Perinatal Conditions and Early Assessment of Low-Birth-Weight Premature Infants

ORAWAN LOUTHRENOO, M.D.*,
SOMPORN CHOTENARUMOL, M.D.**

Abstract

The developmental assessment of 60 low-birth-weight premature infants, who had no major handicap, was compared with that of 30 term infants at a chronological age of 6 months. Both groups showed no statistically significant differences in mean scores for the Bayley Scales of Infant Development, but the premature group was more likely to have a clinically significant lower function. The premature infants' mental performance had a significantly inverse correlation with the number of days spent in hospital. Follow-up was essential for this group of children in obtaining the early detection of any handicap and performing timely therapeutic intervention.

Key word : Prematurity, Low-Birth-Weight, Development, Bayley Scales

LOUTHRENOO O & CHOTENARUMOL S
J Med Assoc Thai 2001; 84: 917-922

Premature infants are at greater risk of chronic medical, neurodevelopmental, and behavioral problems, due to the associated medical complications of prematurity[1,2]. Neurodevelopmental, neurosensory, and functional morbidities increase with decreasing birth weight[3]. The adverse developmental outcome of premature infants with low-birth-weight (LBW; birth weight less than 2,500 g) has been described as cerebral palsy, mental retardation, and sensory deficits during infancy and childhood. These conditions require early detection and appropriate intervention[4], as the effects of intervention are reported greater at the early stage of childhood than in the long term[5-8]. With improvements made in neonatal care, a majority of these infants can survive without a major handicap[2,9]. It is reported that infants with very low-birth-weight (VLBW; birth weight less than 1,500 g) catch up in

* Division of Developmental and Behavioral Pediatrics,
** Division of Neonatology, Department of Pediatrics, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.

growth during infancy and childhood[10]. However, growth problems that may persist for up to 12 years of age have also been reported[11]. Nevertheless, VLBW infants are still prone to having a handicap and they score significantly lower in all fields of behavior than term infants do[12]. A metaanalysis showed that the average developmental or intelligence quotient of LBW infants was significantly lower than that of the control, while there was no difference among those with LBW, VLBW, and extremely low-birth-weight (ELBW; birth weight less than 1,000 g)[13]. The detection of a mental handicap in each individual LBW premature infant is difficult[4].

The assessment of developmental performance, using a standard assessment tool in premature infants, has not been widely performed in Thailand. This report evaluated the early developmental outcome of premature infants who survived and avoided a major handicap, in comparison with healthy term infants, by using the Bayley Scales of Infant Development[14].

SUBJECTS AND METHOD

Population study

All LBW premature infants in this study born between February 1998 and January 2000, and discharged from the intensive care or high risk nursery, were followed-up at the high risk neonatal clinic. The "low risk" premature infants with minor perinatal complications were enrolled.

Inclusion criteria consisted of infants diagnosed with one or more less severe medical complications that included respiratory distress syndrome, for which O_2 was required for less than 28 days; mild bronchopulmonary dysplasia (BPD)[15]; jaundice that required either phototherapy or exchange transfusion; low grade intraventricular hemorrhage (IVH; gr I or II); and perinatal infection. Infants who had major specific problems such as cardiovascular, respiratory, or neurological complications were excluded, as they obviously needed early intervention and were followed-up at a specific clinic.

Method of evaluation

In addition to history taking, physical and neurological examination, growth and developmental assessment were monitored at each visit as well as regular child care. Vision and hearing tests were evaluated, as indicated. As the aim of this study was to assess the development of premature LBW infants at around 6 months, they were included only if born at a gestational age of <37 weeks; with an absence of major motor or clinically diagnosed sensory impairment; and were 6 months of age at the time of the study. The Denver II screening test and Bayley Scales of Infant Development were used to assess the development. The Bayley Scales of Infant Development provided a developmental profile in both the mental developmental index (MDI) and psychomotor developmental index (PDI)[14]. The developmental evaluation was carried out at 4-6 months adjusted age by one examiner (OL), who was not aware of the infants' perinatal status. Normal term infants were used as a control with a ratio of premature LBW to term infants of 2:1.

Data analysis

An SPSS statistical program was used for analysis. Bivariate correlation analysis was used to evaluate the relationship between outcome and perinatal variables (e.g. birth weight, gestational age, Apgar score at 1 and 5 min, days on a mechanical ventilator, and days spent in hospital). A p value of less than 0.05 was considered statistically and significantly different.

RESULTS

During the study period, there were 60 LBW premature infants who met the study inclusion criteria. The perinatal characteristics of these (30 LBW and 30 VLBW) and 30 term infants, which were enrolled as a control, are shown in Table 1. There was no statistically significant difference in the gender and mean corrected age of each group. In comparison with the term group, the premature groups had a lower Apgar score, spent more days in hospital, and had more, although minor, complications.

The difference in mean MDI and PDI of the three groups was not statistically significant, nor was the raw score, which was perhaps clinically significant. Eight premature infants and only 1 from the term group scored below 85 (MDI and/or PDI) (Table 2 and Fig. 1). Denver II screening found "suspect" results in 5 from 9 cases.

Table 3 shows the correlation of perinatal variables with the mental and psychomotor develop-

Table 1. Perinatal characteristics of 60 LBW premature and 30 term infants.

	VLBW (≤1,500 g) N=30	LBW (1,501-2,500 g) N=30	Term (control) N=30
Sex % male	50.0	66.7	56.7
Corrected age, mo (mean ± SD)	5.1 ± 0.9	4.8 ± 0.8	5.1 ± 1.0
Birth weight, g (mean ± SD)	1,149.2 ± 207 (730 - 1,500)	1,888.7 ± 276.3 (1,540 - 2,400)	3,003.7 ± 385.4 (2,220 - 3,950)
Gestational age, wk (mean ± SD)	30.2 ± 2.5	33.7 ± 1.9	38.3 ± 1.2
Apgar score 1 min (mean ± SD)	5 ± 3	7 ± 3	9 ± 1
Apgar score 5 min (mean ± SD)	7 ± 2	9 ± 1	10 ± 0
Days on ventilator (mean ± SD)	6.7 ± 5.7	1.1 ± 2.1	0
Days in hospital (mean ± SD)	55.5 ± 21.5	23.1 ± 12	2.7 ± 1.6
IVH gr I, II (No, %)	5 (16.7)	2 (6.7)	0
Presence of BPD	9 (30)	0	0
SGA	11 (36.7)	4 (13.3)	0

Table 2. Raw mental, MDI, raw psychomotor, and PDI score of 60 LBW premature infants and 30 term infants.

	VLBW (≤1,500 g) N=30	LBW (1,501-2,500 g) N=30	Term (control) N=30	P
Raw mental score (mean ± SD)	53.77 ± 7.96	51.83 ± 7.58	53.93 ± 11.21	0.61
MDI score (mean ± SD)	97.43 ± 12.69	98.67 ± 13.27	99.63 ± 7.72	0.76
Raw psychomotor score (mean ± SD)	33.67 ± 4.83	33.30 ± 4.81	35.23 ± 6.41	0.34
PDI score (mean ± SD)	97.77 ± 13.84	101.63 ± 11.89	102.10 ± 8.22	0.29

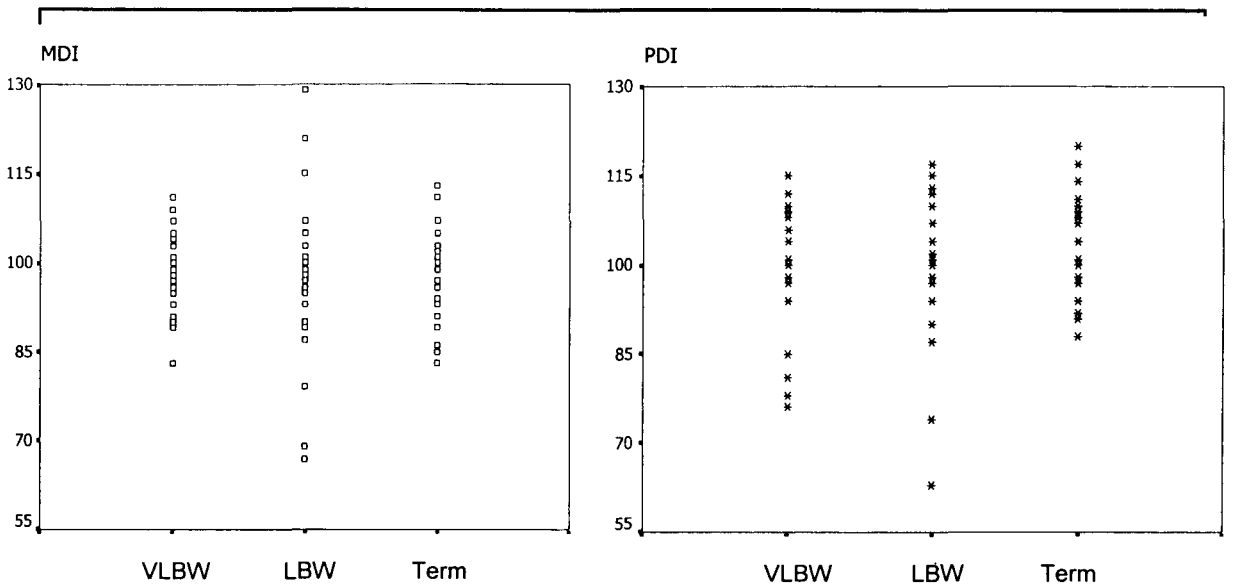

Fig. 1. Distribution of MDI and PDI score of VLBW premature, LBW premature, and term infants, respectively.

Table 3. Correlation between perinatal variables and mental (MDI) and psychomotor (PDI) performance of 60 LBW premature infants.

	BW	GA	Apgar 1 min	Apgar 5 min	Days on ventilator	Days in hospital
MDI score	0.08	0.01	0.12	0.17	-0.06	-0.28*
Sig. (2-tailed)	0.55	0.95	0.37	0.20	0.66	0.03
PDI score	0.05	-0.00	0.14	0.16	-0.13	-0.25
Sig. (2-tailed)	0.68	0.98	0.29	0.22	0.32	0.06

* Correlation is significant at the 0.05 level.

mental index of the premature infants. Only their length of stay in hospital was associated with the mental performance of the LBW infants.

DISCUSSION

The developmental outcome of premature LBW infants receives more attention as the survival rate increases. These infants definitely have a lower birth weight, more complications, and more days spent in hospital than term infants. Fortunately, due to recent neonatal care, most of them survive and avoid a major handicap[2,9]. In this study, no difference was found in the mean score of mental and psychomotor performance between the VLBW, LBW, and term infants, in terms of both raw and index score. The result of this study differed from that of Gross[16] or Ho[17], where a lower mean Bayley mental developmental index score was found in premature infants because their enrollment was different. In Williamson's study, which had similar subjects to those in this one, premature infants scored below term infants significantly in five fields of behavior: adaptive, gross motor, fine motor, language, and personal/social[11]. The degree of neurodevelopmental abnormality and improvement over time is related to the severity of neonatal complications in premature infants. In a study of neurodevelopmental outcome at 6 and 12 months, premature infants at high risk obviously had persistent abnormalities, whereas infants at low risk were found to be poorer in performance than term infants[18].

In 9 cases, whose performance at MDI or PDI was less than 85, 8 cases came from the premature group (5 VLBW and 3 LBW). Denver II screening was "suspect" in 5 of 9 and abnormal neurological findings were found in 7 of 9 cases. This assures the purpose of Denver II screening, and thorough neurological examination is essential for the detection of any developmental impairment.

Many studies have tried to predict future performance by focusing on various perinatal factors, and developing some tools such as the perinatal risk inventory[19], using 18 items of perinatal parameters for an outcome prediction. The neonatal medical index has also been used[20]. This study also investigated factors that might be associated with developmental performance. Because the number of cases was small, only the length of hospital stay had a significantly negative correlation with the mental performance score. The days spent in hospital could reflect the child's perinatal problems directly. No correlation could be found with the motor performance. Williamson's study found that VLBW infants had a language performance that significantly correlated with intracranial hemorrhage, birth weight, and gender while motor performance significantly correlated with bronchopulmonary dysplasia, intracranial hemorrhage, and the number of days spent in hospital[11]. In a study from Taiwan, Wang, et al reported that birthweight, gestational age, and maternal education correlated with developmental outcome[21]. There were reports that small for gestational age premature infants were at a higher risk of neurodevelopmental impairment than was appropriate for gestational age premature infants, irrespective of the degree of prematurity[22,23]. This study did not observe the same findings, although it did have 15 SGA premature infants.

Most infants born with birth weights less than 1,500 g will survive without any handicap. Nevertheless, they are still much more prone to being handicapped than healthy full-term children. This is important in evaluating perinatal management in order to prevent LBW infants from being handicapped in the future. Neurological examinations during the first year of life might be used with other assessments in making decisions concerning referrals to early intervention programs[24].

This study found no difference in the mean score of developmental performance between non-handicapped premature and term infants. This result has implications for counseling parents about the development potential attained by their children. Clinically, the premature group had more cases of low function in this study. It was suggested that their development be monitored closely in order to obtain an early intervention service for them as soon as possible. A larger sample size is needed to provide more information. In addition, an ongoing study is needed to investigate the clinical significance and determine whether this significance remains constant over time.

ACKNOWLEDGEMENT

The authors wish to thank Professor Torpong Sanguansermsri, MD, Head of the Department of Pediatrics, Chiang Mai University, for permission to carry out this syudy.

(Received for publication on October 31, 2000)

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ปัจจัยระหว่างคลอดและการประเมินระยะแรกในทารกคลอดก่อนกำหนดที่น้ำหนักน้อย

อรวรรณ เลาห์เรญ, พ.บ., สมพร โชตินฤมล, พ.บ.***

การประเมินพัฒนาการของทารกคลอดก่อนกำหนดที่น้ำหนักน้อยที่ไม่มีความผิดปกติรุนแรง 60 คนเปรียบเทียบกับทารกคลอดครบกำหนด 30 คนที่อายุประมาณ 6 เดือน พบว่าค่าเฉลี่ยของระดับพัฒนาการโดยใช้ Bayley Scale ไม่แตกต่างกัน แต่กลุ่มทารกคลอดก่อนกำหนดที่น้ำหนักน้อยพบว่ามีพัฒนาการต่ำในทางคลินิกมากกว่าระดับพัฒนาการด้านการเรียนรู้ของทารกคลอดก่อนกำหนดมีความสัมพันธ์กลับกันกับระยะเวลาที่ทารกอยู่โรงพยาบาล การติดตามทารกกลุ่มนี้มีความสำคัญเพื่อวินิจฉัยความผิดปกติให้ได้รวดเร็วและเพื่อการดูแลรักษาที่เหมาะสม

คำสำคัญ : ทารกคลอดก่อนกำหนด, พัฒนาการ

อรวรรณ เลาห์เรญ, สมพร โชตินฤมล
จดหมายเหตุทางแพทย์ ฯ 2544; 84: 917-922

* หน่วยจิตเวชเด็ก,
** หน่วยทารกแรกเกิด, ภาควิชากุมารเวชศาสตร์, คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่, เชียงใหม่ 50200