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Original research article

Estimation of Foetal Gestational Age by Measuring the Femur Length

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Abstract

Introduction: The evaluation of pregnancy date can be done by taking measurements of foetal femur length. These additional measurements taken provide a more 'universal view' of the foetal development than can be afforded by any single measurement. In the present study femur length was measured to study the correlation and significance of this parameter with last normal menstrual period (LNMP) in estimating the foetal gestational age [FGA].

Material and Methods: In the Present study, a total of 100 antenatal women attending Out-Patient Department of Obstetrics and Gynaecology at Government Maternity Hospital, Sultan Bazaar, during the period of January 2016 to August 2016 i.e. for eight months were included in the study, undergone ultrasonography of parameters of femur bone.

Result: FL and LNMP value in Total estimating the FGA with correlation coefficient r value of 0.965, correlation was significant at < 0.01 level (p value 0.000). In second Trimester r value of 0.870, and correlation was significant at the 0.01 levels (p value 0.000) and < 0.01 level (p value 0.000). In 3rd Trimester r value of 0.704 and correlation is significant at < 0.01 level (p value 0.000). Coefficient r-value, of femur FL was 0.961, in the study population trimester wise.

Conclusion: We concluded that ultrasonographically measured FL of the foetus is reliable predictor in estimating the foetal GA.

Key words: Femur length, Foetal Gestational Age and Ultrasonography

Introduction

Previously, estimation of gestational age was based on the history and physical examination like the menstrual history, maternal sensations of foetal movements, and assessment of uterine size by bimanual examination in 1st trimester, initial detection of foetal heart tones by doppler and uterine fundal height measurement. (1, 2) The estimation of FGA from menstrual history is done using Naegele's rule and it is the method that is universally used. By this rule, FGA is estimated by taking the first day of the LNMP and adds seven days to it, then subtracting three months and adds a year. This is assuming that the average length of the menstrual cycle is 28 days. In the fundal height method, depending upon the height of the fundus from the symphysis pubis, FGA will be determined. However, it has been reported that even in the best known cases, these techniques were filled with error (3). In most of the cases, the date of the last normal menstrual period is not known or there may be history of irregular menstrual cycles or may be on contraceptives and in such a case, estimation of FGA becomes difficult, hence the estimation of FGA by various parameters measured on ultrasonography will be very much useful. Ultrasonographic foetal biometry is the most wide spread method used to establish gestation age, estimate foetal size and monitor its growth.

FGA is proper assessment of the foetal well being requires an accurate knowledge of gestational age of the foetus. FL is an accurate predictor of gestational age. The normal foetal femoral length growth presents a characteristic appearance between the 12th and 42nd week of pregnancy. In the 12th week of pregnancy it is 11 mm on the average, 33 mm in the 20th week, 58 mm in the 30th week, and 76 mm at birth. Hence, the present study was designed to assess this parameter with LNMP in estimating the FGA.

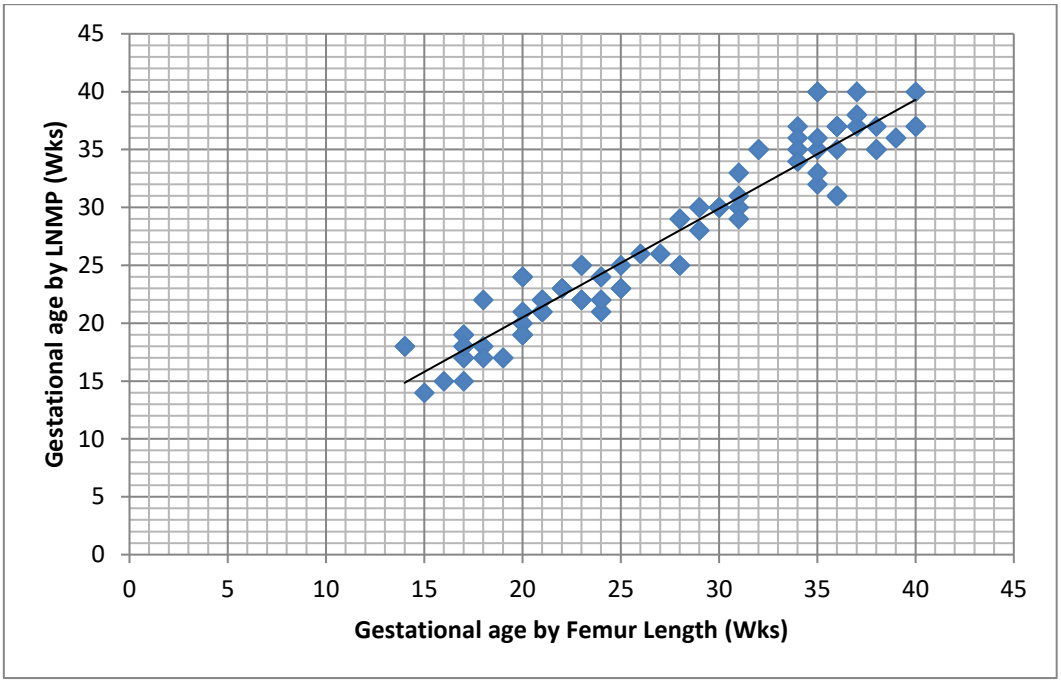
Material and Methods

In the Present study, a total of 100 antenatal women attending Out-Patient Department of Obstetrics and Gynaecology at Government Maternity Hospital, Sultan Bazaar, during the period of January 2016 to August 2016 i.e. for eight months were included in the study. The included patients were undergone the ultrasound scanning in the Hospital and the visibility on ultrasonography of Femur bone parameters were obtained and tabulated. Multiple gestation, uncertain first day of last normal menstrual period, irregular menstrual cycle or <26 or >30 days, IUGR, major fetal abnormalities, and those who are having maternal complications were excluded from the study.

Results:

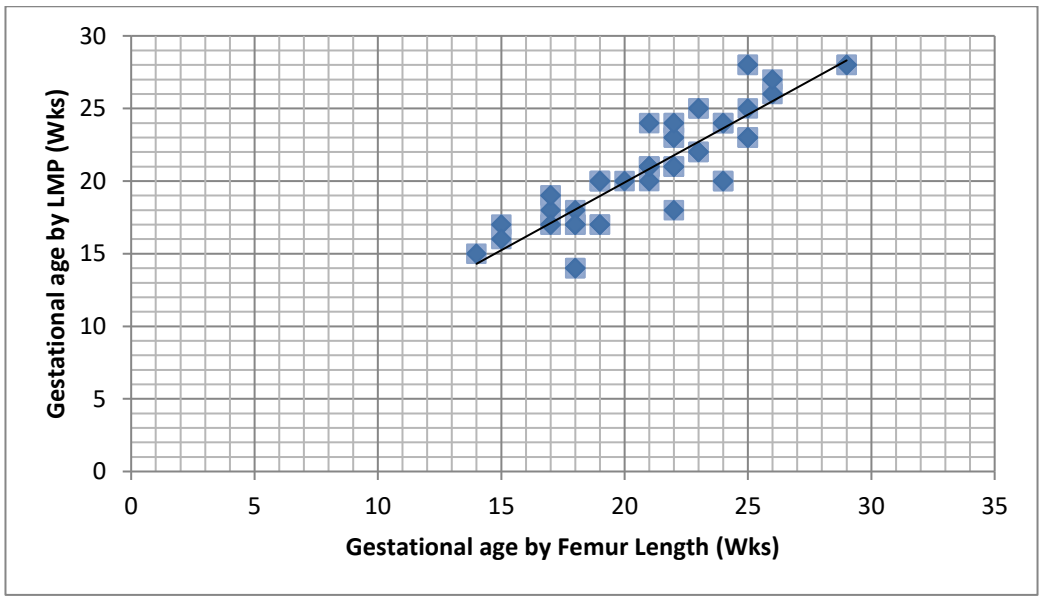
Table 1: Mean Gestational Age of the Foetus in Total participants, Foetus in second trimester, and Foetus in third trimester according to LNMP and FL

	Total			Second trimester			Third trimester		
	Bony parameter measurements in mm (Mean±SD)	GA in weeks Mean±SD	Range (weeks)	Bony parameter measurements in mm (Mean±SD)	GA in weeks Mean±SD	Range (weeks)	Bony parameter measurements in mm (Mean±SD)	GA in weeks Mean±SD	Range (weeks)
GA by FL	48.53±17.40	27.66±7.53	14-40	33.81±9.7	21.19±3.45	14-29	64.48±6.03	34.67±3.19	28-40



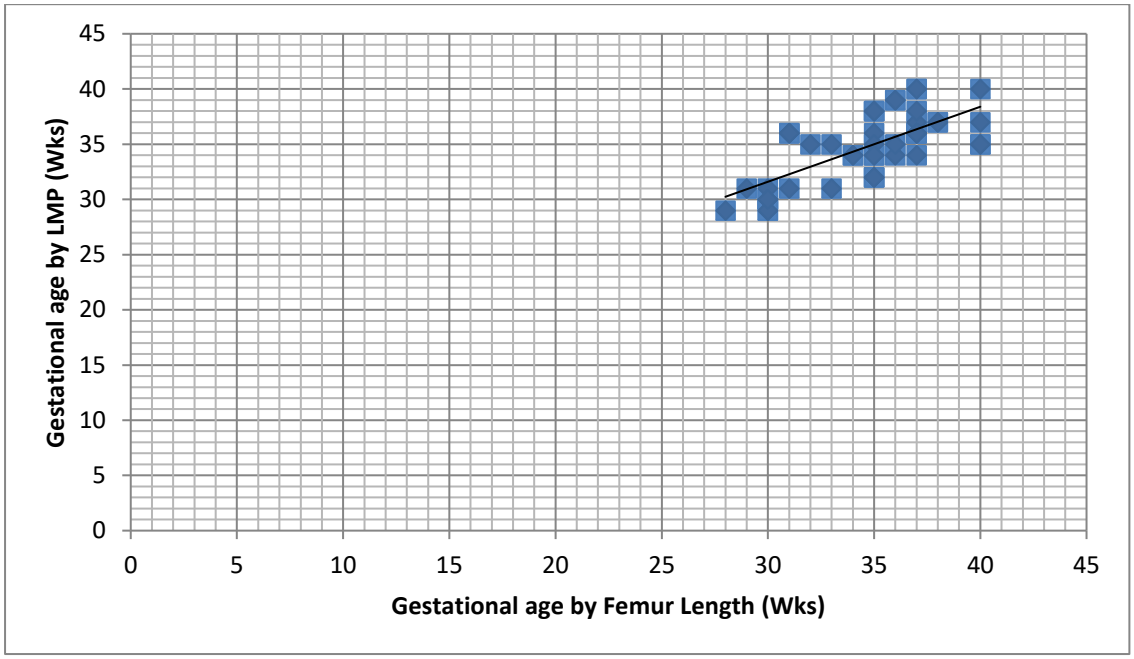
Graph 1: Correlation between FL and LNMP in estimation of Foetal GA

Correlation of Foetal Gestational Age using Femur Length (FL) with LNMP :
On analysis using Pearson correlation coefficient indicates a significant positive linear relationship between FL and LMP value for estimating foetal Gestational Age with r value of 0.870 and correlation was significant at <0.01 level (p value 0.000). The correlation between FL and LNMP was given in Graph 2.



Graph 2 : Correlation between FL and LNMP in estimation of foetal GA in second trimester

Correlation of Foetal Gestational Age using Femur Length (FL) with LNMP:
In the present study, on analysis using Pearson correlation coefficient indicated a significant positive linear relationship between FL and LMP value in estimating the foetal Gestational Age with r value of 0.704 and correlation was significant at < 0.01 level (p value 0.000). The correlation between FL and LNMP was given in Graph 2.



Graph 3 : Correlation between FL and LNMP in estimation of foetal GA in third trimester

Table 2: Correlation coefficient values of various bony parameters in estimating the fetal GA

Bony Parameter	2nd trimester r-value (n=46)	3rd Trimester r-value (n=54)	Total study population r-value (N=100)
FL	0.870	0.704	0.961

Discussion

The most important aspect of pregnancy management is the assessment of gestational age. Gestational age is the estimation of age of an unborn baby. It is generally accepted that safe obstetric practice depends on the valid prediction of gestational age as it is the key for successful ante partum care and critical interpretation of antenatal diagnostic tests and successful planning of intervention. Uncertain gestational age is associated with adverse pregnancy outcomes including low birth weight, spontaneous preterm delivery and post dated pregnancy. Thus by knowing the appropriate gestational age, the follow up in obstetric practice becomes easy and improves the foetal and maternal outcome.

The Femoral length (FL) is of great interest in obstetric practice, as it is helpful in the estimation of fetal age especially in women who do not remember their date of last menstrual period or whose fundal height on abdominal examination is not corresponding with their LNMP gestational age[R1,R2]. The femur length is measured after aligning the transducer with the lower end of the fetal spine and rotating toward the ventral aspect of the foetus and is measured only when femur is horizontal (beam is perpendicular). It is measured along the lateral edge of the shaft from the greater trochanter to the lateral femoral condyle.. It can be measured from 10 weeks onwards**.**

In this study, the estimated mean gestational age in weeks from the mean of bony parameters was calculated i.e., with femur length of mean ± SD (48.53±17.40mm) was 27.66±7.53, with range of 14-40 weeks. The study findings were comparable with the study done by Nagesh R et al (2016).[R5]

Table 3:

	Femur length in mm (mean ± SD)	**Femur length Range in mm**
Present study	48.53±17.40	13-76
Study by Nagesh R et a (2016)	50.21 mm ± 17.14 mm	13.8-79.4

In the present study, the correlation coefficient values in estimating the foetal GA using femur length when compared to LNMP was 0.965. The findings are similar to the studies done by Moawia Gameraddin et al (2015) and Nagesh R et al(2016).

In the study done by Moawia Gameraddin et al (2015) there was a strong positive correlation between gestational age (last menstrual period) .Also strong correlation existed between gestational age and femoral length(r=0.89). Femoral length still remain the most common measurements to assess the foetal growth and evaluation of gestational age .

Table 4: showing the comparison of r value of present study with other studies.

	Present Study Findings (r-value)	**Study done by Moawia Gameraddin eta al (2015) (r-value)**	**Study done by Nagesh R et al (2016) (r-value)**
Femur length	0.965	0.89	0.995

In this study, the antenatal women were grouped according to the age into two groups. It was observed that most of them (97%) belonged to the age group of 18- 27 years and only 3% of them were between the age group of 28 – 37 years. The Mean±SD of age of the patients was 22.1±2.58 years. The antenatal women when categorized according to the parity, it was observed nearly half of them (43%) belong to first gravida (Primi), 36% were in second gravida, 20% in third gravida and only 1% in fourth gravida. It was observed that 48% of the antenatal women included in the study population were in 2nd Trimester and 52% in third trimester. In the present study, when the distribution of the antenatal women according to the type of presentation was assessed, it was observed that majority were in cephalic presentation (72%). The other types of presentations observed were breech (10%), transverse lie (7%) and unstable lie (11%).

In the present study, the mean gestational age of the foetus, was calculated using various parameters likes last normal menstrual period (LNMP) and other bony parameters visualized on ultrasonography FL was given in the Table-1. And we observed that on analysis using Pearson correlation coefficient indicated a significant positive linear relationship between FL and LNMP in estimating the foetal Gestational Age with correlation coefficient r value of 0.961 was given in Graph 1.

In the present study, correlation of the FL and LNMP was also done according to the pregnancy trimester.

In second Trimester: when analysis using Pearson correlation coefficient was done, it indicated a significant FL value helping in estimating the foetal gestational age, with r value of 0.870, and relation was significant at the 0.01 level (p value 0.000) was given in Graph 3

In 3rd Trimester: On analysis using Pearson correlation coefficient was done, it indicated a significant FL value helping in estimating the foetal gestational age with r value of 0.704 and relation is significant at < 0.01 level (p value 0.000) was given in Graph 4

The obtained values for FL, when it was observed that irrespective of the trimester, individually all the dimensions were having a significant positive linear relationship with LNMP in estimation of foetal gestational age .When the study population was analysed according to the trimester and the correlation was assessed, it was observed that the r- value of FL parameters during the second trimester was slightly higher than 3rd trimester, indicating that all these parameters were more linearly associated with LNMP in estimating GA. In this study, it was also observed that from the correlation value of composite GA and Average GA with LNMP for estimating foetal GA, showed significant positive linear relationship.
For estimating the fetal gestational age, FL parameters were measured under ultrasonography guidance.

When the study population was analysed according to the trimester and the correlation was assessed, it was observed that the r- value of all the bony parameters during the second trimester was slightly higher than 3rd trimester, indicating that all these parameters worsened progressively as pregnancy proceeded. The similar finding were seen in the previous studies and suggested that the accuracy of estimating fetal age in 2nd and 3rd trimester decreases as pregnancy progresses due to increasing biological variation. The gestational age estimates done early in the 2nd trimester were more accurate than measurement done later in the second trimester or in the third trimester (7, 8). In general, the accuracy of gestational age prediction in the 2nd trimester is approximately +7 days before 20 weeks and +10 days after 20 week; the accuracy of fetal age prediction in the 3rd trimester is about +21 day (9, 10).

Normally, the ultrasonographic parameters assessed during the first trimester were the best predictors in estimating the foetal gestational age. But unfortunately, in developing countries, most of the antenatal women come for their first check up after their first trimester (11).

Conclusion

From the present study, it was concluded that ultrasonographically measured FL are reliable predictors in estimating the foetal gestational age. By estimating the foetal gestational age, appropriate measures can be taken to prevent the pre-term deliveries / maternal complications / post dated pregnancies, thereby decreasing peri-natal morbidity and mortality.

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