ABSTRACT

Fetal foot length measurement correlates well in prediction of gestational age (P value <0.0001) along with conventional parameters like biparietal diameter femur length and abdominal circumference. It is a reliable biometric parameter in estimation of gestational age in patients with irregular cycles. It has got good stastistically significant correlation in second trimester prediction of gestational age. It has no statistical significance in estimating GA at various gestational ages. It has got less correlation in prediction of GA in patients with IUGR compared to biparietal diameter.

KEY WORDS

Fetal foot length, gestational age.

INTRODUCTION of sonography to obstetrics by IAN DONALD *&* collegues in 1958 is now regarded as one of the major milestones of modern medicine. Whereas ultrasonography was in use for a quite a long time , recent advances like colour Doppler and high intensity transducers have made diagnosis more precise and there are technologically advanced four dimensional ultrasound which allows the clinician to acquire a single volume that can be reformatted at any orientation.

AIM OF STUDY

To evaluate the role of fetal foot length as a biometric parameter in estimation of gestational age along with conventional parameters biparietal diameter, femur length, abdominal circumference in normal singleton pregnancy.

MATERIALS & METHODS

Pregnant women of gestational age 15-40 weeks as assessed clinically and other conventional USG parameters attending the antenatal outpatient department and inpatient department during second & third trimester in our govt. kilpauk medical college hospital Chennai.

Inclusion criteria:

Pregnant women of gestational age 15-40 weeks attending antenatal outpatient department and inpatient department in normal singleton pregnancy.

Exclusion criteria:

1. Structural anomalies.

2. Oligohydraminous.

3. Multiple pregnancies.

SAMPLE SIZE

Sample Size for Frequency in a Population-by Open Epi-software.

Population size(for finite population correction factor or fpc)(N):	3000
Hypothesized % frequency of outcome factor in the population (p):	50%+/-5
Confidence limits as % of 100(absolute +/- %)(d):	5%
Design effect (for cluster surveys-$DEFF$):	1

Sample Size(n) for Various Confidence Levels

Confidence Level (%)	Sample Size
95%	341

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Statistical Analysis: Done by SPSS Package version 17. The continuous variable Foot length, GA by Foot length with respect to Age distribution is done by Analysis of Variance. The statistical Probability value < 0.05 has taken as Significant. The measure of agreement of foot length with BPD, Femur length and Abdominal circumference were done by correlation coefficient and scatter diagram. The classification of correlation coefficient is as follows.

If r = +.70 or higher Very strong positive relationship

+.40 to +.69 Strong positive relationship

+.30 to +.39 Moderate positive relationship

+.20 to +.29 weak positive relationship

+.01 to +.19 No or negligible relationship

-.01 to -.19 No or negligible relationship

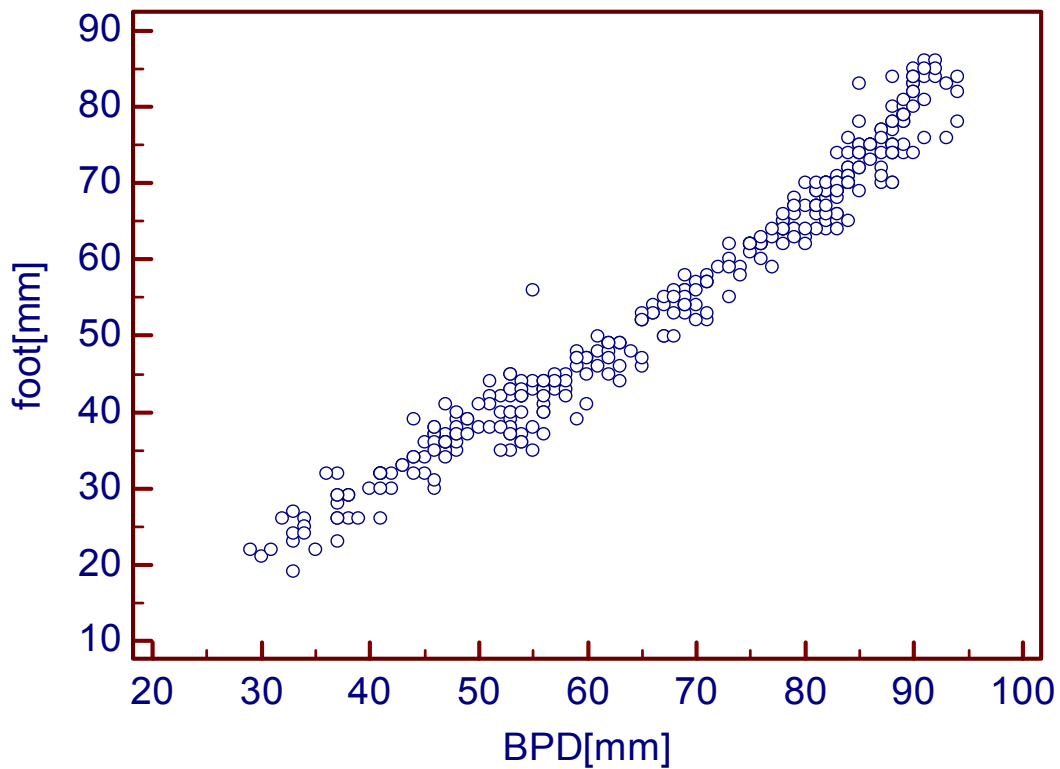-.20 to -.29 weak negative relationship

-.30 to -.39 Moderate negative relationship

-.40 to -.69 Strong negative relationship

-.70 or higher Very strong negative relationship

TABLE I
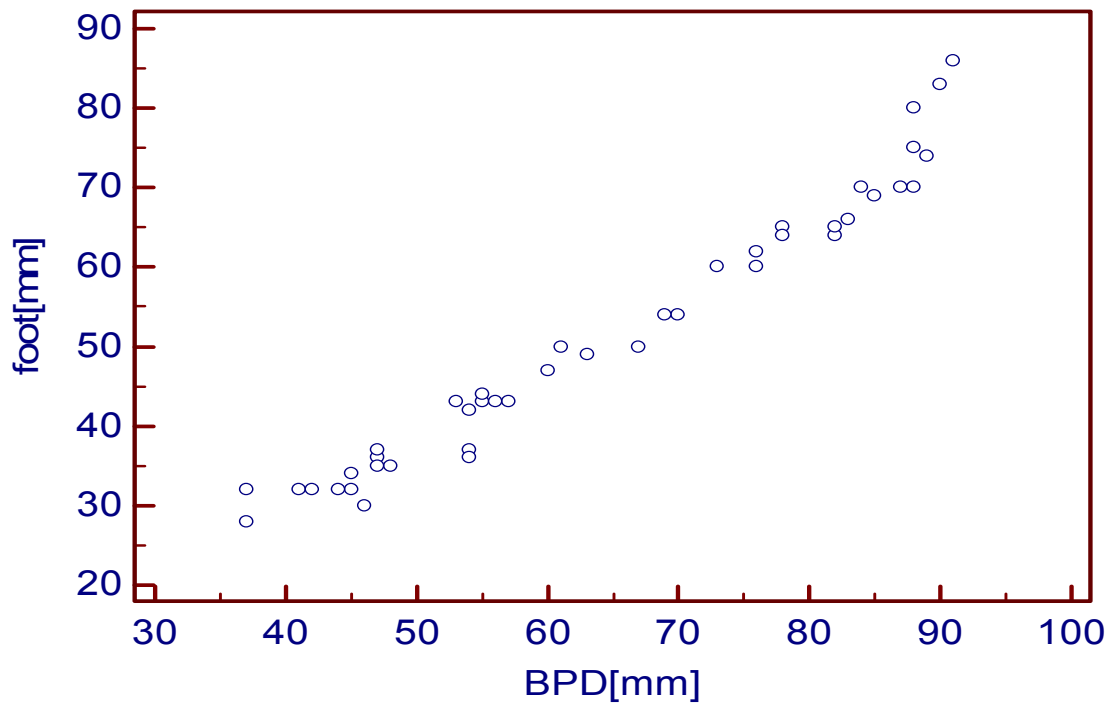**CORRELATION OF FOOT LENGTH WITH BPD IN ESTIMATION OF GA   Correlation**

Variable Y	foot[mm]	
Variable X	BPD[mm]	
Sample size		341
Correlation coefficient r		0.9827
Significance level		P<0.0001
95% Confidence interval for r		0.9786 to 0.9860

TABLE X

IRREGULAR CYCLES: FOOT LENGTH CORRELATION WITH BPD

Correlation

Variable Y	foot[mm]
Variable X	BPD[mm]

Sample size	43
Correlation coefficient r	0.9816
Significance level	P<0.0001
95% Confidence interval for r	0.9660 to 0.9900

DISCUSSION

Accurate gestational age assessment is of great importance in Obstetric practice . Appropriate estimation of GA requires good judgement by the obstetrician caring for the patient. Since clinical data such as the menstrual cycle or uterine size often are not reliable parameter for pregnancy dating should be determined by the obstetrician early in the pregnancy. USG is an accurate and useful modality for the assessment of GA in first &second trimester of pregnancy & as a routine part of prenatal care, can greatly impact obstetric management and improve antepartum care.

The value of any given studied biometric parameter [eg biparietal diameter , femur length, abdominal circumference , foot length] is based on ease of obtaining the measurement and the accuracy with which it predicts menstrual age. A measurement that is easily obtained but inaccurate for judging menstrual age is of little value. As well, a measurement that accurately predicts menstrual age but is very difficult to obtain is also usually not valuable. In most of the cross sectional

studies that measure various biometric parameters data are then analysed using linear regression analysis. Most of the published tables that provide predictions of menstrual age from sonographic measurements in this way.the variability usually the result of measurement error or actual biologic variability in size is expressed as ± 2 standard deviations which is applicable to 95% of foetuses in a normal population.

From analysis of my data with a sample size [n=341] fetal foot lenth measurement as a biometric parameter is a reliable parameter in predicting gestational age fetal foot length correlates well with the conventional parameters like biparietal diameter, femur length, and abdominal circumference. The correlation coefficient [R] of fetal foot length is 0.9827 , 0.9563, 0.9791 with BPD , FL, AC respectively. The correlation of fetal foot length with conventional parameters is statistically significant with a p value of <0.0001 in all of the above three correlations. Also the 95% confidence interval lies within the range of 0.95-0.98 which is a statistically significant value thus fetal foot length measurement is a reliable parameter in determining gestational age in accuracy with conventional parameters. So in situations where there is abnormal head shape as in microcephaly / hydrocephalus , anencephaly where BPD measurement is invalid fetal foot length becomes a better prediction tool.

Femur length becomes unreliable parameter in cases of short limb dwarfism and other skeletal dysplasias, where fetal foot length is a good alternative in gestational age prediction along with other parameters

COMPARISION WITH VARIOUS PIONEER STUDIES.

WITH RESPECT TO GESTATION AGE:

STUDY	CORRELATION COEFFICIENT [R]	P VALUE
Streeter et al ,1920	0.98	<0.0001
Joshi et al, 2011	0.97	0.0001
Platt et al, 1988	0.94	0.0001
Molly et al , 1994	0.89	<0.0001
Wozmiak et al, 2009	0.89	<0.001
Drey et al , 2005	0.87	0.0001
Mhaskar et al ,1989	o.84	0.0004
My study	0.96	<0.0001

About 20% of antenatal women have irregular menstrual cycles or they are not sure of dates. In such pregnant women the obstetrician solely has to depend on early pregnancy dating USG and serial scans to ascertain the interval growth. From the analysis of my data which also includes patients with irregular cycles [n=43] it is found that fetal foot length has a good correlation in second and third trimesters with

correlation coefficient of 0.98 and a statistical significance [p value < 0.0001]

COMPARATIVE STUDY IN IRREGULAR CYCLES

STUDY	CORRELATION COEFFICIENT [R]	P VALUE
Drey et al ,2005	0.87	0.0003
My study	0.98	<0.0001

From my data analysis it is found that there is a statistically significant correlation in gestational age estimation in second trimester than compared to third trimester sample size [n=189] in second trimester was analysed by linear regression with third trimester group [n=152]

The correlation coefficient [R] is 0.94 in second trimester and 0.80 in third trimester with a significant P value <0.0001.

COMPARATIVE STUDY IN SECOND AND THIRD TRIMESTER

STUDY	CORRELATION COEFFICIENT		P VALUE
	II TRIMESTER[R]	III TRIMESTER[R]	
Sahas et al 2009	0.94	0.89	<0.0001
My study	0.94	0.80	<0.0001

The prediction of fetal foot length in assessment of gestation in antenatal women with foetuses with intrauterine growth restriction has less statically correlation when compared with biparietal diameter with a wide range of 95% confidence interval.

CONCLUSIONS

❖ Fetal foot length measurement is a reliable parameter in the prediction of gestational age along with conventional parameters biparietal diameter, femur length, and abdominal circumference.

❖ Fetal foot length measurement reliably predicts gestational age in antenatal women with irregular menstrual cycles.

❖ Fetal foot length can be influenced by fetal growth abnormalities .This study imply that the fetal foot length measurement has a limited role in growth abnormalities.

❖ further studies are required in cohort of IUGR to establish the role of foot length in gestational age prediction.

❖ Foot length is more accurate in ascertaining period of gestation in second trimester when compared to third trimester .

❖ Foot length measurement has no statistical significance in estimating GA in various gestational ages.

❖ Fetal foot length is a reliable biometric parameter in predicting accurate gestation age upon which obstetric decisions can be made with precise for a better perinatal outcome.