

Neonatal Mortality and Its Correlation with Low Birth Weight in Neonatal ICU of a Developing Country

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Abstract

Introduction: Low birth weight (LBW) remains a significant public health problem in Pakistan and further understanding of factors associated with LBW is required.

Study Design: Cross sectional study.

Place and duration of study: Holy Family Hospital, from 1st Aug 2020 to 31st Aug 2020.

Methodology: 643 neonates admitted in Neonatal ICU were selected. The most important causes of admission and mortality were analyzed. Birth weight was categorized into strata, based on the WHO definitions with ELBW, VLBW, LBW, IBW, ABW or MACR. Statistical tools used were SPSS Version 21.

Results: Out of 643 neonates, 400 were male (62.2 %) and 243 (37.8 %) were female. 103 neonates (16 %) were under 1500 g, 251 (39 %) between 1501 - 2500 g, 231 neonates (35.9 %) between 2501 to 3500 g, whereas 58 (9 %) had weight 3501 - 4500 g. 36 % neonates were born premature, 20 % born with Birth Asphyxia, 13 % with RDS, 8 % neonates had EOS, 7 % were admitted with NNJ, 5 % neonates had HIE, 3 % neonates admitted with fits, 2 % neonates presented with delayed crying and 2 % neonates had MAS, 1 % neonates had Meningitis and Meconium Aspiration. 451 neonates (70.1 %) expired, 286 were male (63.5 %) and 165 were female (36.5 %), whereas 29.9 % neonates (192) were discharged.

Conclusion: Our research has demonstrated that the percentage mortality is 70 % in neonates with LBW. It confirms the association between LBW and mortality, which is a measure of mortality risk in resource-constrained settings, especially in developing countries like Pakistan. Improved care for those born with LBW is needed to ensure the well-being of such infants and hence decrease the mortality risk.

Keywords: neonates, Low birth weight, adequate weight, macrosomic, neonate

Introduction

Neonatal mortality is an important indicator of public health for countries around the world [1]. With an estimated 298,000 neonatal deaths annually and a reported neonatal mortality rate of 49 per 1000 live births, Pakistan accounts for 7

% of global neonatal deaths. Infection (36 %), preterm birth (28 %) and birth asphyxia (23 %) account for 87 % of neonatal deaths worldwide [2]. This is a large number compared to many western countries i.e In the United States in 2017, the neonatal mortality rate was 3.8 per 1,000 live births [3]. Low birth weight (LBW) as

defined by the World Health Organization is a birth weight of lower than 2.5 kg [4]. LBW births are more common in low-income countries. As per 2015 statistics, there were about 20.5 million LBW births worldwide, nearly three-quarters of them were in South-Asia and Sub-Saharan Africa. The two main reasons for LBW are preterm birth, intrauterine growth restriction (IUGR), or a combination of these two [5]. Low birth weight can be an appropriate measure of mortality risk in resource-constrained settings, especially in developing countries. A number of studies have linked NMR with LBW. Interestingly, the data varies with each country.

Material and Methods

This cross-sectional study was carried out in the department of Pediatrics, Holy Family Hospital, affiliated with Rawalpindi Medical University, Pakistan. The data was collected during the month August 2020. A total sample size of 643 was achieved.

This institute is situated in the heart of Rawalpindi city. Rawalpindi is a city and capital of Rawalpindi Division located in the Punjab province of Pakistan. It is the fourth-largest city proper in Pakistan, while the larger Islamabad-Rawalpindi metropolitan area is also the country's fourth-largest metropolitan area. Rawalpindi is adjacent to Pakistan's capital of Islamabad, and the two are jointly known as the "twin cities" on account of strong social and economic links between the cities [6]. It has a population of 2,098,231 having an area of 259 km [7]. The Rawalpindi district is divided into seven tehsils, these are Gujar

Hence, in this study, we aim to investigate any possible correlation between NMR and LBW. Accurate birth weight data and its association with mortality will not only help to improve child health care but also spread awareness about it. Furthermore, it would help to identify the most appropriate intervention in a given setting. Targeted measures to examine the reasons for LBW and then actions to improve care for those born with LBW are needed to ensure the well-being of such infants. And if an association is confirmed it might help us to achieve the Millennium Development Goal of lowering under-5 mortality.

Khan, Kahuta, Kallar Syedan, Kotli Sattian, Murree, Rawalpindi and Taxila covering a total area of 5,286 km² and having a population of 4,500,000.

Birth weight was categorized into strata, based on the WHO definitions with the following denominations: extremely low birth weight (ELBW), 500 - 999 g; very low birth weight (VLBW), 1000 - 1499 g; low birth weight (LBW), 1500 - 2499 g; insufficient birth weight (IBW), 2500 - 2999 g; adequate weight (ABW), 3000 - 3999 g; and macrosomic (MACR), 4000 g or more [8].

The database processing and analyses were performed by the Statistical Package for the Social Sciences (SPSS) - version 21. Ethics approval for the collection of data included in this study was granted by the Ethics Committees of the Department of Pediatrics, Holy Family Hospital, Rawalpindi.

Results

Table 1: Weight of neonates admitted in Neonatal ICU

Weight	Frequency	Percent	Valid Percent	Cumulative Percent
Under 1500 g	103	15.7	16	16
1501-2500 g	251	38.3	39	55.1
2501-3500 g	231	35.2	35.9	91
3501-4500 g	58	8.8	9	100
Total	643	98	99.9	262.1

Out of total 643 neonates, 103 neonates (16 %) were under 1500g, 251 neonates (39 %) were between 1501-2500 g, 231

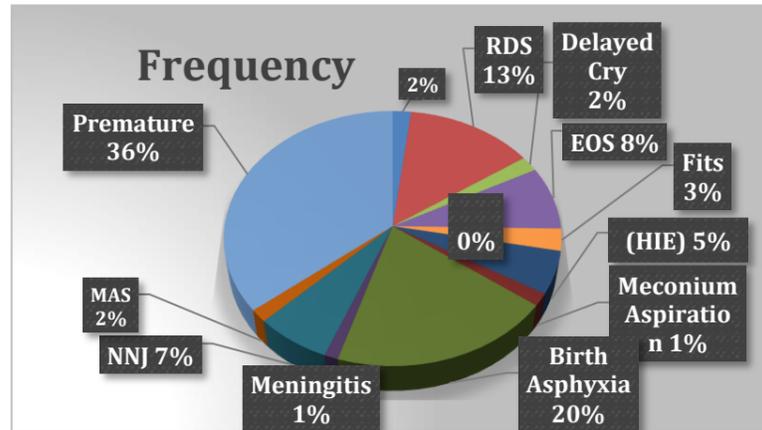
infants(35.9 %) were between 2501 to 3500 g, and where as 58 neonates (9 %) had weight between 3501 - 4500 g (**Table1**).

Table 2: Gender based neonates admitted in Neonatal ICU

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male Baby	400	61.0	62.2	62.2
Female Baby	243	37.0	37.8	100.0
Total	643	98.0	100.0	162.2

Male babies admitted in NICU were 400 (62.2 %) where as female babies were 243 which accounted for (37.8 %). (**Table 2**)

Figure 1: Frequency of diseases occurring in admitted neonates of NICU



36 % neonates were born premature, 20 % were born with Birth Asphyxia, 13 % were born with RDS (Respiratory Distress Syndrome), 8 % neonates had EOS (Familial Gene for Eosinophilia), 7 % neonates were admitted with NNJ (Neonatal jaundice), 5 % neonates had HIE (Hypoxic Ischemic

Encephalopathy), 3 % neonates were admitted with fits, 2 % neonates presented in with delayed crying and 2 % neonates had MAS (Macrophage Activation Syndrome). 1 % of the neonates had Meningitis and Meconium Aspiration. (Figure 1)

Table 3: Prognosis of the neonates admitted in NICU.

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Expired	451	70.1	70.1	70.1
Male Babies	286	63.5	63.5	63.5
Female Babies	165	36.5	36.5	36.5
Discharged	192	29.9	29.9	29.9
Total	643	100.0	100.0	100.0

451 neonates (70.1 %) expired out of which 286 male babies expired (63.5 %) and 165 were female babies (36.5 %) who

expired, where as 29.9 % neonates (192) were discharged from NICU (Table 3).

Discussion

Regarding the risk of neonates mortality, all newborns with strata weighing less than 3000 g presented higher risk when compared with those of adequate birth weight (3000 - 3999 g). Our research has demonstrated that the percentage mortality is 70 % in infants with LBW, 63.5 % in male babies and 36.5 % in female babies. It confirms the association between LBW and mortality. A similar study has demonstrated that newborns with extremely low birth weight were 200 times more likely to die in the first year of life [9].

According to a study done in Ghana, 2016 showed that the Mortality declined with age but was consistently higher for low-birth-weight neonates than for normal-weight neonates. Age-specific illness rates increased over time. Upon adjustment for other factors, birth weight was not associated with infant illness overall although the association varied significantly with time ($P = 0.0013$). Compared with normal weight infants, infants born weighing 1.50 - 1.99 kg and less than 1.50 kg had higher illness rates in the neonatal period. Previous researches have documented that educated women are less likely to have a LBW baby and maternal education has a 33

% protective effect against LBW [10]. This has been observed in

similar low-resource settings such as Nepal [11] and Bangladesh [12], and in another study from Pakistan [13]. We also found that illiteracy was associated with LBW delivery, which is likely related to reduce service utilization and less knowledge of positive health behavior. Improving access to education for young girls will address this issue. Increasing health literacy among illiterate women is complex and requires additional resources directed toward individual counseling [14,15].

A study conducted in rural areas of Pakistan during 2017 showed that nulliparous mothers were more likely to deliver LBW babies compared to multiparous women. This finding was in agreement with previous meta-analyses [16,17] showing that nulliparous women are consistently more likely to have LBW babies compared to their multiparous and grand multiparous counterparts. Several hypotheses have been put forward to explain this association, including the biological immaturity of young mothers and maternal - fetal competition for nutrients in women still trying to achieve their own growth potential [18,19]. In a study conducted during 2001 in Totowa, New Jersey shows that developed countries, preterm birth generates high health care costs, particularly for neonatal intensive care, which is often

required for many months for infants born extremely preterm (< 32 wk gestational age) [20,21]. Severely growth restricted infants are at increased risk of neonatal death and significant short-term morbidity from hypoglycemia, hypocalcemia and polycythemia [22].

A study conducted in Dhaka, Bangladesh 2001 showed the majority of LBW neonates in developing countries are small-for-gestates rather than preterm [23], and the high prevalence of LBW can be explained mainly based on IUGR. For this reason, IUGR has become a focus for potential interventions, two assumptions being that: (i) intra- uterine growth may be more tractable to interventions than preterm labor (although the degree of tractability remains questionable and there are overlaps in etiology between the two areas); and (ii) its numerical dominance in the etiology of LBW means that interventions to reduce IUGR will pay dividends in terms of outcome [24]. This second assumption may be valid in the context of later morbidity, since IUGR may have effects on childhood growth, cognitive development and subsequent diseases in adulthood [25-27].

The cohort study consisted entirely of LBW neonates, and the NMR was 133 deaths per thousand live births, roughly double the figures for unselected South Asian populations, which ranged from 50 to 97 deaths per thousand live births [28-31]. The next most striking finding is that 84 % of cohort deaths occurred in the first week of extra uterine life, half within the first 48 hours. This

Conclusion

Low birth weight is an appropriate measure of mortality risk in resource-constrained settings, especially in developing countries like Pakistan. Targeted measures to examine the reasons for LBW

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Conflict of Interest: This study has no conflict of interest to be declared by any author.

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is generally consistent with previous findings from Bangladesh indicating that 21 % of neonates die within the first three days [32], comparable results have been reported for Brazil [33]. By contrast, a study in the Gambia (NMR = 39 deaths per thousand live births) suggested that early and late neonatal deaths were roughly equal [34], although early deaths may have been underreported.

It also shows that VLBW is strongly associated with high mortality. VLBW neonates made up only 7 % of the LBW total, but accounted for a third of deaths and had a mortality rate of 780 per thousand live births. Like VLBW, lower gestational age at birth also carries a high mortality risk (769 per thousand live births at less than 32 weeks). More interesting, perhaps, is that 75 % of all deaths occurred in preterm neonates, even though they constituted only a third of all LBW babies [27].

A global network study conducted during 2015 showed Between October 2009 and March 2011, 153,728 babies were delivered and followed through day 28. Neonatal death rates ranged from 41 per 1000 births in Pakistan to 8 per 1000 in Argentina. 54 % of the neonatal deaths were > 37 weeks and 46 % weighed 2500 grams or more. Half the deaths occurred within 24 hours of delivery [35]. In our data set most of the patients with LBW were premature (31 %), making it the most common reason for LBW. Out of total 643 neonates, (16 %) were under 1500 g, (39 %) were between 1501-2500 g, 231(35.9 %) between 2501 to 3500 g, whereas (9 %) had weight between 3501 - 4500 g.

and then actions to improve care for those born with LBW are needed to ensure the well-being of such infants and hence decrease the mortality risk.

Author's contribution: HM, TM - Conception of study; FM, AT - Experimentation/study conduction; TN, HB - Statistical Analysis; AS, SS - Facilitation/ Material analysis; ZR - Critical review; SM - Manuscript writing

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