

FETAL FOOT LENGTH AS A PREDICTOR OF GESTATIONAL AGE IN NORMAL PREGNANCIES AND IN INTRAUTERINE GROWTH RETARDATION

N. GULATI ● N. DUHAN ● SHARMA V.K.

SUMMARY

Fifty antenatal patients with normal pregnancies and 50 with suspected intrauterine growth retardation (IUGR) between 32 to 41 weeks of pregnancy were analysed ultrasonographically and postnatally for foot length measurements. Comparative evaluation of foot length versus biparietal diameter, femur length, and femur length/abdominal circumference (FL/AC) ratio revealed that the accuracy of foot length (95.12 percent) for estimation of gestational age paralleled that of femur length (96.07 percent) and was higher than that of biparietal diameter (83.07 percent). Foot length was more accurate than biparietal diameter and femur length and approximately equalled the accuracy of FL/AC ratio for prediction of IUGR. For the prediction of IUGR, FL/AC ratio was the most accurate parameter (73.91 percent accuracy) followed by foot length (69.73 percent), biparietal diameter (60.83 percent) and femur length (56.52 percent).

INTRODUCTION

The determination of gestational age and the antenatal detection of IUGR are of paramount importance for the

management of pregnancies at risk. With the development of obstetrical ultrasound as an adjunct to antenatal assessment, many parameters have been studied for prediction of gestational age and IUGR. In 1920, Streeter reported a series of 576 pathologic specimens

Dept. of Obs. and Gyn., & Radiodiagnosis, Pt. B.D. Sharma PGIMS, Rohtak, Haryana (India)

in which he correlated foot length to gestational age. Many specimens were fixed in ten percent formalin which may cause tissue swelling. Usher and McLean in 1969 gave similar results with postpartum data. There are no studies to our knowledge that have reviewed foot length for the antenatal detection of IUGR.

In the present study, we endeavoured to establish a correlation between fetal foot length and gestational age and to compare the accuracies of foot length, femur length, biparietal diameter and FL/AC ratio for predicting IUGR and gestational age.

MATERIAL AND METHODS

The study included 102 antenatal patients between 32 to 41 weeks of pregnancy. Group I included 52 patients with normal pregnancies while Group II included 50 patients with suspected IUGR on clinical examination. The inclusion criteria were singleton pregnancy, secure dates, no identifiable anomaly and no maternal medical complication.

A single observer performed ultrasonographic measurements of fetal foot length, femur length, biparietal diameter and abdominal circumference with the help of International General Electric RT 3600 equipped with 3.5 mHz linear/sector transducer probes. Fetal foot was measured from the heel to the tip of great toe including the soft tissues. Both plantar and longitudinal views of the foot were taken, when possible. The babies of the patients who delivered within three days of

the ultrasonic examination were taken up for gestational age estimation, foot length measurement and birth weight measurement. Postpartum foot length was measured with the help of a ruler and the gestational age was estimated according to Mcharban's scoring system. Babies with birth weight less than the tenth percentile of the expected weight for the particular age were classified as growth retarded.

The mean ultrasonic foot length measurements at each week of gestation were compared to Streeter's data. Mathematical evaluation of the relationship between foot length and gestational age was performed with use of linear regression model. The accuracy of foot length for the prediction of gestational age and IUGR was compared to that of biparietal diameter, femur length and FL/AC ratio.

RESULTS

The study included 102 antenatal patients between 32 to 41 completed weeks of pregnancy. Two patients with normal pregnancy on antenatal examination delivered growth retarded fetuses and were hence excluded for the purpose of analysis other than accuracy. Group II was further subdivided into two sub groups, depending upon whether the patients delivered average for gestational age (AGA) babies or small for gestational age (SGA) babies.

Scatter plots of foot length versus gestational age and gestational age versus foot length were made. The mean foot length values in the two

FIGURE 1

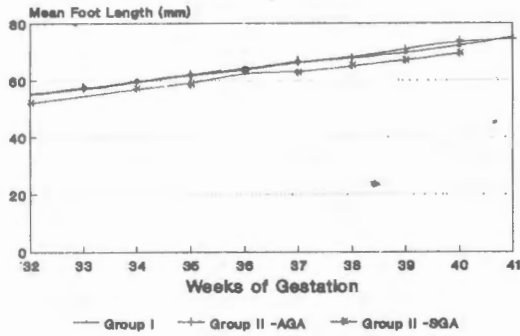


Fig. 1.

groups were compared. Foot length measurements showed linear relationship with gestational age (Fig. 1). In 1988, Goldstein et al 1988 had also observed a statistically significant linear relationship between fetal foot length and gestational age.

By the use of linear regression model the following equations were derived :

(1) $Y = 0.36 \times X + 13.1$ for estimation of gestational age from foot length

Y = Gestational age (weeks)

X = Foot length (mm)

(2) $Y = 2.17 \times X + (-14.5)$ for estimation of foot length from gestational age.

Y = Foot length (mm)

X = Gestational age (weeks)

The correlation coefficient (r1) of foot length versus gestational age was derived (r1 = 0.844)

Comparison of accuracies for gestational age estimation revealed that the femur length (96.07 percent accuracy) and the foot length (95.12 percent) were the most accurate, followed by biparietal diameter (83.07 percent). For the prediction of IUGR, FL/AC ratio was the most accurate parameter (73.91 percent accuracy) followed by foot length (69.73 percent), biparietal diameter (60.86 percent) and femur length (56.52 percent).

DISCUSSION

Although the foot length data followed Streeter's predictive curve, the foot lengths were found to be consistently lower by approximately one centimetre than the predicted values. This could be due to lower average birth weight of Indian babies. Fetal foot length was found to be a good predictor of gestational age.

Amongst the single parameters, foot length was found to be the most accurate for antenatal detection of IUGR. The FL/AC ratio was slightly more accurate than foot length. Hence, foot length measurement can be of value for antenatal detection of IUGR and for estimation of gestational age.

REFERENCES

1. Streeter GL: *Contrib. Embryol Carnegie Inst* : 11; 143; 1920.
2. Usher R, McLean F. : *J Pediatr* : 74 : 901 : 1969.
3. Goldstein I, Reece EA, Hobbins JC. : *Am. J. Obstet Gynec* : 159; 923; 1988.