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Original Research Article

Fetal Growth Pattern Based on Fetal Sonographic Biometry

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Abstract

Background: Fetal biometric measurements of different anatomical structures are valuable in radiological and obstetric practice for the estimation of gestational age, assessment of intrauterine growth and differentiation of normal from abnormal fetuses. Birth weight estimation also depends on different fetal biometric measurements and has tremendous value for neonatal management in terms of appropriate time of delivery, specific obstetric interventions and delivery under intensive neonatal care support. ***Material and methods:*** Present study was a descriptive study carried out on 500 pregnant women coming to OBGY department were referred to department of radiodiagnosis for antenatal ultrasound for the first time or for follow up scan were enrolled for the study. ***Results*:** On outcome of disease, 65% had AGA, 17% had IUGR and 18% had SGA. Mean gestational age in weeks among SGA was 37.97+1.66, IUGR was 35.03+1.18 and AGA was 38.01+1.76. Mean EFBW among AGA was 2954.7+343.5, among IUGR 2390.11+245.9, and SGA was 2546.44+242.5. p value showed high statistical significance. ($p<0.0001$). ***Conclusion***: Ultrasound biometry is the gold standard for assessment of fetal size. Fetal weight less than 10th percentile for gestational age is mostly used to diagnosis SGA and IUGR but other criteria like elevated HC/AC ratio, elevated FL/AC ratio, and presence of oligohydramnios without ruptured membranes, presence of advanced placental grade can also be used for improving the accuracy of diagnosis.

Keywords: Fetal growth, IUGR, sonography, biometry.

INTRODUCTION

Normal fetal growth takes nine months, or 40 weeks, or 280 days from the last menstrual period. Growth does not occur linearly, but proceeds at a different pace in different phases. Fetal growth restriction (FGR) refers to a condition of inadequate quantitative development of the fetus. Often, growth does occur, but it is less than expected. In other definitions of FGR, fetal weight or fetal size is compared to population reference curves. Commonly used cut-offs are a weight below the 10th, 5th, or 3rd percentile, or minus 2 standard deviations [1].

Being too small in utero can have several causes: congenital and/or syndromic abnormalities, fetal infection, placental disease, or being constitutionally small. It is of great clinical importance, however, to distinguish between placental disease and being constitutionally small. FGR due to a lack of nutrients and oxygen, i.e. placental disease, results in an increased risk of perinatal mortality and widespread morbidity [2].

There are two types of IUGR, symmetric and asymmetric. Symmetric IUGR is due to complications

early in the gestational period while the asymmetric IUGR is due to complications later in the gestational period [3].

With the advent of ultrasonography (USG), it has become the most widely used, standard and simple way of detecting and confirming IUGR. Growth chart is a very useful tool for detection of early FGR. Serial plotting of the fetal birth weight on the growth chart helps determining the growth trend of the fetus and need for early intervention if required. IUGR is associated with four to eight fold increased risk of perinatal mortality and morbidity [4].

Accuracy of fetal weight prediction improves with inclusion of minimum three body parts measurement. No further improvement in accuracy is achieved by adding a fourth or fifth body parts to the weight formulae. The three important anatomical region the head, abdomen and femur are used for weight estimation. Additional sonogaphic criteria like elevated HC/AC ratio, elevated FL/AC ratio, and presence of oligohydramnios without ruptured membranes [5], presence of advanced placental grade are also used for improving the accuracy of diagnosis of IUGR.

MATERIAL AND METHODS

Present study was a descriptive study carried out on 500 pregnant women coming to OBGY department were referred to department of radiodiagnosis for antenatal ultrasound for the first time but before 22 weeks or for follow up scan were enrolled for the study. Equipment used was High end USG machine- TOSHIBA XARIO 100 and XARIO 200. The fetal biometry included assessment of biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral length (FL). HC/AC ratio, FL/AC ratio, fetal heart rate, placental maturity and amount of liquor were noted. Amniotic fluid index was calculated by adding the vertical depths of the largest pocket in each of the four uterine quadrants. Fetal weight was estimated according to the Hadlock formulae that uses FL, AC and BPD. Fetal weight less than 10^{th} percentile based on the chart given by Doubilet *et al.*, in 1997 were taken as small for gestational age (SGA) babies and fetal weight between 10^{th} percentile to 90^{th} percentile were taken as appropriate for gestational age (AGA) babies.

OBSERVATION AND RESULT

A total of 500 cases were included in the study, 325 were AGA (Appropriate for gestational age), 85 were IUGR (Intrauterine growth retardation), 90 were SGA fetus (Small for gestational age).

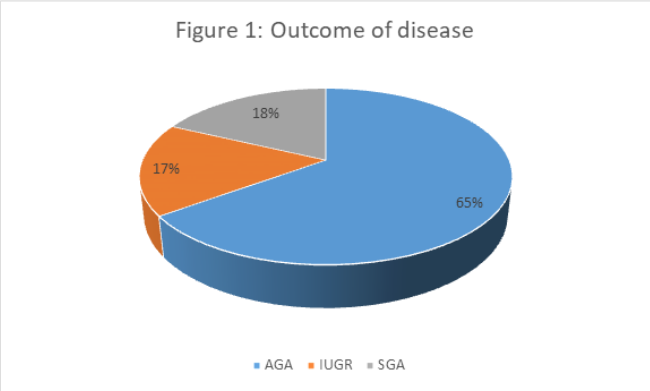


Figure 1: Outcome of disease

Table 1: Gestational age at the time of delivery

Outcome	Gestational age Mean	SD	P-value
AGA	37.97	1.66	0.04*
IUGR	35.03	1.18	
SGA	38.01	1.76	

Table 2: Comparison of Gestational outcome by HC/AC Ratio (N=500)

HC/AC	Outcome			P value
	AGA	IUGR	SGA	<0.00001
<1	300	0	35	
>1	25	85	55	
Mean +SD	0.93+0.07	1.32+0.06	1.1+0.15	

Table 3: Comparision of Gestational outcome by FL/AC Ratio (N=500)

FL/AC Ratio	AGA	IUGR	SGA	TOTAL
>23.5	25	40	60	125
≤ 23.5	300	45	30	375
Total	325	85	90	500

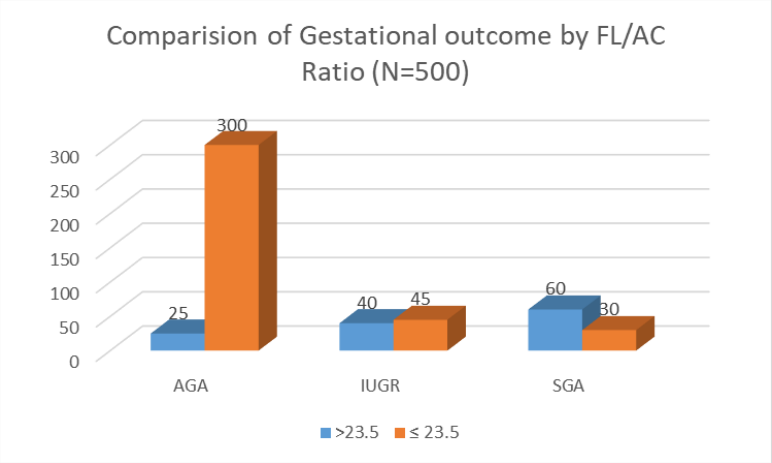


Figure 2: Comparison of Gestational outcome by FL/AC Ratio (N=500)

Table 4: EFBW

EFBW	Mean	SD	P value
AGA	2954.7	343.5	<0.00001%
IUGR	2390.11	245.9	
SGA	2546.44	242.5	

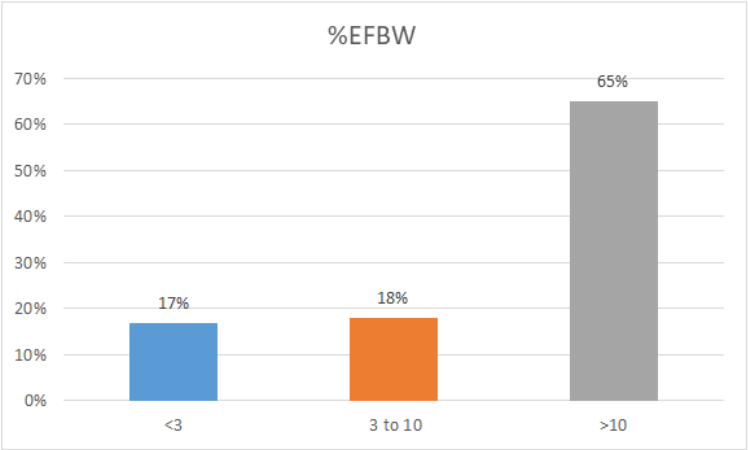
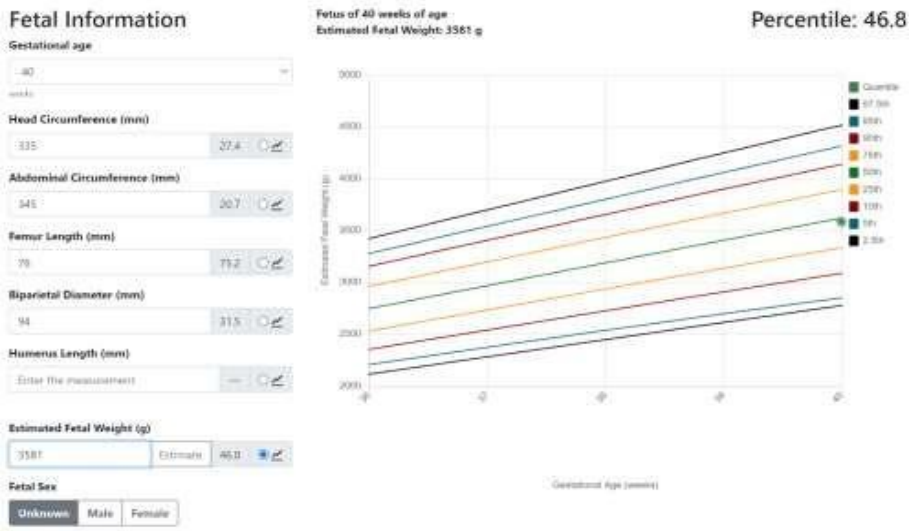


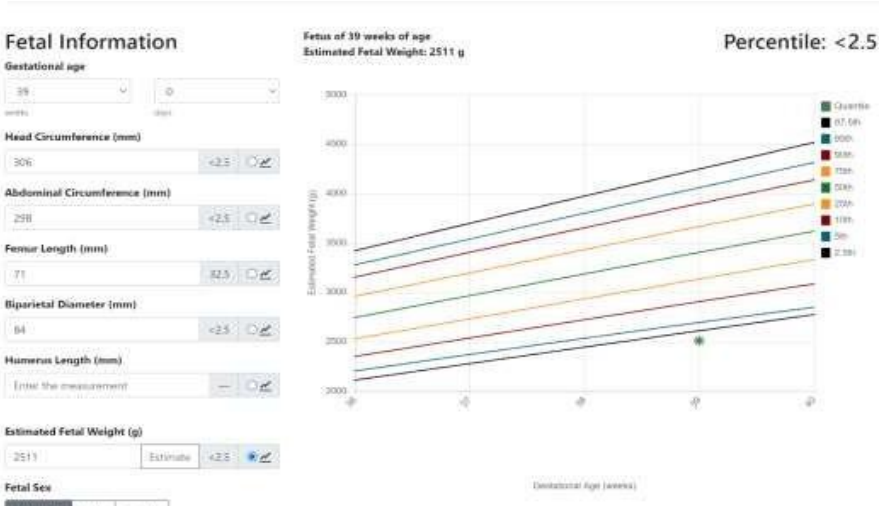
Figure 3: %EFBW

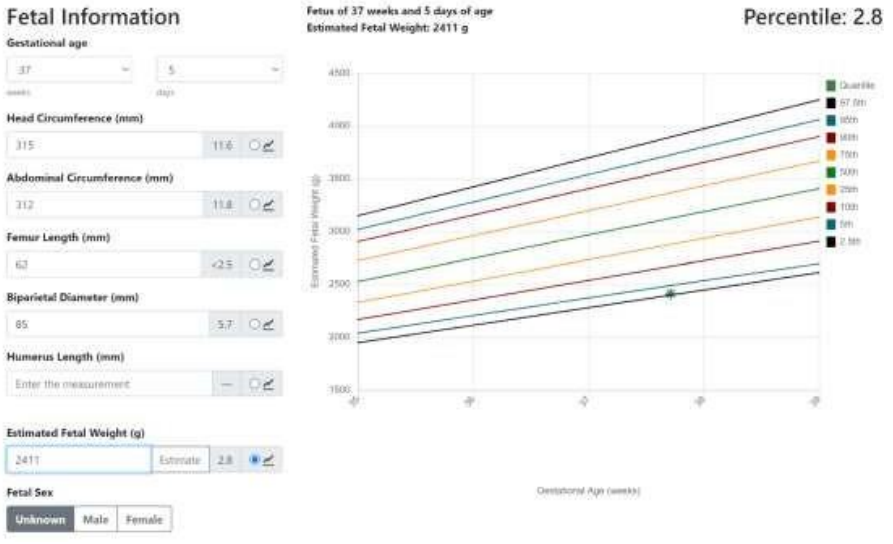
Growth charts

1) **Appropriate for gestational age (AGA) fetus**. The estimated fetal birth weight (EFBW) is more than 10% for the current gestational age on all scans during gestation.


Fetal Information
Gestational age
Head Circumference (mm)
Abdominal Circumference (mm)
Femur Length (mm)
Biparietal Diameter (mm)
Humerus Length (mm)
Estimated Fetal Weight (g)
Fetal Sex
Unknown
Male
Female
Fetus of 40 weeks of age
Estimated Fetal Weight: 3581 g
Percentile: 46.8

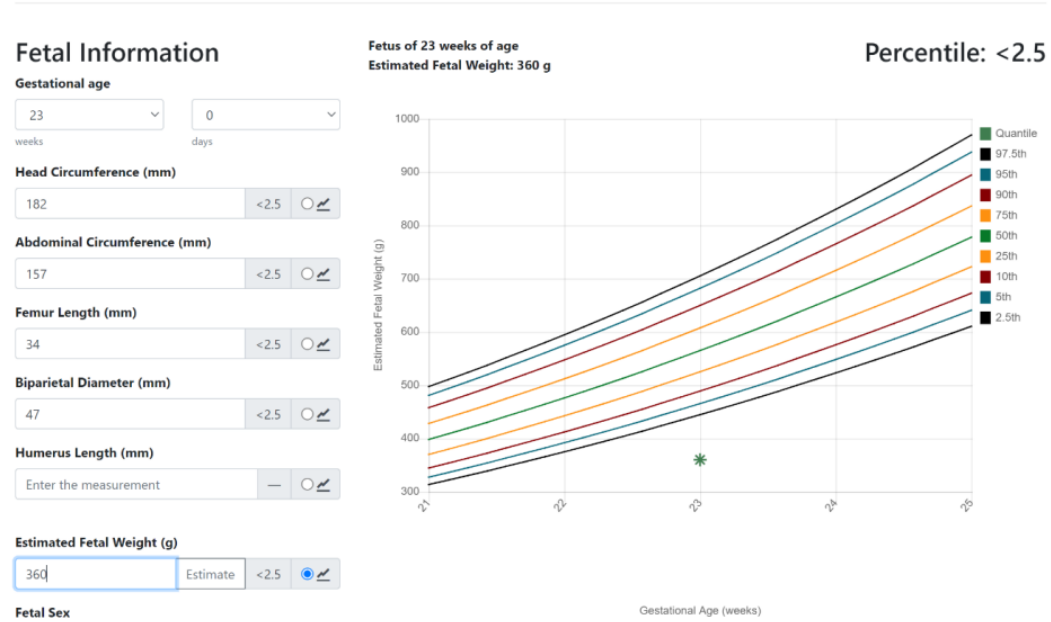
2) IUGR fetus

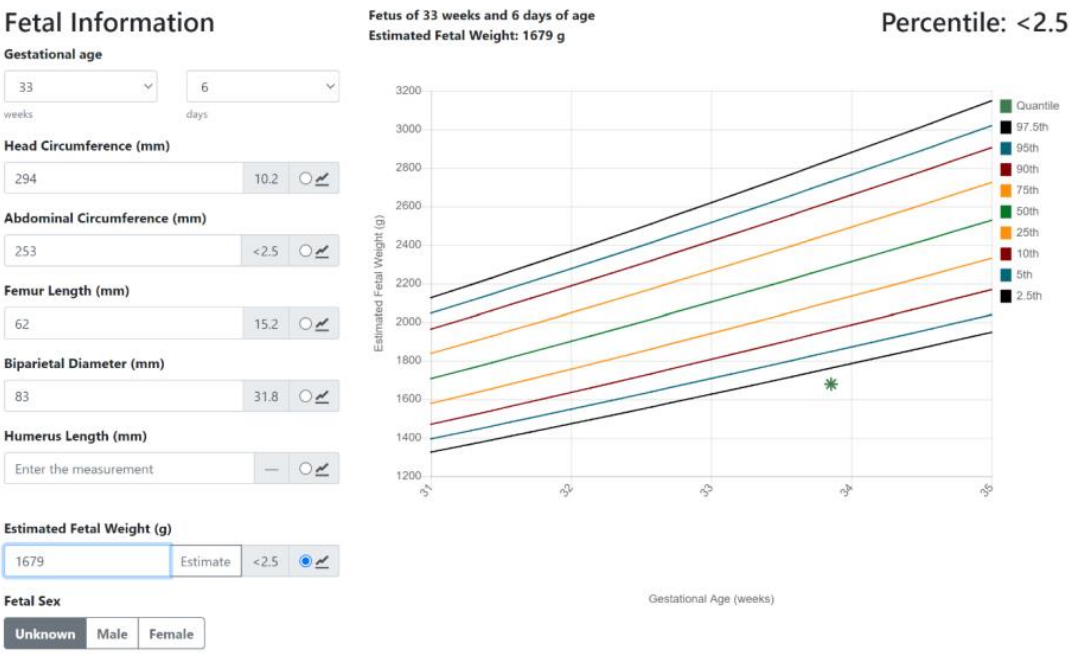

Fetal Information
Gestational age
Head Circumference (mm)
Abdominal Circumference (mm)
Femur Length (mm)
Biparietal Diameter (mm)
Humerus Length (mm)
Estimated Fetal Weight (g)
Fetal Sex
Unknown
Male
Female
Fetus of 39 weeks of age
Estimated Fetal Weight: 2511 g
Percentile: <2.5


Fetal Information
Gestational age
Head Circumference (mm)
Abdominal Circumference (mm)
Femur Length (mm)
Biparietal Diameter (mm)
Humerus Length (mm)
Estimated Fetal Weight (g)
Fetal Sex
Unknown
Male
Female
Fetus of 37 weeks and 5 days of age
Estimated Fetal Weight: 2411 g
Percentile: 2.8

The estimated fetal birth weight is less than 3 % for the current gestational age.

3) **Early onset IUGR** - The EFBW is less than 3% for the gestational age before 32 weeks and is consistent on all successive sc.





DISCUSSION

On outcome of disease, 65% had AGA, 17% had IUGR and 18% had SGA. Study by To WW et al [6] showed that 96.7% had SGA.

Present study showed that Mean gestational age in weeks among IUGR was 35.03+1.18, SGA was 37.97+1.66 and AGA was 38.01+1.76. Study by B. O. Verburg *et al.*, [7] showed that mean gestational age in weeks was 40+1. Sato N *et al.*, [8] showed that mean gestational age for IUGR was 38.4+1.3, for SGA was 39.3+1.5 and AGA 39.5+1.2.

Mean HC/AC ratio among AGA was 0.93+0.07, IUGR was 1.32+0.06, and SGA was 1.1+0.15. p value showed high statistical significance. ($p<0.0001$). Study by B. O. Verburg *et al.*, [7] showed that mean HC/AC ratio was 0.99.

Among 500 cases 125 had >23.5 FL/AC ratio and 375 i.e majority had <23.5 FL/AC ratio. Among those 125 having >23.5 FL/AC ration25 were AGA, 40 IUGR and 60 SGS. And among 375 having <23.5 FL/AC ratio 300 were AGA, 45 IUGR and 30 SGS. p value showed high statistical significance. ($p<0.0001$). Study by B. O. Verburg *et al*., [7] showed that mean FC/AC ratio was 1.00. Even Sato N *et al*., [8] showed that he AC/FL ratio history (trajectory) was less relevant to neonatal size than the AC/FL ratio at the late gestation or growth velocity trajectories.

Mean EFBW among AGA was 2954.7+343.5, among IUGR 2390.11+245.9, and SGA was 2546.44+242.5. p value showed high statistical significance. ($p<0.0001$). 17% had %EFBW <3, 18% had %EFBW 3 to 10 and 65% had %EFBW >10. In 2004, Thomas J Garite *et al*., [9] noted that 37% (about1/3) of infants who were thought to be growth restricted antenatally were not less than the 10th percentile at birth (545/1451) and that adverse outcome was seen only when the antenatal diagnosis of IUGR was actually associated with a neonatal birth weight less than the 10th percentile. Study by Juhn Zhang *et al*., [10] suggest that the incidence of adverse outcome is substantially higher only when the weight falls below the 5^{th} percentile. The likelihood ratios indicate that only weight below the 5th percentile may have predictive power for adverse outcome.

CONCLUSION

Ultrasound biometry is the gold standard for assessment of foetal size. Foetal weight less than 10th percentile for gestational age is mostly used to diagnosis SGA and IUGR but other criteria like elevated HC/AC ratio, elevated FL/AC ratio, and presence of oligohydramnios without reptured membranes, presence of advanced placental grade can also be used for improving the accuracy of diagnosis.

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