

Comparison of Clinical, Hematological and Bacteriological Profile of Neonatal Sepsis between Term and Preterm Babies

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Abstract

Background: Neonatal sepsis is an important public health problem with a high morbidity and mortality. Globally, it has been reported that preterm newborns have a 13 times greater risk of death than full term newborn babies. Clinical, hematological parameters and the spectrum of organisms causing neonatal sepsis may vary between term and preterm. Present study is a good opportunity to evaluate clinical, haematological & bacteriological profile of neonatal sepsis in preterm & term.

Materials and methods: This hospital based observational and comparative study was carried out in Special Care Newborn Unit (SCANU) of Chittagong Medical College Hospital where a total of 100 clinically suspected neonatal sepsis cases was enrolled, out of which 50 were preterm and 50 term neonates. Clinical, hematological and bacteriological profiles were compared between two groups.

Results: Hypothermia was an important clinical feature occurring in 70.0% preterm and 16.0% term cases. Mean platelet count was 1.04 ± 0.73 lacs/cmm in preterm and 1.52 ± 0.78 lacs/cmm in term cases. In term and preterm neonates CRP were observed to be 39.42 ± 32.99 mg/L and 26.20 ± 22.25 mg/L ($p=0.021$). *Klebsiella* species was the predominant isolated bacteria in both groups, showing 16.0% in preterm and 14.0% in term cases, followed by *S. aureus*, *Acinetobacter* species and *Candida* species.

Conclusion: Neonatal sepsis is an important cause of morbidity and mortality. There is need of large scale studies, in hope of developing a better prevention policy in both term and preterm babies.

Key words: *Acinetobacter* species; *Candida* species; Health problem; Morbidity and mortality; Neonatal sepsis; Preterm neonates.

Introduction

Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteremia in the first month of life.¹ The most important neonatal factor

predisposing to infection is prematurity or Low Birth Weight (LBW). Reported prevalence of LBW is 22% in Bangladesh which remains one of the major public health challenges. Newborns are perhaps the most vulnerable population the world over. Preterm or babies born too early, less than 37 weeks gestation, are particularly at risk. Currently prematurity is the leading cause of death among children under 5 around the world, and a leading cause of disability and ill health later in life.²

Preterm LBW infants have a 3 to 10 fold higher incidence of infection than full term normal birth weight infants. Premature infants have documented immune dysfunction and often require prolonged intravenous access, endotracheal intubation, or other invasive procedures that provide a portal of entry or impair barrier and clearance mechanisms, putting them at continued risk for hospital acquired infections.³

Preterm neonates are more susceptible to infections due to lack of inherent defensive mechanism, both humoral and cellular defense mechanism and due to low lysozyme level and low birth weight. In addition, there is lack of resistance as well as bacteriostatic and bactericidal activity of blood serum is less vigorous than mature babies. Their white blood corpuscles phagocytize bacteria less efficiently than do those of matured infants. They have been deprived of some maternal antibodies that would normally cross placenta in last trimester. The preterm babies also does not manufacture antibody in response to injection of antigen to the same degree as does the matured infants.⁴ Mortality from neonatal sepsis in this group of infants has remained between 18-20% in the developed and around 80% in the developing world for last three decades with little sign of decline.⁵ To combat against neonatal mortality, we have to search the reasons for this lack of success in combating neonatal sepsis. As preterm LBW babies are more vulnerable to develop infections, care of these babies is a critical issue in this regards.

The uncertainty surrounding the clinical approach to treat neonatal sepsis can be minimized by periodic epidemiological survey of etiological agents

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recognition of the most frequently encountered pathogens in a particular neonatal setting. Moreover clinical features and bacteriological pattern may vary between term and preterm neonate.⁶ There is very limited data available on the problems regarding comparison of clinico-bacteriological profile between preterm and term babies having neonatal sepsis. Keeping these areas of concern in mind, this study was planned to compare the two study groups to evaluate difference in clinical and laboratory parameters if any.

Materials and methods

This hospital based observational study was carried out in Special Care Newborn Unit (SCANU) of Chittagong Medical College Hospital during the period of January-December, 2015. Ethical issue was obtained from the authority.

Inclusion criteria⁷:

Any neonate having clinical signs/symptoms of sepsis according to Integrated Management of Childhood Illness (IMCI) and World Health Organisation (WHO).

Exclusion criteria⁸:

- i) Neonates having extreme prematurity (Less than 30 weeks of gestational age)
- ii) Birth weight less than 1000 gm.
- iii) Gross congenital anomalies
4. Who did not give consent.

Blood samples were taken from 100 suspected neonatal sepsis cases, among which 50 from preterm (Group A) and 50 from term (Group B). Under all aseptic precautions, at least 3 ml of blood from each neonate was collected by an expert nurse, after taking informed written consent from the responders. 2 ml of blood for estimation of CBC and CRP, and 1 ml for blood culture were transported immediately to the laboratory for further processing.⁹

All clinical data and laboratory reports were recorded in a predesigned data sheet and analyzed by using IBM-SPSS Statistics v. 20.0 for Windows. Statistical significance was set at $p < 0.05$ and confidence interval was set at 95% level.

Results

Statistics of age among the study groups- group A (Preterm) and group B (Term). In group A mean age was 6.16 ± 6.46 days & in group B mean age was 9.50 ± 8.82 days. This difference was significant ($p = 0.033$) (Table I).

Table I : Statistics of age among the study groups

Study Group	n	Mean age (Days)	± SD (Days)	Median age (Days)	Range	Significance*	
Neonatal Age (Days)	Group A	50	6.16	6.46	3.50	1-28	p = 0.033 S
	Group B	50	9.50	8.82	5.00	1-28	
	TOTAL	100	7.83	7.87	4.00	1-28	

* Unpaired / Independent Sample t – test significance, * S = Significant ($p < 0.05$).

Distribution of neonatal clinical variables among the study groups where hypothermia was observed in 70.0% of group A & 16.0% of group B, this difference showed statistically highly significant. Other clinical parameters showed no significant difference between study groups (Table II).

Table II : Comparison of clinical variables among the study groups

Clinical Variables	STUDY GROUPS				Total		χ^2 Test Significance	
	Group A		Group B		n	%		
Cyanosis	Present	10	20.0	11	22.0	21	21.0	$\chi^2 = 0.060$ p = 0.806 ^{NS}
	Absent	40	80.0	39	78.0	79	79.0	
Jaundice	Present	11	22.0	14	28.0	25	25.0	$\chi^2 = 0.480$ p = 0.488 ^{NS}
	Absent	39	78.0	36	72.0	75	75.0	
Body Temperature	Hypothermia	35	70.0	08	16.0	43	43.0	$\chi^2 = 34.278$ p = 0.000 ^{HS}
	Fever	01	2.0	17	34.0	18	18.0	
	Normal	14	28.0	25	50.0	39	39.0	
Convulsion	Present	07	14.0	14	28.0	21	21.0	$\chi^2 = 2.954$ p = 0.086 ^{NS}
	Absent	43	86.0	36	72.0	79	79.0	
CRT	Delayed	38	76.0	36	72.0	74	74.0	$\chi^2 = 0.208$ p = 0.648 ^{NS}
	Normal	12	24.0	14	28.0	26	26.0	

*NS = Not Significant ($p > 0.05$), HS = Highly Significant ($p < 0.001$)

Comparison of laboratory parameters between two study groups. Platelet count was significantly lower in group A and value of C-Reactive Protein (CRP) was significantly increased in group B (Table III).

Table III : Statistics of laboratory investigations among the study groups

Study Group	n	Mean	± SD	Median	Range	Sign.*	
Haemoglobin (gm/dl)	Group A	50	15.12	2.65	15.00	10-20	p = 0.584 NS
	Group B	50	15.43	3.09	15.00	8-22	
	TOTAL	100	15.28	2.87	15.00	8-22	
TC WBC (Thousands /cmm)	Group A	50	9.94	3.66	10.50	3-18	p = 0.572 NS
	Group B	50	9.55	3.23	10.00	4-16	
	TOTAL	100	9.74	3.44	10.00	3-18	

Platelet Count (Lacs/cmm)	Group A	50	1.04	0.73	0.75	0.2 – 2.9	p = 0.002 HS
	Group B	50	1.52	0.78	1.55	0.2 – 4.0	
	TOTAL	100	1.28	0.79	1.32	0.2 – 4.0	
CRP (mg/L)	Group A	50	26.20	22.25	21.0	4 – 95	p = 0.021 S
	Group B	50	39.42	32.99	33.0	4 – 130	
	TOTAL	100	32.81	28.77	28.8	4 – 130	

* Unpaired / Independent Sample t – test significance, * NS = Not Significant (p > 0.05), S = Significant (p < 0.05), HS = Highly Significant (p < 0.01)

Culture positive neonatal sepsis was 30% in group A and 26.0% in group B (Table IV).

Table IV : Distribution of blood culture reports among the study groups (n = 100)

Blood Culture Report	Study Groups				Total	
	Preterm		Term		n	%
	n	%	n	%		
Growth (Positive)	15	30.0	13	26.0	28	28.0
No Growth (Negative)	35	70.0	37	74.0	72	72.0
Total	50	100.0	50	100.0	100	100.0

χ^2 value = 0.198, p = 0.656. Not Significant.

Distribution of isolates among the study groups showed *Klebsiella* spp. was predominant isolated organisms in the study groups, 16.0% and 14.0% in group A and group B respectively. *Staph. aureus* (4.0%) and *Acinetobacter* spp. (6.0%) were found in group B. *Candida* was found (4.0%) in group A (Table V).

Table V : Distribution of isolates among the study groups

Blood Culture Report	Study Groups				Total	
	Preterm		Term		n	%
	n	%	n	%		
<i>Klebsiella</i> spp.	08	16.0	07	14.0	15	15.0
<i>Pseudomonas</i> spp.	02	4.0	00	0.0	02	2.0
<i>E. coli</i>	02	4.0	01	2.0	03	3.0
<i>S. aureus</i>	00	0.0	02	4.0	02	2.0
<i>Acinetobacter</i> spp.	01	2.0	03	6.0	04	4.0
<i>Candida</i> spp.	02	4.0	00	0.0	02	2.0
No Growth	35	70.0	37	74.0	72	72.0
Total	50	100.0	50	100.0	100	100.0

Discussion

Neonatal sepsis is one of the major health problems in developing countries including Bangladesh. Early diagnosis of neonatal sepsis is primarily based on clinical evaluation but it requires clinico-pathological & microbiological correlation.¹⁰ The present study was conducted to make a comparative evaluation among preterm (Group A) and term (Group B) neonates having sepsis in terms of clinical, hematological and bacteriological profile.

Mean age of presentation of neonatal sepsis in group A was found 6.18 days and in group B 9.5 days. The difference between the groups was statistically significant (p=0.033). This may be due to the fact that preterm LBW babies are referred earlier than term babies.

In this study, by observing different clinical variables between the two study groups we found that hypothermia present in 70% of group A and 16% of group B, fever present in 2% of group A and 34% in group B. These differences were statistically highly significant (p=0.000). In a study assessing indicators of early outcome in neonatal sepsis done in Pakistan showed that hypothermia effected 39% of the cases.¹¹ The hypothermia in neonatal age has not only found to be associated with high neonatal mortality but also been associated with poor psychomotor development on long term follow up of survivors of neonatal sepsis.¹² Cyanosis was observed in 20% cases of group A and 22% cases of group B, Jaundice in 22% cases of group A and 28% cases of group B. Convulsion was observed in 14% cases of group A and 28% cases of group B. Delayed CRT was seen in 76.0% of group A and 72% cases of group B.

In this study, mean of hemoglobin (Hb%) was observed as 15.12 gm/dl in group A and 15.43 gm/dl in group B. The difference was not significant. Mean Total Count (TC) of WBC was 9.94 thousand/cmm in group A and 9.55 thousand/cmm in group B. These findings were comparable with the findings of Tasneem, where mean Hb% was 14.3gm/dl and mean TC of WBC was 10.37 thousand/cmm.¹³ Mean platelet count showed 1.04 lac/cmm in group A and 1.52 lac/cmm in group B. This difference was statistically significant (p=0.013). Waseem et al also found, thrombocytopenia in neonatal sepsis.¹¹ Thrombocytopenia was frequently associated with sepsis and indicated poor prognosis. This is thought to be due to increased platelet destruction, sequestration secondary to infections, failure in platelet production due to reduced megakaryocytes or damaging effects of endotoxin.¹⁴ Mean value of CRP was 26.20 mg/L in case of group A, range of which was 4-95mg/L. In group B CRP mean was 39.42 mg/L with ranging from 4-130mg/L. This difference was statistically significant (p=0.021). This may be due to the fact that preterm infants have

lower CRP baseline values and a lower rise in response to infection. Synthesis of CRP occurs in liver in response to inflammatory cytokines and may increase more than thousand fold during an acute phase response. It significantly reflects the individual balance between the microbes and the immune system of neonate.^{15,16}

Incidence of blood culture positivity was 30% in group A and 26% in group B. This result goes in agreement with study of Ahmed et al., where blood culture positivity rate was equivalence for preterm (31%) and term (38%).¹⁷

Klebsiella spp. was predominant isolated organisms in the study groups, 16.0% and 14.0% in group A and group B respectively. *Staph. aureus* (4.0%) was found in group B but not in group A whereas *Candida* & *Pseudomonas* spp. were found (4.0%) each, in only group A, not in group B. *Acinetobacter* spp. was found in both groups in frequency of 2.0% and 6.0% in group A and B, respectively. In group A 2.0% *E. coli* was found and 4.0% in group B. Similar to present study, Tasneem also found, *Klebsiella* spp. (24.4%) as predominant isolates followed by *Salmonella*, *Serratia*, *Acinetobacter* spp. and *E. coli*.¹³ Barua et al also found *Klebsiella* spp. 54.17% followed by *Pseudomonas* spp. (16.67%), *Acinetobacter* spp. (14.58%), *S. aureus* & *E. coli*.¹⁸ Begum et al found similar finding with *Klebsiella* spp predominance in their study.¹⁹ Although the present work aimed to compare bacteriological profile between two groups, pattern of isolated organism was almost similar regardless of birth weight, gestational age and age of presentation. Ahmed et al also narrated similar type of findings. However, growth of *Candida* was found entirely in group A and *S. aureus* was found in group B. Ahamed et al showed similar finding¹⁷.

Limitations

The study population was selected from one selected hospital in Chattogram. The result of the study may not reflect the exact picture of the country. The study was conducted at a very short period of time and moreover small sample size was also a limitation of the study.

Conclusion

Comparing clinical and laboratory parameters of neonatal sepsis between preterm and term babies has been showed that hypothermia was highly significant clinical feature affecting preterm low

birth weight babies. Significant decrease on platelet count was observed in preterm babies and CRP was significantly elevated in term neonate with sepsis. In both groups percentage of blood culture sensitivity was observed almost same. *Klebsiella* species were the predominant isolates among the both study groups.

Recommendation

Multicenter large scale study is recommended.

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Contributors of authors

SSHM: Conception, initial design, acquisition of data, interpretation of data, manuscript writing and final approval.

AHMSKC: Acquisition of data, data analysis, critical revision of the version and final approval.

Disclosure

Both the authors declared no competing interest.

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