



## Growth and Neurodevelopmental Outcome of Very Low Birth Weight Babies at 1 Year of Age

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### ABSTRACT

**Background:** *Advances in perinatal care and improved neonatal services have improved the survival rates of very low birth weight (VLBW) babies. The risk of neurodevelopmental deficit increases as gestational age decreases, which includes high risk of cerebral palsy, developmental delay, hearing and vision impairment and subnormal academic achievement. So these infants require periodic follow up for assessment of growth, sensory function and neurodevelopment for early detection and management of deficits.*

**Materials & Methods:** *This is a prospective hospital based study to study the growth and neurodevelopmental outcome of very low birth weight (VLBW) babies,  $\leq 1500$  g, in the 1<sup>st</sup> year of life. 50 consecutive VLBW babies discharged from NICU of a tertiary level centre in the Government sector were followed for 1 year. Babies with major congenital anomalies, those with of intrauterine infections and hypoplastic babies were excluded. Detailed antenatal history and events during neonatal period were noted. Gestational age of babies was determined by 1<sup>st</sup> trimester Ultrasound scan, New Ballard score and date of Last Menstrual Period. Assessment of growth was done by 3 monthly measurements of weight, length, Head circumference and interpreted using IAP charts. Development was assessed using DDST II and severe developmental delay was defined as  $DQ < 75$ . ROP screening started at 1 month by indirect ophthalmoscopy and hearing assessment was done by BERA/OAE. Assessment for intermittent illnesses/ rehospitalisations was also done.*

**Results:** *Mean gestational age of study group was 31.5 weeks and mean birth weight was 1.297 kg. At 1 year of age, 59.6% of babies had weight less than 3<sup>rd</sup> centile, 38.2% had length under 3<sup>rd</sup> centile and 6.3% had head circumference less than 3<sup>rd</sup> centile. 18% had severe developmental delay, of which 4% had cerebral palsy. 16% developed ROP, of which 14% underwent laser therapy. Myopia was detected in 62.5% and strabismus in 58% at 1 year follow up. None had hearing impairment. Two babies expired on followed up due to probable*

*meningitis. 19% were readmitted in hospital. Bronchiolitis was the major morbidity.*

**Conclusion:** *The incidence of post natal growth failure, weight less than 3<sup>rd</sup> percentile, in the study group was high. Interventions like early aggressive parenteral nutrition may be required to improve this. The incidence of cerebral palsy was comparable to other studies. Follow up for visual morbidities and developmental delay is necessary for all VLBW babies. Drawback of the study was the small sample size.*

**Keywords:** *Very low birth weight, growth, neurodevelopmental outcome.*

## INTRODUCTION

Advances in perinatal care and improved neonatal services have improved the survival rates of very low birth weight (VLBW) babies. The National Institute of Child Health and Neonatal Research Network (NICHD) established in 1986 showed that in 1995 to 1996, 84% of the VLBW cohort survived to discharge compared to 80% in 1991 and 74% in 1988 <sup>(1)</sup>. The quality of life of survivors is a matter of concern now. Hospital care of VLBW babies requires massive expenses in terms of sophisticated equipments and trained personnel. The negative health and developmental effects of these babies often extend to later life. Morbidity and mortality is inversely related to birth weight. VLBW babies are at high risk of many complications. The risk of neurodevelopmental deficit increases as gestational age decreases, which includes high risk of cerebral palsy, developmental delay, hearing and vision impairment and subnormal academic achievement. So these infants require periodic follow up for assessment of growth, sensory function and neurodevelopment for early detection and management of deficits. Half of global VLBW burden is in South Asia, with India 3<sup>rd</sup> in ranking. Despite having highest rate of hospital deliveries and excellent antenatal coverage, prevalence of LBW in Kerala remains high, with a prevalence of 19%.

## MATERIALS AND METHODS

The objective was to study the growth and neurodevelopmental outcome of very low birth weight (VLBW) babies ( $\leq 1500$ g) in the 1<sup>st</sup> year of life. This was a hospital based prospective descriptive study conducted in the neonatal ICU and outpatient clinic of newborn division of a tertiary level teaching centre in the government

sector at Thiruvananthapuram. The participants were consecutive VLBW newborn babies discharged during the study period. Babies with major congenital anomalies, those with evidence of intrauterine infections and hypoplastic babies were excluded.

50 babies (consecutive sample) with birth weight  $\leq 1500$  g who were discharged from NICU were included in study group. Detailed antenatal history including age, parity, antenatal steroid administration, and other antenatal co-morbidities were documented. Details of baby including Birth weight, gestational age, sex, APGAR score, history of complications in immediate neonatal period were recorded.

Gestational age was determined by New Ballard Score, Last menstrual period and 1<sup>st</sup> trimester antenatal Ultrasound scan. Follow up for 1 year was done and assessment of growth was done by 3 monthly measurements of Weight, Length, Head circumference using infant weighing scale, infantometer and non stretchable tape by same person and interpreted using IAP growth charts. Poor growth was defined as weight, length and Head circumference or weight-to-length ratio below 3<sup>rd</sup> centile in IAP chart.

Thorough general and neurological examination was carried out during follow up visits. Cerebral palsy was defined as a non progressive motor impairment with spastic or dystonic muscle tone, brisk tendon reflexes and persistent primitive reflexes. Developmental evaluation was done by DDST II. Severe developmental delay was defined as Developmental Quotient  $< 75$ . ROP screening was started at 1 month of age using indirect ophthalmoscopy and was classified according to ICROP <sup>(3)</sup>. Hearing evaluation was done using BERA/OAE.

Assessment for intermittent illnesses /rehospitalisation was also done. Parents were asked to keep the records of all illnesses including OP and IP treatment.

## RESULTS

Mean Gestational age of study group was 31.5 weeks and mean birth weight of study group was 1.297kg. Maternal PIH was the single most risk factor leading to preterm delivery. 58% of babies were small for gestational age and 86% of them were preterm. Of the 50 babies included in study, 48% were male, and 26% females. Most of babies had gestational age around 30 weeks. None were term babies.

Most common neonatal morbidity was Neonatal hyperbilirubinemia (56%), followed by shock (22%), apnea(14%), birth asphyxia (14%), Necrotizing enterocolitis (14%), Respiratory distress syndrome (12%), sepsis(6%),acute kidney injury (2%) and PDA(2%). Mean duration of hospital stay was 17 days. Two babies expired on follow up due to features suggestive of meningitis. On follow up at 1 year, 59.6% of babies had weight less than 3<sup>rd</sup> centile, 38.2% had length less than 3<sup>rd</sup> centile and 6.3% had head circumference less than 3<sup>rd</sup> centile. 18% had severe developmental delay at 1 year of age, of which 4% had Cerebral palsy (spastic diplegia).On Neurosonogram, babies with cerebral palsy had evidence of periventricular leucomalacia.

16% developed ROP of which 2 cases had stage 1 disease, 1 had stage 2, 5 babies had stage 3 and 2 babies had plus disease. 14% underwent laser therapy. Of them, 62.5%had myopia and 58% had strabismus at 1 year follow up. No babies had hearing impairment during follow up period. Rate of hospital readmissions was 19%.Bronchiolitis was the major morbidity.

**TABLE .1** Growth Profile Of Vlbw Babies At 1 Year Of Age-Position In Iap Centile Chart

CENTILE POSITION	<3 <sup>RD</sup> CENTILE	3-95 <sup>TH</sup> CENTILE	>95 <sup>TH</sup> CENTILE
WEIGHT / AGE	28(59.6%)	19 (40.4%)	0
LENGTH / AGE	18(38.2%)	29(61.7%)	0
WEIGHT /HEIGHT	6 (12.7%)	41 (87.2%)	0
HEAD CIRCUMFERENCE	3(6.3%)	44(43.7%)	0

**TABLE. 2** Developmental Outcome At 1 Year

DEVELOPMENTAL DOMAIN	DQ >85	DQ 75-85	DQ <75
GROSS MOTOR	38(76%)	5(10%)	4(8%)
FINE MOTOR	43(86%)	3(6%)	1(2%)
PERSONAL AND SOCIAL	43(86%)	3(6%)	1(2%)
LANGUAGE	42(84%)	2(4%)	3(6%)

## DISCUSSION

Very Low Birth weight (VLBW) babies are defined as babies with birth weight less than 1500 g. They carry a significant risk of mortality and morbidity. Developmental sequelae are major problems among VLBW babies. Long term follow up reveals a higher frequency of developmental impairments like cerebral palsy, mental retardation, motor performance problems, visual, auditory impairment, problems in cognition and behavioural development. Quality of VLBW survival is important. An expert panel constituted by members of AAP, NICHD and Vermont Oxford group has objectively defined quality of care indicators for the neurodevelopmental follow up of very low birth weight children. The panel recommended a total of 70 indicators in 5 post discharge follow up areas of general care, physical health, vision, hearing, speech and language, developmental and behavioral assessment and psycho social issues<sup>(4)</sup>.

Mean weight at 1 year of age was 7.001 kg and mean length 68.35 cm. 59.6%babies had weight for age less than 3<sup>rd</sup> centile, 38.2% had height for age less than 3<sup>rd</sup> centile and 6.3% had head circumference below 3<sup>rd</sup> centile. Ernst etal<sup>(5)</sup> studied the growth outcomes of 122 VLBW babies and found that at 12 months of corrected age, 30% remained at less than 5th percentile in weight, 21% in length, and 14% in occipitofrontal circumference. Eighteen infants (15%) had a marked discrepancy in weight for length, with a weight/length ratio less than 5th percentile.

Preterm babies are at higher risk for developing Retinopathy of prematurity (ROP) .They are also at risk of later vision disorders, such as strabismus, defective visual acuity and myopia, whether or not they ROP.<sup>(6)</sup> In this study ROP was detected in 16 % of the babies. 14% underwent

laser therapy. Of them, 62.5% had myopia and 58% had strabismus at 1 year follow up. Associated risk factors for ROP were prematurity (<32 wks), use of nasal CPAP, apnea, shock, sepsis, neonatal jaundice. Although many risk factors have been proposed only low birth weight, low gestational age and supplemental O<sub>2</sub> therapy following delivery have been constantly associated with ROP.

An association between VLBW (<1500g) and hearing loss has been long recognized<sup>(7)</sup>. The incidence of sensorineural hearing loss among NICU graduates is 0.7 to 1.5%. None of babies had hearing impairment in this study.

There is paucity of information on the neurodevelopmental outcome of very preterm babies published from resource limited settings. In a three year follow up study in KEM Hospital, Pune high risk infants weighing less than 2000g discharged from a Neonatal special care unit. Out of 336 high risk infants 4.8% had cerebral palsy and 11 % had associated MR. Sensorineural hearing loss was seen in 1.5% while 1 subject had cortical blindness<sup>(8)</sup>. The prevalence of CP among the general population is approx 2-4/1000 live births. Between 1980 and 1996 CP rates dropped from a mean of 60.6/1000 live VLBW infants to 39.5<sup>(9)</sup>. For infants born between 28 – 31 wks of gestation, over all prevalence of CP fell from 80 to 50/1000 live births. In a study done by Mukhopadhyay et al, of 101 VLBW babies available for follow up at corrected age 1 year, 3 (3%) babies had Cerebral Palsy. Their mean mental (MeDQ) and motor (MoDQ) quotients were 80.4±10.7 and 77.2±13.3 and a score of <70 was found in 17% (MeDQ) and 25.7% (MoDQ) VLBW babies<sup>(10)</sup>. In our study 18% had severe developmental delay at 1 year of age, of which 4% had Cerebral palsy (spastic diplegia). Neurosonogram revealed periventricular leucomalacia in babies with cerebral palsy. Main morbidities faced by the study group till 1<sup>st</sup> birthday are frequent hospitalizations for respiratory illnesses, growth retardation, developmental delay and visual morbidity.

## CONCLUSION

The incidence of post natal growth failure, weight less than 3<sup>rd</sup> percentile, in the study group was high. Interventions like early aggressive parenteral nutrition may be required to improve this. The incidence of cerebral palsy was comparable to other studies. Follow up for visual morbidities and developmental delay is necessary for all VLBW babies. Drawback of the study was the small sample size.

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## REFERENCES

1. Lemons JA, Bauer CR, Oh W, Korones SB, Papile L, et al. Very Low Birth Weight Outcomes of the National Institute of Child Health and Human Development Neonatal Research Network, January 1995 Through December 1996. *Pediatrics*. 2001;107(1):E1
2. An international classification of retinopathy of prematurity. II. The classification of retinal detachment. The International Committee for the Classification of the Late Stages of Retinopathy of Prematurity [published correction appears in *Arch Ophthalmol* 1987.
3. Wang JC, McGlynn EA, Brook RH, Leonard CH, Piccuch RE, et al. Quality-of-Care Indicators for the Neurodevelopmental Follow-up of Very Low Birth Weight Children: Results of an Expert Panel Process. *Pediatrics*. 2006;117(6):2080-2092.
4. Ernst JA, Bull MJ, Rickard KA, Brady MS, Lemons JA. Growth outcome and feeding practices of the very low birth weight infant (less than 1500 grams) within the first year of life. *J Pediatr*. 1990 Aug;117(2 Pt 2):S156-66.
5. O'Connor AR, Stephenson T, Johnson A, Tobin MJ, Moseley MJ, et al. Long-Term Ophthalmic Outcome of Low Birth Weight

- Children With and Without Retinopathy of Prematurity. *Pediatrics*. 2002;109(1):12-18.
6. Cristobal R, Oghalai JS. Hearing loss in children with very low birth weight: current review of epidemiology and pathophysiology. *Arch Dis Child Fetal Neonatal Ed*. 2008;93:F462-F468
  7. Chaudhari S, Kulkarni S, Pajnigar F, Pandit AN, Desmukh S. A longitudinal follow up of development of preterm infants. *Indian Pediatr*. 1991 Aug; 28(8):873-80.
  8. Modi M, Saluja S, Kler M, Batra A, Kaur A, Garg P, et al. Growth and Neurodevelopmental outcome of VLBW infants at 1 year corrected age. *Indian Pediatr*. 2013; 50:573-7.
  9. Platt MJ, Cans Christine, Johnson A, Surman G, Topp M. Trends in cerebral palsy among infants of very low birthweight (<1500 g) or born prematurely (<32 weeks) in 16 European centres: a database study. *Lancet*. 2007; 369:43-50.
  10. Mukhopadhyay K, Malhi P, Mahajan R, Narang A. Neurodevelopmental and behavioral outcome of very low birth weight babies at corrected age of 2 years. *Indian J Pediatr*. 2010;77(9): 963-7.