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NEURODEVELOPMENTAL OUTCOMES BY RAPID NEURODEVELOPMENTAL ASSESSMENT (RNDA)OF NEONATES DISCHARGED FROM NEONATAL WARD

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ABSTRACT

Background: Early detection of neurodevelopmental impairments (NDIs), followed by appropriate intervention, can optimize quality of survival. Babies discharged from neonatal wards are among those at high risk. To address the lack of expertise in low and middle-income countries (LAMICs), the Rapid Neurodevelopmental Assessment (RNDA) for 0-2-year olds was validated tool which can be administered by mid-level professionals detecting a range of NDIs (primitive reflex, gross motor, fine motor, vision, hearing, speech, cognition, behavior and seizures); with severity ratings. **Objective:** To ascertain NDIs including seizures in babies being discharged from the neonatal ward of a national children's hospital by administering the RNDA. **Methods:** This cross-sectional study was conducted in DSH at neonatal ward between June 2011 to October 2013. Developmental Therapists routinely administered the Rapid Neurodevelopmental Assessment (RNDA) to all neonates on the day of discharge between this period. All with NDIs were provided strategies for intervention, and/or referral for further investigation when deemed necessary. All were advised to attend a Child Development Center (CDC) within the hospital or in any of the 15 CDCs within government hospitals across the country, within 3 months. **Results:** 900 children were assessed of whom 63.4% were boys, 44% were born preterm, 25% were from low income families. 56.7% had =>1 NDI. Specific impairments included depressed or exaggerated primitive reflexes (46.6%), and/or impairments in the following domains: gross motor (36.6%), speech (11.7%), vision (11%), cognition (10.6%), hearing (8.2%), behavior (7.6%), fine motor (3.6%). **Conclusion:** The RNDA is a useful method to identify very young infants on a range of neurodevelopmental domains which can provide the family a program for appropriate management and the child the hope of an optimum quality of life.

KEYWORDS: Neurodevelopmental, neonatal, newborn, seizures.

INTRODUCTION

Neurobiological research indicates the plasticity of the brain during /first two years of life when maximum neuronal maturation and connectivity takes place.[1] Therefore Early and accurate identification, followed by appropriate intervention of NDDs in infants and young children is very important to prevent impairment (temporary function limitation) and facilitate optimization of functional status before the conditions becomes permanent (disability).[2]

Large unrecognized populations of children are at risk for neurodevelopmental impairments (NDIs) from an early age. These missed opportunities increase the level of dependence and disability of an individual and decrease the productivity of the community at large. Department of Pediatric Neuroscience was established in 1991 within Dhaka Shishu Hospital as the first Shishu Bikash Kendro (SBK). Which has been providing services for neurodevelopmentally delayed children; while several other hospitals have started similar services later.[3]

Pediatricians use developmental screening tests infrequently and probably only after evidence of developmental delay has been established by other criteria.[4] This is exemplified by the fact that the estimated proportion of the children at risk for disability in Bangladesh has risen more than two-fold in the past two decades, from 8% in 1988 and to 20% in 2005.[5,6]

An ICF-based assessment tool, for use by generic child care professionals, has been developed in Bangladesh, for ages 0-<2 years (Khan, Muslima et al, 2010)[7]; 2-<5 years (Khan, Muslima et al, 2012);[8] and 5-9 years (Khan, Muslima et al, 2014).[9]

Aim of the study of this article is to ascertain NDIs including seizures in babies being discharged from the neonatal ward of a national children's hospital.

METHODS

This cross sectional study was conducted in DSH at neonatal ward between June 2011 to October 2013. Dhaka Shishu Hospital is the largest children hospital in Bangladesh. It has well stablished Neonatology and Neuroscience department. The neuroscience department works by a multidisciplinary team of professionals, comprising of pediatricians, pediatric neurologists, developmental therapist and psychologists. Presently it is the Key resource center for training and research on child development, developmental neurology and disabilities. Neonatal unit has beds in SCABU and NICU with well-equipped modern instrumental facilities to manage sick newborn. This study was conducted with the collaboration of these two departments. Routine Neuro-developmental assessment was performed on every neonates on the day of discharge from the neonatal wardby the developmental therapists (DT) using the 'Rapid Neurodevelopmental Assessment' (RNDA) tool for 0- 2year age In addition to the babies' functional assessment, a detail history of pre-, peri- and postnatal period was taken during the rapid neurodevelopmental assessment (RNDA).

The RAPID NEURODEVELOPMENTAL ASSESSMENT (RNDA) for 0 -<2 year old was validated against standard psychometric tests, for use by mid-level professionals to detect a range of NDIs (Khan et al, *Pediatrics*, 2014).[9] NDIs include: primitive reflex (for <1 month old), gross motor, fine motor, vision, hearing, speech, cognition, behavior and seizures); A Severity Rating (low, moderate, or high risk) is determined for each type of NDI found. 'Mild Risk' is between -1 to -2 SD; 'Moderate Risk' is between -2 to -3 SD; 'Severe Risk' is less than -3 SD for any given impairment. All with NDIs were provided strategies for intervention, and/or referral for further investigation when deemed necessary. All were advised to attend a Child Development Center (CDC) within the hospital or in any of the 15 CDCs within government hospitals across the country, within 3 months.

Before going for the study, approval from the Ethical Review Committee of Dhaka Shishu Hospital and Bangladesh Institute of Child Health will was obtained. Number, percentage were described frequency and distribution. Association of neurodevelopmental outcome with different variables were obtained by chi-squared. Data was analyzed in SPSS version 21.

RESULTS

900 children were assessed of whom 570(64%) were boys and 330(36%) were female. Maleand female ratio was 1.7:1. 44% were preterm. (Table 1).56.7% had =>1 NDI. Specific impairments included weak or absent primitive reflexes (46.6%), and/or impairments in the following domains: gross motor (36.6%), speech (11.7%), vision (11%), cognition (10.6%), hearing (8.2%), behavior (7.6%), fine motor (3.6%) (Fig 1). Mild risk' was highest for primitive reflexes, cognition and behavior; 'moderate risk' for vision, hearing, speech and seizures; and 'highest risk' for fine motor impairments. (Figure 2).

Table 1: Profile of study neonates (N-900)

Variable	Number(N)	Percentage(%)
Male	570	64%
Female	330	(36%)
Total	900	100%
Term baby	504	56%
Preterm Baby	396	44%
Total	900	100%

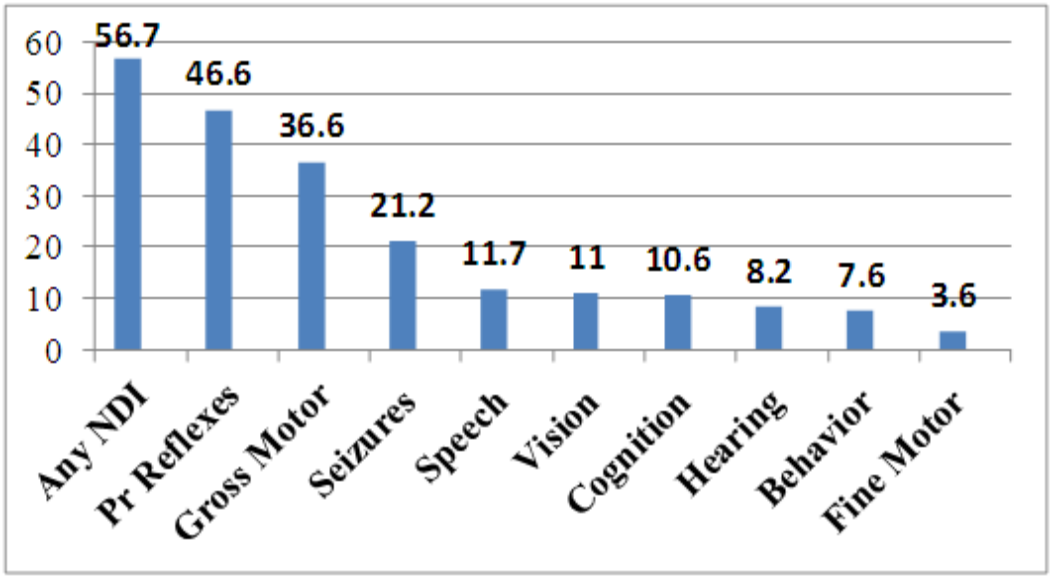

Fig 1: % Neurodevelopmental Impairments (NDIs) at Discharge (n=900).

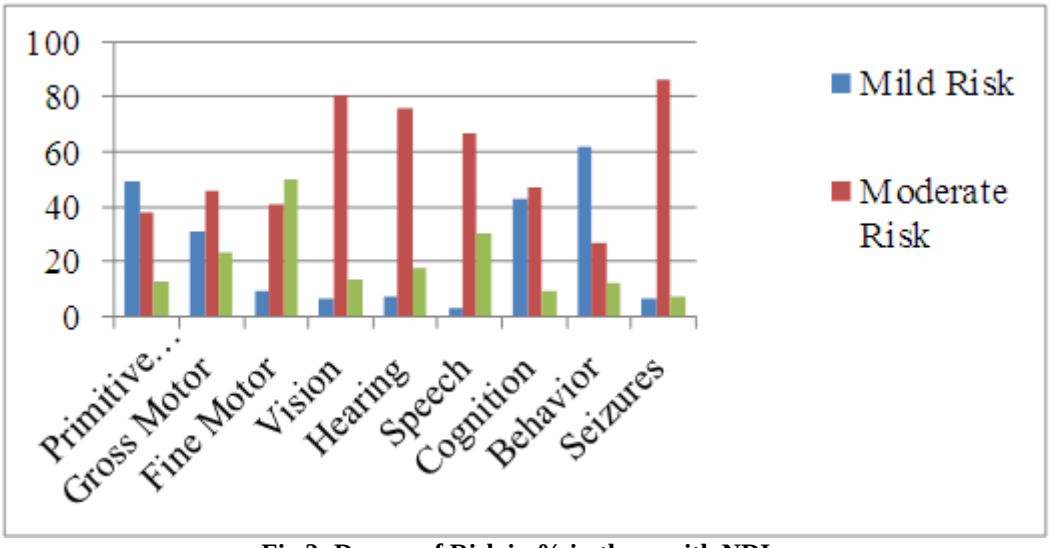

Fig 2: Degree of Risk in % in those with NDIs.

Table 2: Comparison of Significant Perinatal Risk Factors in Children with and Without NDIs. N=888*

Variable	% with no NDI N=378	% with =>1 NDI N=510	p value
Prolonged Labor	67.7	64.9	0.020
Delayed Cry after Birth	23.3	49.0	0.0001
Blue or Pale in Color	12.4	25.3	0.0001
Neonatal Seizures	4.5	92.0	0.0001
Neonatal Jaundice	45.8	34.5	0.018

Note- *Perinatal information missing for 12 children

Significant perinatal risk factors in those with NDIs included delayed cry after birth (p value 0.0001); blue or pale color at birth (p value 0.0001); and neonatal seizures (p value 0.0001). (Table 2). Prolonged labor (p value 0.020) and neonatal jaundice (p value 0.018) were inversely related to NDIs (Table 2).

When we compare the neuro development impairment of term and preterm neonates, we found term infants had more impairments than preterm, which is statistically significant. (Table-3)

Table 3: Comparison of Preterm and Term Babies with NDIs at Discharge N=895*

Type of Neurodevelopmental Impairments (NDI)	% Preterm with NDI N= 394	% Terms with NDI N= 501	p value
Primitive Reflexes	41.4	50.9	0.0001
Gross Motor	33.0	43.1	0.005
Fine Motor	1.5	5.2	0.011
Vision	6.6	14.6	0.001
Hearing	5.3	10.4	0.019
Speech	6.9	15.6	0.0001
Cognition	5.3	14.8	0.0001
Behavior	4.6	10.0	0.008
Seizure	8.6	31.3	0.0001
Any NDI (=>1)	49.5	62.7	0.001

Note- *Perinatal information missing for 5 children

DISCUSSION

More than half (56.7%) of neonates at discharge had a Neurodevelopmental Impairment (NDI) and the most common NDIs were in Primitive Reflexes (46.6%), Gross Motor (36.6%) functions and Seizures (21.2%). This findings are quiet similar to a case-control study done by Banu et al in 2015, where NDI was identified in neonates with HIE was 88.8% and neonates other than HIE was 34.6% and total NDIs among 162 neonates was 62%.[10] Another study done by Islam MMZ et al in 2016, where he applied RNDA on preterm neonates and found 39.8% had more than one domain affected.[11] Our study did not corelate with a study done by Mwaniki, et al, who found the overall median risk of at least one sequela in any domain was 39·4% (IQR 20·0-54·8) in a review of 153 studies.[12] The reason behind this large number of neonates with NDIs in our study as we included the 'mild risks' neonates (between -1 to -2SD,) which might be considered within normal limits, but may be most amenable to early interventions.

In our study significant perinatal risk factors in those with NDIs included delayed cry after birth, blue or pale color at birth and neonatal seizures. In a longitudinal study done by Glass et al in 2011 showed among 129 newborns with neonatal encephalopathy, neonatal seizures and brain injury on MRI were strong risk factors for epilepsy, and the children with epilepsy all had adverse neurodevelopmental outcome.[13] Several other study by Palmer et al and Ronen et al showed that NDIs developing Cerebral Palsy and Seizure Impairment developing Epilepsy, especially in term infants is high and requires long-term monitoring.[14,15] Therefore Severity risk estimates by specific NDI were able to provide a guideline for immediate advice ('Mild Risk'), close monitoring and follow ups ('Moderate Risk') and immediate referrals ('High Risk'). We found terms infants had higher rates of NDIs(62.7%) than preterm(49.5%) in more than 1 domain. But in other study Islam MMZ concluded that preterm neonates are at substantial risk for neurodevelopmental impairments.[11]

Children with impaired neurodevelopment are at high risk for permanent functional limitations, reducing their educational and economic opportunities later in life. Early identification of children with neurological deficits is critical to preventing long-term disability.

CONCLUSION

From this study we can conclude that the RNDA is a useful method to identify very young infants on a range of neurodevelopmental domains which can provide the family a program for appropriate management and the child the hope of an optimum quality of life. Substantial numbers of children may be found to have early NDIs and delay which can be either reversed or ameliorated by detection of specific limitations, followed by early intervention. A protocol for universal neonatal surveillance can be developed through this study will be used by doctors, nurses and other professionals within hospital settings.

REFERENCES

1. Adrienne L. Tierney and Charles A. Nelson, III. Brain Development and the Role of Experience in the Early Years. Zero Three, 2009 Nov 1; 30(2): 9–13.
2. Adrienne N. Villagomez, Flor M. Muñoz, Robin L. Peterson, Alison M. Colbert, Melissa Gladstone, Beatriz MacDonald, Rebecca Wilson, et al. Neurodevelopmental delay: Case definition & guidelines for data collection, analysis, and presentation of immunization safety data. Vaccine, 2019 Dec 10; 37(52): 7623–7641. doi: 10.1016/j.vaccine.2019.05.027
3. N Z Khan, R Sultana, F Ahmed, A B Shilpi, N Sultana, G L Darmstadt. Scaling up child development centres in Bangladesh. Child Care Health Dev., 2018 Jan; 44(1): 19-30. doi: 10.1111/cch.12530.
4. Richard D.SmithM.D. The use of developmental screening tests by primary-care pediatricians. The Journal of Pediatrics. September 1978; 93(3): 524-527.
5. Zaman SZ, Khan NZ, Islam S, Dixit S, Shrout P, Durkin M, et al. Validity of the "Ten Questions" for screening serious childhood disability: results from

urban Bangladesh. Int J Epidemiol, 1990; 19: 613-20.
6. UNICEF. Monitoring child disability in developing countries. Results from the multiple indicator cluster surveys. New York: United Nations Children's Fund. Division of Policy and Practice, 2008.
7. Khan NZ, Muslima H, Begum D, Shilpi AB, Akhter S, Bilkis K, et al. Validation of rapid neurodevelopmental assessment instrument for undertwo-year-old children in Bangladesh. Pediatrics, 2010; 125: e755-62.
8. Khan NZ, Muslima H, Shilpi AB, Begum D, Parveen M, Akter N, et al. Validation of rapid neurodevelopmental assessment for 2- to 5-year-old children in Bangladesh. Pediatrics, 2013; 131: e486-94.
9. Naila Z Khan 1, Humaira Muslima 1, Shams El Arifeen 2, Helen McConachie 3, Asma Begum Shilpi 1, Shamim Ferdous 4, Gary L Darmstadt . Validation of a rapid neurodevelopmental assessment tool for 5 to 9 year-old children in Bangladesh. J Pediatr, 2014 May; 164(5): 1165-1170.
10. Banu SH, Salim AFM, Ara R, Akter R, Khan NZ. Neurodevelopmental Evaluation in Full-term Newborns with Neonatal Hypoxic Ischemic Encephalopathy (HIE): A Case Control Study. Bangladesh J Child health, 2015; 39(1): 6-13.
11. Islam MMZ, Hossain MM, Haque SA, Khan NZ. Neurodevelopmental Assessment in Preterm Neonates at Early Ages: Screening of at-risk Infants for Long Term Sequlae. Bangladesh J Child health, 2016; 40(1): 5-11.
12. Mwaniki, Michael K., et al. "Long-term neurodevelopmental outcomes after intrauterine and neonatal insults: a systematic review." *The Lancet*, 2012; 379.9814: 445-452.
13. Hannah C Glass, Karen J Hong, Elizabeth E Rogers, Rita J Jeremy, Sonia L Bonifacio, Joseph E Sullivan, A James Barkovich, and Donna M Ferriero. Risk Factors For Epilepsy In Children With Neonatal Encephalopathy. Pediatr Res., 2011 Nov; 70(5): 535–540.
14. Palmer, Frederick B. "Strategies for the early diagnosis of cerebral palsy." *The Journal of pediatrics*, 2004; 145.2: S8-S11.
15. Ronen, Gabriel M., et al. "Long-term prognosis in children with neonatal seizures A population-based study." *Neurology*, 2007; 69.19: 1816-1822.