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Original article

Reading difficulty in school-aged very low birth weight infants in Japan

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Abstract

Objective: To investigate the prevalence of and the perinatal risk factors related to reading difficulty in school-aged very low birth weight infants (VLBWI) with normal intelligence.

Methods: Subjects were 79 Japanese children in the second to fourth grade of elementary school who had been born at very low birth weight and who regularly visited a follow-up clinic at one of four hospitals. All members had a full-scale IQ score of 80 or higher. Perinatal information was obtained retrospectively from medical records. Each subject underwent four reading tasks, testing monomoratic syllable reading, word reading, non-word reading and short sentence reading. Subjects with an SD reading time score greater than 2.0 in two or more tasks were considered to have reading difficulty (RD). Furthermore we investigated the relations between RD and perinatal factors using logistic regression analysis adjusted for potential confounding factors.

Results: Twenty-five (31.6%) out of 79 subjects had RD. We discovered that treated retinopathy of prematurity (tRoP) was a significant risk factor (adjusted OR = 5.80, 95% confidence interval = 1.51–22.33).

Conclusion: The rate of RD in school-aged VLBWI was higher than the estimated prevalence of dyslexia in Japan. Even in children with normal intelligence, long-term developmental follow-up including support for reading skills is necessary for VLBWI. Further investigation is desired to elucidate the relations between visual problems and RD in school-aged children.

Keywords: Very low birth weight infant; Premature; Reading difficulty; Dyslexia

1. Introduction

A recent study showed that the survival rate of very low birth weight infants (VLBWI, less than 1500 g) in Japan has improved to more than 90% in the past 10 years [1]. Yet about 15% of VLBWI discharged from

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Japanese Neonatal Intensive Care Units (NICUs) exhibited developmental delay at 3 years of age [2]. Previous studies from abroad have shown that many school-aged preterm children without mental retardation have learning difficulties in reading, writing or mathematics [3]. Reading difficulty in school-aged preterm children has been particularly well studied in many countries, and a recent meta-analysis of English-speaking school-aged children showed that preterm children perform worse than peers born at term at both decoding and reading comprehension [4].

In Japan, however, there have been few studies about learning problems including reading difficulty in school-aged preterm children. More than 10 years ago, Hara et al. reported that 6 (14%) out of 44 children without major neurodevelopmental sequelae but with extremely low birth weight (less than 1000 g) had learning disabilities in the third grade (approximate age 8–9) [5]. Also, Koeda et al. reported that 3 (25%) out of 12 children born at very low birth weight (VLBW) had typical learning disabilities [6]. Because the methods of evaluating learning problems in those two studies were subjective, however, the authors of both studies noted the need for established methods for the objective assessment of learning problems in Japanese children.

Recently, a new set of Japanese guidelines for the diagnosis and treatment of specific developmental disorders [7] was published. In these guidelines, standardized objective tests for evaluating subjects' ability to read hiragana script were proposed. In the present study, using these objective evaluations, we aimed to estimate the prevalence of reading difficulty in school-aged children born at VLBW and to elucidate the perinatal risk factors for reading difficulty in children born at VLBW.

2. Methods

2.1. Subjects

Japanese children with normal intelligence in the second to fourth grades of elementary school (approximate age range 7–10) who had been born at VLBW and who regularly visited a follow-up clinic at one of the participating hospitals (Okayama Medical Center, Kyushu Medical Center, Saga Hospital and Mie Chuo Medical Center) were eligible for the study and were recruited prospectively between April 2013 and March 2015. Subjects had been scored according to the Wechsler Intelligence Scale for Children (WISC)-III or IV during preschool or later, and all participants had full-scale IQ scores of 80 or higher. Children with hearing difficulties, impaired visual acuity in spite of using eyeglasses, or articulatory disorders were excluded. Also, children in inappropriate educational settings were excluded. Written informed consent was obtained from all participants and/or their parents at the time of this study. This study was approved by the Ethical Committee of the National Hospital Organization (H25-0213005).

2.2. Reading tests

Each subject underwent all four of the reading tasks described below, in accordance with the methods previously reported by Ogino et al. [8]. All subjects were examined by experts on neuropsychology in quiet rooms. During each of the four tasks, we recorded the subjects' voices with an IC recorder.

2.2.1. Monomoratic syllable reading task [7–9]

We defined 'mora' as the smallest rhythmic element into which a word can be divided. Subjects were instructed to read aloud 50 monomoratic syllables, including 20 contracted sounds, as quickly and as accurately as possible. Syllables were printed in hiragana on 210 × 297 mm white cards, arranged into five rows and 10 columns of syllables on each card. Before trial, subjects practiced with sample cards. The amount of time each subject required to read all 50 syllables was recorded.

2.2.2. Word reading tasks [7,8,10]

Subjects were instructed to read aloud 30 Japanese words of three to four moras each (e.g., "げんかん" [genkan] (entrance)) as quickly and as accurately as possible. Words were printed in hiragana on 210 × 297 mm white cards, arranged into three columns and 10 rows of words on each card. Before trial, subjects practiced with sample cards. The amount of time each subject required to read all 30 words was recorded.

2.2.3. Non-word reading tasks [7,8,10]

Subjects were instructed to read aloud 30 non-words of three to four moras each (e.g., "してぼう" [shitebou] (no meaning)) as quickly and as accurately as possible. These non-words were printed in hiragana on 210 × 297 mm white cards, arranged into three columns and 10 rows of non-words on each card. Before trial, subjects practiced with sample cards. The amount of time each subject required to read all 30 non-words was recorded.

2.2.4. Short sentence reading task [8,11]

Subjects were instructed to read aloud three short sentences of 23–27 moras each. Each sentence was printed in mixed hiragana and kanji on a 210 × 297 mm white card. Above the kanji letters, there were hiragana indicating the correct pronunciation of the kanji letters. Subjects were shown three cards in succession, and were instructed to read the short sentences aloud as quickly and as accurately as possible. The amount of time each subject required to read all of the sentences was recorded.