

## Survival and Major Morbidity Pattern of Preterm Infants Admitted in a Level -3NICU: A Retrospective Study

N. Venugopalan<sup>1</sup>, Salahudeen<sup>2</sup>, Pavan Kumar D.<sup>3</sup>, Vidya Singaravelu<sup>4</sup>, Manoj Narayanan K.A.<sup>5</sup>

<sup>1</sup>Professor & Head <sup>2</sup>Senior Resident <sup>3</sup>Assistant Professor <sup>4</sup>Associate Professor, Dept. of Pediatrics, DMWIMS Medical College, Naseera Nagar, Meppadi (P.O), Wayanad, Kerala 673577, India.

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### Abstract

**Objectives:** To assess the morbidity pattern and mortality among preterm infants admitted in Level – 3 NICU of a teaching hospital of a backward district of Kerala and to analyze the quality neonatal survival and cause of death in such preterm neonates. **Methods:** A retrospective study of all preterm infants admitted in the level – 3 NICU of a teaching hospital for a period of one year from 01/01/2017 based on hospital records. This includes both inborn and out born babies. Gestational age at delivery, mode of delivery, birth weight, major congenital anomalies, number of deaths and causes of deaths are recorded. Data are entered in Microsoft excel and data are correlated for any significance. **Results:** A total of 141 infants born below completion of 34 weeks of gestation were included in the study. 8 infants (6%) were of extremely low birth weight out of which only one died in the hospital. Six infants (4.25%) died during NICU stay. Major morbidities were present in 84% of all infants, and multiple morbidities were present in 66% infants. **Conclusions:** In a level 3 NICU of a teaching hospital 6% of babies were of extremely low birth weight and all except one survived. Death and morbidity are directly related to gestational age.

**Keywords:** Preterm Infants; Gestational Age; Neonatal Asphyxia.

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### Introduction

Preterm infants by definition are babies born before completion of 37 weeks of gestational age. These infants are at high risk of death and morbidity. Infants born before 28 weeks of gestation if also having multiple congenital anomalies are prone for neonatal asphyxia, respiratory distress, sepsis, hypoglycemia and prolonged neonatal hyper-bilirubinaemia. With advances in perinatal and neonatal care, more infants are surviving at lower gestational ages [1-3]. However, the rates of mortality and severe neonatal morbidity increase with decreasing gestational age [4-6]. Death and major morbidity can be avoided if prompt care is given to these infants in a level 3 neonatal ICU. This study highlights the favorable outcome among preterm

infants treated in a level 3 NICU of Wayanad, a relatively backward district of Kerala. Wayanad is an officially declared backward district of Kerala. It has the largest contingent (%) of tribal population in the state. About 18% of the district's population (about 11 L) are tribes. DMWIMS Medical College Hospital provide Level – 3 neonatal care and is the only institution with a level – 3 NICU in this hill district catering to a total population of about 20 lacks taking in to account the adjacent districts of Tamiladu and Karnataka.

### Objectives

To assess the rates of mortality and morbidity among preterm infants admitted in NICU of a tertiary care hospital of a backward district of Kerala and to examine the cause of neonatal survival and death at each gestational age.

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**Corresponding Author:** Manoj Narayanan, Associate Professor, Pediatrics, DMWIMS Medical College, Naseera Nagar, Meppadi (P.O), Wayanad, Kerala 673577, India.  
E-mail: [saisailesh.kumar@gmail.com](mailto:saisailesh.kumar@gmail.com)

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## Methods

For the purpose of this study those babies born before 34 weeks of gestation alone are included. Those born after 34 weeks are neurologically mature enough to suck by themselves while feeding and are not routinely admitted in NICU for observation and stabilization.

This is a retrospective analysis of hospital data of infants born below 36 weeks of gestation for a period of one year from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2017. This includes both inborn and out born infants admitted in the NICU of a tertiary care hospital during the study period. Gestational age at birth, maternal morbidity, birth weight of the infants, congenital anomalies, other comorbidities, number of hospital days, type of support provided and outcome are recorded. These data are entered in to Microsoft Excel for data analysis. Individual perinatal characteristics and maternal demographic characteristics are compared in the survivors and non survivors

### Definitions

*Moderate preterm:* Gestational age from 32 to 36 completed weeks

*Very preterm:* Gestational age between 28 to 31 completed weeks

*Extreme preterm:* Gestational age less than 28 completed weeks.

*Low birth weight:* <2500g

*Very low birth weight:* <1500g

*Extremely low birth weight:* <1000g

## Results

A total of 1036 babies were admitted in the NICU of the institution from 01-01-2017 to 31-12-2017. 947 were in born and 89 were born in other institution and referred in. Out of 1036, 141 (31.61%) were born below 34 weeks of gestation. These 141 babies were included in this retrospective cohort study. Mean birth weight increased with each increasing gestational week, from 354 g at 24 weeks to 2450 g at 34 weeks. 77 infants in the cohort were male (54.6%), and 64 (45.4%) were females (Table 1).

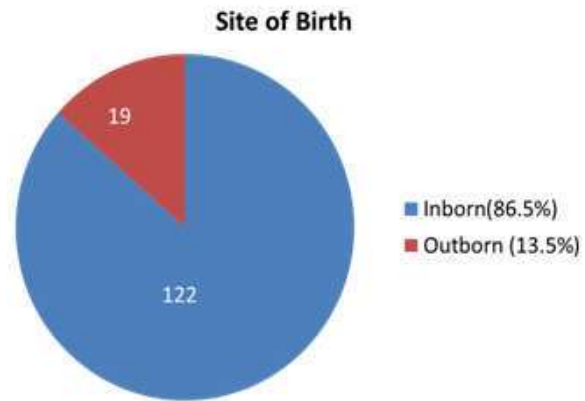
122 infants were born in this hospital and 19 were born in peripheral hospitals and referred for neonatal care (Figure 1).

Among these 15 (10.6%) were between 24-28 weeks of gestation, 21(14.9%) were between 29-31 weeks

**Table 1:** Sex distribution among preterm infants

Sex	No.	Percentage
Male	77	54.6
Female	64	45.4
Total	141	

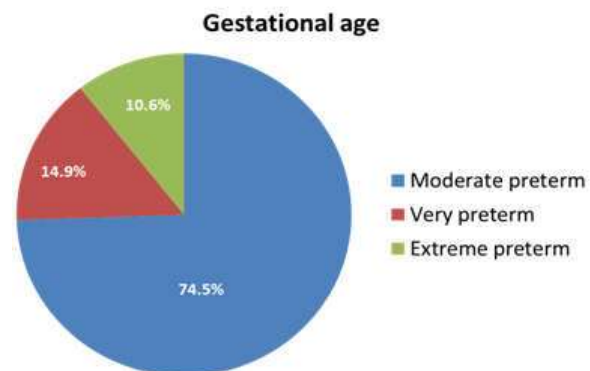
of gestation and 105 (74.5%) were between 32-34 weeks of gestation (Figure 2). Out of these 20 (14.2%) were born of cesarean delivery. 8 infants



**Fig. 1:** Number of inborn and out born infants

were of extremely low birth weight (5.6%), 32 (22.7%) were between 1000-1500 gm and 101 (71.7%) were between 1500 to 2500 gm weight category (Figure 3). There were 6 deaths (4.25%) out of which only one was among the extremely low birth weight category (Figure 4). The total number of deaths in the NICU for the year was 12 out of a total admission of 1036. This shows that 6 babies out of 141 die constituting mortality of 4.26% for those below 34 weeks of gestational age. Only 6 out of the remaining 895 (above 34 weeks of gestation) died during the study period constituting a mortality of 0.67%.

Minimum stay in the hospital was 1 day and maximum was 79 days with a mean of 21 days. Out of 6 deaths 5 occurred in the first week and one in the third week. Major congenital heart diseases



**Fig. 2:** Number of infants born at different gestational ages

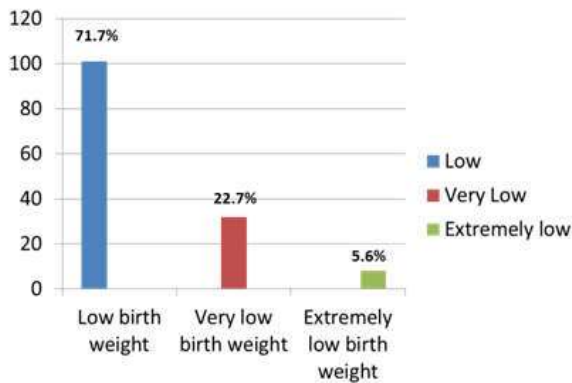


Fig. 3: Number of children in different weight groups

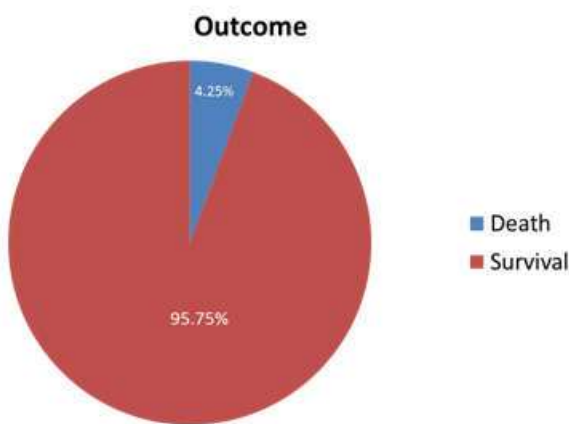


Fig. 4: Death among preterm infants

detected were ASD and PDA. Other problems were Hydrocephalus, Lung immaturity, Retinopathy of prematurity (ROP), other congenital anomalies like limb and chest wall abnormalities, jejunal atresia, undescended testes, tracheo esophageal fistula and hydro-uteronephrosis. Multiple major abnormalities were detected more in infants born below 31 weeks of gestation. Major associated comorbidities noted were perinatal asphyxia, hyaline membrane disease, respiratory distress, neonatal sepsis, hypoglycemia, neonatal hyper-bilirubinaemia, pneumothorax, metabolic acidosis and multiorgan dysfunction syndrome. Respiratory distress syndrome was present in 22 (15.6%) infants, ASD in 4 (2.8%) and Retinopathy of prematurity (ROP) in 6 (4.25%) infants.

All the preterm deliveries were attended by pediatrician. All preterm deliveries were informed in advance to NICU prior to delivery and most of the cases referred from outside are informed before being shifted from those institutions, so that NICU is prepared for receiving the baby. All babies < 34 weeks were shifted to NICU for preterm care. 22 (17%) infants needed resuscitation at birth. All the premature

infants were nursed in thermo-neutral environment (around 36.5°C). Oil is applied to skin to reduce convective heat loss and evaporative water loss. Stable babies are given kangaroo mother care to provide warmth. All preterm infants developed jaundice within the first week. If the baby is found to be jaundiced serum bilirubin is estimated and phototherapy started based on bilirubin level. Jaundice was not controlled by phototherapy in one infant and was subjected to exchange transfusion.

## Discussion

In a hospital-based cohort of infants born between 24 and 34 weeks of gestation and taken care of in a level - 3 NICU, survival during the hospital stay was substantially good across all gestational age and birth weight. Although 84% of infants had one or other morbidity, all of them responded well to resuscitation and supportive care in the NICU.

Even though sepsis, respiratory distress and ROP have been reported among this cohort, it is less when compared to other studies [7-11]. Few other studies have shown higher rates of cerebral palsy, cognitive impairment, and behavioral problems among those born at very early gestations [12-15], and causing major neonatal morbidities and high risk for significant impairment in later life. These possible morbidities can be assessed only on subsequent follow up for a sufficiently long period after discharge from NICU.

The rates of attempted resuscitation for infants in our study were similar to several other studies [16]. These infants received interventions such as surfactant therapy, tracheal intubation, ventilator support, parenteral nutrition, or chest compressions. It is possible that the differences in resuscitation practices may influence survival and mortality. Previous studies have proposed individual decision-making in resuscitation of extremely preterm infants [17,18] whereas other studies have examined more major differences in resuscitation practice and subsequent outcomes at the hospital level [19-21]. Population-based studies and analyses are needed to gain a better understanding of the determinants of, and extent to, which regional practice variations influence mortality and quality of survival rates.

Differences in perinatal factors and maternal demographic characteristics have not influenced mortality. But increased birth weight and female sex, demonstrate favorable predictors for survival, as described by Tyson et al. [22]. Majority of extremely

preterm births in this cohort occurred in hospitals and this may be the reason for low mortality. Better survival was seen in infants born at a hospital with a regional-level NICU, which has been reported in other studies [23,24].

Future population-based studies are needed to examine neurodevelopmental and other outcomes in these infants after discharge from the hospital. Large, population-based studies of neurodevelopmental outcomes in survivors of extreme prematurity have been conducted in the United Kingdom [13,25], Sweden [26], Australia [27], and France [12].

### Conclusions

This study provides information on mortality of preterm infants treated in a tertiary level-3 NICU in a backward district of Kerala state in India. It also explores the resuscitative and supportive care to the preterm infants and look at major morbidity among survivors. Mortality among this cohort is only 4.25% and only one baby among the 8 extremely low birth weight category was lost. This study highlight that survival can be considerably improved if delivery is conducted in an institution with level - 3 NICU facility and immediate NICU care is provided to all infants who need it. Even though there are multiple anomalies and comorbid conditions in these babies survival is comparable to other advanced NICUs.

### References

1. Costeloe KL, Hennessy EM, Haider S, Stacey F, Marlow N, Draper ES. Short term outcomes after extreme preterm birth in England: comparison of two birth cohorts in 1995 and 2006 (the EPICure studies). *BMJ*. 2012;345:e7976pmid:23212881.
2. Hintz SR, Poole WK, Wright LL, et al; NICHD Neonatal Research Network. Changes in mortality and morbidities among infants born at less than 25 weeks during the post-surfactant era. *Arch Dis Child Fetal Neonatal Ed*. 2005;90(2):F128-F133. pmid:15724036.
3. Serenius F, Ewald U, Farooqi A, Holmgren PA, Håkansson S, Sedin G. Short-term outcome after active perinatal management at 23-25 weeks of gestation. A study from two Swedish tertiary care centres. Part 2: infant survival. *Acta Paediatr*. 2004;93(8):1081-89. pmid:15456200.
4. Ancel PY, Goffinet F, Kuhn P, et al. EPIPAGE-2 Writing Group. Survival and morbidity of preterm children born at 22 through 34 weeks' gestation in France in 2011: results of the EPIPAGE-2 cohort study [published correction appears in *JAMA Pediatr*. 2015;169(4):323]. *JAMA Pediatr*. 2015;169(3):230-238pmid:25621457.
5. Fellman V, Hellström-Westas L, Norman M, et al; EXPRESS Group. One-year survival of extremely preterm infants after active perinatal care in Sweden. *JAMA*. 2009;301(21):2225-2233pmid:19491184.
6. Stoll BJ, Hansen NI, Bell EF, et al. Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. Neonatal outcomes of extremely preterm infants from the NICHD Neonatal Research Network. *Pediatrics*. 2010;126(3):443-56. pmid:20732945.
7. Rees CM, Pierro A, Eaton S. Neurodevelopmental outcomes of neonates with medically and surgically treated necrotizing enterocolitis. *Arch Dis Child Fetal Neonatal Ed*. 2007;92(3):F193-F198. pmid:16984980.
8. Msall ME, Phelps DL, DiGaudio KM, et al. Severity of neonatal retinopathy of prematurity is predictive of neurodevelopmental functional outcome at age 5.5 years. Behalf of the Cryotherapy for Retinopathy of Prematurity Cooperative Group. *Pediatrics*. 2000;106(5):998-1005.
9. Calisici E, Eras Z, Oncel MY, Oguz SS, Gokce IK, Dilmel U. Neurodevelopmental outcomes of premature infants with severe intraventricular hemorrhage. *J Matern Fetal Neonatal Med*. 2015;28(17):2115-20. pmid:25354288.
10. Anderson PJ, Doyle LW. Neurodevelopmental outcome of bronchopulmonary dysplasia. *Semin Perinatol*. 2006;30(4):227-32. pmid:16860163.
11. Mitha A, Foix-L'Hélias L, Arnaud C, et al; EPIPAGE Study Group. Neonatal infection and 5-year neurodevelopmental outcome of very preterm infants. *Pediatrics*. 2013;132(2). Available at: [www.pediatrics.org/cgi/content/full/132/2/e372](http://www.pediatrics.org/cgi/content/full/132/2/e372).
12. Delobel-Ayoub M, Arnaud C, White-Koning M, et al; EPIPAGE Study Group. Behavioral problems and cognitive performance at 5 years of age after very preterm birth: the EPIPAGE Study. *Pediatrics*. 2009;123(6):1485-92. pmid:19482758.
13. Marlow N, Wolke D, Bracewell MA, Samara M; EPICure Study Group. Neurologic and developmental disability at six years of age after extremely preterm birth. *N Engl J Med*. 2005;352(1):9-19. pmid:15635108.
14. Hack M, Taylor HG, Drotar D, et al. Chronic conditions, functional limitations, and special health care needs of school-aged children born with extremely low-birth-weight in the 1990s. *JAMA*. 2005;294(3):318-25. pmid:16030276.
15. Hintz SR, Kendrick DE, Wilson-Costello DE, et al. NICHD Neonatal Research Network. Early-childhood neurodevelopmental outcomes are not improving for infants born at <25 weeks' gestational age. *Pediatrics*. 2011;127(1):62-70. pmid:21187312.
16. Rysavy MA, Li L, Bell EF, et al. Eunice Kennedy Shriver National Institute of Child Health and Human

- Development Neonatal Research Network. Between-hospital variation in treatment and outcomes in extremely preterm infants. *N Engl J Med*. 2015;372(19):1801-11. pmid:25946279.
17. Macfarlane PI, Wood S, Bennett J. Non-viable delivery at 20-23 weeks gestation: observations and signs of life after birth. *Arch Dis Child Fetal Neonatal Ed*. 2003;88(3):F199-F202. pmid:12719392.
  18. Partridge JC, Freeman H, Weiss E, Martinez AM. Delivery room resuscitation decisions for extremely low birthweight infants in California. *J Perinatol*. 2001;21(1):27-33. pmid:11268864.
  19. Bodeau-Livinec F, Marlow N, Ancel PY, Kurinczuk JJ, Costeloe K, Kaminski M. Impact of intensive care practices on short-term and long-term outcomes for extremely preterm infants: comparison between the British Isles and France. *Pediatrics*. 2008;122(5). Available at: [www.pediatrics.org/cgi/content/full/122/5/e1014](http://www.pediatrics.org/cgi/content/full/122/5/e1014) pmid:18977951.
  20. Lorenz JM, Paneth N, Jetton JR, den Ouden L, Tyson JE. Comparison of management strategies for extreme prematurity in New Jersey and the Netherlands: outcomes and resource expenditure. *Pediatrics*. 2001;108(6):1269-74. pmid:11731647.
  21. Pignotti MS, Donzelli G. Perinatal care at the threshold of viability: an international comparison of practical guidelines for the treatment of extremely preterm births. *Pediatrics*. 2008;121(1). Available at: [www.pediatrics.org/cgi/content/full/121/1/e193](http://www.pediatrics.org/cgi/content/full/121/1/e193) pmid:18166538.
  22. Tyson JE, Parikh NA, Langer J, Green C, Higgins RD. National Institute of Child Health and Human Development Neonatal Research Network. Intensive care for extreme prematurity – moving beyond gestational age. *N Engl J Med*. 2008;358(16):1672-81. pmid:18420500.
  23. Jensen EA, Lorch SA. Effects of a birth hospital's neonatal intensive care unit level and annual volume of very low-birth-weight infant deliveries on morbidity and mortality. *JAMA Pediatr*. 2015;169(8):e151906. pmid:26237466.
  24. Cifuentes J, Bronstein J, Phibbs CS, Phibbs RH, Schmitt SK, Carlo WA. Mortality in low birth weight infants according to level of neonatal care at hospital of birth. *Pediatrics*. 2002;109(5):745-51. pmid:11986431.
  25. Moore T, Hennessy EM, Myles J, et al. Neurological and developmental outcome in extremely preterm children born in England in 1995 and 2006: the EPICure studies. *BMJ*. 2012;345:e7961. pmid:23212880.
  26. Serenius F, Källén K, Blennow M, et al. Express Group. Neurodevelopmental outcome in extremely preterm infants at 2.5 years after active perinatal care in Sweden. *JAMA*. 2013;309(17):1810-20. pmid:23632725.
  27. Doyle LW, Roberts G, Anderson PJ. Victorian Infant Collaborative Study Group. Outcomes at age 2 years of infants < 28 weeks' gestational age born in Victoria in 2005. *J Pediatr*. 2010;156(1):49-53. e1 pmid:1978300.
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