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# Short Term Outcome of Preterm Infants Admitted in a Tertiary Care Neonatal Unit in Nepal: A Five Year Review

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## ABSTRACT

**Background:** Premature birth is an important cause of neonatal mortality worldwide. However, the survival of preterm infants have been known to vary widely. Auditing the survival of these tiny infants will help in antenatal counselling to parents expecting premature birth.

**Objectives:** The aim of this study is to look at the survival of preterm infants till discharge from neonatal unit and to analyse the cause of death in those who did not survive.

**Methods:** All preterm infants (born <37 weeks) admitted in the neonatal unit between November 2017 till October 2022 were included. Survival till discharge, common morbidities and primary cause of death were analysed.

**Results:** Total number of preterm infants admitted in the neonatal unit over a 5 year period was 652, out of which 600 (92%) survived till discharge. Out of these, survival of infants born <28 weeks was 19/40 (47.5%), 28-32 weeks was 147/167 (88%) and that of 33-36 weeks was 434/445 (97.5%). As per birth weight, survival of those infants born <1000g was 20/41 (48.8%), 1000g-1499g was 108/130 (83.1%) and 1500g-2499g was 351/360 (97.5%). The common causes of death were complications arising from culture positive sepsis (50%) and intraventricular hemorrhage (grade III or IV, 21.2%). Mortality for out born preterms were more than double compared to inborn preterm infants (16.7% V 6.8%).

**Conclusion:** The survival of infants born beyond 28 weeks and with birth weight >1000g was >80% in our set-up but for those born at <28 weeks and/or <1000 g was just under 50%.

**Keywords:** *Preterm, low birth weight, mortality, survival*

## INTRODUCTION

Premature birth is defined as birth of a baby prior to completion of 37 weeks of gestational age. Annually, around 15 million babies are born prematurely worldwide[1], around 10.1% of all live births[2]. Preterm birth is a major cause of neonatal morbidity and mortality[3,4]. Vast majority of preterm deaths occur in low and middle income countries[5]. Respiratory distress syndrome (RDS), necrotizing enterocolitis (NEC) and intraventricular hemorrhage (IVH) in the west[6], and neonatal sepsis in developing countries[7,8]are considered to be common causes of death in preterms .

In high income countries, birth of a baby beyond 22 weeks of gestational age is now considered viable[9]. In terms of chances of survival for prematurely born infants, there are huge inequalities among the developed and the developing countries. According to the World Health Organization

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(WHO) report, more than half of the infants born at gestational age less than 26 weeks survive in the developed countries compared to low income counties, where 90% of these infants die[10]. However, in recent years, survival of premature babies has improved worldwide, including in developing countries.

There is paucity of literature on the outcome of premature infants in our country, specially of those born at less than 33 weeks of gestational age. Understanding the morbidity and survival of prematurely born infants in our local setup will help understand whether our neonatal intensive care unit (NICU) care and outcome is on par with the reported survival, and also will help in antenatal counselling to parents expecting premature birth.

## METHODS

### Study design and participants

This is a single centre, retrospective, cohort study carried out over a five year period in a tertiary care NICU in Nepal. All infants who were <37 weeks of gestational age at birth and admitted in the NICU of Nepal mediciti hospital from November 2017 till end of October 2022 were included. The admission criteria for admission of preterm infants in NICU were, birth gestation ≤34 weeks, birth weight ≤1800g, and those born >34 weeks and <37 weeks with clinical concerns. Those infants born at >34 weeks of gestational age with birth weight >1800g and no clinical concerns were not admitted to NICU and hence, not included in this study.

### Definitions

Extremely preterm (EPT) infants are those born earlier than 28 weeks of gestational age, very preterm (VPT) are those born between 28-32 weeks of gestational age, and moderately preterm (MPT) infants are those born between 33-37 weeks of gestational age1.

Extremely low birth weight (ELBW) infants are those who are <1000 g at birth, very low birth weight (VLBW) infants are those who weighed between 1000g and 1499g at birth, low birth weight (LBW) infants are those who weighed between 1500g and 2499g, and normal birth weight are those who weighed >2500g at birth.

### Data collection

Data were entered prospectively in a neonatal database (Microsoft Excel) maintained in the NICU of Nepal mediciti hospital. For this study, relevant data were collected retrospectively from this database. General characteristics including gestational age at birth, birth weight, gender, place of birth, mode of birth and maternal antenatal steroid therapy status were noted. Data on common morbidities including respiratory distress syndrome (RDS) requiring surfactant therapy, haemodynamically significant patent ductus arteriosus (PDA) requiring treatment, necrotizing enterocolitis (NEC), intraventricular hemorrhage (IVH) and culture positive sepsis were also noted. Finally, for those who did not survive till discharge, the single most important cause of death was noted. Where data were incomplete in the database, data were collected from electronic discharge summaries or hospital case records were retrieved from the medical case record department to complete the database.

### Statistical analysis

Data were analysed using Microsoft excel and expressed in numbers and percentage. To compare categorical variables, chi square test was used to check the statistical significance using SPSS version 17.0

## RESULTS

In the five year period, there were 1615 admissions in Nepal mediciti hospital NICU and neonatal nursery. Out of those, 90 were re-admissions and 25 had incomplete data set. Out of the remaining 1500 patients, 848 were born at ≥ 37 weeks. Thus, 652 infants who were born prematurely (<37 weeks of gestational age) and admitted in NICU were included in this study.

574/652 (88%) were inborn. The general characteristics of the patients are tabulated in Table1.

Among those born at <33 weeks of gestational age (n=207), 149 (72%) had received either partial or complete course of antenatal steroids. Important morbidities in infants born <33 weeks were RDS requiring surfactant therapy in 94 (45%), PDA requiring treatment in 54 (26%), IVH of any grade in 52 (25%) and NEC in 16 (8%).

The overall mortality among preterm infants was 52/652 (7.9)%. Mortality was remarkably lower in inborn infants compared to outborn infants (6.8% V 16.7%, p value <0.001). Mortality according to the gestational age groups are given in Table 2 and according to each week of gestational week are given in Table 3. Among the 40 EPT infants, 19 (47%) survived, among 167 VPT infants, 147 (88%) survived and among the 445 moderately preterm, 434 (97.5%) survived. There was only one infant born at 23 weeks of gestational age. The family did not wish to escalate treatment on this baby and the baby died. Two other babies in the EPT group were transferred to other centre on request of the family before the discharge criteria were fulfilled but the babies were stable during transfer.

When survival till discharge was calculated according to the birth weight (Table 4), all premature infants with normal birth weight survived till discharge. 97.5% of LBW and more 83.1% of VLBW infants survived till discharge. Among the 41 ELBW infants, only 20 (49%) survived till discharge.

The most common primary cause of death (Table 5) were due to complications arising from culture positive sepsis and grade III/IV IVH. Among those who had culture positive sepsis, 26/80 (33%) died. This included both early onset and late onset culture positive sepsis. 11/21 (52%) infants with grade III or IV IVH died. Among the 207 infants born <33 weeks, 94 (45%) required surfactant due to severe RDS, only 6 died due to complications of RDS.

## DISCUSSION

Historically, neonatal mortality was considered inevitable if a baby is delivered prior to 24 weeks of gestation[11]. In

recent years, the survival of preterm infants has improved worldwide. Especially, in the developed nations, the survival of extremely preterm infants has improved dramatically. In fact, the World Association of Perinatal Medicine defines peri-viable birth as delivery occurring from 20 0/7 weeks to 25 6/7 weeks of gestation[12]. There is a scarcity of data on survival of prematurely born infants in resource limited countries.

The results of this study show that the survival of infants born beyond 28 weeks of gestational age and/or more than 1000g of birth weight is more than 80% even in a resource limited country like Nepal. Despite advancement in neonatal care, survival of extremely preterm and extremely low birth weight infants is still less than 50% in our set up. As evidenced by various previous studies, culture positive sepsis remains the most important cause of death in newborns in a developing country[13]. In this study, 50% of the deaths were attributed to culture positive sepsis and its complications. Severe IVH has also been shown to be an important cause of mortality in prematurely born infants, specially those born at less than 26 weeks. It would be interesting to look at the neurodevelopmental outcome outcome of surviving preterm infants in a developing county in any future study.

Table 1. Baseline characteristics and morbidity review

| | Count (%) | Mortality(%) |
|---|---|---|
| **Gender**<br>Male<br>Female | <br>363 (55.7)<br>289 (44.3) | <br>30 (8.3)<br>22 (7.6) |
| **Place of birth**<br>Inborn<br>Outborn | <br>574 (88)<br>78 (12) | <br>39 (6.8)<br>13 (16.7) |
| **Mode of delivery**<br>Lower section Caesarean section<br>Vaginal delivery | <br>559 (85.7)<br><br>93 (14.3) | <br>43 (7.7)<br><br>9 (9.7) |
| **Culture positive sepsis**<br>Early onset neonatal sepsis (EONS)<br>Late onset neonatal sepsis (LONS) | <br>12/652 (1.8)<br>68/652 (10.4) | 26 (32.5%) |
| **RDS requiring surfactant therapy (<33 weeks)** | 94/207 (45.4) | Mortality due to complications of RDS 6 (6.3%) |
| **PDA requiring treatment (<33 weeks)**<br>Yes<br>No | <br>54/207 (26)<br>153 (74) | No mortality due to complications of PDA |
| **NEC (<33 weeks)**<br>Stage 1<br>Stage 2<br>Stage 3<br>Total | <br>11<br>3<br>2<br>16/207 (7.7%) | Mortality due to complications of NEC<br>3 (19%) |
| **IVH (<33 weeks)**<br>Grade I<br>Grade II<br>Grade III<br>Grade IV<br>Total | <br>23<br>8<br>7<br>14<br>52/207 (25.1%) | Mortality due to complications of Grade III/IV IVH<br>11/21 (52%) |

infants in both developed and developing nations[14]. Not surprisingly, in our study, the second commonest cause of mortality in preterm infants was grade III/IV IVH. The other interesting observation made in our study was the difference in survival of inborn V outborn infants. The mortality was more than double in outborn preterm infants compared to those born in our centre (16.7% V 6.8%, p value <0.001). This re-iterates the importance of the golden first our after premature birth[15] and also the risks associated with transfer of premature infants. In a country like Nepal where there is lack of dedicated transfer teams, transfer incubators and transfer ventilators, transfer of premature infants still carries a great risk. In our study, 72% of mothers had received at least one dose of antenatal steroid prior to delivering babies before 33 weeks of gestational age. 100% of preterm infants who required mechanical ventilation had received surfactant. This reflected in the low mortality due to RDS related complications. Unlike in other reported cases[16], mortality related to NEC was negligible in our study.

The limitation of our study is low number of extremely preterm

Table 2. Survival data according to gestational age groups

| | Total number | Mortality | Survival (%) |
|---|---|---|---|
| Extremely preterm (<28 weeks) | 40 | 21 | 19 (47.5) |
| Very preterm (28-32 weeks) | 167 | 20 | 147 (88) |
| Moderately preterm (33-36 weeks) | 445 | 11 | 434 (97.5) |

Table 3. Survival data according to gestational age in weeks

| Gestational age | Total number | Mortality | Survival (%) |
|---|---|---|---|
| **23 weeks** | 1 | 1 | 0 (0) |
| **24 weeks** | 4 | 2 | 2 (50) |
| **25 weeks** | 3 | 1 | 2 (66.7) |
| **26 weeks** | 13 | 7 | 6 (46.2) |
| **27 weeks** | 19 | 10 | 9 (47.4) |
| **28 weeks** | 19 | 4 | 15 (78.9) |
| **29 weeks** | 32 | 5 | 27 (84.4) |
| **30 weeks** | 35 | 7 | 28 (80) |
| **31 weeks** | 35 | 1 | 34 (97.1) |
| **32 weeks** | 46 | 3 | 43 (93.5) |
| **33 weeks** | 56 | 5 | 51 (91.2) |

| | | | |
|---|---|---|---|
| **34 weeks** | 102 | 5 | 97 (95.1) |
| **35 weeks** | 103 | 1 | 102 (99) |
| **36 weeks** | 184 | 0 | 184 (100) |
| **Total** | 652 | 52 | 600 (92) |

Table 4.Survival data according to birth weight

| | **Total** | **Mortality** | **Survival (%)** |
|---|---|---|---|
| **Extremely low birth weight (<1000g)** | 41 | 21 | 20 (48.8) |
| **Very low birth weight (1000g-1499g)** | 130 | 22 | 108 (83.1) |
| **Low birth weight (1500g-2499g)** | 360 | 9 | 351 (97.5) |
| **Normal birth weight (≥2500g)** | 121 | 0 | 121 (100) |

Table 5. Primary cause of death

| **Primary cause of death** | Number (%) |
|---|---|
| Culture positive sepsis and related complications | 26 (50) |
| Grade III/IV intraventricular hemorrhage | 11 (21) |
| Respiratory distress syndrome and related complications | 6 (11.5) |
| Congenital heart disease/ cardiogenic shock | 2 (3.8) |
| Congenital anomalies | 2 (3.8) |
| Birth asphyxia/ HIE III | 2 (3.8) |
| Withdrawal of support on parental request | 2 (3.8) |
| Hydrops fetalis | 1 (1.9) |

## CONCLUSION

This retrospective cohort study has demonstrated that the survival of infants born after 28 weeks of gestational age is promising even in a resource limited country like Nepal. However, for those born before 28 weeks of gestational age, survival is still less than 50%. Culture positive sepsis and severe IVH are the most common causes of mortality in our setting. Future research and development should be aimed at improving the incidence of infection and IVH, and also better management of these conditions.

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