Validity of New Ballard Score Untill 7th Day of Postnatal Life In Preterm Neonate

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Abstract

Background: *Premature infant mortality & morbidity is influenced by intrauterine growth & maturation. In our perspective unavailability of accurate LMP from mother, early USG report or home delivered preterm baby that admitted after 4th day of postnatal age create great dilemma regarding the assessment of gestational age (GA).*

Objective: *To validate the New Ballard Score (NBS) until 7th day of postnatal age in preterm neonate.*

Methods: *This observational cross sectional study was conducted in pediatric ward, Rajshahi Medical College Hospital from 1st January 2009 to 31st December 2009. A total of 129 preterm neonate, GA ranging from 29wk to 35 wk, without any medical problem were included in this study. Accurate documentation of LMP of mother and USG during early pregnancy period were available for each study sample. GA of the babies were determined by NBS on 1st, 5th and 7th postnatal age and compared with LMP & USG based GA. Various raw score was obtained from broken total score in D1 compared with D5 & D7. LMP based GA also compared with USG based GA.*

Results: *Total NBS of D1 were tested with D5 & D7 for level of agreement & degree of correlation. For D1 with D5, r value was 0.97 and for D1 with D7, r value was 0.681. So, NBS of D1 positively correlated with NBS of D5 and D7. The total physical score also positively correlated with D1 versus D5 & D7 (r value 0.975 & 0.796). The total neurological score positively correlated with D1 versus D5 & D7 (r value 0.893 & 0.630). Neurological score were more significant than physical score. All p values were statistically significant (p value $\leq$0.001). GA by NBS & LMP was positively correlated (r=0.94) as well as GA by NBS & USG (r=0.94). GA by NBS did not differ more than 2 weeks from LMP or USG based GA of any particular subjects.*

Conclusions: *The tendency of over estimates the GA by NBS increased from Day 1 to Day 5 to Day 7. But the GA calculated from LMP & USG did not differ more than 2 weeks from GA by NBS. Thus NBS can be used as a clinical tool to detect GA up to Day 7 of postnatal life.*

Keywords: *Validity, New Ballard Score (NBS)*

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Introduction

GA estimation has clinical importance for appropriate management of new born and to distinguish preterm from term and small for date infant.[1-5] Knowledge of accurate GA is helpful in identification of infant's at risk for mortality and morbidity such as RDS, hypoglycemia just after birth, septicemia, feeding problem or asphyxia.[6-8] We can measure GA by LMP, early USG report or by physical and neuromuscular characteristic including Dubowitz chart, Parkins method, Ballard method or New Ballard Score (NBS) chart.[9-17]

New Ballard Score is already worldwide accepted up to 4th day of life.[1,18,19] The tendency to over estimates the GA increase from day 1 to day 5 to day 7. But the GA that calculated from LMP not differ more than 2 weeks from GA calculated from NBS, then NBS could be used as a clinical tool for calculation of GA up to 7th day of post natal age.[20]

Materials and Methods

This observational cross sectional study was done in paediatric ward of Rajshahi Medical College Hospital from January 2009 to December 2009. Total sample size was 129. Included babies mother had known accurate LMP and prenatal early USG. Newborn who had any medical problem or congenital anomaly was excluded from the study. Informed written consent was taken and structured questionnaire was used for data collection. If one perform a post hoc power calculation, a sample size of 129 has greater than 99.9% power to dated a difference of two weeks or more from the GA by LMP, with an alpha error of 5%.

To overcome biasness of these study, examination of the baby and data recording was cross examined by two expert pediatricians.

GA was assessed by LMP, early USGreport and by NBS (total raw score, physical score and neuro muscular score) on Day 1, Day 5 and Day 7 in broad day light when the baby was awake and calm.

All data were expressed as mean ±standard deviation. Pearson correlation co-efficient was calculated to see relationship between various quantitative variables.

Results

Total 51.2% of the study subject were male and 48.8% were female. 51.9% of babies were delivered in hospital, 31% of babies were delivered in private clinic and 17.1% of babies delivered by home delivery. Total 72.1% of babies were delivered by NVD.

Mean GA by LMP 32.93 ± 1.84 weeks, by USG 32.30 ± 1.86 weeks and by NBS 32.17 ± 1.93 weeks. Mean weight of delivered baby was 1331.53 ± 252.53 gm (range 998 -1800 gm).

Total NBS of D1 were tested with D5 & D7 for level of agreement & degree of correlation. For D1 with D5, (r value was 0.97) and for D1 with D7, (r value was 0.681). So, NBS of D1 positively correlated with NBS of D5 and D7 (Table-I).

The total physical score also positively correlated with D1 versus D5 & D7 (r value 0.975 & 0.796 respectively) (Table 1). The total neurological score also positively correlated with D1 versus D5 & D7 (r value 0.893 & 0.630 respectively) (Table 1). Neurological score were more significant than physical score (Table-I).

LMP based & USG based GA positively correlated with NBS based GA (Table-II). Current study also revealed that, from neuro muscular score posture has highest correlation with LMP based GA on D5 & D7 (r = 0.763 & 0.653 respectively) (Table 4) and from physical score genitalia has highest correlation with LMP based GA on D5 & D7 (r = 0.693 & 0.842 respectively) (Table-III).

Table-I
Correlation of NBS values between D1, D5 & D7

Comparison group	Correlation Coefficient			95% CI	P value
		lower	upper		
Total NBS score	D1 vs D5	0.972	-0.749	-0.367	<0.001
	D1 vs D7	0.681	-0.698	-0.278	<0.001
Physical score	D1 vs D5	0.975	-0.483	-0.261	<0.001
	D1 vs D7	0.796	-0.982	-0.298	<0.001
Neuro muscular score	D1 vs D5	0.893	-0.507	-0.206	<0.001
	D1 vs D7	0.630	-0.840	-0.140	<0.001

Table-II
Correlation between LMP, USG & NBS based GA

Comparison group	Correlation Coefficient	P value
LMP vs NBS based GA	0.94	<0.001
USG vs NBS based GA	0.94	<0.001
LMP vs USG based GA	0.96	<0.001

Table-III

Correlation of raw physical NBS values between D1, D5 & D7

Total physical score	Comparison group	Correlation coefficient	95% CI lower	95% CI upper	P value
Skin score	D1 vs D5	0.777	-0.128	-0.011	<0.001
	D1 vs D7	0.645	-0.225	-0.109	<0.001
Eye & ear score	D1 vs D5	0.717	-0.500	-0.322	<0.001
	D1 vs D7	0.864	-0.232	-0.078	<0.001
Lanugo score	D1 vs D5	0.853	-0.211	-0.052	<0.001
	D1 vs D7	0.726	-0.564	-0.987	<0.001
Planter surface score	D1 vs D5	0.767	-0.395	-0.194	<0.001
	D1 vs D7	0.650	-0.163	-0.023	<0.001
Breast score	D1 vs D5	0.676	-0.388	-0.201	<0.001
	D1 vs D7	0.704	-0.181	-0.470	<0.001
Genitalia score	D1 vs D5	0.693	-0.172	-0.029	<0.001
	D1 vs D7	0.842	-0.015	-0.109	<0.001

Table-IV

Correlation of raw neuro muscular NBS values between D1, D5 & D7

Neuro muscular score	Comparison group	Correlation coefficient	95% CI lower	95% CI upper	P value
Posture score	D1 vs D5	0.763	-0.191	-0.073	<0.001
	D1 vs D7	0.653	-0.131	-0.272	<0.001
Square score	D1 vs D5	0.480	-0.268	-0.087	<0.001
	D1 vs D7	0.704	-0.354	-0.098	<0.001
Arm recoil score	D1 vs D5	0.671	-0.398	-0.184	<0.001
	D1 vs D7	0.776	-0.316	-0.152	<0.001
Popliteal angle score	D1 vs D5	0.689	-0.115	-0.106	<0.001
	D1 vs D7	0.721	-0.296	-0.152	<0.001
Sarf sign score	D1 vs D5	0.453	0.045	0.243	<0.001
	D1 vs D7	0.495	0.172	0.353	<0.001
Heel to ear score	D1 vs D5	0.641	-0.359	0.137	<0.001
	D1 vs D7	0.563	0.234	0.091	<0.001

Discussion

This prospective observational study has conducted in babies of GA (by LMP) ranging from 29 weeks to 35 weeks to see the reliability of NBS to calculate GA in 5th and 7th day of post natal age. The result suggest that, NBS can be used as clinical tool for GA assessment at least 7th day of post natal age.

Neonate less than 28 weeks usually need extra medical care and greater than 36 weeks remain usually well. So, we choose this particular age of newborn. The study subjects are divided into four groups (29-30 weeks, 31-32 weeks, 33-34 weeks &35 weeks) for represent of all GA. The sample is smaller than Ballard et al studies in which 252 & 578 sample was taken.[1,13] Mean ± SD of GA by LMP is 32.4 ± 1.8 weeks in these study.

Current study reveal that, exact agreement between gold standard GA and NBS based GA on D1, D5 & D7 have analyzed, the tendency of slight over estimation of GA increase from D1 to D5 to D7, as the neonate become more mature with passage of time. We found that, NBS assessment on day 5 or day 7 is as good as within 24 hours of life. LMP based GA not differ more than 2 weeks from GA by NBS on D1, D5 or D7 in any subject. These result also reflect in previous study by Sasidharan K et al in 2009. [20]

When NBS have broken down into raw neuro muscular and physical score, it was found that, the agreement of neuro muscular score is more accurate than the agreement of physical score on D5 & D7. This findings suggest that, physical feature change more rapidly than neuro muscular feature post natally and rate of change of physical characteristic is not uniform. Similar results are also found in previous studies.[2,13,20,21] Current study also reveal that, from neuro muscular score posture and from physical score genitalia has highest correlation with LMP based GA on D5 & D7. Previous study also reveal similar findings.[12,20] Certain limitation such as, all GA group could not be analyzed separately, because of small number of total study subjects.

Conclusions

Our study has important implication particularly in situation where newborn encounter physician after first day of life. NBS may be validated in clinical assessment of GA until 7th day of post natal age in preterm neonate. Further multicenter large scale studies are needed to confirm this finding.

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