

## TO STUDY THE EFFECT OF MATERNAL FACTORS ON MORTALITY OF VERY LOW BIRTH WEIGHT NEONATES

ANITA HARINKHEDE<sup>1</sup>, DEEPAK KUMAR PATEL<sup>1</sup>, JYOTI NAGWANSHI<sup>2</sup>, AMIT RAHANGDALE<sup>3\*</sup>

<sup>1</sup>Department of Pediatrics, CIMS, Chhindwara, Madhya Pradesh, India. <sup>2</sup>Department of Medicine, CIMS, Chhindwara, Madhya Pradesh, India. <sup>3</sup>Department of Orthopaedics, CIMS, Chhindwara, Madhya Pradesh, India.

\*Corresponding author: Dr. Amit Rahangdale; Email: dramit1488@gmail.com

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### ABSTRACT

**Objectives:** The present study is to determine the influences of maternal risk factors on neonatal mortality in very low birth weight (VLBW) infants born in central India.

**Methods:** A nested case-control study was conducted in the prospectively assembled cohort at the Department of Pediatrics Government Medical College and Hospital, Nagpur, India, for 2 years. Intramural neonates admitted to NICU with a birth weight of 500–1500 g were included in the study. Newborns with major congenital malformation and those who died in the delivery room or within 12 h of birth were excluded from the study.

**Results:** A total of 260 inborn VLBW newborns admitted to the NICU were enrolled. The mean gestational age was 33.58±4.8 weeks, and the mean birth weight was 1256.56±182.8 g. The overall case fatality rate was 50.38%. Maternal body mass index (BMI) <18.5 g/m<sup>2</sup> (p=0.0019 [(Odds Ratio [OR]=3.23) (95% confidence interval [CI]. 1.43–7.80)]) and ante partum hemorrhage (p=0.0001 [(OR=3.57) (95% CI 1.82–7.22)]) were two maternal factors which significantly increased the risk of death. However, antenatal steroid coverage (p=0.0005 [(OR=2.25) (95% CI 1.12–5.35)]) was associated with improved survival of VLBW neonates.

**Conclusion:** It can be said that very low birth neonates, especially those weighing <1000 g, preterm, and who are critically ill due to disturbance in pulmonary and circulatory physiology have a very high risk of mortality. Low maternal BMI and antepartum hemorrhage in mothers of VLBW neonate were associated with increased neonatal mortality and ACS therapy was associated with decreased neonatal mortality.

**Keywords:** Neonatal mortality, Maternal risk factors, ACS, VLBW.

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### INTRODUCTION

The neonatal period (first 28 days of life) carries the highest risk of mortality than any other period during childhood [1]. Neonatal mortality is a global public health issue, disproportionately affecting low- and middle-income nations [2]. Out of 130 million babies born every year globally, about 4 million die in the first 4 weeks of life [3].

Although the past two decades have witnessed a steady improvement in the quality of perinatal care in India, more initiatives to accelerate the progress are required to meet the 2030 Sustainable Development Goals objectives.

Therefore, we aimed to develop an observational study to determine the influences of maternal risk factors on in-hospital neonatal mortality in very low birth weight (VLBW) infants born in central India.

### Objectives

The present study is to determine the influences of maternal risk factors on in-hospital neonatal mortality in VLBW infants born in central India.

### METHODS

A nested case-control study was conducted in the prospectively assembled cohort at the Department of Pediatrics Government Medical College and Hospital, Nagpur, India, for 2 years. Intramural neonates admitted to NICU with a birth weight of 500–1500 g were included in the study. Newborns with major congenital malformation and those who died in the delivery room or within 12 h of birth were excluded from the study. The aim was to evaluate the effect of maternal risk factors on mortality of VLBW neonates. The

outcome measure was in-hospital death. Survival was defined as the discharge of a live infant from the hospital. After ethical clearance from the institutional ethical committee, all inborn VLBW neonates who fulfilled the inclusion criteria were enrolled. All deliveries were attended by a pediatrician, trained in resuscitation. Careful attention was given to fluids, nutrition, metabolic, hematologic, and environmental parameters. Standard indications for mechanical ventilation were used. Proper maternal, antenatal, and natal history was taken. Data were collected using a structured data collection sheet. It included in the study:

### Maternal and neonatal data

Birth weight, gender, gestational age (as per the New Ballard Score), intrauterine growth status, and APGAR at 1, 5 min need for resuscitation at birth. Maternal data included in the study: age, parity, maternal body mass index (BMI), presence of severe anemia, any addiction, other maternal health-related problems, number of antenatal visits, antenatal steroid coverage, mode of delivery, multifetal gestation, and pregnancy-related complications such as pregnancy-induced hypertension, antepartum hemorrhage, and leaking per vagina.

### Statistical analysis

Considering the expected proportion of mortality in VLBW neonates in a tertiary care hospital be 40.8%, with a relative precision of 15%, considering the desired confidence level (1- $\alpha$ ) being 95%, the minimum sample size was found to be 256. The statistical software STATA Version 14.0 was used for data analysis. Categorical variables were compared by Chi-square test and calculating Odds ratio [OR] and 95% confidence interval [CI]. Continuous variables were compared by independent t-test. p<0.05 was considered statistically significant.

Logistic regression analysis was performed to determine predictors for mortality.

## OBSERVATION AND RESULTS

Out of 260 VLBW neonates enrolled in the study, 129 survived and 131 died. The overall case fatality rate was 50.38%. The mean gestational age of all cases was 33.58±4.8 weeks, which ranged from 28 weeks to 39 weeks. The mean birth weight of cases enrolled was 1256.56±182.8 g. Among the 15 neonates with gestational age ≤30 weeks' gestation, only 13.3% survived. The overall case fatality rate among VLBW neonates was documented to be as high as 50.38%.

Table 1 shows the age-wise and weight distribution of enrolled cases along with the pattern of survival of cases enrolled in the study. Among all enrolled cases, 131 cases were expired, hence overall case fatality rate is 50.39% and 129 cases survived, and thus survival rate is 49.61%. The table shows that survival increases with an increase in gestational age and birth weight. None of the infants with birth weight <900 g survived and their case fatality is 100%. Only 13 out of 15 neonates with gestational age ≤30 weeks expired, their case fatality rate is 86.6%. Out of 59 cases belonging to gestational age between 31 and 32 weeks, 25 survived while 34 expired, thus case fatality rate of this group is 57.62%. Out of 86 neonates with a gestational age of 33–34 weeks, 29 could not survive with a case fatality rate of 33.72%. Similarly, case fatality rates are 54.79% and 29.41% for neonates belonging to gestational age of 35–36 weeks and ≥37 weeks.

Table 2 shows that maternal factors such as age, parity, and presence of severe anemia was comparable between survived and expired group. Similarly, maternal medical and obstetric complications such as leaking per vagina, pregnancy-induced hypertension, and multifetal gestation were not significantly associated with neonatal mortality. Maternal BMI <18.5 g/m<sup>2</sup>, (p=0.0019 [(OR= 3.23) (95% CI 1.43–7.80)]), antepartum hemorrhage (p=0.0001[(OR=3.57) (95% CI 1.82–7.22)]), were two maternal factors which significantly increased the risk of death. And antenatal steroid coverage significantly decreased the risk of neonatal mortality of VLBW neonates in NICU with p-value of: (p=0.0005 [(OR=2.25) (95% CI 1.12–5.35)]).

## DISCUSSION

The mortality rates of VLBW babies admitted to NICUs in India are quite higher than in the developed world, with wide variation in the

performance in different NICUs within the country. This situation is mainly due to the poor infrastructure and limited resources. There is an absence of data to explain, the way in which birth weight, gestational age and preterm risks interact and lead into neonatal mortality in a high mortality burden setting.

Out of a total of 260 VLBW neonates enrolled in the study 129 survived, and 131 expired. In our setup, we documented a total case fatality rate of 50.38%. This was significantly higher than the similar previous study by Basu *et al.* [4], where out of a total of 260 cases 96 expired and the fatality rate was 36.9%.

Similarly, Gera and Ramji [5] found a mortality of 40.86%. In their study, 115 participants were enrolled, out of these 47 died; 36 (76.5%) in the early neonatal period and the rest (23.5%) in the late neonatal period. The mean maternal age in survived group was 27.65±5.86 years and in the expired group it was 26.29±5.32 years. This was not statistically significant p=0.051.

The study by Almeida *et al.* [6] out of 44 neonates who did not survive 13 (29.5%) neonates had their mother's age <20 years while in the survived group there were 29 (20.7%) such neonates, p=0.311 [(OR=1.61) [95% CI=0.70–3.68]]. Thus, similar to our study maternal age did not increase mortality risk.

In the study by Almeida *et al.* [6], maternal BMI <18.5 kg/m<sup>2</sup> was present in 28 (21.37%) mothers of expired group neonates while it was <18.5 kg/m<sup>2</sup> only in 10 (7.75%) mothers of survived group neonates. Maternal BMI <18.5 kg/m<sup>2</sup> had p=0.0019 [(OR=3.23) [95% CI 1.43–7.80]]. This suggested that maternal BMI is a significant variable in predicting the risk of mortality in VLBW neonates.

Devi Meenakshi *et al.* [7] analyzed that out of 99 cases enrolled, four (4.04%) mothers had anemia. Similar to our study, the frequency of anemia was comparable between mothers of expired group neonates and survived group neonates. The mean gravida of mothers in the expired group and survived group neonates is 1.58±0.76 and 1.77±0.77, respectively. It is found that gravid does not increase the mortality risk (p=0.0503).

In the study by Basu *et al.* [4], the mean gravida of mothers of expired group neonates was 2.7±2.03 and in survived group, it was 2.5±1.82. This difference was not significant. Thus gravida of the mother does not affect mortality in VLBW neonates.

**Table 1: Distribution of very low birth weight neonates in relation to gestational age and birth weight**

Gestational age/Birth weight	≤30 week		31–32 week		33–34 week		35–36 week		≥37 week		Total	Survived
	Total	Survived	Total	Survived	Total	Survived	Total	Survived	Total	Survived		
500–700	3	0	0	0	0	0	0	0	0	0	3	0
701–900	7	0	4	0	0	0	0	0	0	0	11	0
901–1100	5	2	21	5	3	3	5	3	0	0	34	13 (38.20%)
1101–1300	0	0	16	12	49	30	17	12	0	0	92	54 (58.2%)
1301–1500	0	0	18	8	34	24	51	18	17	12	120	62 (51.66%)
Total	15	2 (13.33%)	59	25 (42.37%)	86	57 (66.27%)	73	33 (45.20%)	17	12 (70.58%)	260	129 (49.61%)

**Table 2: Comparison of maternal risk factors between the survived group and expired group**

Maternal factors	Expired (n=131)	Survived (n=129)	Unadjusted OR	95% CI	p-value
Maternal age (year)	26.29±5.32	27.65±5.86	–	–	0.051, NS
Maternal BMI <18.5 kg/m <sup>2</sup>	28 (21.37%)	10 (7.75%)	3.23	1.43–7.80	0.0019, HS
Severe anemia	38 (29.00%)	25 (19.37%)	1.69	0.91–3.16	0.070, NS
Gravida	1.58±0.76	1.77±0.77	–	–	0.0503, NS
Leaking Pervagina	21 (16.03%)	17 (13.17%)	1.25	0.59–2.68	0.5151, NS
Multifetal gestation	22 (16.79%)	15 (11.62%)	1.53	0.71–3.35	0.233, NS
Pregnancy-induced hypertension	20 (15.26%)	16 (12.40%)	1.27	0.59–2.77	0.5038, NS
Antepartum hemorrhage	44 (33.58%)	16 (12.40%)	3.57	1.82–7.22	0.0001, HS
Meconium stained liquor	12 (9.16%)	5 (3.87%)	2.50	0.78–9.31	0.085, NS
Antenatal steroid coverage	9 (6.8%)	30 (23.2%)	2.25	1.12–5.35	0.0005, HS

In our study, mortality in VLBW neonates born to mothers with Antepartum hemorrhage was 73.38%, while it was 36.36 % among babies born to mothers without antepartum hemorrhage. Antepartum hemorrhage was present in 44 (33.58%) mothers of an expired group of neonates, while it was present only in 16 (12.40%) mothers belonging to survived group neonates. With  $p=0.0001$  ([OR=3.57] [95% CI 1.82-7.22]), antepartum hemorrhage was found as a significant variable determining the mortality risk. This finding was consistent with the results of Basu *et al.* [4] in which antepartum hemorrhage was found a significant variable ( $p<0.01$ ).

The study of the risk factors of neonatal death enables us to understand the links in the chain of determinant events that lead to death and to identify groups exposed to different risks. In the case of VLBW newborns, the study of factors associated with death will lead to the critical analysis of health-care services and actions aimed at improving care for this group. In our study, 39 (15.0%) of antenatal mothers had received antenatal corticosteroids, out of them 30 (23.2%) neonates survived and nine (6.8%) neonates were expired. Thus, ACS therapy has a significant role for reducing the neonatal mortality. This study finding is consisted with the study done by Wang *et al.* [8]

### CONCLUSION

This study found a high neonatal mortality among VLBW neonates and there are various factors that are significantly associated with an increased mortality. Preterm delivery and low birth weight were found to be significant predictors that increase mortality risk. Low maternal BMI and antepartum hemorrhage in mothers of VLBW neonate was associated with increased mortality and ACS therapy was associated with decreased neonatal mortality. The strength of our study is that it is a prospective cohort study with case-control design, which allowed us to assess the association between various maternal factors and neonatal outcome in VLBW neonates of birth weight (500–1500 g).

### CONFLICT OF INTEREST

None declared.

### FUNDING

Nil.

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