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Original Article

Evaluation of the social skills of low birthweight infants using the Interaction Rating Scale

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Abstract. [Purpose] This study aimed to examine, using the Interaction Rating Scale, the effect of social skills at 18 months of life on the subsequent development of low birthweight infants. [Participants and Methods] The study participants were made up of a total of 23 infants who were admitted to the neonatal intensive care unit of Hospital A and whose developmental indexes were followed up at the outpatient clinic for up to 3 years of age. The survey was conducted twice in each infant, at a corrected age of 18 months and at 36 full months of age. Social skills and developmental indexes were assessed at the corrected age of 18 months, meanwhile only developmental indexes were assessed at 36 full months, to examine associations. The Interaction Rating Scale was used to assess social skills. This scale measures various aspects of social development by observing caregiver-child interactions in situations wherein children are engaged in tasks more difficult for their age. [Results] The results demonstrated that social skills at 18 months were associated with the developmental indexes at 18 and 36 months, whereas more items were associated with the developmental index at 36 months. [Conclusion] The results indicate the need for early prediction of developmental delay and timely intervention, by assessing social skills in low birthweight infants.
Key words: Low birthweight infants, Development, Social skills

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INTRODUCTION

Advances in perinatal care technology have improved survival rates for low birthweight infants[1–5]. However, the number of infants undergoing treatment in neonatal units has increased, and their high risk of neurodevelopmental abnormalities represents a considerable challenge[6–9]. There are developmental risk challenges posed by preterm delivery and low birthweight[10–13]. In the neonatal intensive care unit (NICU), care is tailored to the developmental needs of the newborn, such as adjusting lighting and machine sounds[14, 15]. In clinical practice, follow-up outpatient clinics have been established to monitor children's development over time and provide the necessary support when needed. The effectiveness of many interventions aimed at developmental support has been reported[16]. Developmental support should not be provided only for a short period during hospitalization but should involve a long-term perspective[17, 18]. Long-term follow-up has revealed that children who are hospitalized face a higher risk of developmental abnormalities compared to children who were not hospitalized, and their behavior during hospitalization is a predictor of this[19, 20]. Attention deficit hyperactivity disorder and autism spectrum disorders are considered severe developmental risks for high-risk children, who often have difficulty interacting with others and adjusting to group living. The symptoms of these problems often become apparent around the age of three. The challenge is to assess the child's development and link it to the appropriate support in the follow-up outpatient clinic. In clinical situa-

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tions, signs, such as “frequent crying” and “difficulty adjusting to the environment”, may be identified at an early stage. Early detection and early support based on predictive signs would be useful for the individual and their family.

In developmental cohorts of children in Japan, “social skills” have been the focus of attention, and assessments using the “involvement index” have been conducted[21–27]. Some studies have used pre- and post-intervention assessments and found that these abilities are changeable through intervention[28–32]. Moreover, it has also been found that “relationships with others” lead to change, that is, as social skills increase, developmental indices also increase[33–37]. However, no studies have evaluated and validated social competence using the “Interaction Rating Scale (IRS)” in preterm infants. Therefore, it would be useful to add it to the index in follow-up outpatient care for preterm infants and to evaluate the developmental assessment situation objectively.

This study aimed to measure the involvement index in low birthweight infants who have experienced NICU hospitalization and verify its association with birth risk and developmental index.

PARTICIPANTS AND METHODS

The participants comprised 23 children who were admitted to Hospital A’s NICU (Osaka city, Japan) between October 1, 2014 and December 31, 2018 with a birthweight of less than 1,500 g and a fertility week of less than 0 weeks. Their parents had consented to and participated in the 18-month and 36-month surveys. Figure 1 shows the process of selecting the study participants and the characteristics of the target children. The mean birthweight was 1010.5 (553–1,499) g, and the mean number of weeks of gestation was 28 w0d (23 w0d–36 w3d). The developmental index averaged 96.6 ± 19.2 (50–120) at 18 months corrected and 89.4 ± 14.9 (57–113) at 36 full months.

The following items were investigated: the birthweight, number of days after conception at birth, social skills (IRS)[38], and developmental index (Kyoto Scale of Psychological Development 2001 [KSPD 2001])[39]. After discharge, social skills (18M) and the developmental index were assessed at the follow-up outpatient clinic.

In this study, we used the IRS to assess social ability. This index measures various aspects of social development by observing the interaction between caregivers and children. The reliability and validity of the assessment have been examined. The content is based on a situation in which a caregiver engages the child in a more difficult task than appropriate for the child’s age. The child works toward achieving the goal, and the interaction is assessed in an everyday, naturalistic manner[38]. The authors have conducted this evaluation as a preliminary study with three pairs of parents and children and have confirmed its feasibility[39]. It consists of five domains on the child’s side (autonomy, responsiveness, empathy, motor regulation, and emotional regulation) and five domains on the caregiver’s side (children’s independence, responsiveness, empathy, cognitive development, and consideration for socio-emotionality). In this study, only the “children’s aspect” was assessed because the social aspect of children was the subject of analysis. Five minutes of building blocks and drawing scenes were set up, which were used as the children’s domain score. The evaluation method was based on a binary evaluation (0 points, 1 point) of the occurrence or non-occurrence of the behavioral evaluation, and the domain score was calculated by simple addition.

The developmental outcome was evaluated at 18 months of corrected age and at 3 years of age using the KSPD 2001[39]. The KSPD 2001 is a standardized developmental test that has been widely used in clinical settings in Japan.

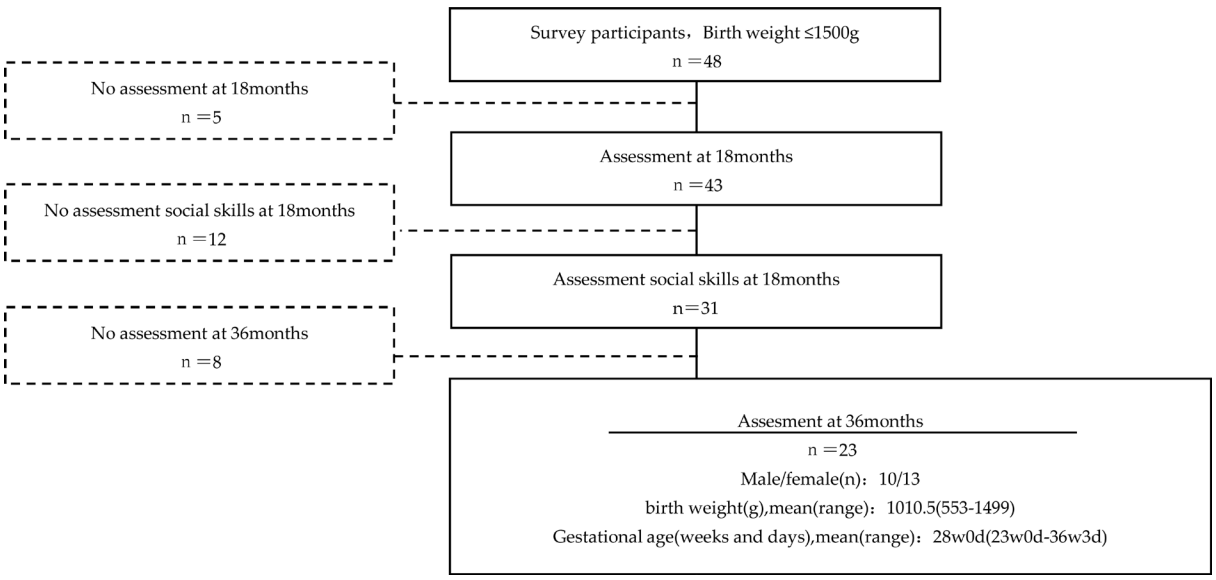

Fig. 1. Process of selecting the study participants and the characteristics.

The purpose, methods, and ethical considerations of the study were fully explained to the parents, and consent was obtained. Participation in the study was voluntary and could be terminated at any time. Names were kept anonymous and ID numbers were used to protect personal information. It was explained that the personal information would be kept strictly confidential, data would not be used for any purpose other than the study, and there would be no disadvantage or hindrance to the medical care provided if the study was terminated. The study was conducted with the approval of the Morinomiya Medical University Medical Review Committee (Approval No. 2019-073 Recognition date; October 11, 2019).

Analysis was conducted by calculating Spearman's correlation coefficient to examine the relationship between the impression scores in each domain and the developmental index. In addition, the Mann–Whitney test was used to examine the relationship between impression scores and developmental indices. IBM SPSS Statistics 27 (Tokyo, Japan) was used as the analysis software.

RESULTS

Median values were compared by the occurrence of the behavior in each area. The results are shown in Table 1. There were no significant differences in behavioral occurrence in weeks of gestation and birthweight. In the modified 18-month developmental index, the medians for "Child stops displaying distress cues without caregiver's soothing attempts" in the emotional regulation domain were 104.0 and 104.0. In the emotional regulation domain, the scores for "Child is not startled by caregiver's movements or changes in their facial expression" were 104.0 for those with the behavior and 68.0 for those without it (p=0.01). The developmental index was significantly higher for those with the behavior.

In the developmental index at 36 months, the scores for "Child becomes appropriately active in response to task situation" in the autonomy domain were 95.0 and 86.0 (p=0.03) for those with and without the behavior, respectively; for "Child gives, shows, or points to task material to share emotion with a caregiver", the scores were 98.0 and 83.5 (p=0.001) for those with and without the behavior, respectively. Furthermore, we obtained the following results: "Child smiles at a caregiver within five seconds" of the emotional regulation domain; "Child stops displaying distress cues without caregiver's response" (Yes 96.5, No 87.0, p=0.02); "Child stops displaying distress cues without caregiver's soothing attempts" (with 94.0, without 63.5, (p=0.03)). Regarding "Child is not startled by caregiver's movements or changes in their facial expression", the developmental scores were 94.0 for children with the behavior and 63.5 for children without it (p=0.03). The index was significantly higher for children with the behavior.

DISCUSSION

The contributions of this study are as follows. First, it was possible to measure social competence in a follow-up outpatient setting for low birthweight infants. With an increase in impulsive behavior and social maladjustment during school age and adolescence, interest in children's social development in this era of declining birthrates has increased. Hence, it is paramount to accurately capture the development of children's social skills and propose early interventions[40]. The development of children's social competence arises under the interaction between children's innate individual factors and family relationships, including caregivers, peer relationships, and socio-cultural environmental factors[41]. Particularly, in the early stages of development, an attachment relationship is formed between the child's innate temperament and the caregiver's involvement as the most immediate social environment because of their mutual interaction[42, 43]. Stable attachments with caregivers represent an internal working model that defines the nature of subsequent peer and retreat relationships and fosters the social skills necessary for communication[28–37]. Several indicators have been developed from the perspective of their importance in child development; HOME has been utilized in many national and international studies, including the NICHD study[44]. Index of Child Care Environment ICCE) has been utilized in a Japanese childcare cohort[45], and the IRS was developed as a methodology that could efficiently measure various aspects of social competence in an internationally comparable and institutional manner. Interactions between children and caregivers can be efficiently assessed in everyday settings to measure social competence. Moreover, professionals can use it in practice settings for interventions[46–52]. In the present study, the index was used in a follow-up outpatient setting after the discharge of low birthweight infants. It can be administered in a natural setting in a short five-minute period before the developmental examination. It can also provide simple feedback to the caregivers present, allowing them to collectively discover the beneficial aspects of child development and link them to growth. This enabled us to measure the social skills needed by high-risk children in a simple way.

Second, social competence at 18 months was related to the developmental index at 36 months as well, suggesting the possibility of predicting developmental risk from an earlier age. In Japan, medical advances have made it possible for high-risk children to survive. However, it is challenging to provide long-term support for the upbringing of high-risk children[17, 18]. Particularly, early detection and early intervention for the risk of developmental disabilities is a challenge[53]. Low birthweight infants are at risk for developmental disabilities and are followed up with by outpatient clinics to observe their progress. Various reports have already been published[17]. In general, social development starts early, but it only becomes apparent after three years of age, when group living begins[18]. It is crucial that early detection lead to early intervention. In the present study, social scores using the IRS were significantly associated with the developmental index. Higher social competence tended to

Table 1. Comparison of related factors by the occurrence of involvement behavior during the task (Mann–Whitney test)

					Birth weight (g)		Gestational period (days)		18 months		36 months	
			n	%	median	p-value	median	p-value	median	p-value	median	p-value
1. Autonomy	Child vocalizes while looking at the task materials.	yes	15	65.2	896.0	0.21	198.0	0.43	100.0	0.83	95.0	0.24
		no	8	34.8	1,252.5		206.5		101.0		88.0	
	Child becomes appropriately active in response to task situation.	yes	16	69.6	1,006.5	0.45	203.5	0.41	101.5	0.18	95.0	0.03
		no	7	30.4	699.0		202.0		87.0		86.0	
	Child attempts to make eye contact with caregiver.	yes	21	91.3	998.0	0.51	201.0	0.96	98.0	0.44	94.0	0.39
		no	2	8.7	901.5		203.5		106.5		86.5	
	Child initiates interaction with caregiver spontaneously.	yes	22	95.7	959.0	0.78	201.5	0.96	99.0	0.78	92.5	0.61
		no	1	4.3	1,197.0		205.0		104.0		86.0	
	Child attempts to elicit caregiver's response.	yes	21	91.3	920.0	0.20	201.0	0.79	98.0	0.16	94.0	0.51
		no	2	8.7	1,308.5		205.5		112.0		87.5	
2. RESPONSIVENESS	Child displays strong reaction during the interaction	yes	22	95.7	959.0	0.78	201.5	0.96	99.0	0.78	92.5	0.61
		no	1	4.3	1,197.0				104.0		86.0	
	Child gazes at caregiver's face or task materials after caregiver's nonverbal behaviors.	yes	22	95.7	959.0	0.78	201.5	0.96	99.0	0.78	92.5	0.61
		no	1	4.3	1,197.0		205.0		104.0		86.0	
	Child looks at caregiver's face or eyes when caregiver attempts eye contact	yes	20	87.0	959.0	0.97	199.5	0.76	99.0	0.76	94.5	0.09
		no	3	13.0	1,197.0		205.0		104.0		86.0	
	Child vocalizes or babbles within five seconds after caregiver's verbalization.	yes	9	39.1	896.0	0.60	197.0	0.28	103.0	0.44	95.0	0.52
		no	14	60.9	1,153.5		205.5		97.0		90.0	
	Child vocalizes or babbles within five seconds of caregiver's gestures, touch, or changes in facial expression.	yes	10	43.5	908.0	0.69	197.5	0.23	101.5	0.61	95.0	0.21
		no	13	56.5	1,197.0		206.0		98.0		89.0	
3. EMPATHY	Child gives, shows, or points to task material to share emotion with caregiver.	yes	15	65.2	998.0	0.78	201.0	0.55	100.0	0.39	98.0	0.00
		no	8	34.8	1,058.5		203.5		97.5		83.5	
	Child looks at caregiver's face to gather information/gain understanding.	yes	20	87.0	959.0	0.83	199.5	0.36	99.0	0.90	94.5	0.46
		no	3	13.0	1,197.0		205.0		104.0		87.0	
	Child vocalizes or adjusts own behavior within five seconds in response to caregiver's verbalization.	yes	19	82.6	1,015.0	0.05	206.0	0.46	100.0	0.73	91.0	0.91
		no	4	17.4	688.5		201.5		98.0		90.5	
	Child smiles at caregiver within five seconds of caregiver's verbalization.	yes	16	69.6	1,006.5	0.45	203.5	0.41	101.5	0.18	95.0	0.03
		no	7	30.4	699.0		202.0		87.0		86.0	
	Child behaves within five seconds in accord with caregiver's gestures, touch, or changes in expression.	yes	21	91.3	998.0	0.57	202.0	0.39	100.0	0.64	91.0	0.71
		no	2	8.7	942.0		187.5		95.5		90.0	
4. MOTOR REGULATION	Child widens eyes and/or shows postural attention to task situation.	yes	23	100	998.0		202.0		100.0		91.0	
		no	0	0.0								
	Child becomes appropriately active in response to task situation.	yes	23	100	998.0		202.0		100.0		91.0	
		no	0	0.0								
	Child's movements are clearly directed toward/away from the task or task material.	yes	23	100	998.0		202.0		100.0		91.0	
		no	0	0.0								
	Child makes clearly recognizable hand motions towards task materials during the episode. (60% or more of the time).	yes	23	100	998.0		202.0		100.0		91.0	
		no	0	0.0								
	Child is neither restless nor overactive.	yes	22	95.7	1,006.5	0.96	203.5	0.35	99.0	0.96	92.5	0.44
		no	1	4.3	780.0		197.0		103.0		81.0	

Birth weight, weeks of gestation, and developmental index were compared for the occurrence or non-occurrence of involvement behavior in each domain as "yes" or "no".

Table 1. Continued

					Birth weight (g)		Gestational period (days)		18 months		36 months	
			n	%	median	p-value	median	p-value	median	p-value	median	p-value
5. EMOTIONAL REGULATION	Child stops displaying distress cues without caregiver's response.	yes	16	69.6	1,006.5	0.54	203.0	0.82	104.0	0.07	96.5	0.02
		no	7	30.4	780.0		202.0		96.0		87.0	
	Child stops displaying distress cues without caregiver's soothing attempts.	yes	16	69.6	1,006.5	0.54	203.0	0.82	104.0	0.07	96.5	0.02
		no	7	30.4	780.0		202.0		96.0		87.0	
	Child stops displaying distress cues without caregiver's soothing attempts.	yes	19	82.6	1,015.0	0.22	205.0	0.14	104.0	0.01	94.0	0.03
		no	4	17.4	739.5		192.0		68.0		63.5	
	Child asks caregiver for help or consolation.	yes	22	95.7	1,006.5	0.61	203.5	0.70	101.5	0.70	91.0	0.78
		no	1	4.3	780.0		197.0		96.0		95.0	
	Child is not startled by caregiver's movements or changes in his/her facial expression.	yes	19	82.6	1,015.0	0.22	205.0	0.14	104.0	0.01	94.0	0.03
		no	4	17.4	739.5		192.0		68.0		63.5	

Birth weight, weeks of gestation, and developmental index were compared for the occurrence or non-occurrence of involvement behavior in each domain as "yes" or "no".

be associated with a higher developmental index at 18 months and at age three. This confirms the findings of previous studies and suggests the need for early intervention. Children with low scores can be monitored for developmental trends. Appropriate support can be implemented by shortening the time until the next outpatient visit and connecting with the health center.

Nevertheless, the limitations of this study are as follows. First, the number of participants was small; the follow-up period for each person is three years. Therefore, it takes time to accumulate data. In the future, it will be necessary to increase the number of participants and conduct multifaceted analyses by collaborating with multiple facilities. Second, the observation period was short. The risk of developmental disorders related to social skills becomes more apparent and severe after school age. In this regard, it is necessary to conduct continuous observation and report the results.

Despite these limitations, we believe that we achieved a certain level of success in verifying how assessable the social abilities of high-risk children are and clarifying their relationship with developmental risk. The future challenge will be to establish a system for appropriate support, early detection, and early intervention and to verify the effectiveness of this system.

Author contributions

Conceptualization, Y.S., N.H., M.N., and H.M.; methodology, Y.S., N.H.; software, Y.S., N.H., M.N.; validation, Y.S., N.H.; formal analysis, Y.S., N.H.; investigation, Y.S., M.N.; resources, Y.S.; data curation, Y.S., M.N.; writing—original draft preparation, Y.S; writing—review and editing, Y.S., N.H., M.N., and H.M.; supervision, H.M.; project administration, Y.S.; funding acquisition, Y.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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