

Correlative Growth Study of Foetal Femur and Tibial Length in Third Trimester for Gestational Age Estimation by Ultrasound in Central Rajasthan

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ABSTRACT

Background: Ultrasonography has become an integral part of modern day evaluation of pregnancy and foetal wellbeing. The rapidity, safety and diagnostic yield of ultrasound have made this procedure a necessity for many obstetricians. The knowledge of normal foetal growth and development is important for retardation and intrauterine growth acceleration both of which contributes significantly for perinatal mortality and morbidity. Foetal femur growth as an index of intrauterine growth and development is sensitive and precise variable to use in the assessment of foetal gestational age. The estimation of tibial length and its correlation with femur length will be a new study work, since there is very little work is available.

Aims and objective: Estimation of foetal femur and tibial length to assess foetal growth and gestational age.

Material and Method: Total of 500 cases was taken for the study in Radio-diagnosis Department of Janana Hospital and J.L.N. Medical Hospital, Ajmer i.e from 28th to 40th weeks of pregnancy.

Results: Linear regression equation was derived for both foetal femur and tibial length. The co-variance for foetal femur length was 89.95 and tibial length is 80.15. The Correlation is 0.962 and 0.952 respectively.

Key words: Gestational age, Foetal femur length, Foetal tibial length.


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INTRODUCTION

Clinical application of ultrasound in obstetrics was introduced and popularised by Donald and Glasgow in 1958. ¹ Ultrasonography has become an integral part of modern day evaluation of pregnancy and foetal well-being. The pregnant womb is an almost perfect environment for ultrasonic examination. The rapidity, safety and diagnostic yield of ultrasound have made this procedure a necessity for many obstetricians. ¹

Foetal ultrasonography has been one of the fastest developing fields in imaging of foetus. The ability to examine the foetus and to detect foetal growth, foetal gestational age (FGA) and any other foetal anomalies has dramatically changed the diagnosis and practice of obstetrics. ²

The knowledge of normal foetal growth and development is important for an understanding of variation from the i.e. intrauterine growth retardation and intrauterine growth acceleration both of which contribute significantly to prenatal mortality and morbidity. Alterations in intrauterine growth due to IUGR and intrauterine acceleration are very important factors, which controls the prenatal mortality and morbidity. Inaccurate antenatal diagnosis of altered foetal growth would unable the obstetricians to evaluate and manage these problems more carefully. ³

Femur length measured ultrasonically has become an important factor in determination of foetal age. Femur is usually measured in lateral plane. The present study is undertaken to estimate the foetal gestational period ultrasonographically with the use of femur length. ⁴

The use of multiple parameters improved the accuracy of gestational age assessment compared with any single parameter. If the gestational age estimates derived from all of the parameters are similar, assignment of gestational age from the average of all the parameters will improve accuracy. ⁵

Femur contributes to grow normally throughout pregnancy, while BPD, HC, AC growth rates decreases in last 10 weeks of pregnancy. Femur length measurement may be a more reliable parameter to use for gestational age assessment in gestation during the third trimester. ⁶ Sonographic measurement of the ossified shafts of foetal long bones is possible after 12th week of gestation. Several studies have established standard growth curves for the femur, but only a few authors have described normal values of the humerus, tibia, fibula, radius, ulna. ⁷

The data regarding the tibial length in the population is meagre. Femur tibial length measurement in ultrasound can be utilized as an accurate parameter to determine gestational age.

AIMS AND OBJECTIVES

The estimation of fetal gestational age with fetal tibial length and its comparison with fetal femur length will be a new work, study since there is a little data available. It will include:-

- Measurement of fetal femur and tibial length and noting the tentative FGA.
- Evaluating the FGA from the obtained formulations.
- Comparison of two parameters growth curves.

MATERIALS AND METHODS

This study on the assessment of fetal gestational age in normal pregnant women by real time ultrasound was carried out in Radio-diagnosis Department of Janana Hospital and J.L.N. Medical Hospital, Ajmer i.e from 28th to 40th weeks of pregnancy. A total of 500 cases were considered. The ultrasonic measurement of fetal femur length, tibial length (in mm) and tentative foetal gestational age were noted by real time ultrasonography.

Table 1: Distribution of NO. Of cases along with mean fetal gestational tibial & femur length

S.No	Gestational age	No. Of cases	Foetal tibial length		Foetal femur length	
			Mean(mm)	Std. Dev	Mean (mm)	Std. Dev
1	28	29	44.55	3.61	51.64	4.44
2	29	39	50.92	3.16	54.56	2.16
3	30	30	53.29	3.18	56.25	2.68
4	31	34	54.66	3.34	58.45	3.32
5	32	34	58.54	3.36	62.18	3.40
6	33	31	59.25	2.42	62.46	1.32
7	34	32	61.09	1.53	64.81	1.42
8	35	41	62.33	1.64	66.38	1.34
9	36	48	63.00	1.94	66.68	1.80
10	37	51	65.40	0.34	69.40	1.53
11	38	48	68.40	0.40	72.20	0.66
12	39	55	70.71	1.33	74.00	0.48
13	40	28	72.00	-	75.00	0.32

Table 2: Calculate equation to estimate foetal femur and tibial length by fetal gestational age

S.No		Versus fetal tibial length	Versus fetal femur length
1	Number of cases	500	500
2	Covariance	80.15	89.95
3	Correlation	0.952	0.962
4	intercept	-15.85	-12.69
5	Slope	2.259	2.281
6	Standard error of slope	0.033	0.029

Table 3: Estimation of fetal tibial and fetal femur length at different gestational age

S.No	Weeks	Fetal tibial length (Y) Y=-15.85+2.259 *GA(in mm)	Fetal femur length (Y) Y=- 12.69+2.281*GA(in mm)
1	28	47.14	51.32
2	29	49.66	53.43
3	30	51.92	55.74
4	31	54.17	57.99
5	32	56.43	60.30
6	33	58.69	62.55
7	34	60.95	64.86
8	35	63.21	67.11
9	36	65.47	69.24
10	37	67.73	71.67
11	38	69.99	73.98
12	39	72.25	76.23
13	40	74.51	78.55

Table 4: Calculated equation to estimate gestational age by fetal femur and tibial length

S.No		Via fetal tibial length(X)	Via fetal femur length(X)
1	Number of cases	500	500
2	Covariance	80.15	80.95
3	Correlation	0.952	0.962
4	intercept	8.95	7.19
5	Slope	0.401	0.406
6	Standard error of slope	0.006	0.005
7	Std error of estimate	1.833	1.625
8	Students T value	69.079	78.806
9	Probability	0.00	0.000
10	Equation generated	Y=8.95+0.401*X	Y=7.19+0.406*X

Table 5: Calculated gestational age by fetal femur and tibial length

S.No	Fetal Gestational age (Y) from tibial length (X); Y=8.95+0.401*X		Fetal Gestational age (Y) from femur length (X); Y=7.19+0.406*X	
	weeks	Tibial length	weeks	Femur length
1	27.59	44.55	28.36	51.64
2	28.88	50.92	29.56	54.56
3	29.89	53.29	30.64	56.25
4	30.48	54.66	31.16	58.45
5	32.13	58.54	32.68	62.18
6	32.43	59.25	33.00	62.46
7	33.21	61.09	33.76	64.81
8	33.74	62.33	34.41	66.38
9	34.03	63.00	34.53	66.68
10	35.05	65.40	35.64	69.40
11	36.33	68.40	36.79	72.20
12	37.31	70.71	37.53	74.00
13	37.86	72.00	37.94	75.00

RESULTS & DISCUSSION

An important point for the sonologist to understand is that no sonographic method can precisely define gestational age in every case properly constructed studies of the relationship between gestational age and sonographic parameters in the fetus should indicate the range of error that may be associated with the prediction of age by ultrasonography. The range of error usually reported \pm SD, which should be applicable to approximate to 95% of a normal fetal population. Thus it assigns a gestational age based on the sonographic measurement of the fetus and the variability is \pm 1 week, than we are in effect stating that a 95% of time are age estimate should be within 1week of the true menstrual age.

In the present study the fetal femur length and fetal tibial length from 28-40 weeks of gestational age were analysed the means of method of least square linear regression and the result analysis generated the following equation:- $Y = -12.69 + 2.281 * GA (X)$ where $Y =$ fetal femur length and $X =$ fetal gestational age and $Y = -15.85 + 2.259 * GA$ here $Y =$ fetal tibial length. In the present study as per mentioned earlier the main emphasis given on the fetal tibial length, though the literature related with this were available apparently less for comparison. After analyzing the data the distribution of mean of fetal tibial length give the linear growth of tibial length from 28 to 40 weeks of gestational age. On the comparison with growth curve of fetal femur length and fetal tibial length, we found that the gradual increment in the length of tibia is more precise as compare to the femur length. Odita JC observed that there were strong linear relationship between length of tibia and femur with gestational age. The correlation coefficient between fetal femur length and fetal tibial length were respectively 0.97 and 0.94 they found there is no significant difference in length of lower limb bones between the sexes.

CONCLUSION

We have shown that fetal long bone length show a high correlation with gestational age and a low interobserver variation, thus suggesting their usefulness in the assessment of menstrual age as an alternative basis, when it is impossible to obtain reliable measurements of the biparietal diameter. Long bone length may be used for monitoring fetal growth and for diagnosing of bone dysplasias.

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