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Original Article

Developmental outcomes of very low birth weight infants in a tertiary care teaching hospital in India

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Abstract

Background: *Recent advances in medicine has improved the overall management of premature infants who are in turn at risk of developing developmental problems. This area of research is currently explored to limited extent.*

Methods: *This is a longitudinal study of very low birth weight infant (VLBW) survivors born between 2017 and 2020 and were followed up to assess their developmental outcomes till 3 years. All neonates have been assessed with general examination and clinical history and factors associated with poor outcomes were evaluated.*

Results: *Thirty-four neonates with a mean age of 2.4±0.5 years (Range 2-3) with equal male to female ratio 17(50%) were included. The mean gestational age was 32.8 months (Range 27.2-37.6). Their mean birth weight was 1.3±0.2kg. Majority were born Preterm 22(64.7%) and only a few 7(20.6%) were adequate for gestational age. Respiratory distress and fetal cervical hyperextension were commonly diagnosed in these infants. Developmental abnormalities were noted in 8(23.5%) infants. The most common development issues were gross motor in 4(50%), fine motor 3(37.5%), vision 3(37.5%), and language 2(25%) impairment. The mean age of these were 31.7 years, mean weight was 1.2kg, 6(75%) were small for gestational age, 4(50%) had respiratory distress.*

Conclusions: *Among VLBW survivors a significant one quarter (23.5%) proportion of infants had poor developmental outcomes. VLBW infants can develop learning difficulties at school and need long-term follow up.*

Keywords: *Very low birth weight infants, developmental impairments, Preterm, Outcomes.*

Introduction

Although the rate of preterm very low birth weight (VLBW) babies is increasing, disparities exist in survival rates due to varied quality care.[1] Better neonatal care has contributed to improvement in survival rates of VLBW infants.[2] But some of these VLBW infants are prone to short term adverse outcomes and long-term neurodevelopmental abnormalities.

Developmental problems range from cerebral palsy, cognitive impairment, blindness and hearing loss to impairment of short term memory, strabismus, learning difficulties, language delays, and behavioral disorders.[3-5] VLBW neonates contribute to 1.4% to 2.1% of total live births.[6,7] Studies have shown that preterm small for gestational age infants and VLBW infants had the poorest cognition at the age of 12 years.[8] There is paucity of data from western India related to developmental outcomes of VLBW infants. This study assessed the growth and neurodevelopmental outcomes of VLBW infants at two and three years.

Methods

This is a longitudinal study of very low birth weight infant (VLBW) survivors born between 2017 and 2020 and were followed up to assess their developmental outcomes till 3 years. All VLBW inborn neonates delivered during the study period at the hospital were included. Neonates with one or more of the following were excluded: (i) birth weight <500g and/or gestational age (GA) less than 25 weeks; (ii) presence of lethal congenital malformations and
(iii) death within 6 hours of life.

Gestational age was determined by first trimester scan finding. Neonatal data including gender, birth weight was recorded. Growth was assessed by measuring weight for age, length for age and head circumference for age. Weight was measured using infant weighing scale. Vision was assessed by the ability to fix and follow a target and hearing was checked using a bell.

Major neurodevelopmental abnormality was defined if at least one of the following was present i) Cerebral palsy ii) either mental or motor impairment iii) vision impairment, or iv) hearing impairment. Visual impairment was defined as blindness with no functional vision in at least one eye. Hearing impairment was defined as the need for sound amplification. Hearing loss was defined as hearing loss greater than 30 dB in the better hearing ear. The presence of only morbidity was considered as minor neurodevelopmental abnormality. The neurodevelopmental assessment was done at two / three years using general examination, clinical history and asking relevant questions thereby factors associated with poor outcomes were evaluated. All neonates were managed as per standard NICU protocol. This study was conducted in accordance with Good Clinical Practice and in a manner to conform to the Helsinki Declaration of 1975, as revised in 2013 concerning human rights.

Statistical Analysis

Statistical analysis was carried out with the help of Statistical Package for the Social Sciences (SPSS) Statistics for Windows [version 24.0, Professional] (IBM Corp., Armonk, N.Y., USA). The description of the data was done in the form of arithmetic mean ± SD for quantitative data, and frequency (%) for qualitative (categorical) data. Results are graphically represented as 3d stacked bar graphs and pie chart as deemed necessary.

Results

Thirty-four neonates with a mean age of 2.4±0.5 years (Range 2-3) with an equal male to female ratio 17(50%) were included (Table 1). The mean gestational age was 32.8 months (Range 27.2-37.6). Their mean birth weight was 1.3±0.2kg (Fig.1). Majority were born Preterm 22(64.7%) (Fig.2) and only a few 7(20.6%) were adequate for gestational age. Respiratory distress and fetal cervical hyperextension were commonly diagnosed in these infants. Other causes included sepsis, Patent ductus arteriosus, intrauterine growth restriction, meconium-stained amniotic

fluid and premature rupture of membranes. Minor and major developmental abnormalities were noted in 8(23.5%) infants (Fig.3). The most common developmental abnormalities were gross motor in 4(50%), fine motor 3(37.5%), vision 3(37.5%), and language 2(25%) impairment (Fig.4). None developed cerebral palsy at follow-up. No infant was noted to have hearing impairment. The mean age of these neonates were 31.7 months, mean weight was 1.2kg, 6(75%) were small for gestational age, 4(50%) had respiratory distress.

Fig. 1 Distribution of developmental impairment with birth

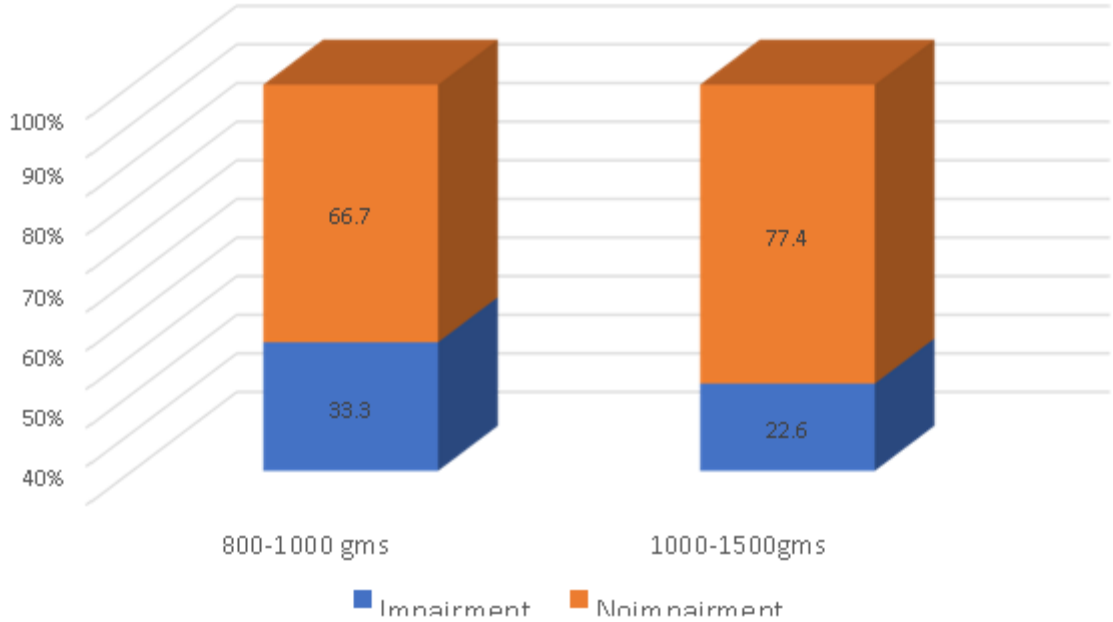

Fig. 2 Birth incidence of pregnancies

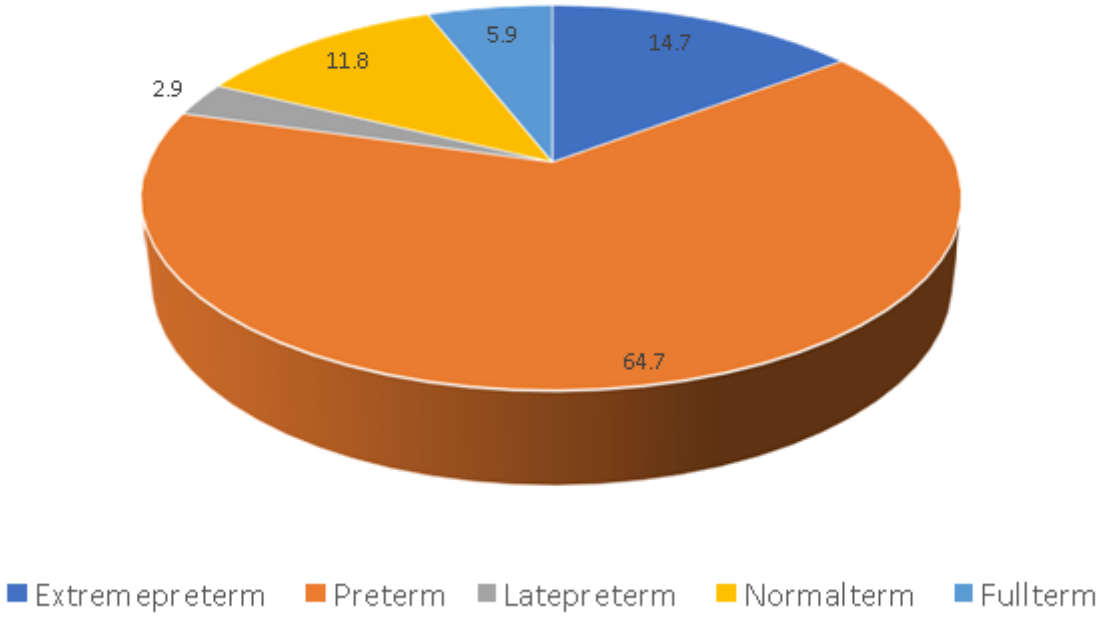

Fig.3 Developmental impairment in infants

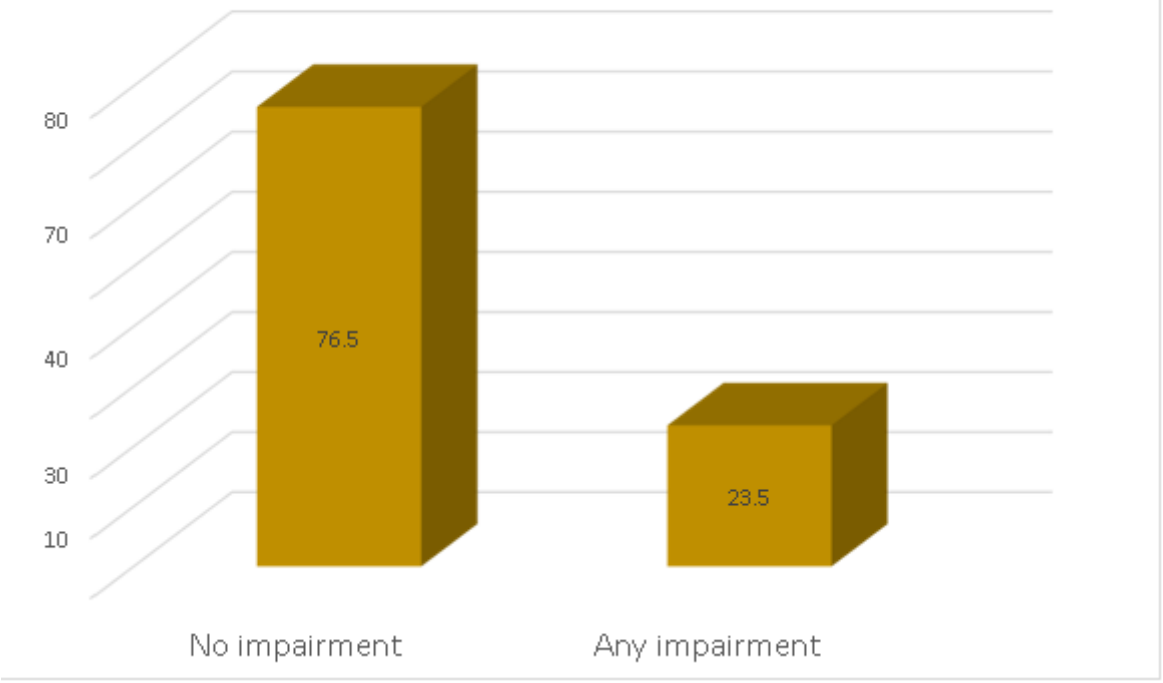

Fig. 4 Distribution of developmental abnormalities among neonates

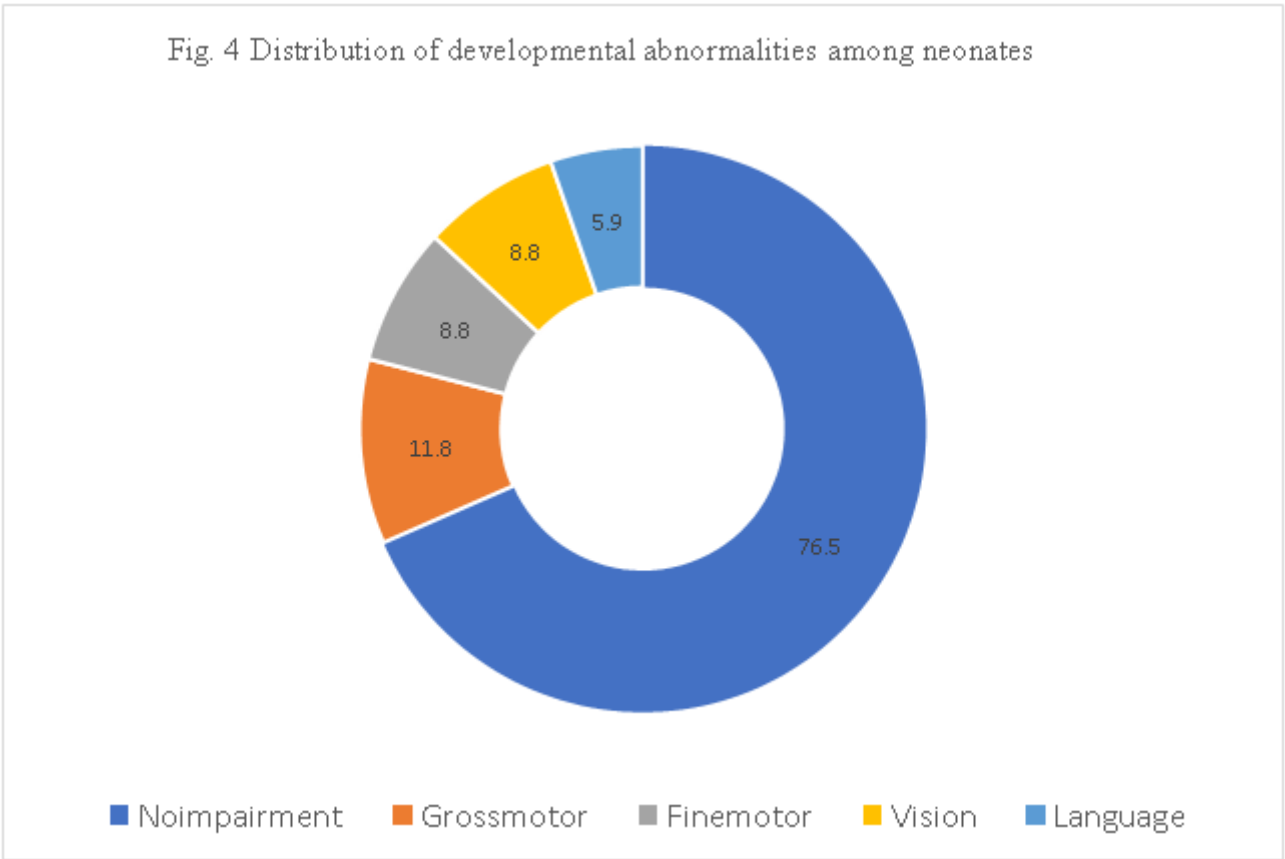

Table 1 Overall patient characteristics and their association with outcomes

Variable	N=34
Age at presentation, years Mean±SD Range	 2.4±0.5 2-3
Birth weight, kg Mean±SD Range	 1.3±0.2 0.84-1.48
Birth weight distribution, grams <1,000 1,000-1500	 3(8.8%) 31(91.2%)
Gender distribution, n(%) Male Female	 17(50%) 17(50%)
Gestational age, weeks Mean±SD Range Median (IQR)	32.8±2.9 27.2-37.6 33(30.2-34.75)
Extreme preterm Preterm Late preterm Normal term Full term	5(14.7%) 22(64.7%) 1(2.9%) 4(11.8%) 2(5.9%)
Gestational age distribution Small for gestational age, n(%) Adequate for gestational age, n(%)	 27(79.4%) 7(20.6%)
Diagnosis# Sepsis Respiratory distress Fetal cervical hyperextension Patent ductus arteriosus Intrauterine growth restriction Meconium-stained amniotic fluid Premature rupture of membranes	 5(14.7%) 12(35.3%) 12(35.3%) 2(5.9%) 4(11.7%) 1(2.9%) 1(2.9%)
Developmental abnormalities	8(23.5%)

#Some neonates may have more than one diagnosis

Discussion

By following up VLBW survivors over a three-year period, we studied the developmental abnormalities. The rates (23.5%) of developmental problems among VLBW infants are concerning. The most common developmental abnormalities were in 4(50%), fine motor 3(37.5%), vision 3(37.5%), and language 2(25%) impairment. Gestational age, birth weight, gender, multiple births, antenatal corticosteroid therapy, neonatal infection, necrotizing enterocolitis, periventricular leukomalacia and IVH are risk factors that influence both short- and long-term outcomes.[9] Local NICU data on expected

mortality and adverse longterm outcomes may be useful to counsel parents of VLBW neonates. There is a need to develop supportive care while managing preterm VLBW infants to control environmental stressors, i.e., minimal handling, prone positioning, kangaroo mother care, clustering of care, dim lights, and low noise environment.[2,10] Various factors are significantly associated with VLBW among which some are modifiable such as education of parents. The birth weight and gestation of our cohort was comparable to other Indian studies.[11,12]

As per Neuroprem 2 study severe functional disability, and cerebral palsy were seen in 9.6% and 5.4%, respectively.[13] The rates of severe functional disability and cerebral palsy were higher in neonates with a lower gestational age. Extra-uterine nutrition and comorbidities at birth could have influenced both growth and development.[2] A healthy intrauterine environment for up to 37–

40 weeks of gestation benefits neonatal brain development, while early extra-uterine life interferes with normal brain maturation, increasing the risk of neurological impairment even in the absence of documented cerebral lesions. The early identification of children at risk for subsequent developmental problems may inspire interventions, potentially mitigating the course of otherwise persistent disabilities.[13] A humidified and heated high-flow nasal cannula is to be considered as the initial mode of ventilator support in preterm VLBW infants with respiratory distress.[14] Expressed breast milk for feeding preterm VLBW infants and absolutely no formula milk.[15] Hand washing and following "Bundle Care Approach" for central lines as the cardinal cornerstones for maintaining strict asepsis.[16] These measures will decrease the mortality and morbidity of preterm VLBW babies.

The study does have its limitations. This is a longitudinal study with a modest sample size. Being single centered with a non-randomized study design the results may not be generalizable outside of this environment. There may be an element of referral bias. Selection bias cannot be ruled out, although it looks less likely to have influenced the final outcome. The follow-up did not extend beyond 3 years. We used clinical history instead of neurodevelopmental scales since these have not been validated in local language. Nevertheless, the decent study results will act as a reference to future studies in India and across the world.

To summarize, gestational age < 32 months, mean weight < 1.2kg, respiratory distress are common risk factors for poor developmental outcomes which supports further follow-up programs from a national perspective and timely rehabilitative interventions.

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