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Early Motor Developmental Trajectories of Pre Term Infants With Very Low Birth Weight - An Observational Study

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Abstract

Introduction: Very low birth weight (VLBW) is a term used to describe babies who are born weighing less than 1,500 grams (3 pounds, 4 ounces). Infants who are born preterm with low birth weight and secondary to intrauterine growth restriction, can be subjected to increased morbidity, mortality, and cost [5]. Babies with a very low birth weight are at a higher risk of motor development, depression, Attention deficits and other psychiatric conditions in adulthood, compared with those born a healthy weight [6]. The purpose of this study is to find out the effect of very low birth weight and gestational age on motor development in preterm infants at 18 months of corrected age.

Materials and Methods: This study is a observational study design and was conducted in VAPMS College of Physiotherapy, outpatient Department and R.K. MISSION hospital. A study sample of 50 subjects was selected on simple random sampling method. The study questionnaire was applied and the infants were prospectively evaluated using Alberta Infant Motor Scale (AIMS) for their gross motor development at 18 months of corrected age. The observational study was done for 20 minutes for each infant. In addition, the perinatal and the socio-environmental data were obtained from the parental interview. The assessment emphasizes the anti gravity movement of the limbs in prone, supine, sitting and standing positions, postural alignment, weight bearing of the body with further evaluation in attainment of gross motor skills.

Results: The sample was segregated into three sub group model and thus identified 3 motor trajectories among VLBW preterm infants: stably normal (n=36), slightly deteriorating (n=11), persistently delayed (n = 3). Infants with a normal trajectory manifested the typical motor performance with AIMS Z scores of 0.4 to 0.5. Infants with deteriorating trajectory displayed the motor performance in the typical range initially but then deteriorated from 12 months. Infants with a persistently delayed trajectory revealed a significant delay from 9 months. All the infants were observed at 18 months of corrected age.

Conclusion: The study concluded that very low birth weight has a significant effect on the motor development observed in preterm infant. The early motor trajectories were also a predictive of subsequent developmental outcomes in preterm infants specifically with VLBW. In addition the study emphasizes that socio-environmental factors are not associated with motor trajectories in preterm infants with VLBW.

Keywords: Very low birth weight; Preterm infant; Gross motor trajectories

Introduction

Preterm birth, which is defined as a birth that takes places before the completion of 37 weeks of pregnancy, occurs in 12–13% of live births in the USA and in 5–9% of live births in other developed countries. It is the leading cause of perinatal morbidity and mortality in developed countries. Very low birth weight babies are often born before 30 weeks of pregnancy [1, 2]. It is probably due to the greater numbers of multiple birth babies who are more likely to be born early and weigh less [3]. There are sub-categories of preterm birth, based on gestational age. They are extremely preterm (less than 28 weeks), Very preterm (28 to 32 weeks), Moderate to late preterm (32 to 37 weeks) [4].

A premature baby has less time in the mother's uterus to grow and gain weight. Low-birth-weight infants, born after a preterm birth or secondary to intrauterine growth restriction, account for much of the increased morbidity, mortality, and cost [5]. Infants who are very preterm (born < or = 32 weeks of gestation) and very low birth weight (VLBW) (weighing < or = 1500 g) can be at risk of delay in gross motor, fine motor and visual motor integration and will exhibit poor developmental outcomes. Preterm birth is associated with neurological injury that results in neuro-sensory, motor, and severe cognitive disabilities and as a result, even though preterm children do not frequently exhibit severe damages, many children with a wide range of gestational ages can present with low-severity impairments [6].

Research implies that birth weight has a close relationship with infant mortality, neonatal mortality (NM) and postnatal mortality (PNM) besides the gestational age and gender of the new born. The lower the birth weight and the gestational age, the greater is the chance of death in the first year of life. Every year, an estimated 15 million babies are born preterm (before 37 completed weeks of gestation), and this number is rising. Seventy five percent of these deaths could be prevented with early detection and cost effective interventions. Across 184 countries, the rate of preterm birth ranges from 5% to 18% of babies born [4].

More than 60% of premature births occur in Africa and South Asia, and this is truly a global problem. In the lower-income countries, on average, 12% of babies are born too early compared with 9% in higher-income countries [8]. Birth weight is one of the most accessible variables in epidemiology. Moreover, as motor development is multifactorial, the role of socioeconomic and cultural factors should also be analysed. This topic has been chosen as the area of research relating to the motor trajectories in very low birth weight on gross motor development of pre term infants which has been less explored and the findings are inconsistent.

The aim of this study is to identify the motor trajectories in Preterm infants with very low birth weight at 18 months of corrected age. This study was done on 50 preterm infants. The study objective is to assess the gross motor development of premature infants, evaluated through Alberta Infant Motor Scale (AIMS), to identify the developmental outcomes at 18 months of corrected age (CoA).

Materials and Methodology

This is an observational research approved by the Institutional Ethics Committee (REG NO: EC/NEW/INST/2019/397) (SERIAL NO: AMC/JUNE 2021).

This study included 50 preterm infants with very low birth weight. The infants were assessed for gross motor development at 18 months of corrected age using Alberta Infant Motor Scale (AIMS). The observational study was done for 20 minutes on each infant.

During motor evaluation, the infants were placed in different positions like supine, prone, sitting and standing and the infant was observed for 5 minutes in each position respectively. Only sensory-motor stimuli were performed with the use of sound emitting and colored toys. Further the perinatal and the socioeconomic data was obtained from the parental interview. Perinatal variables included infant's gender, gestational age, birth body weight and Folic acid supplementation of the mother. Socioeconomic variables include the parent education background (high, moderate and low), Ethnicity which includes the Dravidian group and whether any type of intervention is received in clinic or home for treating the developmental delay. All the assessments were recorded in a file.

The test was performed in a quiet room with adequate space and toys required for assessment and adjustable room temperature. The child was observed in the evaluation room in the presence of the mother and she was active and awake during the assessment. Toys were used to encourage and prompt some children to move to different positions. This assessment took approximately 45 minutes per infant, including waiting for the infant to adjust to therapist and surroundings. Informed consent was obtained from the parents of all the subjects before participation in the study.

Outcome Measures

Assessment tool and procedure: Alberta Infant Motor Scale (AIMS)

The Alberta Infant Motor Scale (AIMS) is an instrument indicated for the assessment of children's motor development from birth up to 18 months of age. The scale contains 58 items distributed into four sub-scales that describe the development of spontaneous movement and motor skills in prone, supine, sitting and standing postures. It also identifies infants who have a delay in gross motor development. The least and most observed items in each position are defined as 'window' of current motor development. AIMS is graded on a score sheet as observed items (one point) or not observed (zero point) within this window, a manual is available to provide more details on scoring movements.

The total score is the sum of the scores in prone, supine, sitting and standing positions, which range between 0 to 58. Higher scores indicate better motor development. The raw score is converted to a percentile ranking which can be compared with normal age. Below the 10th percentile of the motor development was classified as abnormal.

AIMS have many advantages such as easy evaluation through observation, it is non-invasive and can be applied quickly (approximately 20-30 minutes) and does not require excessive handling of the child. All the gross motor development at 3, 6, 9, 12 and 18 months were evaluated by parental interview. The perinatal and socio economical data was also obtained from the parental interview.

Results

The AIMS Z scores across ages were analyzed to identify sub groups with similar motor trajectories during the first year of life. The statistical analyses were performed using SPSS version 2.0 for Windows. The quantitative variables were presented as means with standard deviations. The mean AIMS scores, standard deviations and percentiles were calculated.

The three sub group model was selected to identify the motor trajectories among VLBW preterm infants: stably normal (n=36), slightly deteriorating (n=11), persistently delayed (n = 3). Infants with a normal trajectory showed a typical motor performance with AIMS Z scores of 0.4 to 0.5 at 18 months of corrected age. Infants with deteriorating trajectory had an initial motor performance within the typical range and then deteriorated from 12 months. Infants with a persistently delayed trajectory had demonstrated a significant delay from 9 months.

Motor trajectory	*No. of infants*	*Individual raw scores*	*Z scores*
Stably normal	36	35infants - 58 1 infant - 57	35 infants = 0.433 1 infant = 0.5
Slightly deteriorating	11	6 infants - 55 4 infants - 54 1 infant - 53	6 infants = 0.7 4 infants = -0.66 1 infant= -2.11
Persistently delayed	3	1 infant:31 1 infant:34 1 infant:39	1 infant: -0.9 1 infant: - 0.16 1 infant: 1.07

Table 1: Showing the motor trajectory, number of infants, individual raw scores and Z scores.

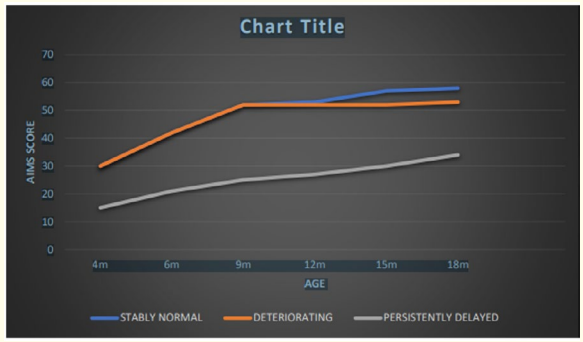

Figure 1: Mean AIMS raw scores for the 3 motor trajectories in preterm infants with VLBW at 3,6,9,12 and 18 months of corrected age.

Discussion

The present study was conducted with children born prematurely to determine reference values and categorization of motor performance using the AIMS as an outcome measure. The results indicate that preterm infants during the first year of life, present different motor trajectory when compared to those with full-term. The results of this study showed that during the first year of life, preterm infants with VLBW manifested 3 gross motor trajectories: stably normal, deteriorating and persistently delayed. With reference to the previous research that categorized preterm infants into stable or unstable motor patterns, our results were based on statistical inferences that provided a valid description of the trajectories.

Preterm infants exhibited 3 motor trajectories during their first year of life: stably normal, deteriorating and persistently delayed. Furthermore, the early motor trajectories were predictive of subsequent developmental outcomes in preterm infants with VLBW [33].

A total of 50 preterm babies aged between 18 to 24 months were selected considering the correction of gestational age. The study included infants who were preterm, with birth weight less than 1500gm and with no congenital abnormalities. Infants with neonatal conditions such as Periventricular leukomalacia (PVL), Grade 3 to 4 ventricular hemorrhage (IVH), stage 4 Retionopathy of prematurity (ROP) were excluded.

According to a study done by I C Van Haastert [37], children with PVL grades III and IV did not achieve the potential to walk independently compared to grade I and II. They are more dependent on environmental modifications for daily activities, on mobility devices and support from others.

This study considers the socioeconomic factors which include parental education level and if the infant was receiving an intervention program. A study done by Paraskevi Styliau Riga [44], demonstrate the association of parental education, socio economic factors with prematurity and low birth weight.

AIMS scale was used to assess the gross motor development of children from birth to 18 months of age and provides raw scores. The sample were observed in different positions like prone (21 items), supine (9 items), sitting (12 items) and standing (16 items) which represent the sequence of motor acquisitions development. The total score also can be converted into a percentile rank. According to Busra Kepenk Varol, High percentile ranks indicate maturity of the infant's gross motor skills [45].

The 3 sub group model identified the motor trajectories among the VLBW infants preterm infants: stably normal (n=36, 72%), slightly deteriorating (n=11, 22%) and persistently delayed (n=3, 6%). Infants with a stable motor trajectory had a typical motor performance with AIMS Z scores of 0.1 at 18 months. Infants with a slightly deteriorating motor performance have recorded AIMS Z scores of -0.66, -2.11and 0.68 at 18 months. Infants with delayed motor trajectory exhibited AIMS Z scores between -0.16 and 1.07.

Preterm infants with a deteriorating motor trajectory showed borderline motor delay after 6 months of age, providing evidence for the existence of specific development and postural acquisitions, in a different rhythm than their full-term peers and with variation in the quality of the movements, with developmental trajectory differences observed. Preterm infants with a persistently delayed trajectory relatively exhibited poor motor performance, suggesting that they require intensive therapy at early stages to enhance their development. The study therefore provides useful strategies to plan clinical decisions regarding the developmental trajectory and interventions for preterm infants with VLBW.

This finding is further strengthened by the fact that preterm infants were relatively "healthy," as the study excluded neonatal diseases which are known with increased risk for abnormal motor development. The significantly lower gross motor maturity of preterm infants is associated with some neonatal morbidity factors, including RDS, IVH, and ROP. Morbidity factors should be taken into account in decision making for early intervention or physical therapy in these infants.

The results emphasize that preterm infants with VLBW have to be closely monitored during the early years of life for the motor development in the presence or absence of risk factors. It has been observed that preterm infants without any risk factors have obtained their motor skills similar to the term infants, but at a slower pace. Our results also show that the infants who have been assessed in the early months of life and those who scored abnormal can evolve to normal motor development in the later years of life.

This study had some limitations namely the sample size taken was small. Only gross motor skills were observed. Further studies are recommended to have a larger sample size, longer duration with follow up. Infants with neurological conditions and congenital abnormalities should also be included and assessed.

Conclusion

The importance of this study for the adequate evaluation of premature children was highlighted, since the essential intervention will only be possible through adequate screening. In this research, the percentages described indicate that preterm infants presented lower motor performance than full-term children and that the AIMS has discriminate ability for the clinical evaluation of these children The early motor trajectories were predictive of the subsequent developmental outcomes in preterm infants with very low birth weight. These when identified early may improve the early detection and prevention of developmental disorders in preterm infants with VLBW.

In this study, 72% of the preterm infants exhibited a stably normal motor trajectory, 22% of them have exhibited a slightly deteriorating motor trajectory and 6% have shown a persistently delayed motor trajectory. Thus, the use of the standards determined in this study to evaluate premature infants is recommended which would help to identify the delay in motor development and also establishes a plan for intervention. The socioeconomic factors however were not associated with motor trajectories in preterm infants with VLBW.

Author's Contribution

First author has contributed in the conception and design of the work, Second author has contributed in collection of data and supervising the protocol. Draft analysis, Interpretation of data and final revision of the article was done by both of them.

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