



ORIGINAL ARTICLE

The Growth of Very-low-birth-weight Infants at 5 Years Old in Taiwan



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Key Words

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Background: The goal of this study was to compare the growth and effect of growth on cognitive performance at 5 years of age of a group of very-low-birth-weight (VLBW) infants and a group of healthy full-term infants.

Methods: Beginning in 1995, under the sponsorship of the Premature Baby Foundation, the Society of Neonatology, Taiwan, conducted a multicenter follow-up study of VLBW infants in Taiwan. The study enrolled 322 VLBW infants and 103 controls for assessment of growth data and cognitive performance at several time points from birth through to 5 years of age. Growth data were assessed with measurements of weight, height, and head circumference taken at the ages of 6 months, 12 months, 24 months, and 60 months. Cognitive performance was assessed at the age of 5 years. The VLBW infants were regarded as "failed" if a measurement was 2 standard deviations below the mean measurement of the control group. Neonatal and perinatal data had been collected prospectively as part of a longitudinal study. Cognitive performance was assessed using the Chinese version of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-R).

Results: From 6 months to 5 years, VLBW infants had lower weight, height, and head circumference than the controls. Two hundred twenty-four VLBW infants (69.6%) returned for assessment at 5 years old. Of the 224 VLBW infants, complete sets of measurements of weight, height, and head circumference were obtained for 126 cases (56.3%), 127 cases (56.7%), and 106 cases (47.3%), respectively. Of these, 13 patients (10.3%) failed in weight, 11 patients (8.7%) failed in height, and 17 patients (16.0%) failed in head circumference at the age of 5 years. The mean WPPSI-R scores at the age of 5 years for VLBW children were: 94.1 ± 16.4 (performance IQ), 87.2 ± 12.8 (verbal IQ), and 89.5 ± 14.6 (full IQ). All of these values were

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also lower than those of the control group, with the differences being statistically significant ($p < 0.05$). The WPPSI-R scores of VLBW children who failed in head circumference were notably lower than those of VLBW children whose head circumference had caught up with that of their peers.

Conclusion: The growth of VLBW infants was lower than that of healthy full-term infants through 5 years of age. The cognitive performance for VLBW children was also decreased compared to that of the control group, and there was an association between slower growth and decreased cognitive ability.

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1. Introduction

Following the tremendous progress in neonatal intensive care, particularly in developed countries, the survival of very-low-birth-weight (VLBW) and extremely-low-birth-weight (ELBW) infants has improved dramatically. In most modern perinatal centers in North America and Europe, neonatal deaths are uncommon among infants with birth weights higher than 1000 g in the absence of congenital anomalies.^{1,2} Therefore, many studies have traced the long-term outcomes of VLBW infants in those countries.

Among the long-term complications linked to prematurity, the growth pattern of VLBW infants has been of great concern to parents and medical professionals alike because growth after discharge is a good measure of physical, neurologic, and environmental well-being.¹ Although “catch-up” growth has been reported, large-sample studies have revealed the persistence of poor growth among VLBW from birth through adolescence.^{3,4} In addition, it has been estimated that approximately half of VLBW infants develop cognitive and behavioral deficits.⁵

Recent studies in Taiwan have also demonstrated improvement in overall perinatal and neonatal mortality and increasing survival of VLBW and ELBW infants over time.⁶ However, limited information is available on longer-term growth outcomes of such infants in Taiwan. Prior to our study, their cognitive performance had not been studied in Taiwan. Beginning in 1995, under the sponsorship of the Premature Baby Foundation, the Society of Neonatology, Taiwan, conducted a follow-up study of VLBW infants in Taiwan.

In 2003, we reported growth outcomes of VLBW infants at 2 years.⁷ Some of these infants were followed for up to 5 years, and this article describes their long-term growth outcomes and cognitive performance.

2. Methods

In 1995, the Society of Neonatology, Taiwan, under the sponsorship of the Premature Baby Foundation, began an ongoing, prospective research project. Between January 1, 1995 and June 30, 1996, 436 VLBW infants were discharged from 19 hospitals located throughout the island of Taiwan. The infants were followed-up and their growth assessed until they were 2 years old. The children were measured for weight, height, and head circumference in the individual

follow-up clinics at 6 months, 12 months, and 24 months of age.⁷ Because of limited funds and manpower, a group of 322 infants born at three hospitals (National Taiwan University Hospital, Mackay Memorial Hospital, and Women and Children's Campus, Taipei City Hospital) in the northern region was recruited for follow-up to 5 years of age. Of these infants, 224 infants returned to the follow-up clinic for measurements of their weight, height, and head circumference. Cognitive testing was performed at the same follow-up sessions. Cognitive performance was assessed using the Chinese version of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-R), which was administered by trained psychologists. The WPPSI-R provides subtest and composite scores that measure intellectual functioning in verbal (VIQ) and performance (PIQ) cognition; the instrument also provides a composite score that reflects a child's general intellectual ability (full IQ, or FIQ).

In addition, maternal characteristics, including socioeconomic status, perinatal factors, and some morbidity data likely to influence weight, height, and head circumference, were recorded. A total of 103 infants born at gestational ages from 37 weeks to 42 weeks in the three hospitals served as controls. The VLBW infants were regarded as “failed” if their weight, height, or head circumference was 2 standard deviations (SD) below the mean value of the control group.

All data were presented as mean \pm standard deviation (SD). The level of statistical significance was set at $p < 0.05$. The Chi-square test was used for noncontinuous data, and the Student *t* test or Mann-Whitney U test was used for continuous data. The maternal characteristics, perinatal factors, and neonatal morbidity data were collected and analyzed using multivariate logistic regression.

3. Results

The mean birth weight for the 322 VLBW infants was 1164 ± 228 g (range: 586–1500 g), and the mean gestational age was 29.4 ± 2.6 weeks (range: 24–36 weeks). Mean birth weight for the 103 control infants was 3309 ± 379 g (range: 2590–4550 g), and the mean gestational age was 39.2 ± 1.1 weeks (range: 37–42 weeks).

Maternal socioeconomic status, perinatal factors, and neonatal morbidity of the VLBW cohort are presented in [Table 1](#). Growth data for VLBW and control (full-term)

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