-Design, interpretation of data, critical revision & final approval.

Disclosure

The authors declared no competing interests.

References

1. UNICEF. Committing to Child Survival: A Promise Renewed Progress Report.New York. 2014.

2. Yamey G, Horváth H, Schmidt L, Myers J, Brindis CD. Reducing the global burden of Preterm Birth through knowledge transfer and exchange: A research agenda for engaging effectively with policymakers.Reprod Health. 2016;13(26):1–9. doi:10.1186/ s12978-016-0146-8.

3. Nighat A, Nasrul H. Disease Burden of NICU at a Tertiary Care Hospital, Karachi, Pakistan. J DOW Univ Health Sci. 2012;6(1):32–35.

4. Haslam BD. The Fetus and the Neonatal Infant: Epidemiology of Infections. 21th ed. New York: Elsevier. 2019;996.

5. https://dhsprogram.com/pubs/pdf/PR104/PR104.pdf-Bangladesh Demographic and Health Survey 2017–18.

6. Goldstein B, Giroir B, Randolph A. International pediatric sepsis consensus conference: Definitions for sepsis and organ dysfunction in pediatrics. In: Pediatric Critical Care Medicine. PediatrCrit Care Med. 2005.

7. Rohsiswatmo R. Kontroversi diagnosis sepsis neonatorum. In: Hegar B, Trihono PP, Ifran EB, editor. Update in neonatal infection. Jakarta: DepartemenIlmu Kesehatan Anak FKUIRSCM. 2005;32–43.

8. Sheikh AM, Javed T, Afzal MF, Sheikh CA. Course and complications of early onset neonatal sepsis: A descriptive study. Annals. 2010; 16(4): 307-310.

9. Schelonka RL, Chai MK, Yoder BA, Hensley D, Brockett RM, Ascher DP. Volume of blood

required to detect common neonatal pathogens. J Pediatr [Internet]. 1996;129(2):275–278. https://linkinghub.elsevier.com/retrieve/pii/S0022347696702548 https://doi.org/10. 1016/s0022-.

10. Begum S, Baki M, Kundu G, Islam I, Kumar M, Haque A. Bacteriological Profile of Neonatal Sepsis in a Tertiary Hospital in Bangladesh. J Bangladesh Coll Physicians Surg. 2012; 30(2):66–70.

11. Muley VA, Ghadage DP, Bhore AV. Bacteriological profile of neonatal septicemia in a tertiary care hospital from Western India. 2020.

12. Pokhrel B, Koirala T, Shah G, Joshi S, Baral P. Bacteriological profile and antibiotic susceptibility of neonatal sepsis in neonatal intensive care unit of a tertiary hospital in Nepal. 2021.

13. Gebremedhin D, Berhe H, Gebrekirstos K. Risk factors for neonatal sepsis in public hospitals of Mekelle City, North Ethiopia, 2015: Unmatched case control study. PLoS One. 2016; 11(5).

14. P A, A A, SM S, RA A, AK K, E A et al. Risk Factors for Neonatal Sepsis: A Retrospective Case-Control Study Among Neonates Who Were Delivered by Caesarean Section at the Trauma and Specialist Hospital, Winneba, Ghana. Biomed Res Int. 2018;2018. https://doi.org/10.1155/2018/6153501 PMID: 30662911.

15. Hasan MS, Mahmood CB. Predictive Values of Risk Factors in Neonatal Sepsis.J Bangladesh CollPhys Surg. 2011; 29: 187-195.

16. Jabiri A, Wella HL, Semiono A, Sariah A, Protas J. Prevalence and factors associated with neonatal sepsis among neonates in Temeke and Mwananyamala Hospitals in Dar es Salaam, Tanzania. Tanzan J Health Res. 2016;18(4):1–7.

17. Wardlaw T, You D, Hug L, Amouzou A, Newby H. UNICEF Report: Enormous progress in child survival but greater focus on newborns urgently needed. Vol. 11, Reproductive Health.BioMed Central Ltd. 2014; 1–4. https://doi.org/10.1186/1742-4755-11-1 PMID: 24383405.

18. Quddus AR, Islam MN, Uddin MB, Mahmud AA, Badruzzaman M, Saha SK, et al. Study of Risk Factors, Causative Organisms & Their Sensitivity Pattern in Neonatal Sepsis in a Community Based Tertiary Level Hospital. Mymensingh Med J [Internet]. 2019; 28(4):839–848. http://www.ncbi.nlm.nih.gov/pubmed/31599249 PMID: 31599249.

19. Edmond K, Zaidi A. New approaches to preventing, diagnosing and treating neonatal sepsis.PLoS Med. 2010;7(3):1–8.

20. Adatara P, Afaya A, Salia SM et al. Risk factors associated with neonatal sepsis: a case study at a Specialist Hospital in Ghana. Sci World J. 2019;2019:0–2.

21. P. Bager, J. Simonsen, S. Ethelberg, and M. Frisch. Cesarean delivery and risk of intestinal bacterial infection, e Journal of Infectious Diseases. 2010;201(6):898–902.

22. H. J. Rowe-Murray and J. R. W. Fisher. Baby Friendly Hospital practices: Cesarean section is a persistent barrier to early initiation of breastfeeding. Women and Birth. 2002;29(2)124–131.

23. World Health Organisation [WHO]. Indicators for Assessing Infant and Young Child Feeding Practices. Part 3 Country profles. Geneva. 2010.
http://www.who.int/nutrition/ publications/ infantfeeding/ 9789241599757/en/.

24. G. Mugadza, M. Zvinavashe, F. Z. Gumbo, and B. S. Pedersen. Early breastfeeding initiation and incidence of neonatal sepsis in Chipinge District Zimbabwe. International Journal of Contemporary Pediatrics. 2018; 5:1–5.

25. Chan GJ, Lee AC, Baqui AH, Tan J, Black RE. Risk of Early-Onset Neonatal Infection with Maternal Infection or Colonization: A Global Systematic Review and Meta-Analysis. PLoS Med. 2013; 10(8).

26. Adejumo by OA, Daniel OJ, Adebayo BI, Adejumo EN, Jaiyesimi EO, Akang G, et al. Predictors of Early Onset Neonatal Sepsis among Neonates in Dodoma, Tanzania: A Case Control Study. J Trop Pediatr [Internet]. 2016; 62(2):131.
http://m.tropej.oxfordjournals.org/ content/53/2/103.short
https://doi.org/10.1093/tropej/fmv089 PMID: 26705331.

27. Schrag SJ, Cutland CL, Zell ER, Kuwanda L, Buchmann EJ, Velaphi SC et al. Risk factors for neonatal sepsis and perinatal death among infants enrolled in the prevention of perinatal sepsis trial, Soweto, South Africa. Pediatr Infect Dis J. 2012; 31(8):821–826.

28. Kpikpitse, Semuatu S, Mohamed. NEONATAL SEPSIS IN RURAL GHANA: A CASE CONTROL STUDY OF RISK FACTORS IN A BIRTH COHORT 1 MATE SIAKWA [Internet]. International Journal of Research In Medical and Health Sciences. 2014;4.
http:// www.ijsk.org/ijrmhs.htmlMID: 26705331.

29. Masanja Pendo P, Kibusi Stephen M, MkhoiMkhoi L. Predictors of Early Onset Neonatal Sepsis among Neonates in Dodoma, Tanzania: A Case Control Study. J Trop Pediatr [Internet]. 2016; 62(2):131.
http://m.tropej.oxfordjournals.org/content/53/2/103.short .
https://doi.org/ 10.1093/tropej/fmv089 PMID: 26705331.

30. Bayer A, Kirby W, Sherris J, pathol MT-AJ clin, undefined. Antibiotic susceptibility testing by a standardized single disc method. 1966.