The growth assessment of very low birth weight infant at corrected two years old

Original Article

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Received: 22 June 2019
Revised: 25 July 2019
Accepted: 28 Aug 2019

Abstract

Background: The aim of this study was to determine the growth status of very low birth infant at corrected age of two years.

Methods: This cross-sectional study was performed on all babies with birth weight ≤1500 gr without any congenital anomalies, genetic disturbance and chronic disease (e.g. cardiopulmonary insufficiency, cholestasis, malabsorption). They were called at corrected age 2 years, namely the calendar age by month + (40-gestational age by week). Their height, weight and head circumference were recorded and a nutritional check list was prepared. The values were entered into the WHO Standard Growth Curve Chart for male and female genders (CDC, November 2009) in the <10th, 10-49th, 50-89th and ≥90th percentiles.

Results: Forty-three children with mean gestational age of 30.08±3.23 weeks and mean birth weight of 1163.95±240.77 g were studied. Thirteen cases (30.2%) in length, 10 cases (23.3%) in weight, 6 cases (14%) in head circumference and 17 cases (39.5%) in weight-for-height were below the 10th percentile. There was no significant difference between the sex, gestation age and the birth weight of these children below and above the 10th percentile (P<0.05).

Conclusions: According to the findings of this study, about one-third of infants born ≤1500 grams were below 10th percentile for height, and nearly a quarter of them were under10th percentile for weight at corrected 2 years old. Therefore, their growth should be more accurately controlled by health care centers based on the growth curve in the first year and any problem case should be referred to specialized centers.

Keywords: Growth, Premature, Preterm Infant, Very Low Birth Infant

Citation:
Akbarian Rad Z, Hajiahmadi M, Verich Kazemi M, et al. The growth assessment of very low birth weight infant at corrected two years old. Caspian J Pediatr Sep 2019; 5(2): 353-7.

Introduction

Every year, 25 million babies with birth weight ≤1500 grams (very low birth weight (VLBW)) are born in the world and 90% of them are in developing countries [1]. By improving the conditions for the care and treatment of these infants, nowadays, most of them, requiring special growth monitoring are discharged from NICUs. A systematic review study on VLBW and low birth weight (LBW) cases in Africa has shown a strong correlation between LBW and growth retardation with delayed neuronal development and mortality [2]. On the other hand, the nutritional disorders are very common among these groups of neonates and infants, and unlike term infants, there is still no international or national consensus on the nutritional status of these babies [3]. The main goal of feeding in premature baby is to allow the process of intrauterine weight

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[DOI: 10.22088/CJP.BUMS.5.2.353]

gain for the same gestational age, but achieving this goal of nutrition and growth is very difficult and most preterm infants will be less likely weight at discharge time from hospital. More than half of the babies weighing ≤1500 gr were under 10th percentile for weight at the time of discharge from NICU. In this study, high levels of urea had an inverse relationship with weight gain [4].

Postnatal growth failure (PGF) is defined when these babies have weight below 10th percentile for their gestational age which has been 50.3% in other study [5].

PGF can cause permanent harmful effects including neuro-developmental delay, ischemic heart disease, glucose intolerance, diabetes mellitus type II, hypertension and metabolic syndromes [6], and the impact of growth on the neuro-development of extreme LBW (ELBW) infants is much more important [5].
For example, in a Taiwanese study that looked at the growth of VLBW at age 5, abnormality in weight, length and head circumference showed10.3%, 8.7% and 16% respectively [6].

Lee et al. reported that growth disturbance was more severe in VLBW neonates with small for gestational age (SGA) than those with appropriate for gestational age (AGA), and the SGA group had lower weight at 3-6 years old [5].

In few studies ELBW infants were fallowed until 14 years old for growth and showed that they had dilated weight and length versus control group [7, 8]. On the other hand in a study that fallowed ELBW until 20 years old showed this group of babies will have an appropriate length with their presents [9], According to the Fenton Chart [10] the growth of these babies can be followed, but in our country's health care program, the use of this chart has not been operational yet.

The aim of this study was to determine the frequency of growth disturbances in VLBW babies discharged from NICU, a center for maternal and neonatal care, with up to date information. In addition, the purpose of the current study was to plan more accurately for monitoring and caring of these infants at urban and rural health centers.

Methods

This cross-sectional study was conducted on VLBW infants (≤1500 grams) discharged from NICU of the Ayatollah Rohani Hospital affiliated by Babol University of Medical science from April 2016 to June 2017.

At first, infants born two years ago (from April 2015 to the end of March 2016) with ≤1500gr weight were identified.

Babies without congenital anomalies such as cardiovascular, gastrointestinal, neurological and genetic disorders were entered into the present study. Other inclusion criteria were absence of chronic diseases such as cardio-pulmonary failure, cholestasis, absorption disorders and renal failure at the time of discharge.

All these babies were discharged with a weight of 1500-1600 grams, full oral feeding with human milk (±fortifiers) or premature infants formula, multi-vitamin drop and recommendations for using oral iron supplementation (time of birth weight doubling or two months old) and zinc.

They were called at corrected age of 2 years [24 months+(40 weeks- gestational age)]. Their weight, length and head circumference were measured by a trained nurse.

We used the Seca scale (made in Germany) for weighing, the Seca plastic height gauge (made in Germany) in supine position on the bed for length and plastic tape-cloth centimeter for head circumference.
The measurements were recorded on the WHO Standard Growth Curve Chart (CDC November 2009) and classified in the percentiles $<10^{th}$, $10\text{-}49^{th}$, $50\text{-}89^{th}$ and $\geq 90^{th}$.

Data were analyzed using SPSS 8. To compare the qualitative variable of gender in groups $<10^{th}$ percentile or more, the Chi-square test was used and independent t-test was applied for quantitative variables of birth weight and gestational age.

Checklist of demographic data with nutritional information in the first and second six months, as well as the second year was completed.

Results

From April to March 2015, 63 neonates ≤1500 g were discharged from the NICU of Rohani Hospital. Seven cases had chronic illnesses, and finally, 55 ones were entered into the present study.

They were invited by phone call to refer this center at corrected 2 years old to assess the child and 43 of them responded to the call (fig.1). Twenty (46.5%) and 23 (53.5%) were boy and girl, respectively. The average gestational age of these children was 30.08±3.23 weeks and the average birth weight was 1163.95±270.77 gr.

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[DOI: 10.22088/CJP.BUMS.5.2.353]

The frequency of each growth index in percentile is presented in table 1. In terms of weight, 23.2% of the studied populations were <10th percentile and based on weight-for-length and head circumference were 39.5%, and 14% respectively, for the cases <10th percentile.

According to weight, the boys were more at the 10-49 percentile (35%) and girls at 50-89 percentiles (34.8%). In terms of length, the boys were more at the 50-89 percentile (35%), girls at 50-89 (34.8%) and <10 (34.8%) percentiles. Based on head circumference, both genders were more at the 49-10 percentile (50% boys and 56.5% girls). Weight-for-length in boys was more at 10-49 (50%) and in girls <10 (47.8%).

There was no statistically significant difference between two genders in any growth indices.

Comparing the <10th percentile with other groups (All groups≥10th percentile) showed that the mean gestational age was 31.8±4.28 and 28.57±2.72 weeks, respectively (P=0.054).

The mean birth weight in the group <10th percentile and other groups was 1166±293 and 1163.33±227.9 grams, respectively (P=0.976).

During the first 6 months, 40 cases had a history of using premature infant formula or human milk fortifier with breast milk. During the second 6 months, 9 and 6 cases were fed with breast milk and formula, respectively and 25 ones of both groups were fed with supplemental nutrition.

There was no significant relationship between <10th percentile and other groups on breast milk, formula or both combination. (P>0.05)

Based on the history, zinc supplementation was not received or received irregular and for a short time. Oral iron supplementation was obtained by all cases, except one, up to 2 years of age. A multivitamin or A+D drop was taken until the end of one year and thereafter received irregularly.

Table 1: Frequency of variables: weight, length, head circumference, and weight to length ratio in preterm infants

percentile / Variable	<10 N(%)	10-49 N(%)	50-89 N(%)	≥ 90 N (%)
Weight	10(23.2)	14(32.6)	14(32.6)	5(11.6)
Length	13(30.2)	7 (16.3)	15(34.9)	8(18.6)
Head circumference	6(14)	23(53.4)	11(25.6)	3(7)
Weight / length	17(39.5)	13(30.3)	9(20.9)	4(9.3)

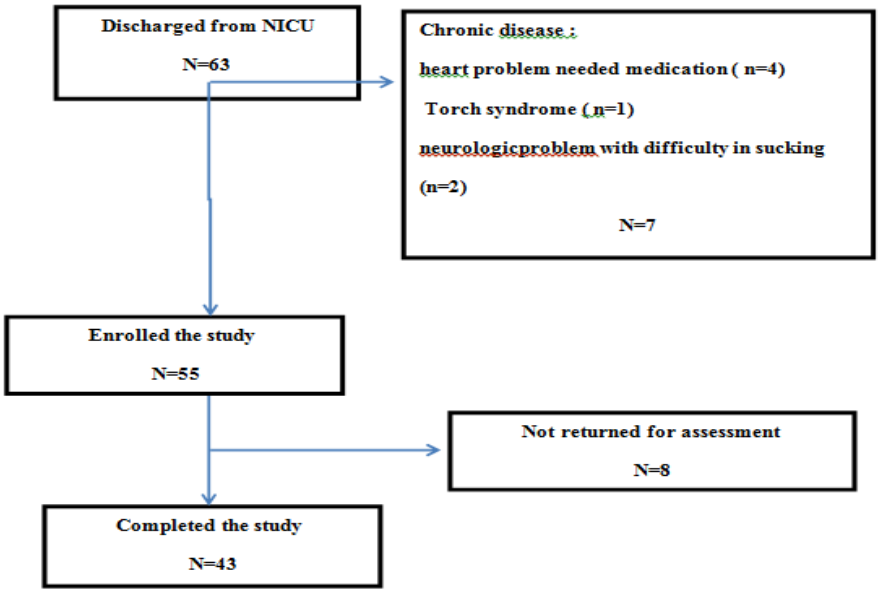

Figure 1: Flowchart of study selection

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[DOI: 10.22088/CJP.BUMS.5.2.353]

Discussion:

This study about a quarter of children was under the 10th percentile in terms of weight, and in terms of length, weight-for-length and head circumference was 30%, 40% and 14% respectively. Accordingly, it seems that these children had an inappropriate status of length and weight-for-length.

However, in a study in Cameroon on the short-term growth (6 months) of VLBW babies, all infants at 6 months of age had enough weight gain which was comparable to that of term infants, and the growth of length and head circumference with a delay afterwards reached the values of the term infants [1].

Nevertheless, the mean weight of infants was higher than that in this study [1] (1390 g compared to 1163 g). As noted in our study, the mean birth weight or gestational age had no significantly effect on growth at 2 years old, although we did not know about the growth status of babies at 6 months of age.

Six months of age are important because of starting supplemental nutrition and after that time, nutritional disturbances may change the growth trend.

Gao et al. also suggested that the premature babies had an adequate weight gain at 6 months of age but multiple gestation and history of intrauterine growth restriction (IUGR) increased the risk of postnatal growth retardation and they recommended that this risk could be reduced by appropriate and reasonable nutritional interventions [11].

Comparison of growth variables was different based on gender, which was not statistically significant; thus, the gender has no effect on how they grow.

The mean gestational age and birth weight in the group <10th percentile compared to other groups did not differ significantly. So, it seems that children <10th percentile were not necessarily those with lower birth weight or less gestational age, and factors affecting growth are mainly dependent on postnatal factors.

Howsoever, Soon Lee et al. reported that the growth disorder incidence in VLBW infants with SGAs was almost twice as the AGA group [5]. Unfortunately, in the present study, no valid records of SGA status of patients were available. For this reason, there was no possibility of comparison of this variable.

In a systematic review study by Fenton in 2013, the growth curve was revised for preterm children. In the previous Fenton's curve (2003), a growth chart was used for both male and female infants. While in the new chart, it can be found that all three parameters including weight, length and head circumference for girls are slightly lower than those for boys and this is because of slightly higher curve in boys after the 40th week and the maximum is in the 50th week. This difference is especially more in the length growth of boys than girls [10].

In a further study by Bertino et al., it has been observed that the VLBW infants at corrected age of 18 months reach a maximum of 25th percentile in the standard growth curve. The authors concluded that this group of infants should have different growth curves [12].

Sallivan et al. evaluated the growth of height, weight and body mass index (BMI) of VLBW infants from birth to 12 years old. They stated that the premature baby had an appropriate BMI at age 4, as well as this group of children demonstrated catch-up growth at age 6-9 [13]. In another study in southern Brazil, the growth of VLBW infants at corrected age of 40 weeks, 6 and 12 months, and it was found that they reached the standard weight growth of 57.8, 82.2 and 92%, respectively. These values were 50.9, 82 and 86.9% for length, respectively. In the current study, the growth of head circumference was slightly better than that of two others with 93.4% and 85% at corrected age of 40 weeks and 12 months, respectively [14].

In conclusion, Based on the findings of this study, about one-third of VLBW were below 10th percentile for height, and nearly a quarter of them were under10th percentile for weight at corrected 2 years old.

The authors suggest that, growth monitoring program for VLBW babies in health care center should be followed during the first 2 years after birth and emphasized careful monitoring of nutritional supplementation in this group of babies.

Acknowledgement:

The present study was supported by Babol University of Medical Sciences. The authors would like to thank the Clinical Research Development Unit of Rouhani Hospital.

Funding: This study was supported by a research grant from the Non-Communicable Pediatric Diseases Research Center of Babol University of Medical Sciences (Grant Number: 9337621).

Ethical approval: This study obtained ethics committee of Babol University of Medical Sciences (MUBABOL.REC.1393.23).

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[DOI: 10.22088/CJP.BUMS.5.2.353]

Conflict of Interest: The authors have no conflict of interest.

References:

Mah EM, Chiabi A, Chetcha AB, et al. Evaluation of short-term growth in very low birth weight preterm infants at a tertiary hospital in Cameroon. J Clin Neonatol 2016; 5(4): 247-53.

2. Tchamo ME, Prista A, Leandro CG. Low birth weight, very low birth weight and extremely low birth weight in African children aged between 0 and 5 years old: a systematic review. J Develop Orig Health Dis 2016; 7(4): 408-15.

3. Villar J, Giuliani F, Barros F, et al. Monitoring the postnatal growth of preterm infants: a paradigm change. Pediatrs 2018; 141(2): e20172467.

4. Avila-Alvarez A, Boga AS, Bermúdez-Hormigo C, Carballal JF. Extrauterine growth restriction among neonates with a birthweight less than 1500 grams. Anales de Pediatría (English Edition). 2018;89(6):325-32.

5. Lee SM, Kim N, Namgung R, et al. Prediction of postnatal growth failure among very low birth weight infants. Scientif Rep 2018; 8(1): 3729.

6. Wang PW, Fang LJ, Tsou KI, Group TIDCS. The growth of very-low-birth-weight infants at 5 years old in Taiwan. Pediatrs Neonatol 2014; 55(2): 114-9.

7. Ford GW, Doyle LW, Davis NM, Callanan C. Very Low Birth Weight and Growth Into Adolescence. JAMA Pediatrics 2000; 154(8): 778-84.
8. Peralta-Carcelen M, Jackson DS, Goran MI, et al. Growth of adolescents who were born at extremely low birth weight without major disability. The Journal of pediatrics 2000; 136(5): 633-40.
9. Doyle LW, Faber B, Callanan C, et al. Extremely low birth weight and body size in early adulthood. Archives of disease in childhood 2004; 89(4): 347-50.
10. Fenton TR, Kim JH. A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants. BMC Pediatrs 2013; 13(1): 59.
11. Gao XY, Feng L, Xu J, Pan XN. [Follow-up observation of catch-up growth of preterm infants after discharge and risk factors for extrauterine growth retardation]. Chin J Contempor Pediatrs 2018; 20(6): 438-43.
12. Bertino E, Coscia A, Mombro M, et al. Postnatal weight increase and growth velocity of very low birthweight infants. Arch Dis Childhood Fetal Neonatal Edit 2006; 91(5): F349-56..
13. Sullivan MC, McGrath MM, Hawes K, Lester BM. Growth trajectories of preterm infants: birth to 12 years. J Pediatr Health Care 2008; 22(2):83-93.
14. Oliveira MG, Silveira RC, Procianoy RS. Growth of very low birth weight infants at 12 months corrected age in Southern Brazil. J Trop Pediatrs 2007; 54(1):36-42.

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