Investigation of Mean Data for the Parent-Rated Ability for Basic Movement Scale for Children Type T (ABMS-CT) in Toddlerhood

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Abstract

Objective: This study aimed to follow the data of fine motor, coordination, and balance function as determined by the parent-rated Ability for Basic Movement Scale for Children Type T (ABMS-CT) of children born at our hospital at 2, 3, 4 years of age.

Material and methods: This study included children who were born at our hospital and whose parents gave informed consent to participate in the study. The subjects were comprised of 2,403 babies. Questionnaires were distributed to their parents, and the children's fine motor, coordination, and balance function were evaluated according to the ABMS-CT at 2, 3, 4 years of age.

Results: The mean-2SD cut-off point for each parameter in the ABMS-CT were as follows: 'Oral and facial area' at 2 years (0.331), 3 years (1.25), and 4 years (2.037) of age, 'Hands and fingers' at 2 years (0.111), 3 years (1.064) and 4 years (2.247) of age, 'One leg' at 2 years (-0.486), 3 years (-0.014)and 4 years (1.732) of age, 'Both leg' at 2 years (-0.062), 3 years (1.17) and 4 years (1.414) of age, and 'Stairs' at 2 years (0.211), 3 years (1.43) and 4 years (2.216) of age.

Conclusions: By using the mean data of the parent-rated ABMS-CT obtained in this study, we may be able to utilize this questionnaire to screen infants for delay of fine motor, balance ability, or developmental coordination disorder (DCD) during early childhood.

Keywords: Fine motor function; Coordination; Balance function, Ability for Basic Movement Scale for Children Type T (ABMS-CT); Questionnaire survey

Introduction

Very few studies have investigated the performance of fine motor, coordination, and balance function in pediatric patients at early childhood. It is difficult to administer the rather specialized scales used in developmental evaluation or pediatric rehabilitation medicine. Our group developed a new scale, the Ability for Basic Movement Scale for Children Type T (ABMS-CT), to make available an instrument that can easily assess a patient's ability to perform fine motor and balance function at a young age. We have already provided evidence for the validity and reliability of the ABMS-CT with regard to assessment of functional ability in disabled pediatric patients [1].

On the other hand, there are no normal data for each item of the ABMS-CT. Therefore, we cannot evaluate developmental problem of fine motor, coordination, and balance function in pediatric patients with some developmental disability using the ABMS-CT.

In this study, we investigated the fine motor, coordination, and balance function of children born in our hospital at 2,3, and 4 years of age with questionnaires distributed to their parents to elucidate the normal range of data of items in the parent-rated ABMS-CT.

Subjects and Methods

Among the women who received medical care for pregnancy and delivery at the National Center for Child Health and Development between December 2010 and January 2015, informed consent for participating in the mother and Child Cohort Study on Children's Health and Development was obtained and data were collected overtime from 2,404 mothers and their infants including the babies from multiple births, premature babies, and low birth weight babies to investigate the range of data on each item of the ABMS-CT in all infants, and the subjects in this study comprised 1243 children.

Fine motor, coordination, and balance function was evaluated according to the ABMS-CT [1]. The ABMS-CT (Figure 1) issued to evaluate the degree of achievement of fine motor, coordination and complex basic movement (balance function) in infants by physicians and medical staff in daily practice. There are five evaluation variables: "Oral and facial area", "Hands and fingers", "One leg", "Both legs", and "Stairs". Each variable is scored in 4 grades of 0,1,2, and 3. Each variable is scored based on the maximum capacity of babies at that time. For example, if a child is unable to jump forward with two feet together but is able to skip, "Both legs" is scored as grade 3.

The statistical software SPSS® Statistics Desktop Version 22.0 (IBM) was employed.

This study was carried out as part of a large birth cohort study in which both mothers and their infants were included as subjects (a mother and small-for-gestational-age child cohort on children's health and development). This study was approved by the ethical committee of the National Center for Child Health and Development. Informed consent was obtained from all mothers after a detailed explanation of the study was provided.
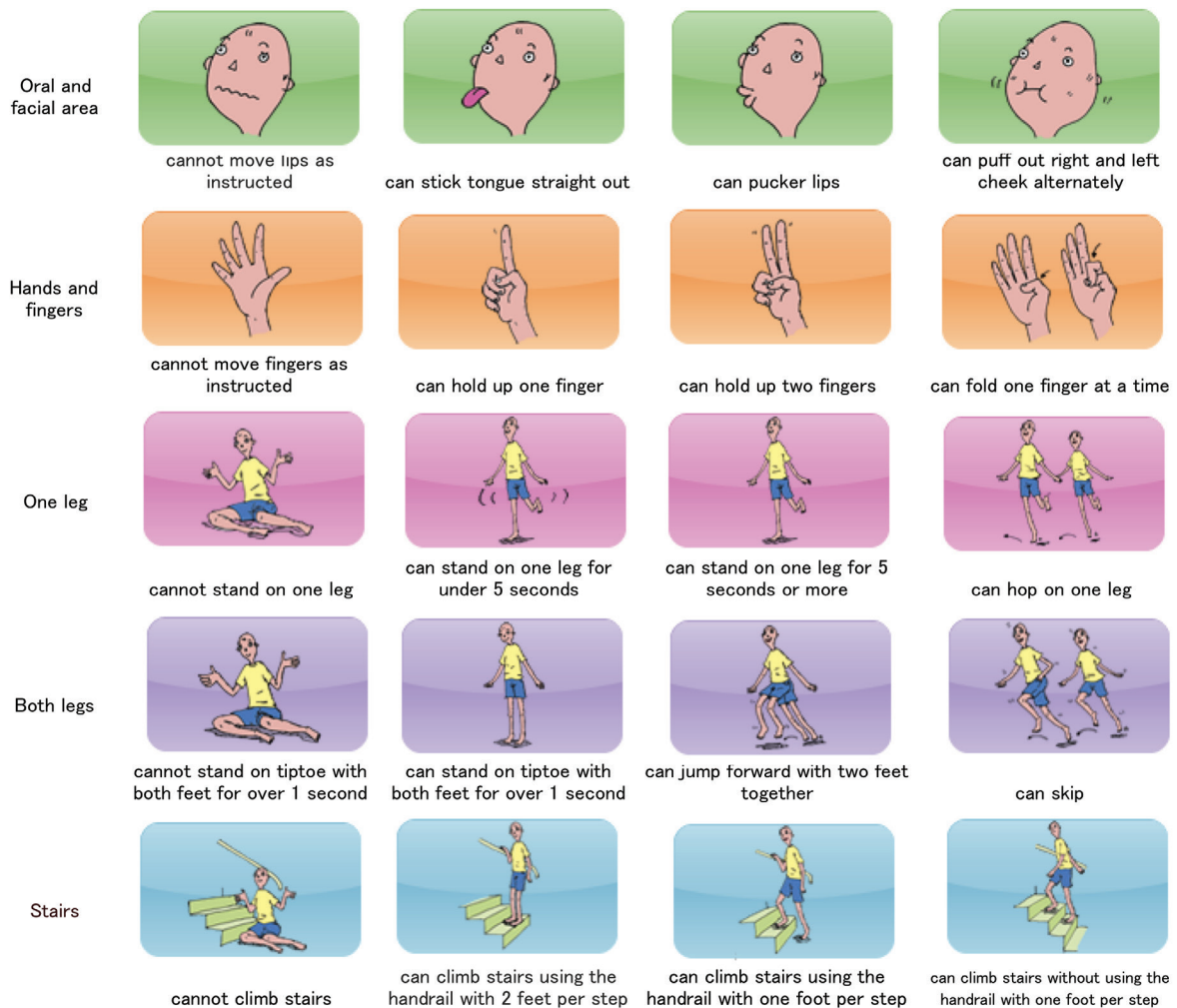
Figure 1: Ability for Basic Movement Scale for Children Type T (ABMS-CT)

Results

The characteristics of the infants in this study are summarized in table 1. Table 2 summarizes the scores [mean ± standard deviation (SD)] on "Oral and facial area", "Hands and fingers", "One leg", "Both legs", and "Stairs" of the ABMS-CT.

Table 3 summarizes the cutoff data (mean score-SD cutoff and mean score -2 SD cut off) for each item of the mother-rated ABMS-CT at 2, 3, and 4 years of age.

As a result, similar to the Ages & Stages Questionnaires® third edition (ASQ-3), which is used in the National Birth Cohort Study on Children's Health and the Environment conducted by the Ministry of the Environment of Japan (the Japan Environment and Children's Study [JECS]), [2] we can categorize babies into three groups according to the baby's score on the ABMS-CT as follows (Table 3):

i) If the child's score is in the □ (white) area in table 3, it is above the Mean-SD cut off, and the baby's gross motor function appears to be on schedule.

ii) If the child's score is in the ▤ (grey) area, it is close to the cutoff. Provide learning activities and monitor.

iii) If the child's score is in the ▪ (black) area, it is below the Mean-2SD cutoff. Further assessment with a professional may be needed.

Table 1: Profiles of the participant

N	2403
Gestational age (days)	272.02 ± 13.04
Birth weight (g)	2926.5 ± 494.78
Age of the mother (y)	35.7 ± 4.32
Annual family income (yen)	7,600,000 ± 3,000,000
Educational years of the mother (y)	12.7 ± 3.0
Educational years of the father (y)	13.8 ± 4.2

Table 2: Scores on each item of the ABMS-CT

	Age (y)		
ABMS-CT	2	3	4
Oral and facial area	1.887 ± 0.778	2.47 ± 0.610	2.831 ± 0.397
Hands and fingers	1.299 ± 0.594	2.37 ± 0.653	2.901 ± 0.327
One leg	0.72 ± 0.603	1.81 ± 0.912	2.80 ± 0.534
Both legs	1.354 ± 0.708	2.03 ± 0.430	2.47 ± 0.528
Stairs	1.709 ± 0.749	2.62 ± 0.595	2.898 ± 0.341
Number of children	1243	964	477

Results are shown as mean ± standard deviation.

Table 3: Cutoff data for each item of the parent-rated ABMS-CT

Age (y)	Score				Mean-SD cutoff	Mean-2SD cutoff
Oral and facial area	0	1	2	3		
2					1.109	0.331
3					1.86	1.25
4					2.434	2.037
Hands and Fingers	0	1	2	3		
2					0.705	0.111
3					1.717	1.064
4					2.574	2.247
One leg	0	1	2	3		
2					0.117	-0.486
3					0.898	-0.014
4					2.266	1.732
Both legs	0	1	2	3		
2					0.646	-0.062
3					1.6	1.17
4					1.942	1.414
Stairs	0	1	2	3		
2					0.96	0.211
3					2.025	1.43
4					2.557	2.216

1-If the child's score is in the □ (white) area in table 3, it is above the Mean-SD cut off, and the baby's gross motor function appears to be on schedule.
2-If the child's score is in the ▦ (grey) area, it is close to the cutoff. Provide learning activities and monitor.
3-If the child's score is in the ■ (black) area, it is below the Mean-2SD cutoff. Further assessment with a professional may be needed.

Discussion

Previously, we reported evidence for the evaluative value of the Ability for Basic Movement Scale for Children (ABMS-C) with regard to gross motor functional ability in disabled pediatric patients [3] and demonstrated the normal data of healthy babies [4]. In that study, the scale did not include a grade for a function that was appropriate for assessing development in children who can walk independently. We considered that information on the degree of ability of children with a disability to perform complex basic movements in an environment other than the bedside would be valuable in understanding their physical functional ability.

Our group developed the ABMS-C and ABMS-CT to make available an instrument that could easily assess a patient's abilities to perform the basic movements used in daily life at a young age. One of more useful points of the ABMS-CT in comparison with other scales such as the Functional Independence Measure for Children (WeeFIM) [5] is that we can easily record the child's ability to perform five different complex basic movements and thereafter can monitor the progress of that child's ability to perform each individual movement about fine motor, coordination, and balance function. There were high correlations between the motor and cognitive WeeFIM score and all items on the ABMS-CT, also, inter-rater reliability for each task were established using a κ coefficient [1]. Based on these results, we believe that the ABMS-CT is appropriate to evaluate the fine motor and balance ability of pediatric patients who can walk to make complex basic movements.

In this study, we could obtain data on the mother-rated ABMS-CT from over 1,000 children. By using these data, we may be able to utilize this questionnaire to screen young children for delay of fine motor, coordination and balance ability.

There were several limitations in the present study. First, the assessments in this study were carried out based on parent-rated questionnaires and not on objective development evaluation administered by specialists. We must consider the possibility that parents may tend to overestimate or underestimate their own child's fine motor and balance function compared with evaluation by a specialist. Second, to see if the cut-off score is reliable, we should test the reliability and validity of the ABMS-CT in healthy subjects by using some standard developmental test in the next study. Third, the relationship between the parents' information and the score of the ABMS-CT need to be identified. Last, to predict fine motor and balance functional ability or developmental disabilities such as developmental coordination disorder (DCD), it is necessary to evaluate children at 6 or 8 years of age. Follow-up studies on the development of the children at 6 or 8 years of age using various kinds of measure including intelligent quotient, physical and coordination ability should be performed in a future study.

Acknowledgement

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