Brain & Development 36 (2014) 572–577

BRAIN & DEVELOPMENT
Official Journal of the Japanese Society of Child Neurology

www.elsevier.com/locate/braindev

Original article

Spontaneous movements in the supine position of preterm infants with intellectual disability

Masanori Kouwaki [a,*], Mitsuko Yokochi [b], Takeshi Kamiya [c], Kenji Yokochi [d]

[a] Department of Neonatal Medical Center, Toyohashi Municipal Hospital, Toyohashi, Aichi, Japan
[b] Department of Rehabilitation, Seirei-Mikatahara General Hospital, Hamamatsu, Shizuoka, Japan
[c] Department of Rehabilitation Center, Toyohashi Municipal Hospital, Toyohashi, Aichi, Japan
[d] Department of Pediatric Neurology, Seirei-Mikatahara General Hospital, Hamamatsu, Shizuoka, Japan

Received 4 February 2013; received in revised form 14 June 2013; accepted 14 August 2013

Abstract

Objective: Spontaneous movements at 2 months of corrected age in preterm infants with intellectual disability (ID) were investigated by assessing individual motor elements separated from movements involving the entire body. *Methods:* Video recordings of 20 preterm infants with ID (16 males, 4 females; median gestational age 26 weeks; median birth weight 810 g) were analyzed and were compared with those of 21 normal preterm infants (8 males, 13 females; median gestational age 30 weeks; median birth weight 1216 g). *Results:* In the preterm infants with ID at 2 months corrected age, startle response, lateral decumbent position, predominant shoulder rotation, and maintaining hip adduction were more frequently observed and hand sucking, maintaining shoulder abduction, to-and-fro shoulder abduction, to-and-fro elbow flexion, isolated hip adduction, to-and-fro hip abduction, and leg lift were less frequently seen than in the normal preterm infants (Fisher's exact test, $p < 0.05$). *Conclusion:* Abnormal spontaneous movements at 2 months of age in preterm infants with ID result from persistent immature movements and non-emergence of mature movements.

Keywords: General movements; Spontaneous movements; Isolated movements; Preterm infants; Intellectual disability

1. Introduction

Qualitative assessment of general movements (GMs) has developed as a diagnostic tool for the functional assessment of the young nervous system [1–4]. Abnormal GMs have been found to be associated not only with a high risk of cerebral palsy [5], but also with minor neurological dysfunction [6,7] or lower intelligence [8,9]. In our previous study on GMs in preterm infants with periventricular leukomalacia (PVL) [10], we examined specific motor elements separated from spontaneous movements involving the entire body instead of a global impressionistic Gestalt perception of their complexity or variations for assessing abnormal GMs. We concluded that a failure of the evolution of isolated movements at 2 months corrected age was suggested to be a useful sign for the diagnosis of cerebral motor disorders. For this report, we investigated basic postures and spontaneous movements at 2 months corrected age in preterm infants with intellectual disability (ID) using the same method as in the previous study [10].

2. Methods

2.1. Participants

Twenty preterm infants (16 males and 4 females) with ID were selected from patients admitted to the neonatal intensive care units of the Toyohashi Municipal Hospital

* Corresponding author. Address: Toyohashi Municipal Hospital, 50 Aza Hachiken Nishi, Aotake-Cho, Toyohashi, Aichi 441-8570, Japan. Tel.: +81 532 33 6111; fax: +81 532 33 6177.
E-mail address: kouwaki-toyomh@umin.ac.jp (M. Kouwaki).

0387-7604/$ - see front matter
http://dx.doi.org/10.1016/j.braindev.2013.08.003

in 2006–2009. Their gestational ages were 22–34 (median 26) weeks, and birth weights were 370–1412 (median 810) g. Intellectual development was assessed in all of these children at 3 years corrected age by means of the Kyoto Scale of Psychological Development 2001 [11], which is a popular scale in Japan. This scale consists of three areas: postural-motor, cognitive-adaptive and language-social. A child whose overall developmental quotient (DQ) was 75 or less was included among subjects with ID. The overall mean DQ of the participants was 58.4 ± 8.9 (41–75); mean postural-motor DQ, cognitive-adaptive DQ, and language-social DQ were 76.1 ± 22.4 (35–103), 53.1 ± 11.5 (30–83), and 57.2 ± 10.8 (30–75), respectively. Among DQs of the three areas, the calculated average of the cognitive-adaptive DQ and language-social DQ was regarded as the intellectual DQ. The intellectual DQ of the study group was 55.1 ± 9.8 (36.5–75.0). Six of the 20 children were diagnosed as having autism and none was diagnosed as having cerebral palsy. Examination by magnetic resonance imaging after one year of corrected age revealed unilateral cerebellar atrophy in 2 children, but neither PVL nor porencephaly was found in any subject.

Twenty-one preterm infants (8 males and 13 females) with normal development, the same infants as the previous study [10], were adopted as control subjects. Their gestational ages were 28–32 (median 30) weeks and birth weights were 776–1844 (median 1216) g. Intellectual and motor development were assessed to be normal at 3 years of age. Their overall mean DQ was 96.8 ± 4.7 (90–105) and their mean postural-motor DQ, cognitive-adaptive DQ, and language-social DQ were 100.0 ± 8.6 (77–112), 97.8 ± 6.0 (84–108), and 95.1 ± 6.6 (82–105), respectively.

2.2. Video recording procedure and comparison of spontaneous movements

Video recording procedure was the same as in the previous study [10]. Infants were mainly in the supine position during their daily care. In the preterm infants with ID, video recordings were performed at 2 months corrected age (±7 days). Spontaneous movements in the supine position in the preterm infants with ID at 2 months corrected age were compared with those in the preterm infants of the same age who had normal development.

2.3. Classification of spontaneous movements

We used the same classification of basic postures and spontaneous movements as in our previous work [10] with the addition of three items (Table 1, Fig. 1).

Determination of spontaneous movements was made independently by three assessors (M.K., M.Y., and K.Y.) without access to clinical information on any of the infants. The rate of agreement among the three observers was 86%. When there was disagreement regarding a determination, if the opinion of two observers concurred, that opinion was used in tabulating the results. Differences in spontaneous movements among the preterm infants with ID and those with normal development at 2 months corrected age were analyzed statistically with Fisher's exact test, using Excel 2003.

As a supplementary study, basic postures and spontaneous movements in the subjects in the previous study [10] were assessed by the three newly adopted items. Assessments were made in the healthy term infants at term and 1, 2 and 3 months of age and those in the preterm infants with PVL at 2 months of corrected age.

The study was approved by the ethics committee of Toyohashi Municipal Hospital. Signed consent to allow their infants to participate in this study was obtained from the parents of all participating infants.

3. Results

There was a significant difference between spontaneous movements in the preterm infants with ID at 2 months corrected age and those in the preterm infants with normal development at the same ages in 11 of the 25 items examined (Table 2). This difference was not explained by a difference in spontaneous movements between males and females. The reason was that a statistical difference was not found in only one item, that is, hand sucking, which was more frequently observed in females than in males; 8/13 vs. 1/8 ($p = 0.037$). The 11 items classified as abnormal were as follows: startle response, lateral decumbent position, hand sucking, predominant shoulder rotation, maintaining shoulder abduction, to-and-fro shoulder abduction, to-and-fro elbow flexion, isolated hip adduction, maintaining hip adduction, to-and-fro hip adduction, and leg lift (isolated knee extension). Startle response and assuming the lateral decumbent position were more frequently seen in the ID infants than in the normal infants. Predominant shoulder rotation was more frequently observed and hand sucking was less frequently observed in the ID infants than in the normal infants. Emergence of isolated upper extremity movements was not found to be significantly different between the two groups. However, two types of to-and-fro movements were less frequently seen in the ID infants than in the normal infants. Also, in contrast with the normal infants, the ID infants seemed to have difficulty maintaining shoulder abduction. Two out of three types of isolated movements, including the leg lift, and two types of to-and-fro movements of the lower extremities were less frequently noted in the ID infants than in the normal infants. The ID infants were apt to maintain hip adduction in contrast to the normal infants. Downward thrust of the arm or extreme ankle plantar-flexion and inversion at kicking was rarely found in either group.