Neonatal Behavioral Assessment and Very Early Treatment of Premature Infants Who Achieved Normal Development or Who Ended in Cerebral Palsy

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Abstract In the development of SFD infants, the indices at 6 months and 12 months were significantly lower ($P < 0.05$) compared to AFD infants, whereas the indices at 36 months didn't show significant differences.

The environment scores at 6 months by Caldwell (Home) significantly affected the development indices.

Prospective diagnosis of high risk infants is difficult when it is based only on the scores of individual clusters for the neonatal behavioral assessment. However, such a prospective diagnosis in the neonatal period is available to some extent when the duration of low cluster scores and the frequency of overlapped lowscores are taken into consideration.

It seems essential to perform assessment of high risk infants using the NBAS as a means of early intervention and to observe the process of development under early treatment and care. We would like to carry out further studies with more cases.

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Key Words : NBAS, Premature infants,
Early intervention,
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Introduction

The development of the neonates is strongly affected by environmental factors such as the neonates' personality fostered through the fetal period and mother-infant interaction, in addition to the genetic factors.

Disorganization of the neonate is generally disadvantageous in mother-infant interaction. However, the procedure of the NBAS (Neonatal Behavior al Assessment Scale) that is to assess the neonate's best performance using a variety of maneuvers should serve as a useful method of earlyintervention to strengthen the mother-infant interaction in the neonatal period. This suggests that the NBAS is applicable also to the assessment of high risk children in a state of depressed activities due to brain damage, and as a means of intervention into early habilitation.

Previously, the NBAS was used for the reinforcement of mother-infant interaction and for the comparative study of neonatal behavior between different culture areas. Recently, however, it is applied as a means to intervene with immature infants and infants with intrauterine development insufficiency due to the corruptive social environments such as alcoholism, drug use and AIDS.

We have made some achievements by applying the NBAS to early assessment and early treatment of cerebral palsy infants and mentally retarded infants. In this paper, we studied how useful the NBAS is for the very early diagnosis and treatment of cerebral palsy infants.

Subjects and Methods

This study was carried out on 25 AFD, 12 SFD and their families who received intensive care at the NICU of Nagasaki University Hospital.

Gestational age, birthweight and Ap. Scores are shown in Table 1.

Neonatal behavioral assessment was conducted by the examiners trained using the Brazelton's scale. Assessment by the NBAS was performed three times between week 36 and week 48, and comparative studies were made on 8 clusters, namely, Habituation, Orientation, Motor, State Range, State Regulation, Autonomic Stability, Reflexes and Supplemental Items. For assessment of development, Bayley's scale and McCarthy's scale were used. Upon visiting home, Bayley's test was performed at age 6 and 12 months (converted age) and McCarthy's test at age 36 months.

At 6 months, home observation was made for Caldwell's measurement of the environment in an attempt to study any possible correlation between the scores of the environment and development indices using Pearson's correlation coefficient.

Results

The development indices by the Bayley Scales of the AFD and SFD at 6 and 12 months after birth (converted age) are shown in Fig. 1.

In comparison to the AFD group, the SFD group showed significantly lower indices for PDI (Psychomotor Development Indices) at 6 months and MDI (Mental Development Indices) at 12 months.

Caldwell's environment scores of SFD were also significantly lower in comparison with those of AFD.

McCarthy's development indices and devations at 3 years are shown in Fig. 2. No longer could we recognize a signifcant difference between AFD and SFD.

Among the 25 AFD and 12 SFD cases, totalling 37 cases, 4 cases (case 1~4)

Table 1 Subject

	AFD	SFD
Numbers of Subjects	20	12
Gestational ages	32w1d (29w4d ~ 36w1d)	36w6d (34w ~ 39w6d)
Birthweights (g)	1735.3 (1120 ~ 2300)	1712.5 (1080 ~ 2490)
Ap sc. 1 min	7.0	7.0
Ap sc. 5min	8.9	8.5

Table 3 Correlation (Home 6M × Development indices)

MDI	6M	Total	r=0.44 (P<0.05)
MDI	12M	Total	r=0.47 (P<0.01)
		SFD	r=0.72 (P<0.01)
PDI	6M	Total	r=0.42 (P<0.05)
		SFD	r=0.63 (P<0.05)
PDI	12M	Total	r=0.48 (P<0.01)
		SFD	r=0.80 (P<0.01)
IQ	36M	AFD	r=0.48 (P<0.05)
Memory	36M	AFD	r=0.45 (P<0.05)

Table 2 Cerebral palsy and Mental retardation

	Gestational age	Birth-weight	Ap sc. 1 min	Ap sc. 5 min	neonatal findings	type of delivery	artificial ventilation	oxygen therapy
case1	34W6D	2010	9		·preterm AFD ·transient tachypneu ·hyperbilirubinemia			1d
case2	29W2D	1240	8	9	·preterm AFD ·hyperbilirubinemia ·sepsis ·anemia ·apnea	cesarean section		2d
case3	30W4D	1689	6	7	·preterm AFD ·hyperbilirubinemia ·persistent fetal circulation	cesarean section	8d	19d
case4	25W3D	830	7	9	·preterm AFD ·RDS ·hyperbilirubinemia ·anemia	cesarean section	62d	75d
case5	28W6D	1380	7	9	·preterm AFD ·RDA ·hyperbilirubinemia ·apnea			8h

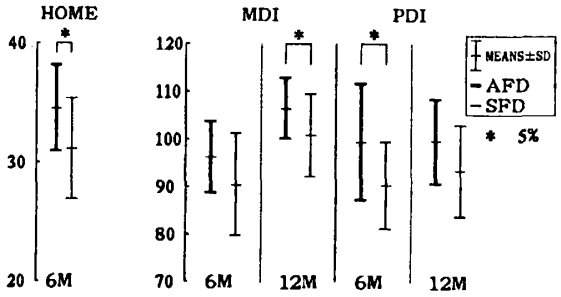

Fig. 1 Development indices (Bayley scale)

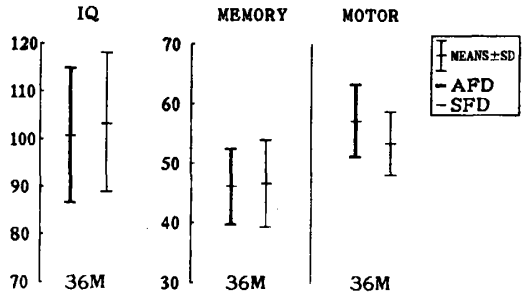

Fig. 2 Debelopment indices (McCarthy scale)

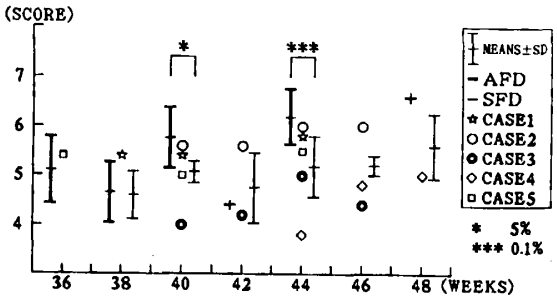

Fig. 3 MOTOR

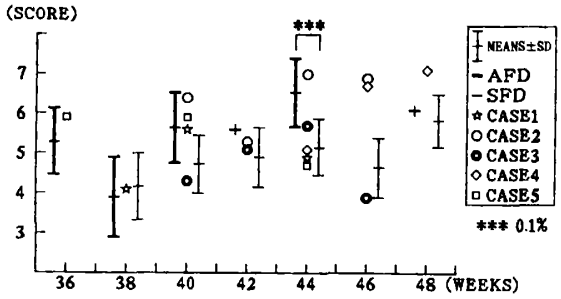

Fig. 4 ORIENTATION

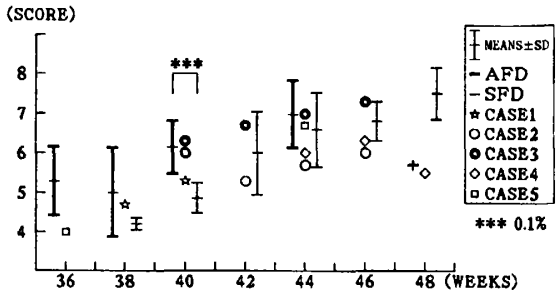

Fig. 5 AUTONOMIC STABILITY

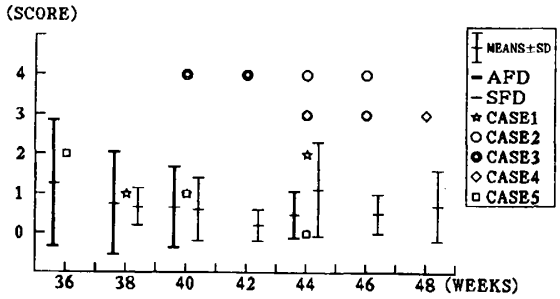

Fig. 6 REFLEXES

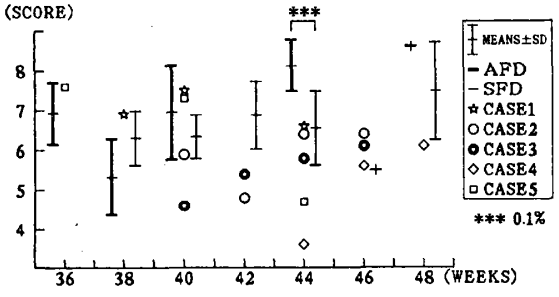

Fig. 7 SUPPLEMENT

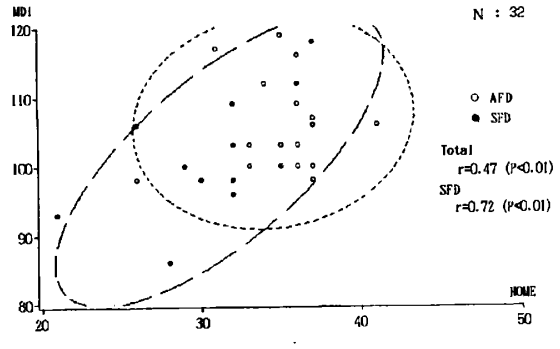

Fig. 8 Correlation (HOME 6M×MDI 12M)

of AFD became cerebral palsy and 1 case (case 5) of AFD became mental retardation (Table 2).

These five infants were compared with the normal development group concerning the scores of NBAS clusters and recovery curve.

In comparision between SFD and AFD, at converted gestational age of 44 weeks, moter showed a significantly higher ($p < 0.1\%$) score in the AFD group. The cerebral palsy, case 3, 4 and one mental retardation, case 5 showed lower scores than those in AFD (Fig. 3).

Orientation score was significantly higher ($p < 0.1\%$) in AFD than SFD at 44 weeks. Two cerebral palsy (case 1, 3) and one mental retardation (case 5) showed lower scores than those in AFD (Fig. 4).

Autonomic stability score was significantly higher ($p < 0.1\%$) in AFD than in SFD at 40 weeks. Three cerebral palsy (case 1, 2, 4) showed lower scores than those in AFD (Fig. 5).

State Regulation score was significantly higher ($p < 1\%$) in AFD than in SFD at 44 weeks. Two cerebral palsy (case 3, 4) and one mental retardation (case 5) showed lower scores than those in AFD.

State Range score was significantly higher ($p < 5\%$) in AFD than SFD at 44 weeks. One cerebral palsy (case 4) and one mental retardation (case 5) showed lower scores than those in AFD.

Habituation and Reflexes score didn't show significant difference between AFD and SFD. In the former, three cerebral palsy (case 1, 3, 4) and one mental retardation (case 5) showed lower scores than those in AFD and SFD, in the latter, three cerebral palsy (case 2, 3, 4) showed higher scores than in AFD and SFD (in the reflexes cluster, the greater the number of abnormal items, the higher is the score) (Fig. 6).

Supplement cluster showed a significantly higher ($p < 0.1\%$) score in AFD than in SFD at 44 weeks.

Especially, item 30 (Cost of Attention), item 33 (Robustness and Endurance), item 34 (Regulatory Capacity), item 35 (State Regulation) and item 36 (Balance of Motor Tone) served as assessment of dysfunction of the central nervous system. Excessively stressed signs in a long period of time could be evidence of damage to the central nervous system. These five cases showed lower scores than those in AFD. This was evident at 44 weeks (Fig. 7).

Table 3 shows the correlation between development indices and Caldwell's environment scores. Environment scores at 6 months and development indices at 6, 12 and 36 months showed highe correlation.

Fig. 8 shows a correlation between environment scores at 6 months and MDI at 12 months. As a whole, a stronger correlation was recognized in SFD than in AFD group throughout the first 12 months.

Case 3 was one of the twins and moderate diplegia. At week 40, primary standing showed excessive responses, being accompanied with adduction of legs and pes equinovarus. It was difficult to induce primary walking. Medium grade stress signs were observed. Hand-to-mouth movement was satisfactory. At week 42, primary standing showed excessive responses with right-left difference and primary walking and placing reaction showed weak responses. Medium grade stress signs were observed. At week 44, foot clonus and primary standing showed excessive responses and primary walking was suppressed. The movement of the eyeball was poor in the rotation test. Opisthotonic posture in whole body was liable to appear with dominant extensor tone. Medium grade stress signs persisted even at this time. However, his orientation responses were relatively good.

In another normal infant, the primitive reflexes were normal at weeks 40-44, and the medium grade stress signs that were observed at week 40 were recovered at week 41.

Discussion

Although the five immature infants who resulted in cerebral palsy and mental retardation marked low scores in the several clusters and Supplement cluster and high scores in the Reflexes cluster, it is difficult by only one assessment to estimate the prognosis of development in the neonatal period. These signs are available after performing several assessments. A high risk infant can be identified when the following factors are involved.

(1) Abnormal findings are present in several items of the Reflexes cluster and persist for a long period of time.
(2) Low scores of supplemental items, especially of stress signs, are per sistent.
(3) Low scores of other clusters or specific items overlap and persist for a long period of time.
(4) The above items (1), (2) and (3) overlap.

Using the above method, prospective diagnosis was made in the neonatal period and very early treatment could be commenced for three of the four cases of diplegia. Our previous data[1] indicates that "fall" in ability of behavior in the neonatal period such as 1) hypotonia and poor postural reaction, 2) diminished spontaneous movement, 3) weak or absent primitive reflexes, 4) weak or no crying, 5) weak sucking, and 6) neonatal seizure, is observed during the period of episodes of the damage to the central nervous system such as asphyxia, intracranial bleeding and nuclearicterus, and pointed out that an approximate prognosis could be predicted from the period of "fall". NBAS is believed to have the assessment of "fall" made more objectively.

The advantage of applying the NBAS for assessment of high risk infants is not only because it is useful in eary diagnosis of cerebral palsy and mental retardation but because the assessment is directly related to treatment. It is important to consider the infant as a person with individuality from the time of birth even if brain damage is present, and to deal with the infant by assessing the best performance of his behaviors in order to draw his potential abilities.

It is possible, even with a high risk infant, to suppress stress signs to a minimum level by the handling of not giving any excessive burden and to induce desirable behaviors by appropriate sensory stimulation.

In the all cases of four diplegia and one mental retardation we experienced, the parents aggressively dealt with their infants.

Generally there is a trend that the greater is the risk and the handicap, the worse is the environment of child care (Caldwell's home score). In early intervention, the importance of plasticity of brain and environment should be emphasized.

It seems essential to perform early assessment of high risk infants using the NBAS as a means of intervention and to observe the process of development under early treatment and care.

References

1) Akiyama T.: Early diagnosis of cerebral palsy. Perinatal Medicine, 11: 475-484, 1981 (Japanese).
2) Als H, Tronick E, Lester BM, & Brazelton T. B: Specific neonatal measures, The Brazelton Neonatal Behavioral Assessment Scale, In J. D. Osofsky (Ed.), Handbook of infant development (pp. 185-215), New York, John Wiley and Sons, (1979).
3) Apgar V.: A proposal for a new method of evaluation of the newborn infant, Current Research in Anesthesia and Analgesia, 32, pp. 260-267, (1953).
4) Bayley N.: Manual for the Bayley Scales of Infant Development, pp. 1-176, The Psychological Corporation, New York, (1969).
5) Brazelton TB.: Neonatal Behavioral Assessment Scale, Clinics in Developmental Medicine, No. 88, pp. 1-104, Blackwell Scientific Publication Ltd., London, 1984.
6) Brazelton TB and Nugent JK.: Neonatal Assessment as an Intervention, Psychobiology and Early Development (pp. 215-229, H. Rauh and H-Ch. Steinhausen (Ed.). Elsevier Science Publishers B. V, (North-Holland), (1987).
7) Caldwell BM and Bradley RH.: Home Observation for Measurement of

the Environment (Administration Manual) pp. 1-38, University of Arkans as at Little Rock, Little Rock, (1984).
8) Littman B and Pamelee AH.: Manual for obstetrical complications, pp. 1-9, Department of Pediatrics, School of Medicine and Mental Retardation Center, Neuropsychiatric Institute, University of California, Los Angeles, 1974.
9) McCarthy D.: McCarthy Scales of Children's Abilities (pp. 1-209), The Psychological Corporation, New York, (1972).
10) Nugent JK.: Using the NBAS with Infants and Their Families, pp. 5-13, March of Dimes Birth Defects Foundation, White Plains, New York, (1985).

正常発達を遂げた未熟児または脳性麻痺となった未熟児の新生児行動評価と超早期療育

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要　旨　発達指数では，修正年齢6ヶ月のPDIおよび12ヶ月のMDIにおいて，危険率5％でSFD児がAFD児より低値を示したが，36ヶ月の時点では有意差がなかった．

6ヶ月時の家庭環境値（Caldwell）と発達指数との間に，有意な相関を認めた．

新生児行動評価の個々のクラスター値のみからは発達障害児の予後診断は困難であるが数回の評価を通して，低クラスター値の持続期間とそれらの重複度数とから可能となる．したがって，high risk児に対してはNBASを介入手段として早期評価を実施し，必要に応じて早期療育下に発達経過を観察することが肝要である．

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