OPEN ACCESS

Corresponding Author
B. Binish Joseph,
Department of Paediatrics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, India
coolbinish@gmail.com

Author Designation
[1]Associate Professor
[2,3]Post Graduate
[4]Professor and HOD

Neuro Behavioral Pattern of Newborn Babies Using Modified Brazelton Neonatal Behavioral Assessment Scale in a Tertiary Care Centre

[1]Sanjay K. Masaraddi, [2]B. Binish Joseph, [3]Naveen and [4]K.E. Elizabeth
[1-4]*Department of Paediatrics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, India*

Abstract
Neuro-behavioral pattern of newborn babies describe newborn competencies and adaptation to extra uterine environment. Various models have been designed to assess this TBNBAS is one of the scales commonly used in evaluation of behavior of newborn babies. The scale is applied through observation of a newborn's individual responses to reflexes and responding sound by stimuli. Scale describes the current status of the individual infant's autonomic, motor and social-attentional systems, as these factors interact with each other and become integrated during the neonatal period. Those Newborn babies available for assessment within 72 hrs. of birth, irrespective of gestational age using NBAS. In this study, 40 newborn babies were enrolled, 20 term and 20 preterm. 19 were low birth weight and 21 normal birth weight. 72.50% of were born by normal vaginal delivery, 27.50% of them had LSCS. The mean habituation response score was 5.5, mean Social Interaction Responses score 4.9, mean state organization Response score 5.2, mean state regulation response 5.1, mean autonomic system response score 5.67, mean supplementary response score was 5.38 and mean reflexes score was 1.9. NBAS is a good tool to study neurobehavioral pattern and assist in parental counselling. Follow up of babies to study neurodevelopment outcome in relation to NBAS is recommended.

INTRODUCTION

Neuro-behavioural patterns are important in shaping extrauterine environment and future neuro developmental outcome. Neuro-behavioural pattern of newborn babies describe newborn competencies and adaptation to extrauterine environment. Various models have been designed to assess this[1]. The Brazelton Neonatal Behavioral Assessment Scale (NBAS) is one of the scales commonly used in evaluation of behaviour of newborn babies[2]. It was developed in 1973 and was revised in 1995. Clinical examination with the Brazelton NBAS has been both infant-centered and family-focused. The scale may serve both as a diagnostic screen and as a form of intervention with parents. The scale is applied through observation of a newborn's individual responses to reflexes and responding sound by stimuli[3]. The scale therefore describes the current status of the individual infant's autonomic, motor and social-attentional systems, as these factors interact with each other and become integrated during the neonatal period[4]. There are only very few studies on neurobehavioral assessment in the literature and Indian studies are scanty.

MATERIALS AND METHODS

It is aCross-Sectional Study with study population n = 40 newborns delivered at our institution. After approval of the study protocol by our institutional research and human ethics committee, the newborns, who fulfilled the inclusion criteria- New-born babies available for assessment within 72hrs of birth, irrespective of gestational age known by LMP Ultrasound were included in the study. Written informed consent was taken from the mother/parent and explained in detail about the study and the procedure. Major congenital malformation and chromosomal defects. Sick new born admitted to NICU New born whose parents are not willing for this study are excluded. Gestational age was noted in all cases based on LMP and USG. NBAS was assessed after training using NBAS kit, that consisted of a red ball, a rattle, a bell, a foot probe and a torch and scoring chart. The various neurobehavioral profile, that can predict future neuro developmental outcome. The data was computed and analyzed using SPSS version 20.1.

RESULTS AND DISCUSSION

Total 40 newborn babies were included in the study.

Among the study population, 50% of them were term,50% werepreterm. The Male to Female Ratio was 1.3: 1.

Among the study population, 72.50% of them were normal vaginal delivery, 27.50% of them underwent LSCS.

The mean habituation response score for dec to light was 5.7±0.94, it was 5.3±1.36 for dec. to rattle, it was 5.48±1.5 for dec to bell and it was 5.35±1.08 for dec. to foot. The mean habituation responses score was 5.5.

The mean social interactive response score for Animate Visual4.35±1.69, it was 4.48±1.71 Animate Visual and Auditory, it was 5.48 ± 1.69 for Inanimate Visual, it was 5.1±1.52 Inanimate Visual and Auditory, it was 5.28±1.6 for Animate Auditory, it was 5.58±1.48 for Inanimate Auditory and it was 4.68±1.58 for Alertness. The mean Social Interaction Responses score was 4.9.

The mean motor system responsescore for General Tone was 3.68±1.19, it was 4.43±1.48 for Motor Maturity, it was 4.85 ± 1.48 pull to sit, it was 4.93±1.47 for defensive and it was 4.4±1.55 activity level. The mean motor system responses score was 4.45.

The mean state organization response score for Peak of Excitement was 4.35±1.94, it was 5.18±1.34 for Rapidity of Build-up, it was 5.28±1.62 for irritability, it was 6.03±1.49 for Lability of States. The mean state organization responsescore was 5.21.

The mean state regulation responsescore for Cuddliness was 5.7±1.18, it was 4.5±1.55 for consolability, it was 5±1.74 for Self-Quieting and it was 5.33±1.51 for Hand to Mouth. The mean state regulation responsescore was 5.1.

The mean autonomic system response score for tremulousness was 6.33±1.42, it was 5.73±1.47 for Startles and it was 4.95±1.06 for Lability of Skin Color. The mean autonomic system response score was 5.67.

The mean Supplementary items response score for quality of Alertness was 5.33±1.83, it was 6.35±1.12 for Cost of Attention, it was 6.28±1.32 for Examiner Facilitation, it was 5.98±1.14 for General Irritability, it was 4.75±1.08 for Robustness / Endurance, it was 4.43±1.17 for State Regulation and it was 4.55±1.15 for Examiners Emotional Response. The mean supplementary response score was 5.38.

Among the study population, the mean reflexes score was 1.9±0.78. The mean reflexes score was 1.9

Among the study population, none of the outcome variables namely the median difference of habituation parameter, social interactive parameter, Motor system parameter, State organization parameter, State regulation parameter, Autonomic system parameter, Supplementary items parameter and reflexes between males and females statistically significant. (P>0.05)

The goal of this study was to describe the behavioral responses of newborn babies as measured by NBAS. There are only very few studies on this and most studies were done on term babies and a few studies have focused on mode of delivery. Indian data on NBAS is scanty.

Table 1: Distribution of Newborn babies according to Term/ Preterm

Parameter	Frequency	Percentage
Term	20	50
Preterm	20	50
Total	40	100

Among the study population, 50% of them were term,50% were preterm. The Male to Female Ratio was 1.3: 1.

Table 2: Distribution of newborn babies according to mode of delivery (n = 40)

Mode Of Delivery	Frequency	Percentages
LSCS	11	27.50
NVD	29	72.50

Among the study population, 72.50% of them were normal vaginal delivery, 27.50% of them underwent LSCS.

Table 3: Descriptive analysis of 'Habituation Responses' in study population (n=40)

Parameter	Mean ± SD	Median	Minimum	Maximum
Response Dec. to Light	5.7±0.94	6.00	4.00	7.00
Response Dec. to Rattle	5.3±1.36	6.00	3.00	7.00
Response Dec to Bell	5.48±1.5	5.00	3.00	8.00
Response Dec. to Foot	5.35±1.08	5.00	4.00	7.00

Table 4: Descriptive analysis of "Social Interaction Responses' in study population (n = 40)

Parameter	Mean ± SD	Median	Minimum	Maximum
Animate Visual	4.35±1.69	4.00	2.00	8.00
Animate Visual and Auditory	4.48±1.71	4.50	2.00	8.00
Inanimate Visual	5.48±1.69	6.00	3.00	8.00
Inanimate Visual and Auditory	5.1±1.52	5.00	3.00	8.00
Animate Auditory	5.28±1.6	5.00	3.00	8.00
Inanimate Auditory	5.58±1.48	5.00	3.00	8.00
Alertness	4.68±1.58	4.50	3.00	8.00

Table 5: Descriptive analysis of 'Motor system responses' in study population (n = 40)

Motor system	Mean±SD	Median	Minimum	Maximum
General Tone	3.68±1.19	3.50	1.00	6.00
Motor Maturity	4.43±1.48	4.00	2.00	7.00
Pull to Sit	4.85±1.48	5.00	2.00	7.00
Defensive	4.93±1.47	5.00	2.00	7.00
Activity Level	4.4±1.55	4.00	2.00	7.00

Table 6: Descriptive analysis of 'State organization Response' in study population (n = 40)

State organization	Mean±SD	Median	Minimum	Maximum
Peak of Excitement	4.35±1.94	4.00	2.00	8.00
Rapidity of Build-up	5.18±1.34	5.00	3.00	7.00
Irritability	5.28±1.62	5.50	2.00	8.00
Lability of States	6.03±1.49	6.00	4.00	8.00

Table 7: Descriptive analysis of "State regulation Reponses' in study population (n = 40)

State regulation	Mean±SD	Median	Minimum	Maximum
Cuddliness	5.7±1.18	5.00	4.00	8.00
Consol ability	4.5±1.55	4.00	2.00	8.00
Self-Quieting	5±1.74	5.00	2.00	8.00
Hand to Mouth	5.33±1.51	5.00	2.00	8.00

Table 8: Descriptive analysis of 'Autonomic system Responses' in study population (n=40)

Autonomic system	Mean±SD	Median	Minimum	Maximum
Tremulousness	6.33±1.42	7.00	3.00	8.00
Startles	5.73±1.47	6.00	3.00	8.00
Lability of Skin Color	4.95±1.06	5.00	3.00	7.00

Table 9: Descriptive analysis of 'Supplementary items Response' in study population (n=40)

Supplementary items	Mean±SD	Median	Minimum	Maximum
Quality of Alertness	5.33±1.83	6.00	2.00	8.00
Cost of Attention	6.35±1.12	6.50	4.00	8.00
Examiner Facilitation	6.28±1.32	6.50	4.00	8.00
General Irritability	5.98±1.14	6.00	4.00	8.00
Robustness / Endurance	4.75±1.08	5.00	3.00	6.00
State Regulation	4.43±1.17	4.00	3.00	6.00
Examiners Emotional Response	4.55±1.15	5.00	3.00	6.00

Table 10: Descriptive analysis of reflexes in study population (n = 40)

Parameter	Mean±SD	Median	Minimum	Maximum
Reflexes	1.9±0.78	2.00	1.00	3.00

Among the study population, the mean reflexes score was 1.9 ± 0.78. The mean reflexes score was 1.9

The NBAS Behavioral Items: These were grouped into six clusters: (1) Response Decrement-4 items on the ability to respond to and inhibit discrete stimuli while sleeping, (2) Social Interactive-7 items on the ability to attend to visual and auditory stimuli and the quality of overall alertness, (3) Motor System-5 items on tone, motor control and the ability to perform integrated motor activities, (4) State

Organization-4 items on newborn's arousal and state lability, (5) State Regulation-4 items on the newborn's ability to regulate his/her state in response to increased stimulation and (6) Autonomic Stability-3 items on the newborn's physiological responses to stress such as startles, tremors and color changes.

The scoring was done on a scale of 1-9, 1 being lowest and 9 being highest. Horowitz *et al*. (1976) stated that greater than 1 point difference in mean scores was considered significant.

Habituation Response: This item represents the response of the newborn in shutting out noxious stimuli. Mean habituation response score observed in this study was 5.5, which was slightly higher than the Korean study by shin[5] on term babies (4.87). Response decrement to foot was much lower in the Korean study, probably due to the higher CS rates. In this study, it was 5.7±0.94 for dec to light, 5.3±1.36 for dec. to rattle, 5.48±1.5 for dec to bell and 5.35±1.08 for dec. to foot, compared to shin[5]- 5.19 for dec to light, 5.26 for dec. to rattle, 6.50 for dec to bell and 3.15 for dec. to foot.

The mean score of Response Decrement to light was 5.7 in this study, comparable to 5.19 in the Korean study (Yeonghee Shin)[5]. This was lower than 6.5 for Indonesian neonates (Piessens, 1991)[7], 6.3 for American White neonates (Als, Tronick, Lester, and Brazelton, 1979)[8] and 7.03 for Swedish neonates (Welles-Nystrom, 1991)[9]. This difference may be due to the difference in the gestational age and birth weight between the sample populations.

Social Interactive Response: Mean Social Interactive score was 4.9, compared to 5.34, in the Korean study. The average response to animate visual and auditory- human face and voice was lower (4.48) in comparison to 5.95 in the Korean study (Yeonghee Shin)[5], 7.4 in t Indonesian newborns (Piessens, 1991)[7], 6.6 for American White newborns (Als[8] and 7.18 for Swedish newborns (Welles-Nystrom, 1991)[9]. The average score for alertness was 4.68 compared to 4.76 in the Korean study (Yeonghee Shin)[5], but lower than 7.0 in Indonesian newborns (Piessens, 1991) 7and 5.6 in American White newborns Als[8]

The lower scores is attributable to the subgroup of preterm babies in this study. Previous studies have reported that the type of delivery and the use of obstetric medication during labor and delivery is correlated with lower scores on the Social Interactive and Motor System scales (Kuhnert, Linn, and Kennard, 1988, Ransjo-Arvidson *et al.,* 2001, Sepkoski, Lester, Ostheimer and Brazelton, 1992). Van den Boom and Graven horst (1995) found that

newborns of mothers who received obstetric medication were less able to shut out disturbing stimuli than newborns of the undedicated mothers.

This finding is similar to the study conducted by Shin[5] where the social interactive capacity, measured by the infant's response to animate and inanimate objects, was an average of 5.34. Piessens et al7noted for the Social Interaction cluster, item scores were lower compared with those of other ethnic newborns. The average response to human face and voice (animate visual and auditory) was only 7.4, 6.6 for American White sample newborns by the study conducted by Als[8] and 7.18 for Swedish newborns by Welles-Nystrom9. In particular, the average score for alertness was less in this study. Other samples scored higher.

Motor System Responses: Mean Social Interactive score was 4.45, compared to 4.9, in the Korean study. The mean score for General Tone was 3.68±1.19, it was 4.43±1.48 for Motor Maturity, it was 4.85±1.48 pull to sit, it was 4.93±1.47 for defensive and it was 4.4±1.55 activity level.

This finding differs from the study done by Shin Y et al5 where they each item of Motor System was rated separately. General tone and activity level were rated 5.34 and 4.12, respectively, on a scale with a range of 1-5. Motor maturity, pull-to-sit and defensive responses were moderate, with levels ranging from 4.32-5.84.

State Organization Response: As per State Organization cluster (e.g., peak of excitement, rapidity to build up, irritability, labiality of state), the mean score was 5.21 in comparison to 3.86 in the Korean study5

The mean score for Peak of Excitement was 4.35 ± 1.94, it was 5.18±1.34 for Rapidity of Build-up, it was 5.28±1.62 for irritability, it was 6.03±1.49 for Lability of States.

This finding is quite high compared to the study conducted by Shin[5] where the mean score on State Organization was 3.86 on a 1-6 scale, from low to high responses

State Regulation Response: In the State Regulation cluster (e.g., cuddliness, consolability, self-quieting, hand-tomouth) the mean score was 5.1, in comparison to 5.6 in the Korean Study Shin[5]. Most babies did not demonstrate hyper-or hypoactive responses. According to Sumner and Spietz, 1994, the items used to get adults' attention were Cuddliness and the use of hand-to-mouth. The responses indicated that the newborns in this study were agreeable and manageable which is positive to promote attachment to the caretaker, as reported

by the Korean study.

This finding is similar to the study conducted by Shin[5] where state Regulation is a infant's own ability to control his or her state, for example, cuddliness, consolability, self-quieting, and acts of hand-to-mouth. State Regulation was a moderate level of 5.60 on a 1-9 scale, with 1 equal to the lowest score and 9 the highest score.

Autonomic system Responses: The mean score in the study was 5.67, compared to 5.83, in the Korean study. This finding differs from the study conducted by Shin Y et al5 where the mean score on the Autonomic System was 5.83, indicating a moderate response. The mean score for tremulousness was 8.40±1.14, it was 5.56±1.68 for Startles and it was 3.62±0.61 for Lability of Skin Colour.

When comparing the performance of Motor, State Organization, State Regulation and Autonomic Stability clusters, the findings were similar to Korean, Indonesian (Piessens7 , 1991) and White newborns (Als[8]).

Supplementary Items Responses: The mean score was 5.3 in this study. The Spanish study by Pereira *et al,* reported 7.33 in both normal and low birth weight studies. The difference may be due to ethic and socio-cultural differences.

Reflexes: the mean score was 1.9, in comparison to 0.73 in normal birth weight and 0.65 in low birth weight Spanish babies.

Among the study population, the mean reflexes score was 1.9±0.78. This is similar to the study conducted by J. Canals[6] where the mean reflex score was 1.85 (SD 0.47) and 1.6 (SD 0.38) at 3 days and 4 weeks, respectively. In the study by J. Canals[6], where a total of 18 reflex responses were tested. All newborns showed normal reflex responses in the Babinski, ankle clonus, rooting, glabella, placing, tonic deviation head and eyes, nystagmus, tonic neck reflex, and Moro reflex. However, some of the neonates tested showed weakened or atypical reflex responses. Fifty-four percent of the newborns were weak in the walking reflex. A considerable number of newborns had weakness in standing (22%), crawling (14%) and sucking (12%) responses. A small number of newborns had weakness in a few reflex responses, such as plantar grasp (4%), palmar grasp (4%) and incurvation (4%). Eleven newborns (22%) showed more than three atypical scores on the examination

Limitations and Future Research: This study has limitations with respect to small sample size, heterogenicity with respect to gestational age, birth weight, type of delivery and timing of examination.

Maternal factors like socio-cultural background, stress/anxiety levels were not studied. Follow up these babies were not undertaken. Hence, further research in this field is recommended on this interesting domain of newborn behavior and its relation to future neuro developmental outcome.

CONCLUSION

This study was undertaken on 20 term and 20 preterm babies examined within 72 hours of delivery. This helped to establish the various neuro behavioral profile and behavior. This study gave insight on the neurobehavioral pattern in relation to mode of delivery and gender. Mode of delivery showed a significant association with state organization-lability of states. An important part of maternal-newborn care is to facilitate the bonding between parents and their newborns, both physically and emotionally. Demonstrating the NBAS to parents can help them to better understand the newborn behavior and support responsive parenting. This may in turn facilitate parent-newborn attachment. Education about normal neonatal development and appropriate stimulation is an identified need. It is hoped that the use of the Brazelton Neuro- Behavioral Assessment Scale (NBAS) will provide the parents with information on their newborn's capabilities and behavioral needs.

This descriptive research study established that NBAS is a good tool to assist new parents. It has provided the basis for further research in this area. Follow up of babies to study neurodevelopment outcome in relation to NBAS is recommended.

REFERENCES

2. Kramer, M. S., 1987. Determinants of LBW, Methodological assessment and Meta-analysis. WHO Bull. 65: 663-737.

4. Costa, R., B. Figueiredo, I. Tendais, A. Conde, A. Pacheco and C. Teixeira, 2010. Brazelton neonatal behavioral assessment scale: A psychometric study in a portuguese sample. Infant Behav. Dev., 33: 510-517.

6. Xu, Y., K. Yolton and J. Khoury, 2011. Earliest appropriate time for administering neurobehavioral assessment in newborn infants. Pediatrics, 127: 69-75.

8. Noble, Y. and R. Boyd, 2011. Neonatal assessments for the preterm infant up to 4 months corrected age: A systematic review. Dev. Med. Child Neurol., 54: 129-139.

10. Shin, Y., M. Bozzette, C. Kenner and T. Kim, 2004. Evaluation of korean newborns with the

brazelton neonatal behavioral assessment scale. J. Obstetr. Gynecol. Neonat. Nurs., 33: 589-596.

12. Canals, J., J. Fernández-Ballart and G. Esparó, 2003. Evolution of neonatal behavior assessment scale scores in the first month of life. Infant Behav. Dev., 26: 227-237.

14. Piessens, P.W., 1991. Newborn Behavioural and Development in Indonesia. In(Eds), In: The Cultural Context of Infancy (Volume2).Multicultural and Interdisciplinary Approaches to Parentinfant Relations, Nugent, J.K., B.M. Lester and $ T.B. Brazrlton, (Eds.)., Praeger, Inc., 88 Post Road West, ISBN-14: 978-0893916275, pp: 271-298.

16. Als,H., E. Tronick, B.M. Lester, T.B. Brazelton, 1979. Specific neonatal measures: The Brazelton Neonatal BehavioralAssesment scale. IN J.D Osofsky, Handb. of infa development., 185-215.

18. Welles, N.B.L., 1991. The Mature Primipara and her Infant in Sweden: Alife Course Study. In: The Cultural Context of Infancy (Volume 2).Multicultural and Interdisciplinary Approaches to Parent-Infant Relations, Nygent, J.K, B.M. Lester, and T.B. Brazelton, (Eds.)., Norwood, NJ. Ablex., Norwood, New Jersey, ISBN-14: 978-0893916275, pp: 145-168.