

# A Longitudinal Study of High Risk Neonates for Tone Abnormalities and effectiveness of early Neuro-Developmental Therapy- At Teaching Hospital, Pune

Bulla Sharan, H K G Singh, Srinivas Reddy<sup>1</sup>

Department of Paediatrics, Bidar Institute of Medical Sciences, Bidar

<sup>1</sup>Department of Community Medicine M R Medical College, Gulbarga

## Abstract

**Background:** Present neonatal care givers need to develop interventions that optimize care of High- Risk- Neonates during hospital stay and also after discharge with follow up care program to minimize disability who develop tone abnormalities.

**Objective :** Neuro-developmental assessment of High- Risk- Neonates and impact of early Neuro-Developmental-Therapy (NDT) in maximizing growth and Neuro-developmental potential to modify future disability.

**Material and Method:** This prospective study was conducted in Neonatal Intensive Care Unit(NICU) and “ High- Risk-Clinic” from 1<sup>st</sup> August 2007 to 31<sup>st</sup> October 2008 at Teaching Hospital Pune. Fifty-three high-risk babies were examined and screened for assessment of tone during first 3 months of study and followed up till 12<sup>th</sup> month of their age after getting their consent .

**Result:** The present study shows that abnormal tone was present among 42(79.24%) babies and normal tone in 11(20.75%) babies during first clinical examination at 2 to 2.5 months of age. Hypotonia was higher among 31 babies (58.49%) followed by hypertonia in 11(20.75%) babies. Out of 11(20.75%) babies with hypertonia, 8(72.72%) babies normalized tone by 12<sup>th</sup> month of age. Out of 31(58.49%) babies with hypotonia 26(83.87%) babies normalized by 12<sup>th</sup> month. Hypotonia was found to be more common than hypertonia at 2 to 2.5 months of age. After early intervention normalization of tone was 83.87% in hypotonic babies as compared to 72.72% in hypertonic babies. Normal tone was achieved at the age of 12<sup>th</sup> month amongst 34(80.95%) babies after early intervention.

**Conclusion:** Assessment of tone and early NDT intervention had better outcome.

**Key words:** tone, neuro-developmental therapy, high- risk-clinic.

## Introduction

The “High-Risk” babies who would not have survived 20 years ago, are now surviving, with all the technological advances in Neonatal care. Neonatal special care units in the last two decades have given new dimensions to the previously available neonatal care, resulting in decreasing mortality but parallelly increasing morbidity. This has resulted in increased number of survivors of whom some have adverse neuro-developmental outcome but most will not. Changes in neuromotor function observed during the first year of life are closely related to maturation of the central nervous system and the presence or absence of brain damage.

Between zero and three years of life an estimated

1,000 trillion synapses occur through the child's “experiences”, which is twice as many as adults. This fact stresses the need for “effective” early stimulation. Though the greatest enhancement occurs throughout childhood and until puberty, the wiring opportunity is at its best during the first 3 years of life. The windows of opportunity for motor development is 0-24 months [1]. Early intervention consist of identifying a baby who already has or is at potential risk for development of handicapping condition, and subsequently providing remedial measures to lessen its effects. Physiotherapy or neuro-developmental therapy remains the mainstay. Physiotherapy normalizes the muscle tone by inhibiting pathologic tonic reflex activity and by repetitive facilitation of normal, higher integrated

## Address for Correspondence

Dr. Sharan Bulla, H.No-35, (MIG) K.H.B Colony,

Bidar-585401, Karnatka, India.

E-mail:- drsharan@gmail.com

righting equilibrium reactions in the proper development sequence. Therefore it is important to detect abnormalities in the neurodevelopment as early as possible, so that intervention(NDT) programme can be started [2]. Surprisingly, there are no standardized guidelines for follow up of high risk infants even in tertiary care centers [3]. Hence the present study was planned to assess the evolution of tone, early intervention, beneficial effects of NDT, to look for the outcome and predict near normal development among the NICU graduates in relation to tone.

### Aims and Objectives

- 1) Neuro-developmental assessment of High- Risk- Neonates based on evolution of tone.
- 2) To know the impact of early neuro-developmental therapy(NDT) in normalizing tone.
- 3) To look for the outcome and predict the near normal development in relation to tone.

### Material and Methods

This hospital based prospective study was carried out in Neonatal Intensive Care Unit (NICU) and High-Risk- Clinic, Tertiary level Medical Care Teaching and General Hospital, Pune from 1<sup>st</sup> August 2007 to 31<sup>st</sup> October 2009. Parents/guardians of NICU graduates being discharged from NICU after treatment were asked regarding willingness to be followed up for one year at “High-Risk- Clinic” which was conducted on Wednesday and Saturday of every week. Selection of NICU graduates having tone abnormality was done from 1 August 2007 to 31<sup>st</sup> October 2007. During these 3 months 53 babies were selected for the study and followed up till 12<sup>th</sup> month of their age after getting consent and willingness to be followed up till 12<sup>th</sup> month of their age. Unwilling parent/guardians of babies with tone abnormality were excluded. Corrected gestational age (C G A) of 2 -2.5 months was chosen as ideal time for first neurological evaluation [4 and 5]. Assessment of passive tone at the age of 2- 2.5 months is essential for proper follow-up programmed planning interventional therapy. All consented babies were studied at 2 to 2.5 months of CGA and were followed up at 3-3.5 months, 6-7 months, 9-10 months and 12 months. Consented NICU graduates were assessed for tone abnormality, evolution of tone, early

intervention, beneficial effects of NDT looked for the outcome and prediction of near normal development among the NICU graduates. The inclusion criteria for study subjects were 1) Preterm (Neonate born before 37 weeks of pregnancy irrespective of birth weight) requiring NICU admission 2) Birth Asphyxia/hypoxic ischemic encephalopathy (HIE) 3) Neonatal seizure 4) Hyprerbilirubinemia 5) Neonatal sepsis 6) Small for gestational age and 7) Meningitis. The exclusion criteria for study subjects were 1) Chromosomal abnormalities 2) Congenital or Genetic defects 3) External trauma after birth and 4) unwilling parents or guardians. Data regarding detailed history was noted in the proforma which was pre-structured , pre-tested questionnaire by interview method. Detailed clinical examination regarding Neuro –developmental assessment was done starting from two and half months of corrected gestational age up to one year. Head circumference, weight, length of the babies were recorded on each visit. Neurological assessment were based on evolution of tone.

A )Passive tone assessment was done using adductor angle, popliteal angle and scarf sign at corrected gestational age(CGA) 2 to 2.5 months, 3.5 months, 6 to 7 months, 9 to 10 months and 12 months.

B) Active tone assessment was done based on head control, pull to sit, sitting without support and standing with support.

Classification of babies based on tone abnormalities 1) Hypertonic 2) Hypotonic

3) No tone abnormality.

Babies with tone abnormality were intervened with NDT at 2 to 2.5 months, 3 to 3.5 months and 6 to 7 months, 9 to 10 months, their progress was evaluated on subsequent visit at 12<sup>th</sup> month of their age. Babies with tone abnormality were subjected to NDT Occupational therapist designed and individualized the NDT for each child. The main objective of outcome measure was to establish normal motor development and function and prevention of contractors and deformities. Bobath therapy was adapted as mode of intervention[6]. The rapist neurodevelopmental approach focused on sensorimotor components of muscle tone, reflexes and abnormal movement patterns, postural control, sensation and perception. Handling techniques that controlled various sensory stimuli was used to inhibit

spasticity, abnormal reflexes and abnormal movement patterns and were also used to facilitate normal muscle tone, equilibrium responses and movement patterns. The child was a relatively passive recipient of NDT treatment. The normal developmental sequence was advocated as a framework for treatment. This study was approved by Institutional Ethics Committee prior to commencement. Informed and written consent of parent and guardian was taken before including the child in the study. The data was tabulated, analyzed and interpreted.

**Results**

Total of 482 NICU graduates attended High-Risk-Clinic conducted on Wednesday and Saturday from 1<sup>st</sup> August 2007 to 31<sup>st</sup> October 2007. Total number of 53 high-risk babies were included in study, examined and screened for assessment of tone after excluding other babies based on exclusion criteria and unwillingness to give consent. The present study shows that the normal tone and abnormal tone was present among 20.75% (11) and 79.24% (42) babies respectively at first clinical examination at the age of 2 to 2.5 months. Table 1 shows that hypotonia was higher among 31(58.49%) followed by hypertonia 11(20.75%). Out of 11(20.75%) babies with hypertonia 8(72.72%) babies normalized tone by 12 months and 3(18.28%) babies had persistent tone abnormality by 12<sup>th</sup> months of age. Out of 31(58.49%) babies with hypotonia 26(83.87%) babies normalized by 12<sup>th</sup> months and 5(16.12%) babies had persistent abnormal tone at 12<sup>th</sup> months of their age. Hypotonia

was found to be more common than hypertonia at 2 to 2.5 months. After early intervention normalization of tone was 83.87% in hypotonic babies as compared to 72.72% in hypertonic babies. Normal tone was achieved at the age of 12 months amongst 34(80.95%) babies after early intervention.

Table 2 depicts during first examination of the study population at the age of 2 to 2.5 months 42(79.24%) babies out-of 53 babies had abnormal passive tone. These babies underwent interventions and 34 babies of them had normal passive tone at 12<sup>th</sup> months of their age. Eight babies persisted to have abnormal passive tone at their age of 12<sup>th</sup> month. Assessment of head control, pull to sit, sit without support and stand with support were done at 3 to 3.5 months, 6 months and 9 months respectively and 39 babies had abnormal head control, 23 had abnormality with sitting and 2 had abnormality of standing with support at ages expected to achieve above motor milestones. From this table it is clear that number of babies with abnormal tone decreased from 42 at 2.5 months to 2 babies at 9 months; this could be due to stimulation, early interventional therapy and advancement of age. Out of 39 babies who had abnormal head control at the age of 3 to 3.5 months age 38 babies achieved head control by 12 months. Similarly out of 23 babies with abnormality in sitting 20 babies achieved sitting mile stone by 12 months. At the age of 12<sup>th</sup> month 8 babies persisted to have abnormal tone inspite of intervention. Remaining babies improved in terms of tone which could be due to early interventional therapy.

**Table 1. Distribution of babies according to the tone and its final outcome at 12 months after early intervention**

Assessment of Tone N=53	Before intervention		After intervention				χ <sup>2</sup> value	P-value
	2-2.5 months		12 months					
	No	%	No	%	No	%		
<b>Abnormal tone</b>							3.25	0.516
1   Hypertonia	11	20.75	08	72.72	3	18.28		
2   Hypotonia	31	58.49	26	83.87	5	16.12		
Total	42	79.24	34	80.95	8	19.05		
<b>Normal tone</b>	11	20.75	11	100	0	0		

**Table 2. Periodic assessment of tone and its final outcome**

Assesment of tone	Periodic assessment of tone N=53							2	P-value
	first examination		Examination at the age of 12 months						
	Age in Months	Abnormal tone	Persistent abnormal tone		Normal tone				
	No	%	No	%	No	%			
<b>A.Passive tone</b>	02-2.5	42	79.24	08	19.04	34	80.95	45.6	0.0001
<b>B. Active tone</b>									
1.Headcontrol	03-3.5	39	73.00	01	2.55	38	97.45	81.3	0.0001
2.Pull to sit	06	23	43.09	03	13'04	20	86.95	25.4	0.0001
3.Sit without support	06	23	43.09	03	13'04	20	86.95	25.4	0.0001
4.Stand with support	09	02	03.77	01	50'00	01	50.00	12.2	0.002

## Discussion

The mission of a neonatal follow up program is to provide a continuum of specialized care to sick babies discharged from NICUs. The objective is to identify early deviation of growth, development or behavior from normal and provide support and interventions as indicated. The neonate "at-risk" of neurodevelopmental disability must be identified before discharge from NICU. A discharge summary must be provided to primary care provider and parents, the discharge summary should describe the prenatal and perinatal risk factors, neonate's hospital course that can increase the risk of neurodevelopmental disability. Tone abnormality 79.24% was observed in the current study and 11(20.75%) babies were found to have normal tone; 34(80.95%) babies with tone abnormalities normalized at 12months of age. But 8 (19.04%) were found to have persistent tone abnormality. Study conducted by Sudha Chaudhari et al reported that assessment of active tone in the form of head support at 3 month was present in all the infants, 95% had pull to sit at 6 months and all 100% had pull to stand at 9

months [7]. In our study 11 babies who were normal in the beginning of the study continued to be normal at the end of 9 month and 12 month of study. Hypotonia was present among 58.49% and 16.12% babies at the age of 2-2.5 month and 12 month respectively in the present study.

Recent studies in Neurophysiology have proved that synapses are regenerable and neuro transmission can be improved by selectively stabilizing one type of impulse at the expense of others. This modifiability of brain at molecular level forms the basis of early intervention in high risk infants[8]. Extensive brain lesion will limit the outcome of early treatment. In babies with additional severe sensory loss, perceptual impairment, and severe mental retardation the treatment results is very limited. Children with severe proprioceptive and temporo-spatial perception problem perceive only to a small degree normal reactions transmitted through treatment. Their motor progress is slow. They need some additional specific perceptual training. This could be reason for non improvement of 8 babies in our study [9].

## Conclusion

The above parameters indicate that there is need for community based strategy to improve utilization of Health Services, Health education with emphasis on health of High Risk Neonate care. Timely and appropriate intervention can prevent or modify many of these disabilities. There is a lack of knowledge and co-ordination among primary health care providers and lack of parent or care-giver understanding of need for follow up. Structured follow up programme can result in improvement of implementation and compliance of the multidisciplinary followup.

## Recommendation

- 1) All health facilities caring for High- Risk- Neonate must have follow- up program.
- 2) Make efforts to improve compliance to follow up program.
- 3) Timely and appropriate screening or assessment must be offered to every neonate before symptoms or signs of disability appear.

## Limitation

This study is limited to the Outcome of High-Risk-Neonates in one of the Tertiary centers in Maharashtra state of India, the result of which should not reflect the whole nation. These need to be addressed in future research in all sector of population and implementation of NDT in India.

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