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Comparison of correlation of various methods of gestational age assessment in term neonates

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Abstract
Knowledge of gestational age of newborn babies may modify the details of their care. Though gestational age is usually calculated from the date of mother's last menstrual period this date is not known with certainty in large majority of pregnancy. In others there may be misleading information especially when the menstrual cycle is irregular, when conception is shortly after a previous pregnancy or when the mother was taking oral contraceptives shortly before conception. Hence the need of multiple modalities to confirm the gestational age and the reliability of modalities is a major concern. Our study is undertaken to compare the correlation of gestation age assessment by three methods viz., gestational age assessment by last menstrual period dates, gestational age assessment by last trimester ultrasound and gestational assessment by post-natal assessment of modified Ballard score. This study is a prospective study conducted in a rural medical college hospital. Total of 150 term babies were enrolled in the study. Duration of the study was two years. The gestational age of the neonates was calculated by all 3 methods and the correlation was assessed. The study concluded that the modified Ballard score overestimates the gestational age and the third trimester ultrasound underestimates the gestational age.

Keywords: Gestational age, last menstrual period, modified Ballard score, third trimester ultrasound

Introduction
Gestational age assessment is the primary and the most important determinant in deciding the newborn assessment and care. The ambiguity in correct way of the assessment of gestational age presents a major challenge in the newborn care. The most conventional method of gestational age assessment by mother's last menstrual period dates has limitations and hence other methods were needed. The next most reliable method of gestational age assessment in clinical practice is by antenatal ultrasound, but the availability of the same and the period in which the ultrasound is taken also influences the results. Hence in newborn care the neonatologist's contraption of gestational age assessment is the modified Ballard scoring system which assesses the gestational age with the help of neuromuscular maturity and physical maturity of the newborn babies. Hence in this study the correlation of all the above mentioned methods are assessed in term newborns [1, 2, 3].

Methods
The current prospective study was conducted in rural medical college hospital. Duration of the study was from September 2018 to September 2020. One hundred and fifty newborn babies were included in the study. Only term singleton newborn babies with a gestational age more than 37 weeks and postnatal age less than 48 hours were included in the study. The neonates with postnatal age more than 48 hours, preterm neonates, neonates with congenital anomaly, multiple gestation, sick neonates requiring neonatal intensive care unit admission and infant of overt diabetic mothers were excluded from the study. The gestational age of newborn babies were assessed by three methods, firstly the gestational age was assessed from obtaining menstrual history and the date of the last menstrual period. In the second method the gestational age was assessed as per the data given by the third trimester ultrasonogram. The third method of gestational age assessment was calculated by modified Ballard scoring chart where the physical maturity and the neuromuscular maturity of the newborn and then the respective gestational age was ascertained according to the score. The values obtained were statistically analysed.

Results

In the study 150 term neonates fulfilled the inclusion criteria and exclusion criteria. Gestational age of the babies was assessed by all 3 methods. The data obtained so was analysed.

Gestational Age Comparison as Assessed by last Menstrual Period Age and Modified Ballard Score

The gestational age of the neonates as calculated by last menstrual period dates was compared with gestational age assessed by modified Ballard score and the distribution was categorised. Finally the correlation was tested using chi – square test and the statistical significance was calculated.

Table 1: Gestational age (GA) comparison as assessed by last menstrual period (LMP) age and modified Ballard score

Gestational age as per LMP	No of babies (Total=150)	GA by modified Ballard score	Number (%)	Chi square test	P value
37	44	36-38	24(54.5)	58.3	0.0001
		≥38	20(45.5)		
38	48	<38	4(8.4)	50.01	0.0001
		38	17(35.4)		
		>38	27(56.2)		
39	45	<39	4(8.8)	45.16	0.0001
		38-40	17(37.7)		
		>39	24(53.5)		
40	13	<40	2(15.4)	17.06	0.0001
		40	9(69.2)		
		>40	2(15.4)		

The comparison of gestational age by last menstrual period dates and modified Ballard score was statistically significant based on chi square test. At 40 weeks of assessment by LMP and the Ballard score was comparable in majority (69.2%) of babies. The Ballard score overestimated the gestational age in 45.5%, 56.2% and 53.5% of the babies in 37, 38 and 39 weeks of gestation when compared to gestational age by last menstrual period dates.

Gestational Age Comparison as Assessed by Last Menstrual Period Age and Third Trimester Ultrasound

The gestational age of the neonates as calculated by last menstrual period dates was compared with gestational age assessed by third trimester ultrasound scored and the distribution was categorised. Finally the correlation was tested using chi – square test and the statistical significance was calculated.

Table 2: Gestational age (GA) comparison as assessed by last menstrual period (LMP) age and third trimester ultrasound.

Gestational age as per LMP	No of babies (Total=150)	GA by USG	Number (%)	Chi square test	P value
37	44	≤36	26(59.1)	21.6	0.0001
		37	8(22.7)		
		≥38	8(18.2)		
38	48	<38	28(58.3)	17.4	0.002
		38	9(18.8)		
		>38	11(22.9)		
39	45	<39	35(77.8)	15.4	0.004
		39	5(11.1)		
		>39	5(11.1)		
40	13	<40	13(100)	4.9	0.087
		40			
		>40	0(0)		

The gestational age assessment by these two methods are statistically significant only for the 37, 38 and 39 weeks. The values for 40 weeks of gestational has a p value of 0.087 which signifies the statistical insignificance and the event has occurred by chance. This says at 40 weeks of gestation these two methods didn't correlate. The third trimester ultrasound underestimated the gestational age in all the weeks of gestation as assessed by last menstrual period dates.

Gestational Age Comparison as Assessed by Third Trimester Ultrasoundand Ballard Score

The gestational age of the neonates as calculated by third trimester ultrasound was compared with gestational age assessed by ballard score and the distribution was categorised. Finally the correlation was tested using chi – square test and the statistical significance was calculated. In the study 4 babies did not have any record of ultrasonogram.

Table 3: Gestational age (GA) comparison as assessed by third trimester ultrasound and modified ballard score

Gestational age as per USG	No of babies (Total=150)	GA by modified Ballard score	Number (%)	Chi square test	P value
34	6	>34	6(100)	0	0
35	12	>35	12(100)	0	0
36	31	<36	0(0)	15.9	0.003
		36	13(83.9)		
		>36	18(16.1)		
37	37	≤36	2(7.4)	37.7	0.0001

		36-38	1(14.8)		
		≥38	34(84.6)		
38	32	<38	1(10.5)	28.4	0.0001
		38	4(15.8)		
		>38	28(84.3)		
39	23	<39	3(13.6)	15.6	0.004
		38-40	4(17.4)		
		>39	16(72.7)		
40	4	<40	1(50)	3.6	0.461
		40	2(33.3)		
		>40	1(16.7)		
41	1	<41	1(0)	0	0
			0(100)		
		>41	0(0)		

The correlation gestational age assessment done by these two methods is statistically significant only for 36, 37, 38 and 39 weeks of gestation as per ultrasound. When the gestational age of 34, 35 weeks and 40, 41weeks were compared by third trimester ultrasound and modified Ballard score, there was no correlation.

Discussion

The study was conducted to compare the correlation of gestational age assessment done by three methods *viz*., last menstrual period dates, third trimester ultrasound and modified Ballard scoring system. The mean gestational age according to last menstrual period dates and ultrasound was 38.18 weeks and 37.14 weeks respectively with a mean difference of 0.96 weeks. In F.Sunjoh *et al*. study the new modified Ballard scoring showed little validity and correlation with mean variation of 0.35±1.51 SD which is comparable to our study in the 34, 36, 41 weeks of gestation when assessed by third trimester ultrasound. In holger Unger *et al*. the mean gestational age was 38.4, 38.7 and 38 weeks by last menstrual period dates, ultrasound and Ballard score respectively. Correlation in this study with ultrasound to any other method was poor to moderate which is comparable as ultrasound in our study didn't have a statistical significance when compared with Ballard score. According to John R Weinstein *et al*. the mean gestational age at birth by ultrasound was 38.3 weeks. In this study last menstrual period dates were more accurate than Ballard score. The both modified Ballard score and the last menstrual period dates has poor agreement with gestational age assessed by ultrasound. In Anne C C Lee *et al*. the mean ultrasound gestational age was 39.1 weeks and mean gestational age by modified Ballard score was 38.9 weeks. In this study modified Ballard score 95% confidence interval range was from – 4.7 to + 4.0 weeks showing a wide variability in range and poor accuracy [4, 5, 6, 7].

Limitations

This study was done in a small population of 150 babies. Only term neonates were included in the study. A large scale multicentric study has to be conducted to identify the appropriate method for assessing the gestational age at various periods of gestation.

Conclusion

The study concluded that modified Ballard score overestimates the gestational age in majority of term neonates and third trimester ultrasound underestimates the gestational age between 37 to 39 weeks. When the gestational age of 34, 35 weeks and 40, 41weeks were compared by third trimester ultrasound and modified Ballard score, there was no correlation.

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