

Original Article

Neonatal adaptive behavioral assessment in asphyxiated full-term newborn infants as measured by the Brazelton scale

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ABSTRACT

Background Brazelton scale was designed to assess neonatal adaptive behavior, a newborn infant's ability to interact with environmental stimuli. It can be used as a screening tool to detect an infant's deviant behavior.

Objective To assess the adaptive behavior of asphyxiated full-term newborn infants compared to that of non-asphyxiated newborns.

Methods Across sectional analytic study was conducted from March 2003 until March 2004. Subjects were allocated into two groups (non asphyxiated and asphyxiated infants) and enrolled consecutively. The evaluation was done twice, at the age of 3-7 days and 1 month. A p value of <0.05 was considered statistically significant.

Results Forty eight newborn infants in each group were compared. There were no characteristic differences between the groups. At the first evaluation, non asphyxiated infants scored better on motor ($p=0.015$), reflex ($p=0.000$), habituation ($p=0.022$), and social-interaction ($p=0.020$) than asphyxiated infants did. At the age of 1 month, motor ($p<0.0001$), reflex ($p<0.0001$), habituation ($p<0.0001$), state organization ($p<0.0001$), and social-interaction ($p=0.045$) were also better in non-asphyxiated infants.

Conclusion Assesment by the Brazelton scale showed that the adaptive behavior of full-term asphyxiated newborn infants was different from that of non-asphyxiated infants [**Paediatr Indones 2004;44:234-238**].

Keywords: neonatal behavioral assesment, Brazelton scale, asphyxiated newborn infant

After birth, newborn infants go through 4 sequential developmental tasks. He will stabilize autonomy, motor, manage himself when to keep alert or sleep, and then start social interaction.¹ In each developmental task, we can observe adaptive behavior; a newborn infant's ability to interact with environmental

stimuli.^{1,2} In the past, experts thought that an infant was a passive recipient to environmental stimuli. Assesment was confined to Apgar scores, pediatric examinations, and neurological evaluations.³⁻⁵ The neurological evaluation assess posture, muscle tone, passive or active movements, and reflexes, which only reflect subcortical functions.⁶ Since 1960 it was realized that an infant is an active participant who is able to change his state while he responds to stimuli.³⁻⁵ It was recognized that a newborn's state of consciousness influences motor and reflex performances.³⁻⁵ The state of a newborn infant is highly dependent on cortical function, so that a neurobehavioral approach was started to be used to assess higher neurological functions.^{3-5,7,8}

Newborn behavioral assessment should be done if there is a suspicion of injury of the nervous system, such as poor sucking, poor tone or abnormal posture; and in high-risk neonates such as preterm or asphyxiated infants.⁹ Early detection of infant's deviant behavior would lead to appropriate intervention and optimal outcome.^{1,2,9} Brazelton scale is one of the neo-

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natal adaptive behavioral scales.³ The scale assesses 28 behavioral items, 18 reflex items, and 7 supplementary items.³ This study was designed to find out the characteristics of full-term asphyxiated newborn infants, assess adaptive behavior mostly influenced by asphyxia insult, know the influence of the severity of asphyxia on adaptive behavior, know the correlation between adaptive behavior and the age of evaluation.

Methods

An analytic cross sectional, comparative study was conducted at the Perinatology Ward Cipto Mangunkusumo Hospital from March 2003 until March 2004. The subjects were recruited consecutively. The inclusion criteria for asphyxiated fullterm newborn group was 1-minute Apgar score below 7 with neurological manifestation or organ dysfunction; whereas for the non-asphyxiated full-term infant group were the 1-minute Apgar score between 7-10 without any neurological manifestation or organ dysfunction, no risk factor, and no morbidity after delivery. Exclusion criteria encompassed newborn infants with congenital anomaly, neuromuscular or cardiovascular malformations, requirement of ventilatory support, severe organ dysfunction, or parents' refusal to participate.

Seven adaptive behavior items were evaluated, consisting of autonomy, motor, reflex, habituation, state organization, state regulation, and social-interaction. The evaluation was done twice, at the age of 3-7 days and 1 month.

Sample size estimation was determined by the lowest difference of mean score of adaptive behavior cluster in two groups based on a pilot study. The autonomy cluster showed the lowest difference of mean score between the two groups and estimated a big number of subjects. We chose habituation cluster for the sample size estimation because of limited time and fund. Informed consent was obtained prior to the study. The study was approved by the Committee of the Medical Research Ethics of Medical School, University of Indonesia. A p value of 0.05 was considered significant. The power of this study was 90%. Data collected from the research forms were pro-

TABLE 1. SUBJECTS' CHARACTERISTICS

Characteristics	Asphyxiated	Non-asphyxiated
Sex		
Male	25	28
Female	23	20
Gestational age		
38 weeks*	15	14
39 weeks*	9	8
40 weeks‡	20	16
41 weeks‡	3	3
42 weeks‡	1	7
Mode of delivery		
Spontaneous¶	16	15
Forceps extraction¶	7	9
Ventouse extraction¶	1	2
Cesarean section§	24	22

* in analysis combined and referred as <40 weeks

‡ in analysis combined and referred as ≥40 weeks

¶ in analysis combined and referred as pervaginam delivery

§ in analysis referred as perabdominam delivery

Statistical analysis with chi-square test

cessed using SPSS 11.0 computer program. The results were analyzed by independent t test, Mann-Whitney test, paired t test, Wilcoxon test, and regression multiple analysis.

Results

During the study period, 48 subjects were eligible for each group. There were no statistically significant differences in sex ($p=0.538$), gestational age ($p=0.083$), or mode of delivery ($p=0.538$) between the two groups (Table 1).

There were 16 asphyxiated infants with 1-minute-Apgar scores below 3, and only 1 infant with 5-minute Apgar score still below 3. After 10 minutes, all infants had Apgar scores between 7-10 (Figure 1).

Forty three (90%) asphyxiated infants did not have any prenatal risk factor. All infants had intrapartum risk factors, 11 (23%) with prolonged labor, 11 (23%) with preeclampsia/eclampsia, 7 (15%) with infant malpresentation, and 5 (10%) with intrapartum infection. Twenty three (48%) infants did not have any morbidity after delivery. Fifteen (31%) infants suffered from neonatal sepsis and 5 (10%) respiratory distress.

At age 3-7 days the non-asphyxiated infants showed better motor ($p=0.015$), reflex ($p=0.000$), habituation ($p=0.022$), and social-interaction ($p=0.020$) than the asphyxiated infants did. At the age of 1 month, motor

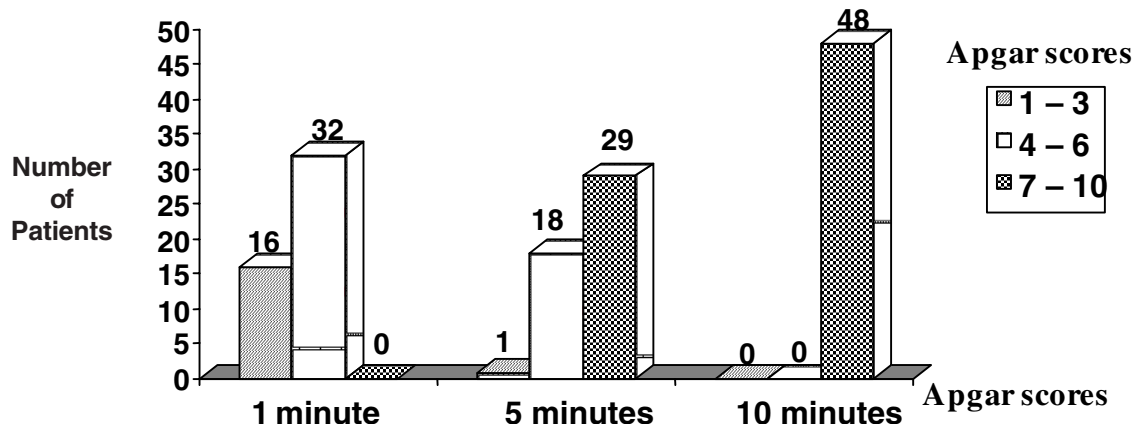


FIGURE 1. DISTRIBUTION OF APGAR SCORES IN ASPHYXIATED NEWBORN INFANTS

($p=0.000$), reflex ($p=0.000$), habituation ($p=0.000$), state organization ($p=0.000$) and social-interaction ($p=0.045$) in non-asphyxiated infants were also better than the non-asphyxiated ones (Table 2).

By multiple regression analysis, we found that at the age of 3-7 days, reflex was the behavioral component mostly influenced by asphyxia insult, while at 1 month old, both reflex and habituation were the most influenced ones. Abnormal reflex of >3 is considered as an abnormality and the infant must be referred to a neurologist. In this study, at the age of 3-7 days, 30 (63%) asphyxiated infants had abnormal reflex score of >3 . At age of 1 month, only sixteen (33%) subjects showed persistent reflex score of >3 .

The severity of asphyxia did not correlate with adaptive behavior mean score. There was a significant increase in mean scores of all adaptive behavior in both groups, except for state organization which decreased at the age of 1 month (Table 3).

At the age of 1 month, the decrease in state organization was due to irritability and lability of state items. Twenty-nine asphyxiated infants showed more irritability and difficulties in modulating states compared to 17 non-asphyxiated infants. In the asphyxiated as well as non-asphyxiated groups, 13 (27%) infants showed a decreased mean score of state regulation. The decrease was due to self-quieting and hand-to-mouth items. Five (10%) asphyxiated infants showed a decreased mean score of autonomy because tremulousness and startles were increased. On the other hand, the non-asphyxiated infants showed increased mean score of autonomy. The differences (delta) between 1-month and 3-7-day mean scores of autonomy, reflex, state organization, state regulation, and social interaction were higher in asphyxiated infants than those in non-asphyxiated ones, but it was not statistically significant.

TABLE 2. COMPARISON OF ADAPTIVE BEHAVIOR MEAN SCORES BETWEEN ASPHYXIATED AND NON-ASPXYIATED NEWBORN INFANTS AT THE AGE OF 3-7 DAYS AND 1 MONTH

Mean score	3-7day			1 month		
	Asphyxiated X(SD)	Non-asphyxiated X(SD)	p	Asphyxiated X(SD)	Non-asphyxiated X(SD)	p
Autonomy	6.75(0.88)	6.77(0.70)	0.759	7.09(0.71)	7.14(0.58)	0.997
Motor	4.28(0.56)	4.61(0.56)	0.015	4.93(0.50)	5.46(0.47)	<0.0001
Reflex	3.96(1.32)	1.98(0.96)	0.000	3.10(1.37)	1.15(0.77)	<0.0001
Habituation	5.44(1.46)	6.09(1.40)	0.022	6.47(0.82)	7.15(0.57)	<0.0001
State organization	4.03(0.73)	4.13(0.69)	0.638	3.42(0.90)	4.10(0.71)	<0.0001
State regulation	3.31(0.61)	3.41(0.63)	0.488	3.74(0.68)	3.77(0.54)	0.764
Social-interaction	4.81(1.25)	5.35(0.87)	0.020	6.29(1.01)	6.71(0.79)	0.045

Note: statistical analysis with Mann-Whitney test.

TABLE 3. COMPARISON BETWEEN MEAN SCORES OF ADAPTIVE BEHAVIOR AT 3-7 DAYS AND THOSE OF 1 MONTH IN ASPHYXIATED AND NON-ASPHYXIATED NEWBORN INFANTS

Mean score Behavior	Asphyxiated		p	Non- asphyxiated		p
	3-7 day X(SD)	1 month X(SD)		3-7 day X(SD)	1 month X(SD)	
Autonomy	6.75(0.88)	7.09(0.71)	<0.0001*	6.77(0.70)	7.14(0.58)	<0.0001*
Motor	4.28(0.56)	4.93(0.50)	<0.0001*	4.61(0.56)	5.46(0.47)	<0.0001*
Reflex	3.96(1.32)	3.10(1.37)	<0.0001*	1.98(0.96)	1.15(0.77)	<0.0001*
Habituation	5.44(1.46)	6.47(0.82)	<0.0001*	6.09(1.40)	7.15(0.57)	<0.0001*
State organization	4.03(0.73)	3.42(0.90)	<0.0001*	4.13(0.69)	4.10(0.71)	<0.0001*
State regulation	3.31(0.61)	3.74(0.68)	<0.0001*	3.41(0.63)	3.77(0.54)	<0.0001*
Social-interaction	4.81(1.25)	6.29(1.01)	<0.0001#	5.35(0.87)	6.71(0.79)	<0.0001*

Paired t test * Wilcoxon test

Discussion

In our study we could not recruit all severely asphyxiated newborns because of their poor clinical condition. Consequently, this study could not represent adaptive behavior of all asphyxiated newborn infants.

Brazelton scale can not be performed in newborn infants who still need oxygen therapy, intravenous fluid drip, or nasogastric tube. Because of the limited availability of subjects in good clinical condition at the age of 3-7 days, we recruited infants who still received intravenous antibiotics.

There have been limited studies about adaptive behavior assessment in asphyxiated newborn infants using Brazelton scale. Most studies reported on infants who were delivered from drug-abusing mothers and preterm infants.

In our study, at the age of 3-7 days, mean scores of motor, reflex, habituation, and social interaction in non-asphyxiated infants were better than those in asphyxiated ones. Another study based on umbilical artery pH and base excess of 15 severe asphyxiated infants reported that at the age of 3 days, the control group performed adaptive behavior much better than the experimental group, except for state organization.¹⁰ But Low, *et al*¹¹ reported that there was no difference between the two groups. This might be due to the different sample size of infants with Apgar scores below 3. Low observed 11 severely asphyxiated infants from 51 infants and did not evaluate all of the subjects. While we studied all 16 from 48 infants and tried to evaluate them at their best performance, even though it required a longer time. For instance, to evaluate two conditions, sleep or full alert, we required 1-4 hours for each subject.

At the age of 1 month, motor, reflex, habituation, state organization, and social interaction in non-asphyxiated infants were better than the asphyxiated ones. Low, *et al*¹¹ reported that at the age of 2 weeks, only state organization was better in the control group than in the asphyxia group.

The severity of asphyxia is determined by duration, severity of insult, neurological manifestation, and organ dysfunction.¹²⁻¹⁴ In this study, the severity of asphyxia did not correlate with the decreased mean score of adaptive behavior at the age of 3-7 days and 1 month. It might be caused by the small number of subjects, probably only 5 (10%) infants were severely asphyxiated (1 infant with 5-minute Apgar score of <3 and 4 infants with neurological manifestation and organ dysfunction).

We found that at 1 month old, both groups showed significant increase in all mean scores, except for state organization. The decrease in state organization at the age of 2 weeks in both groups was also reported by Low without explaining the reason.¹¹ We assumed that when infants were brought to the hospital, their sleep pattern were disturbed and that might influence their irritability and lability state scores. In assessing neurobehavior, state organization especially reflects behavioral aspect. An infant's behavior can change every time, influenced by the last time of feeding, environmental stimuli, and last experiences.¹⁵

Silva reported that at the age of 3 days, asphyxiated infants showed more irritability, hypersensitivity, and difficulties in modulating states than the control group.¹⁰ It was not seen in our study, however, at the age of 1 month, asphyxiated infants showed significant irritability and difficulties in modulating states than non-asphyxiated infants.

The decrease in state regulation in our study was caused by the decreased scores of self-quieting and hand to mouth. It has been recognized that neonatal adaptive behavior is influenced by cultural and ethnic differences.³ From history taking, we found a habit to swaddle newborns and a myth not to cut the infants' nails until the fortieth day. Consequently, infants will be swaddled all day long and their hands covered because they may scratch their faces. Of course, this condition might influence the self-quieting and hand to mouth scores.

Asphyxiated infants showed higher differences (delta) between 1-month and 3-7-day mean scores of autonomy, reflex, state organization, and social interaction than the non-asphyxiated infants did. The increase could be attributed to the parents' concern for their asphyxiated children. They established better parent-child relationship and cared for them more than parents of non-asphyxiated infants. We demonstrated the competence and uniqueness of the infants to the parents in the hope of disillusioning them that their young infants can respond to them in the early phase of life. Based on this, parents can be encouraged to have an intimate relationship with their infants. We hope eventually the outcome will be better. Follow up of short outcome in our study proved brain plasticity. The environmental stimuli can improve the outcome of high-risk neonates. However we still need long term follow up and appropriate intervention to optimize the development of asphyxiated infants.

In conclusion, assesment by the Brazelton scale showed that the adaptive behavior of full-term asphyxiated newborn infants is different from that of non-asphyxiated ones. We recommended that neonatal adaptive behavioral assesment should be performed on high-risk neonates. Brazelton scale gives a detailed description of the newborn behavior and competence. It is useful for screening the infants' deviant behavior.

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