Gestational Age Predicted by Femur Length in Bangladesh

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Summary:

Objective: Fetal femur length is an important parameter for determining gestational age. If we use tables based on Bangladeshi population, gestational age estimation will be more accurate. This study was therefore designed to determine the gestational age by fetal femur length measurement in our country.

Methods: Healthy gravid patients with optimal dates were included in a prospective study. Fetal femur length along with other parameters was measured. A table and a graph were prepared by Polynomial regression model. Previously established nomograms were compared with it.

Results: The gestational age predicted from the femur length measurements of 1223 subjects from 13 to 40 weeks are presented here in a tabulated form. Percentiles, mean and standard deviations were also derived. The quadratic model showed a good fit to the data. There was a gradual increase of the femur length measurements. From 13 to 27 weeks gestation, there was no clinically important difference between this and western nomograms for predicting gestational age but after 32 weeks the difference with western nomograms became significant.

Conclusion: This nomogram is special for Bangladeshi population. It will give more accurate gestational age assessment than the western tables that are still followed in our country, especially in the 3rd trimester.

Key Words: Gestational age, femur length, Bangladesh.

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Introduction:

Literature is fraught with studies and tables to determine gestational age from various fetal parameters. Still we do not have tables by fitting models, for gestational age determination of Bangladeshi population. For this reason our gestational age assessment is not so accurate, especially in the third trimester when the growth trend of our fetuses is less than that of the western fetuses. Therefore if we use western charts for age determination of fetus there is significant error in gestational age estimation and the fetus may appear small for date even when it is not. For this purpose this study was conducted, to prepare nomogram of Bangladeshi population, so that we can determine the gestational age more accurately by using our own table. This is of much importance here as gestational age assessment is the most common reason for fetal ultrsonography in our country since routine scanning is not the practice here in most cases. This is probably due to socio-economic reason.

The accuracy of femoral measurement in the prediction of fetal age has been shown by various studies. [1,2] That is why this parameter has been selected in this study to assess the fetal age accurately.

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Subjects and Methods:

This was a prospective, cross sectional study. It was carried out from December 2004 to November 2007. Structured questionnaires were filled up. Consecutive healthy gravid women were studied who met the following criteria:

Regular periods, well-defined last menstrual period (LMP), an ultrasound scan before 20 weeks which confirmed the LMP age within 10 days, no history of maternal medical, surgical or obstetric complications or malnutrition, no uterine anomaly or large fibroids and no congenital anomaly of the fetus.

The ultrasonic scans were performed by a single sonologist on one ultrasound machine, by a 3.5 MHz curvilinear transducer. This excluded inter-observer variations. The measurements were made by electronic calipers in mm and the gestational age was expressed in weeks (w) with 2 standard deviations (2SD), also expressed similarly, in weeks.

The technique of measuring the femur length (FL) involves an initial determination of the lie of the fetus and locating the femur. Once the femur has been located, an attempt is made to define both ends of the calcified portion. The image is then frozen and with multidirectional electronic calipers, the calcified portion is measured. The aim is a femur which is finely outlined

and has clear-cut ends.[1] After 32 menstrual weeks the distal femoral epiphysis is visible but not included in the measurement.[2]

Body mass index (BMI) was used to determine the nutritional status. 18.5 was taken as the cutoff value.[3] SPSS was used for data entry and analysis in the computer. Polynomial regression model was fitted to the data.

Results:

The demographic characteristics of the study population of 1223 subjects were as follows. Mean maternal age was 26.95 ± 4.49 (1SD) with a range of 17 to 40 years. It was predominantly a middle class population. 96.9% were from middle class, 0.8% belonged to lower class and 2.3% were from upper class.

93.6% were from urban and 6.4% from rural areas. 54.7% were primipara and 45.3% were multipara. Mean parity was 0.6 (± 0.78). Mean BMI was found to be 23.67 (± 3.4).

The coefficient of multiple correlation, $R^2 = 0.975$. The quadratic model gave a good fit to the data. Graph 1 shows raw data of fetal femur length with fitted 3rd, 10th, 50th, 90th and 97th percentiles.

In Table 1, 10mm predicts 13.2 (± 0.75) (2SD) weeks, 45mm predicts 25(± 2.08)weeks, 68mm predicts 36.1 (± 2.95)weeks and 74mm predicts 40(± 3.14) weeks.
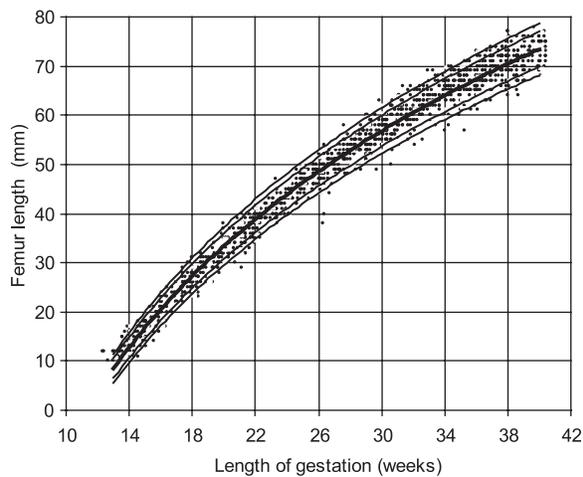

Fig.-1: *Raw data of fetal Femur length with fitted 3rd, 10th, 50th, 90th and 97th centiles.*

Table-I

Weeks of gestation for FL $R^2=0.975$

FL (mm)	G. Age (w) Mean (w)	2 SD (w)
10	13.2	0.75
11	13.5	0.79
12	13.7	0.83
13	14.0	0.87
14	14.3	0.91
15	14.5	0.94
16	14.8	0.98
17	15.1	1.02
18	15.4	1.06
19	15.6	1.09
20	15.9	1.13
21	16.2	1.17
22	16.5	1.21
23	16.8	1.25
24	17.2	1.28
25	17.5	1.32
26	17.8	1.36
27	18.1	1.40
28	18.5	1.43
29	18.8	1.47
30	19.2	1.51
31	19.5	1.55
32	19.9	1.59
33	20.2	1.62
34	20.6	1.66
35	21.0	1.70
36	21.3	1.74
37	21.7	1.78
38	22.1	1.81
39	22.5	1.85
40	22.9	1.89
41	23.3	1.93
42	23.7	1.96
43	24.1	2.00
44	24.5	2.04
45	25.0	2.08
46	25.4	2.12
47	25.8	2.15
48	26.3	2.19
49	26.7	2.23

Table Continue

FL (mm)	G. Age (w) Mean (w)	2 SD (w)
50	27.2	2.27
51	27.6	2.30
52	28.1	2.34
53	28.5	2.38
54	29.0	2.42
55	29.5	2.46
56	30.0	2.49
57	30.4	2.53
58	30.9	2.57
59	31.4	2.61
60	31.9	2.64
61	32.4	2.68
62	32.9	2.72
63	33.5	2.76
64	34.0	2.80
65	34.5	2.83
66	35.0	2.87
67	35.6	2.91
68	36.1	2.95
69	36.7	2.98
70	37.2	3.02
71	37.8	3.06
72	38.4	3.10
73	38.9	3.14
74	39.5	3.17

Discussion:

Estimation of gestational age accurately is one of the most important functions of diagnostic ultrasound. Of all the parameters used to determine gestational age, femur length has been proved to be one of the most accurate, by different studies.[1,2] Determination of gestational age by ultrasound has now become an integral part of maternal antenatal care. Since up to 50% of mothers who claim to know with certainty are in fact more than two weeks in error when gestational age is calculated with ultrasound. A discrepancy of 2 weeks can be critical for the survival of an infant who has to be delivered early because of some antenatal complication.[4]

In this study femur length was measured from 13 to 40 weeks gestational age. It was found to increase gradually with gestational age. After regression analysis of the raw data the table to predict the gestational age from femur length measurement, was prepared. The high value of coefficient of multiple correlations shows a good relation between the two variables. The polynomial regression quadratic model showed a good fit to the data. The graph shows that there was increased dispersion of data and the fitted curves as the gestational age increased.

Previous studies on Bangladeshi population had determined that our fetal measurements were smaller than the western ones.[5-11] In this study 10 mm predicted 13 week (2SD, ±1w) and 74 mm predicted 40 weeks (±3w). Whereas in another Bangladeshi study at 16w, femur length was 19mm (±2.6mm) (1SD) and at 40 week it was 72mm (±3.2mm).[10]

In an Indian study, at 13 week gestational age femur length was 11mm and at 40 week it was 76mm.[12]

In Western studies, 10mm predicted 13 week (±7d) (2SD) and 75mm predicted 40 week (±23d), [13] 10mm predicted 13 week (±10d) (2SD) and 78mm predicted 40 week (±22d) [14] and in an early study 18mm indicated 15w (±6d) (2SD) and 75mm indicated 40 week (±22d). [15]

All studies showed that in the early 2nd trimester Bangladeshi, Indian and Western measurements were similar but as pregnancy progressed there was discrepancy between different races. The observed values of femur length measurement of other Bangladeshi studies were similar to this one. Indian and western were little bigger than Bangladeshi values.

LIMITATION: The study population was predominantly of middle class as poor patients mostly deliver at home. Even when they go to doctors most of them are unable to recall their LMP accurately, which was necessary for this study.

Conclusion:

In 1223 subjects, from 13 to 27 weeks gestation, there was no clinically important difference between this and western nomograms but after 32 weeks the difference with western nomograms became significant. This nomogram is therefore special for Bangladeshi population and can be useful for accurate dating of pregnancies specially in the third trimester, as there was a difference of 2-3 weeks at term between this and different western charts.

Recommendation: More such studies can be done on other fetal parameters to prepare Bangladeshi charts.

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