

ORIGINAL ARTICLE

Association of Admission Temperature and Outcome among Neonates with Sepsis in a Tertiary Care Hospital

Mahfuza Shirin¹, M Monir Hossain², Manifa Afrin³

Abstract

Background: Neonatal sepsis is one of the major causes of mortality in neonates. Hypothermia is also an important contributing factor of neonatal mortality. Neonates with sepsis can present with normal temperature, hypo or hyperthermia.

Objectives: This study was design to find out the pattern of temperature on admission and its association with mortality among neonates admitted with sepsis.

Methods: This cross-sectional study was conducted from September 2017 to April 2018 in the Department of Neonatal Medicine and NICU, Dhaka Shishu (Children) Hospital. Neonates up to thirty days of age, diagnosed as probable sepsis were enrolled. On admission, axillary temperature was recorded for 3 minutes and neonates were categorized according to the recorded temperature. Neonates were classified as early onset sepsis (EOS) and late onset sepsis (LOS) according to the age of onset of the sepsis. Outcome was also recorded. Statistical analysis was done by SPSS program version 25. Chi-square (χ^2) test was done to determine the association and p value, <0.05 was taken as significant.

Results: Among 493 enrolled neonates, 41.2% neonates were with early onset sepsis (EOS) and 58.8% were with late onset sepsis (LOS). Out of 493 neonates, 89(18.1%) died. Among the enrolled neonates, 54.4% had normal temperature, 16.6% had mild hypothermia, 14.6% had moderate hypothermia and 14.4% had hyperthermia. It was found that mild and moderate hypothermia were significantly more in EOS($p<0.05$). Mortality was significantly high in neonates with mild and moderate hypothermia ($p<0.05$).

Conclusion: This study found that mortality was associated with mild and moderate hypothermia in neonates admitted with sepsis.

Keywords: Neonate, sepsis, temperature.

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1. Associate Professor, Department of Neonatal Medicine & NICU, Bangladesh Institute of Child Health (BICH), Dhaka Shishu (Children) Hospital, Dhaka.
 2. Professor, Department of Neonatal Medicine & NICU, Bangladesh Institute of Child Health (BICH), Dhaka Shishu (Children) Hospital, Dhaka.
 3. Assistant Professor, Department of Paediatrics, BISH General Hospital.

Correspondence to: Dr. Mahfuza Shirin, Associate Professor, Department of Neonatal Medicine & NICU, Bangladesh Institute of Child Health (BICH), Dhaka Shishu (Children) Hospital. Cell:01819220582, E-mail: mahfuzashirin@gmail.com

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Introduction

Neonatal period is the most critical time for child survival. Globally around 2.6 million deaths occurred during neonatal period.¹ In Bangladesh, under-five and infant mortality rate have decreased significantly over the last 3 decades, but neonatal mortality (23/1000 live birth)² remains high. Sepsis is an important cause of neonatal mortality and account for approximately one-third of the global burden of neonatal deaths.³ Most of these deaths occur in the developing world.⁴

Signs and symptoms of infection in neonates are subtle and non-specific and may clinically be indistinguishable from those occurring in non-infectious conditions, including almost every sign of neonatal distress.⁵ Neonates with sepsis may be presented with either fever or hypothermia and even with normal temperature. Hypothermia is common and a major contributor of significant morbidity and mortality in developing countries.⁶⁻⁸ Febrile neonates are at risk for bacterial infection, including meningitis, bacteremia, and urinary tract infections. Schwartz et al⁹ and Marom et al¹⁰ reported that the rate of serious bacterial infections was 4 to 28% among those neonates who were presented with fever during admission. Voora et al reported on a prevalence of fever of 1% in term newborns with 10% of these febrile newborns having sepsis.¹¹ It was reported that fever is the presenting symptom of bacterial infection in term neonates whereas preterm neonates were more likely presented with hypothermia.¹²

There were studies reported the incidence and outcome of hypothermia at the time of admission among neonates with different diagnoses.^{13,14} As sepsis is one of the major causes of neonatal mortality, it is necessary to evaluate the association of temperature on admission with mortality as in many cases fever or hypothermia is an important presentation of sepsis in neonates. So, this study was designed to find out the pattern of temperature on admission and its relation with mortality among neonates with sepsis.

Materials and Methods

This cross-sectional observational study was conducted from September 2017 to April 2018 in the Department of Neonatal Medicine and NICU, Dhaka Shishu (Children) Hospital. Neonates up to thirty days of age, diagnosed as probable sepsis with any

3 or more of the following sign/symptoms:¹⁵ poor feeding, lethargy, hypo/hyperthermia, abdominal distension, bradycardia (HR<100/min), tachycardia (HR >200/min), respiratory distress, apnoea, tachypnea, cyanosis, CRT >3 sec and neonates age <72hrs having one or more maternal risk factors: foul smelling liquor, antepartum / intrapartum maternal fever, prolonged or premature rupture of membranes ≥18 hours, offensive vaginal discharge, single unclean vaginal examination(s) during labour were enrolled in this study after taking informed consent from the parents. Neonates with congenital heart diseases, congenital anomalies, hypoxic ischemic encephalopathy, respiratory distress syndromes and did not give consent were excluded from the study.

Those neonates with onset of sepsis within 72 hours of age were classified as early onset sepsis (EOS)¹⁶ and neonates with onset of sepsis at >72 hours of age were classified as late onset sepsis (LOS).

Temperature was recorded in axilla by using clinical mercury in glass thermometer. Before measuring the temperature, it was confirmed that axilla was dry, and then the thermometer was placed high up in the middle of the axilla and the arm was pressed against the side of chest to prevent air pockets between skin and thermometer. Thermometer was kept in this position for 3 minutes. The thermometer was disinfected by using chlorhexidine-soaked cotton after every axillary temperature measurement. In this study recorded temperature was classified according to WHO criteria as: Normal temperature 36.5°C to 37.5°C, hypothermia <36.5°C and hyperthermia >37.5°C. Hypothermia was subclassified into: mild (36.0°C to 36.5°C), moderate (32.0°C to 35.9°C) and severe (<32.0°C).¹⁷

Blood samples of all the patients were obtained for complete blood count (CBC), CRP and blood culture, after enrollment and collected blood samples were send to microbiology and pathology department of Dhaka Shishu (Children) Hospital.

At the time of enrollment, for each neonate, information including gender, gestational age, age, weight, birth history was recorded in a questionnaire. Recorded temperature with category, investigation reports and outcome were also recorded. All enrolled neonates received supportive care and appropriate antibiotics according to unit protocols.

Statistical analysis was done by SPSS program version 25. To determine the association between categorical variables, Chi-square (χ^2) test was done. P value, <0.05 was taken as significant.

Results

Out of 493 enrolled neonates, 70.6% were male with male to female ratio of 2.4:1, mean age of admission was 9.2 ± 6.7 days with mean admission weight was 2337.2 ± 732.04 gm. Mean gestational age was 36.4 ± 2.7 week with 42% were preterm. All the enrolled neonates were out born; 70.8% were born at hospital and 60.6% delivered by normal vaginal delivery. Early onset sepsis (EOS) was present in 203 (41.2%) cases and late onset sepsis (LOS) in 290 (58.8%) cases. Among 493 study cases, 404 (81.9%)

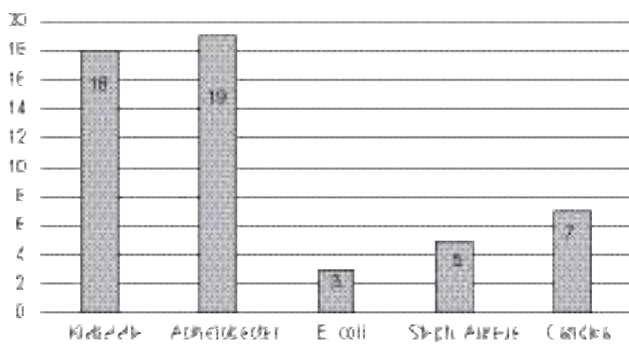


Fig 1 Isolated organisms in blood culture (N=52)

patients were discharged and 89 (18.1%) died (Table I). Among 493 neonates, 52 (10.5%) had growth of single organism in blood culture. Out of those 52 culture positive samples, highest isolated organism was gram negative bacteria, Acinetobacter (19/52) (Fig 1).

The mean axillary temperature was $36.66 \pm 0.72^\circ\text{C}$ with minimum and maximum axillary temperatures were 35.0°C and 38.9°C respectively. Among the enrolled neonates, 54.4% had normal temperature, 16.6% had mild hypothermia, 14.6% had moderate hypothermia and 14.4% had hyperthermia (Table II). Among the neonates who had normal temperature at the time of admission, 37.3% (100/268) and 62.7% (168/268) were suffering from EOS and LOS respectively. It was found that mild and moderate hypothermia were significantly associated with EOS ($p < 0.05$). Hyperthermia was relatively more in neonates suffering from LOS than EOS (69.1% vs. 30.9%), though the difference was not statistically significant ($p > 0.5$) (Table III). Mild and moderate hypothermia were associated with mortality ($p < 0.05$) (Table IV). The mortality was also related to gestational age and was significantly high in preterm neonates ($p < 0.05$) (Table V).

Table I
Baseline characteristics of enrolled neonates (N=493)

Variables	Number (%)
Age on admission (day) mean±sd (min-max)	9.2±6.7 (1-28)
Weight on admission (gm) mean±sd(min-max)	2337.2±732.04 (800-4600)
Gestational age (week) mean±sd (min-max)	36.4±2.7 (26-42)
Preterm	207 (42.0)
Term	286 (58.0)
Gender	
Male	348 (70.6)
Female	145 (29.4)
Place of delivery	
Home	144 (29.2)
Hospital	349 (70.8)
Mode of delivery	
Normal	299 (60.6)
LUCS	194 (39.4)
Diagnosis	
EOS	203 (41.2)
LOS	290 (58.8)
Outcome	
Died	89 (18.1)
Cured	404 (81.9)

Table II*Category of neonates according to recorded axillary temperature (N=493)*

Recorded temperature category (°C)	Number (%)
Normal (36.5-37.5)	268 (54.4)
Mild hypothermia (36-36.4)	82 (16.6)
Moderate hypothermia (<36-32)	72 (14.6)
Hyperthermia (>37.5)	71 (14.4)
Total	493 (100.0)
Mean±sd (min-max) °C	36.66±0.72 (35.0 - 38.9)

Table III*Association of temperature pattern with EOS and LOS (N=493)*

Temperature Category (°C)	Total	Diagnoses		p* value
		EOS n (%)	LOS n (%)	
Moderate hypothermia (<36-32)	72	39 (54.2)	33 (45.8)	0.015
Mild hypothermia (36-36.4)	82	42 (51.2)	40 (48.8)	0.031
Hyperthermia (>37.5)	71	22 (30.9)	49 (69.1)	0.080
Normal (36.5-37.5)	268	100 (37.3)	168 (62.7)	0.070
Total	493	203	290	

*Chi square test (χ^2)**Table IV***Association of mortality with admission temperature (N=493)*

Temperature category (°C)	Total	Died	Cured	p* value
Moderate hypothermia (<36-32)	72	20 (27.8)	52 (72.2)	0.017
Mild hypothermia (36-36.4)	82	22 (26.8)	60 (73.2)	0.023
Hyperthermia (>37.5)	71	7 (9.9)	64 (90.1)	0.077
Normal	268	40 (14.9)	228 (85.1)	0.063
Total	493	89	404	

*Chi square test (χ^2)**Table V***Association of mortality with gestational age (N=493)*

Gestational age	Number	Died n (%)	Survived n (%)	p* value
Preterm	207	53 (25.6)	154 (74.4)	0.000
Term	286	36 (12.6)	250 (87.4)	
Total	493	89	404	

*Chi square test (χ^2)

Discussion

This study was conducted to identify the pattern of temperature on admission among neonates with sepsis and its relation with mortality. In this study, 36.1% neonates had early onset sepsis and 63.9% neonates had late onset sepsis respectively. But Getabelew et al¹⁸ found 65% and 35% of neonates developed early onset neonatal sepsis and late onset neonatal sepsis, respectively, which was opposite to our findings. We found that the rate of isolation of single organism was about 10.5%. In a previous study reported from Bangladesh, the culture positivity rate was 36%.¹⁹ Studies from different countries shown that culture positivity rate varies from 16%-54%.²⁰⁻²²

Presentation of neonatal sepsis is usually subtle and non-specific. Hypothermia or fever is the common presentation. Hypothermia is a common problem in neonates and to identify this problem, studies were conducted in Bangladesh¹¹ and other countries.^{23,24} The prevalence of hypothermia varies widely in those studied. Factors like age, weight, gestational age, place of birth, early bathing, APGAR scores, season and ambient temperature can alter the prevalence of hypothermia in neonates.^{18,25-27} All those studies included neonates with different diagnoses. But very few studies were conducted to evaluate the relationship of hypothermia with sepsis.^{28,29} This study was among those where we found, 31.2% of the neonates had hypothermia on admission. Similarly, Ahmad et al²⁹ found 28.9% of the study patients had hypothermia on admission. We found mild and moderate hypothermia was significantly associated with EOS ($p=0.000$). Similar findings were reported by Ahmad et al.²⁹

Hypothermia is associated with increase rate of mortality in neonates suffering from various diseases. Ogunlesi et al³⁰ found that mortality rate of neonatal sepsis was 32.2%. In the present study all enrolled neonates were out born and mortality rate was 17.6%, which was much less than the finding of Ogunlesi et al³⁰ and similar to the finding of Ahmad et al.²⁹ Ahmad et al²⁹ found that neonates with hypothermia had higher mortality rate as compared to patients with normal temperature among neonates with sepsis. We also found that hypothermia was significantly associated with mortality.

Like hypothermia, neonates with sepsis might be presented with hyperthermia.²⁸ Usually neonate

with fever are at risk for bacterial infection. Approximately 10% of neonates with fever have a serious bacterial infection.¹¹ In this study 14.4% neonates had hyperthermia, which was similar to the findings reported by Ahmad et al.²⁹

Conclusion

This study concluded that mild and moderate hypothermia were associated with mortality among neonates admitted with sepsis. Early onset sepsis was associated with hypothermia.

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