# **Original Research Article**

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# Morbidity and mortality pattern of very low birth weight infants admitted in SNCU in a South Asian tertiary care centre

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#### **ABSTRACT**

**Background:** Around 4-8% of all live births are very low birth weight (VLBW) infants. In India currently 8 million VLBW infants are born each year which constitutes 40% of global burden the highest for any country. The present study was done to determine frequency of disease, complications, survival rate and risk factors for morbidity and mortality in VLBW babies.

**Methods:** Between October 2016 and September 2017, we did a cross-sectional retrospective study at level three SNCU with >98% inborn admissions and about more than 10000 deliveries per year. The American Academy of Pediatrics protocol for neonatal resuscitation was followed for the management of VLBW. Data were entered in predetermined proforma and statistical analysis was done.

**Results:** There were 154 registered cases of VLBW [75 females (48.7%) and 79 males (51.3%)]. The mean birth weight=1.198 (SD=0.211). The mean gestational age in weeks was 31.9 (SD=3.095). Majority of them were in the gestational age 33-36 weeks (n=68, 44.2%), small for gestational age (n=89, 57.8), delivered through normal vaginal delivery (n=95, 61.7%), singletons (n=126, 81.8%), inborn (n=152, 98.7%), maternal age between 21-30 (n=95, 61.6%), clear amniotic fluid (n=137, 89%), on antenatal steroids (n=59, 38.3%), maternal disease were present in 55 mothers (33%) and gestational hypertension being more common (n=14, 9.6%). Majority of babies had Respiratory Distress Syndrome (n=56, 33.6%), birth asphyxia (n=54 32.4%) and sepsis (n=46, 27.6%). Mortality of 40.3% (n=62) observed in present study. Forty three babies with RDS, twenty babies with asphyxia and eight babies with sepsis expired.

**Conclusions:** Multiple regression analysis with adjusted estimates of odds ratio showed that very low birth weight, low Apgar score at 5 minute, intubation and mechanical ventilation were predictors of outcome of VLBW babies. Birth weight and mechanical ventilation were significant predictors of the outcome of ELBW babies.

**Keywords:** Infant, Low birth weight, NICU, Neonatal mortality, Risk factors, Very low birth weight

#### INTRODUCTION

Very low birth weight is the condition where the weight of the new born is less than 1500g as against the normal weight at term delivery between 2500g and 4200g. Around 4-8% of all live births are very low birth weight (VLBW) infants. Around one-third of the neonatal deaths are witnessed in this group. Increased life

expectancy can be attributed to the improvement in the quality of care given to the premature neonates and the innovation in medical technology but this has not had much effect in the incidence of the complications in the neonates especially for those that weigh less than 1000g at birth (called as ELBW infants).<sup>3</sup> These figures vary between 73% in the developing and 90% in developed countries depending on the quality of care given to the

neonates.<sup>4</sup> The care given to the neonates in the prenatal and perinatal period acts as a major determinant in the outcome of very low birth weight (VLBW) infant.

Very low birth weight (VLBW) is one of the most serious challenges in Maternal and Child Health in developing countries. The lower the birth weight the lower is the chances of survival. WHO estimates that globally about 25 million LBW babies were born at each year, consisting 17 % of all live births, nearly 95% of them in developing countries.<sup>5</sup> In India currently 8 million VLBW infants are born each year which constitutes 40% of global burden the highest for any country. In India according to National Family Health Survey (2010), prevalence of low birth weight babies is 21.5%.<sup>6</sup>

Prematurity and low birth weight are major factors for neonatal mortality especially VLBW and many of the previous studies considered birth weight even less than 2Kg, hence this study was done to identify the factors contributing to increased morbidity and mortality in VLBW (<1.5Kg) babies in the study setup, so that necessary steps can be taken to reduce NMR in this VLBW group and ultimately reach target NMR. There are not many studies in the current South Asian scenario.

#### **METHODS**

The present study aims to determine frequency of disease, complications, survival rate and risk factors for morbidity and mortality in VLBW admitted to SNCU in the tertiary care hospital.

## Inclusion criteria

We did a cross-sectional retrospective study at teaching hospital in Chennai with level three SNCU with >98% inborn admissions and about more than 10000 deliveries per year, between October 2016 and September 2017. All VLBW (<1.5Kg) neonates admitted in the SNCU during study period were enrolled in the study.

# Exclusion criteria

Neonates weighing less than 500gms and neonates with multiple congenital anomalies incompatible with life were excluded from the study.

After obtaining the approval of the institutional ethics committee, all relevant prenatal, perinatal and baby details after admission in SNCU were collected from the maternal and neonatal case sheets.

The American Academy of Paediatrics protocol for neonatal resuscitation was followed for the management of VLBW. Regarding diagnosis of birth asphyxia, neonates presented with low Apgar scores (≤3 beyond five minute) with a history of fetal and/or neonatal distress and laboratory evidence of asphyxia was considered. Later severity of neonatal encephalopathy

was assessed with Sarnat and Sarnat staging of hypoxic ischemic encephalopathy. For meconium aspiration syndrome (MAS) diagnosis neonates delivered with meconium stained liquor either presenting with respiratory distress within one hour of life or chest roentgenogram showing features of aspiration pneumonitis were considered.

An apneic spell is defined as when absent airflow is prolonged  $\geq \! 20$  seconds or accompanied by bradycardia or hypoxemia detected clinically (cyanosis) or by oxygen saturation monitoring. The babies with apneic spells were managed using the standard protocol of management of apnea of prematurity with a loading dose of 20 mg/kg of caffeine citrate (10 mg/kg of caffeine base) orally or intravenously over 30 minutes, followed by a maintenance dose of 5 to 10 mg / kg in one daily dose beginning 24 hrs after loading dose.

The respiratory distress syndrome was defined by chest x-ray and one of the following;

- Failure to maintain sp02 above 87% with FiO2 40%
- Silverman-Anderson score of ≥4/10 with FiO2 40%
- Recurrent apnea warranting intubation

Based on above reference criteria RDS diagnosed and further treated with any of the following interventions either alone or in combinations of NCPAP, Surfactant (survanta - 4ml/kg) by INSURE technique in four divided aliquots and mechanical ventilation.

In cases of suspected sepsis, symptomatic cases were hospitalised and started on antibiotics. Blood culture was done before the medications were started. If the baby was asymptomatic, risk factors were assessed. If it was a preterm baby, then the baby was treated like the symptomatic case. If it was a term baby, then it was screened for sepsis. If positive, treated like the symptomatic case and if negative, it was observed, and the entire process was repeated after 48 hours.

Transient tachypnea of the newborn (TTN) is characterised by mild respiratory distress with retractions and cyanosis usually alleviated by supplemental oxygen (<FiO2 40%). Though it was due to delay in accommodation of lung during transition, diagnosis was made by exclusion of all other possible causes.

For retinopathy of prematurity, as per the current recommendations we screened all infants with birth weight <1,500g or gestational age <34 weeks. Infants who were born after 34 weeks' of gestational age were considered for screening if they had been ill (e.g., those who have had severe respiratory distress syndrome, hypotension requiring inotrophe support).

Out of these 154 babies, 14 babies underwent laser treatment for ROP involving zone 1 and 2. Necrotizing enterocolitis (NEC) was defined according to the

modified criteria of Bell et al and intraventricular hemorrhage (IVH) were graded by Papile's classification.<sup>8,9</sup>

Appropriate medications were given. All complications during the course of hospitalization were recorded.

#### Statistical analysis

Data were entered in predetermined proforma and statistical analysis was done using IBM SPSS version 22. Multiple regression analysis with adjusted estimates of odds ratio were done with 95% confidence interval. The significance of p value was considered to be < 0.05 for this study.

#### **RESULTS**

The cross-sectional retrospective study done at teaching hospital in Chennai with level three SNCU with >98% inborn admissions saw 10984 deliveries of which there were 6678 term babies and 4306 preterm babies. There were 154 registered cases of VLBW. There were 75 females (48.7%) and 79 males (51.3%). The mean birth weight was 1.198 with S.D of 0.211. The mean gestational age in weeks was 31.9 with S.D of 3.095. Majority of them were in the gestational age 33-36 weeks (n=68, 44.2%), small for gestational age (n=89, 57.8), singletons (n=126, 81.8%), inborn (n=152, 98.7%) Table 1 depicts the findings from the study.

Table 1: Characteristic features of the study.

Characteristic		No. (%)
Gender	Female	75 (48.7)
	Male	79 (51.3)
Birth weight(mean±SD)		1.198±0.211
Birth weight	≤750	5 (3.2)
	751-1000	27 (17.5)
	1001- 1250	56 (36.4)
	1251-1500	66 (42.9)
Gestational age (We	eks; mean±SD)	31.9±3.095
	≤28	29 (18.8)
	29-32	48 (31.2)
	33-36	68 (44.2)
	≥ 37	9 (5.8)
Birth weight	AGA	57 (37.0)
	LGA	8 (5.2)
	SGA	89 (57.8)
Plurality	Singleton	126 (81.8)
	Twin	28 (18.2)
Place of birth	Inborn	152 (98.7)
	Outborn	2 (1.2)

Table 2 and 3 shows neonates delivered through normal vaginal delivery (n=95, 61.7%), maternal age between 21 and 30 (n=95, 61.6%), clear amniotic fluid (n=137, 89%), on antenatal steroids (n=59, 38.3%), all of them on Dexamethasone, maternal disease were present in 55

mothers (33%) and gestational hypertension being more common (n=14, 9.6%).

Table 2: Maternal details.

Maternal details				
Maternal age (years)				
<18	2 (1.3)			
18-21	42 (27.3)			
21-30	95 (61.6)			
>30	13 (8.4)			
Maternal diseases (n=55, 33%)				
Preeclampsia	8 (5.1)			
Anemia	6 (3.9)			
Eclampsia	4 (2.6)			
Gestational diabetes mellitus	1 (0.6)			
Gestational hypertension	14 (9.6)			
Hypothyroid	8 (4.8)			
Hyperthyroid	2 (1.2)			
Oligohydramnios	10 (6.0)			
Polyhydramnios	1 (0.6)			
Fever	1 (0.6)			
Seizure disorder	1 (0.6)			
Infertility	1 (0.6)			
Amniotic fluid				
Clear	137 (89.0)			
Blood stained	3(1.9)			
Meconium stained	14 (9.1)			
Antenatal corticosteroids				
Antenatal steroid	59 (38.3)			
Type of steroid (Dexamethasone)	59 (38.3)			

**Table 3: Delivery and interventions.** 

Delivery and interventions				
Denvery and inter	Assisted vaginal delivery	3 (1.9)		
Mode of delivery	Normal vaginal delivery	95 (61.7)		
	LSCS	56 (36.4)		
Apgar score One	0-3	62 (40.3)		
	4-6	66 (42.9)		
minute	>7	23 (14.9)		
Amaan aaana Eirra	0-3	2 (1.3)		
Apgar score Five minute	4-6	60 (38.9)		
	>7	89 (57.8)		
Resuscitation at birth 56 (36.4)				
	Bag and Mask	37 (24.0)		
	Tactile stimulation	14 (9.1)		
	Intubation	5 (3.2)		
Surfactant therapy		49 (31.8)		
Mechanical ventilation		61 (36.6)		
NCPAP		45 (27.0)		

Table 4 shows the diagnosis and the outcome of the birth. Majority of them had RDS (n=56, 33.6%), birth asphyxia (n=54 32.4%) and sepsis (n=46, 27.6%).

Forty three babies with RDS, twenty babies with asphyxia and eight babies with sepsis expired. Among sepsis, *Klebsiella pneumonia*, Acinetobacter and pseudomonas was commonly encountered. Rarely fungal infections were seen.

Table 4: Morbidity pattern and outcome.

Diagnosis	Total (n=154)	Discharged 92 (59.7)	Expired 62 (40.3)
Refractory shock	7 (4.2)	4 (2.4)	3 (1.8)
Birth Asphyxia	54 (32.4)	34 (20.4)	20 (12)
Sepsis	46 (27.6)	38 (22.8)	8 (4.8)
MAS	11 (6.6)	8 (4.8)	3 (1.8)
Neonatal hyperbilirubinemia	21 (12.6)	21 (12.6)	-
Pulmonary Haemorrhage	4 (2.4)	-	4 (2.4)
RDS	56 (33.6)	13(7.8)	43(25.8)
DIVC	4 (2.4)	-	4 (2.4)
Apnea of prematurity	3 (1.8)	3 (1.8)	-
Seizures	4 (2.4)	4 (2.4)	-
Congenital Anomalies	5 (3.0)	2 (1.2)	3 (1.8)
NEC	1 (0.6)	1 (0.6)	-
TTN	2 (1.2)	2 (1.2)	-
Congenital pneumonia	1 (0.6)	1 (0.6)	-

Table 5 shows the multiple regression analysis with adjusted estimates of odds ratio. Very low birth weight, Low Apgar score at 5 minute, Intubation and mechanical ventilation were predictors of outcome of VLBW babies.

Table 5: Multiple regression analysis with adjusted estimates of odds ratio.

Characteristic		OR	P value
Birth weight (gm)	<=750	14.11	< 0.05
	751-1000	52.53	< 0.05
	1001-1250	6.71	< 0.05
	1251-1500	0.97	
Vaginal delivery mode		3.12	< 0.05
Apgar score <6 in 5 minute		4.16	< 0.05
Intubation at delivery room		2.35	< 0.05
nCPAP		1.01	< 0.05
Mechanical ventilation+Surfactant		35.12	< 0.001
Mechanical ventilation only		41.12	< 0.001

Figure 1 and 2 shows the outcome of birth by gestational age and birth weight respectively. 47 live births were recorded in the gestational age group of 33-36 weeks while 55 live births were recorded among the birth weight of 1251-1500g.

### **DISCUSSION**

Prevalence of VLBW neonates (1.4%) in this report was lesser than from other countries; world-wide prevalence

of VLBW babies has been reported between 5-7% and that of ELBW as 1%; however, studies from the United

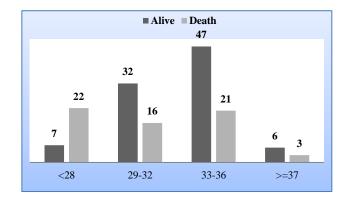


Figure 1: Outcome by gestational age in weeks.

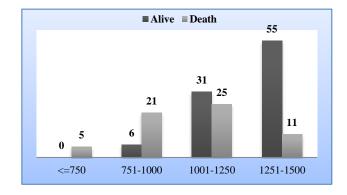


Figure 2: Outcome by birth weight in grams.

States state at 1.1% and 0.7% respectively.<sup>1,10</sup> This study was conducted in a level three SNCU in a tertiary hospital; therefore, our figures may not represent nationwide prevalence of very low birth weight infants.

Maternal co-morbidities are associated with neonatal morbidity and mortality; in the current study 33% of mothers were considered at high risk because of pregnancy-associated complications including preeclampsia (5.1%), gestational hypertension (9.6%), oligohydramnios (6%), and hypothyroidism (4.8%) (Table 2). 10,11 The best mode of delivery for VLBW neonates is debated but most authorities regard caesarean section as the method of choice for these infants; however, 61.7% of our patients had been delivered normally with increased mortality rate (Odds ratio=3.12, p<0.05) and NVD was an independent risk factor for neonatal mortality (Table 4). 12

The survival of the VLBW infants depends on an expert team that can recognize the need to resuscitate and initiate prompt measures to establish adequate respiration. One and five minute Apgar scores are generally used to assess the respiratory status of the newborn and to define the outcome for cardio-pulmonary resuscitation. An Apgar score of <6 at 5 minutes, which is a risk factor for neonatal mortality, was observed in approximately one-third (38.9%) of the VLBW infants in

our study; in a 10-year research performed in USA by Daksha et al, 46.9% of VLBW newborns had an Apgar score of <6 at 5 minutes.<sup>14</sup> This difference may be due to lower gestational age and birth weight infants in Daksha study or our successful resuscitation in delivery room.

RDS has been reported to occur inupto90% of VLBW infants, this was 33.6% (overall incidence) with 76% mortality rate in present study which is lower due to the better management and follow-up. <sup>15</sup> Antenatal steroids were used in 38.3% (n=60) with 61% discharge rate. Four doses of dexamethasone were given in 37 (n=60) of them. The use of antenatal steroids has an improved prognosis for outcome in this study though statistically cannot be stated.

A study by Travers CP et al stated that among infants born from 23 to 34 weeks' gestation, antenatal exposure to corticosteroids compared with no exposure was associated with lower mortality and morbidity at most gestations. <sup>16</sup> Ya-Chen Wang reported that Neonates with multiple-dose ACS had lower incidence of surfactant use and lower rate of intubation than neonates without ACS. <sup>17</sup>

Optimal management requires teamwork between obstetricians and neonatologists and includes meticulous prenatal care, timely administration of steroids, planned delivery in a centre equipped with a level III NICU, presence of trained resuscitation team in the delivery unit, initiation of NCPAP at birth, prompt administration of surfactant and mechanical ventilation if needed.<sup>18</sup>

We followed this recommended guideline in 56 of our patients who developed RDS, with NCPAP (in 27%) and surfactant (in31.8%); however, we had to start mechanical ventilation (57.0%) of these newborns. Despite these measures 43 died, this underlines the severity of RDS in our patients, although NCPAP and Surfactant failure was compatible with some other studies (19-22), NCPAP and mechanical ventilation (with or without surfactant) were independent risk factors for neonatal mortality (Table 5).

Short term complications seen in our study group included sepsis in27.6%, birth asphyxia in 32.4%, and NEC in 0.6%. Multiple regression analysis with adjusted estimates of odds ratio shows very low birth weight, low Apgar score at 5-minute, intubation and mechanical ventilation were predictors of outcome of VLBW babies. Which are comparable to several other similar studies, however, in most studies very low birth weight and need for mechanical ventilation have been quoted as risk factors for mortality, the same as in present study. 15,23

Ninety-two babies (59.7%) survived during the study period. Rate of overall survival for VLBW newborns has been widely different in studies from different parts of the world, 63% from India, 35.6% from a study in Iran, 70% and 71% in 2003 and 2006 from South Africa, 74.5% from Turkey. 24-26 These differences mainly related

to gestational age, birth weight and associated diseases of the newborns and standard care of NICU in different studies. Neonates' weighing ≤750grams at birth had the highest mortality rate. None of them survived, similar to other studies. <sup>23,27,28</sup> Main cause of mortality in our patients was RDS leading to respiratory failure; birth asphyxia: sepsis and major congenital anomalies were also common causes of death, which need improving quality of care in the antenatal, perinatal and postnatal periods of the newborn.

Limitations of this study that it was a retrospective study and limited to short term outcome during hospital course.

#### **CONCLUSION**

Present findings reveal that birth weight and mechanical ventilation are the 2 major factors responsible for mortality in VLBW babies. Although survival of VLBW infants in our study is comparable to other studies around the world, a decline in the mortality and morbidity of these newborns (especially the ELBW neonates) can only be made possible through optimizing perinatal care including regionalization, effective CPR at birth and early NCPAP in the SNCU.

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