International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Ultrasonographic Estimation of Fetal Gestational Age Using Foot Length as a Parameter

Shilpa Gupta[1], Rajni[2]

[1]Assistant professor, Dept of Anatomy, Mulayam Singh Medical College, Nalpur, India

[2]Associate professor, Dept of Anatomy, P.D.U.M.C Churu Rajasthan, India
Corresponding Author: rajni24rajeev[at]gmail.com

Abstract: ***Appropriate assessment of gestational age is paramount in obstetric care for making appropriate management decisions. Numerous equations regarding the relationship between fetal biometric parameters and gestational age have been described. This study has been conducted to assess the reliability of foot length as a new parameter. Ultrasonographic measurement of Foot Length was done without prior knowledge of gestational age. Then the gestational age was confirmed by an early abdominal ultrasound by biparietal diameter, femur length and abdominal circumference followed by correlation of foot length with gestational age. Fetal foot length showed good correlation with gestational age with correlation coefficient 0.960 with p<0.0001. Scatter diagram plotted between gestational age and fetal foot length shows linear relation. The results of the present study are concordant with that of previous studies and foot length can be used as a new emerging parameter.***

Keywords: Gestational age, Foot length

1. Introduction

Accurate pregnancy dating is very important for the obstetricians in the evaluation of fetal growth, in appropriately counseling women who are at risk of a preterm delivery, detection of intrauterine growth restriction, in the interpretation of biochemical serum screening test or for counseling patients regarding the option of pregnancy termination.

Ultrasound assessment of gestational age has become an integral part of obstetric practice in recent times. Over the past three decades, numerous equations regarding the relationship between fetal biometric parameters (gestational sac mean diameter, crown rump length, femur length, biparietal diameter and abdominal circumference) and gestational age have been described and have proven early antenatal ultrasound to be an objective and accurate means of establishing gestational age.[1]

But if the head is unusually rounded (brachycephalic) or unusually elongated (dolicocephalic), BPD measurements would overestimate or underestimate gestational age. Similarly variation in AC measurements in macrosomic and growth-retarded fetuses is due to differences in liver size and width of subcutaneous tissue was observed.Femur achondroplasia leads to underestimation of FL and therefore, of gestational age.

So, the purpose of this study is to find out the other parameters which can be used to determine the gestational age either more accurately or can be used in other conditions where the previous parameters are unreliable such as foot length which can also be used as an adjunct in the diagnosis of many karyotypic defects and syndromes.

2. Literature Study

Mercer et al in 1987 concluded that fetal foot length was a reliable parameter for estimating gestational age and was particularly useful when other parameters did not accurately predict gestational age, e.g. in cases of hydrocephalus, anencephaly or short-limb dwarfism.[2]

Campbell et al in 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.[3]

Goldstein et al in 1988 did the sonographic measurement of fetal foot length and the assessment of fetal heel ossification centers as an additional method for the estimation of gestational age.[4]

Platt L D et al in 1988 described the ultrasonic measurement of fetal foot length and developed mathematical models to quantify the relationships between menstrual age and commonly measured fetal structures.[5]

Molly S Chatterjee in 1994 conducted a prospective study on 53 normal pregnant women. The gestational age ranged from 14 - 40 weeks. The relationship between fetal foot length and gestational age is shown. A significant linear relationship between those parameters (R^2= 0.89, p<<0.0001) was present.[6]

Rajesh Bardale at el in 2008 found a statistically significant linear relationship between fetal hand length (HL) and gestational age (r = 0.978, p <0.0001). Similarly a statistically significant linear relationship was found between fetal foot length (FL) and gestational age (r = 0.975, p < 0.0001). The standard error of estimate for hand length is 1.62 and foot length is 1.76.[7]

3. Problem Definition

Since the previous parameters are found to be unreliable in various congenital anomalies. So, the purpose of this study is to find out the other parameters which can be used to

determine the gestational age either more accurately or can be used in such conditions.

4. Methodology/ Approach

The present study was conducted in the Department of Anatomy, in coordination with the Department of Radio diagnosis. The study was done in 100 normal pregnant women who were sure about their last menstrual period, had regular menstrual cycle, not experienced any vaginal bleeding since becoming pregnant, no one had taken oral contraceptives for at least 3 months before conception, having singleton apparently normal fetuses, no medical pathology.

Ultrasonographic measurement of Foot Length was done without prior knowledge of gestational age using Medison S A 8000 S E ultrasonographic machine with curvilinear linear and sector array 3.5 to 5 MH_Z frequency transducers (probes).Fetal foot can be visualized sonographically around 15 weeks of gestation. The fetal foot is seen perpendicular to the plane of the fetal leg. The image was freezed to measure the foot length. We measured the Fetal Foot Length from heel to the end of big toe on plantar and lateral views. Dorsal views are excluded from the study as it may lead to incorrect assessment of foot length thus affecting the final result obtained by the study

5. Results and Discussion

In our study the earliest age at which fetal foot length could be seen sonographically was found to be 15 weeks of gestation and mean foot length is 17.5±1.29 and mean sonographic foot length at 36 weeks of gestation is 64.4±3.28.

Table 1 shows the relationship of mean foot length (FTL) versus gestational age which increases as pregnancy progresses from 15 to 36 weeks of gestation.

Table 1

GA	MEAN FTL ± SD
15	17.50 ± 1.29
18	22.60 ± 2.96
21	28.00 ± 0.81
24	34.80 ± 0.83
27	36.25 ± 2.06
30	43.40 ± 1.34
33	49.00 ± 3.46
36	64.40 ± 3.28

Figure 1 shows the graph plotted the mean values of foot length against gestational age which shows linear increase in FTL as pregnancy progresses from 15 to 36 weeks of gestation

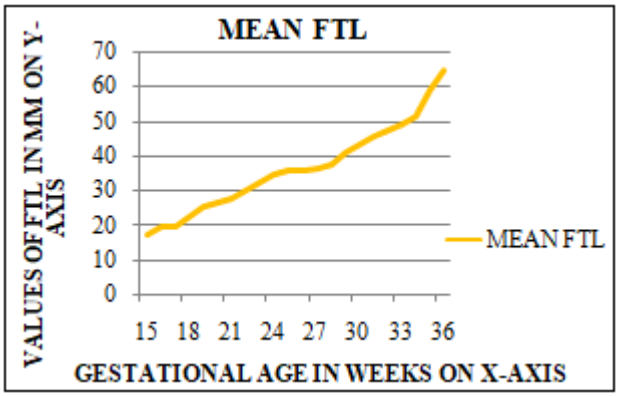

Figure 1

6. Conclusion

In the present study fetal foot length showed good correlation with gestational age with correlation coefficient 0.960 with $p<0.0001$. Scatter diagram plotted between gestational age and fetal foot length shows linear relation of fetal foot length with gestational age. On comparing the results of the present study with that of previous researches we concluded that the present study is concordant with that of previous studies. Nevertheless high correlation coefficient (0.960) and comparatively lesser standard error (1.3) makes this study more reliable.

7. Future Scope

Fetal foot length is a good marker for gestational age especially in cases of femur achondroplasia, dolichocephaly or brachycephaly and in cases who are not sure about their L.M.P. Fetal foot length can be used as an investigational tool in the determination of gestational age in the late second and third trimesters of pregnancy. Fetal foot length was particularly useful when other parameters did not accurately predict gestational age, e.g., in cases of hydrocephalus, anencephaly or short-limb dwarfism.

References

[1] Robin B. Kalish, Frank Chervenak. Sonographic Determination of Gestational Age. Timisoara Medical Journal 2009;2
[2] Mercer BM, Sklar S, Shariatmadar A, Gillieson MS and D Alton ME. Fetal foot length as a predictor of gestational age. Am J Obstet Gynecol 1987;156:350-5
[3] Campbell J, Henderson A, Campbell S. The fetal femur/foot length ratio: a new parameter to assess dysplastic limb reduction. Obstet Gynecol 1988;72(2):181
[4] Goldstein I, Reece EA, Hobbins JC. Sonographic appearance of the fetal heel ossification centers and foot length measurements provide independent markers for gestational age estimation.AM J Obstet Gynecol 1988;59(4):923-6
[5] Platt LD, Medearis AL, DeVore GR, Horenstein JM, Carlson DE, Brar HS. Fetal foot length: relationship to menstrual age and fetal measurements in the second trimester. Obstet Gynecol 1988;71(4):526-31

[6] Molly S Chatterjee. Fetal foot length as a predictor of gestational age 1994.
[7] Rajesh Bardale MD, Vaibhav Sonar MD. Assessment of Gestational Age from Hand and Foot Length. Indian Journal of Forensic Medicine and Pathology 2008;1(2):47-51