Original Article

Incidence, Risk Factors and Outcome of Septicemia in Preterm Very Low Birth Weight Neonates in a Tertiary Care Hospital

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ABSTRACT:

Small preterm babies have greater risk of developing illness in the neonatal period than the mature well-grown babies because of immaturity of structures and functions of various organs. The present study was an exploratory prospective cohort study to find out the incidence, the risk factors and outcome of septicemia in preterm VLBW neonates. The incidence of septicemia among the preterm VLBW neonates was found 62% (57/92). Male sex, delayed admission (>24 hours) in hospital, gestational age (<29.3 weeks), birth weight (<1265grams), rural residence and obstetrical problems (APH, PROM) were found to be associated with increased risk of developing septicemia in preterm VLBW neonates but income status, maternal illness (HTN, DM, Fever), mode of delivery (NVD, CS) and place of delivery (Home, Hospital) were not associated with increased risk. The mean duration of hospital stay of the septic preterm VLBW neonates were 13.57± 5.39days but non septic cases it was 10.88±4.02 days. Sixty (65.3%) preterm VLBW neonates were improved and discharged with advice from hospital, 3(3.3%) took DORB and unfortunately 29(32.4%) expired.

Key words: *VLBW, Incidence, Risk factor, Outcome.*

(The Planet 2020; 4(2): 35-45)

INTRODUCTION

Preterm infants with 'very low' birth weight are those who weigh 1500 gm or less; account for only 1.5%[1]. The incidence of low birth weight (LBW) is about 22% in Bangladesh[2]. But no such data is available about the incidence of VLBW. The under five mortality rate is 65, the infant mortality rate is 52 and the neonatal mortality rate is 37 per thousand live births in Bangladesh[3]. About 60% of the infant deaths occur in the neonatal period in rural Bangladesh. Death of VLBW neonates is 30 times more common than the deaths of newborn of normal weight[4].

The preterm VLBW babies are vulnerable to develop septicemia, necrotizing enterocolitis

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(NEC), respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH). Among them sepsis is the most common morbidity encountered with VLBW neonates in developing countries than the developed countries[5].

Maternal antenatal profiles represent the high risk factors for various complications like sepsis[5]. Among these factors maternal pyrexia, prolonged rupture of membrane (PROM), ante partum hemorrhage (APH), poor socio economic condition, illiteracy contribute the major role. Neonates with early-onset sepsis have significantly longer mean duration of rupture of membranes than those with late-onset sepsis and babies with late-onset sepsis have significantly lower mean hemoglobin (Hb) level than those with early-onset sepsis[6].

METHODS AND MATERIALS:

The study was conducted at especial care baby unit in Dhaka Shishu (Children) Hospital, which is the largest pediatrics' teaching hospital in Bangladesh. It was a prospective cohort study over a period of six months. All the data were collected in written data sheet. The collected data were analyzed thoroughly by SPSS program. In addition to descriptive statistics such as frequency tabulation, mean, standard deviation; statistical tests such as Chi-square test for categorical variables, Student's `t' test for continuous variables and relative risk (RR) at 95% CI were applied to determine statistical significance.

Inclusion Criteria:

- Birth weight <1500 gm.
- Gestational age <35weeks.
- Age range 0-7 days.
- Neonates of both sexes.

Exclusion criteria:

- Birth weight >1500 gm.
- Gestational age >35weeks.

Study Procedure:

For each baby, fulfilling the above inclusion and exclusion criteria, detailed history was recorded in a data sheet from the mother or the attendants. Maternal information was included antenatal care (2 or more antenatal checkup will consider as a positive antenatal care), parity, maternal age, education, employment, socioeconomic status, previous obstetrical problems, maternal illness {Hypertension (HTN), APH, Diabetes mellitus (DM), Jaundice, Fever, Rash}, and medication during pregnancy and obstetrical problems. Information about the place of delivery (home or hospital), mode of delivery (normal or caesarian section), delivery conducted by doctor or others, duration of membrane rupture, condition of the baby at birth (multiple or singleton, H/O delayed cry, resuscitation needed or not) were also recorded.

All the neonates were treated by the concerned consultant with their own protocol. The investigator observed and recorded the patient as septicemia having any two signs and symptoms of suspected septicemia {lethargy, fever, hypothermia, recurrent apnea, bradycardia, abdominal distention, bleeding (per rectal or gastric

aspirate)} **plus** any two laboratory findings {positive blood culture, leukocytosis (total leukocyte count >20000/cu mm of blood), leukopenia (total leukocyte count <5000/cu mm of blood), thrombocytopenia (platelet count <100000/cu mm of blood), positive C-reacting protein (CRP) (>10mg/L)}.

RESULTS:

Total 738 neonates were admitted into the special care baby unit at Dhaka Shishu (Children) Hospital during the study period. Among the admitted neonates, 92 fulfilled the inclusion criteria of preterm VLBW neonates. All the babies were out born and referred from all over the country.

Table I Baseline characteristics of the VLBW neonates (n=92)

Characteristics	**Frequency**
Age (in hours); N(%)	
<24 hours	60(65%)
24 hours to 7days	32(35%)
Sex; N(%)	
Male	52(56.5%)
Female	40(43.5%)
Gestational age (wks) mean±SD (range)	30.76±2.39(27-34)
Birth weight (gm) mean±SD (range)	1320.76±133.74(1030-1500)
Residence N (%)	
Urban	58(63)
Rural	34(37)
Mother's education N (%)	
Below SSC	67(72.8)
Above SSC	25(27.2)
Socioeconomic status N (%)	
Low (<5000TK)	43(46.7)
Middle (5000-15000TK)	45(48.4)
Higher (>15000TK)	4(4.3)
Parity N (%)	
Prime	56(60.9)
Multi	36(39.1)
Antenatal care N (%)	
Regular	42(45.7)
Irregular	41(44.6)
Not at all	9(9.8)
Maternal illness N (%)	
Yes (HTN, DM, Fever, Rash, Jaundice)	26(28.3)

None	66(71.7)
Obstetrical problems N (%)	
Yes (APH, PROM)	40(43.5)
None	52(56.5)
Mode of delivery N (%)	
Normal	63(68.5)
Caesarean section	29(31.5)
Place of delivery N (%)	
Home	18(19.6)
Hospital	74(80.4)

Table II Clinical features of septicemia of VLBW neonates (n=57)

Clinical features	Frequency	Percentage
Lethargy	55	96.5
Fever	18	31.6
Hypothermia	36	63.2
Recurrent apnoea	13	22.8
Bradycardia (HR<100/min)	27	47.4
Abdominal distension	36	63.2
Vomiting	13	22.8
Bleeding manifestation	13	22.8
Blood culture (positive)	17	29.8
Leukocytosis (TLC>20000)	5	8.8
Leukocytopenia (TLC<5000)	30	52.6
Thrombocytopenia (Plt<100000)	46	80.7
CRP (positive >10mg/L)	49	86.0

(Total number of VLBW neonates developed septicemia at hospital)

Incidence of septicemia = × 1000.

(Total number of VLBW neonates admitted into especial care baby unit during the study period)

Incidence of septicemia = (57/92) × 1000 = 619/1000 or 61.9%.

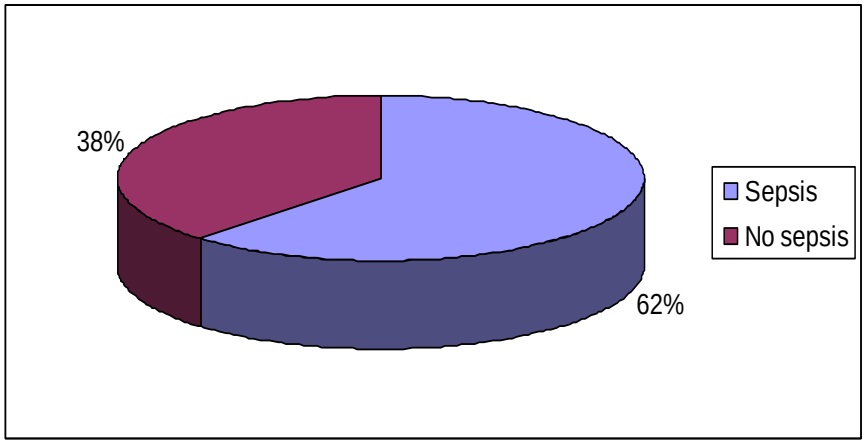

Fig. 1: Distribution of septicemia of the VLBW neonates (n=92)

Total 92 very low birth weight neonate were divided into two groups, those who eveloped septicemia and those who did not developed septicemia.

Table III Relation between age on admission and septicemia (n=92)

Age on admission	Sepsis	No sepsis	Total	RR (95%CI)	P value
<24 hours	31	29	60	0.64 (0.47-0.85)	0.004
>24 hours to 7days	26	6	32		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 7.749, P=0.004].

Table IV Relation between sex and septicemia (n=92)

Sex	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
Male	37	15	52	1.42 (1.00-2.03)	0.03
Female	20	20	40		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 4.292, P=0.032].

Table V Relation between gestational age and septicemia (n=92)

Septicemia	N	Gestational age (in weeks)		P value
		Mean	Std. Deviation	
Sepsis	57	29.30	1.647	.025
No sepsis	35	33.14	1.216	

Table VI Relation between Birth weight and septicemia (n=92)

Septicemia	N	Birth weight (in grams)		P value
		Mean	Std. Deviation	
Sepsis	57	1265.61	127.079	.004
No sepsis	35	1410.57	88.864	

Table VII Relation between residence and septicemia (n=92)

Residence	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
Urban	29	29	58	0.61 (0.45-0.82)	0.002
Rural	28	6	34		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 9.519, P=0.002]

Table VIII Relation between socio economic status and septicemia (n=92)

Socio economic status	Septicemia		Total	RR (95% CI)	P value
	Sepsis	No sepsis			
Low (<5000TK)	25	18	43	3.42 (0.913-2.57)	0.170
Middle class (5000-15000TK)	31	14	45		
Higher class (>15000TK)	1	3	4		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 3.501, P=0.174].

Table IX Relation between maternal illness and septicemia (n=92)

Maternal illness	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
Yes	17	9	26	1.00 (0.77-1.52)	0.670
No	40	26	66		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 0.181, P=0.429].

Table X Relation between obstetrical problems and septicemia (n=92)

Obstetrical problem	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
APH/PROM	31	9	40	1.55 (1.13-2.13)	0.007
Others	26	26	52		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 7.254, P=0.006].

Table XI Relation between mode of delivery and septicemia (n=92)

Mode of delivery	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
NVD	37	26	63	0.85 (0.62-1.17)	0.347
Caesarean section	20	9	9		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 0.883, P=0.241]

Table XII Relation between place of delivery and septicemia (n=92)

Place of delivery	Septicemia		Total	RR (95%CI)	P value
	Sepsis	No sepsis			
Home	11	7	18	0.98 (0.65-1.48)	0.934
Hospital	46	28	74		
Total	57	35	92		

[$\chi 2_{(df=1)}$ = 0.007, P=0.569].

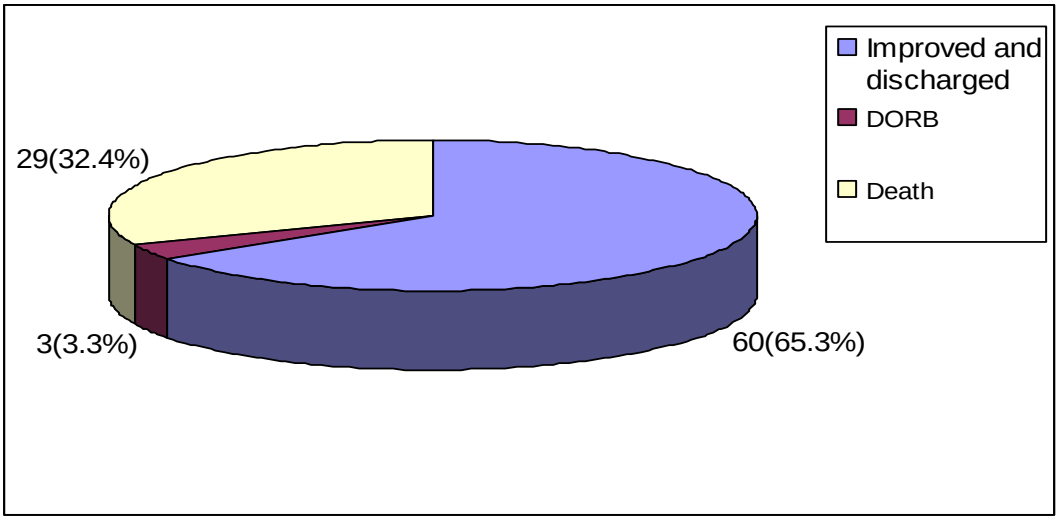

Fig. 2: Outcome of VLBW neonates (n=92)

DISCUSSION:

The present study was an exploratory prospective cohort study to find out the incidence, the risk factors and outcome of septicemia in preterm VLBW neonates. It was not possible to determine the exact incidence of very low birth weight neonates in Bangladesh with this study. In order to do that, cases of very low birth weight neonates occurring in defined geographic region as well as the total birth of that region has to be ascertained. This study had been carried out in the especial care baby unit at DSH. So the data revealed the incidence of septicemia of very low birth weight babies at DSH. Patients usually come to DSH for treatment from all over the country, so it can be assumed that the disease profile of this hospital might reflect the preterm VLBW neonates in Bangladesh.

Small preterm babies have greater risk of developing illness in the neonatal period than the mature well-grown babies because of immaturity of structures and functions of various organs[7]. A total 92 patients were studied during the study period. Sixty (65%) were admitted within 24 hours and 32(35%) admitted after 24 hours to 7 days. The rate of development of septicemia was high when admission was delayed and it was statistically significant ($p<0.005$). This finding is consistent with another study which suggests that in utero transport of VLBW neonates reduces the risk of development complication like septicemia[8]. Among the 52 male neonates 37 developed septicemia and among the 40 female neonates 20 developed septicemia. So male VLBW neonates had higher rate of development of septicemia than that of female VLBW neonates and it was statistically significant ($p<0.05$). This is probably due to associated concomitant genetically determined x-linked immunodeficiency conditions[9]. The babies from middle class socio economic status constituted the major part 45(48.4%), followed by lower class 43(46.7%) and higher class 4(4.3%) which is consistent with other authors[10]. This may be due to the requirement of ICU care for VLBW neonates, which is not affordable for the lower and middle class socio economic income group to admit at private level expensive hospitals. The maternal antenatal care is still much lower. Ten percent mother did not have a single antenatal care at all. In spite of having Government and non government level primary care facilities, the scarcity of antenatal care is probably due to lack of awareness. It is related to the educational status of the mother. In this series 67(72.8%) mother's educational status is below secondary school certificate (SSC) level. Only 26(28.3%) mothers in this study had some form of illness during pregnancy period and 66(71.7%) mother had no problem. So the cause of prematurity and early labor remains obscured. This finding is also consisted with another study which states that preterm birth is one of the major unresolved problems in modern obstetrics[11].

In this study, though eighty percent delivery occurred at hospital but 69% by normal vaginal delivery. This figure is reverse to the national statistics[3]. The low rate of hospital delivery in the national figure is due to

inclusion of total delivery, not the delivery of only VLBW neonates only. Septicemia occurred in 57(62%) cases of VLBW neonates at hospital in this series and it was much higher than other studies. Banu et al found septicemia in 16.4% cases of preterm VLBW infants[12]. Nagar et al in their study of `Small for gestational age babies' found the incidence of neonatal infection is about 26.2%[13]. Stoll BJ et al in their large multi center cohort study of VLBW neonates found that the incidence of culture positive early onset neonatal sepsis was 1.9% though 50% of the cohort had clinical sepsis and 25% had culture positive late onset neonatal sepsis[14].

Gestational age was another risk factor found in this study in the development of neonatal sepsis in VLBW neonates. The rate of infection was inversely related to gestational age and birth weight. The mean gestational age of VLBW neonates who developed septicemia in this study was 29.30±1.647 weeks and the gestational age of VLBW neonates who did not develop septicemia was 33.14±1.216 weeks and this difference was statistically significant ($p<0.05$). The mean birth weight of VLBW neonates who developed septicemia was 1265.61±127.079 grams and those who did not develop septicemia was 1410.57±88.864 grams and this difference was also statistically significant ($p<0.005$).

Residence, educational status of the mother, socio-economical status, parity, antenatal care, maternal illness, mode of delivery and place of delivery were not found to be associated with increased risk of development of septicemia. But obstetrical problems like APH and PROM were found to be associated with increased risk of development of septicemia and it was found clinically significant ($p<0.05$). Salem SY et al found that the use of tocholytics and low gestational age is risk factors of early onset neonatal sepsis[15]. Trotman H et al also found that PROM is highly associated with early-onset neonatal sepsis and low level of hemoglobin in VLBW neonates are associated with late-onset neonatal sepsis[6].

The mean duration hospital stay in neonates with septicemia was 13.57±5.39 days and the mean duration of hospital stay in neonates who did not develop septicemia was 10.88±4.02 days. This indicates that septicemia increases duration of hospital stay; increase workload and morbidity of the VLBW neonates. Stoll BJ et al also stated that early onset neonatal sepsis was uncommon problem but death rate was high (26%) and late onset sepsis of VLBW neonates was a frequent problem and advocated successful strategy to control it to reduce morbidity and mortality[14].

Limitations of the study:

1. This is a hospital-based study.
2. This study had limited time span.
3. It was done in only one center.

CONCLUSION:

In this study the incidence of septicemia was found 619/1000 (62%). Septicemia was inversely related with birth weight and gestational age in VLBW babies and it was clinically significant. Septicemia was found to

have male preponderance in VLBW babies. Significantly higher number of septicemia was also found in the neonates coming to the hospital from rural area and admitting after 24 hours. Obstetrical problems (PROM and APH) increased the risk of septicemia. But no association was found between septicemia and maternal illness, place of delivery or mode of delivery. The death of septic VLBW neonates were also very high.

REFERENCE:

1. Eric C, Eichenwald MD, Ann R, Stark MD. Management and outcomes of very low birth weight. *The New England Journal of Medicine* 2008;358(16):1700-11.
2. UNICEF. *The State of The World's Children* 2008. UNICEF, New York; December 2007. p118.
3. Mitra and Associates. National Institute of Population Research and Training (NIPORT), Dhaka, Bangladesh. *Bangladesh Demographic And Health Survey 2007,* PRELIMINARY REPORT. MEASURE DHS, Macro International Inc. Calverton, Maryland, USA; December 2007.p.25.
4. Kabir ARML, Kawsar CA, Sahidullah M, Hassan MQ, Talukder MQK. Situation analysis of child health in Bangladesh, 1994. *Bangladesh J Child Health* 1995;19(2):53-60.
5. Poundle P, Budhathoki S, Srivastava MK. Maternal risk factors and morbidity pattern of very low birth weight infants: A NICU based study at eastern Nepal. *J Nepal Pediatr Soc* 2008;29(2):59-66.
6. Trotman H, Bell Y. Neonatal sepsis in very low birth weight infants at the University hospital of the West Indies. *West Indian Med J* 2006;55(3):165.
7. Kate F. Transitional care and the convalescing NICU graduate, in *Roberton's Textbook of Neonatology*. 4th ed. China: Elsevier Churchill Livingstone; 2005. p. 385.
8. Lee SK, Zupancic JAE, Pendray M et al. Transport risk index of physiologic stability: A practical system for assessing infant transport care. *J Pediatr* 2001;139:220-26.
9. Gomella TL, Cunningham MD, Eyal FG, Zenk KE. *Neonatology: Management, Procedures, On- Call Problems, Diseases, and Drugs*. 5th edn. New York: McGraw Hill; 2004. p.77-101.
10. Islam MN, Khanom S, Kawsar CA. Maternal and socioeconomic risk factors associated with low birth weight. *Bangladesh J of Child Health* 1995;19(4):112-116.
11. Ciaravino O, Vigliocco G, Gramajo JH, Sola A. Adolescence, not lack of prenatal care, impacts the incidence and outcome of very low birth weight (VLBW) infants in a developing area. 2. *Pediatric Research* April 1997; 41(4, Part 2):3.
12. Banu K, Rahaman S. Disease pattern in neonatal period. *Bangladesh J Child Health* 1982;6(3/4):129-134.
13. Nagar A, Chowdhury MK, Kumar P. Small for gestational age babies: Indian scene. *Indian J Padiatr* 1997;64:221-24.
14. Stoll BJ, Gordon T, Korones SB, Shankeran S, Tyson JE, Bauer CR et al. Early onset and late onset neonatal sepsis in VLBW neonates: a report from the National Institute of Child Health and Human

Development Neonatal Research Network. *J Pediatr* 1996;129(1):63-80.
15. Salem SY, Shierner E, Zmora E, Vardi H. Risk factors for early neonatal sepsis. *Archives of Gynecology and Obstetrics* 2006;274(4):198-202.