Research Article

Correlation of Gestational Age by Last Menstrual Period, Ultrasonography and New Ballard's scoring

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ABSTRACT
Background: Gestational age or menstrual age is the time elapsed from the first day of last menstrual period (LMP), a time that precedes conception. The accurate calculation of gestational age holds key role in prevention of preterm birth; hence the study attempts to find which method gestational age calculation is more accurate.
Methods: prospective observational study with 179 participants whose gestational age was assessed using last menstrual period (LMP), ultrasonography (USG) and New Ballard scoring (NBS) which is considered gold standard.
Results: The mean age of the mother in our study is 24.68 years with a standard deviation of 3.99 and the mean birth weight of babies in our study is 2.80 kg with a standard deviation of 0.45. Pearson coefficient correlation is 0.677 (P <0.001) when comparing gestational age by LMP and gestational age by NBS which is statistically significant. A correlation of 0.779 (P <0.001) was found while comparing gestational age by T1 USG and NBS which was also found to be significant.
Conclusion: T1 USG is more consistent with NBS when compared to LMP gestational age, even though both have positive correlation with NBS.

Keywords: Gestational Age, Ultrasonography, New Ballard's Score, Preterm Birth.

INTRODUCTION

Gestational age or menstrual age is the time elapsed from the first day of last menstrual period (LMP), a time that precedes conception. So technically gestational age is 2 weeks less than ovulation age or postconceptional age.

Calculation of accurate gestational age hold a crucial role in pregnancy. It provides an insight into the maturity of the fetus and aids obstetricians in their decision-making regarding termination of pregnancy. It also has a central role in decisions regarding the gestational age-related testing and influences decisions regarding the management of preterm labor and premature rupture of membranes and helps them to understand when to initiate the post term fetal surveillance.2

Gestational age of the fetus can be calculated by various methods such as Naegele's rule, clinical examination by measurement of fundal height and symphysis fundal height and through ultrasonography (USG) in first trimester of pregnancy in antenatal period and by new Ballard scoring in postnatal period.1

Naegele's rule is not reliable in pregnant women with irregular menstrual cycles, who cannot recall the exact date, who are on oral contraceptive pills, with post conceptual bleed and women who conceive during lactational amenorrhea. It has been reported that only half of the pregnant women could recall their LMP and the discrepancy of more than five days was observed between estimated date of delivery by first trimester USG and LMP in 40% of pregnant women.3

Clinical examination is not reliable in multiple gestation, maternal obesity, intrauterine growth restriction, large leiomyoma, amniotic fluid disorders and it is also subjective in nature with high interobserver's differences.4 Incorrect last menstrual dates, Full bladder, Multiple gestation, Macrosomia, Increased amniotic fluid, Hydatidiform mole, Concealed type of abruptio placenta, Leiomyoma uterus/ovarian tumours/pelvic tumours give

higher gestational age than actual. Decreased amniotic fluid volume, intrauterine growth retardation and intrauterine death gives gestational age lesser than it actual is. It also has some advantages that it's the easiest tool for estimation of gestational age, can also be employed in rural areas which lack USG facilities and no extra cost unlike USG.5

USG first trimester: this is considered to be more accurate than LMP, however if the pregnant woman is very certain of her LMP, then period of gestation calculated by her LMP is considered when the difference is more than seven days.6

Postnatal estimation of gestational age
Ballard scoring system, a simple and rapid method to estimate the gestational age was formulated by Jeanne L Ballard in 1979 and this system was applicable to all the newborns and included even sick infants.7

This system was modified in 1991 to include the premature infants up to 20 weeks and to increase its accuracy and called as modified new Ballard scoring which is being utilized all over the world for the estimation of gestational age after the delivery.8

The physical criteria in the scoring were skin, lanugo, plantar surface, breast, eye/ear, genitalia. Neuromuscular criteria were posture, square window, arm recoil, popliteal angle, scarf sign and heel to ear maneuver. The reliability of this scoring system is poor before 30 hours and after 42 hours of life.8

With higher prevalence of the preterm births and their link to infant mortality, estimation of accurate gestational age becomes a matter of prime importance. Considering new Ballard system as a gold standard for estimation of gestational age, this study was conducted to assess which of the antenatal methods used for estimation of gestational age were more consistent with new Ballard score.

MATERIALS AND METHODS
This is a prospective observational study which was conducted in the Department of Obstetrics and Gynecology at a tertiary care hospital, during the period from November 2019 to October 2021 after getting the approval from the institutional Ethical Committee among the women admitted in department of OBG as per the inclusion and exclusion criteria after taking written informed consent. Purposive Sampling was utilized for recruiting of participants.

Inclusion criteria for mothers included, pregnant women with singleton pregnancy with gestational age more than 28 weeks with previous regular menstrual cycle who knew their last menstrual period and had first trimester ultrasonography. Live term and preterm babies born out of vaginal delivery or lower segment caesarean section (LSCS) without birth asphyxia or perinatal complications or congenital anomalies were included for the study.

All pregnant woman with gestational age more than 28 weeks who attending ANC clinic and coming for delivery who satisfied inclusion criteria were included in the study after taking written informed consent. All patients were subjected to elaborate clinical and obstetric examination along with detailed history taking. Gestational ages were estimated according to the last menstrual period provided by the mother in history. First trimester U S G gestational age and estimated date of delivery were recorded. Mothers were followed throughout the pregnancy period and the assessment of the newborn was made at delivery by New Ballard scoring within 24 hours. Sample size was calculated to be 172 with the following formula **N=**

$$\left[Z^2_{\left(1-\frac{\alpha}{2}\right)} X \sigma^2 \right] \div d^2 [9]$$

RESULTS
Majority of the study subjects (i.e., 54% of 179) are from 21-25 years age group. Only 7.8% of total subjects are over 30 years.
104 subjects of 179 (58.1%) are multigravida and 41.9% are primigravida.

A total of 145 deliveries were term constituting 81% of total deliveries included in the study. Preterm deliveries accounted for 18.4% (n=33) of all the deliveries and only 1 post term delivery.

157 (87.7%) of 179 deliveries were by LSCS and 22 (12.3%) pregnancies were terminated by vaginal delivery.

69.8% (n=125) of 179 babies were in the range of 2-3 kgs whereas 4.5% (n=8) of total babies were in the range of 1-2 kgs and

25.7% (n=46) of the babies were more than 3 kgs.

The mean age of the mother in our study is 24.68 years with a standard deviation of 3.99 and the mean birth weight of babies in our study is 2.80 kg with a standard deviation of 0.45. the minimum age of mother being 18 years and maximum being 38 years. The minimum birth weight being 1.42 kg and maximum being 4.06 kg.

Table 1: Mean gestational age by LMP, T1 USG & NBS

Gestational age	N	Mean	Median	Std. Deviation	Minimum	Maximum
NBS	179	35.49	36.00	4.53	16.00	43.00
Gestational Age by LMP	179	38.08	38.29	1.98	26.29	42.14
Gestational Age by T1 USG	179	38.09	38.29	1.57	31.57	40.43
Gestational Age by NBS	179	38.04	38.00	1.86	30.00	42.00

Table 2: Pearson Correlation

Gestational Age	NBS	Gestational age by LMP	Gestational age by T1 USG	Gestational age by NBS
NBS	1	0.715**	0.824**	0.859**
Gestational age by LMP	0.715**	1	0.767**	0.677**
Gestational age by T1 USG	0.824**	0.767**	1	0.779**
Gestational age by NBS	0.859**	0.677**	0.779**	1

** Statistically Significant at P<0.001, * Statistically Significant at P<0.05

This table demonstrates Pearson coefficient correlation is 0.677 (P <0.001) when comparing gestational age by LMP and gestational age by NBS which is statistically significant. A correlation of 0.779 (P <0.001) was found while comparing gestational age by T1 USG and NBS which was also found to be significant.

Figure 1: Scatter plot for measuring correlation between gestational age by LMP and gestational age by NBS and regression analysis
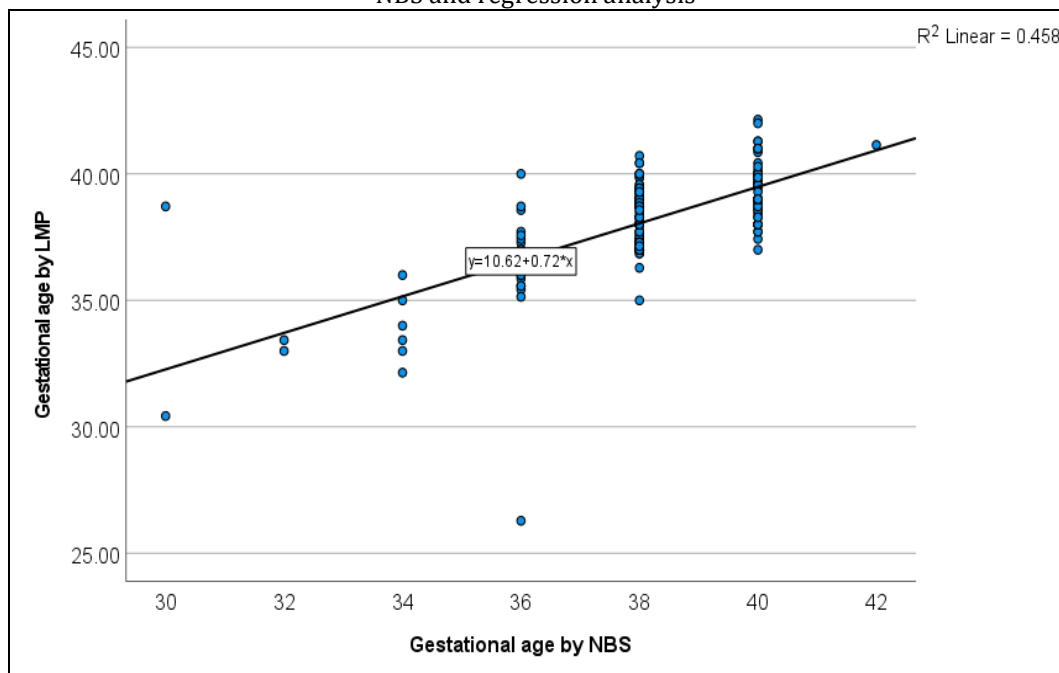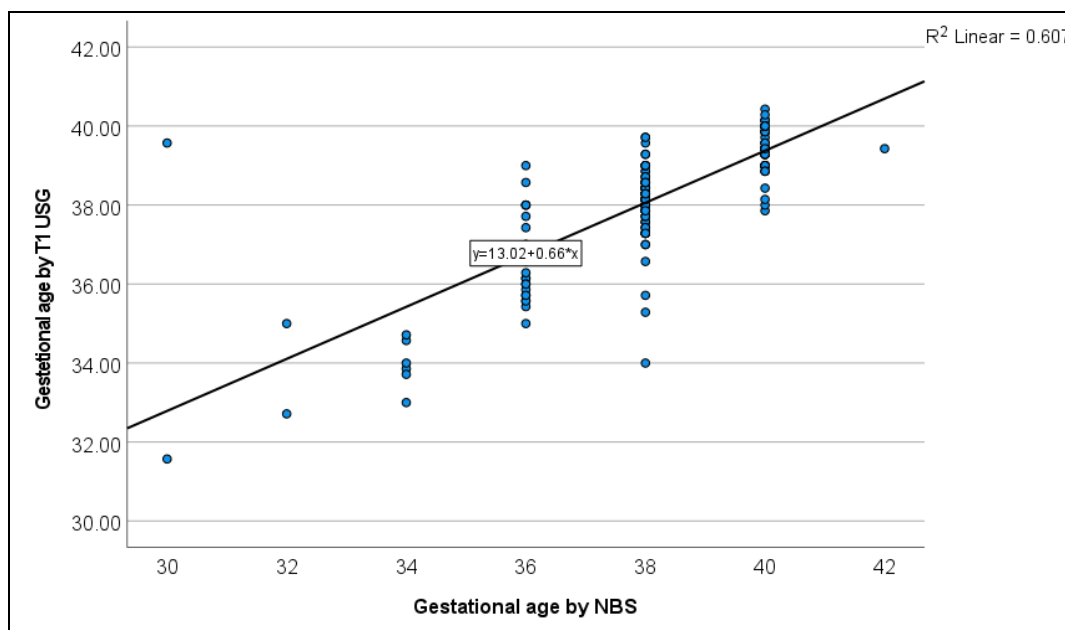

Figure 2: Scatter plot for measuring correlation between gestational age by USG and gestational age by NBS and regression analysis

Figure: Scatter plot of Gestational age by T1 USG versus Gestational age by NBS. R^2 Linear = 0.607; $y = 13.02 + 0.66 \cdot x$

DISCUSSION

This was a prospective observational study conducted in tertiary care center with the aim of assessing correlation between gestational age calculated by various methods such as last menstrual period, ultrasonography and New Ballard's scoring. In the present study a total of 179 antenatal cases attending labor room for delivery at tertiary care center between October 2019 and September 2021 were included in our study after thorough history taking and physical examination to consider inclusion and exclusion criteria after taking a written informed consent.Calculation of accurate gestational age plays an important role in obstetric practice. The assessment ofigestationaliageiisicorneristoneiiniprenatalicareiwhichihelpsitoidetermineitheimaturityiofitheifetus and itakei decisionsi regarding the itermination iofi pregnancy. Hence, with the help of our study we tried to assess which of the prenatal techniques of calculation for gestational age are closer to NBS as NBS is postnatal calculation and appears to be the most accurate.

Mean maternal age at delivery in present study was 24.68 years similar to many other studies. 2,10,11,12,13,14

In present study we found 18.4% of newborns were preterm, 81% were term newborns and 0.6% post-term newborns which was similar to study by Jehan et al[15], Unger et al[2] and JR Weinstein et al[16].

Jyothsna B et al[11] and Razia S et al[13] reported higher percentage of preterm neonates compared to our study with 42% preterm neonates, 56% term neonates and 2% post-term neonates and 39.7% preterm neonates, 59.3% term neonates and 1% post-term neonates respectively.

Our study results showed that there was a strong positive correlation between LMP and USG with NBS scoring. However, the correlation coefficient for first trimester USG (0.779) and NBS was slightly higher than LMP (0.667). Gestational age calculated by all the methods are consistent even if they are varying slightly. Few studies showed almost similar correlation coefficients for both LMP and USG implying that both were equally consistent with NBS score.[2,11,12]

 JR Weinstein et al showed contradictory result to our study where their correlation coefficient for LMP (0.520) was higher than first trimester USG(0.42).[16]

Strenghts and Limitations
Strength of the study includes Sample size calculation with formula giving significant power to the study. Limitations of the study include patients recruited from tertiary care hospital limiting the generalizability of the results, study doesn't involve multiple pregnancy, recall bias in recollection of their LMP.

Clinical Implications and Future Directions

These studies also showcase the significance of LMP so awareness about it can be done through ASHA workers as they are first contact for most of the rural population. Significance of first trimester USG and antenatal visits can also be stressed as calculation of precise gestational age helps prevent iatrogenic preterm deliveries. Future studies can include community samples and from multiple centers and other methos of calculation can also be assessed.

CONCLUSION

Considering NBS as gold standard, our study assessed correlation of NBS with LMP and first trimester USG. Our study results show that both LMP and first trimester USG have positive strong correlation with NBS suggesting that both of the methods are equally reliable.

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