

BEHAVIOR DEVELOPMENT IN NORMAL NEONATES

G.K. Malik
K. Singh
B. Sharma
P.K. Misra
V. Das
P. Sitholey

ABSTRACT

The behavior of normal neonates was studied on day 3, 10 and 30 of life with the help of Brazelton's Neonatal Behavioral Assessment Scale (NBAS). The behavior items were clustered and each cluster was scored. The cluster scores increased on subsequent observations in both term and preterm neonates, the increase usually being significant. The corresponding cluster scores were significantly higher in term babies than preterms. Preterms with questionable delay in development at 3 months of age had significantly lower 30th day scores in 3 of the 7 clusters.

Key words: Behavior assessment, Neonate, Neonatal neurobehavior.

From the Departments of Pediatrics, Obstetrics and Gynecology, and Psychiatry, K.G.'s Medical College, Lucknow 226 003.

Reprint requests: Dr. G.K. Malik, B1-28, Sector A, Aliganj, Lucknow 226 020.

*Received for publication: February 11, 1992;
Accepted: April 7, 1993*

A newborn has an 'individuality' and responds in an organized manner to environmental stimuli. Such responses which represent his neurobehavior vary with the postnatal maturation of the babies. The present study was hence undertaken to study the behavior in normal term and preterm newborns at birth and during the first month of life.

Material and Methods

The present study was carried out on neonates delivered at Queen Mary's Hospital, Lucknow. Only those babies were included in the study whose mothers had uncomplicated pregnancy and were sure of the first day of the last menstrual period and gestational age thus calculated corresponded with their neurological and morphological assessment(1). Twenty six term and 18 preterm babies were studied, all being appropriate for gestational age. The gestational age of preterm babies ranged from 32 to 36 weeks. The babies were well at birth and remained so thereafter.

The behavioral assessment of the babies was done on 3rd, 10th and 30th day of birth with the help of Brazelton's Neonatal Behavioral Assessment Scale (NBAS)(2). The examiners had experience of working in neonatal units, observing and handling babies. Each examiner had administered the NBAS to more than 30 babies according to the instructions given in manual(2) and achieved an inter-scorer agreement level of 90% before taking on this study. The NBAS consisted of 28 behavioral items, each of which is scored on a 9 point scale and 18 elicited responses, each of which is scored on a 3 point scale. The infant's score was based on his or her best performance. For organizing NBAS data that is conceptually and empirically based, the behavioral and reflex items were reduced into 7 clusters.

Twenty two term and 13 preterm babies were followed-up at the age of 3 months. They were screened on Denver Developmental Screening Test(3). Adjustments were made in interpretation if baby was two or more weeks premature by making adjustment in age line by subtracting number of weeks premature from the age of the child. The developmental assessment of the baby was classified as normal, questionable, abnormal and untestable. Statistical analysis was done using 't' test.

Results

Material characteristics were comparable between term and preterm babies (*Table I*). *Tables II & III* show scores of behavior clusters in term and preterm babies, respectively and *Table IV* shows a comparative analysis of the same. It was observed that in each cluster, scoring improved at each subsequent observation in both term and preterm babies, the improvement being statistically significant usually. The cluster scores were significantly higher for term than preterm babies on every observation, *i.e.*, on day 3, 10 and 30. The score for range of state was higher, though not significantly in terms compared to preterms at 30 days of age.

In habituation cluster, the term neonates showed a good response decrement to light, rattle, bell and tactile stimulation. The preterm neonates demonstrated poor habituation to rattle and pin prick, though it

improved significantly with the age.

Term neonates had an average orientation with a mean score of 5.38 ± 0.60 on day 3. Orientation to inanimate visual stimuli was the poorest and that of animate auditory and visual was the best. The orientation was still poorer in preterms. Both terms and preterms showed improvement in orientation during the first month of life.

In motor organization, term neonates had average tone when handled, average elicited and spontaneous activity and good defensive movements on day 3. Preterms performed poorly on all items of motor cluster with less cluster score, which increased significantly with age as in term babies.

Term neonates were less irritable and had few lability of states. They tend to show 3-4 state changes over 30 minute examination period. Range of state did not change in the first 10 days of life. Preterms had low irritability confined to 1-3 stimuli. Usually, they showed 6-8 state changes over 30 minutes. They tended to become more irritable with age.

The state regulation cluster score improved significantly with age. Though improvement was in all four items but that of self-quieting and hand-to-mouth facility was most marked in term babies. In preterm babies, cuddliness, consolability and self quieting improved but hand-to-mouth facility remained poor at the end of the first month.

TABLE I—Sample Characteristics

Characteristics	Term neonates (Mean \pm SD)	Preterm neonates (Mean \pm SD)
1. Maternal age (years)	25.31 \pm 3.79	26.05 \pm 4.68
2. Parity of mothers	1.76 \pm 0.74	1.72 \pm 1.40
3. Gestation (weeks)	39.33 \pm 0.79	35.11 \pm 1.14
4. Birth weight (g)	2923.07 \pm 307.4	1888.8 \pm 395.3

TABLE II—NBAS Cluster Score in Term Babies

Cluster	Cluster score (Mean \pm SD)		
	Days 3	Day 10	Day 30
Habituation	6.39 \pm 0.49	7.18 \pm 0.44	7.57 \pm 0.34
Orientation	5.38 \pm 0.60	6.23 \pm 0.51	7.03 \pm 0.57
Motor organization	5.47 \pm 0.55	5.81 \pm 0.40	6.28 \pm 0.36
Range of state	4.41 \pm 0.51 (NS)	4.41 \pm 0.64	4.60 \pm 0.55
Regulation of state	5.60 \pm 0.68	6.36 \pm 0.90	7.02 \pm 0.48
Autonomic stability	5.91 \pm 0.51	6.51 \pm 0.68	7.06 \pm 0.50
Reflexes	0.69 \pm 0.91	0.19 \pm 0.39	0.08 \pm 0.27 (NS)

The difference between two adjacent observations of each cluster is statistically significant except wherever indicated.

TABLE III—NBAS Cluster Score in Preterm Babies

Cluster	Cluster score		
	Days 3	Day 10	Day 30
Habituation	4.97 \pm 0.92	5.96 \pm 0.77	6.85 \pm 0.59
Orientation	3.87 \pm 0.87	4.56 \pm 0.83	5.76 \pm 0.80
Motor Organization	3.50 \pm 0.90	4.23 \pm 0.86	5.21 \pm 0.62
Range of State	3.85 \pm 0.46 (NS)	4.00 \pm 0.63	4.38 \pm 0.55
Regulation of State	4.08 \pm 0.86	4.74 \pm 0.76	5.71 \pm 0.68
Autonomic Stability	4.82 \pm 0.66	5.61 \pm 0.59	6.18 \pm 0.63
Reflexes	3.44 \pm 1.92	1.94 \pm 1.27	0.61 \pm 0.83

The difference between two adjacent observations of each cluster is statistically significant except wherever indicated.

The term babies had good autonomic stability on day 3 having 2-3 startles, tremors seen only in crying state and had healthy skin color changed minimally over examination period. Preterms had tremors at least 3 times in state 5 or 6, sometimes in lower states also, and had lability of skin color. Autonomic stability improved significantly with age in both classes of babies.

Reflexes cluster score improved significantly in the first 10 days but not beyond in term babies, while it kept on improving significantly in the first month in preterms.

Developmental assessment at the age of 3 months with the help of Denver Developmental Screening Test (DDST) revealed that all the term babies were within normal limits on follow up. Eight of 13 followed up

TABLE IV—Comparison of NBAS Cluster Score between Term and Preterm Babies

Cluster	Cluster score - Mean (SD)					
	Day 3		Day 10		Day 30	
	Term	Preterm	Term	Preterm	Term	Preterm
Habituation	6.39 ± 0.49	4.97 ± 0.92	7.18 ± 0.44	5.96 ± 0.77	7.57 ± 0.34	6.85 ± 0.59
Orientation	5.38 ± 0.60	3.87 ± 0.87	6.23 ± 0.51	4.56 ± 0.83	7.03 ± 0.57	5.76 ± 0.80
Motor organization	5.47 ± 0.55	3.50 ± 0.90	5.81 ± 0.40	4.23 ± 0.86	6.28 ± 0.36	5.21 ± 0.62
Range of state	4.41 ± 0.51	3.85 ± 0.46	4.41 ± 0.46	4.00 ± 0.63	4.60 ± 0.55 (NS)	4.38 ± 0.55
Regulation of state	5.60 ± 0.68	4.08 ± 0.86	6.36 ± 0.90	4.74 ± 0.76	7.02 ± 0.48	5.71 ± 0.68
Autonomic stability	5.91 ± 0.51	4.82 ± 0.66	6.51 ± 0.68	5.61 ± 0.59	7.06 ± 0.50	6.18 ± 0.63
Reflexes	0.69 ± 0.91	3.44 ± 1.92	0.19 ± 0.39	1.94 ± 1.27	0.08 ± 0.27	0.61 ± 0.83

The difference of cluster score between term and preterm babies is significant for any observation except for range of state on day 30.

preterm babies were normal at 3 months, and the remaining 5 were in questionable category and were called 'Not Normal'. It was observed that significantly higher scores were observed in habituation, motor organization and range of state at the age of 30 days in those who were 'Normal' on DDST at 3 months compared to those who were 'Not Normal' (Table V).

Discussion

In the present study, term neonates showed significant improvement in cluster score with the age. The same pattern was observed for preterms; however, preterm babies scored less than the term ones in every behavior cluster.

Iyer *et al.* (4) found a higher habituation and lower orientation and motor organization cluster scores in healthy AGA term babies than observed by us. In these babies Coll(5) and Khadilkar and Karmarkar(6) observed habituation cluster score similar to that of ours but higher scores for motor organization and orientation were observed

by them. In a study of Zinacanteco Indian neonates of South Medico, a moderately high adaptation to repeated stimuli was observed(7). Chinese-American neonates tended to habituate more readily to a pen light than Caucasian infant(8).

Cluster score for range of state on day 3 in term babies were almost similar in other studies(5,9,10). Improvement in this cluster score with age was observed by us. Some workers did not observe variation with age (4,11,12). Khadilkar and Karmarkar(6) even found cluster score to decline in their second observation on day 10. That the term neonates use endogenous mechanism for lowering their aroused state was evident from good hand-to-mouth facility and good self-quieting activity in the present study. The regulation of state cluster improved with age. Khadilkar and Karmarkar(6) observed a rise in score of this cluster during the first month of life. In study of Iyer *et al.* (4), the rise in score on day 10 declined at day 30.

TABLE V—NBAS Cluster Score in Relation to Denver Developmental Screening Test(DDST) Results at 3 months of Age in Preterm Babies

Cluster	NBAS cluster score on day 3		NBAS cluster score on day 30	
	DDST Normal (n = 8)	DDST Not normal (n = 5)	DDST Normal (n = 8)	DDST Not normal (n = 5)
Habituation	5.38 ± 0.95	4.75 ± 1.16	7.16 ± 0.46	6.50 ± 0.48*
Orientation	4.18 ± 0.74	3.33 ± 1.33	6.06 ± 0.56	5.23 ± 1.17
Motor organization	3.85 ± 0.81	2.72 ± 0.98*	5.52 ± 0.58	4.76 ± 0.38*
Range of state	3.88 ± 0.19	3.50 ± 0.56	4.69 ± 0.48	4.05 ± 0.48*
Regulation of state	4.06 ± 0.85	3.70 ± 1.20	5.94 ± 0.72	5.40 ± 0.93
Autonomic stability	5.00 ± 0.80	4.53 ± 0.65	6.16 ± 0.69	6.00 ± 0.53
Reflexes	3.5 ± 2.33	4.00 ± 1.58	0.50 ± 1.07	0.80 ± 0.84

*Statistically significant differences.

10. Moss M, Colombo J, Mitchell DW, Horowitz FD. Neonatal behavioral organization and visual processing at three months. *Child Development* 1988, 59: 1211-1220.
11. Als H, Tronick E, Adamson L, Brazelton TB. The behavior of the full term but underweight newborn infants. *Dev Med Child Neurol* 1976, 10: 590-602.
12. Keefer CH, Tronick E, Dixon S, Brazelton TB. Specific difference in motor performance between Gusii and American newborn and a modification of the Neonatal behavioral Assessment Scale. *Child Development* 1982, 53: 754-759.
13. Vohr BR, Karp D, O'Dea C, *et al.* Behavioral changes correlated with brain-stem auditory evoked responses in term infants with moderate hyperbilirubinemia. *J Pediatr* 1990, 117: 288-291.
14. Brazelton TB, Tryphonopoulou Y, Lester BM. A comparative study of the behavior of Greek Neonates. *Pediatr* 1979, 63: 279-284.
15. Field T, Hillock N, Ting G, Demsey J, Dabiri C, Shuman HH. A first five year follow-up of high risk infants: Formulating a cumulative risk index. *Child Development* 1978, 49: 119-131.

NOTES AND NEWS

CALL FOR CASES (RHESUS ISOIMMUNIZATION)

We have established diagnostic and therapeutic facilities for the prenatal management and postnatal care of Rhesus isoimmunized pregnancies. We have successfully treated a few such fetuses with intrauterine umbilical transfusion (via Cordocentesis). We would be willing to accept such cases at the following addresses:

Dr. S.N. Daftary
Dean,
Nowrosjee Wadia Maternity Hospital,
Acharya Dhonde Marg,
Parel, Bombay 400 012

Dr. S.C. Gupte
Assistant Director,
Institute of Immunohematology (ICMR),
NWM Hospital, Pune,
Bombay 400 012.

Dr. R.H. Merchant
Division of Neonatology,
Wadia Maternity Hospital,
Parel, Bombay 400 012