Evaluation of Gestational Age with Fetal Foot Length Using Ultrasonography

Moawia Gameraddin[1,2], Suliman Salih[1,4,]Mohamed yousef[1,3]
1 Department of Diagnostic Radiologic Technology, College of Medical Applied Sciences, Taibah University Fax: 00966 8475790 P.O: 30001 AlmadinahAlmunawwarah, KSA
2 Faculty of Radiological Sciences and Medical Imaging, Alzaeim Alazhari University.P.O.Box1432 Khartoum Bahri 13311-Sudan
3 College of Medical Radiologic Science, Sudan University of Science and Technology.P.O.Box 1908, Khartoum, Sudan
[4]National Cancer Institute - University of Gezira, Sudan
m.bushra@yahoo.com

Abstract: Correct assessment of gestational age is a cornerstone of management of any obstetric case. Several anatomical parameters are useful in the assessment of gestational age. The ultimate aim of this study is to determine the fetal gestational age through the measurement of the foot(foot length) and to determine the accuracy of fetal foot length in estimating gestational age. **Methods:** There were one hundred pregnant ladies in 2nd and 3rd trimesters had been selected randomly in different medical centers and hospitals in Khartoum State. They were scanned with ultrasound using the international protocols and guidelines of obstetric ultrasonography. Statistical analysis using regression equation and correlation was obtained. **Results:** There was a strong correlation between fetal foot length and gestaional age. **Conclusion:** Fetal foot length is a reliable parameter for use in the assessment of gestational age and is particularly useful when other parameters do not accurately predict gestational age. The study derived an important equation to estimate the GA, the GA= 82.411+2.191FtL.
[Moawia Gameraddin, Suliman Salih, Mohamed yousef. **Evaluation of Gestational Age with Fetal Foot Length Using Ultrasonography.** *J Am Sci* 2014;10(1):5-7]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 2

Keywords: Gestational Age, Fetal Foot,Length, Ultrasound, measurement

1. Introduction

Accurate assessment of gestational age and evaluation of fetal growth is fundamental to perinatal care. Multiple fetal anatomical measurements have been used for ultrasound evaluation ofgestation. Nowadays ultrasound has become one of the primary tools to evaluate fetus growth during pregnancy, Diagnostic ultrasound high frequency 3,5-7 MHz; low intensity sound waves which are transmitted through the tissue by the transducer using trans- abdominal or endo-vaginal scanning FRANK A et al (1985), Correct assessment of gestational age is a cornerstone of management of any obstetric case. Several anatomical parameters are useful in the assessment of gestational age. In early pregnancy, we use mean sac diameter(MSD) (Fossum et al (1988), Bree et al (1989), Daya et al (1991), and crown rump length (CRL)4 to assess gestational age. In second and third trimesters, we use four main anatomic parameters viabiparietal diameter5, head circumference, abdominal circumference Hadlock et al (1982), and femur length. These parameters are more than sufficient in any routine antenatal scan to assess the gestational age. It is preferable for more than one parameter to be used in the second and third trimesters. The most commonly used fetal measurement are biparietal Diameter and femur length or other long bones and Abdominal and head circumferences FL and BPD of great interest in obstetric practice they are helpful in the estimation of fetal age especially in women do not remember that the date of their last menstrual period or whose fundal height on abdominal examination does not corresponding to the date, they used the prenatal multiplier method for predication of limb length discrepancy. Fetal measurements including weight, knee-to-heel length, biparietal diameter, placental weight, and amniotic fluid volume were correlated with foot length. Trolle (1948),The majority of the obstetric ultrasound scans are performed to document fetal age when clinical date is Equivocal or when there is discrepancy between uterine size And dates by last menstrual period. During the second trimester of pregnancy it has been established that fetal biometry can accurately predict gestational age ±7 days (±2 SD) Chervenak et al (1998)

Streeter (1920), showed that the fetal foot has a characteristic pattern of normal growth. He proposed that the fetal foot could be used to estimate gestational age. Goldstein et al found that the fetal heel ossification centers could serve as an adjunct for estimation of gestational age. Campbell et al (1988), evaluated the fetal femur/foot length ratio and found that it was a useful parameter to help differentiate fetuses that have dysplastic limb reduction from those whose limbs are short because of constitutional factors or intrauterine growth retardation. Visualization of the foot is useful to find or exclude anomalies such as

club foot6 and arthrogryposis. Fetal foot polydactyly hasbeen seen in trisomy 13. Campbell et al 17 found that the femur versus foot length ratio was approximately unity throughout 14 and 40 weeks of gestation. Our study demonstrates a statistically significant linear correlation between the fetal foot length and gestational age.

2. Material and Methods

This is a cross-sectional case study conducted in Khartoum State hospital and Clinics. There were 100 normal pregnant women had been selected randomly and evaluated at the prenatal diagnosis in the second and third trimester.All the patients were certain of their last normal menstrual period, had a regular menstrual cycle, and had not experienced any vaginal bleeding since becoming pregnant. All pregnant ladies with history of IUGR, multi-gestaional sacs, diabetes, eclampsia and pre-eclampsia were excluded from the study.

Each patient had been scanned twice in an international scanning guidelines and protocols. The ultrasound measurements were made using a linear-array real-time system (TOSHIBA JUST VISION 2000 Probe: TA convex PVG366.M) with 3.5 and/or 5 MHz transducers. We have measured the fetal foot from heel to end of the big toe on plantar and lateral views.

Fetal foot length was taken from the skin edge overlying the calcaneus to the distal end of the longest toe (the first toe) on either the plantar or the sagittal view. The statistical analyses were performed by SPSS software version 16.

3. Results

There were 100 pregnant women had been canned with ultrasound in the second and third trimesters. General data was collected such as maternal age and weight had been taken and recorded on the data collection sheet. Fetal biometrics such as femoral length and fetal foot length had been calculated. The results being as follows:

Table(1) shows distribution of age of the study

Age	Frequency	Percent%
15-25	36	36.0
25-35	52	52.0
35-45	12	12
Total	100	100

Table (2): Shows distribution of maternal parity

parity	Frequency	Percent
nulliparous	19	19.0
multiparous	81	81.0
Total	100	100.0

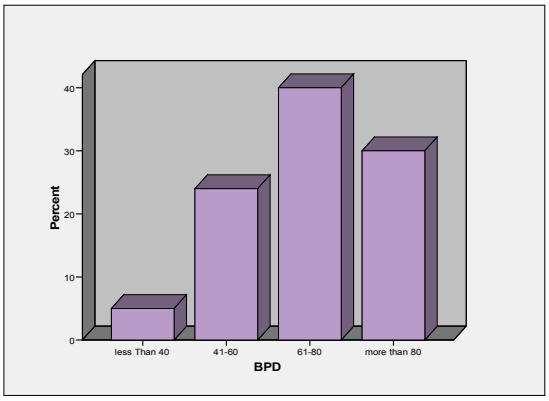

Chart (1): shows distribution of maternal weight

Table(3): Shows distribution of sample by FL (mm)

FL	Frequency	Percentage
>30	9	9.0
30-40	17	17.0
41-50	15	15.0
51-60	23	23.0
61- 70	22	22.0
<70	14	14.0
Total	100	100

Table (4): Shows distribution of sample by foot length (FtL) with mm

Ft	Frequency	Percentage
>30	12	9.0
30-40	14	17.0
41-50	20	15.0
51-60	18	23.0
61- 70	21	22.0
<70	15	14.0
Total	100	100

Table (5): The mean value of FL and Ft.L with the ratio

	Femoral length(FL)	Foot length(Ft.L)
Number of cases(N)	100	100
mean	53.2970	52.0760
Standard deviation	15.48536	15.42910
Ratio	FL/Ft.L = 1	Ft.L/FL= 0.996

Table (6) shows correlation between fetal foot length and gestational age

	Foot length	Gestational age
Foot length Pearson correlation	1	0.943
Sig.(2-tailed)		0.000
N(total cases)	100	100
Gestational age Pearson correlation	0.943	1
Sig.(2-tailed)	0.000	
N(total cases)	100	100

Table(7): shows model Summary of correlation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.839(a)	.704	.701	24.32520

a Predictors: (Constant), FtL

Table(8) shows the equation Coefficients(a) of the foot length and GA

Model	Unstandardized Coefficients		standardized Coefficients	T	Sig.
	B	Std. Error	Beta		Std. error
Constant	82.411	7.913		10.414	0.000
Foot length	2.191	0.144	0.839	15.175	0.000

a Dependent Variable: Note: from the above table equation is derived which stated that **GA=82.411+2.191(Ft.L)**

Discussion

Out of 100cases there were 81 multiparous 19 nulliparous, the maternal age ranged between 15and 45 years. Table (3) shows distribution of the measurement of the femoral length which is concentrated at the range of 51 to 70 mm(43 cases) Table (5) showed the mean value of femoral FL and foot length (Ft.L), which were 53.2970mm and 52.0760mm respectively. It was found that the femur/foot length ratio was 1 which is similar to a study done with Campbell et al (Campbell. S, 1988) who found the femur/foot length ratio to be approximately 1 throughout the gestation ages between 14-40 weeks. This result indicates that the measurement of foot length is still helpful in these situations to find out femur/foot length ratio which can be a useful additional tool for further evaluation of these fetuses.

Table (6) shows there was a strong positive correlation between the foot length and gestational age (r=0.94). There is significant relationship between FL and Ft.L (p-value is 0.000). Table 7,8 demonstrated the linear regression. Simple linear regression analysis shows linear relationship between foot length and gestational age (GA=82.411+2.191FtL) with high degree of correlation (r=0.940 and P=0.000) as shown on table(6). The formula GA=82.411+2.191Ft.L is useful and very accurate to estimate the GA from the fetal foot length. Today most of the obstetricians rely on ultrasound for correct estimation of gestational age. Almost all fetal biometries change with gestational age. Accordingly several parameters are described in the literature to evaluate gestational age. But routinely we use MSD, CRL, BPD, HC,AC and FL.

Conclusion

The study concluded that there was a clear linear relationship between fetal foot length and gestational age with significant correlation between these parameters. This is in comparison with other previous studies which concluded that the ultrasonographic measurement of foot length is a reliable indicator of gestational age.

Corresponding Author:

Dr Moawia Gameraddin, Department of Diagnostic Radiologic Technology, College of Medical Applied Sciences, Taibah University Fax: 00966 8475790 P.O: 30001 Almadinah Almunawwarah, KSA,
E-mail: m.bushra@yahoo.com
or mgameraddin@taibahu.edu.sa

References

1. Bree RL, Edwards M, Böhm-Vélez M, Beyler S, Roberts J, Mendelson EB. (1989). Transvaginal Sonography in the Evaluation of Normal Early Pregnany. Correlation with HSC Level. AJR; 153: 75-79.
2. Campbell J, Henderson A, Campbell S(1988): The fetal Femur/foot Length ratio: A new parameter to Assess Dysplastic Limb Reduction. Obstetrics and Gynaecology. (JC: OC 2). 181-4, August.
3. *Chervenak FA, Skupski DW, Romero R, Myers MK, Smith-Levitin M, Rosenwaks Z, Thaler HT(1998). How accurate is fetal biometry in the assessment of fetal age. Am J ObstetGynecol;* ***178****: 678–687*
4. *Chervenak FA, Tortora M, Hobbins JC. Antenatal sonographic diagnosis of clubfoot. J Ultrasound Med 1985;4:49-50.*
5. Daya S, Wood S, Ward S, Lapalainen R, Caco C (1991). Early pregnancy Assessment of Transvaginal Ultrasound Scanning. Can Med. Assoc J; 144: 441-446.
6. Fossum GT, Davajan V, Kletzky OA (1988). Early detection of pregnancy with Transvaginal ultrasound. FertilSteri; 49: 788-791.
7. Hadlock FP, Deter RL, Harrist RB, Park SK(1982). Fetal Abdominal Circumference, as a Predictor of Menstrual Age.AJR; 139: 367-376.
8. Streeter GL(1920): Weight, Sitting Height, Head Size, Foot length and menstrual Age for the Human Embryo. Contrib Embryology 11:143.
9. Trolle D(1948): Age of foetus determined from its measures. Acta ObstetGynecol Scan 27:327.

12/26/2013