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ARAŞTIRMA / RESEARCH

Can serial measurements of fetal abdominal circumference in the second trimester predict small for gestational age and late fetal-growth restrictions?

İkinci trimesterde seri fetal abdominal çapın ölçümü gebelik haftasına göre düşük doğum ağırlığını ve fetal gelişim geriliğini öngörebilir mi?

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Abstract

Purpose: The aim of the present study was to evaluate whether serial measurements of the ultrasonographic abdominal circumference of the fetus in the second trimester is a predictor for a fetus that is small for gestational age and for late fetal–growth restrictions.

Materials and Methods: Of the 440 pregnant women were analyzed retrospectively, 200 were in the small for gestational age group, 40 were in the late fetal–growth restrictions group, and 200 were in the healthy control group. For screening fetal growth, ultrasound scans were performed at 18±2, 22±2, and 26±2 weeks of gestation and fetal biometric results were compared among groups.

Results: The maternal age, body mass index, nulliparity, and rates of previous cesarean deliveries were similar among the groups. Gestational age at delivery, rates of induced delivery and fetal birth weight were significantly different among the groups. The abdominal circumference diameter at 18, 22, and 26 weeks were similar among the groups; the differences were not significant.

Conclusion: Our results suggest that the serial abdominal circumference measurement in the second trimester has a low capacity for predicting small for gestational age and late fetal–growth restrictions in low-risk pregnancies.

Keywords:. SGA, fetal growth restriction, second trimester, fetal abdominal circumference, serial AC measurements

Öz

Amaç: Bu çalışmanın amacı ikinci trimesterde seri olarak ölçülen ultrasonografik fetal abdominal çapın gebelik haftasına göre düşük doğum ağırlığı ve geç başlangıçlı fetal gelişim geriliğini öngörebilirliğini araştırmaktır.

Gereç ve Yöntem: Toplam 440 gebe retrospektif olarak analiz edilmiş olup 200 gebe gebelik haftasına göre düşük doğum ağırlığı, 40 gebe geç başlangıçlı fetal gelişim geriliği ve 200 gebe sağlıklı kontrol grubu olarak sınıflandırıldı. Fetal büyümenin taranması ultrasonografi ile 18±2, 22±2, ve 26±2 gebelik haftalarında yapıldı ve fetal biyometrik ölçümler gruplar arasında karşılaştırıldı.

Bulgular: Maternal yaş, vucut kitle indeksi, nulliparite ve önceki sezaryen doğum oranları gruplar arasında benzer olarak saptandı. Doğum sırasındaki gebelik haftası, doğum indüksiyonu oranları ve fetal doğum ağırlığı gruplar arasında anlamlı farklılık gösterdi. 18, 22 ve 26. haftalardaki fetal abdominal çap gruplar arasında benzerdi; anlamlı farklılık saptanmadı.

Sonuç: Sonuçlarımız, ikinci trimesterdeki seri fetal abdominal çapın ölçümünün düşük riskli gebeliklerde gebelik haftasına göre düşük doğum ağırlığı ve geç başlangıçlı fetal gelişim geriliğini öngörmede düşük bir kapasiteye sahip olduğunu göstermektedir.

Anahtar kelimeler: SGA, fetal gelişim geriliği, ikinci trimester, fetal abdominal çevre, seri AC ölçümü

INTRODUCTION

During antenatal management fetal growth monitoring is an important part of follow-up. Small for gestational age (SGA) and fetal growth restriction (FGR) are serious situations that associated with placental insufficiency, and adverse perinatal outcomes. SGA is defined as the estimated fetal

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weight below 10 percentile for gestational age in healthy fetuses[1]; and a fraction of these present with a pathological growth pattern also known as FGR[2]. An early diagnosis of FGR is recommended to be able to determine a prognosis and pregnancy management[3]. Indeed, without FGR detection, adverse perinatal outcome and stillbirth are seriously increasing[4, 5]. Despite implementation of screening strategies and the wide availability of ultrasound, ≥30% of FGR is not detected before delivery [6].

The American Association of Obstetrics and Gynecology (ACOG) has described several methods by which to screen for FGR. Selective ultrasonography is an easy method by which to measure fundal height, but its effectiveness is controversial[7, 8]. Routine ultrasonographic examinations are an alternative method by which to screen for FGR, but ACOG recommends that this be conducted between 32 and 36 weeks of gestation[9]. Considering the cases of early-onset FGR, screening between 32 and 36 weeks would certainly not be sufficient.

Recent data have shown that the fetal liver is the key organ that converts maternal factors into differential growth[10] because it is the main determinant for the production of insulin-like growth factors[11]. An association between fetal liver volume measured by ultrasonography and fetal growth was established[12], but the technique is hampered by high variability and difficult to apply. On the other hand fetal liver is the dominant organ in the fetus abdominal circumference (AC) measurement and AC can be used to express liver size. Thus, serial fetal AC measurements would be an important parameter for monitoring fetal growth. Hence, the aim of the present study was to evaluate whether serial AC measurements in the second trimester can predict SGA and late FGR in uncomplicated pregnancies.

MATERIALS AND METHODS

This was a retrospective cohort study approved by the Ethics Committee of Erciyes University, Kayseri, Turkey (Decision no. 2019/540) and was conducted at Kayseri City Hospital in accordance with the Declaration of Helsinki.

The study comprised 440 pregnant women who met the inclusion criteria and delivered at Kayseri City Hospital between May 2018 and July 2019. Pregnant women who delivered singletons between 34 0/7 and 41 6/7 weeks of gestation and aged between 18-35 years were included in study. Pregnant women were divided into three group according to fetal birth weight percentile; 40 were in the late FGR group, 200 were in the SGA group, and 200 were in the healthy control group and second trimester utrasonographic fetal AC diameters were recorded retrospectively. Last menstrual period was used to determine gestational week and when the last menstrual period was unknown, the gestational age was calculated according to ultrasonographic measurements performed in the first trimester. We excluded women who had multiple pregnancies, showed the presence of fetal chromosomal or congenital anomalies, pre-gestational or gestational diabetes, pre-gestational or gestational hypertension, preeclampsia, intrahepatic cholestasis of pregnancy, placenta previa, placental invasion anomalites, nonobstetric morbidities and who smoked and used alcohol or drugs.

Ultrasound scan were conducted at 18±2, 22±2, and 26±2 weeks of gestation in a routine antenatal visits of pregnant women. Philips ClearVue 550 ultrasound machine was used in ultrasonograpic evaluations. Head circumference, biparietal diameter, AC and femur length were obtained at each examination. For AC measurement, transverse section of the abdomen at the level of the portal sinus and stomach with ellipse placement on the outer surface was preferred.

The primary aim of the study was to determine whether SGA and late FGR can be predicted using serial AC measurements in the second trimester of pregnancy. SGA is defined as birth weight below the 10th centile according to the Alexander growth standards [13]. Late FGR is defined as birth weight below the 3rd centile or below the 10th centile in the presence of an abnormal uterine artery doppler result or abnormal cerebro-placental ratio (below the 5th centile)[14, 15]. The patients who had no previous history of high blood pressure were diagnosed with preeclampsia according to the following criteria: 140mmHg systolic blood pressure and 90mmHgdiastolic blood pressure measured at least twice within a 6-h interval after 20weeks of gestation, and 0.3g/24h proteinuria or a 30mg/mmol spot urine protein creatinine ratio [16].

Statistical analysis

A comparison made among more than two groups was investigated using an analysis of variance followed by Tukey's post-hoc test with Minitab 16 (Minitab Inc.; State College, PA, USA). The

difference among the groups was considered statistically significant when p <0.05.

RESULTS

Of the 440 pregnant women were enrolled in the study, 40 were in the late FGR group, 200 were in the SGA group, and 200 were in the healthy control group. Their demographic and obstetric characteristics were compared and are shown in Table 1. The maternal age (p=.831), BMI kg/m^2 (p=.531), nulliparity (p=.972), and rates of previous cesarean deliveries (p=.945) were similar among the groups.

Table 1. Comparision of maternal demographic and obstetric characteristics

	Late FGR (n:40)	SGA (n:200)	Control (n:200)	P value
Maternal age (years)	29.7±1.9	29.6±2.7	29.8±2.8	0.831
BMI kg/m^2	26.0±2.0	26.4±1.9	26.3±1.9	0,531
Nuliparity (n%)	9 (22.5%)	44 (22%)	46 (23%)	0.972
Previous C/S history (n%)	11 (27.5%)	54 (27%)	57 (28.5%)	0.945

Table 2 shows the delivery outcomes according to the AC diameters measured at 18, 22, 26 weeks of gestation. Gestational age at delivery and rates of induced delivery were significantly different among the groups (p<0.001 for both). The fetal birth weight was 2650±230g in the late FGR group, 2850±280 gin the SGA group, and 3320±340g in the control group, a significant difference among the groups (p<0.001). Although the birth weights were significantly different among the groups, the AC diametersat18, 22, and 26 weeks of gestation were similar (p=.849, p=.750, p=.830, respectively).

Table 2. Comparision of delivery outcomes and 18, 22, 26 weeks AC diameter measurements

	Late FGR (n:40)	SGA (n:200)	Control (n:200)	P value
Gestational age at delivery (weeks)	36 (34-37)^a	39(37-40)^b	39(38-40)^c	<0.001
Delivery induction (n%)	22 (55.0%)^a	57 (28.5%)^b	24 (12%)^c	<0.001
Fetal weight (gr)	2650±230^a	2850±280^b	3320±340^c	<0.001
Male gender (n%)	21 (52.5%)	108 (54%)	106 (53%)	0.973
AC diameter in 18 week (mm)	127.3±5.1	126.8±7.9	127.2±7.9	0.849
AC diameter in 22 week (mm)	177.5±9.7	179.3±10.6	179.1±11.7	0.750
AC diameter in 26 week (mm)	220.1±10.2	222.9±11.6	221.1±11.8	0.830

Notes: Different superscripts indicate statistically significant differences.
Comparison of gestational age at delivery among groups (late FGR to SGA p<0.001, late FGR to control p<0.001, SGA to control p<0.001)
Comparison of delivery induction among groups (late FGR to SGA p<0.001, late FGR to control p<0.001, SGA to control p<0.001)
Comparison of fetal weight among groups (late FGR to SGA p<0.001, late FGR to control p<0.001, SGA to control p<0.001)

DISCUSSION

In a routine obstetric clinic, we often encountered pregnant women who had serious concern about fetal-well being because of clinically inadequate fetal growth or an ultrasound confirmed SGA and LGR fetuses. It is clear that early FGR screening and diagnosis is conducted to determine a prognosis and pregnancy management, and an undetected FGR is an important risk factor for adverse perinatal outcome or stillbirth. In spite of screening strategies and the wide availability of ultrasound, ≥30% of LGR fetuses are not detected before delivery.

In the present study, we aimed to evaluate whether using serial AC measurements in the second trimester is successful for predicting SGA and late FGR. Our results indicated that this measurement has a low capacity for predicting these two conditions. Several studies have evaluated the predictive performance of growth velocity in high-risk pregnancies and have reported a relationship between slow growth and adverse outcomes[17-19]. In a prospective observational multicenter study, Barker et al. reported that fetal growth trajectory analysis reliably differentiated fetuses with a pathologic growth pattern among a group of women with growth-restricted fetuses [17]. Sovio et al. showed that screening of nulliparous women with universal third trimester fetal biometry roughly tripled detection of SGA infants[18]. Similarly

Karlsen et al. reported that size centiles and conditional growth centiles contribute independently to the prediction of adverse perinatal outcome, and their combination further improves the prediction model [19]. Although these studies have highlighted this relationship in high-risk pregnancies, there is not enough evidence for using serial AC measurements of a fetus in low-risk pregnancies to predict adverse outcomes.

In the present study, we found that serial AC measurements in the second trimester did not predict late FGR and SGA in low risk pregnancies. Our results are supported by the study by Caradeux et al. [20] who scanned 2,696 low-risk pregnancies at 21 and 32 weeks in a prospective cohort study. They compared the second-and third-trimester longitudinal growth to predict SGA and late FGR and observed that serial evaluation of fetal growth between the second and third trimesters has a low capacity to predict SGA and late FGR [20]. In another study, Hutchean et al [21] have reported that conditional growth assessment provides no improvement in the recognition of adverse perinatal outcomes.

We are aware of some clinical significance and limitations of our study. Retrospective nature and focusing on pregnancies from a single institution are important limitations. In addition, although experienced obstetricians have performed ultrasonographic measurements, retrospective use of measurements of different obstetricians restricts homogenization in measurements. Despite many advances in perinatal diagnoses and ultrasound, detection of SGA and late FGR remains poor in low-risk pregnancies. In clinical practice, because of the inadequate prediction performance of serial ultrasonographic scans, obstetricians should continue to use fetal Doppler parameters and biochemical evidence of anti-angiogenic situations as the gold standard for predicting FGR in pregnancies [22]. The importance of combination of serial ultrasonographic scans, fetal doppler parameters and biochemical parameters are well documented. In a retrospective study, Hendrix et al. reported that it can be better for predict of SGA combination of first trimester PAPP-A, B-hCG, PIGF, and sFlt-1 and ultrasonographic growth velocity screening between 18-22th and 30-34th gestational weeks than baseline screening parameters alone [23]. In another retrospective study which included 23894 singleton pregnancies scanned between 19 and 24 weeks, Familiari et al. showed that combination of mid-trimester fetal biometry, uterine artery doppler indices and maternal demographics characteristics can identify the majority of pregnancies at high risk for SGA birth and showed a higher performance for earlier gestational ages at birth and lower birth-weight centiles [24]. Similarly, Sotiriadis et al. reported that a simple model combining maternal and first- and second-trimester predictors can detect 60% of fetuses that will develop late FGR, and 79% of those fetuses that will be classified prenatally as late FGR [25].

Our results suggest that the serial AC measurement in the second trimester has a low capacity for predicting SGA and late FGR in uncomplicated pregnancies.

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