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A study on interobserver variation on accuracy of estimation of gestational age of the newborn with new ballard score

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Abstract:

Background:

The New Ballard Score is the most extensively used scoring system for postnatal estimate of Gestational Age. New Ballard score is a quick and reliable gestation assessment method that is still valid for newborns delivered to populations with a wide range of demographic differences. Ballard Scores are predicated based on the Physical and neuromuscular maturity at regular intervals. In order to determine the gestational age of the infant, it scores different criteria, and the total of those scores is then extrapolated. The objective is to estimate the agreement between two different observers in estimation of gestational age by New Ballard score.

Materials and methods:

About 200 study participants were included in our study as per inclusion and exclusion criteria following the purposive sampling technique from our tertiary care hospital. We include all the neonates born in the hospital and exclude the sick neonates who need immediate resuscitation and life supports (ventilation and inotropes); neonates who suffered from perinatal asphyxia. All newborn delivered in the hospital will be examined by 2 different investigators. History, last menstrual period, EDD by USG and other relevant details will be recorded in the case sheet. These details will not be provided to the investigators. Both will estimate the gestational age of newborn by New Ballard Score. All data will be recorded and compared.

Results:

There is a strong agreement between the two investigators with an ICC between 0.8523 - 0.9467 agreement between the two investigators was done using the intraclass correlation coefficient (ICC). Also, Kappa Statistics was used to assess the two independent observers values for assessing the gestational age of the newborn using New Ballard's score. There was a perfect agreement between the two observers with a kappa value of 0.952.

Conclusion:

There is a strong agreement between two investigators regarding the estimation of gestational age by New Ballard score as per the interclass correlation coefficient. Hence, New Ballard score will show accurate estimation regarding the estimation of gestational age.

Key words: New Ballard score, gestational age, newborn

Introduction:

Accurate gestation at birth must be determined in order to predict illnesses, choose the appropriate level of newborn care, evaluate anthropometric measurements, and predict neurodevelopmental outcomes. Ultrasonography and the first day of the last menstrual cycle can be used to estimate the gestational period. The results of the ultrasound should be utilized if there is a difference between the gestational period calculated using the first day of the last menstrual cycle and the ultrasonography of more than 14 days [1]. On the other hand, knowing a newborn's gestational time is crucial since it enables management planning and the prediction of the likelihood of a newborn's subsequent problems. Finding a more affordable alternative way to determine gestational period is crucial. The Ballard score was developed to gauge a newborn's gestational period. Ballard developed a condensed form of the Dubowitz system. Neurologic parameters in this process are independent of the baby's level of calm and relaxation.

The New Ballard Score is the most extensively used scoring system for postnatal estimate of GA. New Ballard score is a quick and reliable gestation assessment method that is still valid for newborns delivered to populations with a wide range of demographic differences [2]. Ballard Scores are predicated based on the Physical and neuromuscular maturity at regular intervals. In order to determine the gestational age of the infants, it scores different criteria, and the total of those scores is then extrapolated. These criteria are separated into 6 neurological

and 6 physical categories. With the use of this grading, an age estimate between 26 and 44 weeks may be made. An addition to the above that takes into account extremely preterm infants, particularly those born at 20 weeks or earlier, is the New Ballard Score.

The grading is based on the infant's maturation-related intra-uterine alterations. The physical criteria are based on anatomical alterations, whereas the neurological criteria mostly depend on muscle tone. The neonate, who is under 37 weeks old, is experiencing physiological hypotonia. The fetal development phase sees a rise in this tone, therefore a preterm infant would have less of it. Fetal maturation can differ at a certain GA because to variations in maturation rates among healthy fetuses or anomalies of fetal development. Small variations in GA have enormous effects on outcomes for extremely preterm newborns, and they may even influence whether intensive care is provided. The score ranges from -10, which corresponds to 20 weeks of gestation, to 50, which corresponds to 44 weeks. Ballard score assessment and prenatal ultrasound have a correlation of 0.97, showing that Ballard score reliably predicts gestational period[3]. The objective of this study is to estimate the agreement between two different observers in estimation of gestational age by New Ballard score.

Materials and methods:

This study is an observational study which was conducted among all the neonates born in Vinayaka Mission's Kirupananda Variyar Medical College and Hospital Salem. The study subjects were the inpatients of labour room, NICU and post-natal. About 200 study participants were included in our study as per inclusion and exclusion criteria following the purposive sampling technique. All the neonates during our study period were chosen for the study. We include all the neonates born in the hospital and exclude the sick neonates who need immediate resuscitation and life supports (ventilation and inotropes); neonates who suffered from perinatal asphyxia and those neonates whose parents refused to give consent to participate in study.

All the neonates during the study period delivered in the hospital were examined by 2 different investigators. A detailed History, last menstrual period, EDD by USG and other relevant details were recorded in the case sheet. These details were not provided to the investigators. Both estimated the gestational age of newborn by New Ballard Score. All data were recorded and compared.

Results:

Table 1: Baseline characteristics of the newborn (N-200)

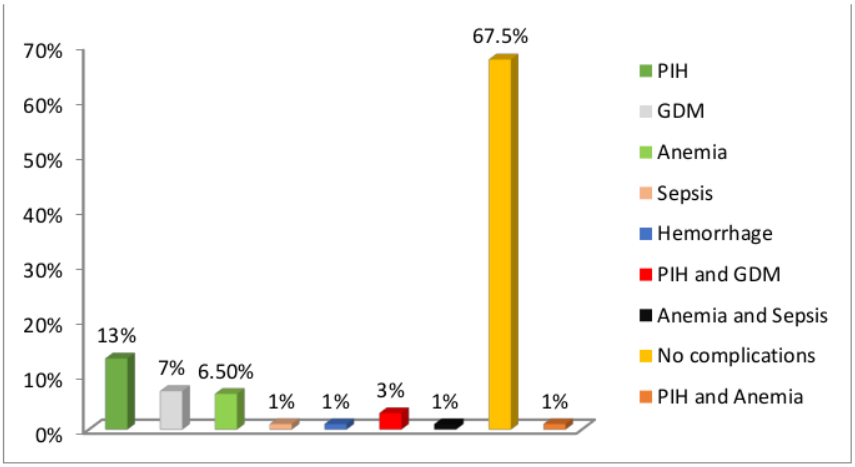
Characteristics	Frequency	%
Gender		
Male	120	60
Female	80	40
Birth		
Vaginal birth	148	74
Caesarean section	52	26
Gestational period		
post term	4	2
term	170	85
preterm	26	13
Birth weight		
> 2500 gms	173	86.5
1500-2500 gms	18	9
1000-1500 gms	8	4
< 1000 gms	1	0.5

The table 1 depicts the distribution of baseline characteristics of newborn. From the table it is evident that majority of about 60% were male and 40% were female babies. And about 74% had bon through normal vaginal birth and remaining about 26% had born through caesarean section. With regarding to the gestation period, mostly of about 85% were born during term, about 13% had born preterm and least of about 2% had born post term delivery. Majority of study participants were born with birth weight of >2500 gm of about 86.5%. The table-2 shows the complication in new born babies. Mostly about 70.5% had born without any complication. Only a least number of babies had born with respiratory distress syndrome (6.5%); sepsis (2%); Convulsions (0.5%); Metabolic abnormality (4%); NICU observation (8.5%); TTN (5.5%); respiratory Distress syndrome and Sepsis (0.5%); Respiratory Distress Syndrome and Metabolic abnormality (1%); Respiratory Distress Syndrome, Metabolic abnormality and Convulsions (0.5%); Sepsis and convulsions (0.5%)

Table-2: Complication in New Born

Complication in Newborn		
Respiratory Distress Syndrome	13	6.5
Sepsis	4	2
Convulsions	1	0.5
Metabolic abnormality	8	4
NICU observation	17	8.5
TTN	11	5.5
Respiratory Distress Syndrome and Sepsis	1	0.5
Respiratory Distress Syndrome and Metabolic abnormality	2	1
Respiratory Distress Syndrome, Metabolic abnormality and Convulsions	1	0.5
Sepsis and Convulsions	1	0.5
No complications	141	70.5
Total	200	100

Figure 1: Complications of the mothers of newborn (N-200)



The Figure-1, illustrates the complications of the mothers of newborn. Only a least percent of mothers had some complications as shown in figure.

Table-3: Intraclass correlation coefficient

Group	Intraclass correlation	95%CI	P
Two investigators	0.943	0.8523 - 0.9467	0.0082

Since the data were numerical, the statistical analysis of the amount of agreement between the two investigators was done using the intraclass correlation coefficient (ICC) is shown in table 3. According to this study, there was a fair level of agreement between the two investigators (ICC: 0.943; 95% CI: 0.8523 - 0.9467 and p0.008). Because the Ballard score uses a number of factors that add up to one score, the results were expressed using the mean.

Agreement between the two independent observers for assessing the gestational age of the newborn using New Ballard's score was tested using Kappa statistics and there was a perfect agreement between the two observers with a kappa value of 0.952.

Discussion:

Before the initiation of the study, both the investigators (residents) were given a refreshing instruction regarding the assessment of newborn babies. The study found that there was a very strong agreement between the two investigators with an ICC between 0.8523 - 0.9467.

Interobserver agreement between two New Ballard Score examiners was described by Maria et al [4] as being very good if the ICC value was more than 0.8.

The new Ballard Score approach has benefits and drawbacks of its own. For instance, the New Ballard Score method's accuracy outperformed USG's (ICC = 0.6-0.8). The New Ballard Score was quicker to evaluate (2 minutes and 48 seconds) than the Dubowitz Score Method (4 minutes and 28 seconds), but it was less accurate than the Dubowitz Score Method (Dubowitz score ICC: 0.94 vs. Ballard score ICC=0.93) [5]. In health care facilities with a shortage of personnel, Verhoeff et al [6] recommendation was that a nurse completes the usual physical criterion test for the New Ballard Score. Mcgready et al [7], who indicated that paramedics can reliably complete the evaluation of neurological criteria of the New Ballard Score, backed this proposal.

Similarly, in the study done by Wibowo et al [8] where the study done between the paediatrician and a trained paramedic. From their study they found that Paediatricians and certified paramedics had a very significant correlation agreement, according to intraclass correlation (r=0.925 and p0.05). The Ballard score examination results that were conducted between 48 and 96 hours of age were nearly identical to the gold standard (r=0.993 and p0.05). In conclusion, paediatricians and skilled paramedics had a fair level of agreement when determining the infant gestational age using NBS.

From our study it is evident that the NBS is better in estimation of gestation age, similar results also seen in the study done by Singhal et al [9] which concluded that In SGA neonates, the physical NBS parameters overstate gestation. In SGA infants, changing scores of the skin and plantar creases improves estimations of gestational age.

The data were gathered by a paediatric resident in order to eliminate bias; as a result, the two examiners were unaware of the research participants and examination outcomes. Variability of observers, subjects, and instruments had an impact on measurement accuracy. Standardisation of measurement, assessment, and repeated measurement were carried out to improve the study's measurement accuracy. Observing the confidence interval is one way to determine the accuracy of a measurement of a numeric variable; the smaller the interval, the more accurate the measurement [10].

Subject bias, examiner bias, and instrumental bias were three types of measurement bias that this study made an effort to minimise. Valid sampling, which involved sequential sampling, was used to reduce subject bias since it covered all eligible subjects up until the required

minimum of subjects. Blinded examination, meanwhile, managed examiner prejudice. The outcomes of each subject's examination were unknown to the two examiners. The standardisation of test time and location prevented institutional bias. An evaluation of the New Ballard Score assessment's repeatability was conducted using intraclass correlation. The limitations of this study are that recruitment was from a single centre and also different day measurement was not done.

Conclusion

From this study it is evident that there is a strong agreement between two investigators regarding the estimation of gestational age by New Ballard score as per the interclass correlation coefficient. Hence, New Ballard score will show accurate estimation regarding the estimation of gestational age.

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